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WEDGE GATE VALVE

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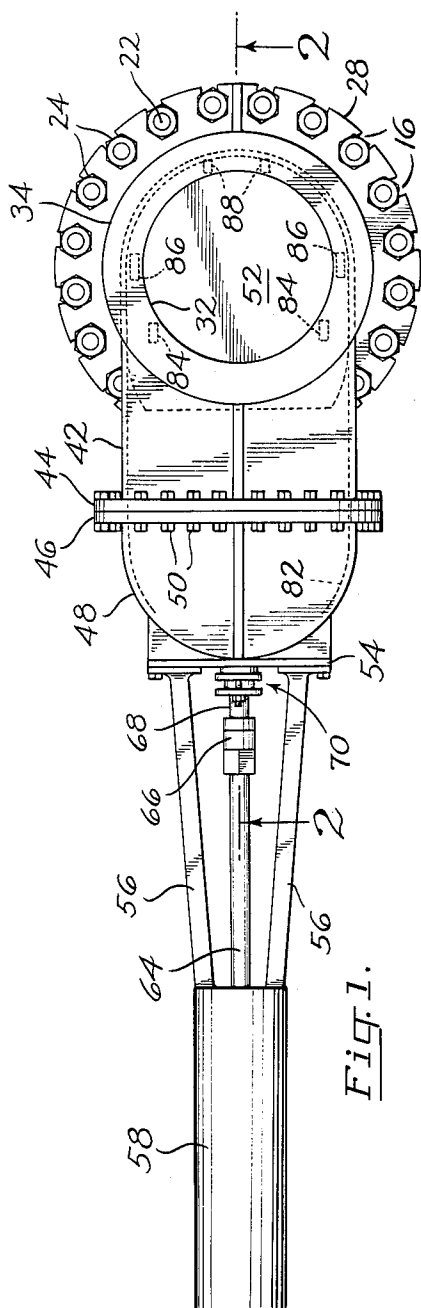


FIG. 1.

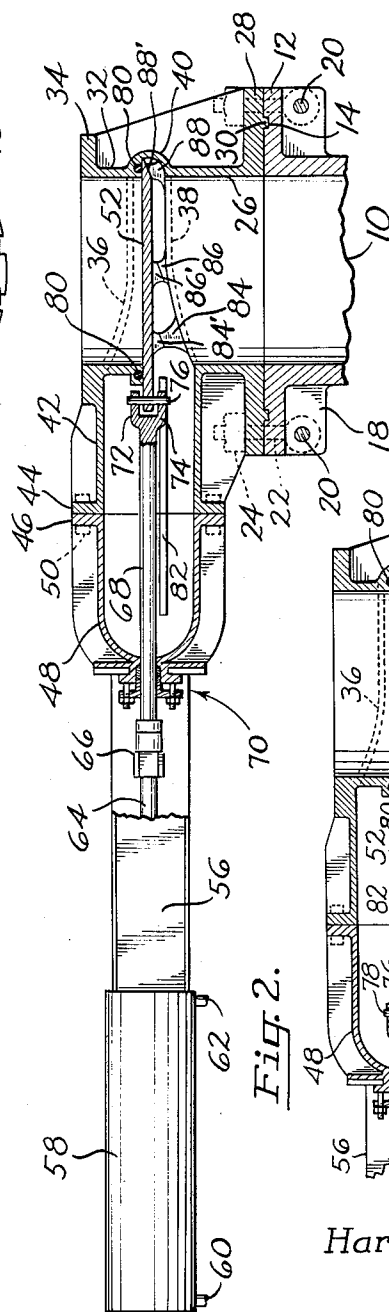


FIG. 2.

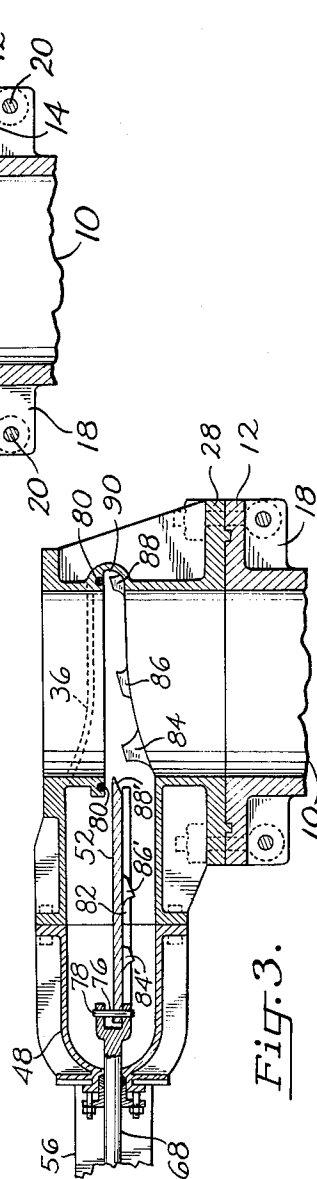


FIG. 3.

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WEDGE GATE VALVE

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6 Claims. (Cl. 251-203)

This invention relates to valves, and more particularly to a gate valve especially suited for use as a closure cap for the chip charging opening of pulp digesters.

It has been the practice heretofore in the pulp and paper industry to provide the chip charging opening at the top of a pulp digester with a closure cap which is removably sealed by means of a multiplicity of circumferentially spaced bolts which are loosened and tightened by manual labor. This practice has had numerous disadvantages: It has incurred the cost of considerable manual labor and the cost reflected by the excessive down time lost from production during manual opening and closing of the cap. It has represented a safety hazard to the workmen, particularly during the removal of the cap, in view of the elevated pressures within the digester. It has presented an obstacle to the effective use of chip feeding mechanism for charging the digester, and it has prevented automation of the digestion cycle by not accommodating automatic charging of the digester.

It is the principal object of the present invention to provide a power operated gate valve especially suited for overcoming the aforementioned disadvantages associated with digester operation.

Another important object of this invention is the provision of a gate valve which seals and unseals quickly and is capable of operation from a remote position and at a predetermined time in an automatically controlled cycle.

Still another important object of the present invention is the provision of a gate valve in which the gate seals and unseals by movement through but a small fraction of its length.

A further important object of the present invention is the provision of a gate valve in which the gate provides a seal on one surface only.

A still further important object of this invention is to provide a gate valve which utilizes but a single simplified seal for the reciprocating components.

Another important object of the present invention is the provision of a gate valve for the chip charging opening of a digester, wherein the valve is provided with means to insure against jamming of the gate by wood chips.

A further important object of this invention is the provision of a gate valve having the foregoing advantages within a simplified structure which affords manufacture at minimum cost and provides long and efficient operating life with a minimum of maintenance and repair.

The foregoing and other objects and advantages of this invention will appear from the following detailed description, taken in connection with the accompanying drawing in which:

FIG. 1 is a plan view of a gate valve embodying the features of the present invention;

FIG. 2 is a sectional view taken along the line 2-2 in FIG. 1, the valve being shown in operative position over the chip charging opening of a digester and the gate in sealing position; and

FIG. 3 is a fragmentary sectional view, similar to FIG. 2, showing the gate in open position.

For purposes of illustration the valve of the present invention is shown in the drawings in operative association with a pulp digester. The upper section of the digester provides a chip charging opening which, during the chemical digestion of the chips, is sealed by a closure cap. For this purpose the upper open end 10 of a conventional digester is provided with an annular projecting flange 12

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having formed therein an annular groove 14 adapted to receive a corresponding annular rib on a closure cap, for the purpose of centering the latter over the digester opening. A plurality of radial slots 16 also are provided in the annular flange, and adjacent underlying radial brackets 18 each supports a transverse pin 20 which pivotally mounts the eyelet end of a clamping bolt 22. Thus, the bolts are mounted pivotally to swing through the radial slots and through registering radial slots in the closure cap. The nuts 24 then are applied to the bolts and tightened down to seal the closure cap over the chip charging opening.

In the valve construction illustrated the valve controlled discharge conduit 26 is provided with a peripheral flange 28 having the annular rib 30 and circumferentially spaced radial slots by which to adapt the valve to the digester. The valve controlled inlet conduit 32 also is provided with a peripheral flange 34 by which to accommodate the mounting of a mechanical chip feeder.

The inlet and discharge conduits are interconnected by an enlarged gate housing which projects outwardly beyond the periphery of the conduits. The gate housing includes opposed face walls 36, 38 spaced apart in the axial direction of the valve controlled openings and interconnected by a peripheral side wall 40. The face walls have registering openings, preferably codimensional with the conduit openings, to provide a continuous passageway between the inlet and discharge conduits.

The face walls of the gate housing diverge rearwardly and continue laterally from the conduits to provide a housing section 42. This housing section terminates in a peripheral flange 44 which matches the peripheral flange 46 of the second housing section 48. These housing sections are secured together by such means as the bolts 50 which extend through aligned openings in the matching flanges. The housing sections thus form a chamber for receiving the valve gate 52 when the latter is retracted.

The rearward end of the housing section 48 supports a transverse bracket 54 to which is secured the forward ends of the spaced elongated support arms 56. The rearward ends of these arms support the forward end of the drive unit which, in the embodiment illustrated, comprises an elongated cylinder 58 containing a piston (not shown) which is reciprocated therein by means of pneumatic or hydraulic pressure supplied from a conventional source selectively to the conduits 60, 62 which communicate with opposite sides of the piston adjacent the opposite ends of the cylinder 58. Extending forwardly from the piston contained within the cylinder is a piston rod 64, and this rod is connected through the coupling 66 to the rearward end of the gate actuating rod 68.

The gate actuating rod extends forwardly through an opening in the housing section 48 for reciprocation relative thereto. A pressure tight seal 70 is provided between the housing section and the rod.

The forward end of the gate actuator rod is provided with a coupling by which to connect the rearward end of the valve gate 52 in such manner as to permit a limited degree of movement of the gate in the direction normal to its plane. In the embodiment illustrated, the coupling is provided in the form of a bifurcated yoke, the forwardly projecting arms 72, 74 of which are spaced apart a distance greater than the thickness of the gate. The rearward end of the gate is interposed between these arms and is connected thereto by means of the transverse pin 76 which extends freely through registering openings in the arms and gate. The pin is retained in position by such means as the cotterpins 78 which extend through openings in the opposite ends of the pin adjacent the outer sides of the arms.

By means of the drive assembly described, the gate 52 is adapted to traverse the opening provided by the conduits 26, 32 and the gate housing face walls. The inner end of the inlet conduit 32 terminates in a surface which is parallel to the plane of the gate. An annular groove in this surface receives a resilient O-ring seal 80 which is disposed for abutment by the adjacent surface of the gate when the latter is in sealing position.

During reciprocation the gate is supported slidably at its lateral sides upon the elongated tracks 82 which project inwardly from the side walls of the housing sections 42 and 48. The supporting surfaces of these tracks are disposed in the plane of the inner surface of the lower arm 74 of the yoke. In this manner the weight of the gate is not impressed upon the actuating rod 68, and the latter operates freely through the seal 70 without binding.

Further, the tracks 82 support the gate in spaced relation to the O-ring seal 80 during substantially the entire distance through which the gate is reciprocated by the drive assembly.

Cam means are provided for moving the gate 52 normal to its plane into sealing position at the forward end of the transverse movement of the gate. In the embodiment illustrated, a plurality of pairs of projections 84, 86 and 88 are mounted in a staggered manner on the inner surface of the gate housing face wall spaced about and adjacent the periphery of the opening therein. The projections extend in the direction of the gate. These projections are provided with cam surfaces which incline toward the gate in the forward direction of closing movement of the gate. Registering pairs of projections 84' and 86', preferably with complementary inclined surfaces, extend from the adjacent surface of the gate for cooperation with the projections 84 and 86.

The forward end of the gate is provided with a beveled surface 88' to complement the forwardly disposed pair of cam projections 88, and thus performs the same function as the rearwardly disposed pairs of projections 84', 86'.

The projections are spaced about the periphery of the gate housing opening to provide uniform and substantially simultaneous sealing and unsealing of the gate member with respect to the entire periphery of the O-ring seal 80.

The pairs of projections 84, 84' and 86, 86' are positioned at various distances to opposite sides of the center line of the gate 52 representing the direction of movement of the gate, to insure freedom of reciprocative movement of the gate without obstruction to the projections 86' carried by the gate by the projections 84 on the gate housing wall.

It is to be noted that the sealing and unsealing of the gate 52 relative to the seal 80 is effected by a very short travel of the gate at the forward end of its stroke. Thus, positive operation of the gate is achieved with minimum sliding contact between the gate and seal. This enhances considerably the operating life of the seal and reduces to a minimum the power requirements for moving the gate between sealing and unsealing positions.

It is to be noted further that the valve construction described hereinbefore involves but a single pressure seal 70 associated with the reciprocating components. This seal is associated with the gate actuating rod and hence may be of conventional construction and minimum cost. Moreover, since the seal frictionally engages only the rod 68, the power requirements for reciprocating the gate are reduced to a minimum.

It is to be noted further that, following the charging of chips into the digester, any chips which might accumulate in the peripheral channel 90 formed by the side wall 40 of the gate housing, will be dislodged therefrom during forward closing of the gate, and will fall by gravity into the digester. In this manner complete and positive closing of the gate is assured by the elimination of all possibility of jamming of the gate.

The drive unit may be controlled from the safety of a remote position, as will be apparent, by the appropriate

location of a control valve associated with the conduits 60, 62. Alternatively, an electrically actuated control valve may be employed, with the control for the electric actuator positioned at the desired remote location. Similarly, the drive unit may take the form of an electric motor, with its control located at the desired remote position.

The drive unit also may be controlled automatically in timed sequence to other automatically controlled steps in the complete digestion process. Accordingly, chip feeding mechanism may be mounted permanently at the inlet conduit 32.

It will be apparent to those skilled in the art that various changes may be made in the details of construction described hereinbefore and that the valve may be employed for purposes other than digester capping, without departing from the spirit of this invention and the scope of the appended claims.

Having now described my invention and the manner in which it may be used, what I claim as new and desire to secure by Letters Patent is:

1. A gate valve comprising a gate housing, an outlet conduit secured to the housing, a coaxial inlet conduit secured to the housing and having a gate sealing end, a gate member in the housing disposed for movement transversely and axially with respect to the inlet conduit, track means mounting the gate member for movement transversely of the inlet conduit in spaced relation to the gate sealing end of the inlet conduit between a retracted position displaced laterally from the inlet conduit and an extended position traversing said inlet conduit, staggered cooperating cam means on the gate member and on the outlet conduit side of the housing outwardly of said outlet conduit and arranged for mutual engagement during further transverse movement of the gate member in the direction of and after substantially reaching said extended position to move the gate member in the axial direction of the outlet conduit into sealing engagement across the gate sealing end of the conduit, drive means for moving the gate member in said transverse direction, and coupling means interconnecting the drive means and gate member for limited relative movement of the latter in said axial direction.

2. The gate valve of claim 1 wherein the cam means on the housing comprises a plurality of cam elements spaced about the periphery of said outlet conduit, and the cam means on the gate member comprises a plurality of cam elements disposed for engagement with the first named cam elements during said further transverse movement of the gate member.

3. The gate valve of claim 1 wherein the coupling means comprises a connector slidably interengaging the drive means and gate member for limited relative movement on an axis substantially normal to the plane of the gate member.

4. For use in releasably closing the top end opening of a pulp digester, a gate valve comprising a horizontal housing, a vertical inlet conduit secured to the upper side of the housing and having a gate sealing end communicating with the interior of the housing, a horizontal gate member in the housing disposed for movement transversely and axially with respect to the inlet conduit, track means mounting the gate member for movement transversely of the inlet conduit in spaced relation to the gate sealing end of the inlet conduit between a retracted position displaced laterally from the inlet conduit and an extended position traversing said inlet conduit, a vertical outlet conduit secured to the under side of the housing coaxial with and on the side of the gate member opposite the inlet conduit, a plurality of staggered first cam elements on the outlet conduit side of the housing disposed outwardly of said outlet conduit, a plurality of second cam elements on the gate member each disposed for engagement with one of the first cam elements during further transverse movement of the gate member in the direction

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of and after substantially reaching said extended position to elevate the gate member vertically into sealing engagement across the gate sealing end of the inlet conduit, the housing including a laterally elongated chamber for receiving the gate member when in said retracted position, drive means for moving the gate member in said transverse direction and extending freely through the housing at the end of said chamber opposite the inlet and outlet conduits, sealing means interposed between the housing and said drive member, and coupling means interconnecting the drive means and gate member for limited vertical movement of the latter in said axial direction.

5. The gate valve of claim 1 wherein the housing extends laterally outward beyond the inlet and outlet conduits and forms a peripheral channel therebetween.

6. The gate valve of claim 4 wherein the housing extends laterally outward beyond the inlet and outlet conduits and forms a peripheral channel therebetween.

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