United States Patent

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[54] SEWAGE COMMINUTOR INSTALLATION

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[51] **Int. Cl.** **B02c 13/282**

[58] **Field of Search** 241/46, 220, 221, 277, 278; 210/152, 173

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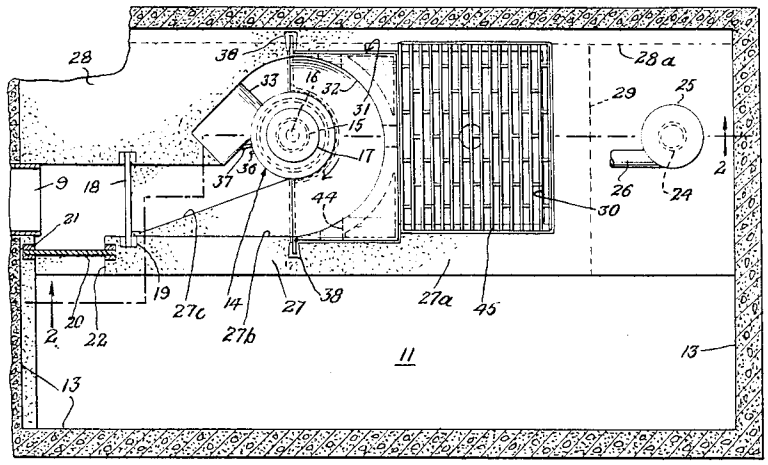
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[57] **ABSTRACT**

A basin and housing structure is disclosed for use with a generally cylindrical comminutor rotatable about an upright axis. The comminutor housing is generally scroll shaped to define a flow passage of progressively diminishing width wrapped around the cylindrical comminutor, and at least a major portion of the comminutor housing comprises a wall structure which is removable so as to provide improved or increased access to the comminutor and thereby facilitate maintenance and service work, especially when replacing comminutor comb bars, shear bars and cutting teeth.

12 Claims, 8 Drawing Figures



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SHEET 1 OF 2

Fig. 1.

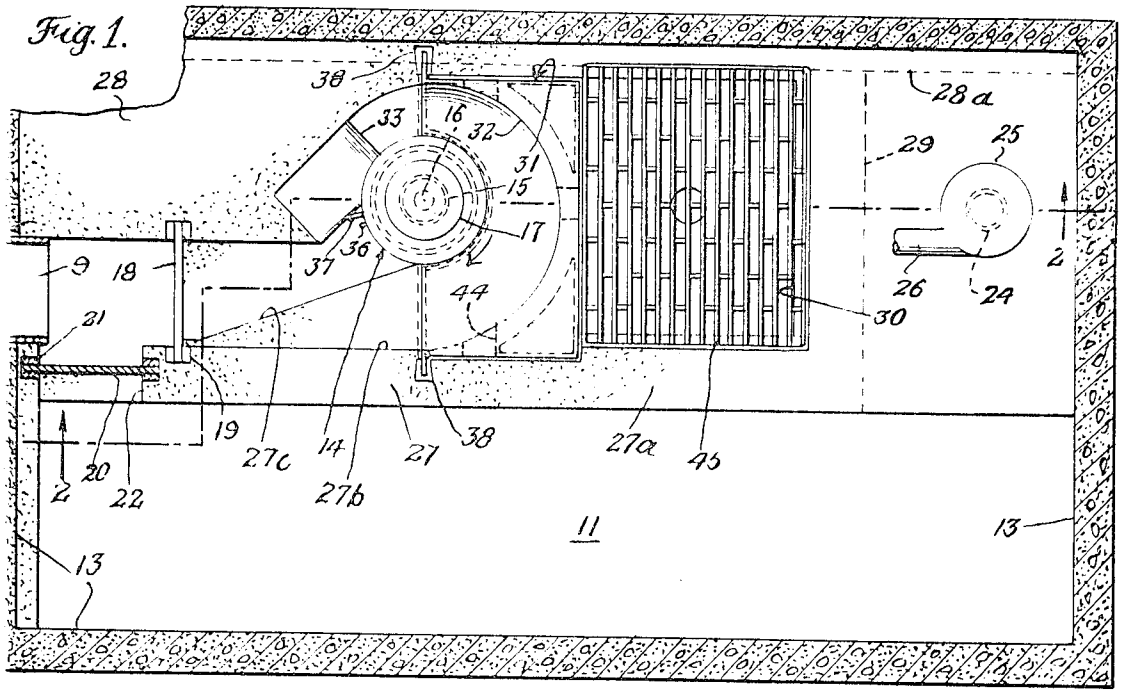
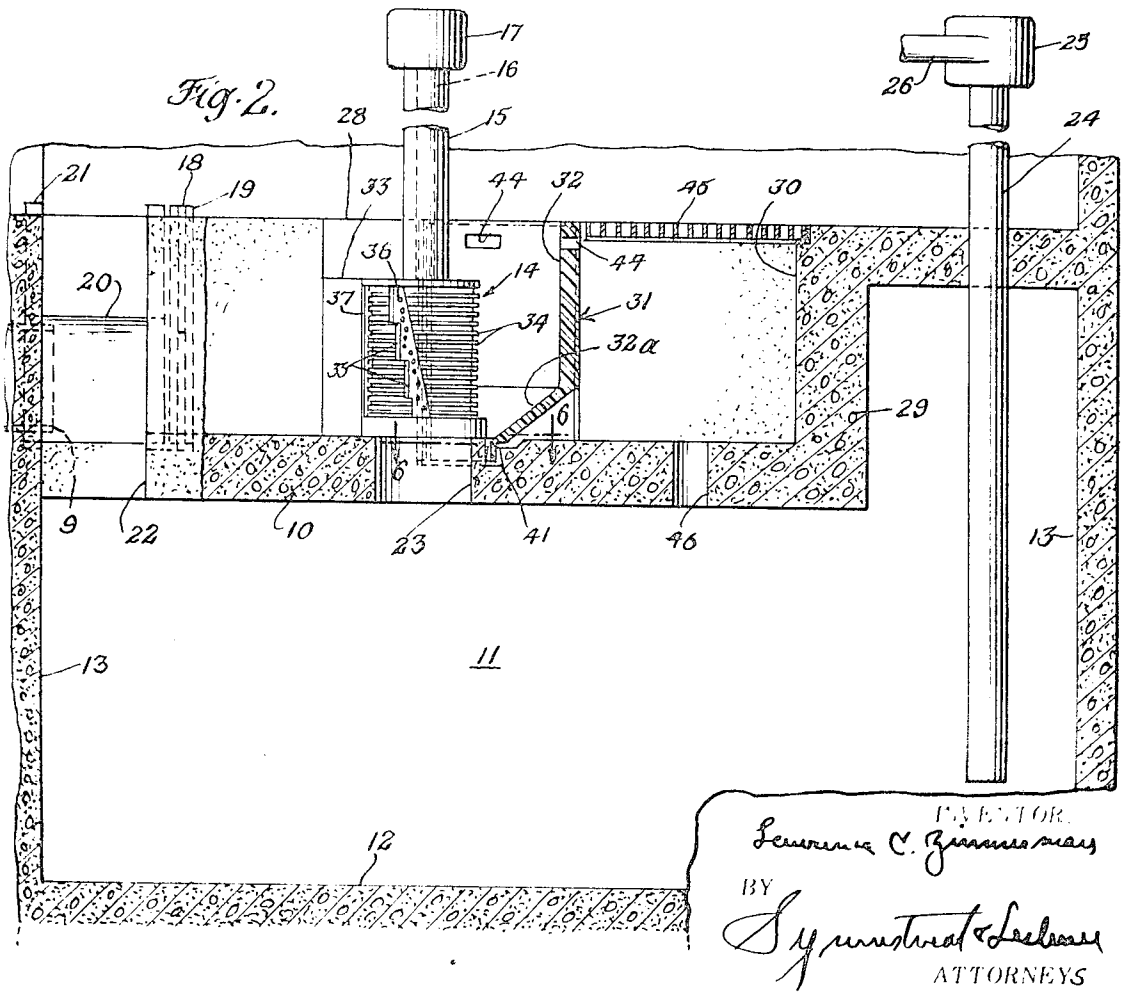
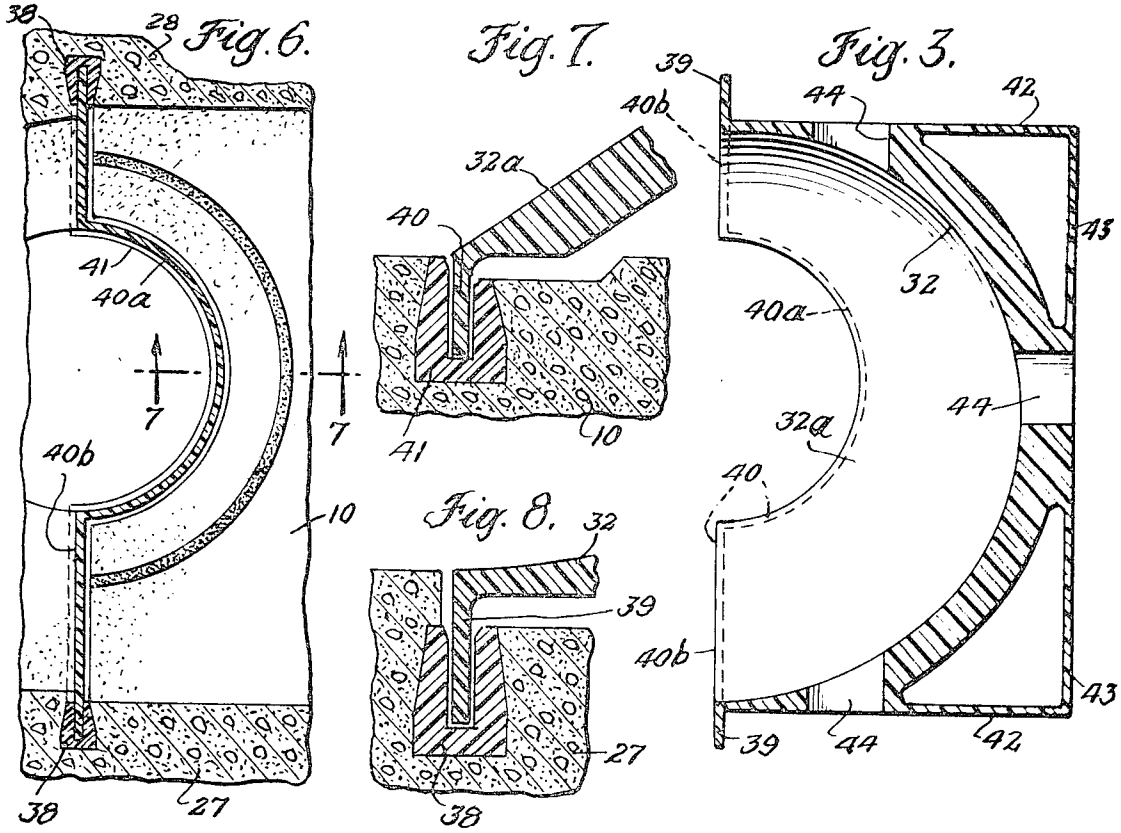
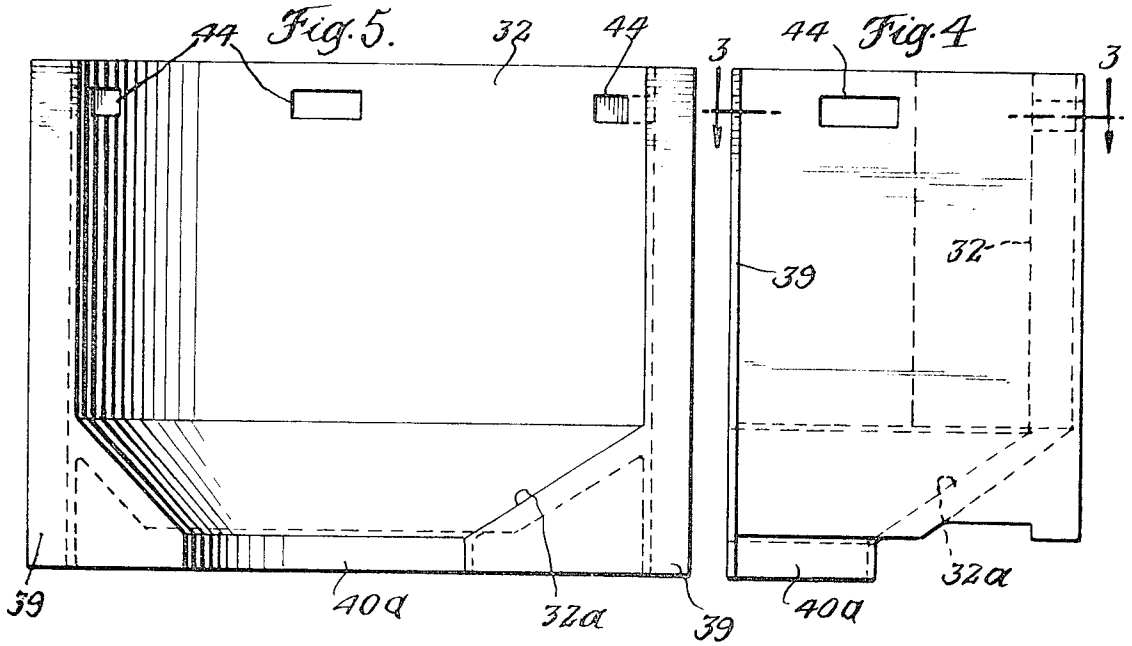


Fig. 2.



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SEWAGE COMMINUTOR INSTALLATION

This invention relates to a sewage comminutor installation of the type in which a generally cylindrical comminutor is rotatively driven about an upright axis.

An installation of this kind is commonly provided at the input end of a sewage disposal plant or system in order to break up or comminute any large pieces of materials carried with the sewage, even including relatively hard materials such as stones. It is of importance to effectively comminute this sewage in advance of its entrance into other portions of the equipment, such as pumps, valves and other devices included in the disposal system.

In a typical installation of this kind, the comminutor is located at the low point of the gravity drainage system, and the sewage is delivered into the large or input end of a scroll shaped housing or basin extended around the upright cylindrical comminutor. The scroll-shaped flow passage distributes the sewage around the cylindrical wall of the rotatable comminutor. The comminutor is commonly formed of a multiplicity of spaced arcuate rings, and carries shearing and cutting elements, as will be described, and the flow passes between these rings into the interior of the comminutor and thence axially downwardly through the lower end of the comminutor into a wet well or sump. The sewage is then pumped from the sump into other portions of the disposal plant for treatment in known ways.

In a comminutor of the kind referred to, stationary notched or "comb" bars are positioned adjacent to the periphery of the cylindrical comminutor at one side of the scroll passage, and the shear bars and cutting teeth carried by the comminutor cooperate with the comb bars as the comminutor rotates in order to break up and comminute any sizable solids carried in the sewage.

Because of the abrasive character of many of the solids carried in the sewage, the comb bars, shear bars and cutting teeth are subject to severe abrasion and wear and it is necessary from time to time, for instance several times each year, to replace these cutting elements in order to maintain the effectiveness of the comminutor installation. Service work of this kind is a major problem in the upkeep of a comminutor installation. Heretofore it has been common practice with many installations of the kind referred to to arrange for the lifting of the entire comminutor mechanism out of the basin or housing in which it normally operates in order to gain access to the cutting elements. For this purpose many installations of the kind referred to have heretofore provided special lifting mechanisms in the form of hoists conveniently available to or permanently installed above the comminutor mechanism. Servicing a comminutor in this manner is difficult, not only because many of these installations utilize comminutors of great weight, but in addition it is a difficult problem to accurately handle and reseat or reposition the removable or mechanical parts, after the service work has been accomplished.

One of the major objectives of the present invention is to greatly simplify servicing and maintenance of comminutors of the kind referred to, this being accomplished in accordance with the present invention by providing a temporary sewage bypass around the comminutor and by forming at least a large part of the scroll housing for the comminutor as a removable wall structure which can readily be taken out and replaced and which, when removed provides adequate work space for effecting the servicing, without the necessity for lifting the comminutor out of its normal operating position, and even without disturbing its normal mounting in any manner.

In considering another aspect of the invention, it is pointed out that in many comminutor installations the basin and scroll housing surrounding the comminutor are formed of concrete which is cast in place at a level just above the sump. In order to effect uniform distribution of the sewage around the comminutor, it is desirable to employ a housing wall quite accurately formed to provide a scroll passage surrounding the comminutor. The concrete must be cast in forms or molds which are hand made at the site of the installation and which are very difficult to properly shape, because of the complex geometry involved in providing the desired scroll contour.

According to the present invention, instead of forming the entire scroll housing by the use of handmade forms and casting concrete at the site of the installation, a separate and separately preformed wall structure is accurately constructed under controlled factory production conditions, and such preformed wall structure is then mounted in the desired position in relation to the cylindrical comminutor. In this way the problems and inaccuracies of site construction of the scroll are substantially eliminated.

How the foregoing objects and advantages are attained, together with others which will occur to those skilled in the art, will be clear from the following description referring to the accompanying drawings, in which:

FIG. **1** is a plan view of a typical comminutor installation, illustrating the use of the preformed removable scroll wall structure of the present invention;

FIG. **2** is a vertical sectional view taken as indicated by the line **2—2** as applied to FIG. **1**;

FIG. **3** is an enlarged plan view with parts in horizontal section, showing features of construction of the preformed removable housing or wall structure of the present invention, this view being taken as indicated by the line **3—3** on FIG. **4**;

FIG. **4** is an elevational view taken from one edge of the structure shown in FIG. **3**;

FIG. **5** is a front or face view of the structure shown in FIG. **3**;

FIG. **6** is an enlarged horizontal sectional view taken as indicated by the line **6—6** on FIG. **2**;

FIG. **7** is a further enlarged view of a flanged and grooved guide used at the lower edge of the removable wall structure; and

FIG. **8** is a transverse sectional view through a flanged and grooved guide employed at the edges of the removable wall structure for the purpose of guiding the displacement movement when the structure is removed and inserted.

In FIGS. **1** and **2** a general arrangement is illustrated incorporating some of the major components which are commonly associated with a comminutor installation and in considering the following description referring to the general features of the installation, it should be kept in mind that those features are subject to wide variation to meet local conditions. Thus the general arrangement shown in FIGS. **1** and **2** is to be understood to be illustrative of one such arrangement by way of example.

Such a comminutor installation is ordinarily made at a low point in the sewage collection and disposal system, to which the sewage may flow by gravity, being delivered into the comminutor installation through a pipe or main, the delivery end of which is shown in FIGS. **1** and **2** at **9**. The main **9** delivers the sewage into a basin formed above the concrete wall **10** (see FIG. **2**) which overlies the wet well or sump **11**, suitable base and sidewalls **12** and **13** being constructed to define the sump. The cylindrical rotative structure of the comminutor, generally indicated at **14**, is positioned within the basin above the wall **10** and is mounted by means of bearing supports within the tubular structure **15** surrounding the comminutor shaft **16** which is extended upwardly to a point well above the comminutor so as to cooperate with a drive motor diagrammatically indicated at **17**.

A vertically displaceable gate **18** mounted in guides **19** provides for opening and closing of the entranceway between the main **9** and the flow passage in the basin surrounding the comminutor **14**. Another similar gate **20** vertically movable in guides **21** controls the flow from the main **9** through the bypass channel **22** which opens into the sump **11**.

By this system of gates **18** and **20**, the flow of the sewage may be directed either through the basin and thus through the comminutor, or through a bypass **22** directly into the sump **11**. In the position of these gates shown in FIGS. **1** and **2**, i.e., with the gate **18** open and the gate **20** closed, the flow from the main proceeds into the comminutor basin and, after passing

through the slots in the sidewall of the comminutor, proceeds downwardly in the interior of the comminutor and thence through the opening **23** into the underlying sump **11**.

The sewage is delivered from the sump **11** by means of the discharge pipe **24** having its lower end projecting well down into the sump, the discharge being effected by means of a pump diagrammatically indicated at **25** from which the sewage is carried to other portions of the disposal plant through the connection **26**.

In accordance with prior practice in making an installation of the kind described above, the basin and the housing for the comminutor is formed by painstakingly and manually building up a concrete form having the shape necessary to define a mold surface having the desired scroll contour, so that by the pouring of concrete into the form, the desired scroll-shaped flow passage will be provided. As seen in FIG. **1** such passage has a large end communicating with the inlet chamber with which the main **9** is connected, and the passage progressively diminishes in width throughout at least one-half of the circumference of the comminutor, and preferably throughout an angular range of the order of 250°–280°.

Instead of this complex form construction and concrete casting operation, the present invention contemplates the building of forms and casting of concrete only throughout a portion of the normal angular dimension of the scroll passage, concrete walls for this purpose being indicated in FIGS. **1** and **2** at **27** and **28**. The walls **27** and **28** join the base wall **10** of the basin at the bottom and project upwardly, preferably somewhat above the top of the cylindrical comminutor, as clearly shown in FIG. **2**. Moreover, the walls **27** and **28** are carried rearwardly beyond the comminutor, as indicated at **27***a* and **28***a*, and an additional and transverse wall **29** is provided in order to define a dry well **30** lying behind the comminutor. These walls **27***a*, **28***a* and **29** need not have any complex or compound curvature, in view of which they may readily be formed by simple and simply constructed forms or molds.

In order to complete the scroll passage around the comminutor, the present invention contemplates the use of a separately preformed wall structure which is shown in detail in FIGS. **3**, **4** and **5** and which is generally indicated in FIGS. **1** and **2** at **31**. This preformed wall structure is provided with an internal scroll shaped surface **32** providing a flow passage of progressively diminishing width, wrapped around the comminutor, the large end of this passage being in communication with the entranceway of the basin and thus also with the main **9** when the gate **18** is open.

Certain nonrotative structure associated with the rotative cylinder of the comminutor, as indicated at **33**, bridges or closes the scroll-shaped flow passage at the narrow end thereof. Although various details of the comminutor drum and the associated equipment need not be considered in detail herein as they form no part of the present invention per se and are well known in this art, it is to be observed that the rotative comminutor cylinder or drum is made up of arcuate bars **34** which are spaced from each other axially of the cylinder to provide the flow passages for the sewage from the basin into the interior of the cylinder and thence downwardly through the opening **23** in the wall **10** and into the sump **11**. The drum structure also includes replaceable shear bars **35**, as well as cutting teeth **36** which cooperate with nonrotative comb bars **37** which are mounted in association with the nonrotative structure **33**. The cutting teeth have portions projecting from the surface of the drum in positions to pass between the teeth of the comb bars, and the shear bars **35** cooperate with the comb bar teeth, the cutting or comminutor action of both the teeth and the bars being of importance in comminuting solids carried with the sewage. With the arrangement shown in FIG. **1** the direction of rotation of the comminutor is indicated by the arrow.

At opposite ends of the transverse diameter of the comminutor drum the walls **27** and **28** are provided with grooved guides **38—38** which cooperate with flanges **39—39** which project at opposite ends of the wall structure **31** (see particularly FIGS. **1**, **3**, **6** and **8**). The interengagement of the flanges **39—39** in the grooves guides **38—38** provides for proper positioning of the removable wall structure **31** and also provides for guided displacement movement of the removable wall structure when it is removed from and inserted into its proper position surrounding the comminutor.

Along the lower front edge of the removable wall structure there is a downwardly extending lip or flange **40** adapted to engage in a recess or slot formed in a guide **41** mounted in the floor **10** of the basin (see particularly FIGS. **2–5** and **7**).

As above mentioned, the removable wall structure has an inside surface **32** in the form of a scroll, thereby providing a scroll shaped passage wrapped around the comminutor. As best seen in FIGS. **2–5**, the lower portion of this wall surface **32** is inclined inwardly and downwardly as indicated at **32***a* to the region immediately adjacent to the periphery of the cylindrical comminutor, the depending flange **40** being provided not only around the circular lower edge of this wall, as indicated in FIG. **3** at **40***a*, but also along the adjoining straight edges as indicated at **40***b* in FIGS. **3** and **6**.

If desired the rear corners of the removable wall structure **31** may be provided with corner wall panels **42—42** and **43—43** (see FIG. **3**). The panels **42** may lie adjacent to the upright walls **27** and **28** of the concrete structure and thereby aid in stabilizing the removable wall in its proper position.

Near the upper edge of the removable wall structure **31** hand holes **44** are provided in order to facilitate removal of the wall structure from and reinsertion of the wall structure into its normal operating position.

From FIGS. **1** and **2** it will be observed that a grating **45** overlies the dry well **30**, this grating being removable to provide convenient access for a workman to enter the dry well. The floor of the dry well is provided with a drain **46** so that any sewage which enters the dry well will be discharged downwardly into the underlying sump **11**.

In connection with the operation of the arrangement described above, it is first pointed out that under normal operating conditions the gate **20** is closed in order to shut off the bypass, and the gate **18** is open so that the sewage main **9** delivers into the entranceway or larger end of the scroll passage wrapped around the comminutor. The drum of the comminutor if rotationally driven in the direction indicated by the arrow in FIG. **1**, and this action serves to cut and break up lumps and various solids to a degree providing for passage of the particles between the arcuate elements **34** of which the drum is formed. The sewage then flows into the interior of the cylindrical drum and downwardly into the sump **11** from which it is pumped as by the pump **25**, to be delivered to other treatment equipment of the plant. It is not contemplated that the flanges **39** and **40** fit tightly in the slotted or grooved guides **38** and **41**. Such tight fit is not needed and in the event of any liquid leakage past the lower edge and the upright edges of the removable wall structure **31**, such liquid entering the substantially dry well **30** will merely flow out of the drain **46** into the sump **11**.

After operation of the equipment, usually for a period of some months, the cutting or comminuting elements including the comb bars **37**, the shear bars **35** and the cutting teeth **36**, even when those elements are formed of specially hard or specially hardened metals, will become worn to such an extent as to require replacement in order to continue any reasonably effective comminuting action. At that time the bypass gate **20** is opened and the gate **18** is closed, so that the entire flow of sewage bypasses the comminutor temporarily. During that interval the grating **45** is removed and the removable wall structure **31** is lifted out, whereupon workmen may enter the dry well **30** and effect replacement of the cutting parts without in any way disturbing the normal mounting or positioning of the comminutor. In this way the servicing work may be accomplished with a minimum of interruption in the normal operation and the flow of sewage may again be returned to its normal path, by closing the bypass gate **20** and opening the gate **18**.

It will be understood that the angular extent of the removable wall structure **31** may be greater or less than the 180° employed in the illustrated embodiment, but the use of a removable wall structure extended throughout about 180° is preferred.

With the removable wall structure preformed to the exact curvature desired for the scroll, irregularities and resultant inefficient operation of the comminutor are avoided, it being unnecessary to rely upon manual construction of a mold or form of highly complex geometry at the site of the installation.

The portions of the flow passages adjoining the portion defined by the prefabricated wall structure are relatively easy to cast, because they need not be extensively developed in curvature.

Indeed in the entrance or large end of the flow passage the principal sidewall need only be a flat or planar surface as indicated at **27***b* in FIG. **1**, and the lower portion which is inclined downwardly, for instance to the line indicated at **27***c* may also comprise nothing more than a planar surface. At the small end of the scroll, the portion of the passage extended beyond the passage provided by the preformed wall structure is relatively short, and may be shaped to be concentric with the comminutor drum without appreciable loss in efficiency. Moreover, even if this short terminal portion of the passage is formed with some slight inaccuracies this would not extensively impair the operation of the installation as a whole.

In the fabrication of the removable wall structure **31** it is contemplated that glass fiber reinforced polyester resin materials be employed. Such materials may readily be shaped to desired contours by use of an appropriately contoured master mold or form. Such materials, i.e., the glass fiber reinforced resin materials and especially the polyester resin materials, are also highly desirable in the formation of the removable wall structure, because such materials have high abrasion resistance and thus will not deteriorate extensively as a result of the flow of the sewage and entrained particles flowing through the system. This is also a highly suitable type of material for use in forming the slotted or grooved guides **38** and **41**.

Still further the use of the glass fiber reinforced resin materials is also highly desirable for the removable wall structure because these materials have relatively light weight, especially as compared with various metals which would be capable of offering equal abrasion resistance. A removable wall structure made in this way can readily be handled manually, without the necessity of resorting to lifting or hoisting equipment. This factor is of still further importance in accelerating the overall servicing operation, it being of great importance to minimize the time during which the sewage bypasses the comminutor.

I claim:

1. A housing for a generally cylindrical sewage comminutor rotatable about an upright axis, said housing being generally of scroll form defining a flow passage of progressively diminishing width wrapped around the cylindrical comminutor and having an inlet at the large end thereof, at least a major portion of said housing comprising a wall structure mounted for removal by displacement axially upwardly with respect to the comminutor.

2. A housing as defined in claim **1** in which the lower portion of said removable wall structure is downwardly and inwardly inclined to a lower edge closely conforming with the cross sectional shape of the cylindrical comminutor.

3. A housing as defined in claim **1** in which said wall structure has a scroll length extended around about one-half of the circumference of the comminutor.

4. A sewage comminutor installation for a generally cylindrical comminutor rotatable about an upright axis and discharging into a subjacent sump, comprising a basin for the comminutor having a bottom wall adjacent the lower end of the comminutor and above the level of the sump, the basin including a comminutor housing of generally scroll form defining a flow passage of progressively diminishing width wrapped around the cylindrical comminutor and having an inlet at the large end, and a dry well offset at one side of the comminutor, at least a major portion of the comminutor housing comprising a wall structure lying between the comminutor and the dry well and being mounted for removal by displacement axially upwardly with respect to the comminutor thereby providing access to the comminutor from said dry well.

5. An installation as defined in claim **4** in which the dry well is provided with means for drainage into the sump.

6. A housing for a generally cylindrical sewage comminutor rotatable about an upright axis, said housing defining a flow passage wrapped around the cylindrical comminutor and having an inlet for sewage to be comminuted, at least a major portion of said housing comprising a removable wall structure having mounting flanges projecting at its upright edges to provide for removal by displacement axially upwardly with respect to the comminutor.

7. A housing as defined in claim **6** and further having handgrips formed adjacent the upper edge of said removable wall structure to provide for manual upward displacement thereof.

8. A housing as defined in claim **6** and further having a mounting flange projecting downwardly from the lower edge of said removable wall structure.

9. A sewage comminutor installation for a generally cylindrical comminutor rotatable about an upright axis and discharging into a subjacent sump, comprising a basin for the comminutor having a bottom wall adjacent the lower end of the comminutor and above the level of the sump, the basin including a comminutor housing of generally scroll form defining a flow passage of progressively diminishing width wrapped around the cylindrical comminutor and having an inlet at the large end, a dry well offset at one side of the comminutor, at least a major portion of the comminutor housing comprising a wall structure lying between the comminutor and the dry well and being mounted for removal by displacement axially upwardly with respect to the comminutor thereby providing access to the comminutor from said dry well, and grooved guides at the upright edges of said removable wall structure cooperating with the edges thereof for guiding the axial displacement movement of the removable wall structure.

10. A housing for a generally cylindrical sewage comminutor rotatable about an upright axis, said housing being generally of scroll form defining a flow passage of progressively diminishing width wrapped around the cylindrical comminutor and having an inlet at the large end thereof, at least a major portion of said housing comprising a wall structure mounted for removal by displacement axially upwardly with respect to the comminutor, and grooved guides adjacent the upright edges of the removable wall structure, the wall structure having guide flanges projecting from its edges into said grooved guides.

11. A housing as defined in claim **10** in which the removable wall structure has a flange projecting downwardly at its lower edge, and a grooved socket receiving the downwardly projecting flange.

12. A housing as defined in claim **10** in which the housing is formed of fiber reinforced polyester resin material.

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