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Gallauresi et al.

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[54] **MACERATING PUMP WITH MEANS FOR PREVENTING BLOCKAGES**

[75] Inventors: **Alfred P. Gallauresi,** Solvay; **Walter V. Kurgan,** Manlius, both of N.Y.

[73] Assignee: **Oberdorfer Foundries, Inc.,** Syracuse, N.Y.

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[21] Appl. No.: **188,048**

[52] **U.S. Cl.** **241/46.02,** 241/46.11

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

[58] **Field of Search** ..... 241/46.02, 46.06, 241/46.08, 46.11, 46.17, 257 G

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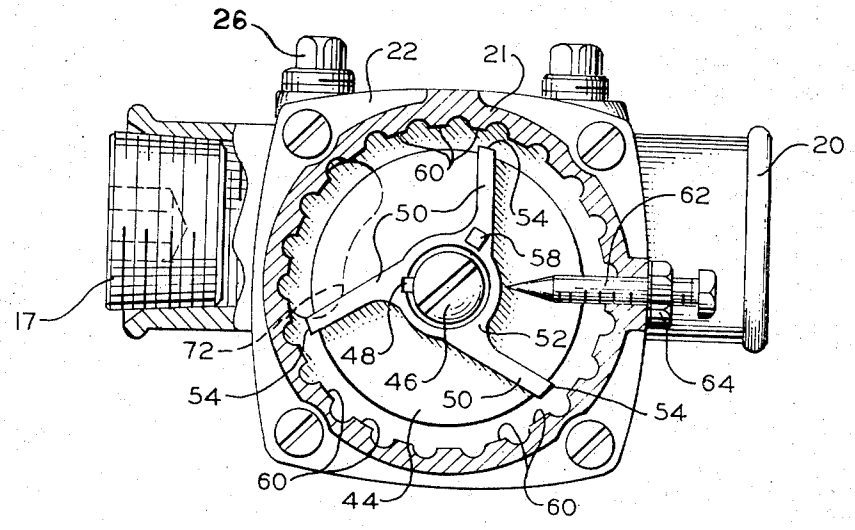
Primary Examiner—Granville Y. Custer, Jr.

Attorney—F. P. Keiper and Charles S. McGuire

[57] **ABSTRACT**

A pump including means at the inlet for grinding maceratable solids into a pumpable slurry. One or more stripper picks or sharp projections extend radially inward adjacent the inlet side of a rotating grinder wheel having a sharp edged boss projecting outwardly to rotate in close proximity to the stationary point of the pick, thereby preventing rotational blockage by sewage masses entwining on the rotating wheel or stationary blockage to flow in advance of the wheel.

14 Claims, 6 Drawing Figures



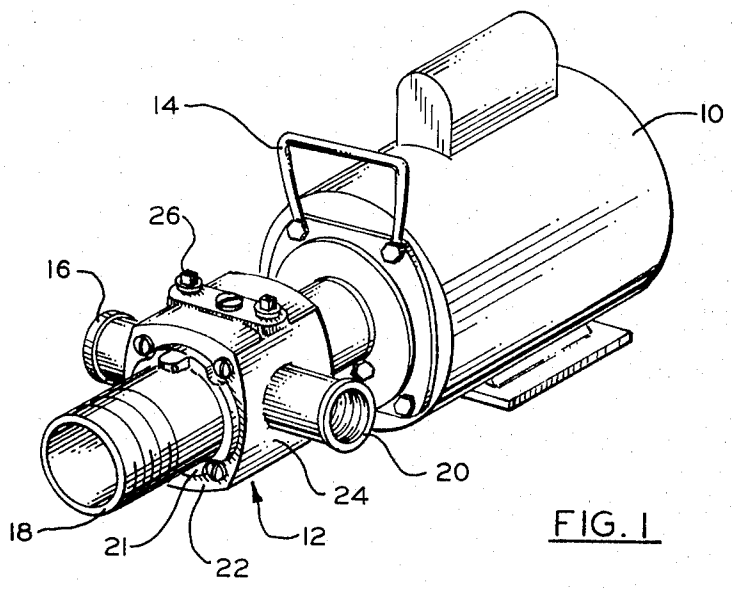


FIG. 1

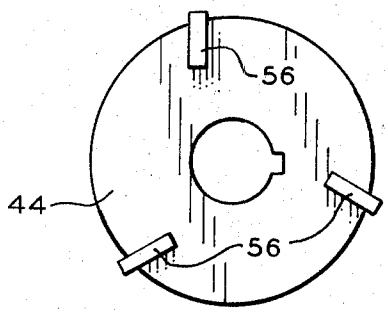


FIG. 5

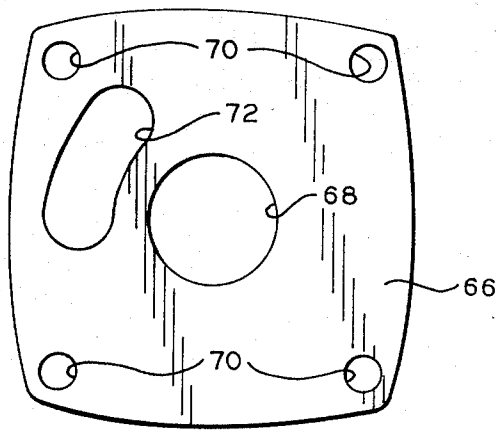


FIG. 6

Alfred P. Gallanresi
and
Walter V. Kurgan
INVENTORS

BY Charles S. McGuire
ATTORNEY

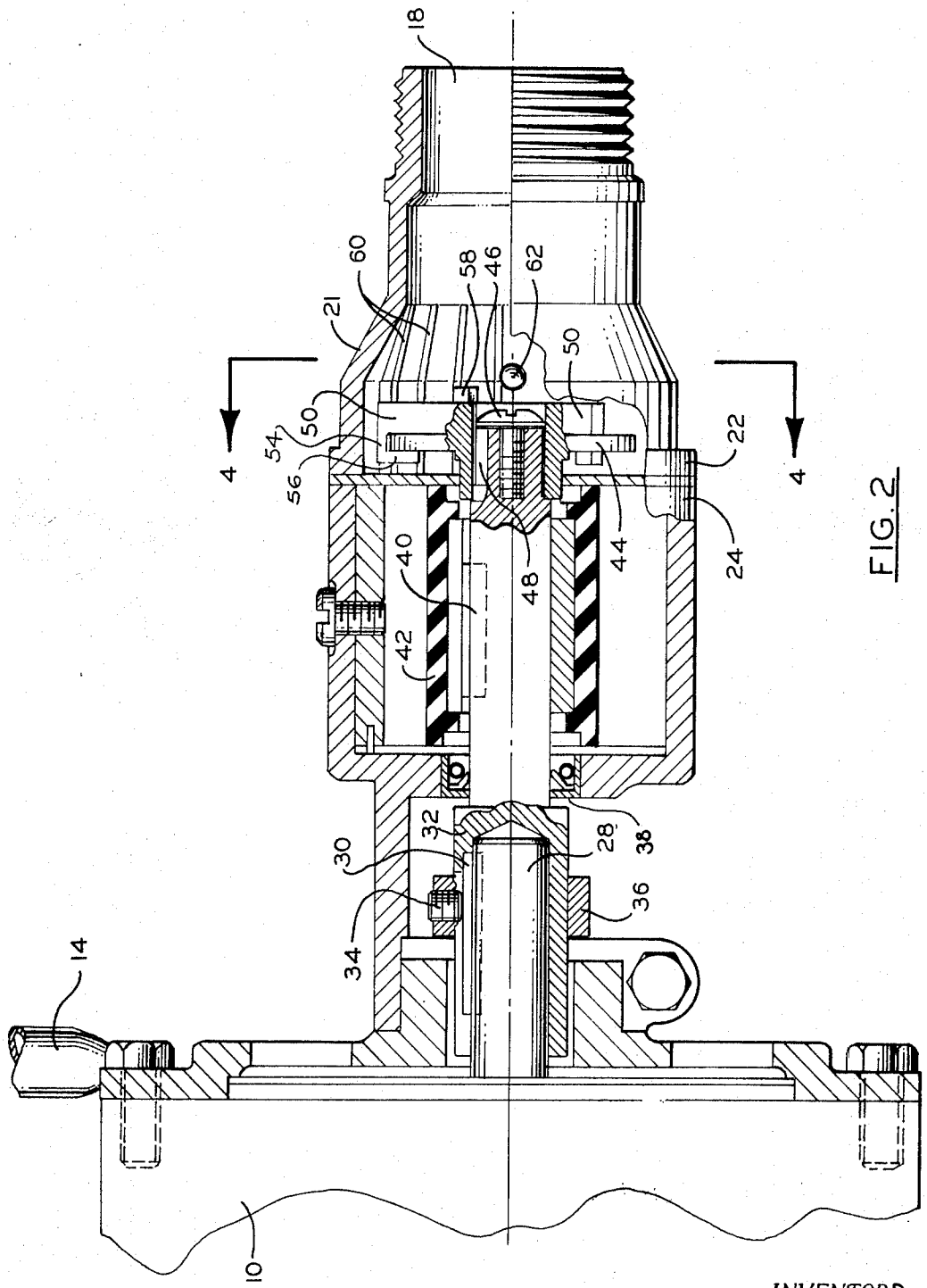


FIG. 2

INVENTORS
Alfred P. Gallaureci
BY Walter V. Keegan
Charles S. McGuire
ATTORNEY

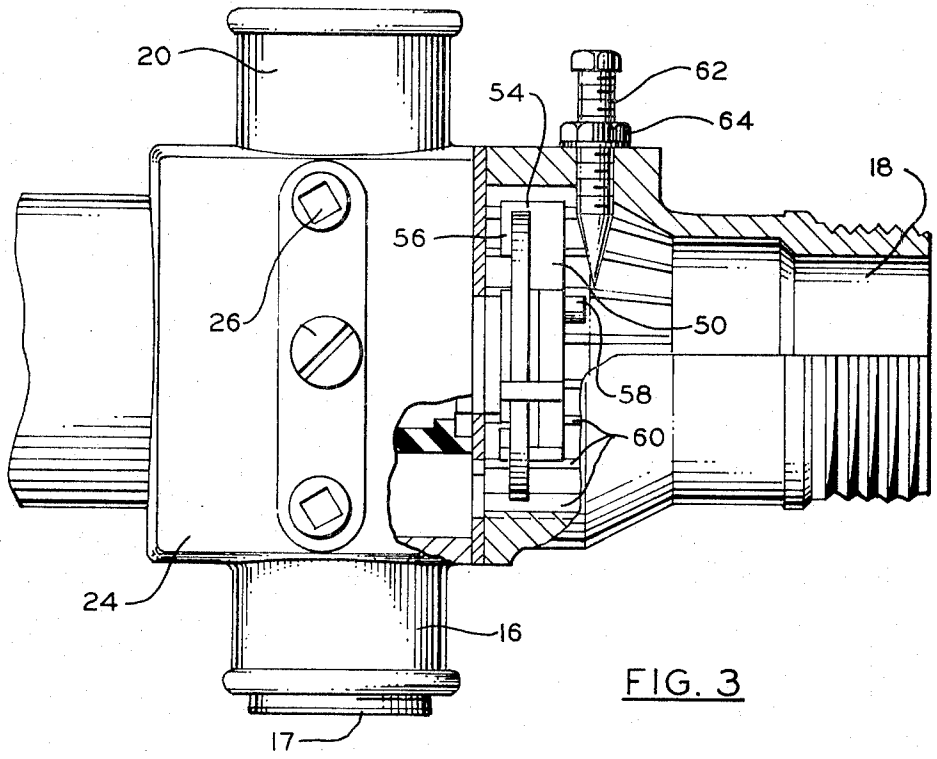


FIG. 3

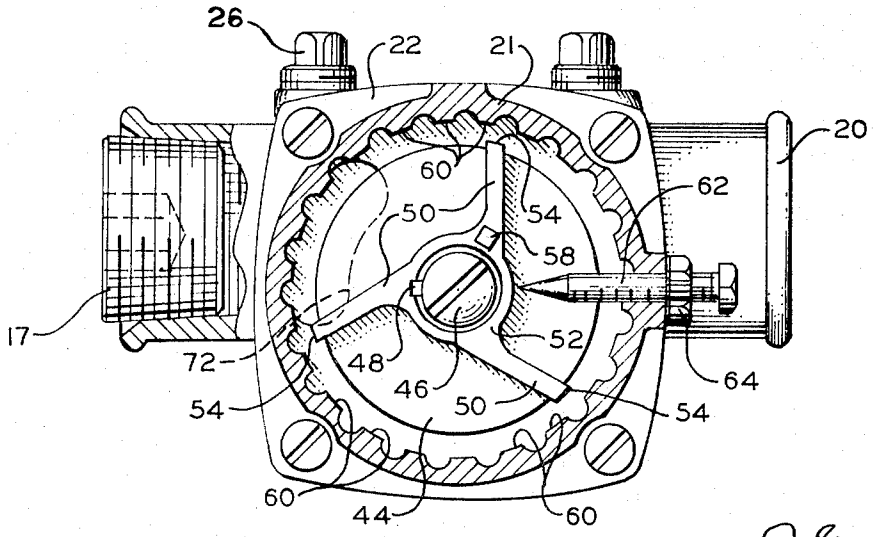


FIG. 4

Alfred P. Gallanese
and
Walter V. Keegan
INVENTOR.

BY Charles S. McGuire
ATTORNEY

MACERATING PUMP WITH MEANS FOR PREVENTING BLOCKAGES

The present invention relates to pumps with grinding or macerating means and, more particularly, to means combined with a macerating pump to prevent or retard blockages.

In many types of sewage handling and disposal systems it is desirable to cut or grind the solids found in raw sewage into a slurry capable of being handled by pumps, particularly those of the non-positive displacement type, e.g., rubber impeller, centrifugal and helical rotor. The ground-up sewage slurry can then be pumped through small, economical sized piping and for relatively long distances such as would be required to reach private or municipal sewage disposal facilities located a distance away from marine dockside pump-out stations, mobile home holding tank dump stations, and the like.

The raw sewage to be handled could include sanitary napkins, which often cause blockages in grinding units employed with macerating pumps in either of two ways: (1) they tend to mat and form a stationary mass in the cover entrance region of the grinding unit, thereby blocking flow, or (2) they become entwined on the rotating grinder wheel causing a rotating blockage and also interfering with or completely stopping flow.

A principal object of the present invention is to provide a grinding unit for a sewage pump which includes mechanical means for preventing both of the aforementioned types of blockages.

Another object is to provide grinding unit having a rotating cutting wheel with cooperable stationary elements which combine to form an essentially blockage-free unit adapted to handle virtually all types of raw sewage.

In a more general sense, the object of the invention is to provide an efficient yet economical grinding unit with simple and rugged blockage-preventing means.

The above and other novel features of the invention will appear more fully hereinafter from the following detailed description when taken in conjunction with the accompanying drawings. It is expressly understood that the drawings are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, references being had for this purpose to the appended claims.

In the drawings, wherein like reference characters indicate like parts:

FIG. **1** is a perspective view of the exterior of a grinding unit-pump-motor of a type wherein the present invention may be incorporated;

FIG. **2** is a fragmentary side elevation, partly in section, of the assembly of FIG. **1**;

FIG. **3** is a plan view with the grinder unit in partial section;

FIG. **4** is a front view in section on the line **4—4** of FIG. **2**;

FIG. **5** is an elevational view of the rear side of the grinder wheel; and

FIG. **6** is a front view of the separator plate.

For illustrative purposes, the macerating unit is shown and described in combination with a rubber impeller pump. The unit is not limited to use with pumps of this type, however, being equally well suited for combination with many other types of pumps. The pump itself, and the motor or other means providing power for operation thereof, may be of conventional design.

In FIG. **1** the entire unit is shown with electric motor **10** having a shaft to which the pump, indicated generally by reference numeral **12**, is coupled. The unit may be permanently installed in a desired location, or be carried from place to place by means of handle **14**. Inlet port **16** is normally used when no macerating unit is provided, but is closed by plug **17** (FIG. **4**) when used in the application of the present invention, axial inlet **18** being used instead. Outlet port **20** may be of considerably smaller diameter than inlet **18** since the latter must be adapted to contain relatively large pieces of solid raw sewage, while the outlet receives this material only after it has been finely ground and converted to a slurry. From inlet port **18**, inlet body **21** gradually increases in diameter to the point where it joins integral inlet cover **22**, which is bolted to the end of pump body **24**. Plug **26** may be removed from the opening in pump body **24** and replaced by a vacuum-sensitive automatic shutoff switch in conventional manner.

Turning now to FIG. **2**, motor shaft **28** is rotationally coupled by key **30** to shaft extension **32** and affixed thereto by set screw **34** in collar **36**. Shaft extension **32** passes through seal **38** into the chamber within pump body **24** where it is secured by key **40** to impeller **42**. The impeller is symmetrically designed, having a plurality of flexible blades of equal length extending radially from the cylindrical central part through which the shaft extends. Impeller blades are bent as they pass over the inserted cam located at the top of the chamber. As each blade bends it occupies space previously containing liquid. The liquid is thus displaced in a squeezing action.

Macerator wheel **44** is secured by screw **46** and key **48** to the end of shaft extension **32** for rotation therewith. On the side facing inlet **18**, wheel **44** has three ridges or vanes **50** extending outwardly from the face of the wheel in a generally radial direction from a similarly raised central, annular portion **52**. Vanes **50** extend around the edges of wheel **44**, forming peripheral extensions **54**, and for a portion of the distance from the edge toward the center on the opposite side of the wheel. The vanes on the rear side are shown more clearly in FIG. **5**, denoted by reference numeral **56**. Extending from annular portion **52** is a substantially square projection or boss **58** having sharp side and top edges. The edges of vanes **50** and **56**, and peripheral extensions **54** also form sharp cutting edges to macerate sewage as it passes between the inlet and pump sections, as explained later in more detail.

The inner wall of inlet body **21** is cast with longitudinal ridges **60**, the edges of which are machined to form a plurality of stationary, sharp cutting edges. The grooves between ridges form transfer passages through which the sewage passes as it is macerated. The edges of ridges **60** are in close proximity to the rotating edges of peripheral extensions **54** of macerator wheel **44**.

Extending through an opening in inlet body **21** is stripper pick **62** having a sharp point positioned in close proximity to boss **58** as the latter rotates past the pick point. Preferably, pick **62** and the opening through which it extends are threaded to permit adjustment of the extent to which the pick extends into inlet body **21**. Locking means such as nut **64** may be provided for releasably fixing the position of the pick, and such means

may be arranged to prevent movement of the pick into the inlet body far enough to contact boss **58**.

Mounted between inlet cover **21** and pump body **24** is separator plate **66**, shown in FIG. **6**. Shaft extension **32** passes through central opening **68** in the plate, and openings **70** are provided for passage of the bolts which secure the inlet cover to the pump body. In passing from the inlet into the pump, the sewage must pass through transfer port **72** in plate **66**, which must be mounted with the transfer port in the correct hydraulic position, as shown in FIG. **4**, to allow the sewage to enter the suction side of the pump chamber.

As sewage is pumped through the unit, the cutting edges of vanes **50** macerate sewage impinging on the inlet side of wheel **44** due to suction flow velocity. The cutting edges of peripheral projections **54** macerate sewage passing between the periphery of wheel **44** and the inner wall of inlet body **21** in conjunction with the stationary cutting edges of ridges **60**. The cutting edges of vanes **56** macerate sewage by close proximity to separator plate **66**, and in conjunction with the sharp edge of transfer port **72**. To prevent stationary sewage blockages and rotational blockage of the macerator wheel, projection boss **58** located on rotating wheel **44** and stationary pick **62** are provided. The size, location and proximity of the rotating projection boss and stationary pick are important to insure that both of the aforementioned types of blockages are prevented. If the projection boss is too small, or the distance between the pick point and boss at the closest point during rotation of wheel **44** is too small, the stationary mass tendency will dominate and a stationary mass and blockage will form. Conversely, if excessive in dimension or spacing, rotating masses will tend to entwine on the macerator wheel with eventual blockage of rotation thereof. The pick point should be spaced on the order of one thirty-second inch both radially and axially from the closest point on boss **58** when the latter is at the rotational position of closest proximity to the pick.

Pick **62** and separator plate **66** are preferably of stainless steel, and inlet body **21**, pump body **24** and macerator wheel **44** of bronze or other corrosions resistant alloy. Although only one pick and boss are provided in the disclosed and preferred embodiment, more than one of either or both may be utilized so long as the proper balance of size and spacing is maintained.

What is claimed is:

1. A macerating pump unit having means to prevent blockages, said unit comprising in combination:

a. power driven pump means having an inlet and outlet;

b. macerating means within said inlet including a rotary cutting wheel disposed transversely to the direction of flow through said inlet, and having peripheral edge portions cooperable with adjacent stationary portions of said inlet to macerate solids passing therebetween;

c. at least one projecting boss on the face of said wheel toward said inlet and located intermediate of the peripheral edge and center thereof, said boss terminating at a point substantially spaced from said edge; and

d. at least one stationary element extending from an inner wall of said inlet to terminate in a sharp point in close proximity to the closest point passed by said boss as the latter rotates with said wheel.

2. The invention according to claim **1** wherein said pump comprises a non-positive displacement type pump.

3. The invention according to claim **2** wherein said pump comprises a rubber impeller pump.

4. The invention according to claim **1** wherein said inlet is circular in cross section and said stationary element extends radially thereinto.

5. The invention according to claim **1** wherein the position of said point is adjustable.

6. The invention according to claim **5** wherein said stationary element comprises a stripper pick engaged in a threaded opening in said inlet wall, and the position of said point is adjustable by advancing or retracting said pick through said opening.

7. The invention according to claim **6** wherein said point is positioned less than one-quarter inch from the closest point passed by said boss as the latter rotates with said wheel.

8. The invention according to claim **7** wherein said point is spaced both axially and radially from said closest point passed by said boss.

9. In a pump having inlet and outlet passages leading to and from a pumping chamber, macerating means positioned in said inlet passage comprising:

a. a rotatable cutting wheel disposed transversely to the direction of flow through the inlet passage;

b. a solid plate disposed across said inlet passage between said wheel and pumping chamber, and having an opening through which all flow from must pass in entering the pumping chamber, said opening being significantly smaller than the inlet passage; and

c. a stationary member extending substantially radially into the inlet passage and terminating in a sharp point closely adjacent a cutting member extending from said wheel on the opposite side from said plate.

10. The invention according to claim **9** and further including stationary cutting edges on the inner wall of the inlet passage cooperable with said wheel to macerate solids passing between the periphery of the wheel and said inner wall.

11. The invention according to claim **10** wherein said wheel includes cutting edges on both the front and rear surfaces, those on the rear surface being closely adjacent said plate.

12. The invention according to claim **11** wherein said wheel further includes cutting edges on the periphery thereof.

13. The invention according to claim **12** wherein said cutting member comprises a projecting boss on said front surface of said wheel, displaced from the center thereof.

14. The invention according to claim **13** wherein said boss is substantially square and passes within less than one-quarter inch of said point during rotation of said wheel.

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