United States Patent [19]

Bradley

[11] **3,815,827**

[45] **June 11, 1974**

[54] **WASTE DISINTEGRATOR**

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[73] Assignee: **General Signal Corporation,** New York, N.Y.

[22] Filed: **Sept. 11, 1972**

[21] Appl. No.: **288,056**

[52] **U.S. Cl.** ..... **241/46 R,** 241/46.11

[51] **Int. Cl.** **B02c 18/40**

[58] **Field of Search** ..... 241/46 R, 46.02, 46.04, 241/46.08, 46.11, 46.13, 46.15, 46.17, 92, 278, 296, DIG. 19

[56] **References Cited**

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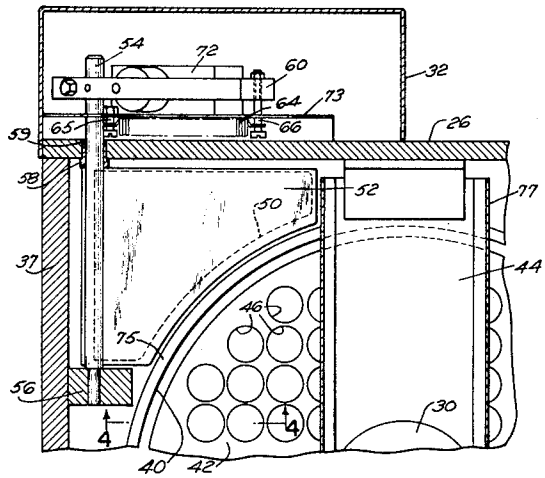
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Primary Examiner—Granville Y. Custer, Jr.
Attorney, Agent, or Firm—Barlow & Barlow

[57] **ABSTRACT**

A waste disintegrator for comminuting solid particles in a fluid passing therethrough having a transverse wall in its housing, the transverse wall having a central opening through which the fluid is channeled and a comminuting means is mounted in that opening. A fluid bypass is formed in the transverse wall in a peripheral area thereof and covering this opening is a flapper valve that is pivotally secured to the downstream side of the transverse wall. The flapper valve has one of its ends fixedly secured on a shaft that passes through a housing wall of the disintegrator and to this shaft at its end is attached an arm. A coil spring that has one of its ends secured to the housing and its other end secured to one end of the arm, provides a relatively constant spring tension on the arm and thus constantly urges the flapper door to remain in its closed position or to return to its closed position when the differential pressure across the transverse wall diminishes to a predetermined level. Also mounted on the wall housing is a microswitch which is part of a warning signal circuit. The switch is in engagement with the arm when the flapper door is closed and it is under this condition that the switch is open. As increased differential pressure forces the flapper door open, the arm moves away from the switch closing the circuit which in turn activates the warning signal.

7 Claims, 8 Drawing Figures



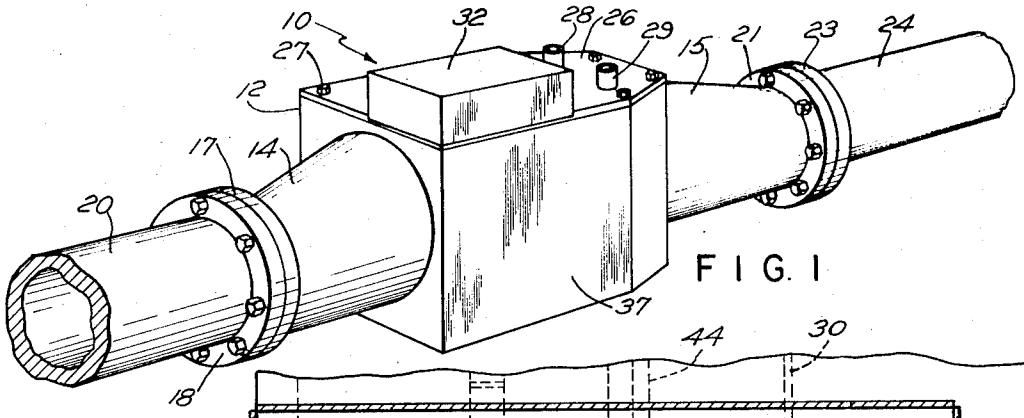


FIG. 1

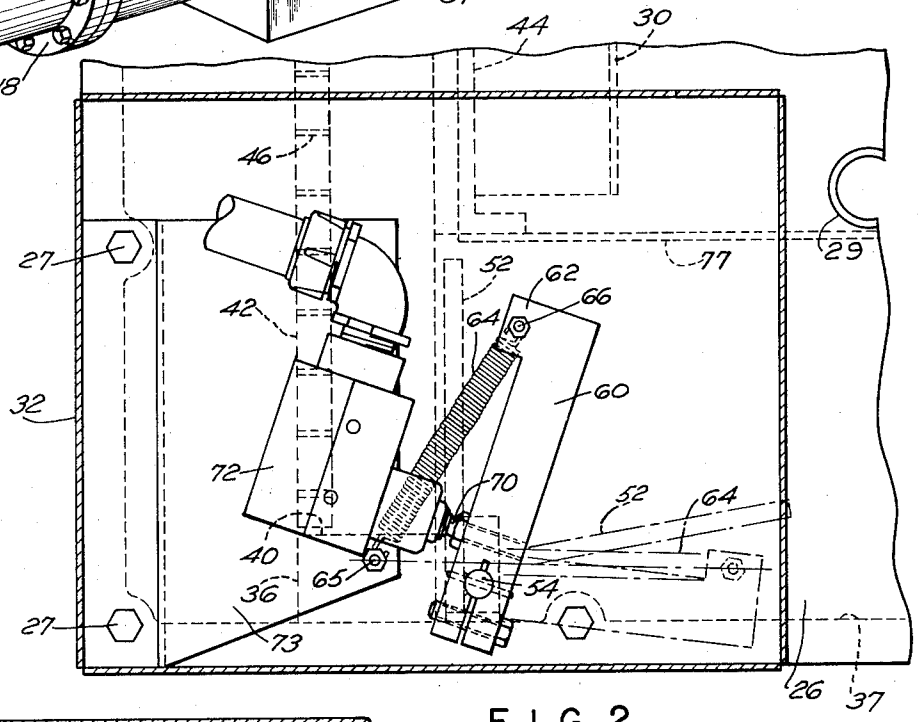


FIG. 2

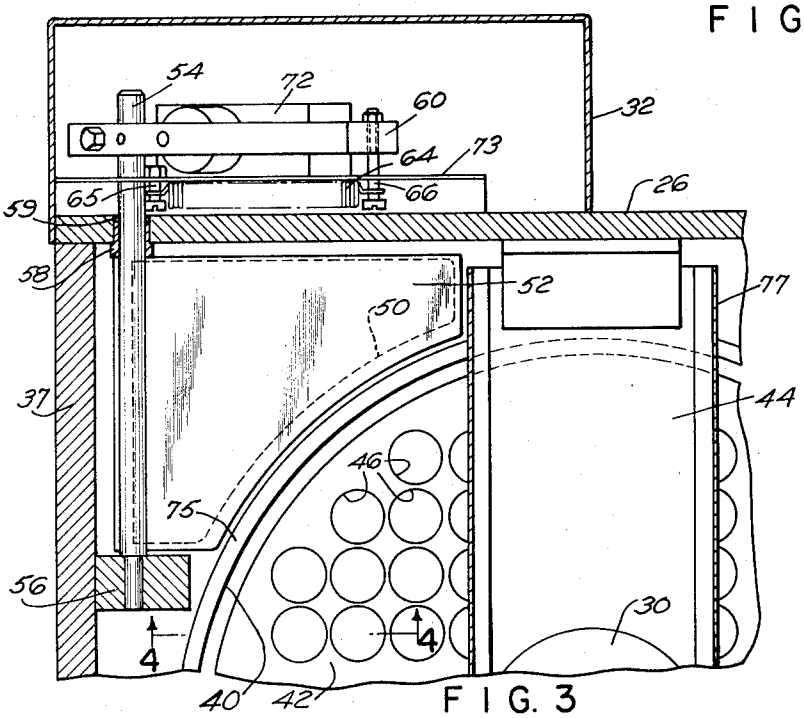


FIG. 3

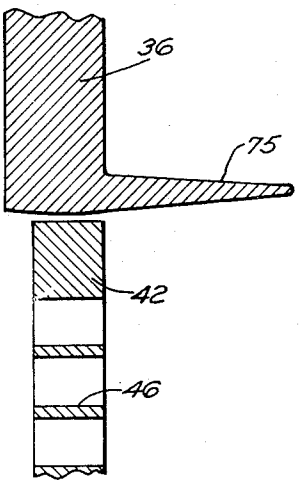


FIG. 4

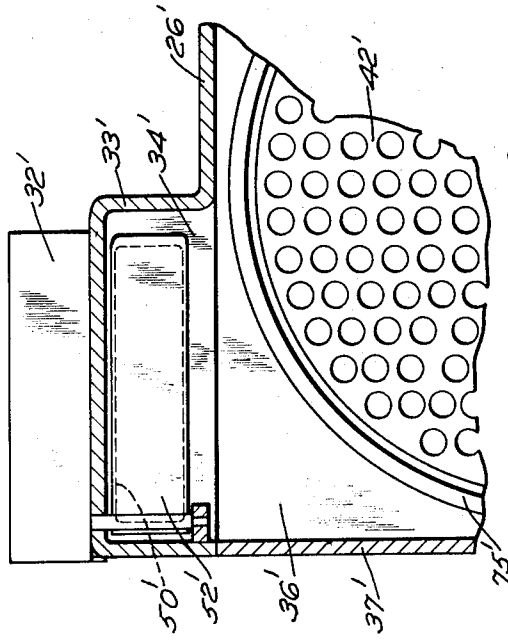


FIG. 6

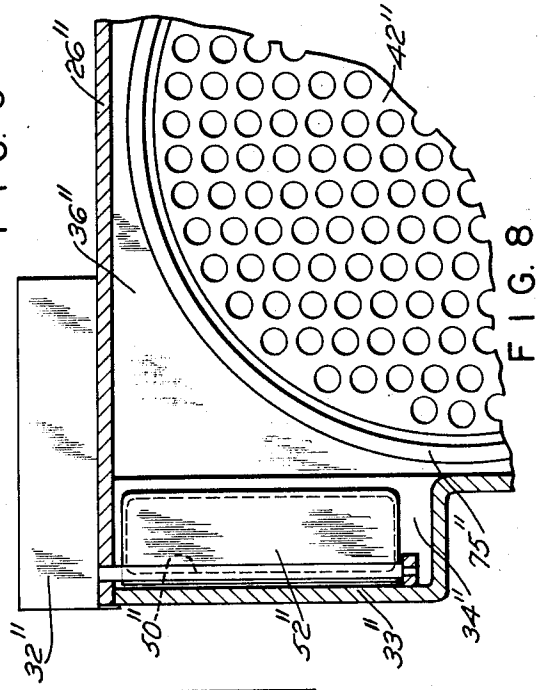


FIG. 8

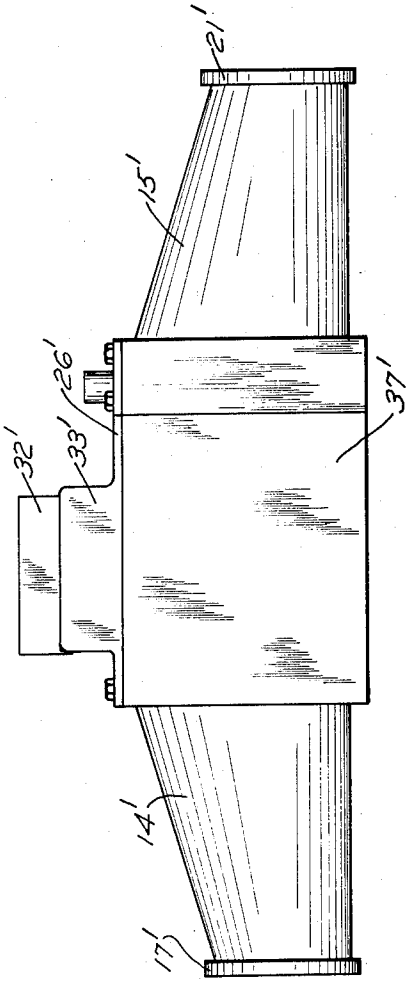


FIG. 5

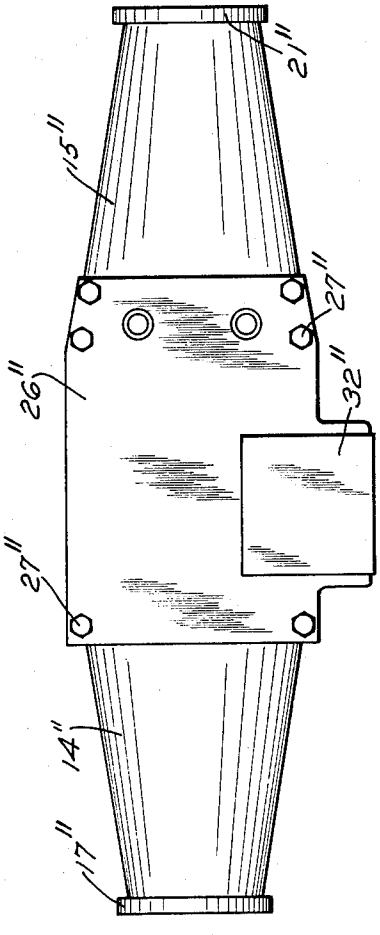


FIG. 7

WASTE DISINTEGRATOR

BACKGROUND OF THE INVENTION

This invention relates to a waste disintegrator and more particularly to a disintegrator to be inserted into the flow of a fluid containing solid particles for the purpose of comminuting those solid particles in the fluid as it is passed therethrough. In the past some comminuting devices reduced the size of the particles in the fluid by cutting or shredding them and leaving them in the waste water. Other devices utilized screens to eliminate easily removed solids and oversized material in the fluid. In these more elementary devices the screen which had collected the solid particles would be hand raked or removed and replaced periodically, while in the more sophisticated machines there would be a mechanically operated rake that would periodically pass across the face of the screen and carry the collected solid particles away to a location where they were ground, crushed, shredded, or merely carried away in bulk.

Waste disintegrator units are utilized in a variety of applications, some of which are in sewage treatment systems, in food and chemical processing, and industrial plants. Today these units are most important due to the need to meet new state and federal pollution control regulations.

SUMMARY OF THE INVENTION

The disintegrator unit is inserted into the flow path of a fluid containing solid particles such as a pipe through which sewage is passed. The unit has a housing which is connected into the pipe, and the fluid is allowed to pass therethrough. Within the unit is a transverse wall having its central area cut away to form a first opening through which the fluid is channeled. A grinding rotor is rotatably mounted in said opening to substantially close the opening. The rotor is fixedly mounted on a shaft extending downstream from the panel that is connected to a hydraulic motor. The hydraulic motor is ideally suited to this application since it eliminates motor failure caused by proximity to liquids and the explosion hazard due to gases in the sewer line. The grinding rotor has its upstream face formed of an abrasive grit with a plurality of apertures of a predetermined size extending axially therealong through which the fluid and solid particles of a predetermined maximum size may pass. In the wet grinding operation, the hydraulic motor rotates the rotor in the path of the passing fluid. Particles of a size too great to pass through the openings in the rotor are held against the rotor by the pressure of the flow and ground into particles of a size small enough to pass therethrough. When the differential pressure across the transverse wall becomes great enough to damage the rotor or motor, a fluid bypass valve automatically opens to relieve this buildup of pressure and diverts a portion of the flow until the rotor and/or motor can handle the differential pressure without damage.

The fluid bypass valve structure is preferably formed in the transverse wall by an area which is cut away to form a second opening in an upper corner portion of the transverse wall. A flapper door is pivotally hinged on the downstream side of the wall. The flapper door has one of its ends fixedly secured on a shaft that passes upwardly through the top of the disintegrator housing, and to this shaft at its top is attached an arm. A coil spring which has its one end secured to the top of the housing and its other end secured to one end of the arm maintains the flapper door closed when the pressure differential across the transverse wall is below a predetermined level. When the pressure differential becomes greater than this predetermined level, the additional pressure on the upstream side works against the spring tension and opens the flapper door to reduce the differential pressure. Also as the door is opened, a microswitch is actuated by the arm to close its circuit and energize a safety alarm. The microswitch may be utilized to shut off the motor driving the hydraulic power pack and also any pumps which may be feeding the unit. Once the pressure differential has reduced, the tension of the spring will automatically close the flapper door and along with this the microswitch has its circuit broken to shut off the safety signal.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view illustrating the waste disintegrator coupled into a pipeline carrying a fluid flow;

FIG. **2** is a partial top plan view looking down on the portion of the cover supporting the flapper door tensioning arm and alarm switch;

FIG. **3** is a partial cross section view looking at the rear of the transverse panel;

FIG. **4** is a partial cross section of the transverse wall and rotor;

FIG. **5** is a side elevation view of a first alternative embodiment of the waste disintegrator;

FIG. **6** is a partial end view illustrating the bypass valve of the first alternative embodiment with selective portions broken away;

FIG. **7** is a plan view of a second alternative embodiment of the waste disintegrator; and

FIG. **8** is a partial end view illustrating the bypass valve of the second alternative embodiment with selective portions broken away.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Looking to FIG. **1** of the drawings, it will be seen that the waste disintegrator is generally designated numeral **10.** It consists of a housing **12** that may have neck portions **14** and **15** extending from its opposite ends. The housing would normally be cast or molded to form an integral member. It could be made of a polyester fiberglass, metal or other material as desired. Neck **14** may have a flange **17** on its upstream edge for connection to a mating flange **18** of pipe **20** or other connections may be used. Neck **15** likewise has a flange **21** at its downstream end that mates with a flange **23** on pipe **24** or other connections. A cover **26** serving as a top wall is secured to the housing **12** as by bolts **27** and is removable so that the internal structural elements may be easily serviced or replaced. Extending upwardly through housing cover **26** are hydraulic motor hoses **28** and **29** which are connected to a hydraulic power pack (not shown) for driving the hydraulic motor **30.** Also mounted atop cover **26** is switch cover **32.**

The structure within switch cover **32** and housing **12** is best understood by referring to FIGS. **2** thru **4.** Positioned within housing **12** is a transverse wall **36** that blocks the flow of fluid through the disintegrator. Its opposite sides stretch between and are in engagement with the opposite side walls **37.** It also extends from the bottom of the housing upwardly to housing cover **26.**

Transverse wall **36** has its central area cut away to form an opening **40.** Grinding rotor **42** is rotatably mounted in the opening to substantially close it. Rotor **42** is mounted on a shaft extending forward from motor **30.** This shaft (not shown) passes through channel cross member **44** which acts to support the shaft and motor. Cross member **44** is attached to transverse wall **36** so that the whole assembly lifts out readily when necessary. The cross member also serves to align rotor **42** with opening **40.** The grinding rotor has a plurality of apertures **46** that pass through the thickness of the rotor, and these are of a predetermined size to control the maximum size of solid particles in the fluid which may pass therethrough. The rotor is made of abrasive silicon carbide granules of diamond hardness set in high epoxy resin reinforced with fiberglass and stainless steel wire which grinding rotor and method of making the same are the subject matter of a co-pending patent application, Ser. No. **185,795,** filed Oct. 1, 1971, now U.S. Pat. No. 3,746,266 dated July 17, 1973. This new and improved rotor is less susceptible to clogging than screens, and it is more effective in comminuting metal, glass or plastics than present day comminutors or disintegrators. Also the use of a rotor eliminates the troublesome shearing action of blades of former disintegrators. The direct drive of the rotor grinder also eliminates gear reducers which were a common cause of ordinary comminutor breakdowns. The grinding unit is additionally located remotely from both its power pack and electrical controls to avoid electrical problems due to proximity of the liquids or gases. It will be easily understood that as the fluid containing solid particles passes through the housing **12,** the fluid is free to pass through the apertures **46,** and those particles too large to pass therethrough are ground up into smaller particles by the wet grinding process. Rotor **42** could also be driven by an electrical motor if it were so desired.

In operation, when an excessive flow of fluid containing particles or a normal flow with an abnormal volume of solids is passed into the waste disintegrator, the grinding rotor cannot process the particles quickly enough, and a buildup of particles across the face of the grinding rotor occurs. This causes an increased pressure drop across the grinding rotor and results in excessive forces being developed on the rotor and/or motor. The same condition can also develop through a gradual accumulation of material over a period of time which clogs the holes of the grinding rotor. In order to alleviate these types of situations, a bypass path is provided which takes the form of an aperture **50** in transverse wall **36** through which the fluid may pass when the differential pressure becomes greater than can be handled by the rotating rotor mounted in opening **46.** Bypass aperture **50** is preferably located in the upper portion of the transverse wall. Normally this aperture is covered by a flapper door or valve **52** that has one of its ends secured to flapper shaft **54.** The lower end of shaft **54** is journalled in bearing block **56** on the downstream side of the transverse wall **36.** The upper end of flapper shaft **54** passes upwardly first through thrust collar **58** and then bushing and liquid seal **59** in the top of the housing, and it has an arm **60** fixedly secured thereto.

The arm **60** is L-shaped with its offset leg portion **62** being directed toward the front of housing **12.** A coil spring **64** has its opposite ends attached to anchors **65, 66** mounted on cover bracket **73** and offset leg portion **62,** respectively, and functions to retain the flapper door in its closed position during the time when the fluid flow from the upstream area is being sufficiently handled by the main central opening **40** and the plurality of apertures **46** in rotor **42,** and no excessive differential pressure has developed. Because of the specific location at which the spring is attached to the arm and also the specific location at which it is attached to the housing cover, when the flapper door has been extended to its maximum position, the amount of extension in spring **64** will be kept to a minimum. In addition, the angle at which spring **64** exerts its pull on the arm **60** as related to the arm itself decreases. The component of force that exerts a closing torque with the flapper door with these two factors considered will be relatively constant throughout the rotation of the door. An ancillary function performed by arm **60** is that when flapper door is in its closed position, it contacts the plunger **70** of switch **72** mounted on bracket **73** affixed to cover **26** by bolts **27.** Under these conditions the switch is opened, and it remains so until the flapper door has been pushed open on the downstream side of the transverse wall **36.** The switch is part of a circuit (not shown) containing a warning signal such as a light, and it is utilized to keep operating personnel apprised to the fact that the differential pressure across the wall **36** has increased to an amount greater than can be handled through the main opening **40.** This circuit may be utilized to shut off the motor driving the hydraulic power pack. Also additional pumps feeding the unit can also be shut down by incorporating their circuit into the switch circuit. It will thus be understood that as the switch arm **60** is pivoted away from microswitch **72,** plunger **70** will rise causing the circuit switch to close. Continued movement of the actuating arm **60** to its dot dash maximum position indicates that it would remain out of contact with the plunger all the while an excess flow of fluid is passing through bypass aperture **50.** While the shutdown of the motor should be automatic, the start-up will normally be manual since the unit may require cleaning before the rotor will pass the required flow. Although not shown in the drawings, a handhole may be formed in the housing of the disintegrator on the upstream side of the rotor to provide access to the interior of the unit for cleaning purposes.

As seen in FIG. **4,** the downstream side of transverse wall **36** has a shroud or flange **75** extending outwardly from its surface. This shroud is located between apertures **40** and **50,** and it functions to prevent any turbulence of the fluid passing through central opening **40** and apertures **46** in the rotor from buildup of a back pressure against flapper door **52.** Also shroud **75** helps to maintain a laminar flow in the fluid passing through said central opening and the apertures in the rotor. The shroud normally extends only around approximately **180°** of the central aperture, but it could be extended around the entire central aperture if desired. Further, to avoid turbulence about motor **30** and its hoses **28, 29,** an enclosure **77** of U shape (see FIGS. **2** and **3**) extends from cross member **44.**

It will be seen that there is provided a simple but effective overflow device for waste disintegrators that will substantially prevent damage to the grinding rotor due to excessive head buildup.

Alternative embodiments of the waste disintegrator are illustrated in FIGS. **5-8** which show the fluid bypass path as being located in a bulge in the housing. The particular location of the bulge is basically a matter of

choice with the embodiment seen in FIGS. **5** and **6** having a bulge **33'** formed in the cover member **26'**, while the bulge **33''** in FIGS. **7** and **8** is on the side wall of the housing. The bulge **33'**, **33''** is of sufficient size to permit a valve means to be positioned therein which takes the form of a flapper **52'**, **52''** pivotally arranged to operate against a wall **34'**, **34''** to close or open the aperture ', **50''** therein through which fluid may flow. The remaining structure of the disintegrator and the valve apparatus is similar to that of the embodiment previously described with the elements in FIGS. **5** and **6** identified by the like numbers but having a prime (') designation, while in FIGS. **7** and **8** the elements are identified by like numbers but having a double prime designation ('').

What is claimed is:

1. A waste disintegrator to be inserted into the flow of a fluid containing solid particles for comminuting the solid particles in fluid as it is passing therethrough comprising:

a housing having a transverse wall that blocks the flow of fluid through the disintegrator,

said transverse wall having its central area cut away to form a first opening through which the fluid is channeled,

comminuting means mounted in said opening to substantially close said opening,

a second opening in said wall to pass the fluid in a path through said waste disintegrator that bypasses said comminuting means,

a normally closed fluid bypass valve means positioned along said path, means maintaining said valve normally closed but responsive to pressure differential across said wall to allow said valve to open.

2. A waste disintegrator as recited in claim **1** wherein said fluid bypass valve means comprises flapper door means pivotally mounted in the said path, spring means having its opposite ends attached to said housing and said flapper door means, respectively, to keep said flapper door closed when the pressure differential is below a predetermined level.

3. A waste disintegrator as recited in claim **2** further comprising a switch in a warning signal circuit, said switch being open when said flapper door is closed and the switch being closed when said flapper door is open, said flapper door means having structure that contacts said switch to open and close said switch.

4. A waste disintegrator as recited in claim **1** wherein a predetermined portion of the transverse wall has a shroud extending from its downstream face, said shroud being located about at least a portion of said first opening, thereby helping to maintain a laminar flow of the fluid after it has passed through said first opening.

5. A waste disintegrator as recited in claim **2** wherein said flapper door means further comprises a shaft passing through a wall of said housing with a portion of its length both above and below said wall of the housing, said shaft having its lower end journalled in a bearing block, the flapper door being fixedly secured to said shaft in the area above said bearing block and below the wall of the housing so that as the flapper door opens and closes, the flapper shaft rotates back and forth.

6. A waste disintegrator as recited in claim **5** wherein said flapper door means further comprises an arm fixedly secured to the portion of the flapper shaft extending above the wall of the housing whereby as the flapper door opens and closes, the arm rotates in and out of contact with the switch.

7. A waste disintegrator as recited in claim **6** wherein said spring means comprises a coil spring whose one end is secured to portion on the arm and whose other end is secured to a portion of the housing at a point adjacent to the axis of the flapper shaft axis whereby when the flapper door is forced open to its maximum open position, the amount of elongation of said spring is insignificant and the angle of pull diminishes to thus maintain a relatively constant spring tension that continues to urge the flapper door closed.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,815,827 Dated June 11, 1974

Inventor(s) Earl H. Bradley

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

In column 5, line 8, please delete " ' " and insert --50'--.

Signed and sealed this 1st day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

USCOMM-DC 60376-P69
★ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.