Jan. 23, 1934. M. SVORCINA 1,944,770

EXPLOSION OR BLEEDER VALVE FOR BLAST FURNACES

Filed May 15, 1933 3 Sheets-Sheet 1

Fig. 1

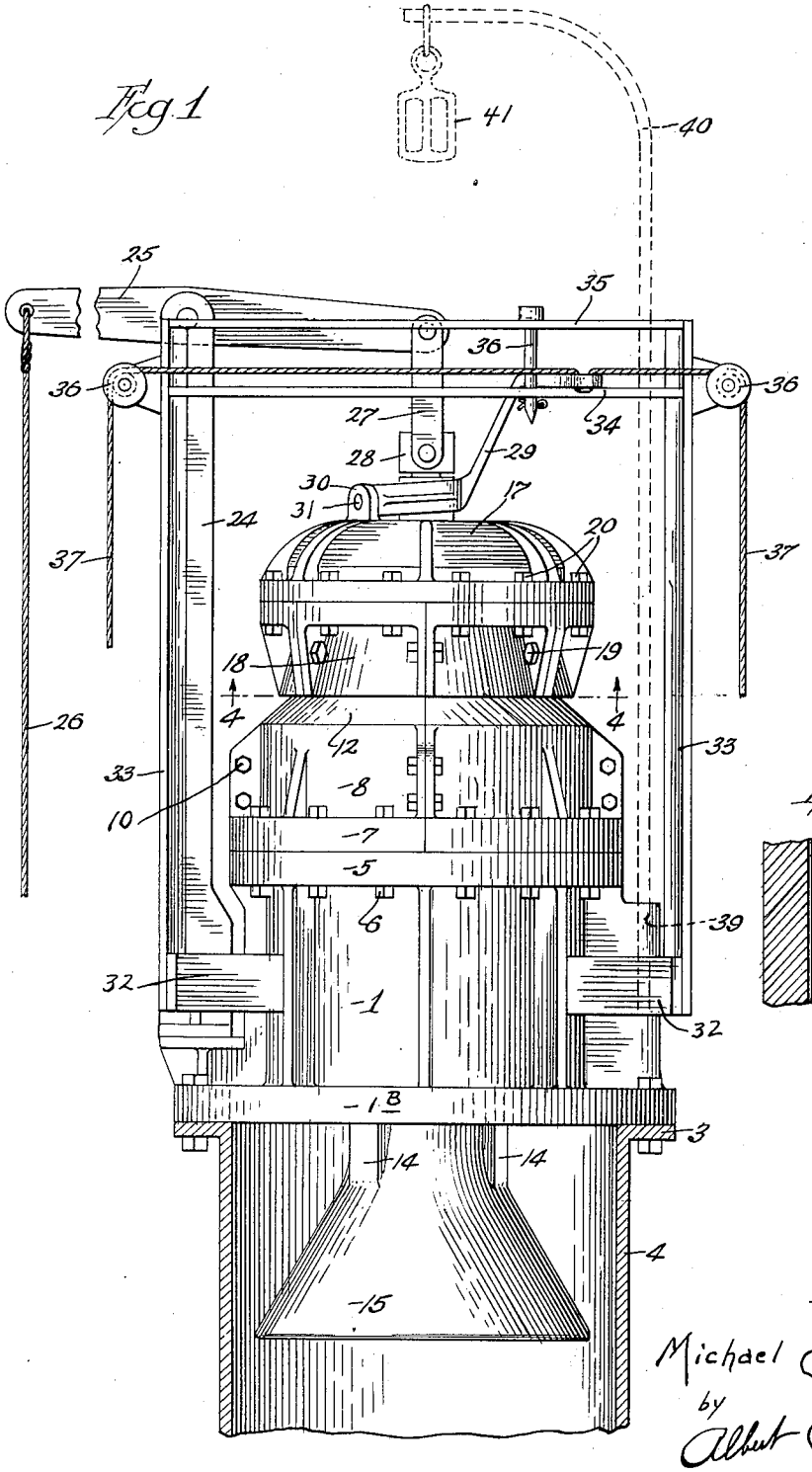
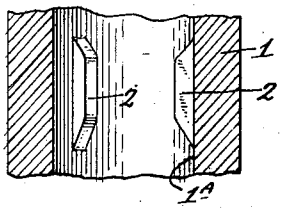


Fig. 10



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Jan. 23, 1934. M. SVORCINA 1,944,770

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Filed May 15, 1933 3 Sheets-Sheet 2

Fig. 2

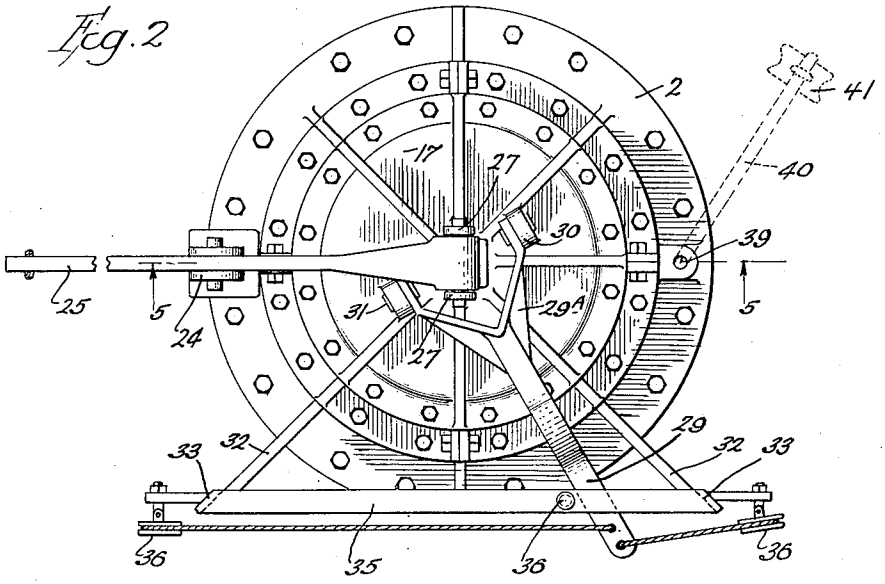


Fig. 3

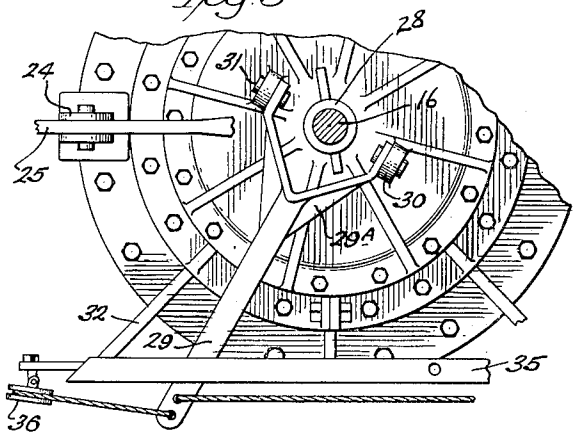
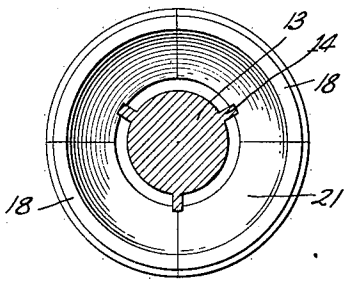


Fig. 4



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EXPLOSION OR BLEEDER VALVE FOR BLAST FURNACES

Filed May 15, 1933 3 Sheets-Sheet 3

Fig. 5

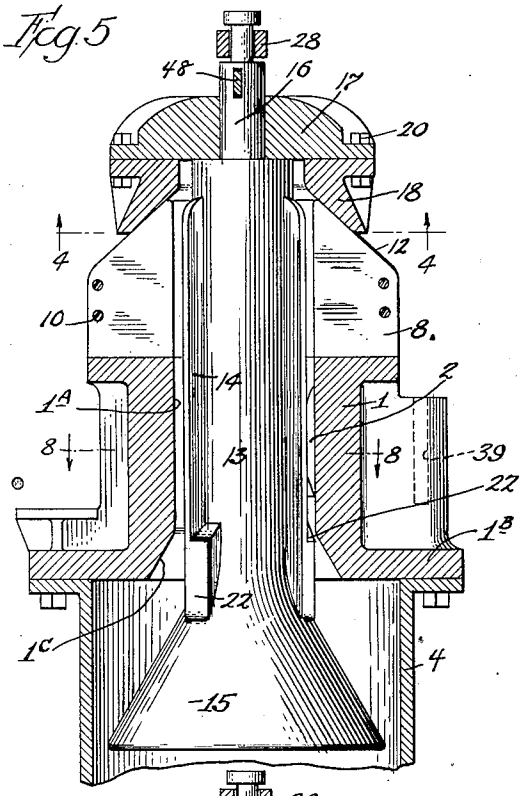


Fig. 6

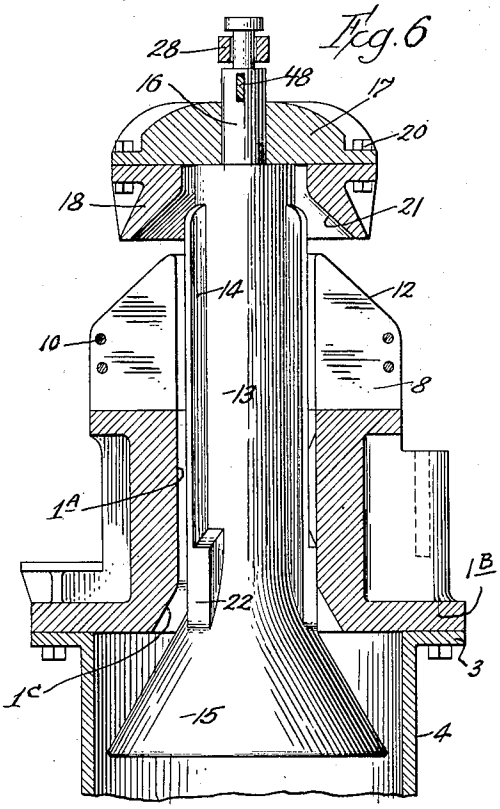


Fig. 7

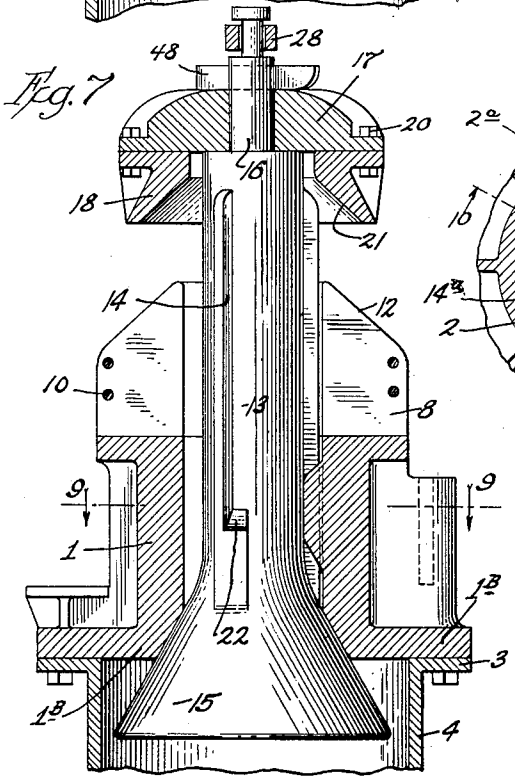


Fig. 8

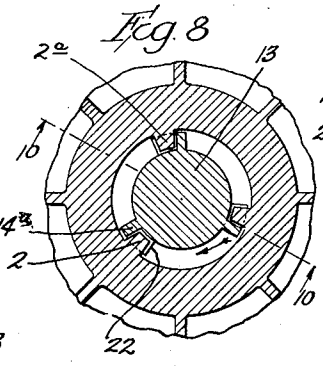
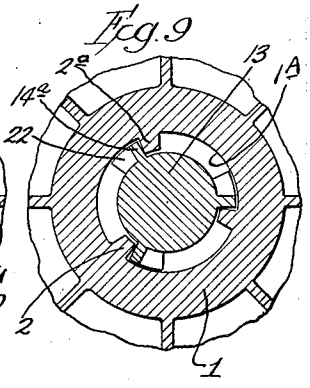


Fig. 9



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UNITED STATES PATENT OFFICE

1,944,770

EXPLOSION OR BLEEDER VALVE FOR BLAST FURNACES

Michael Svorcina, Chicago, Ill.

Application May 15, 1933. Serial No. 671,186

16 Claims. (Cl. 137—53)

My invention relates to improvements in so-called explosion valves or bleeder valves, such as the valves commonly employed at the upper ends of vent ducts leading either from the interior of a blast furnace or from a dust-collecting chamber through which the gases from the furnace flow.

As heretofore employed, an explosion valve of this class usually has a vertically movable valve plunger presenting two heads, with the upper head normally seated by gravity on the upper end of the tubular valve body to close the outlet end of that body, and with the lower head disposed for engaging a relatively lower part of the valve body when the plunger is lifted by a forcible puff of gas, thereby preventing the plunger from being blown or lifted entirely out of the valve body when an explosion is caused within the blast furnace by the sudden dropping of material which had previously caked within the furnace.

When the plunger of such an explosion valve is blown upwards so as to raise the upper head of the plunger off the upper end of the valve body, the hot gases which flow upward around the stem of the said plunger usually carry with them some of the normally solid material from the interior of the furnace. Consequently, batches of molten iron, more or less intermingled with coke, will at times be splashed out of the upper end of the valve body, and some of this emitted material may cling to the upper end of the valve body (or upper valve seat). If the pressure then drops before such chunks of material have been blown off the upper valve seat by gases flowing out through the valve, the upper head of the plunger will seat on these particles, thereby preventing the valve from closing after the pressure due to the explosion has subsided.

In one of its important objects, my invention aims to provide simple means whereby the plunger can conveniently be raised (whenever the emitting of flames and the like shows that it has not properly closed), so that the blast up the vent pipe will blow such clogging matter off the valve seat, and aims to provide stop means which will normally prevent the plunger from being raised to such an extent as to close the lower end of the bore of the valve body. In addition, my invention aims to provide simple means for rendering the said stop means inoperative, thereby permitting the valve plunger to be raised to the maximum extent for shutting off the flow of gases through the valve body, and also to provide positive but readily releasable means for keeping the stop means operative during the normal operation of the blast furnace.

Moreover, the flames, hot coke, molten particles and hot gases all gradually wear away both the upper valve seat and the upper head of the plunger or movable valve member; and since these parts are quite hot as long as the vent pipe leading to the valve is operative, both the upper valve seat and the upper plunger head can only be repaired or replaced (with the present practice) after the blast furnace has been shut down long enough to cool the vent pipes. This necessity of shutting down the furnace and restarting it after the repairs have been made adds greatly to the cost of such repairs or replacements on an explosion valve, and such costs are further increased by the difficulty of hoisting and handling the enormously heavy single-piece castings commonly employed for both the upper valve seat and the upper plunger head, and the inconvenience of getting access to these parts.

My present invention aims to reduce these repair costs greatly, by providing a valve construction which will afford convenient access to both the upper valve seat and the upper plunger head when the plunger is raised to such an extent as to shut off the flow of hot gases and the like through the valve body, and by constructing both the upper valve seat and the upper plunger head of sections which can readily be detached and replaced separately. Furthermore, my invention aims to provide simple means, operable by men on the ground floor, for manipulating the valve plunger so that this will entirely shut off the flow of hot gases through the valve, thereby permitting this valve to cool off before the workmen ascend to the valve for making any needed repairs.

Illustrative of the manner in which I accomplish the above recited as well as other objects,

Fig. 1 is an elevation of an explosion or bleeder valve embodying my invention and of parts adjacent to it, with the vent pipe leading to this valve shown in central vertical section, as it appears when in normal use.

Fig. 2 is a plan view of the same valve and its adjuncts.

Fig. 3 is a fragmentary plan view allied to Fig. 2, but taken after the valve plunger has been rotated so that this plunger can be raised to a position in which it entirely shuts off the flow of gases through the vent pipe.

Fig. 4 is a horizontal section, taken along the line 4—4 of Fig. 1 and looking upward.

Fig. 5 is a diametric vertical section through

the valve body, the valve cap and the upper portion of the vent pipe, showing the valve cap as seated on the upper end of the valve body.

Fig. 6 is a section similar to Fig. 5, but showing the valve plunger as it appears when an explosion within the blast furnace has raised the plunger to the maximum venting position permitted by the stops on the plunger and the valve body.

Fig. 7 is a section, also allied to Fig. 5, showing the plunger as it appears when raised to the maximum elevation at which it permits the valve body to cool and affords convenient access for repairs.

Figs. 8 and 9 are fragmentary horizontal sections taken respectively along the lines 8—8 of Fig. 5 and 9—9 of Fig. 7.

Fig. 10 is a fragmentary central and vertical section through the portion of the valve body which includes the stop lugs.

In the drawings, my explosion or bleeder valve includes an upright tubular main body portion 1 having a generally cylindrical bore 1A and having a base flange 1B which seats on a flange 3 at the upper end of a vent pipe 4, this pipe being usually one of four vent pipes connected to the interior of the blast furnace. The main valve body portion 1 has at its upper end a flange 5 detachably fastened by bolts 6 to the lower end flanges 7 of the four segmental sections which together constitute an upper body extension 8, and which sections are fastened to each other by bolts 10.

The body extension 8 has a cylindrical bore alining with the bore 1A of the main body portion and has its upper end tapering upwardly to afford a frusto-conical upper valve seat 12. Extending freely through both the main body portion 1 and the body extension 8 is the cylindrical stem 13 of a valve plunger which also includes upright guide ribs 14 projecting radially from the said stem part way towards the bore of the entire valve body, and a downwardly flaring lower plunger head 15 adapted to engage the downwardly flaring lower end portion 1C of the bore of the valve body portion.

The plunger stem 13 is continued upwards by a smaller-diametered stem extension 16 which extends through the top portion 17 of a plunger cap. This cap top 17 seats on the upper end of the plunger stem and is clamped against that stem end by a key 48. Underhanging the peripheral portion of the cap top 17 is a lower cap part 18 composed of counterpart sections which are fastened to each other by bolts 19 and each of which sections is clamped to the cap top 17 by bolts 20. This four-section lower cap part has the lower portion 21 of its bore flaring downward at the same angle as the upper valve seat 12.

In addition to the guide ribs 14 which keep the stem 13 of the plunger approximately central of the valve body while permitting gases to flow freely alongside this stem in the spaces between these ribs, the plunger also has stop elements 22 disposed so that the upper ends of these elements will engage the lower ends of the stop lugs 2 on the valve body if the plunger is in a certain rotational position.

Each such stop element preferably is adjacent to one side of a guide rib 14 and integral with it, as shown in Figs. 6 and 7, and the interengageable ends of the stop elements 22 and the stop lugs 2 desirably slope radially outward of the plunger and the valve body, so that any solid material which might tend to collect on the upper end of one of the stop elements 22 on the plunger will readily slide off.

When the plunger is in its normal rotational position, as shown in Fig. 5, each stop element 22 on the plunger underhangs one of the stop lugs 2 on the valve body, as shown in Figs. 5 and 8; and when the plunger is then raised by the pressure of gases in the vent pipe 4 due to an "explosion" within the blast furnace, the stop elements 22 on the plunger engage the lower ends of the stop lugs 2 on the valve body to limit the lifting of the plunger to the extent shown in Fig. 6, namely to a position of the plunger in which the gases still can flow freely between the lower head 15 of the plunger and the lower valve seat 1C.

However, if the plunger is first rotated so as to bring the said stop elements out of vertical alinement with the stop lugs 2, the plunger can be raised still further so as to have its lower head 15 seat on the lower valve seat 1C, thereby preventing the gases in the vent pipe from entering the bore 1A of the valve body. To effect such a rotation of the valve plunger and to prevent this plunger from accidentally rotating out of its normal position of Fig. 5, and also to permit a convenient raising of the valve plunger to its valve-inlet closing position of Fig. 5, I provide the following arrangement:

First, I provide a riser post 24 exteriorly of the valve and reaching for some distance above the top of the valve cap, on which post I pivot an approximately horizontal lever 25 having its outer end fastened to a depending wire rope 26. The inner end of this lever is connected by links 27 to a member 28 swiveled on the upper end of the plunger extension 16, so that a downward pull on the wire rope 26 (as by means of a winch on the ground) will raise the plunger and the cap of the valve.

Second, I provide a plunger-rotating arm 29 extending radially outward from the cap of my valve, by means of which arm the plunger can be rotated for moving the stop elements 22 on the plunger into and out of vertical alinement with the stop lugs 2 within the bore of the valve body. For this purpose, I am here showing the plunger-rotating arm 29 as having its inner end forked to span the plunger extension 16 freely, the two fork arms 29A being pivoted respectively to two riser lugs 30 on the top 17 of the cap of the plunger, the pivoting being on alined horizontal pivot pins 31.

To prevent this rotating arm from flopping up and down when the plunger responds to an explosion in the blast furnace, I provide two bracket arms 32 (Figs. 2 and 3) extending outward from the valve body 1 and respectively supporting two posts 33. These posts are spanned (at higher elevation than the top of the plunger cap) by two superposed horizontal bars 34 and 35, between which the rotating arm 29 extends, and on the lower of which bars this arm normally rests. Each post also supports a pulley 36 for guiding a wire rope 37 fastened to the rotating arm 29, so that a downward pull on either of these ropes will slide this arm in one direction or the other, thereby partially rotating the plunger. I also provide releasable means (such as the latch pin 36 of Fig. 1) for normally preventing the said arm from sliding out of the position in which it holds the plunger (as in Fig. 8) so that the stops on the plunger and the valve body will limit the raising of the plunger to the venting position shown in Fig. 6.

With my valve thus constructed, an explosion

in the blast furnace automatically raises the valve plunger to the halted position shown in Fig. 6 to afford the needed vent, and when the force of the explosion is spent, the plunger drops by gravity so as to seat the lower cap part 21 on the tapering upper end of the valve body. However, if any solid material has collected on the upper valve seat 12 to prevent a proper closing of the valve after an explosion, the furnace attendant can readily see this from the continued emission of fumes and the like. Then, a prompt raising of the plunger (effected through a pull on the wire cable 26) will permit the clogging material to slide off the upper end of the valve body or to be blown off this upper valve seat by the blast of the emitted gases, thereby greatly reducing the wear on this valve seat.

When repairs are needed either for this upper valve seat or for the lower (seating) portion of the cap of the plunger, the latch member 36 is first released. (While here shown as a manually movable pin, this latch member obviously might be connected also to means whereby a man on the ground can lift it so as to clear the rotating arm 29). The plunger can then be raised slightly, so as to eliminate the friction of the cap on the top of the valve body, by a downward pull on the wire cable 26, after which a pull on the left-hand wire cable 37 causes the rotating arm 29 to rotate the plunger so that a further lifting of the plunger will permit the interior stops 2 and 22 to clear each other while the plunger is raised still further to the position of Fig. 7 in which the lower plunger head 15 closes the bore of the valve body.

Since this shutting off of the valve prevents a further flow of hot gases through the valve body and the vent pipe 4, both of these soon cool sufficiently to permit the needed repairs to be made, and with the plunger cap then raised high above the upper end of the valve body (as shown in Fig. 7), the workmen have ready access to the upper valve body part 8 as well as the lower cap portions 18.

Since the lower cap part 18 and the upper valve body part 8 are both constructed in sections, only one or two sections of either of these parts may need to be replaced for the average repair; and since each of these parts forms only a fraction of the valve member of which it is a part, the time and labor required for removing and replacing the damaged part is greatly reduced.

To facilitate such repairs still further, I also desirably provide an exterior portion of the main valve body portion 1 with a socket in which the lower end of a derrick or davit 40 is socketed, and support a pulley block 41 on the other end of this davit, so that a wire rope passing over this pulley block will expedite the handling of such parts, such a davit and pulley block being shown in dotted lines in Fig. 1.

From the above recital of the new features of my explosion valve it will be obvious that all of the ordinarily needed repairs can be made without the enormous expense and delay of first shutting down the blast furnace and allowing this to cool, and thereafter restarting the furnace. It will also be obvious that the facility with which the valve plunger can be raised to permit clogging material to be blown off the upper valve seat will greatly reduce the wear both on this seat and on the seating portion of the plunger cap, and that the labor and material costs for any needed repairs are enormously reduced.

To secure the full benefit of these advantages, it is of course important that the valve plunger is rotated back to an adequate extent (after the making of any repairs, replacements or even a mere inspection of the parts most subject to wear) for insuring a proper underhanging of the stop lugs 2 on the valve body by the stop elements 22 on the valve plunger.

To insure this, I preferably construct each stop element 22 as a side extension of the lower portion of one of the plunger ribs 14. With this arrangement, it will be seen from Fig. 8 that when the plunger has been rotated in a counterclockwise direction for operatively alining the stop formations on the plunger with those on the valve body, a side face of the plunger rib 14*a* will engage one of the stop lugs 2 within the valve body, thereby affording a positive halting of the rotation when the plunger is in its normal position. And when the plunger is rotated in the opposite direction (as shown by the arrow in Fig. 8), the rotation will be halted by having the other side face of the same plunger rib 14*a* engage the next rib 2*a* in the valve body, as shown in Fig. 9, so that the extent of the needed plunger rotation is not left to mere guesswork on the part of the attendant.

However, I do not wish to be limited to having the stop elements 22 integral with the plunger ribs, nor to other details of the construction and arrangement above described, since many changes might be made without departing either from the spirit of my invention or from the appended claims. Nor do I wish to be limited to the use of my here disclosed valve in connection with explosion-vent pipes for blast furnaces.

I claim as my invention:

1. An explosion valve for use at the upper end of a vent pipe, comprising an upright tubular valve body adapted to surmount the said pipe, a valve plunger extending through the valve body and having upper and lower heads respectively adapted to close the upper and lower ends of the bore of the said body; means operable from the exterior of the valve body for raising the plunger and for rotationally moving the plunger; the valve body and the plunger having relatively cooperating stop portions adapted to be engaged, when the said plunger is in a certain rotational position with respect to the valve body, to limit the raising of the plunger to a position in which the said heads are both out of their closure positions.

2. An explosion valve as per claim 1, including means for limiting the rotational movement of the plunger in one direction to a position in which the said cooperating stop portions are adapted to be engaged.

3. An explosion valve as per claim 1, including means for limiting the rotational movement of the plunger in one direction to a position in which the said cooperating stop portions are adapted to be engaged, and means for limiting the rotational movement of the plunger in the opposite direction to a position in which the said cooperating stop portions are widely spaced rotationally of the plunger.

4. An explosion valve as per claim 1, in which the plunger has radially projecting ribs equally spaced circumferentially of the plunger and extending longitudinally of that member part way toward the bore of the valve body, and in which the valve body has a similar number of inwardly directed formations disposed for engaging certain of the said ribs to limit rotational movement

of the plunger in both directions with respect to the valve body.

5. An explosion valve as per claim 1, including a plunger-rotating bar connected to and projecting radially from the upper end of the plunger and adapted to be moved in a generally horizontal direction for rotating the plunger, and a generally horizontal rod supported by the valve body and upon which a portion of the said bar can slide while thus moved.

6. An explosion valve as per claim 1, including a plunger-rotating bar connected to and projecting radially from the upper end of the plunger and adapted to be moved in a generally horizontal direction for rotating the plunger, and a generally horizontal rod supported by the valve body and upon which a portion of the said bar can slide while thus moved; the said bar having its inner end forked to present two fork arms, and the said fork arms being pivoted to the plunger on a common horizontal axis transverse of the general axis of the bar.

7. An explosion valve as per claim 1, including a plunger-rotating bar connected to and projecting radially from the upper end of the plunger and adapted to be moved in a generally horizontal direction for rotating the plunger; a generally horizontal rod supported by the valve body and upon which a portion of the said bar can slide while thus moved; and a second horizontal rod at higher elevation than the said bar and disposed for preventing an undue lifting of this bar.

8. An explosion valve as per claim 1, including a plunger-rotating bar connected to and projecting radially from the upper end of the plunger and adapted to be moved in a generally horizontal direction for rotating the plunger; a generally horizontal rod supported by the valve body and upon which a portion of the said bar can slide while thus moved; a second horizontal rod at higher elevation than the said bar and disposed for preventing an undue lifting of this bar; and a detachable latch pin normally extending vertically through both of the said rods and disposed for preventing the said bar from moving in the direction for rotating the plunger to dispose the said cooperating stop portions out of relatively interengageable positions.

9. An explosion valve as per claim 1, including a plunger-rotating bar connected to and projecting radially from the upper end of the plunger and adapted to be moved in a generally horizontal direction for rotating the plunger; and releasable latching means normally disposed in the path of the said bar for preventing a movement of the plunger-rotating bar in a direction in which this bar moves the plunger out of a rotational position in which the said cooperating stop portions are interengageable when the plunger is raised.

10. An explosion valve as per claim 1, including a bar pivoted upon a horizontal axis to the upper end of the plunger and adapted to be moved in a generally horizontal direction for rotating the plunger; a generally horizontal rod supported by the valve body and upon which a portion of the said bar can slide while thus moved, and releasable stop means associated with the said rod for normally preventing the bar from being moved out of a position in which the said cooperating stop portions of the valve body and the plunger are adapted to be interengaged.

11. An explosion valve as per claim 1, including a plunger-rotating bar connected to and projecting radially from the upper end of the plunger and adapted to be moved in a generally horizontal direction for rotating the plunger; and releasable latching means normally disposed in the path of the said bar for preventing a movement of the plunger-rotating bar in a direction in which this bar moves the plunger out of a rotational position in which the said cooperating stop portions are interengageable when the plunger is raised; and auxiliary means engageable by the plunger-rotating bar for limiting the movement of the bar in the said direction after the latching means have been released.

12. An upright valve of the class described, comprising a tubular valve body having an upright bore and having its upper and lower ends both formed to present upwardly tapering valve seats; an upright plunger including a stem coaxial with and of smaller diameter than the said bore and two heads spaced by a greater distance than the said seats and respectively adapted to engage the said seats; the valve body and the plunger having interengageable portions disposed, when the plunger is in its normal position rotationally of the valve body, for limiting the upward movement of the plunger to a position in which both heads of the plunger are freely spaced from the seats adjacent to these heads; means associated with the plunger for rotating the latter about its axis; and releasable means normally preventing the plunger from rotating away from its said normal position.

13. A valve as per claim 12, in which the plunger includes radial surface ribs extending longitudinally of the said stem upon the stem, each rib having a lower portion thereof widened to present an upwardly facing stop shoulder; and in which the valve body has stop elements projecting radially into the bore of this body and normally respectively engaging the said stop shoulders; the said shoulder-presenting lower rib portions and the said stop elements constituting the said interengageable portions of the plunger and the valve body.

14. A valve as per claim 12, in which the engaging faces of the said interengageable portions slope downward radially outward of the axis of the bore of the valve body.

15. A valve as per claim 12, in which the upper head of the plunger comprises a cap fastened to the stem of the plunger, and an annular seat-engaging head part detachably suspended from the cap and composed of separable segments.

16. A valve as per claim 12, in which the tubular valve body comprises an integral lower portion having the lower end of its bore flaring downwardly to afford the lower valve seat, and an upper body portion having the exterior of its upper end of an upwardly tapering frusto-conical shape affording the upper valve seat; the upper body portion being composed of segments detachable from each other and from the lower body portion.

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