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GATE VALVE COOLING SYSTEM

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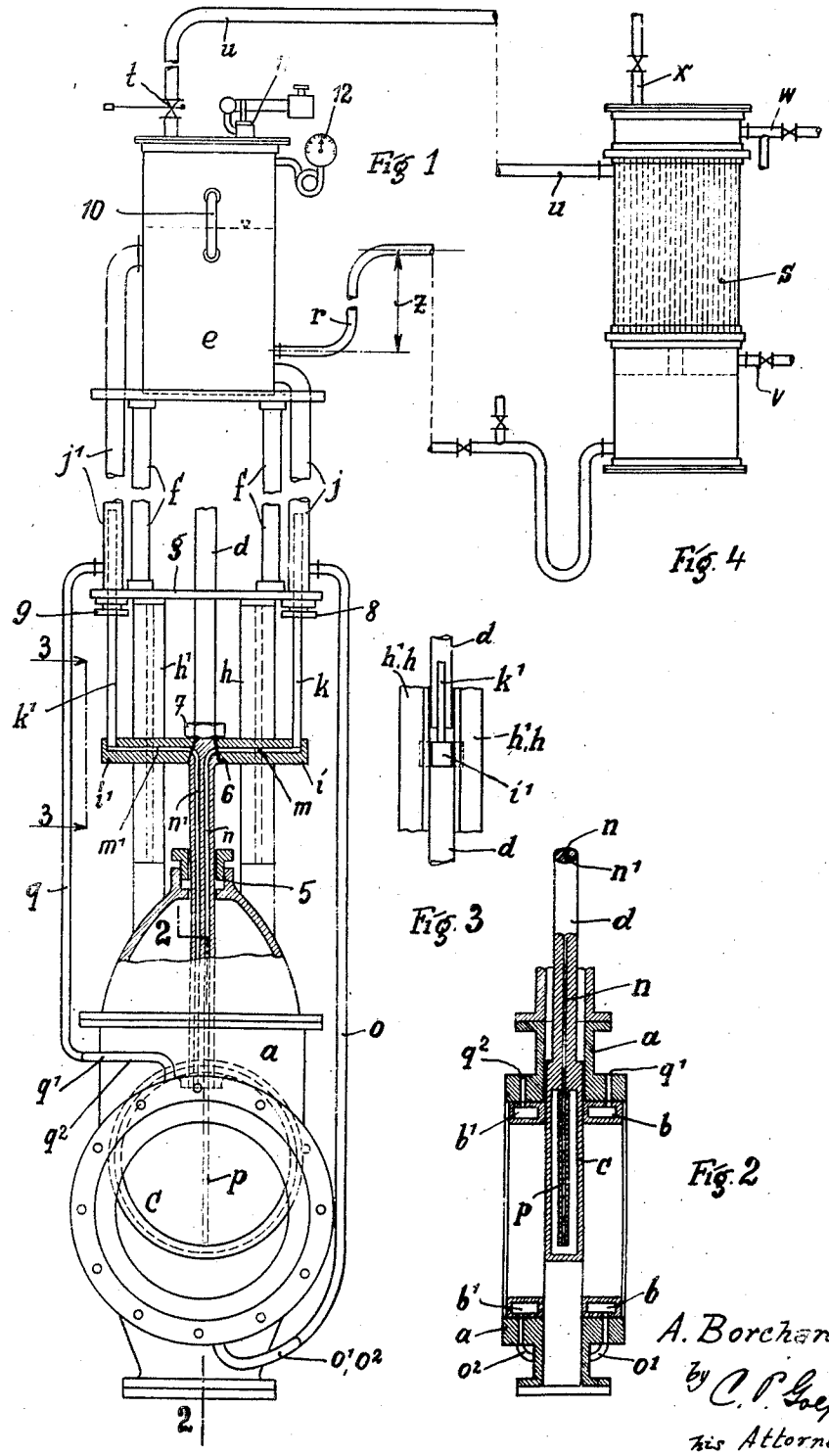


Fig. 1

Fig. 4

Fig. 3

Fig. 2

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GATE-VALVE-COOLING SYSTEM.

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My invention relates to improvements in the method of and apparatus for cooling valves or gates for hot fluids, and more particularly in the method in which cooling water is circulated through cavities or passages made in the valves or gates. When the water used for cooling the valves or gates is not previously purified, the chemical matter contained in the cooling water is gradually precipitated on the walls of the said cavities or passages, so that the cooling action is reduced. Further, the valves or gates and their seats are frequently deformed by differences of temperature, and in gates for gas pipes the seats located at the intake side are frequently incrusted by precipitation of parts of the gas deposited thereon by cooling the seats. The change of the temperature of the parts of the gates or valves will be understood when considering that when opening the pipe the gate is located in the top part of the casing, where it is not exposed to the action of the hot gas, while the seats of the gates are acted upon by the hot gas, so that their temperature is considerably higher than that of the gate. If, however, the valve is closed, the temperature of the gate is higher than that of the seat.

The object of the improvements is to provide a method and a system in which the gate or valve and their seats are cooled so that their temperature is always substantially alike.

With this object in view my invention consists in circulating the cooling water through passages made in the members to be cooled such as rings or gates and through a container communicating therewith, the circulation being regulated so that the parts to be cooled are always at uniform temperature. Preferably the container for the cooling water is connected at its top part with a condenser disposed at a higher level than the container, so that the water of condensation is automatically returned to the container.

For the purpose of explaining the invention an example embodying the same has been shown in the accompanying drawing in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawing,

Fig. 1, is an elevation partly in section showing a gate and the cooling means therefor,

Fig. 2, is a sectional elevation taken on the line 2—2 of Fig. 1,

Fig. 3, is a detail view showing a part of Fig. 1 and looking in the direction of the arrows 3—3, and

Fig. 4, is an elevation showing the condenser used in connection with the cooling system, it being understood that the said condenser is located at a higher level than the container for collecting the cooling water.

In the example shown in the drawing the valve consists of a casing *a* provided with hollow rings *b* and b^1 forming seats for the gate *c*. The gate *c* is connected with a stem *d* guided in a stuffing box 5. Any known or preferred means are provided for opening and closing the valve, such for example as gear wheels.

Above the casing *a* there is a container *e* for cooling water, which container is supported by means of pillars *f* on a plate *g* supported by means of four pillars *h* and h^1 on the casing *a*. The pillars *h* and h^1 provide guides for a transverse member formed with two arms *i* and i^1 and secured to the stem *d*, the arm *i* being guided between the pillars *h* and the arm i^1 between the pillars h^1. The arms *i*, i^1 are in tight engagement with the stem, and as shown, they are fixed to a conical collar 6 of the stem and held in position thereon by means of a nut 7.

To the bottom part of the container *e* a pipe *j* is secured, which is connected at its bottom end to the plate *g*. In a stuffing box 8 provided at the bottom end of the pipe *j* a pipe *k* is guided which is fixed at its bottom end to the arm *i*. Thus the pipe *k* can follow the vertical movements of the gate *c*, the stem *d* and the arm *i*. The arm *i* is provided with a passage *m* communicating with a passage *n* made in the stem *d*, and the passage *n* extends through a tubular extension *p* provided at the bottom part of the stem *d* and within the cavity of the gate *c*, the tubular

extension p ending near the bottom of the said cavity. To the pipe j a pipe o is secured which is bifurcated at its bottom end, and the branches of the said pipe are connected respectively with arms o^1 and o^2 communicating with the cavities of the rings b and b^1. The stem d is provided with a second longitudinal passage n^1 communicating with a passage m^1 made in the arm i^1, and the said arm is connected with a vertical pipe k^1 telescopingly engaging in a pipe j^1 connected to the container e substantially at the middle of its height and below the level of the water contained therein, a stuffing box 9 being provided for producing a tight joint between the pipes k^1 and j^1. From the pipe j^1 a pipe q is branched off, which is bifurcated at its bottom end and is connected with arms q^1 and q^2 connected with the top parts of the cavities of the rings b and b^1. The container e is connected near its bottom by a pipe r for the supply of cooling water. The pipe r is preferably connected with a condenser s the cooling pipes of which are connected by a pipe u with the top part of the container e, the said pipe including a pressure regulating valve t. Thus the steam developed within the container e is condensed within the condenser s and the water of condensation is returned to the container e through the pipe r. In the drawing the condenser s is shown substantially at the same level as the container e, but I wish it to be understood that practically the said condenser is disposed at a higher level so that the water of condensation flows by gravity to the container e. Cooling water is circulated through the condenser through an intake pipe v and a discharge pipe w. Any air developed within the system escapes through a pipe x.

The container e comprises a gage glass 10 showing the water level within the container, a safety valve 11 and a manometer 12. Preferably the safety valve is set so that it blows off at a slightly higher pressure than the pressure set by the regulating valve t.

The operation of the system is as follows:

The container e and the passages connected therewith are filled with water to the level indicated in Fig. 1, the said water flowing from the container through the conduits j, k, m, n, p into the gate c and through the conduits j, o, o^1, o^2 into the rings b, b^1, and it rises within the said spaces from the bottom part thereof. Thereby the water which has been heated within the said spaces rises upwardly by reason of its smaller specific gravity, the water flowing from the gate c upwardly through the conduits m^1, n^1, k^1 and j^1 and from the rings b and b^1 through the conduits q^1, q^2, q and j^1, and into the container e. The pressure within the container e is always slightly lower than the pressure within the cavities b, b^1 and within c. Therefore, the hot water returned through the pipe j^1 into the container e develops steam, the amount of the steam corresponding to the reduction of the pressure within the container e and the reduction of the boiling temperature of the water connected therewith. After some time the whole amount of the circulating water has been heated to the boiling temperature corresponding to the pressure maintained within the container e by means of the pressure regulating valve t. The steam developed within the container e is condensed within the condenser s, and the water of condensation is returned to the container e. Therefore the water of condensation performs a complete cycle, and special means for circulating the water are not needed. Ordinarily a supply of fresh water may be dispensed with, because the vaporized water is returned to the container.

In some cases the condenser s is dispensed with, in which case the steam generated within the container e is used for other purposes. In this case the water transformed into steam is replaced by a supply of fresh water. In other cases the circulation of the water is carried out so that no steam is generated, and the water is under atmospheric pressure, the comparatively cold water circulating through the system merely by reason of the difference of the specific gravity of the hot and the cold water.

I wish it to be understood that the container e and the condenser s may be disposed laterally of and above the valve casing a.

While in describing the invention reference has been made to a particular example embodying the same I wish it to be understood that my invention is not limited to the construction shown in the drawing, and that various changes may be made in the general arrangement of the apparatus and the construction of its parts without departing from the invention.

I claim:

1. A gate valve cooling system of the type including water jacketed valve seats, a gate valve cooperating with the seats and having circulation flow-paths therein, a water container elevated above said seats and valve, circulation pipes extending downwardly from the container to said seats and valve, also upwardly to the container from said seats and valve, said system designed to flow cooling water downwardly from the container to said seats and valve and to permit the hot vapors to rise upwardly to the container from the seats and valve, and said system operating to maintain less pressure in the container to which the hot vapors rise than in said seats and valve in which downwardly gravitational force is exerted by reason of the elevation of the container.

2. A gate valve cooling system of the type including water jacketed valve seats, a gate valve cooperating with the seats and hav-

ing circulation flow-paths therein, a water container elevated above said seats and valve, circulation pipes between the container and said seats comprising a main pipe extending downwardly from the container to said seats, a main pipe extending upwardly to the container from said seats, and branch pipes connected with said valve to move therewith and communicating with the flow-paths therein, said branch pipes extending upwardly from said valve and having portions telescoping within and communicating with the main pipes below the container.

3. A gate valve cooling system of the type including water jacketed valve seats, a gate valve cooperating with the seats, and having a chamber therein, a stem for the valve provided with inlet and outlet flow-paths communicating with the chamber, a water container above the seats and stem, a main pipe extending downwardly from the container to the seats and including a branch pipe communicating with the inlet flow-path, whereby to supply cooling water to the seats and valve by gravitational force, a main pipe extending upwardly to the container from the seats and including a branch pipe from the outlet flow-path, whereby to permit hot liquid and vapor to rise to the container from the seats and valve, said branch pipes being carried by the stem to move therewith and having portions slidably telescoping within the main pipes, and means arranged to seal the connection between the operating branch pipes and main pipes.

4. A gate valve cooling system of the type including water jacketed valve seats, a gate valve cooperating with the seats and provided with a stem, the valve and stem having circulation flow-paths therein, a water container elevated above said seats and stem, circulation pipes comprising a main pipe extending downwardly from the container to the seats, a main pipe extending upwardly to the container from the seats, branch pipes connected with the valve stem to move therewith and communicating with the flow-paths therein, said branch pipes extending upwardly from the stem and having portions telescoping within and communicating with the main pipes below the container, and guide means for the branch pipes.

5. A gate valve cooling system of the type including water jacketed valve seats, a gate valve cooperating with the seats and provided with a stem having lateral arms, the valve, stem and arms having circulation flow-paths therein, pillars rising from the casing and supporting a water container elevated above the stem and arms, said pillars forming guides for the stem and arms, circulation pipes comprising a main pipe extending downwardly from the container to the seats, a main pipe extending upwardly to the container from the seats, branch pipes connected with arms to move therewith and communicating with the flow-paths therein, said branch pipes extending upwardly from the arms and having portions telescoping within and communicating with the main pipes below the container.

In testimony whereof I hereunto affix my signature.

ANDREAS BORCHARDT.