July 20, 1965 J. N. COATS 3,195,761

DIGESTER CAP ASSEMBLY (SWING CAP)

Filed Feb. 9, 1962 4 Sheets-Sheet 1

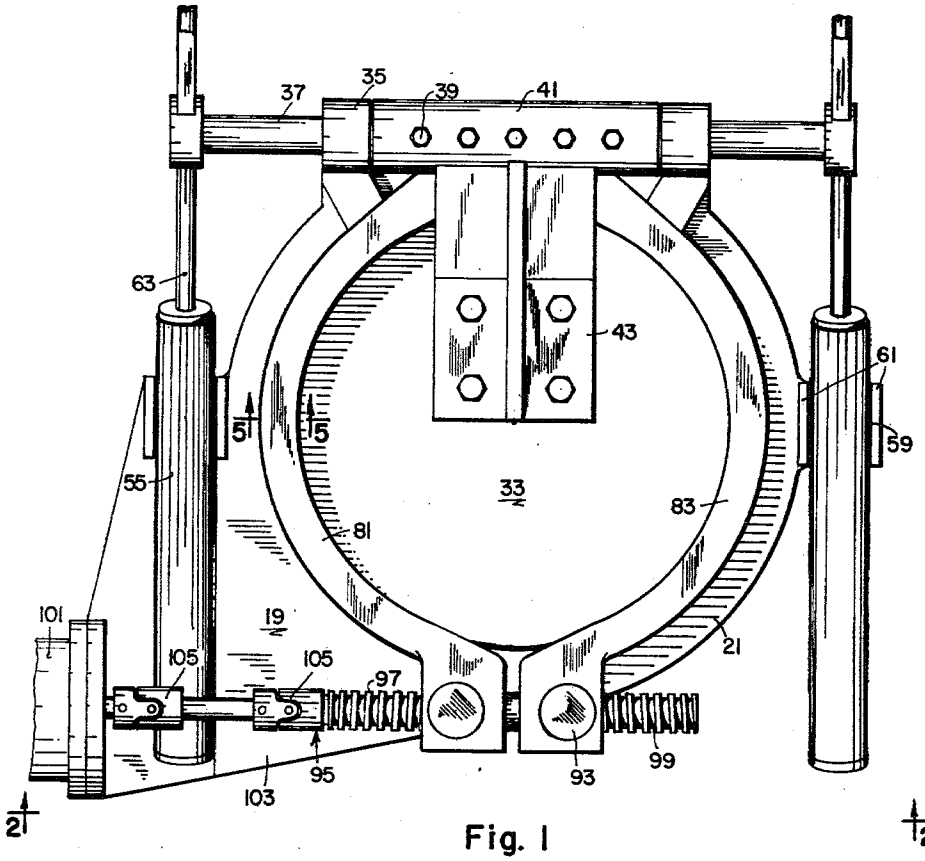

Fig. 1

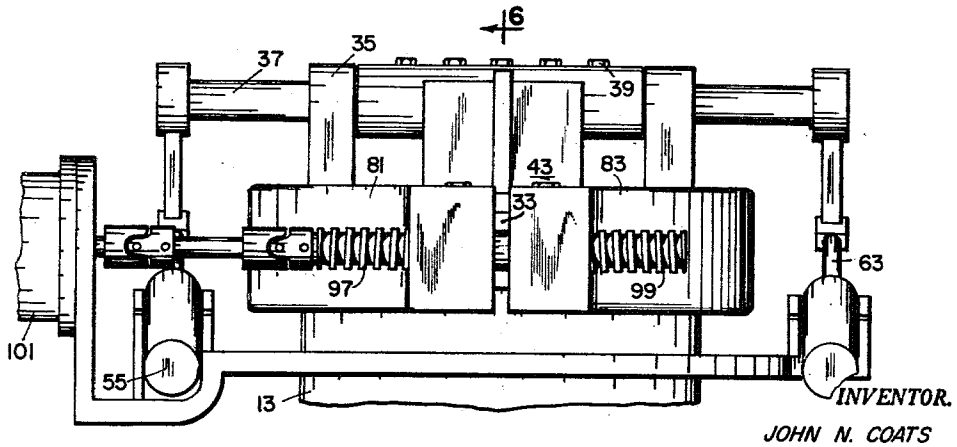

Fig. 2

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DIGESTER CAP ASSEMBLY (SWING CAP)

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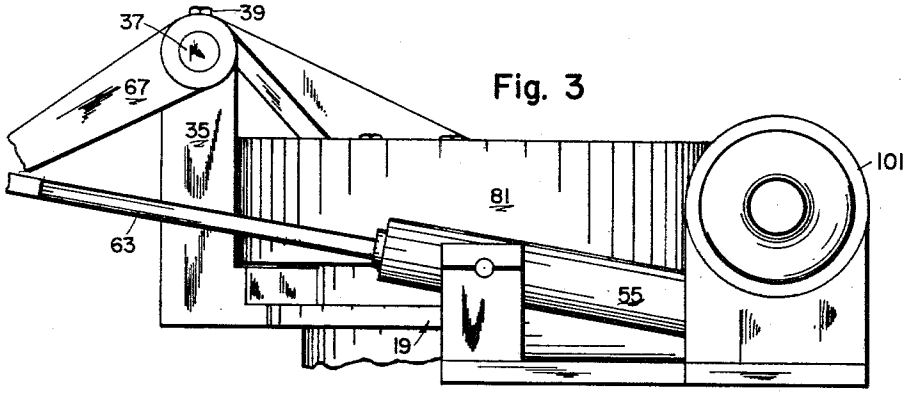

Fig. 3

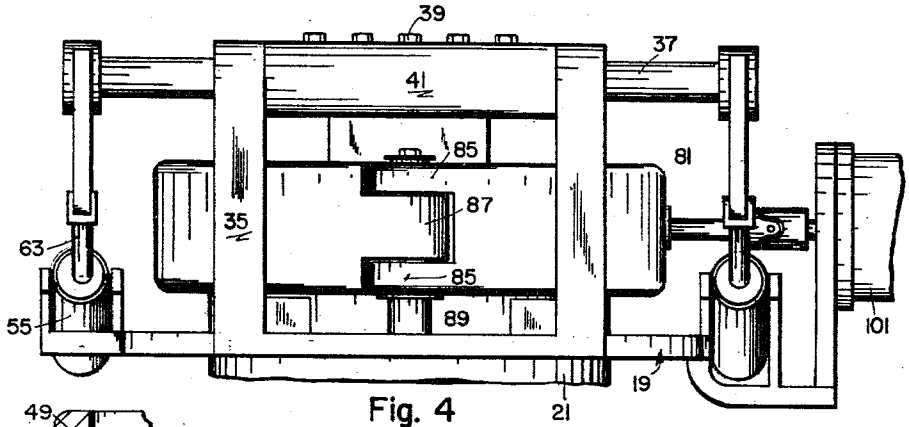

Fig. 4

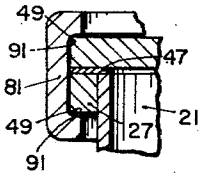

Fig. 5

Fig. 6

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DIGESTER CAP ASSEMBLY (SWING CAP)

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Fig. 7

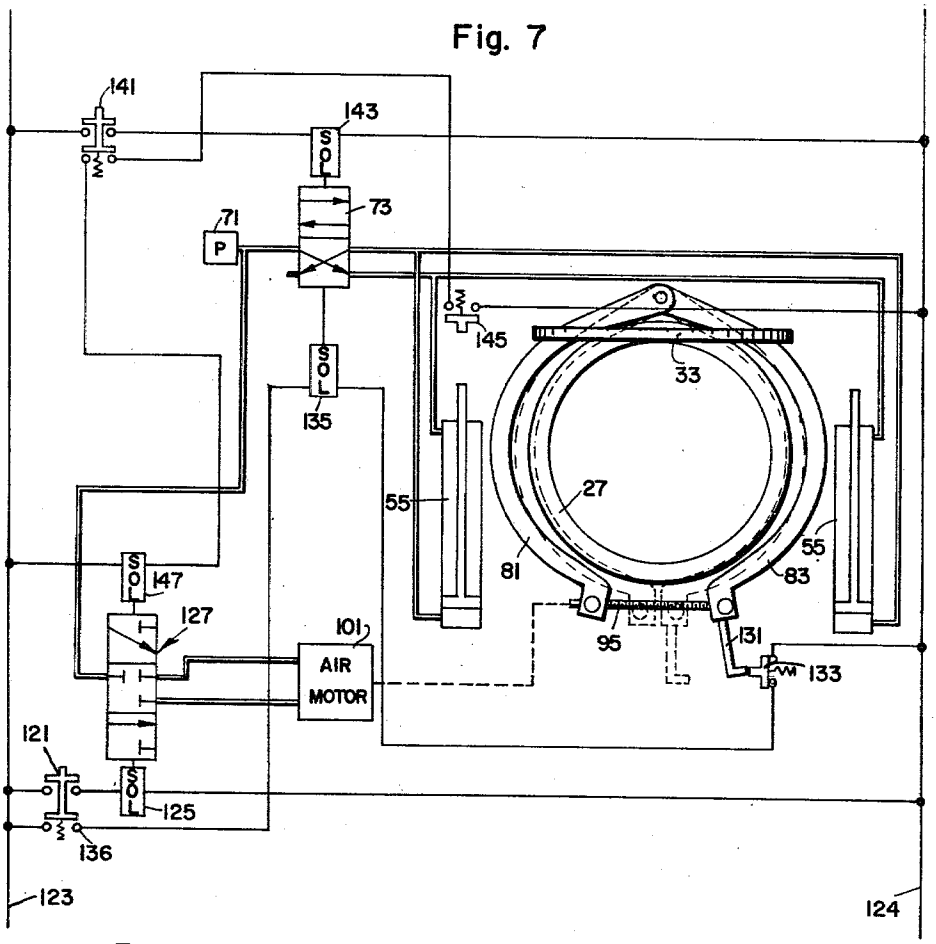
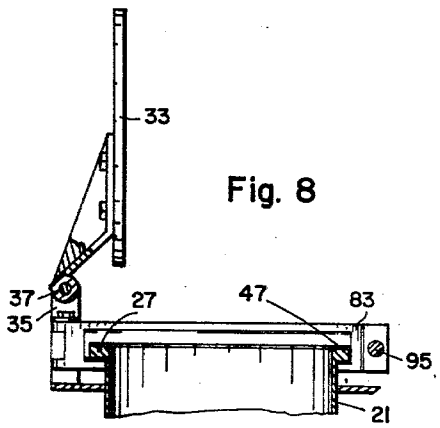


Fig. 8



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DIGESTER CAP ASSEMBLY (SWING CAP)

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Fig. 9

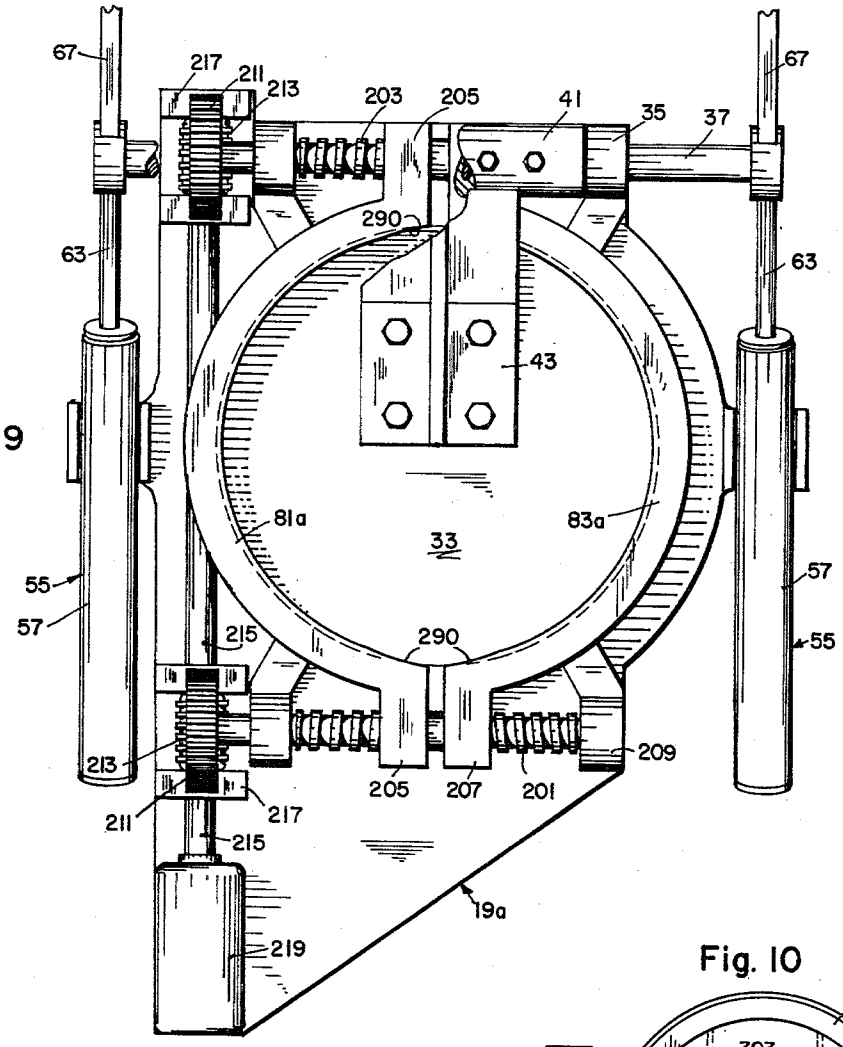


Fig. 10

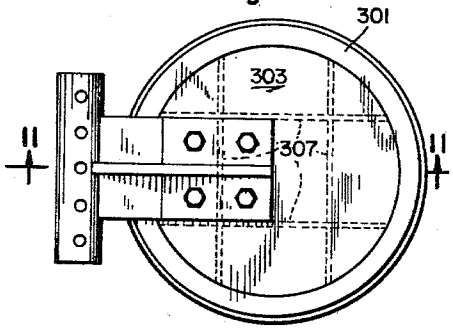
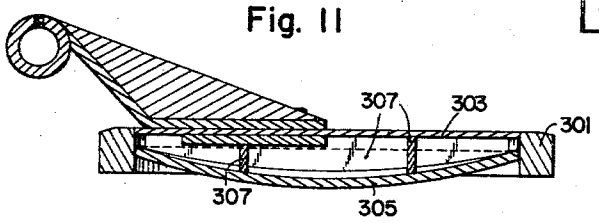


Fig. 11



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DIGESTER CAP ASSEMBLY (SWING CAP)

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Filed Feb. 9, 1962, Ser. No. 172,247
5 Claims. (Cl. 220—36)

This invention relates to closure means for a digester and in particular to a digester cap assembly.

Prior closures have been defective in several respects. The multiple swing bolt type is not only expensive but requires considerable time to open and close. The type having a simple latch to clamp a hinged cap closed has not proved satisfactory in high pressure installations because the clamping pressure is applied only at one, or at most, two places. Hence leakage sometimes occurs.

It is a main object of the present invention to provide a digester cap assembly of simple construction yet which applies a clamping pressure all around the cap or closure member.

A further object is to provide such an assembly that is power operated, and particularly to provide such an assembly in which there are separate power means for opening and closing the cap or closure member and separate power means for applying a clamping force to the cap or closure member in its closed position.

Another object is to provide a cap assembly that may be readily applied to an existing digester, and particularly a power operated cap assembly that may be so applied.

Various other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a plan view of a cap assembly of the invention;

FIG. 2 is a front view, taken in the direction of the arrows 2—2 in FIG. 1;

FIG. 3 is a side view 90° from that shown in FIG. 2;

FIG. 4 is a rear view of the assembly;

FIG. 5 is a fragmentary section taken along line 5—5 of FIG. 1;

FIG. 6 is a vertical mid-section taken along line 6—6 of FIG. 2;

FIG. 7 is a schematic diagram of the control system;

FIG. 8 is a diagrammatic view showing the cap open;

FIG. 9 is a plan view of a modified form of invention;

FIG. 10 is a plan view of a modified cap; and

FIG. 11 is a vertical section taken along line 11—11 of FIG. 10, on an enlarged scale.

Referring to FIGS. 2 and 6 of the drawings, a conventional digester 11 has an upwardly extending neck 13 having at its upper end a radially outwardly extending flange 15 (FIG. 6). The flange 15 is conventionally formed with slots 17 to receive the conventional swing bolts. The neck 13 and flange 15 provide a mouth for the digester through which wood chips or other material to be digested may be dumped.

The closure or cap assembly of the invention comprises a base structure 19 of plate like form fitting around and welded to a tubular riser or neck extension 21 intermediate the length of such extension. The extension has a lower annular flange 23 secured by bolts 25 to the flange 15. Secured to the upper end of the extension 21 is an annular flange 27. The extension 21 and flange 27 provide a mouth for the digester through which material may be dumped into the digester.

A closure member in the form of a circular cap 33 (FIGS. 1 and 6) is pivotally mounted on the base structure by means of a pair of standards 35 fixed to the base structure 19 and pivotally receiving a shaft 37. The shaft extends through and is fixed by set screws 39 to a knuckle or sleeve 41. The knuckle or sleeve 41 is fixed to an arm 43, in turn fixed to the top of the cap 33 in spaced relation to but adjacent one edge thereof. This leaves the margin of the cap free. Between the flanges is a corrosive resistant gasket 47 which may be free and separate from the flanges, or secured to one of them.

The outer corners 49 (FIG. 5) of the flanges 27 and 45, that is the corners of the flanges remote from one another, are curved for a purpose to presently appear.

The cap is raised and lowered by a pair of double acting fluid operated piston and cylinder units 55 having cylinders 57 pivotally mounted by trunnions 59 (FIG. 1) on blocks 61. The blocks 61 are carried by the base structure 19. The piston rods 63 of the units are pivotally connected at 65 (FIG. 6) to a pair of cranks 67 secured to the shaft 37.

Referring to FIG. 7, a source 71 of air under pressure is connected to the units 55, and the supply of air to and from the units is controlled by a two position solenoid valve 73. When the valve is in one position, air pressure is supplied to the units to contract them to open the cap. When the valve is in its second position, the units are extended to close the cap.

For clamping the cap 33 against the flange 27, a quick disconnect coupler is provided. The coupler includes two generally semicircular arms 81 and 83 (FIG. 1) having interfitting knuckles 85 and 87 (FIGS. 4 and 6) at one set of ends received by an upright hinge pin 89. The pin 89 is fixed to the base structure 19 in a position centrally beneath the shaft 37. A spacer 90 (FIG. 6) disposes the knuckles at the desired level.

The two arms 81 and 83 are concave on their inner surfaces (FIG. 5) providing grooves of a size to receive the flanges 27 and the margin of the cap 33. The inner surfaces are formed so as to provide spaced camming surfaces 91 for engaging the corners 49 of the flange and cap and camming the cap tightly against the flange. The camming surfaces are obliquely related to the plane of the coupler.

Each of the ends of the arms 81 and 83 remote from the hinge pin is provided with a swivel nut 93 (FIG. 1) rotatably mounted in the end of its arm for movement about an axis perpendicular to the plane of the coupler.

Threadedly received by the nuts 93 is a screw 95 having left hand threads 97 threadedly received by nut 93 of arm 81 and right hand threads 99 threadedly received by the nut 93 of the arm 83.

An air motor 101 is mounted on an extension portion 103 of the base structure 19 and is connected by two universal joints 105 to the screw 95.

FIG. 7 shows a control system for the cap and coupler. A cap opening and closing switch 121 has its upper contacts connected between supply lines 123 and 124 and in series with a solenoid 125 of a three position solenoid valve 127. The movable valve member of the valve is biased to a central cut off position. When switch 121 is closed, solenoid 125 moves the valve member in a direction to connect the air source 71 to the air motor 101 so as to rotate the screw 95 in a direction to move the arms 81 and 83 from the closed broken line positions in FIG. 7

to the open full line positions. In the open positions of arms 81 and 83, a lug 131 on the arm 83 closes a switch 133 which is normally biased to open position. The switch 133, when closed, energizes a solenoid 135 for the valve 73 to actuate the valve to supply air from the source 71 to the cylinders 57 in a manner to cause the cylinder units 55 to contract and open the cap to the full line position shown in FIGS. 7 and 8.

The operator will then release the switch 121, which opens to open the lower contacts 136, which are in series with solenoid 135 and switch 133. Thus, the solenoid 135 is de-energized, and the opening cycle is complete.

To close the cap, a double pole switch 141 is depressed to energize a solenoid 143 of the valve 73. This reverses the valve to cause the cylinders units 55 to extend to lower the cap 33. As the cap reaches its fully lowered position, a switch 145 on the base structure 19 is closed by a lug (not shown) on one of the piston rods 63. Switch 145 is in series with the lower contacts of switch 141 (which are now closed) so that a solenoid 147 of the valve 127 is energized to shift the valve member in a direction to drive motor 101 so as to close the arms 81 and 83 to clamp the cap 33 tightly down on the flange 27.

FIG. 9 shows a modified and preferred form of the invention in which there are two parallel screws 201 and 203 threadedly extending through ears 205 on clamp arm 81*a* and ears 207 (one being shown) on clamp arm 83*a*. The screws have right and left hand threads as shown, are journaled in eyes 209 on a base structure 19*a*.

The screws extend beyond the left hand eyes, as the parts are shown in FIG. 9, and carry worm gears 211 meshing with worms 213. The worms are fixed on a drive shaft 215 which is journaled in lugs 217 on the base structure and is driven by an air motor 219 mounted on the base structure 19*a*.

The remaining structure is the same as in FIGS. 1–8, and similar reference numerals are employed to indicate this.

When it is desired to open the cap 33, the motor 219 is energized to drive the screws 201 and 203 in directions to separate the arms 81*a* and 83*a* a distance to clear the cap 33. Then the piston and cylinder units 55 are energized to pivot the cap to its open position. In closing the cap the cap is first swung to its closed position, and then the arms 81*a* and 83*a* are moved to engage the cap and underlying flange to cam the cap tightly against such flange. The arms 81*a* and 83*a* may be relieved at 290 for sooner clearance of the cap.

FIGS. 10 and 11 show a modified form of cap which includes an annular piece 301 surrounding and fixedly secured to a flat disk 303 and to an underlying doubly curved (dished) disk 305. Cross braces 307 are secured between the disks 303 and 305.

Upwardly acting pressure on the disk 305 tends to flatten it, but any flattening that occurs will tend to secure the cap tighter, because flattening will expand the annular piece 301 and jam it tighter against the camming surfaces of the coupler.

Having described the invention in what is considered to be the preferred embodiment thereof, it is desired that it be understood that the invention is not to be limited other than by the provisions of the following claims.

I claim:

1. A digester cap arrangement comprising a cap for closing the mouth of a digester;
- first fluid operated power means for moving said cap between a closed operative position relative to said mouth and an open inoperative position relative to said mouth;
- second fluid operated power means independent of said first means for clamping said cap against said mouth;
- a common source of fluid under pressure for said first and second power means,
- valve means for directing fluid under pressure from said source first to one power means and then to the other to effect a desired sequence of operation,
- said second means comprising a pair of arcuate arms for embracing said cap and a portion of said mouth;
- and means for clamping said arms against said cap and portion;
- the last named means comprising a pair of spaced elements threadedly engaging the ends of said arcuate arms and operable when turned one way to separate said arms and operable when turned the opposite way to move said arms toward one another.

2. A digester cap assembly for mounting on a digester of the type having an upwardly projecting neck terminating in an opening, comprising
- a tubular member constituting an extension of said neck;
- means for detachably mounting the lower end of said tubular member on said neck, the upper end of said neck having a flange defining a mouth;
- a supporting structure secured to said neck;
- a cap for closing said mouth and being of a size to fit against said flange;
- first power means for moving said cap between a closed operative position against said flange and an open inoperative position clear of said mouth; and
- second power means independent of said first power means for clamping said cap against said flange and for effecting release of said cap;
- both of said power means being mounted on said supporting structure whereby said assembly can be removed from or applied to said neck as a unit.

3. A digester cap assembly for mounting on a digester of the type having an upwardly projecting neck terminating in an opening, comprising:
- a base structure for mounting on said neck providing a flange defining a mouth;
- a cap for closing against said mouth and of a size to fit against said flange;
- first power means mounted on said base structure for moving said cap between a closed operative position against said flange and an open inoperative position clear of said mouth;
- second power means mounted on said base structure and independent of said first means for clamping said cap against said flange and for effecting release of said cap; and
- control means operable when actuated for effecting operation of said second power means and then said first power means when opening said cap, and for effecting operation of said first power means and then said second power means when closing said cap.

4. In combination,
- a digester having a neck and an open mouth,
- base means mounted on the neck,
- a cap,
- a shaft mounted on the base means and adapted to pivot the cap between a closed position closing the mouth and an open position opening the mouth,
- first fluid pressure operated means mounted on the base means for driving the shaft,
- a split ring having a pair of arms mounted pivotally on the base means at one end of each arm and movable between closed positions clamping the cap to the mouth and open positions releasing the cap from the mouth,
- and second fluid pressure operated means mounted on the base means for moving the arms between the open positions thereof and closed positions thereof.

5. The combination of claim 4 wherein the first fluid pressure operated means comprises a pair of piston members having pison rods,
- a pair of cylinders mounting the piston members slidably with the rods projecting out of one end of each cylinder,

means mounting the cylinders pivotally on the base means on a single axis at points adjacent said one end of each cylinder in parallel positions on opposite sides of the base means,

and a pair of arms pivotally connected to the piston rods and drivingly connected to the shaft.

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