May 13, 1924.

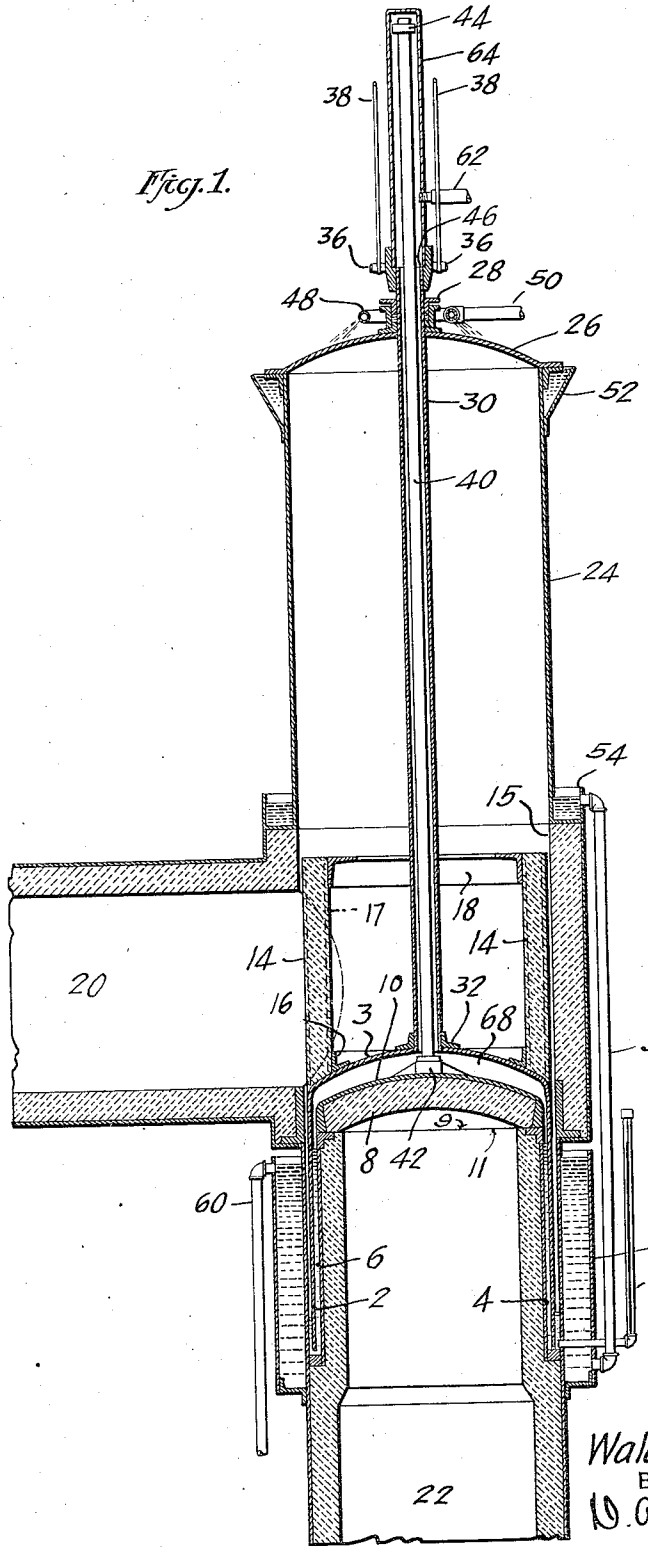
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W. DYRSSEN

VALVE FOR BLAST FURNACES

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Fig. 1.



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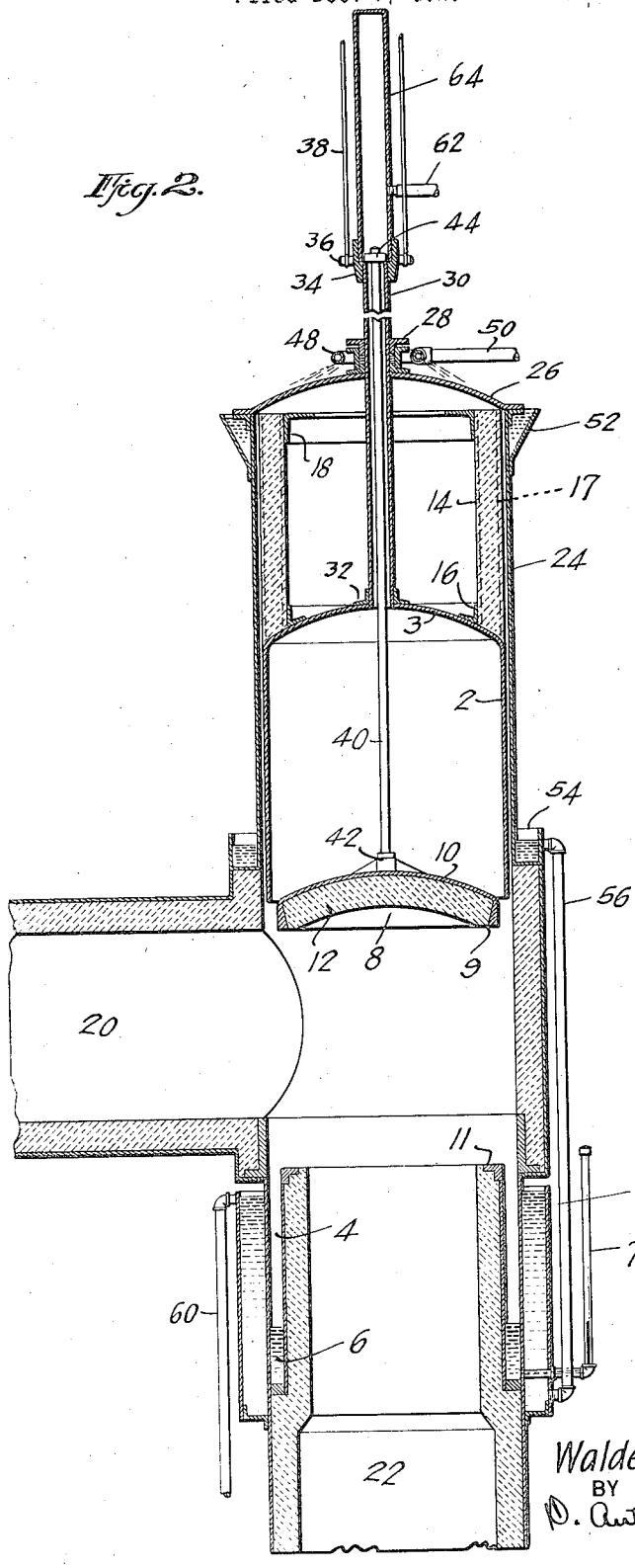
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Fig. 2.



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UNITED STATES PATENT OFFICE.

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VALVE FOR BLAST FURNACES.

Application filed December 1, 1921. Serial No. 519,107.

To all whom it may concern:

Be it known that I, WALDEMAR DYRSSEN, a citizen of the United States, and resident of the city, county, and State of New York, have invented certain new and useful Improvements in Valves for Blast Furnaces, of which the following is a specification.

This invention relates to valves for controlling the passage of the blast of air or gas from a hot blast stove to a blast furnace or vice versa. Valves used for this purpose are subjected to extremely high temperatures and it has formerly been necessary to provide means for water cooling such valves and also their valve seats. In order to make the valves air-tight it has therefore been necessary to use parts which were carefully machined so that the valve would accurately contact with its seat. In order to prevent the valve seat from becoming warped or distorted it has also been customary to make the same hollow to provide for a circulation of cooling water. This practice has been unsatisfactory because even when water cooled, the valve seats often warp which results in a leakage of hot air or gas past the valves which soon burns them away and makes necessary frequent renewals. This results in interfering with the continuous operation of the furnace and consequently reduces the output thereof. Water cooled valves and valve seats also tend to reduce the temperature of the surrounding brickwork and consequently this reduces the temperature of the air passing through the conduits in said brickwork. The leakage of cooling water is a disadvantage inherent to valves formerly constructed. Such leakage moistens the gas or air and interferes with the proper operation of the blast furnace and increases the fuel consumption thereof.

One object of my invention is to overcome the disadvantages above enumerated and other objects will be apparent from the following description when read in connection with the accompanying drawings in which—

Fig. 1 is a vertical section showing my improved valve in closed position;

Fig. 2 is a similar view showing the valve in open position;

The valve as a whole consists of several parts and includes a substantially cylindrical bell 2 which is adapted to enter an annular trough 4 which contains a body of suitable fluid 6, such as mercury, which makes a fluid seal. A gage 7 is connected to the trough 4 to indicate the height of the mercury therein. Mercury is a convenient medium to use for this seal as it will readily withstand the heat and the pressures which exist in installations of this kind. For example, a seal or column of mercury 40 inches high will withstand a pressure of 19 pounds per square inch.

Located below the bell 2 of the valve is a cover 8 comprising a shell 10 provided with a suitable refractory lining 12 such as firebrick. The top or dome 3 of the bell 2 supports another part of the valve comprising a hollow cylindrical wall 14 which is provided with securing angles 16 at the base and an angular rim 18 at the top which are connected to one another by suitable uprights 17. The cylindrical wall 14 is of substantially the same diameter as the bell 2 and is arranged to be moved therewith. When the valve is in the closed position shown in Fig. 1, the cylindrical wall 14 cuts off communication between the pipe 20 which leads to the hot blast main and the flue 22 which is connected to the hot blast stove.

The valve is so constructed that pratically no heat is carried by radiation to the metallic parts of its structure. In its opened position the valve is enclosed by a cylindrical hood 24 having a head 26 which is provided with an air-tight bushing or gland 28 through which slides a tubular stem 30 which is connected by an annular fitting 32 to the dome 3 of the bell. To the upper end of the stem 30 is secured a head 34 carrying studs 36 to which are fastened cables 38 which pass over sheaves and are connected with suitable means, not shown, for lifting and lowering the valve stem and associated parts. Located within the valve stem 30 is a second stem 40 which is connected at 42 to the casing 10 of the cover 8. This second stem 40 is provided at its upper end with a collar 44 which is adapted to co-act with a shoulder 46, formed by the end of the valve stem 30, when the latter is lifted. As will be apparent from Fig. 1 the valve stem 30 must be lifted an appreciable distance before the shoulder 46 strikes the underside of the collar. This arrangement permits the bell member 2 of the valve to be lifted a greater distance than the cover member 8. In other words, when the stem

30 is lifted there is lost motion between the shoulder 46 and the collar 44 so that the bell 3 is lifted in advance of the cover 8. When the parts are lifted to the extreme position they occupy the relative positions shown in Fig. 2 where it will be seen that there is an unobstructed passage from the flue 22 to the pipe 20 which leads to the hot blast main. The heated air from the flue 22 flows upwardly and part of it strikes the underside of the cover 8 and is deflected out through the pipe 20.

It is to be noted that the portion of the cover 8 which is exposed to the heated air is formed of fire-brick or other refractory material so that it is practically unaffected thereby. In valves formerly used the metallic mushroom valve head would occupy about the same position as the dome 3 of the bell 2 in Fig. 2. It is clear that a metallic valve of mushroom shape in such location would be subjected to the destructive action of the excessive heat from the air coming from the hot blast stove, the temperature of such air blast being approximately 1400 degrees F. In former installations the air pocket above the pipe 20 interferes with the free passage of the heated air from the stove to the hot blast main. To prevent the mushroom valves heretofore used from being ruined by the hot gases, it has been customary to water cool them and in practice water frequently leaks out and the moisture is carried to the blast furnace, and as before stated, interferes with its best operation and increases the consumption of fuel. Such water cooling also tends to cool the brickwork and consequently reduces the temperature of the air supplied to the furnace and hence absorbs part of the heat supplied by the stoves, thereby lowering their efficiency. On the other hand my improved valve does not require water cooling means and hence the above objections are overcome.

When the valve is in closed position, Fig. 1, air flowing from the pipe 20 cannot possibly escape by leakage to the hot blast stove through the flue 22 because of the liquid seal formed by the bell 2 extending down into the body of mercury 6.

When the bell 2 is in the closed position, the wall 14 closes the opening at the end of the pipe 20 and prevents the radiation of heat to the metallic parts of the valve. The small quantity of air or gas which escapes through the clearance space between the wall 14 and the inner surface 15 of the body of the valve into the space enclosed by the hood 24 will be cooled by the effect of the surrounding atmosphere. If necessary or desirable the outer surface of the hood 24 and its dome 26 may be water cooled by means of a spray emanating from a circular pipe 48 which is connected to a supply pipe 50. A trough 52 is provided near the upper portion of the hood and fills up with water and overflows, thus permitting a thin film of water to trickle down the outer surface of the hood which is caught in another trough 54 formed near the bottom of said hood. The trough 54 is connected by a pipe 56 with an open water jacket 58 which surrounds the portion of the valve adjacent to the liquid seal and an overflow pipe 60 is connected near the top of the water jacket and leads to a suitable discharge. The water connections described are not absolutely essential and are illustrated merely to show that in handling gas or air of exceedingly high temperatures above that normally used in blast furnace practice that such water cooling means can be applied. Or if a fluid of a lower melting point than that of mercury be used for the seal, it may be desirable to provide the water cooling arrangement to prevent the boiling away of the fluid used for such seal.

The valve stems 30 and 40 are preferably air cooled by means of air introduced through a pipe 62 connected to a tubular extension 64 secured to the fitting 34 above the valve stem 30. The cooling air flows down in a space between the stem 40 and the interior surface of the hollow stem 30 and into the chamber 68 between the bell 2 and cover 8. This air cannot escape to the hot blast main through pipe 20 because of the fluid seal, but can leak out between the surfaces 9 and 11 to the hot blast stove which is not a disadvantage. When the valve is in open position, Fig. 2, the entrance of cooling air from pipe 62 will automatically be prevented because the pressure in the hot blast main 20 is substantially the same as that which is supplied to the pipe 62.

From the foregoing it will be apparent that when the valve is closed no pressure can escape from the pipe 20 to the flue 22 because of the liquid seal, and that all parts exposed to excessive heats are lined with firebrick or other refractory material, that it is unnecessary to carry cooling water to the valve seats or valves which is liable to be carried into the blast furnace in the form of moist air or vapor.

The valve could be employed where pressures lower than those common in blast furnace practice are encountered and any suitable fluid other than mercury can be used for the seal. For higher temperatures a metal or fluid with very high melting point and high boiling point, such as tin could be effectively used. The valve could also be designed to withstand a greater pressure below the bell than that encountered in usual blast furnace operation, either by increasing the weight of the bell and associated parts to offset such pressure, or by the provision of locking means to hold the bell in place.

The terms flue and pipe used herein are

intended to include any main, conduit, passage or tunnel used for conveying air, gas or fluid.

Though I have described with great particularity of detail the embodiment of my invention, yet it is not to be understood therefrom that the invention is restricted to the particular embodiment disclosed. Various modifications thereof in detail and in the arrangement of parts and the substitution of equivalents may be made by those skilled in the art without departing from the invention as defined in the following claims.

What I claim is:

1. The combination with a flue and a pipe communicating therewith of a valve structure including a vessel surrounding a portion of said flue and containing a fluid, a bell forming part of said valve structure shaped to enter said vessel to prevent leakage between said pipe and said flue and a cover lined with refractory material operatively connected to said bell and arranged to close the flue and protect the bell from the destructive action of the air or gases emanating from said flue.

2. The combination of a substantially vertical flue and a substantially horizontal pipe connected therewith and forming a space surrounding said flue, said space containing a fluid, of a compound valve including a cover adapted to close the top of said flue and means movable relatively to said cover for entering said space to form a fluid seal to prevent the gas or air escaping between the cover and the flue from reaching said pipe.

3. The combination of a substantially vertical flue and a substantially horizontal pipe connected therewith of a cover having a refractory lining arranged to close communication between the flue and the pipe, a vessel containing a fluid and surrounding the upper portion of said flue, a bell, shaped to enclose said cover and enter said vessel to form a liquid seal and a member carried by said bell arranged to close the end of said pipe when the bell is in its closed position.

4. In combination with an upright flue and a pipe connected with said flue at an angle thereto, a valve adapted to control the communication between said flue and said pipe comprising a cover adapted to close the top of said flue and a member adapted to close the end of said pipe, a vessel containing a fluid surrounding the upper part of said flue and a bell surrounding said cover and movable with said member and adapted to enter said vessel to positively prevent the escape of air or gas from said pipe to said flue or vice versa.

5. The combination with a flue and a pipe connected therewith and arranged at an angle thereto of a duplex valve comprising a cover adapted to close the end of said flue and a member adapted to close the end of said pipe, means for lifting said member operatively connected with said cover whereby said member is lifted higher than said pipe and said cover is lifted to a plane substantially in alignment with the top of said pipe.

6. The combination with an upright flue and a lateral pipe connected therewith of a member adapted to close the end of said pipe, a cover adapted to close the top of said flue, a hood above said flue and pipe to prevent the escape of air or gas when said member and said cover are moved to open position, a tubular lifting device connected to said member, a stem extending into said tubular lifting device and arranged to position said cover in a plane substantially in alignment with the top of said pipe when said member is lifted to its extreme position so that the cover protects said hood from the destructive action of the air or gases flowing from the flue to said pipe or vice versa.

7. The combination with an upright flue and a lateral pipe connected therewith of a member adapted to close the end of said pipe, a cover adapted to close the top of said flue, a hood above said flue and pipe to prevent the escape of air or gas when said member and said cover are moved to open position, a tubular lifting device connected to said member, a stem extending into said tubular lifting device and arranged to position said cover in plane substantially in alignment with the top of said pipe when said member is lifted to its extreme position so that the cover protects said hood from the destructive action of the air or gases conveyed by the flue and pipe, and means for supplying air to said tubular device to cool it and its associated parts.

8. The combination of a flue and a pipe connected therewith and arranged at an angle thereto, of a duplex valve comprising a cover adapted to close the end of said flue, a member comprising a bell having a closed top and arranged to enclose said cover in its closed position, a vessel surrounding the upper end of said flue and containing a fluid and arranged to receive the lower end of said bell to form a seal, lifting means operatively connected with said member and said cover and so arranged that when said member is lifted higher than said pipe the cover will be lifted to such position that its under-surface will lie in a plane substantially in alignment with the inner surface of the top of said pipe.

In witness whereof, I have hereunto signed my name.

WALDEMAR DYRSSEN.