

## Grease Injection System for a Gate Valve Stem

### Background of the Invention

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#### 1. Field of the Invention

This invention relates to gate valves. More particularly, the invention relates to a system for lubricating the stem which drives the gate of the gate valve.

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#### 2. Description of Related Art

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Frequently, manually operated large bore and high pressure gate valves experience high friction between the stem threads and lift nut threads. Lubrication serves to reduce this friction, thereby reducing the operating torque by as much as 50%. After a few cycles of opening and closing the valve, the grease or other lubricant becomes displaced. As the friction increases between the stem threads and the gate lift nut threads due to the displacement of lubricant, the operating torque likewise increases. When this elevated operating torque becomes too great, the operator needs a method for lubricating between the stem and gate lift nut threads.

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Presently, several methods exist for lubricating the threads, including: (1) disassembling the valve, and (2) filling the valve body cavity with lubricant in order to infuse lubricant into the stem relief hole where the stem threads are located. Disassembly of the valve enables lubricant to be placed directly on the stem and lift nut threads, but requires a breach of the valve pressure system which renders the valve inoperable while disassembled. Additionally, disassembly is a labor intensive, time consuming procedure. The method of filling the body cavity with lubricant is also ineffective. This method is neither labor intensive nor does it render the valve inoperable; however, even with a great deal of lubricant being placed into the valve body cavity, very little lubricant actually works its way into the stem relief hole. Therefore, very little lubricant contacts the stem

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threads. Another disadvantage of this method is the potential for lubricant to leak into the valve body cavity and mix with the fluid flowing in the valve flow path.

Therefore, there is a need for a gate valve wherein lubricant may be applied directly to the valve stem and gate lift nut threads without (1) disassembling the gate valve body, or (2) filling the valve body cavity.

#### Summary of the Invention

According to one embodiment of the invention, there is provided a gate valve with an improved lubricating means for reducing operating torque, wherein the gate valve comprises a valve housing having a flow passage therethrough adapted to mate between two open conduits in a flow line so as to form a continuous closed flow path therewith; a valve gate that is movably mounted in the valve housing and adapted to move into and out of the flow path so as to create a stop flow and an open flow position, respectively; a gate lift nut that has a threaded internal through hole and is mounted to said valve gate; a rotatable valve stem that extends into the valve housing such that a first end of the stem extends outside the housing and is adapted to receive torque to effect rotation of the stem and a second end of the stem has a threaded surface and is received within a lift nut through hole, whereby rotation of the valve stem causes the lift nut and the gate to translate along the stem moving the gate selectively into a stop flow or open flow position; a lubricant reservoir; at least one distribution hole for distributing lubricant to the threaded surface of the stem; and channel means contained within the valve stem and in communication with the reservoir and the distribution hole to distribute lubricant from the reservoir to the threaded stem surface.

According to another embodiment of the invention, there is provided an improved valve stem with a lubricating means for use in a gate valve of the type comprising a threaded valve stem and gate lift nut assembly, wherein the improved valve stem comprises a valve stem shaft having a first end and a second end whereby the first end of the shaft is adapted to receive torque to effect rotation and the second end of the shaft has a

threaded surface adapted to mate with and cooperate with a threaded opening through a gate lift nut such that rotation of the valve stem relative to the gate lift nut causes the lift nut to translate along the stem; at least one lubricant distribution hole extending from the threaded surface of said valve stem shaft to the interior of said valve stem shaft for distributing lubricant to said threaded surface; and a channel means axially extending through the valve stem shaft and in communication with the lubricant distribution hole and a lubricant reservoir.

According to a further embodiment of the invention, there is provided a gate valve comprising a stem having threads, a lubricant reservoir, a hole for distributing lubricant to the threads of said stem, and a channel that connects the reservoir to the hole.

The present invention will be better understood by a reading of the following detailed description, with reference to the attached drawings, wherein like parts in each of the several figures are identified by the same reference character.

#### Brief description of the Drawings

Fig. 1A is a cross-sectional schematic drawing of one embodiment of the invention;

Fig. 1B is an enlarged detail of a portion of the invention depicted in Fig. 1a;

Fig. 2 is a cross-sectional schematic drawing of another embodiment of the invention;

Fig. 3 is a cross-sectional schematic drawing of a further embodiment of the invention; and

Fig. 4 is a cross-sectional schematic drawing of a still further embodiment of the invention.

#### Detailed Description of the Preferred Embodiments

Referring to Figs. 1A and 1B, an embodiment of a gate valve 1 according to the present invention is shown. The valve 1 comprises a stem 10 having threads 11, a layered coil-shaped washer 12, a lubricant distribution channel or hole 13 for distributing lubricant to threads 11 of

stem 10, and a channel or hole 14 that connects the washer 12 to the distribution hole 13 via a transverse hole 8 that is positioned transverse to the longitudinal central axis of the stem 10. Thus, lubricant flows from the washer 12 through the transverse hole 8, through the longitudinal hole 14 and finally to the distribution hole 13. In this embodiment, the distribution hole 13 is a hole that runs from the threaded surface 11 of the stem 10 to the longitudinal hole 14. The layered coil-shaped washer 12 preferably has a number of approximately 0.0625 inch thick coils which stretch around the outside diameter of the stem backseat 20. In the embodiment shown, the top four coils are notched to allow lubrication to travel into the transverse hole 8 and into the hole 14. With the gate 17 in the closed position, lubricant is forced into the threads of the lift nut 18. With the gate 17 in the open position, which is depicted in Fig. 1A, the lubricant fills the stem relief hole 19 of gate 17, thereby forcing lubricant onto the stem threads 11. The lower coils 15 of washer 12 restrict lubricant in washer 12 from entering the valve body cavity 16. Coils 15 force the lubricant into the transverse hole 8 in the stem, instead of letting it pass into the valve body cavity 16. The valve 1 also comprises an injection fitting 22 on the outside diameter of the bonnet flange 21. Lubricant may be injected through the injection fitting 22 to infuse the washer 12 with lubricant.

Referring to Fig. 2, another embodiment of the present invention is shown. The valve 2 of this embodiment comprises a stem 10 having threads (not shown), a receptacle for lubricant, such as injection fitting 22, a hole 13 in the stem 10 for filling the stem relief hole 19 of the gate 17 with lubricant, and a channel or hole 14 that connects the receptacle 22 to the hole 13. The injection fitting 22 is connected anteriorly to the stem 10. The hole 14 runs the length of the stem 10 between the injection fitting 22 and the hole 13 in the bottom of the stem 10. With the gate 17 in the open position, which is depicted in Fig. 2, the lubricant fills the stem relief hole 19 of gate 17, thereby forcing lubricant onto the stem threads. As the gate 17 is closed, lubricant is forced onto the threads of the lift nut 18.

Referring to Fig. 3, a further embodiment of the present invention is

shown. The valve 3 of this embodiment comprises a stem 10 having threads 11, a receptacle for lubricant, such as injection fitting 22, a hole 13 for distributing lubricant to the threads 11 of the stem 10, and a channel or hole 14 that connects the receptacle 22 to the hole 13. The injection fitting 22 is disposed anteriorly to the stem 10. The valve 3 comprises a check valve 23 between the hole 13 and the hole 14 that restricts lubricant flow from the hole 13 back up the hole 14. The check valve 23 is a spring loaded valve preferably located in the lower portion of hole 14. A pipe plug 24 blocks the end of hole 14 and retains the spring loaded ball check valve 23 in position.

Referring to Fig. 4, a further embodiment of the present invention is shown. The valve 4 of this embodiment comprises a stem 10 having threads (not shown), an injection fitting 22 for supplying lubricant, a hole 13 for distributing lubricant to the threads of the stem 10, and a channel or hole 14 that connects the injection fitting 22 to the hole 13. The stem 10 may be set to force the lubricant to pass through a transverse hole 8 that connects with the longitudinal hole 14. The lubricant injection fitting 22 is located on a bonnet flange 21. The lubricant hole 14 comprises the distribution hole 13 at the lower end of the stem 10, up through the center of the stem 10, through the transverse hole 8 in the backseat shoulder 20, and through a channel or hole 7 in the bonnet flange 21. This embodiment allows for lubrication when the gate 17 is first closed. The lubricant is injected through the bonnet flange lubricant fitting 22. The lubricant passes through the hole 7 in the bonnet flange 21, through the hole 8 in the stem back seat shoulder 20, down the hole 14 in the center of the stem 10, and out hole 13. The lubricant then fills the stem relief hole 19 in the gate 17. As the gate 17 is opened, lubricant is forced onto the stem threads (not shown in Fig. 4). After the lubrication process has been completed, the gate 17 is returned to its normal operating position. The valve 4 also comprises a vent hole 25 through the side of the gate 17 located near the lift nut 18.

It should be noted that while the invention has been described in

terms of the preferred embodiments wherein the hole 14 is located down the longitudinal central axis of the stem 10, it need not necessarily be so located; for example, the hole 14 may be located down the outside of the valve casing around the stem. In such an embodiment, a distribution hole  
5 or holes would be located through the casing to allow for lubricant communication to the threads, etc.

While the particular embodiments for lubricating threads of a valve as herein shown and disclosed in detail is fully capable of obtaining the objects and advantages herein before stated, it is to be understood that they are  
10 merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended by the details of construction or design herein shown.



What is claimed is:

1. A gate valve comprising:
  - a valve housing having a flow passage therethrough and adapted to mate between two open conduits in a flow line thereby forming a continuous closed flow path therewith;
  - a valve gate movably mounted in said valve housing and adapted to move into and out of the flow path causing a stop flow and an open flow position, respectively;
  - a gate lift nut having a threaded internal through hole and mounted to said valve gate;
  - a rotatable valve stem extending into said valve housing such that a first end of the stem extending outside the housing is adapted to receive torque to effect rotation of the stem and a second end of the stem has a threaded surface and is received within said lift nut through hole, whereby rotation of the valve stem causes the lift nut and the valve gate to translate along the stem moving the gate selectively into the stop flow or open flow positions;
  - a lubricant reservoir;
  - at least one distribution hole for distributing lubricant to the threaded surface of the stem; and
  - channel means contained within said valve stem and in communication with said reservoir and said distribution hole to distribute lubricant from said reservoir to said threaded stem surface.
2. A gate valve according to claim 1, wherein said lubricant reservoir is a coil-shaped washer.
3. A gate valve according to claim 1, wherein said lubricant reservoir is positioned about said stem.
4. A gate valve according to claim 1, further comprising a plurality of said distribution holes for distributing lubricant to the threaded surface of the stem.
5. A gate valve according to claim 1 further comprising:
  - a valve cavity formed inside the valve body containing the flow



passage, said valve gate and said second end of said valve stem; and  
a valve bonnet assembly positioned adjacent to said valve  
body and having a bonnet opening through which said first end of said  
valve stem extends, whereby said lubricant reservoir is located within said  
5 bonnet assembly.

6. A gate valve according to claim 5 further comprising a  
lubricant sealing means for preventing lubricant from leaking into said valve  
cavity.

7. A gate valve according to claim 6 wherein said lubricant  
10 sealing means is a ring seal located in said bonnet assembly about said  
stem.

8. A gate valve according to claim 1, further comprising a check  
valve between said at least one distribution hole and said channel means  
that restricts lubricant back flow from said at least one distribution hole to  
15 said channel means.

9. An improved valve stem with lubricating means for use in a  
gate valve of the type comprising a threaded valve stem and gate lift nut  
assembly, said improved valve stem comprising:

a valve stem shaft having a first end and a second end  
20 whereby said first end of said shaft is adapted to received torque to effect  
rotation and said second end of said shaft has a threaded surface adapted  
to mate with and cooperate with a threaded opening through the gate lift nut  
such that rotation of said valve stem relative to said gate lift nut causes said  
lift nut to translate along said stem;

25 at least one lubricant distribution hole; and

a channel means axially extending through said valve stem  
shaft and in communication with said lubricant distribution hole and a  
lubricant reservoir.

10. An improved valve stem according to claim 9, wherein said at  
30 least one lubricant distribution hole extends from the threaded surface of  
said valve stem shaft to the interior of said valve stem shaft for distributing  
lubricant to said threaded surface.



11. An improved valve stem according to claim 9, wherein said at least one lubricant distribution hole extends from a surface of said second end of said shaft to the interior of said valve stem shaft for filling a stem relief hole of a gate with lubricant.
- 5            12. A valve comprising:  
              a stem having threads;  
              a lubricant reservoir;  
              a hole for distributing lubricant to the threads of said stem; and  
              a channel that connects said reservoir to said hole.
- 10           13. A valve as in claim 12, wherein said reservoir is a coil-shaped washer.
14. A valve as in claim 12, wherein said reservoir is positioned about said stem.
15. A valve as in claim 12, further comprising a plurality of holes  
15 for distributing lubricant to the threads.
16. A valve as in claim 12, wherein said channel is within said stem.
17. A valve as in claim 12, further comprising means located about said stem for restricting lubricant from a valve body cavity.
- 20           18. A valve as in claim 12, further comprising a check valve between said hole and said channel that restricts lubricant flow from said hole to said channel.
19. A valve as in claim 12, further comprising a ring located about said stem that restricts lubricant from entering a valve body cavity and a  
25 check valve between said hole and said channel that restricts lubricant flow from said hole to said channel.
20. A valve according to claim 12, further comprising a lubricant receptacle for infusing said reservoir with lubricant.