STOCK VALVE HAVING NON-CLOG GATE BLADE

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FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

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This invention relates to gate valves for handling paper stock and like fluids, and particularly to a self-cleaning gate valve for handling stock with a high pulp content.

There has long existed a demand for a stock valve capable of handling stock having a high pulp content without clogging. By high pulp content, it is meant on the order of eight percent. There are valves on the market capable of handling stock with ordinary pulp content without clogging. By ordinary pulp content, it is meant on the order of three percent. However, these valves when placed in lines handling high pulp content stock become clogged within a relatively short time. In fact, approximately four days of use has been sufficient to clog valves now on the market. After such time, the valve has to be cleaned, and this normally means that the plant must shut down and the valve removed from the line, or the valve partially disassembled while in the line and cleaned.

Clogging occurs in valves handling high pulp content stock because the amount of pulp clinging to the walls of the valve is much greater than with ordinary stock. Also these valves are utilized in places requiring them to be frequently opened and closed, as many as ten to twenty times a day. Thus there is a great tendency for the blade, when moving from its open to its closed position, to compact pulp against the walls of the valve. Soon the valve becomes very difficult to close, next the valve cannot be fully closed, and finally the valve cannot be closed sufficiently to cut off the flow of stock. When the valve cannot be fully closed, there is a tendency for the water in the stock to leak past the gate blade, leaving the pulp on the inlet side of the valve to form a pulp log which must be removed.

It is a main object of the present invention to provide a self-cleaning gate valve especially designed for handling high pulp content stock without clogging.

It is a further object of the invention to provide a gate valve having a gate blade provided with a curved lower end, the blade having flanking shoulders at the ends of the curved edge of the blade for scraping off pulp, instead of compacting the pulp against the walls of the body.

A further object of the invention is to provide a gate valve of the type just described which is so constructed that the pulp which piles up on the faces of the shoulders is urged inwardly to break the hold of the pulp masses on the faces of the shoulders to enable ready entrainment of the pulp masses in the stock flowing through the valve.

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

Fig. 1 is a side view of a valve embodying the invention;
Fig. 2 is an enlarged partial end view taken in the direction of the arrows 2—2 of Fig. 1;
Fig. 3 is a longitudinal vertical section taken along 3—3 of Fig. 2 on an enlarged scale;
Fig. 4 is a view of a part of Fig. 2 on a further enlarged scale illustrating the manner of operation of the gate blade; and
Fig. 5 is a horizontal section on an enlarged scale taken along line 5—5 of Fig. 2.

Referring to Fig. 1, the valve includes a valve body having a cylindrical shell 11 provided with bossing flanges 13 and 15. The body includes a chest portion defined by end walls 17 and side walls 19 enclosing a slot 21 formed in the shell 11, as best shown in Fig. 3. The chest extends upwardly through a pad 23 which is secured to the flanges 13 and 15 and supports yoke arms 25. A gate blade, generally entitled 26, projects into the chest 17 and through a packing gland assembly 27 of the type disclosed in my copending application, Serial No. 539,539, filed October 10, 1955, now Patent No. 2,832,564, which has been reissued as Re. 24,735.

Referring to Fig. 2, the packing 28 of the assembly 27 engages the upper edges of the valve chest walls 17 and 19, and securing bolts 29, connected to the pad 23, cause the desired pressure between the packing and the chest edges.

The upper end of the blade, as the parts are shown in Fig. 1, is connected to a stem 31 which threadedly extends through a handwheel 33 mounted on the yoke arms 25. When the handwheel 33 is rotated in the proper direction the stem 31 will be threadedly upwards through the wheel to elevate the gate blade 26.

Referring to Fig. 2, the gate blade 26 is shown as having a semicircularly curved beveled edge 41 on the lower end thereof, and the blade is provided with shoulders 43 and 45 at the ends of the curved edge 41. The faces of the shoulders 43 and 45 form an acute angle of less than 90 degrees with the side edges of the gate blade 26 for a purpose presently to appear.

I have found that an angle of 45 degrees works very well, but a variation of several degrees either way is acceptable. I have also found that a shoulder width of ½” is satisfactory on small valves, for instance 2” to 10”; that a shoulder width of ¾” is satisfactory for medium size valves, for instance 12” to 18”; and that a shoulder width of ¾” is satisfactory for large valves, for instance 20” to 30”. It is desirable to keep the shoulder width to a minimum, for instance the shoulder width to increase, the diameter of the curved edge decreases. This would mean that a larger seat would be required to engage the curved edge properly, and a larger seat would decrease the capacity of the valve. A circular seat 51 is provided within the valve on the outlet side of the blade, and a partial ring type backing member 53, such as is disclosed and claimed in my prior copending application, Serial No. 425,114, filed April 14, 1954, now abandoned, supports the valve blade against the seat 51 when the gate blade is moved to its closed position. As best shown in Fig. 2, when the gate blade is in its closed position, the shoulders 43 and 45 are disposed below the centerline of the flow passage provided by the shell 11. The ends of the backing member 53 are in the form of yielding kicker fingers and terminate at the centerline of the flow passage. Because of the bevel on
the edge 41, the kicker fingers do not come into engagement with the blade until just as the blade is reaching its fully closed position. The kicker fingers will also release the blade as soon as it has been moved away from its closed position.

During closing movement of the gate blade, pulp clinging to the walls of the chest will be scraped off by the faces of the shoulders 43 and 45 rather than being compressed against the walls of the chest. Referring to Fig. 4, the pulp will build up on each shoulder, as shown in the case of shoulder 43, but because of the upward and inward inclination of the face of the shoulder, there is an upward and inward component of force F2 resulting from the normal force F1. The force F1 represents the resistance of the pulp to the scraping action of the shoulders. Thus the masses of pulp scraped off by the shoulder are urged to move inwardly in the direction of the arrow F2 to break the hold of the pulp masses on the face of the shoulder. When this occurs, the pulp masses either drop off, as shown in the case of pulp mass F1 in Fig. 4, or if the hold of the pulp masses on the shoulders is sufficiently decreased that they may be readily pulled off by the flow of stock through the valve. It is pointed out that the bevel on the blade 26 extends around to the shoulders so as to provide inclined wall portions as clearly shown in Fig. 5, next to the shoulders to urge pulp that is crowded inwardly of said shoulder face axially of said flow passage to break the hold of the pulp on the faces. It is further apparent from Fig. 5 that the combination of the shoulders and the bevel provide shoulder faces extending inwardly beyond the partial ring 53 in the fully closed position of the valve blade so that pulp is not trapped between the seat and the partial ring during closing movement of the blade.

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 otherwise than by the provisions of the following claims.

I claim:

1. A self-cleaning stock gate valve for handling paper stock of high pulp content comprising a valve body having a cylindrical through-flow passage, said body having a chest providing a gate blade passageway intersecting said flow passage, a round fitting in said chest being secured therein next to said passageway to serve as a seat, a partial ring secured in said flow passage opposite said seat and symmetrically disposed relative to the center line of said passageway and located adjacent the intersection of said passageway and flow passage, a gate blade having an end projecting into said flow passage from said passageway, said passageway having a width at least equal to the diameter of said flow passage, said blade having a width approximating the diameter of the flow passage, the mentioned end of the blade having a semicircularly curved edge having a radius of curvature less than that of the flow passage but greater than that of the interior of the seat so as to close off flow through the flow passage when said blade is moved to its fully closed position, said blade providing a shoulder at each end of the curved edge projecting outwardly from said curved edge, said chest and ring seat and partial ring providing guideway portions defining the side margins of the blade and said shoulders serving to scrape the walls of such guideway portions during closing movement of said blade, said curved edge of said blade being beveled to provide a knife edge next to said seat, the face of each shoulder making an angle of less than 90 degrees with the adjacent side edge of said guideway walls, said guideway walls being crowded inwardly, said bevel extending around to said shoulders so as to provide inclined wall portions next to said faces to urge pulp that is trapped by said shoulders inwardly toward the outer edge of the associated shoulder to provide a shoulder face of trapzoidal shape, said shoulder faces extending inwardly beyond said partial ring in the closed position of said blade so that pulp is not trapped between said seat ring and partial ring during closing of said blade, said shoulder faces being so located on said blade and said partial ring being so dimensioned that said shoulder faces are disposed below the ends of said partial ring in the closed position of said blade to avoid build-up of stock between said partial ring and said chest.

2. A self-cleaning stock gate valve for handling paper stock of high pulp content comprising a valve body having a cylindrical through-flow passage, said body having a chest providing a gate blade passageway intersecting said flow passage, a gate blade having an end projecting into said flow passage from said passageway, said passageway providing channel-shaped guideway portions for the side edges of said blade, said passageway having a width at least equal to the diameter of said flow passage, said blade having a width approximating the diameter of the flow passage, a seat for said blade, the mentioned end of the blade having a semicircularly curved edge having a radius of curvature less than that of the flow passage but greater than that of the interior of the seat so as to close off flow through the flow passage when said blade is move to its fully closed position, said blade providing a shoulder at each end of the curved edge projecting outwardly of said guideway walls beyond said partial ring in the closed position of said blade, said curved edge of said blade being beveled to provide a knife edge next to said seat, the face of each shoulder making an angle of less than 90 degrees with the adjacent side edge of said blade so that pulp scraped from said guideway walls is crowded inwardly, said bevel extending around to said shoulders so as to provide inclined wall portions next to said faces to urge pulp that is crowded;

3. A self-cleaning stock gate valve for handling paper stock of high pulp content comprising a valve body having a cylindrical through-flow passage, said body having a chest providing a gate blade passageway intersecting said flow passage, a ring fitting in said flow passage and being secured therein next to said passageway to serve as a seat, a partial ring secured in said flow passage opposite said seat and symmetrically disposed relative to the center line of said passageway and located adjacent the intersection of said passageway and flow passage, a gate blade having an end projecting into said flow passage from said passageway, said passageway having a width at least equal to the diameter of said flow passage, said blade having a width approximating the diameter of the flow passage, the mentioned end of the blade having a semicircularly curved edge having a radius of curvature less than that of the flow passage but greater than that of the interior of the seat so as to close off flow through the flow passage when said blade is moved to its fully closed position, said blade providing a shoulder at each end of the curved edge projecting outwardly from said curved edge, said chest and ring seat and partial ring providing guideway portions for the side margins of the blade and said shoulders serving to scrape the walls of such guideway portions during closing movement of said blade, the face of each shoulder making an angle of less than 90 degrees with the adjacent side edge of said blade so that pulp scraped from said guideway walls is crowded inwardly, said bevel extending around to said shoulders so as to provide inclined wall portions next to said faces to urge pulp that is crowded.
inwardly by said shoulder faces to be shoved generally axially of said flow passage to break the hold of said pulp on said faces, said bevel terminating inwardly of the outer edge of each shoulder to provide shoulder faces of trapezoidal shape, said shoulder faces extending inwardly beyond said partial ring in the closed position of said blade so that pulp is not trapped between said seat ring and partial ring during closing of said blade, said shoulder faces being so located on said blade and said partial ring being so dimensioned that said shoulder faces are disposed below the ends of said partial ring in the closed position of said blade to avoid build-up of stock between said partial ring and seat ring.

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