May 7, 1968 H. B. CARR 3,381,702

WATER-COOLED VALVE FOR BLAST FURNACE STOVES

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Fig. 1.

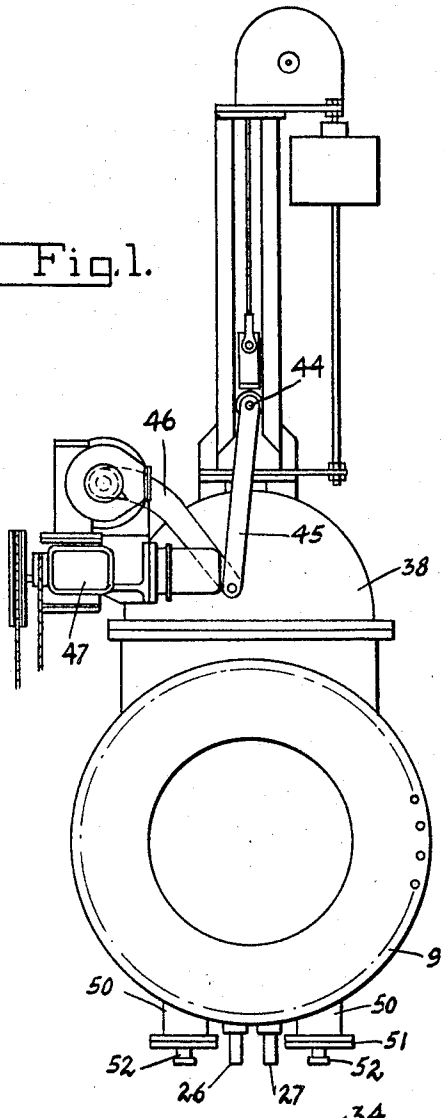
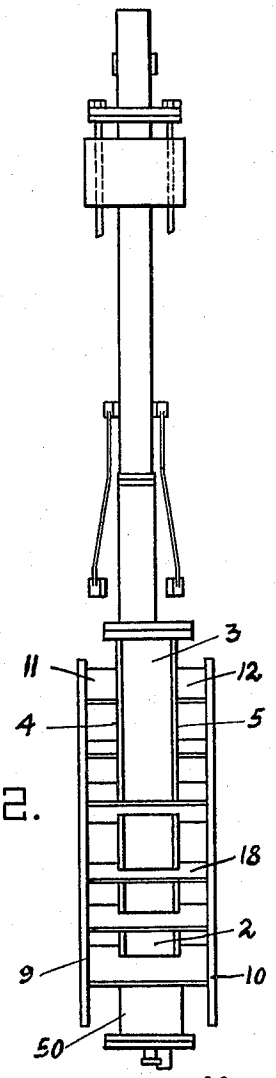


Fig. 2.



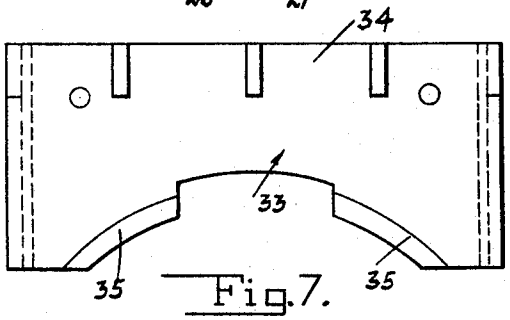


Fig. 7.

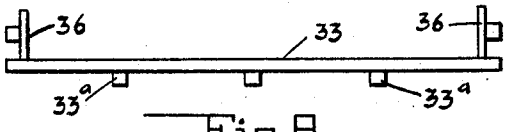


Fig. 8.

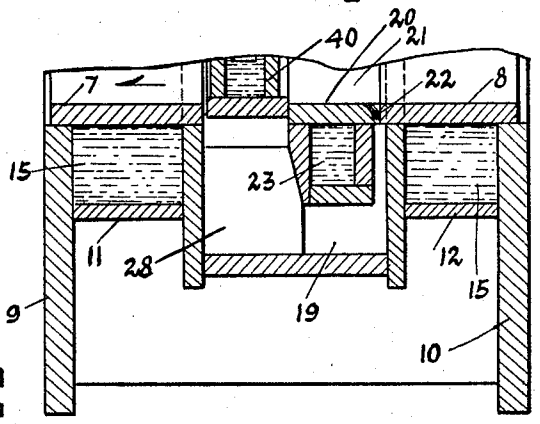


Fig. 9.

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Fig. 3.

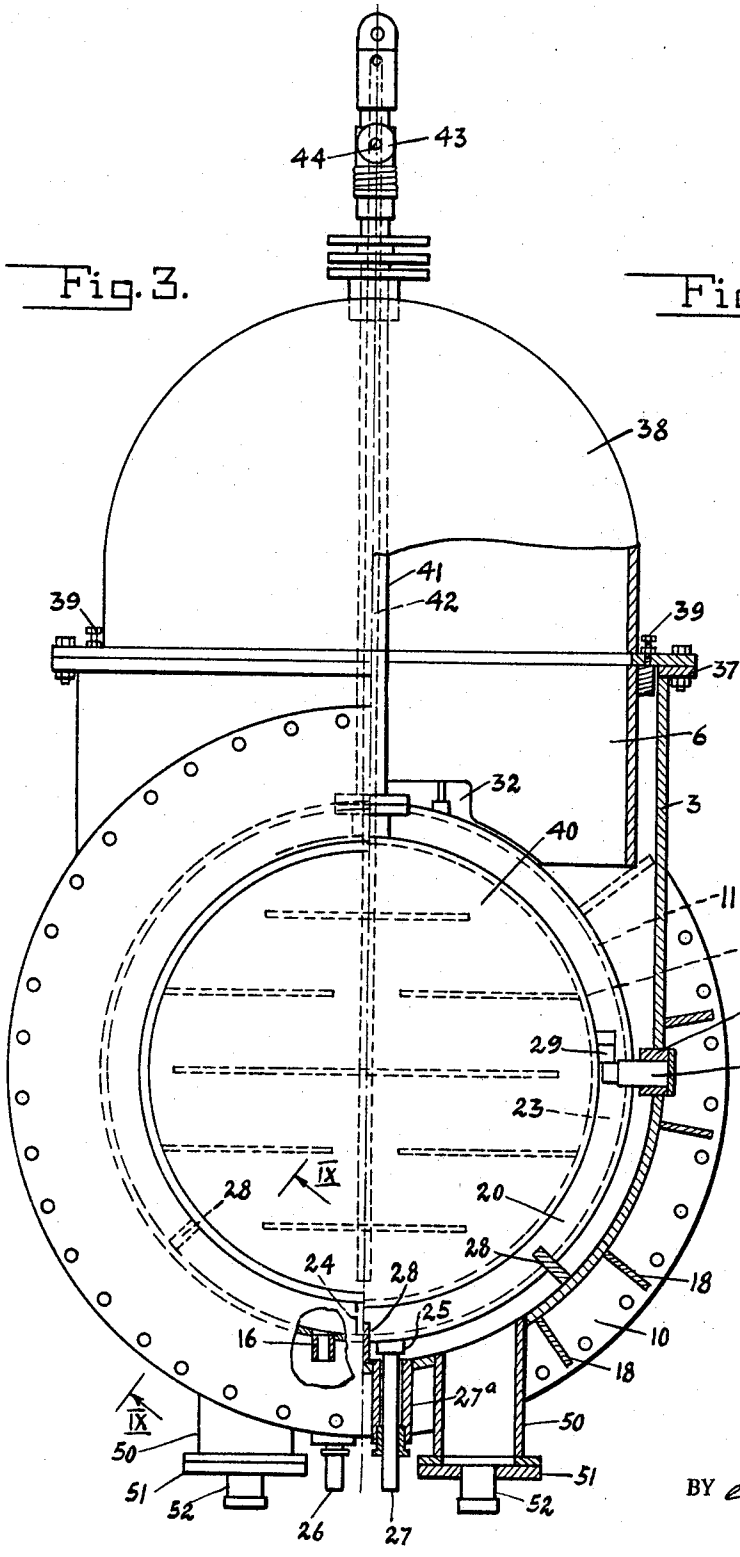
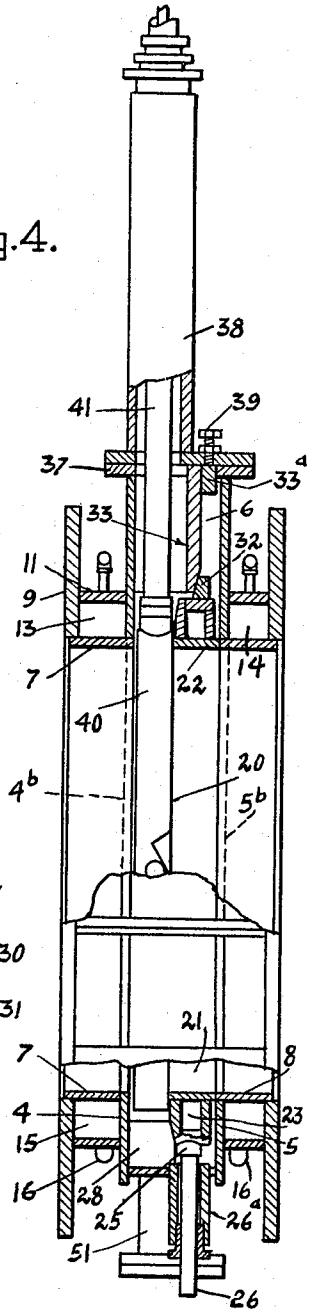


Fig. 4.



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WATER-COOLED VALVE FOR BLAST FURNACE STOVES

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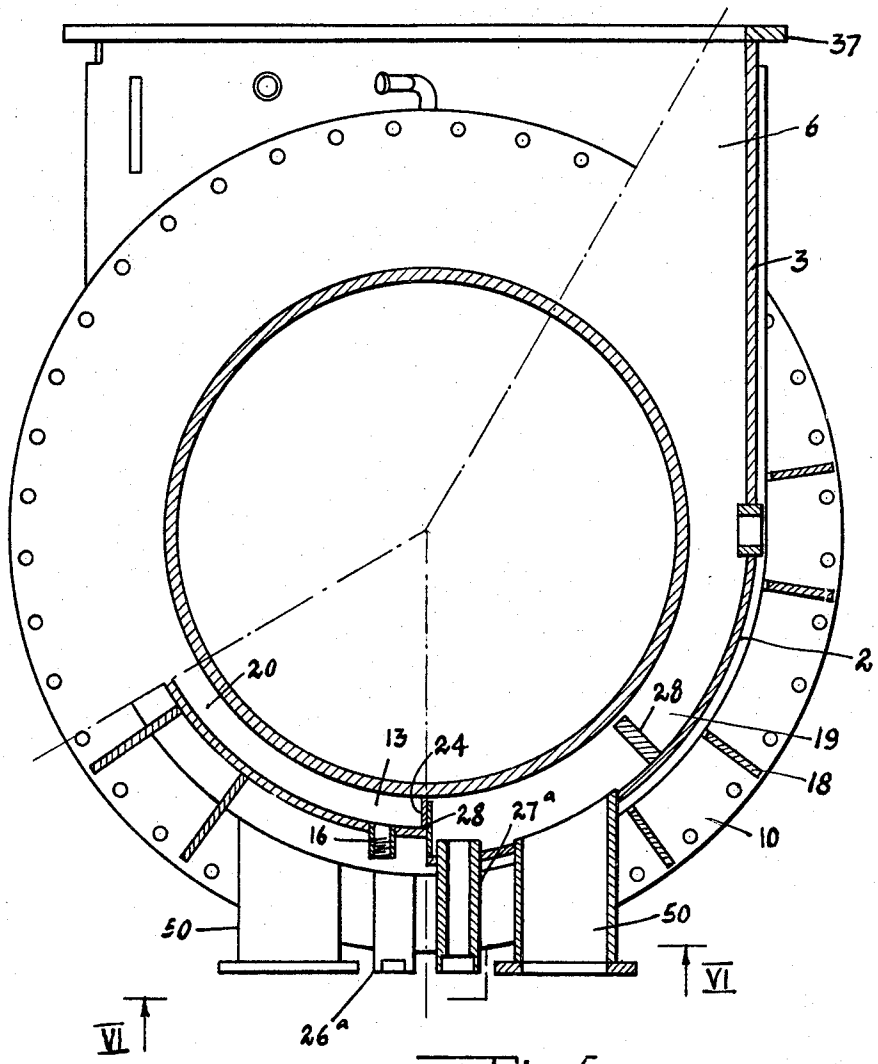

Fig. 5.

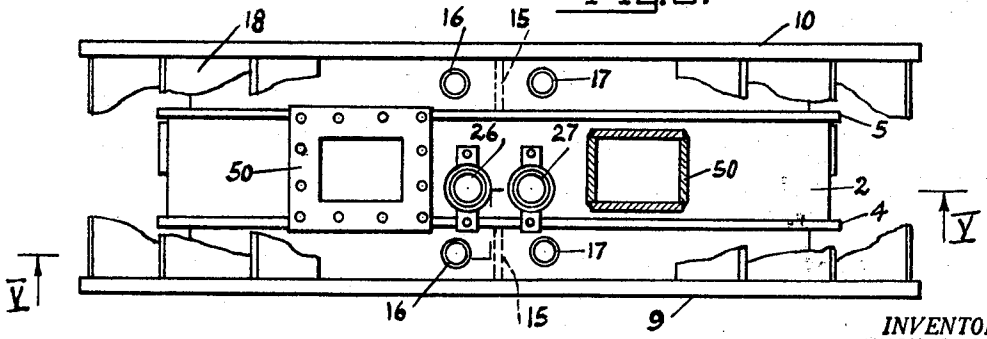

Fig. 6.

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United States Patent Office 3,381,702 Patented May 7, 1968

3,381,702

WATER-COOLED VALVE FOR BLAST FURNACE STOVES

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Filed Dec. 6, 1965, Ser. No. 511,602
5 Claims. (Cl. 137—340)

ABSTRACT OF THE DISCLOSURE

This application pertains to a water-cooled valve designed particularly for use with the burners of blast furnace stoves. The valve body is fabricated from sections which are welded together. The valve gate seats against valve rings held in the body by wedges which, at the lower quadrant of the valve body, are in the form of integral webs, and which, in the diametrically-opposite sides of the valve body and at the top of the valve rings are removable when the bonnet of the valve is removed. Upon removal of the last two mentioned wedging elements, the rings may be lifted out through the open top of the body.

This invention is for a water-cooled valve designed for use particularly with the burners for blast furnace stoves, as for example, with the burner disclosed in patent to S. P. Kinney, No. 3,086,592, granted Apr. 23, 1963.

In the operation of a conventional blast furnace stove, fuel gas and air are supplied to a burner and the burning gas travels up the combustion chamber of the stove and hot products of combustion then travel through the checker brick of the stove. When the stove is put on blast and air under pressure is blown through the stove, the burner port and burner must be closed against the backflow of air through the burner. There may be variations of this arrangement, but the function of the burner valve is to seal the stove against the backflow of air when the stove is on blast.

In the environment in which the valve is used, it is desirable that it be water-cooled, and it is further desirable that the valve be so constructed that all normal service and repairs can be made while the valve stays in the line, that is, the repairs can be made without removing the valve from the burner. To a certain extent the valve is a modification of the double disk valve of my application Ser. No. 344,319, filed Feb. 12, 1964, now Patent No. 3,266,517 granted Aug. 16, 1966.

The principal object of the invention is to provide a water-cooled burner valve having a single valve disk, the valve being of unique construction with a water-cooled body, a water-cooled seat ring removable through the valve body upon removal of the bonnet, and a water-cooled valve disk, also removable from the valve upon removal of the bonnet.

A further object of the invention is to provide such a valve wherein the valve body may be fabricated by welding the various parts.

These and other objects and advantages are secured by this invention, as will become hereinafter more fully apparent to those skilled in the art.

The invention may be more fully understood by reference to the accompanying drawings, in which:

FIG. 1 is an elevation of the valve looking at the downstream or discharge side;

FIG. 2 is a side elevation of the valve shown in FIG. 1;

FIG. 3 is a view generally similar to FIG. 1 but on a larger scale and partly in section and partly in elevation to show the interior of the structure at one side of the vertical center line;

FIG. 4 is a side view of FIG. 3 also partly in section and partly in elevation;

FIG. 5 is an enlarged view of the valve body itself with a bonnet and seating ring removed, the figure being a broken section generally in the plane of line V—V of FIG. 6;

FIG. 6 is a bottom plan view with parts shown in section, the section being in the plane of line VI—VI of FIG. 5;

FIG. 7 is a front elevation of the wedging frame removed from the valve body;

FIG. 8 is a top plan view of the wedging frame; and

FIG. 9 is an enlarged detail sectional view through the bottom portion of the valve body, the view being a section in the plane of line IX—IX of FIG. 3.

Referring to the drawings in detail, they show a valve body fabricated by shaping and welding metal plates, as contrasted with the more common cast metal construction. The valve body comprises a central plate bent to a generally U-shaped form, with a half-circular lower portion **2** and upwardly-extending parallel sides **3** which extend tangentially from the curved bottom portion. This plate is disposed between two confronting spaced transverse inner plates **4** and **5**, each shaped to the contour of the body plate with a half-circular lower portion and upward extensions **4***a* and **5***a*, respectively. Each of the plates **4** and **5** has a circular port **4***b* and **5***b* respectively therethrough. These metal parts, welded together, form a generally U-shaped enclosure with a circular passageway therethrough and with a vertically-extending chamber **6** which is rectangular in horizontal section with the long axis of the rectangle being transverse to the passage through the ports. This part of the structure constitutes an intermediate section between two tubular sections to be next described.

Extending axially from the outer face of each of the inner plates **4** and **5** are short cylindrical tubular inner sections **7** and **8**, respectively. Welded to the outer end of each of these sections are flange plates or annuli **9** and **10**, respectively, for connecting the valve body into the tubular burner sections (not shown). Concentric about and spaced from the inner tubular sections are outer tubular sections **11** and **12** respectively, which are also welded to the outer faces of the plates **4** and **5** respectively, and to the annuli **11** and **12** respectively. There are thus provided two annular water-circulating spaces **13** and **14** respectively, one around each tubular end section of the valve body. There is a transverse wall **15** across each of these spaces, and there is a pipe nipple **16** in the outer cylindrical wall of each space near this wall or partition for cooling water inlet pipes (not shown), and near the opposite sides of the partitions **15** are water outlet nipples **17**. Spaced connecting plates **18** are positioned around the exterior of the valve body and welded thereto both to brace it and provide heat dissipating fins.

The radius of the cylindrical sections **7** and **8** is substantially the full diameter of the openings **4***b* and **5***b* in the plates **4** and **5**, respectively, but the semi-circular portion **2** of the central plate is curved about a larger radius, so that there is a channel-like recess or offset **19** between the inner ends of the cylindrical sections **7** and **8**. There is a seating ring **20** that is inserted into the valve body through the rectangular top portion **6** and which sets into this offset or channel. It is in the form of a hollow annulus with the opening **21** therethrough of the same diameter as the inside diameter of the cylindrical body portions **7** and **8**. Its radius is greater than the cylindrical body **8** against which it bears, but less than the radius of the curved portion **2**, or its diameter is less than the width of the space **6** in the rectangular extension of the body as hereinbefore described. In one side

face it has an annular gasket **22** that bears against the inner end of the cylindrical body member **8**. This gasket is of a heat-resistant material, and because it is between two water-cooled surfaces, silicone rubber is preferably used. The hollow passageway **23** in the seating ring is blocked at the bottom by a transverse wall or partition **24**. There is a pipe nipple **25** in the periphery of the ring at each side of this partition into one of which is screwed the end of a cooling water inlet pipe **26** and into the other a water outlet pipe **27**, the arrangement therefore being such that the cooling water must travel practically entirely around the interior of the hollow seat ring from the inlet to the outlet. There are sleeves **26***a* and **27***a* through which pipes **26** and **27**, respectively, pass, with glands at their lower ends to prevent the escape of gas from the valve around pipes **26** and **27**. When the valve seat is raised out of the body for repair or replacement, these sleeves provide a guide in the body in which the pipes **26** and **27** slide so that they always remain in position to enable the seat to be readily lowered and replaced inside the valve body. For jamming the lower portion of the seating ring against the end of the cylindrical body section **8**, there are fixed wedge plates **28** in the channel **18** which extend part way across the channel, and which are of increasing width downwardly so that as the seat ring is pushed down into position, it is wedged to the right by these plates as shown in FIG. 9. There are preferably three of the fixed wedge plates, one at each side of the longitudinal center plane of the valve body, and one at the central plane.

In addition to this, the seating ring has diametrically opposed cam elements **29** thereon, one at each side of the ring, and to one side of the central transverse plane of the ring. A sleeve **30** passes through the sides of the valve body adjacent these cams. There is a rotatably adjustable stud **31** in each sleeve with an eccentric inner end that contacts the adjacent cam element **29** as the seat is forced into place, thereby exerting increasing pressure against the ring to jam it against the end of the cylindrical section **8**. The stud may be adjusted from time to time by rotating it to a position to exert a positive thrust against the ring.

In addition to the foregoing, the top of the ring has a cam **32** of downwardly-increasing width at each side of the vertical center line. There is a wedging frame **33** inside the chamber **6** having a vertical plate **34** with a lower edge that straddles the top of the seating ring, and which has a beveled edge **35** that cooperates with the cams **32** for forcing the top of the seating ring against the end of cylindrical section **8** when the frame is forced down. The plate **34**, which is parallel with plate **5**, has wings or thrust strips **36** at each end that bear against the inner surface of plate **4** to resist the lateral thrust against the plate **34**.

At the top of the rectangular extension enclosing the space **6** there is a peripheral flange **37** on which sets a bonnet **38** that is removably bolted and sealed to the flange and the interior **39** of which forms with the chamber **6** a continuous chamber or space into which the valve disk, to be hereinafter described, is raised when the valve is open. This bonnet has jack-screws **37** at its base that bear against an offset **33***a* on the wedging frame for forcing and holding the wedging frame down.

There is a circuilar valve disk **40** of slightly smaller diameter than the seating ring **20** which is hollow with interior baffles therein. It has a stem at the top comprising an outer tube **41** that extends up through a packing on the top of the bonnet, and which constitutes a water outlet pipe, and an inner water inlet pipe **42** of smaller diameter extending coaxially thereof and projecting into the lower portion of the hollow disk. There is a combined water supply and outlet fitment to the respective pipes and operating connection **43** at the top of the stem. This connection includes studs **44** at each side of the fitment

over each of which is the end of an operating link arrangement **45**, these links having their lower ends connected to a lever **46** that is raised and lowered selectively by motor of a hand-operated chain drive assembly **47**. This arrangement is known in the art, being generally shown in Patent 3,113,589, granted Dec. 10, 1963. The drive is mounted on a bracket extending upwardly from the valve body. Through the operation of this drive and linkage the valve disk may be raised from a closed position where it is against the seating ring, which is the upstream side of the burner valve, to an open position where the disk is drawn up into the chamber inside the vertical extension of the valve body and the bonnet. The wings or thrust elements **36** on the wedge frame are sufficiently far apart that they do not interfere with the valve disk when it is raised to full open position.

When the bonnet is loosened it may be raised and the valve disk lifted clear of the body. The wedging frame **33** may be removed, after which the seating ring may be removed for inspection, repair or replacement.

In the bottom of the curved body plate portion **2** are two clean-out sumps or wells **50**, one at each side of the vertical center line as viewed in FIG. 3. Each well has a removable bottom plate **51** bolted thereto, and each bottom plate has a nipple **52** which is normally capped, but to which a tube or pipe may be connected for either injecting or draining water to flush sediment from the valve, particularly the channel **19** below the seating ring and valve disk.

This valve is normally placed in the burner between the discharge end of the burner and the air and gas supply lines. It is open at all times the burner is operating, but when the stove is on blast the valve is closed and the pressure in the stove urges the disk against the seating ring. By machining the inner end of the cylindrical body member **8** and having it extend slightly to the left of the transverse plate **5** as viewed in FIG. 1, a good seal is provided between the seating ring and the valve body, particularly with the various wedging elments around the valve seat, and because the gasket **22** is adjacent water-cooled metal on both the seating ring and the valve body, it is cooled adequately so that a rubberous silicone resin may be used. The valve as thus constructed can therefore be serviced without removing it from the burner. This is important both from the standpoint of reducing down time for a stove if repairs are required during an operating campaign, reduces labor and eliminates hazard. The construction is especially advantageous where the valve body is fabricated from metal plate.

While I have shown and described a preferred construction, various modifications may be made within the contemplation of my invention.

I claim:

1. A valve of the class described comprising

(a) a valve body comprised of two spaced tubular sections in axial alignment providing a passageway through the valve,

(b) an intermediate connecting section having a semi-circular lower portion providing a channel-like recess between the two tubular sections and having tangential sides extending upwardly from the semi-circular lower portion and providing an extension providing an enclosed chamber of generally rectangular cross sectional shape with the long axis of the rectangular section shape being crosswise of the passage through the valve,

(c) means forming with each of said tubular sections a water-circulating passage around the exterior of each tubular section,

(d) a valve seat ring in the form of a hollow annulus set in said intermediate section and confronting and bearing against one of said tubular end sections, with the interior diameter of the annulus substantially the same as the interior diameter of the tubular section, the lower half of said annulus being received

in said channel-like recess, the size of the annulus being less than the chamber such that the annulus may be inserted and removed through said enclosed extension,

(e) wedging elements in the lower portion intermediate section for holding said seat ring against the tubular section which it abuts,

(f) the seat ring having lugs at the top thereof,

(g) a removable wedge frame in said chamber having a lower edge portion wedged behind said lugs for urging the upper part of the seat ring against the tubular end section which it abuts, said wedge frame extending parallel with the long dimension across the chamber and having a wing element at each end projecting therefrom in a direction away from the seat ring and bearing against the wall of the chamber in a manner to hold the wedge frame against said lugs,

(h) a bonnet on said extension having a hollow interior forming part of said chamber,

(i) a hollow valve disk in the body movable from a closed position against said seat to an open position in said chamber, the wings on the wedge frame being spaced apart greater than the width of the valve disk to clear the valve disk when it is raised to the open position,

(j) a stem attached to said disk passing up through the bonnet, said stem having duel passageways therein for circulation of water into and from the disk,

(k) inlet and outlet water pipes connected into the lower portion of the seat ring for circulating water therethrough, and

(l) a partition across the interior of the seat ring between the inlet and outlet pipes.

2. A valve as defined in claim 1 wherein the seat ring has a wedge element at diametrically opposite points thereon midway between the top and bottom thereof and which are on that face of the ring which is remote from the tubular end section against which the ring abuts, the valve body having diametrically opposite studs mounted thereon against which said wedge elements engage for urging the portion of the seat ring between the top and bottom against the tubular section which it abuts.

3. A valve as defined in claim 1 in which the surface of the seat ring which bears against said tubular end section has a gasket therein that seals against said tubular end section.

4. A valve as defined in claim 1 in which the water inlet and outlet pipes are slidably guided in the valve body to move up and down with the seat ring when it is moved upwardly out of the valve body or lowered into position.

5. A valve as defined in claim 1 in which the bonnet has jack screws thereon passing downwardly therethrough and bearing against the top of the wedging frame to force it downwardly.

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HENRY T. KLINKSIEK, *Primary Examiner.*