March 13, 1934. F. M. PATTERSON 1,951,037

BLOW-OFF VALVE

Filed June 10, 1930

Fig. 1

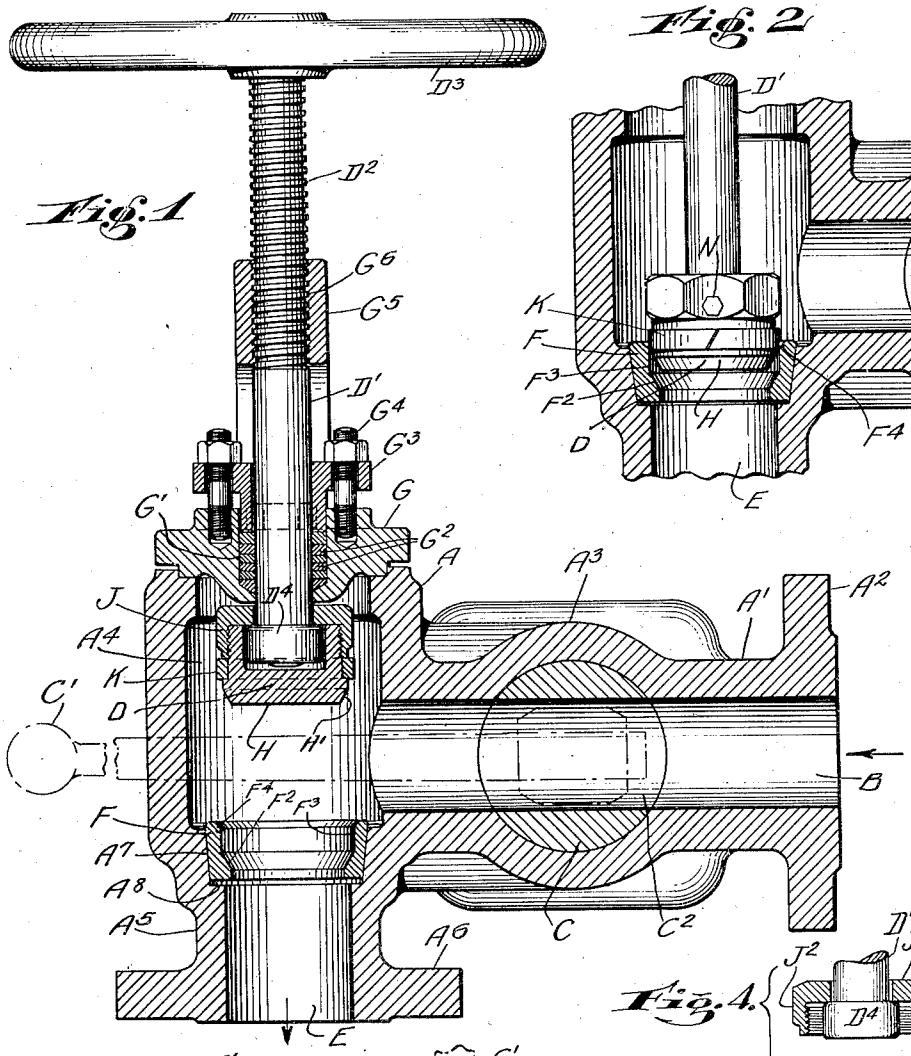


Fig. 2

Fig. 3

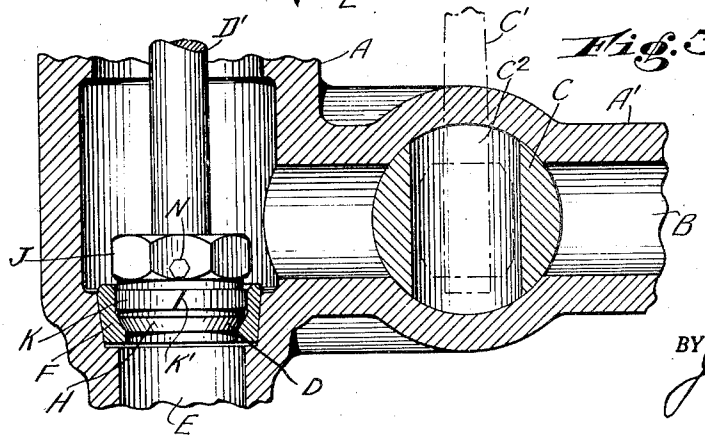
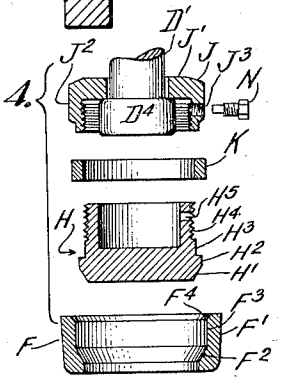


Fig. 4.



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BLOW-OFF VALVE

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11 Claims. (Cl. 251—28)

The present invention relates in general to the construction and mode of operation of valves particularly adapted for use in the operation of blowing down a steam boiler. The necessity and desirability of periodic blow-down operations for the removal of mud and other scale forming matter from the boiler is well established. While a single blow-off valve is sometimes used in low pressure boiler installations, it is now almost universal practice with modern steam boilers to use a two valve, or tandem, blow-down arrangement for insuring the greatest economy and safety. In one type of tandem valve arrangement, such as is illustrated for example, in my prior application, Serial No. 206,259, filed July 16, 1927, issued as Patent No. 1,843,930, on February 9, 1932, only the valve next to the boiler is subject to the boiler pressure between the blow-down operations and for such operations is advantageously opened first and closed last, while the outer main or stop valve, which actually controls the blow-down operation, is opened after and closed before the first valve. This main valve is desirably constructed so as to lessen as much as possible the corrosive and erosive actions of the water and solid impurities carried thereby on the valve sealing parts, particularly when the valve is in such a position that wire drawing will occur. Such valves when incorporated in a common one-piece forged steel body, as illustrated in my said prior application, are adapted for use with pressures as high as 1,350 lbs. per sq. in. The high cost of manufacture of such valves, however, generally prohibits their use for pressures less than 400 lbs. per sq. in. The present invention particularly relates to blow-off valves adapted for use in a single or tandem valve blow-down arrangement with pressures generally below 400 lbs. per sq. in.

The main object of my invention is the provision of a valve of this character with an improved construction and mode of operation, and more particularly, a blow-off valve characterized by its extremely low cost of manufacture, long life, ease and economy of operation, simplicity of construction, capacity for self-cleaning and adaptability for rapid assembly, and replacement and repair of the parts subject to wear. A further specific object of my invention is the provision of a blow-off valve having improved means for taking up the wear due to corrosion and erosion during the wire drawing action to which the valve sealing parts are ordinarily subjected, without decreasing the efficiency of the valve as a whole.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, and the advantages possessed by it reference should be had to the accompanying drawing and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawing:

Fig. 1 is a vertical section of a tandem valve blow-down arrangement incorporating my invention;

Fig. 2 is a vertical sectional view of a portion of the main valve of Fig. 1 with the valve member in an intermediate position;

Fig. 3 is a vertical sectional view of a portion of the tandem valve arrangement with the valves in their normal completely closed position; and

Fig. 4 is a vertical sectional view of some of the valve parts disassembled.

In the preferred embodiment of the invention illustrated, A designates a valve body, preferably formed of high grade cast iron or cast steel and adapted for use in boiler installations with pressures up to 250 lbs. per sq. in. and 400 lbs. per sq. in. with such materials, respectively. The valve body is shown as L-shaped in form with an elongated horizontal section A', adapted to be connected to the boiler by an end flange A^2, and through which connection a valve inlet passage B is brought into communication with the boiler mud drum. An intermediate portion of the body section A' is enlarged at A^3 to permit the incorporation therein of a rotary plug valve C arranged for movement by an operating lever C' to cause a valve passage C^2 therein to register with and provide communication between the adjacent portions of the inlet passage B or to close the latter. The rotary plug valve illustrated is preferably constructed and operated in the manner described in my said prior application and inasmuch as its specific construction forms no part of my present invention, a more specific description of this valve is unnecessary.

The inlet passage B at its inner end opens into a substantially cylindrical valve chamber A^4 formed in the valve body and in which the main valve D is vertically movable. The valve body is formed with a short outlet section A^5 flanged at A^6 in the usual manner for connecting an axial outlet passage E therein to a suitable drainage pipe system. The portion of the valve section A^5 adjacent the upper end of the outlet passage E is internally enlarged and tapered at A^7 and

terminating at its lower end in an annular shelf A^8, to receive therein a valve seat member F, hereinafter described.

The valve body is closed at its upper end by a bonnet G removably held in fluid-tight engagement therewith and formed with an axial passage G' therein for the valve stem D' of a main valve D. The passage is closed in a well known manner by packing rings G^2, a gland nut G^3, and stud bolts G^4. A vertical yoke G^5 is secured to the bonnet G and provided with a threaded passage G^6 therein for the upper threaded end D^2 of the valve stem.

In tandem valve boiler blow-down arrangements heretofore in use, the valve seat member and corresponding contacting parts of the movable valve member have been usually subjected to severe scoring and corrosive actions when the valve member is approaching or being withdrawn from its seating position due to wire drawing of the high pressure steam and water passing therethrough and the large quantities of solids carried by the escaping water. Such conditions result in rapid destruction of the parts subjected thereto and leakage through the valve unless the worn parts are quickly replaced. To reduce the effects of the wire drawing action on the valve and valve seat member, provisions have been suggested for closing the valve outlet passage during a portion of the movements of the valve towards and away from its seating position. Provisions heretofore proposed for this purpose have been generally objectionable because either the escaping solids were caused to collect on the valve seat and thereby prevent the complete closing of the passage by the valve member or because the flow was only partly cut off before the valve member was seated due to the necessarily loose fit of the auxiliary provisions. Improved provisions for this purpose are provided in the present valve by a special construction and mode of operation of the valve D and the valve seat member F, as is hereinafter described.

The valve seat member F illustrated has an external taper F' corresponding to that of the body seat receiving section A^7 and so proportioned as to be firmly held therein. The inner wall of the valve seat member defining the axial passage therethrough comprises a lower seat section F^2, preferably tapered, and an upper cylindrical section F^3 which forms a continuation thereof, and both of which are accurately machined to provide a snug contact with corresponding parts of the valve D. The uppermost portion of the cylindrical section F^3 is slightly flared at F^4, for a purpose hereinafter described. The axial passage so formed in the seat member thus comprises a plurality of portions successively decreasing in diameter from top to bottom. The valve seat member is preferably formed of a high grade alloy steel, such as nitralloy, which is characterized by its high resistance to corrosion and erosion by water.

The main valve D comprises a valve stem D' vertically arranged in the bonnet structure G and axially movable therein, due to the threaded engagement of the valve stem and yoke, by rotation of a hand wheel D^3. The lower end of the valve stem is formed by a cylindrical enlargement D^4 which, as hereinafter described, forms a part of the means by which a valve sealing disc H is positioned relative, and detachably connected, to the valve stem D'.

The valve sealing disc H, as shown in Fig. 1, consists of a lower frusto-conical section H' having an external taper corresponding to that of the valve seat section F^2, a cylindrical section H^2 forming a continuation of the frusto-conical section and of slightly less diameter than the cylindrical section F^3 of the valve seat, and a slightly longer reduced cylindrical portion H^3 immediately above the portion H^2, and terminates in an elongated externally threaded annular extension H^4 in which the valve stem enlargement D^4 is adapted to be positioned. The disc H is preferably made of the same material as the valve seat member and with the surfaces of the sections H', H^2 and H^3 accurately machined to the proper size. The disc is detachably connected to the valve stem D' by means of a nut J having a horizontal portion J' surrounding the valve stem immediately above and supported on the upper side of the enlargement D^4. A depending internally threaded sleeve J^2 of the nut is arranged to engage the externally threaded extension H^4 of the disc. These parts are so proportioned as to bring the lower end of the nut at substantially the upper level of the disc section H^3, thus forming a circumferential recess defined by the lower side of the nut, the upper side of the disc section H^2, and the outer surface of the disc section H^3.

In the recess thus formed is positioned a sealing ring K, preferably of Monel metal, and having an external diameter greater than the maximum disc diameter and slightly greater than the diameter of the cylindrical wall section F^3 of the valve seat member. The sealing ring is vertically split at K', as indicated in Figs. 2 and 3, and the connection of the disc and nut therewith prevents any relative vertical movement but permits a slight circumferential expansion and compression of the ring when in position. The sealing ring illustrated may advantageously be quite heavy inasmuch as it is positioned during the assembling of the valve parts, no springing of the ring into the recess being required. With the disc, nut and sealing ring arranged as described, the parts are preferably locked in their proper positions, by means of a locking screw N threaded through an opening J^3 in the depending sleeve of the nut, which when the parts are properly positioned, registers with an opening H^5 in the disc extension. This locking arrangement insures maintenance of the various cooperating valve parts in their positions described while the valve is in use.

When the valve construction described is used in a tandem valve blow-down arrangement and a blow-down operation is required and the tandem valves are in their normal closed position illustrated in Fig. 3, the operator first moves the valve lever C' to the rotary plug valve open position, whereupon the main valve D will then be exposed to the action of the boiler water and solid impurities therein at boiler pressure. The hand wheel D^3 is then turned to gradually raise the main valve from its seated position. As the valve moves upwards towards the position illustrated in Fig. 2, the frusto-conical portion H' of the disc moves out of contact with the valve seat section F^2. The axial passage in the valve seat member will remain closed during this movement due to the sealing ring K being in contact with the walls of the cylindrical section of the valve seat member, except for possible leakage through the split K' in the sealing ring. When the valve reaches the position indicated in Fig. 2, the sealing ring will pass out of contact with the cylindrical seat section F^3 and expand into contact with the lower end of the flared wall

section F^4. After the sealing ring had expanded to its maximum degree it will pass out of contact with the flared portion F^4 and permit the water and solid matter therein to rush into the outlet passage E. Substantially all the corrosive and erosive effects caused by this wire drawing of the water will be taken up by the sealing ring lower edge portions and the upper end of the valve seat member with little or no injury to the disc seating section H' or valve seat section F^3. The wearing action on the valve parts substantially decreases as the valve is raised to the fully open position shown in Fig. 1 in which it is out of the discharge path of the water.

When the blow-down operation has continued for the desired time, the main valve D is gradually lowered to its seating position. During this movement, the corrosive and abrasive action of the water will again occur, but to a lesser degree. As the valve approaches the position shown in Fig. 2, the lower edge of the sealing ring will come into contact with the flared seat section F^4, which circumferentially compresses the ring to permit it to enter the cylindrical section of the seat. By this arrangement an extremely close fit can be maintained with the cylindrical section F^3, but without tending to jam the valve therein and cause the position of the valve seat member to be varied when the valve is withdrawn. The valve movement continues until the disc H reaches its sealing position. The plug valve C will then be closed by the operator.

The main valve construction described in addition to the advantages heretofore stated, thus incorporates the double tightness principle by the sealing actions between the ring K and seat wall and between the disc H and its seat. No leakage can take place when the valves are closed and any leakage occurring through the ring split while the main valve is being moved will serve to wash the valve seat rather than cause accumulations thereon. Cleaning and repairing of the valve can be quickly effected by removing the bonnet structure. The valve can be easily adapted for a higher pressure range by substituting a suitable forged steel body for that shown herein.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

Having now described my invention what I claim as new and desire to secure by Letters Patent, is:

1. A blow-off valve comprising a valve body having inlet and outlet openings therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein and having an upper cylindrical inner wall section and a lower seat section, and a valve member adapted to control said outlet opening and comprising a disc adapted to seat on said lower seat section of said seat member, a valve stem connected to said disc, a heavy metallic sealing ring positioned above said disc and arranged to circumferentially contact with the cylindrical section of said seat member and close said axial passage during the movements of said disc towards and away from its seating position, and means movable on said valve stem for holding said sealing ring in position relative to said disc.

2. A boiler blow-off valve comprising a valve body having inlet and outlet openings therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein and having an upper cylindrical inner wall section and a lower tapered seat section forming a continuation of said cylindrical wall section, and a valve member adapted to control said outlet opening and comprising a tapered disc adapted to seat on said tapered seat section of said seat member, a valve stem, a heavy compressible sealing ring positioned above said disc and arranged to contact with the cylindrical wall section of said seat member and close said axial passage during the seating movement of said disc, and means mounted on said valve stem for holding said sealing ring in position relative to said disc.

3. A boiler blow-off valve comprising a valve body having inlet and outlet openings therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein and having an upper cylindrical inner wall section and a lower tapered seat section, the uppermost portion of said cylindrical wall section being slightly flared, and a valve member adapted to control said outlet opening and comprising a tapered disc adapted to seat on said tapered seat section of said seat member, a valve stem, a split sealing ring positioned above said disc and arranged to initially contact with the flared portion of said cylindrical wall section of said seat member and close said axial passage during the seating movement of said disc, and means for holding said sealing ring in position relative to said disc.

4. A boiler blow-off valve comprising a valve body having inlet and outlet openings therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein and having an upper cylindrical inner wall section and a lower tapered seat section, the uppermost portion of said cylindrical wall section being slightly flared, and a valve member adapted to control said outlet opening and comprising a tapered disc adapted to seat on said tapered seat section of said seat member, a valve stem, a split sealing ring positioned above said disc and arranged to initially contact with the flared portion of said cylindrical wall section of said seat member and close said axial passage during the seating movement of said valve, and a nut member positioned above said sealing ring and holding the latter in position relative to said disc.

5. A boiler blow-off valve comprising a valve body having inlet and outlet openings therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein and an upper cylindrical inner wall section and a lower tapered seat section, the uppermost portion of said cylindrical wall section being slightly flared, and a valve member adapted to control said outlet opening and comprising a tapered disc adapted to seat on said tapered seat section of said seat member, a valve stem, a split sealing ring positioned above said disc and arranged to initially contact with the flared wall portion and close the cylindrical section of said seat member before said disc seats on said tapered section of said seat member, and means detachably connected to said disc for holding said sealing ring in position relative to said disc.

6. A boiler blow-off valve comprising a valve

body having inlet and outlet openings therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein and an upper cylindrical inner wall section and a lower tapered seat section, and a valve member movable relative to said seat member to control said outlet opening and comprising a tapered disc adapted to seat on said tapered section of said seat member and having an upper extension, a valve stem having an enlarged end portion, a nut member supported by said enlarged stem end portion and detachably connected to said disc extension to connect said disc to said stem, and a sealing ring on said extension positioned between said nut member and disc and arranged to close said outlet opening during a predetermined portion of the movements of said disc towards and away from said tapered seat section.

7. A boiler blow-off valve adapted for relatively low pressures and comprising a valve body having inlet and outlet openings therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein and an upper cylindrical inner wall section and a lower tapered seat section, and a valve member movable relative to said seat member to control said outlet opening and comprising a tapered disc adapted to seat on said tapered section of said seat member and having an upper reduced annular extension, a valve stem having an enlarged end portion positioned within said extension, a nut member supported by said end portion and secured to said extension to connect said disc to said stem, and a sealing ring on said extension between said nut member and disc and arranged to close said outlet opening during a predetermined portion of the movements of said disc towards and away from said tapered seat section.

8. A boiler blow-off valve adapted for relatively low pressures and comprising a valve body having inlet and outlet openings therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein having an upper cylindrical section and a lower tapered section, and a valve member movable relative to said seat member to control said outlet opening and comprising a tapered disc adapted to seat on said tapered section of said seat member and having an upper reduced externally threaded annular extension, an axially movable valve stem having an enlarged end portion positioned within said extension, means for axially moving said valve stem, a nut member supported by said end portion and threaded on said extension to detachably connect said disc to said stem, and a split sealing ring on said extension positioned between said nut member and disc and arranged to contact with said seat member and close said outlet opening during a predetermined portion of the movements of said disc towards and away from said tapered seat section.

9. In a tandem boiler blow-off valve arrangement, a stop valve comprising a valve body having inlet and outlet openings formed therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein and having an upper section and a lower section, and a valve member adapted to control said outlet opening and comprising a disc adapted to seat on said lower section of said seat member, a valve stem, a nut arranged on said stem and secured to said disc, and a sealing ring positioned between said disc and nut and arranged to close said passage during a predetermined portion of the movements of said disc towards and away from its seating position.

10. In a tandem boiler blow-off valve arrangement, a stop valve comprising a valve body having inlet and outlet openings formed therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein and having an upper cylindrical section and a lower tapered section, and a valve member adapted to control said outlet opening and comprising a tapered disc adapted to seat on the tapered section of said seat member, a valve stem, a nut arranged on said stem and detachably secured to said disc, and a split sealing ring removably mounted between said disc and nut and arranged to contact with the cylindrical portion of said seat member during a predetermined portion of the movements of said disc towards and away from its seating position.

11. In a tandem boiler blow-off valve arrangement, a main valve comprising a valve body having inlet and outlet openings therein, a valve seat member positioned in said outlet opening and formed with an axial passage therein and having an upper cylindrical section and a lower seat section, and a valve member adapted to close said outlet opening and comprising a tapered disc adapted to seat on said lower seat section of said seat member, a valve stem, a nut arranged on said stem and secured to said disc, and a sealing ring positioned between and in contact with said disc and nut and arranged to circumferentially contact with the cylindrical portion of said seat member during a predetermined portion of the movement of said disc toward and away from its seating position.

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