United States Patent

Laval, Jr.

[15] **3,701,425**

[45] **Oct. 31, 1972**

[54] **SEWAGE SOLID SEPARATING DEVICE**

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[52] **U.S. Cl.** **210/136,** 210/188, 210/512

[51] **Int. Cl.** **B01d 21/26**

[58] **Field of Search** 210/512, 188, 136; 55/457, 55/459, 466, 429, 433, 395

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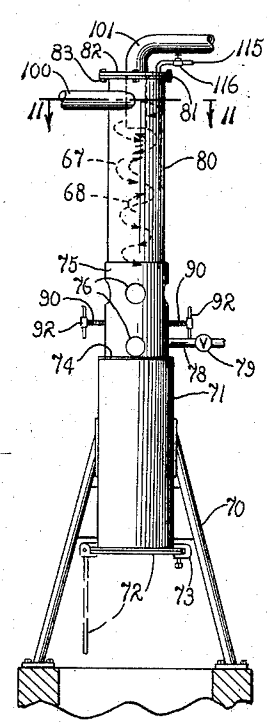
Attorney—Huebner and Worrel

[57] **ABSTRACT**

A device for separating sewage solids from sewage fluids. The device is characterized by a variably dimensioned orifice for tangentially jetting a stream of fluid into a vortexing chamber supported in an upwardly spaced relationship with an accumulator for descending solids. A flexible closure member is extended across the orifice in the direction of the flow and is provided with a first surface against which fluids passing through the orifice impinge and a second surface against which fluids within the chamber impinge, whereby the effective dimension of the orifice is varied in response to variations in the flow characteristics of the stream.

6 Claims, 11 Drawing Figures



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SHEET 1 OF 2

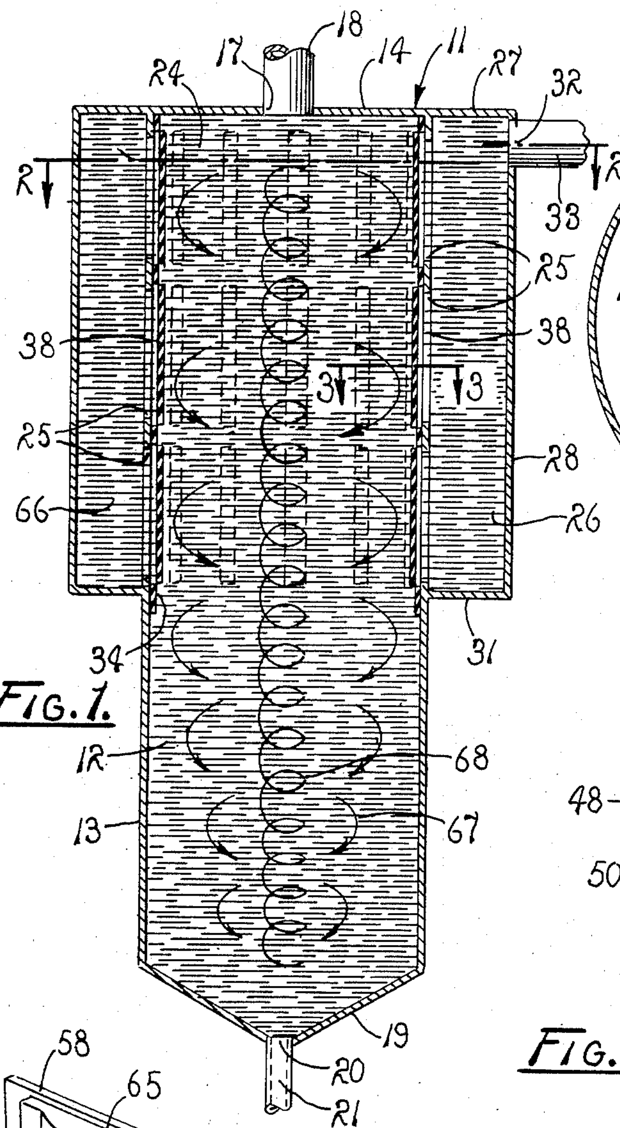

FIG. 1.

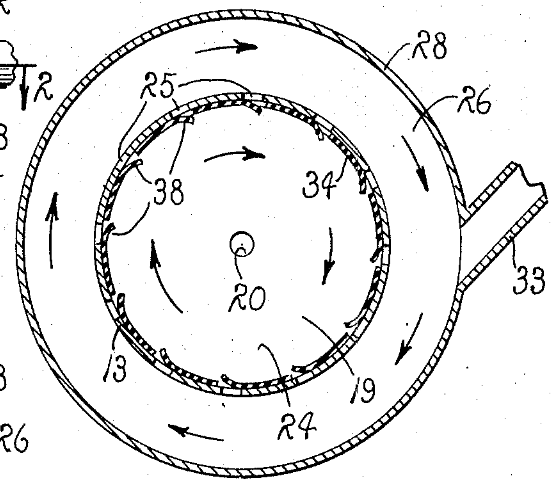

FIG. 2.

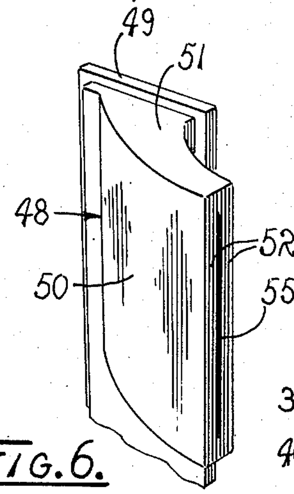

FIG. 6.

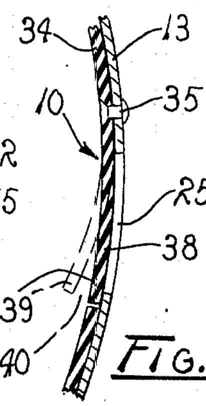

FIG. 3.

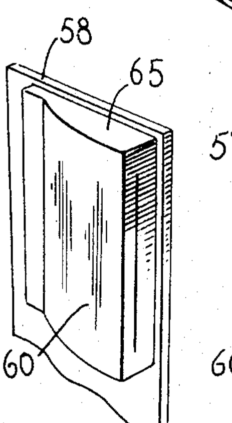

FIG. 8.

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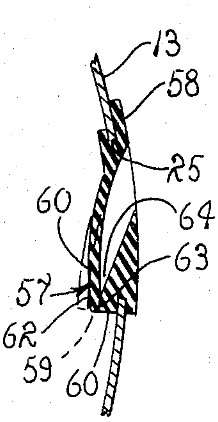

FIG. 7.

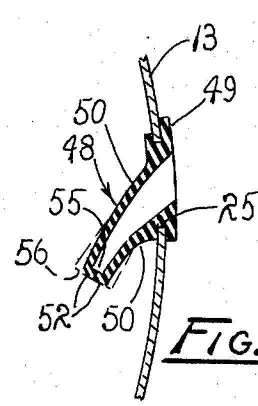

FIG. 5.

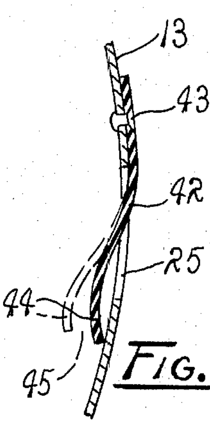

FIG. 4.

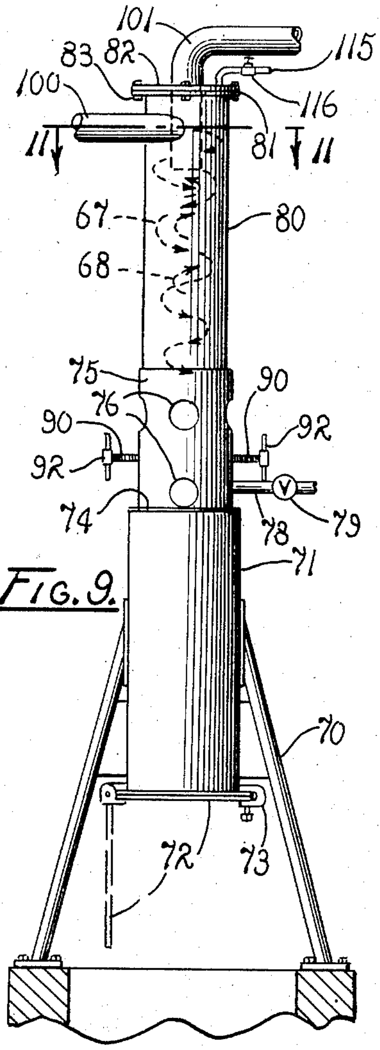

FIG. 9.

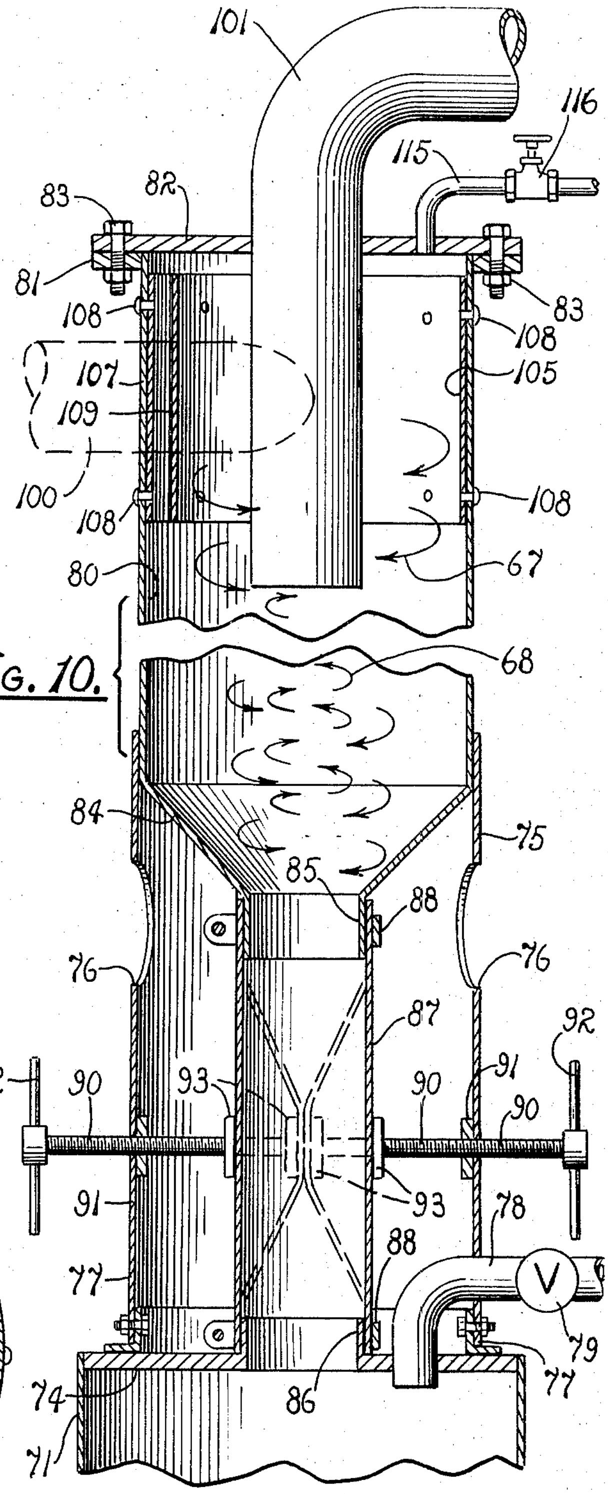

FIG. 10.

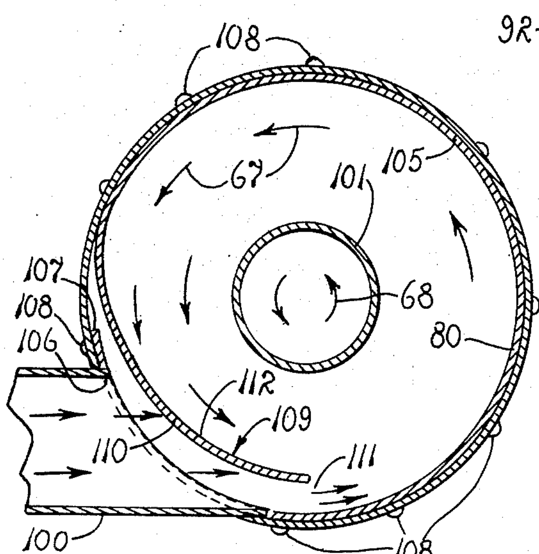

FIG. 11.

SEWAGE SOLID SEPARATING DEVICE

This application is a division of application, Ser. No. 656,312, filed July 24, 1967, now Pat. No. 3,568,837, which, in turn, is a continuation-in-part of application, Ser. No. 478,177, filed Aug. 9, 1965, and now abandoned.

BACKGROUND OF THE INVENTION

The device of the present invention is adapted to be used with a variety of types of fluid passageways through which it is desired to maintain the fluid flow at an adequate velocity for certain operational purposes. It is especially well suited, however, for use with the vortexing chamber of a sand trap or separating device, which separates foreign particles from fluid under pressure. A separating device of this type is described in my U.S. Pat. No. 3,289,608 issued Dec. 6, 1966. For convenience of description and illustration, the device of the present invention is described in connection with such a separating device.

The separating device of said patent provides improved separation and removal of the foreign particles carried in rapidly moving fluid, such as water pumped from wells. This is achieved by effecting a high-velocity influx of fluid into a vortexing chamber, through one or more orifices or inlets, so as to form a rapidly vortexing stream of foreign particles and fluid within the chamber. The foreign particles are displaced outwardly of the stream by centrifugal forces, for removal separately of the main body of fluid. Since the centrifugal forces vary with the rotational velocity and acceleration of the vortexing stream, it is necessary to maintain the fluid influx at a sufficient velocity to sustain operation.

The inlets described in said patent are of fixed cross-sectional area and consequently, for lower fluid pressures and volumes than that for which a given unit is designed, the influx velocity is not sufficiently high to achieve a rapid vortexing. Under such circumstances, as the velocity and volume decrease, the fluid tends to pass directly from inlet to outlet without sufficient rotation or vortexing to throw foreign particles outwardly for separation and to achieve the reversing axial movement in the vortexing, as described in said patent.

Since such devices are often disposed at a remote location, such as at the bottom of a well, control of the fluid flow through the chamber inlets is preferably automatic. However, considering the number of inlets involved, as well as space limitations and other factors, conventional automatic valves are not suitable for this purpose.

Therefore, it is an object of the present invention to provide a device for automatically regulating or controlling the velocity of fluid flowing through an orifice or passageway.

Another object is to provide such a device which may be used with a vortexing chamber of a sand trap or separating device for maintaining operable velocity of fluid flowing into said chamber even at reduced pressures and volumes.

Another object is to provide such a device which controls the flow of fluid automatically in response to fluid pressure differentials and/or volumetric variations.

Another object is to provide such a device which maintains at least a minimum fluid velocity for a wide range of operational fluid pressures, volumes and velocities.

Another object is to provide such a device which automatically adjusts the cross-sectional flow area of the fluid passageway in response to relatively varying opposed internal and external pressures.

Another object is to provide a flexible flow regulating lip in cooperation with an orifice through which a fluid stream is projected, which lip is extended across the orifice in the direction of fluid projection and has an outer surface disposed toward the orifice subjected to inward pressure of said stream and an opposite inner surface subjected to the outward pressure of a fluid stream bearing thereagainst whereby the opposed forces position the lip toward and from the orifice to regulate the effective capacity thereof so that increased pressure of fluid projection moves the lip away from the orifice against said outward pressure to dilate the orifice to accommodate increased volume of fluid through the orifice and decreased pressure of fluid projection moves the lip toward the orifice as a result of the overbalancing outward pressure to constrict the orifice and insure continued jetting action.

Another object is to provide such a device having a simple durable structure and which is economical to maintain in operation condition.

These and other objects and advantages will become more fully apparent upon reference to the following description in the specification and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a vertical section of a sand trap showing an illustrative form of device embodying the principles of the present invention.

FIG. **2** is a horizontal section of the sand trap of FIG. **1** taken in a plane represented by line **2—2** thereof.

FIG. **3** is an enlarged fragmentary horizontal section of the sand trap of FIG. **1** taken in a plane represented by line **3—3** thereof and showing a first form of velocity control device.

FIG. **4** is an enlarged fragmentary horizontal section of the sand trap of FIG. **1** showing a second form of device embodying the principles of the present invention taken in a plane equivalent to that of FIG. **3**.

FIG. **5** is an enlarged fragmentary horizontal section of the sand trap of FIG. **1** showing a third form of device embodying the principles of the present invention taken in a plane equivalent to that of FIG. **3**.

FIG. **6** is a perspective view of the device shown in FIG. **5**.

FIG. **7** is an enlarged fragmentary horizontal section of the sand trap of FIG. **1** showing a fourth form of device embodying the principles of the present invention taken in a plane equivalent to that of FIG. **3**.

FIG. **8** is a perspective view of the form of device shown in FIG. **7**.

FIG. **9** is a side elevation of a further form of the subject invention having particular utility in a sewage solids separator.

FIG. **10** is a fragmentary enlarged vertical section of the device of FIG. **9**.

FIG. **11** is a transverse section of the device of FIG. **9** taken on line **11—11** thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIRST FORM

Referring more particularly to the drawings, a first form of device embodying the principles of the present invention is indicated generally at **10** in combination with a sand trap or separating device **11** of the type described in my above-designated patent. The separating device provides an elongated tubular separation or vortexing chamber **12** formed of a continuous wall **13** of preferably non-corrosive material. The upper end of the chamber provides a flat annular fluid barrier **14** concentric to the axis of the chamber, not shown, and having an outlet opening **17** concentrically thereof, to which a suction pipe **18** is connected. The suction pipe in turn is connected to a pump, not shown.

The bottom end of the chamber **12** provides a frusto-conical downwardly sloping annular floor **19** concentric to the axis of the chamber and having a discharge opening **20** to which a discharge conduit **21** is connected for removal of sand or other abrading or foreign particles by any suitable means, such as is described in my patent.

The upper portion of the chamber **12** forms a fluid inlet section **24**, around which the chamber wall **13** provides a plurality of circumferentially spaced rows of openings or fluid inlets or orifices **25**. In the present embodiment, the inlets are preferably elongated and aligned axially with the chamber, in substantially equally spaced relation thereabout.

An annular fluid receiving chamber **26** circumscribes the fluid inlet section **24** of the separation chamber **12**. It is formed preferably of the same material as the chamber wall **13** and is enclosed by an annular top wall, a surrounding side wall **28** and an annular bottom wall **31**. An opening **32** is provided in the side wall subjacently of the top wall and an intake conduit **33** is connected therein to the side wall. The intake conduit extends to a source of particule-laden fluid, not shown.

A continuous sheet **34** of resiliently flexible material, preferably elastomeric, is disposed about the interior of the inlet section **24** of the separation chamber **12**. It is secured to the wall **13** adjacently of each inlet **25** by any suitable fastening means, such as rivets **35** or the like. The sheet is slit in juxtaposition to each inlet to form a resiliently flexible flap **38** having a lip **39** allowing passage of fluid upon flexing of the lip away from the inlet. In the absence of fluid pressure, each lip may be biased by its inherent resiliency into a position of occlusion across its corresponding inlet, as shown in full lines in FIG. **3** but it need not be for reasons soon to become apparent. Upon application of fluid pressure, it is displaced from said position to provide a passageway **40** having a cross-sectional area varying substantially directly with the amount of pressure being applied. When so displaced, the respective flaps are disposed in acute angular relation with the corresponding radius, not shown, of the chamber wall so as to serve as deflectors of the fluid flowing through the passageways and to direct the influx substantially tangentially into the chamber to achieve a centrifuging action.

SECOND FORM

A second form of the velocity control device of the present invention is shown in FIG. **4**, in combination with a fluid inlet or orifice **25**. It consists of a resiliently flexible flap or lip **42** of elastomeric material, shaped to conform with the corresponding inlet in longitudinally overlapping relation therewith. It is secured to the outer surface of the wall **13** adjacently of the inlet by any suitable means such as a rivet **43** or the like. The flap is curved arcuately inwardly of the inlet and then reversely to bear against the inner surface of the wall in occlusion of the inlet, as shown in FIG. **4**. The free end of the flap forms a lip **44** which is displaceable from the inlet by the force of fluid flowing therethrough to provide an open passageway **45** of varying cross-sectional area depending upon the amount of pressure applied. The inherent resilience of the flap may bias it towards the inlet so as to deflect the fluid influx substantially tangentially and so as to form a passageway of decreased area for lower pressures.

THIRD FORM

A third form of device of the present invention is shown in FIG. **5**, in combination with an inlet or orifice **25**. It consists of a curved broadened spout **48** mounted on a grooved base **49** adapted to be secured within the inlet in tongue-and-groove relation therewith. The spout may have any suitable shape but is preferably formed of arcuate side walls **50** and end walls **51**, as shown in FIG. **6**, terminating at their respective outer extremities in a pair of resiliently flexible valve lips **52** to form an elongated mouth **55**.

The device of the third form may be of any suitable noncorrosive material but is preferably formed of an elastomeric material to allow a unitary casting thereof in combination with the resiliently flexible lips **52**, and so as to allow convenient installation of the device in each inlet **25**. The flexibility of the lips is such that they become spread apart, as shown in FIG. **5**, in response to internal fluid pressure and, as a result, the mouth **55** provides a passageway **56** having a cross-sectional area which varies substantially directly with said pressure. For longer inlets, the spout may be separated into a number of individual spouts **48**, all mounted on the same base **49**. In this way, mouths having excessive lengths axially of the chamber **12** are avoided.

FOURTH FORM

A fourth form of the device of the present invention is shown generally in FIG. **7**, in association with an inlet or orifice **25**. The fourth form consists of a spout **57** having a grooved base **58** adapted to be secured in the inlet, as shown in FIG. **7**, and providing a passageway **59** therethrough. An arcuate wall or flap **60** extends from the base and provides a valve lip **62** at its outer portion which seats against the matching opposite edge **63** of the base to provide an expansible and contractible mouth **64**. The opposite ends of the arcuate wall are preferably connected to the base by end walls **65**. As with the third form, the device of the fourth form is preferably formed of a suitable elastomeric material adapted to be conveniently fitted into the inlets. Such material also allows construction of the device as a unitary casting while providing the necessary resilient flexibility for the lip. For use with longer inlets, the device may be separated into a number of individual spouts, as with the third form, so as to avoid excessively long lips.

FIFTH FORM

The second, third and fourth forms of the invention are excellently suited to the operational environment described for the first form and other environments having comparable requirements. The fifth form is similarly usable but has particular advantage when employed in a sewage solids separator and thus is illustrated in FIGS. **9**, **10** and **11** in such an operational environment.

In sewage separating plants, it is necessary to separate solids from the sewage for chemical digestion and disposal of the resultant products of digestion and the indigestible solids. This is normally accomplished in large settling basins which present major problems of maintenance, location, and delay in achieving the desired separation. Previous efforts to achieve such separation by centrifugation or the like have not been successful because of the large liquid content remaining with the solids after the separation has proceeded as far as economically feasible.

As in many centrifuging operations, the water driven centrifuging of a sewage solids separator is subject to the requirement that a sufficient jetting action be maintained over a wide range of input volumes and pressures so as to have the desired driving effect on the requisite swirling action. However, such separators are subject to many additional problems. Such sewage frequently contains balls, sticks, cans, bottles and other large and unyielding objects. A successful sewage separator must be capable of handling such objects without clogging or having its operation significantly impaired. Further, such separators are prone to accumulate large masses of fat at points of constriction or obstruction to flow. These and other difficulties have heretofore made fluid driven sewage centrifuges largely impractical.

A sewage separator embodying the principles of the present invention is shown in FIGS. **9** through **11**. Any suitable stand **70** is utilized to support a cylindrical accumulator **71** having a lower end closed by a trap door **72** and any suitable device **73** for releasably retaining the trap door in closed position. The accumulator also has a substantially closed upper end **74**. A spacer housing **75** having access openings **76** is mounted on the upper end **74** of the accumulator, as at **77**. An overflow **78** having a valve **79** is provided in the upper end of the accumulator and extended outwardly from the housing.

A cylindrical centrifuging chamber **80** is mounted in the upper end of the housing **75** as by welded association therewith. The upper end of the chamber **80** has a circumscribing flange **81** to which a closure cap **82** is secured in fluid tight relation by a plurality of nut and bolt assemblies **83**. Any suitable gasket, not shown, may be employed between the flange **81** and the cap. The lower end of the centrifuging chamber is preferably provided with a funnel **84**. The funnel has a downwardly extended nipple **85**. A similar nipple **86** is weldably secured in an opening concentrically in the upper end **74** of the accumulator **71**. A tubular member **87** of flexible material, such as rubber or plastic, interconnects the nipples and is secured thereto as by vulcanizing and/or circumscribing clamps **88**.

The tubular member **87** constitutes a conduit for flowable solids from the bottom of the centrifuge downwardly to the top of the accumulator and also serves as a shut-off valve. To the latter end, opposed screws **90** are mounted in the spacer housing **75**, as at **91**, and have outer ends which provide turning handles **92** exteriorly of the housing. The screws are diametrically related and provide shoes **93** at their inner ends in abutment with the tubular member **87**. To close the tubular member, the screws are rotated by the handles **92** to compress the shoes **93** thereagainst and to pinch it to a closed position, as shown in dashed lines in FIG. **10**.

A sewage supply conduit **100** is connected tangentially to the centrifuging chamber **80** adjacent to the upper end thereof and is ported to the interior of the chamber. An outlet conduit **101** is extended concentrically of the chamber downwardly through the cap **82**, to which it is welded. The outlet conduit is sometimes referred to as a "vortex finder" for reasons which will subsequently become apparent. As best shown in FIG. **11**, the conduit **100** has an inner end extended inwardly of the chamber **80** a short distance. A rectangular sheet **105** of flexible material, such as rubber, Teflon or the like, has an opening **106** provided therein fitted to the inner end of the conduit **100**. The thickness of the sheet **105** is preferably substantially equal to the distance of inward extension of the inner end of the conduit. It will be appreciated that as fluid is forced into the centrifuge chamber through the conduit **100** it swirls in a counterclockwise direction, as viewed in FIG. **11**.

The sheet **105** has an end **107** affixed against the inner surface of the wall of the chamber **80** at the upstream side of friction conduit **100**. The sheet is extended from the end **107** in the direction of the swirling movement of the fluid around the inner surface of the side wall of the chamber **80** approximately 300° to a position adjacent to said end and thence is free of the wall in a further extension **109** constituting a flap or lip. The sheet is secured to the side wall of the chamber by flush however. rivets, vulcanizing, bonding, or other suitable means. wear flap has an having a higher specific gravity are thrown outwardly by centrifugal fore against outer surface **110** against which fluid from the conduit **100** obliquely impinges. The flap in association with the inner end of the conduit defines an orifice **111** of automatically constricted and distended size. The flap provides an inner surface **112** against which the swirling fluid acutely impinges to exert an outwardly directed force. The balancing of the outer force on the surface **112** against the inner force imposed on the surface **110** automatically effects the constriction and distention of the orifice.

It will be appreciated that when fluid is first introduced to the chamber **80** through the supply conduit **100**, air is trapped in the chamber above the lower end of the outlet conduit **101**. In small units, this air is soon dissolved in the fluid and carried out of the chamber but it has been found preferable to have a bleeding conduit **115** in communication with the interior of the chamber extended through the cap **82** and provided with a valve **116**. Thus, when operation is initiated, the valve **116** is opened to bleed air out of the upper end of the chamber and the valve then closed for subsequent operation.

OPERATION

The operation of the described embodiments of the present invention is believed to be clearly apparent and is briefly summarized at this point. With the separating device of FIG. 1 in substantially an upright position and the intake conduit **23** disposed in contact with a source of particle-laden fluid, such as water at the bottom of a well casing, not shown, the fluid **66** is forced or drawn through the intake conduit into the separating device under a hydrostatic head depending upon the depth of submersion in the well. The pump, not shown, upon activation, enhances the flow by creating a suction at the outlet opening **17**. The water is forced by the resulting pressure differential through the inlets **25** leading from the receiving chamber **26** into the separation chamber **12**. In the various forms of the invention, the lips **39**, **44**, **52**, **62** and **109** are automatically forcefully displaced a sufficient distance from their respective positions of occlusion of the inlet passageways **40**, **45**, **56**, **59** and **106** to allow passage of the fluid therethrough at a velocity sufficient to cause swirling of the fluid in their respective separation chambers. The fluid swirls within the separation chambers **12** and **80** in a direction indicated by the arrows in FIGS. **2**, **9**, **10** and **11**, preferably taking advantage of the well-known Coriolis force, and proceeds downwardly towards the bottom end of the chambers.

The fluid entering the separation chambers **12** and **80** forms an influx layer **67** of downwardly cumulative thickness and accelerating velocity even though freiction has some retarding effect on the very outermost fluid. This, in effect, causes the main influx stream to constrict in its helical descent and thus, in traversing a tighter spiral, to increase in velocity. Such constriction is also caused by the contraction required to swirl upwardly to the outlet conduit **101**. It would appear that since the swirling action is generally conical that a conical chamber would be preferable. Such is not the case, however, It has been discovered that conical chambers werar out rapidly because of abrading by sand and the like. The cylindrical form of chamber has a useful life which is a multiple of that of a conical chamber because the outer layer of fluid which is retarded by friction is of downwardly increasing thickness. This somewhat slower movement protects the wall and facilitates gravitational descent of the solid particles. During the centrifuging swirling movement of the fluid, the foreign particles borne by the fluid centrifugal force against the walls of the chambers or into the slower moving layer of fluid. The particles then move downwardly along the walls, partially by gravity and also by the movement of swirling fluid, toward the bottom **19** or funnel **84** of the chambers, where the particles are collected and subsequently discharged, as described in my patent designated above. In the bottom portion of the chambers, the swirling fluid is diverted upwardly in vortices **68** in the same direction of rotation and concentrically of the influx layer and into the suction pipe **18** or **101** leading to a pump or point of disposition. Any extraneous particles that move upwardly in the central vortex are likewise thrown outwardly into the downwardly swirling outer influx layer of water.

At lower fluid pressures in the receiving chamber **26**, supply conduit **100**, or at lower hydrostatic heads, the fluid influx into the separation chambers **12** and **80** is correspondingly decreased, thereby tending to reduce the driving effect exerted on the swirling influx layers **67** and vortices **70**, as well as the entire centrifuging process. In fact, if excessively reduced, the fluid passes directly from the inlet orifices to the outlets with no centrifugation whatsoever. However, in response to such lower pressures, the resilient lips **39**, **44**, **52**, **62** and **109** in the various forms of the present invention automatically retract or constrict their respective orifices and thereby diminish the cross-sectional area of the respective fluid passageways **40**, **45**, **56**, **59** and **111**. In this manner, the influx velocity is maintained above minimum operational levels even with reduced volumes and pressures and is sufficient to cause a swirling movement of the fluid within the separation chamber. In an inverse manner, increased volumes and pressures are accommodated by orifice distention. This phenomenon is not automatically apparent but is readily evident in embodiments of the subject invention which have been constructed of transparent material for observation purposes. It is probably most easily understood in its simplest form by reference to FIG. **11**. As sewage is pumped into the chamber **80** through the conduit **100**, a vigorous swirling action is set up. The influx fluid impinges on the surface **110** and urges the flap or lip **109** inwardly. As soon as the chamber fills, the swirling fluid exerts a balancing outer thrust on the surface **112**. Thus, these counterbalancing forces always control the position of the flap. when the input pressure or volume decreases, the the pressure at **110** decreases. However, the chamber remains full and the pressure at **112** either does not decrease or decreases much less than that at **110**. Consequently, the flap moves outwardly to constrict the orifice **111**. This insures continued jetting action to maintain the vigorous swirling movement, albeit the influx volume or pressure has decreased. Under such conditions, the centrifugation continues, the fluid moves downwardly in an accelerating and tightening spiral and thence upwardly for discharge while throwing its solid components outwardly and downwardly. Conversely, if the influx fluid suddenly increases in volume or pressure, the pressure at **110** increases, the pressure at **112** remains the same or does not increase as much, and the flap moves inwardly to distend the orifice and to accommodate the desired increased flow. Somewhat similarly, if a can, bottle, stick, ball or other relatively large and unyielding object is delivered through the conduit **100**, the flap opens wide to admit it to the chamber where it is centrifuged from the fluid, after which, the flap or lip returns to its pressure balancing position to jet the influx into the chamber to drive the swirling action.

With the tubular member **87** open, the solids centrifuged from the fluid pass downwardly into the accumulator **71** where they are collected. If desired, the valve **79** may initially be opened to release any entrapped air and to fill the accumulator with fluid whereupon the valve is closed. As the solids accumulate, they gradually displace the fluid upwardly from the accumulator into the chamber **80**. It can be determined when the accumulator is full of solids by periodically opening the valve. When no fluid is emitted through the valve, the accumulator is full of solids. Under such conditions the solids are no longer freely flowable and contain a much smaller amount of water than previously attainable in sewage solid separators.

At this point, the screws **90** are manipulated to close the tubular member **87**. The lock **73** is released, the trap door **72** dropped to its open position and the solids deposited from the accumulator onto a conveyor, truck or other portable container, not shown. This emptying operation can be performed without interrupting the centrifuging operation. The trap door is then closed and locked, the tubular member **87** opened, and accumulation resumed. In reference to the sheet **105**, it should be noted that its described form and circumscribing mounting present virtually no obstructions or nuclei for fat accumulation. The flexing of the flap **109** minimizes or obviates objectionable fat collection in the orifice **111**.

The lips **39, 44, 52** and **62** forming the mouths, orifices or passageways **40, 45, 56** and **59** in each of the earlier forms of the device of the present invention function substantially identically to the flap or lip **109** described above. By assuring the highest velocity of swirling movement of the fluid commensurate with the fluid pressure differentials available, the swirling action in the chamber is maintained at as an effective velocity as possible as the orifices are automatically constricted or distended to insure an optimum jetting action.

As noted, all of the flaps or lips are of an elastomeric material to provide adequate flexibility for the described distention or dilation of the openings while maintaining a jetting action of the fluid but should have sufficient body or rigidity to resist flutter and its resultant impeding effect on high velocity fluid flow. In the first through the fourth forms, they preferably have sufficient resilience to insure tangential entry to initiate the swirling action. Once in operation, however, the balancing pressures control.

Further, in all of the forms of the invention illustrated, the jetting action which drives the centrifugation is achieved by pressure differentials on opposite sides of the orifices. Such differentials can be achieved by connecting the intake conduits or passages to any suitable source of hydrostatic head pressure or to the discharge of any suitable pump or by connecting the outlet conduits or passages to the intake or suction of any suitable pump.

In view of the foregoing, it is readily apparent that the velocity control device of the present invention provides a means for maintaining the velocity of fluid flowing into a vortexing chamber of a separating device at least at a predetermined minimum velocity, namely, in the illustrative embodiments at least the minimum velocity at which the centrifuging is effective. The velocity control is automatic in response to the fluid pressure and requires no manual adjustment. In addition, the device has a simple, durable structure and is economical to maintain in operational condition. Many of the suitable elastomeric materials resist the abrasion of water-borne impurities better than metal.

Although the invention has been herein shown and described in what are conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices and apparatus.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A solids separating device comprising a substantially cylindrical vortexing chamber having upper and lower ends, means for jetting a substantially tangential flow of fluids containing solids into the vortexing chamber, including means defining an orifice in the chamber and means comprising a flexible closure member extended across said orifice, means substantially closing the upper end of the vortexing chamber providing an outlet conduit extended therethrough substantially concentrically of the vortexing chamber, an accumulator mounted in a substantially upright position, means supporting the vortexing chamber in an upwardly spaced relationship with said accumulator, means defining a conduit interconnecting the lower end of the vortexing chamber with the upper end of the accumulator including a valve operable to open and to close the conduit, and means in the lower end of the accumulator movable between a closed position, for retaining solids descending thereto through the conduit and an opened position for releasing said solids.

2. The device of claim **1** in which the outlet conduit of the vortexing chamber extends downwardly into the vortexing chamber and a bleeding valve is provided in the closed upper end of the vortexing chamber to bleed air trapped therein above the lower end of the outlet conduit.

3. The device of claim **1** wherein said flexible closure member comprises a displaceable flap supported within said chamber and extended across said orifice in the direction of said flow, having a given surface disposed for impingement thereagainst of fluid passing through the orifice and an opposite surface disposed for impingement thereagainst of fluid within said chamber.

4. The device of claim **1** wherein said flap comprises the distal end a curved, rectangular sheet of flexible material supported in circumscribing relation with a portion of the internal surface of said chamber.

5. In a device for use in separating sewage solids from sewage fluids, the improvement comprising:

A. a substantially cylindrical vortexing chamber having an upper and a lower portion;

B. means defining within said chamber an orifice for jetting a flow of fluid containing sewage solids into the vortexing chamber adjacent to the upper portion thereof;

C. means substantially closing the upper portion of the vortexing chamber and having an outlet conduit extended therethrough in a substantially concentric relationship with the chamber;

D. an upright accumulator;

E. means supporting the vortexing chamber in an upwardly spaced relationship with said accumulator;

F. a conduit interconnecting the lower portion of the vortexing chamber with the upper portion of the accumulator;

G. an operable valve mounted in said conduit;

H. operable closure means disposed in the lower portion of the accumulator for selectively retaining solids therewithin; and

I. a flexible flap extended across said orifice in the direction of the flow of fluid interiorly of the vortexing chamber having an inner surface disposed for oblique impingement thereagainst of fluid passing through said orifice for establishing a tangentially directed flow from said orifice and an opposite surface disposed for acute impingement thereagainst of fluid within the vortexing chamber, whereby opposed forces incident to such impingement automatically position the flap for regulating the effective size of the orifice.

6. The improvement of claim 5 further comprising a bleeding valve supported at the closed upper portion of the vortexing chamber for bleeding air trapped within the chamber above the lower end of the outlet conduit.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,701,425 Dated October 31, 1972

Inventor(s) Claude C. Laval, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 35 the word "friction" should be omitted.

Signed and sealed this 13th day of March 1973.

(SEAL)

Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents