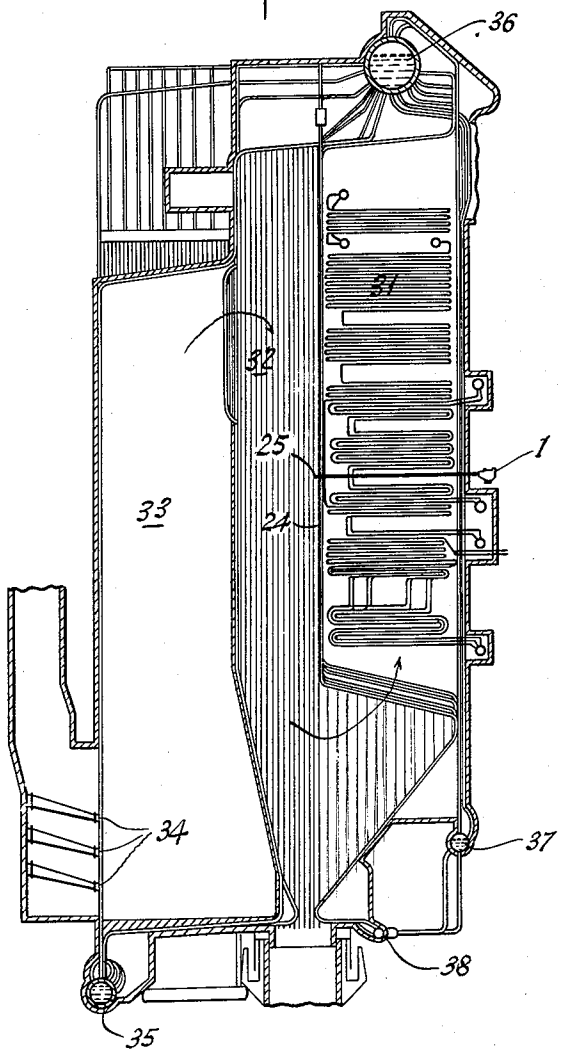
Nov. 1, 1960 J. C. SINGLETON 2,958,311

SOOT BLOWER ACCESS AND SEALING MEANS

Filed June 25, 1954 2 Sheets-Sheet 1

Fig. 1.



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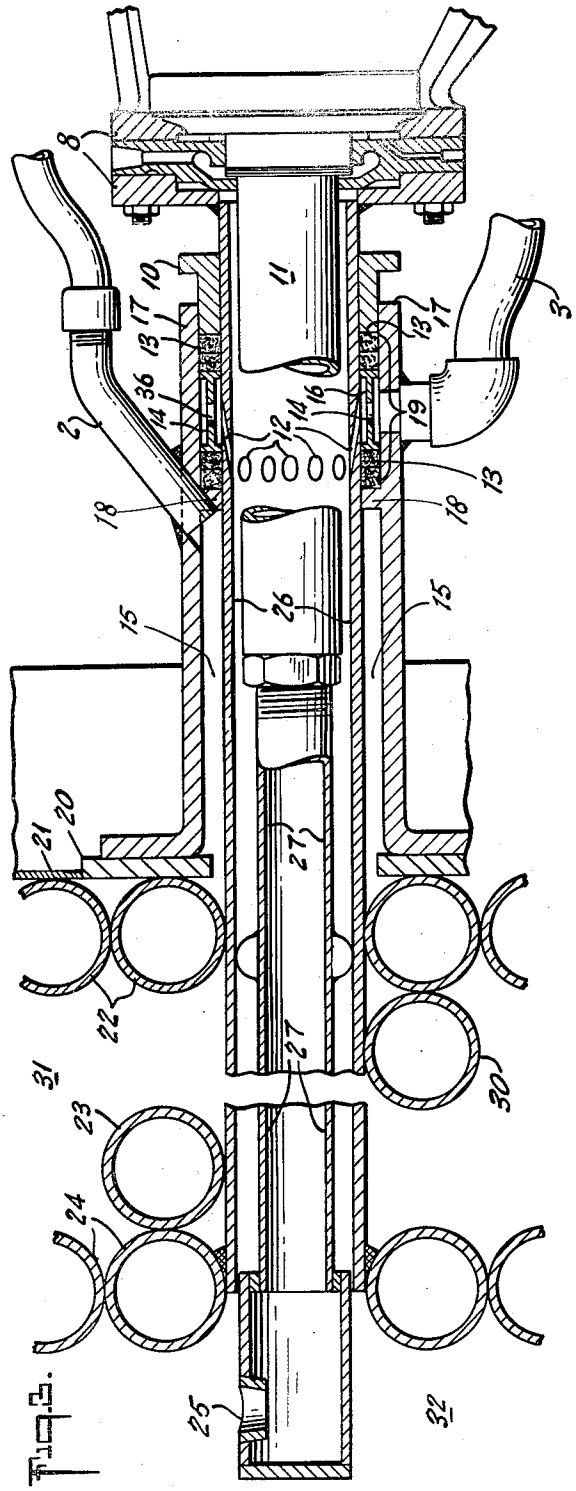


Fig. 1.

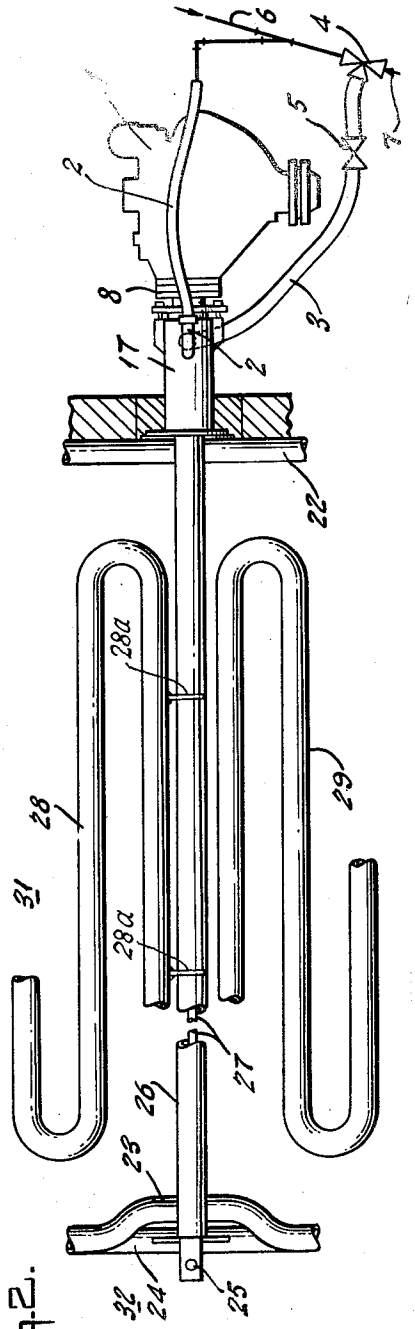


Fig. 2.

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SOOT BLOWER ACCESS AND SEALING MEANS

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5 Claims. (Cl. 122—392)

The present invention relates in general to the construction of access and closure members especially adapted for use with furnaces or other similar closed chamber structures which require access at intervals without necessitating a shut-down or causing interference with their prescribed functions. Structures suitable for the practice of my invention include boilers, for example, having a combustion chamber together with a communicating gas flow space wherein the gases of combustion are utilized mainly for the generation and heating of vapor. In other suitable structures the high pressure gases may be produced for various other purposes such as for utilization in processes or as a hot motive gaseous fluid for gas turbines.

In such installations the enclosing walls are often fluid cooled to provide protection from high furnace temperatures and further are preferably made gas-tight throughout to avoid the troublesome and dangerous condition resulting from the leakage of high temperature gases and other products of combustion.

Further, the pertinent installations are generally arranged with multiple heating gas flow passes arranged in series flow. It is often desirable to gain access to the furnace passes and it may be required to go through another gas pass where the access means may be exposed to heating gas. This exposure to heating gases will cause the device to obtain a temperature greater than the average of the fluid cooled structure thus requiring a provision for absorbing thermal expansion of the device. In doing this it is imperative that there be no source of leakage from one gas pass to another and that the device used, must be suitably constructed and arranged so as to maintain the gas-tight integrity of the overall structure.

One embodiment of the invention relates to sealing means for soot blower elements which are used in conjunction with vapor generators operating under relatively high internal gaseous pressures. The soot blower seals have the purpose of securing a fluid tight connection between the soot blower element and the vapor generator whereby expansion due to a temperature differential existing between the element and the vapor generator can be absorbed.

The soot blowers, being in contact with the heating gases, often accumulate soot and slag particles on the operating parts which are carried there by the leakage of hot gaseous fluid through the soot blower seal to atmosphere. These accumulations normally result in mal-functioning of the soot blower.

The invention contemplates the provision of means to absorb expansion due to temperature differences existing between a soot blower access tube and the gaseous container. Also there is provided a means for preventing hot pressurized gas from coming in contact with the expansion absorbing means by maintaining a cold gas pressure on the absorber which is higher than that of the hot gas. Further, there is provided a means for closing the opening to a pressurized gaseous container when the soot blower elements are removed for repairs and maintenance which is accomplished by cold high pressure gas being expanded through a ring of nozzles which point inwardly and in opposition to the direction which the hot gases would tend to discharge, whereby the high velocity energy of gas is converted to pressure, such pressure exceeding that of the hot gases.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of the specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which is illustrated and described a preferred embodiment of the invention.

Of the drawings:

Fig. 1 is a side elevation of a vapor generator illustrating the position of use of the invention.

Fig. 2 is an enlarged side view of the illustrative soot blower structure in operating position.

Fig. 3 is a plan view of the details of the invention.

The vapor generator shown in Fig. 1 is of the natural circulation open pass type having a convection heating gas pass 31 and a furnace composed of a combustion chamber 33, and an open gas pass 32. The inner division wall 24 between the open pass 32 and the convection pass 31 is composed of closely arranged tubular elements constructed to preclude gas leakage.

Steam riser tubes form the walls of the combustion chamber 33 and the passes 31, 32. The risers are part of the vaporizable fluid circulation system. The upper drum 36 receives a vapor-liquid mixture and after separation, downcovers deliver the liquid to the lower drum 35 and headers 37, 38 for distribution to the riser tubes. Fuel is fired into the combustion chamber 33 by the burners 34 and forms heating gases containing soot and slag particles which deposit on the tubular furnace and gas pass walls. To maintain the high heat transfer effectiveness of the unit soot blowers are utilized. In the illustrative embodiment soot blower nozzle 25 is positioned so as to remove slag from the back wall 24 of the furnace open pass 32. In order to accomplish this positioning, the soot blower has to go through the convection pass 31.

A more detailed disclosure of the soot blower installation is presented in Figs. 2 and 3. The soot blower nozzle 25 is placed adjacent the inner division wall 24 so as to remove slag therefrom. To accomplish the cleaning, the nozzle 25 is rotated 360° by a soot blower drive mechanism 1 and as the soot blower nozzle 25 revolves, it discharges high pressure fluid conducted thereto by the soot blower supply tube 27. The soot blower drive mechanism 1 is connected by flanges 8 to the soot blower access tube 26. This tube crosses the convection pass 31, is supported from the superheater tube 28 at spaced intervals by the tube ties 28a, and its outer end is fastened to the inner division wall 24. In order to form an opening for the soot blower access tube at the division wall, cooling tube 23 has been bent outwardly and to the side locally. The access tube 26 also passes through the outer cooling wall 22 of the pressure casing 21 of the vapor generator. This is accomplished in a manner similar to that of the division wall, and the tube 30 has been pulled out and to the side. An outer tubular member 17 is rigidly attached to a reinforcing plate 20 of the boiler casing 21.

Internally of the outer tubular member 17, there is an annular packing retaining ring 18 which is of a smaller internal diameter and is adjacent but spaced from the outer end of the outer member 17. The access tube 26 is positioned coaxially inside the outer tubular member

17 and is slidably in contact with the packing seat ring 18.

The outer surface of the access tube 26, the inner surface of the tubular member 17 and the inner side of the packing ring 18 form a sealing fluid chamber 15 in communication with the heating gases in the gas pass 31. Into the sealing chamber 15 there is introduced air from the vapor generator forced draft fan (not shown). This serves as a barrier against escape of heating gases. The air constantly flows into the heating gases thus overheating of the seal assembly is prevented.

The inner surface of the outer tube member 17, the outer surface of the soot blower access tube 26 and the outer side of the seat ring 18 combine to form a packing chamber 19. Into the outer end of the packing chamber 19 a packing retainer 10 is slidably fitted. In the packing chamber 19 there is also placed pliable packing 13 at both ends of the chamber with a fluid distributor means 14 in the center. The retainer 10 is connected to the member 17 by the usual compression member utilizing bolts to compress the packing 13.

The fluid distributor 14 is an H shaped ring and has a number of holes 36 drilled through it in a radial direction similar to a conventional lantern ring. The flanges of the ring 14 allow the packing 13 to be compressed by the retainer 10 to form a fluid tight manifold chamber 16 in the packing chamber 19. In the access tube 26 opposite the packing chamber and fluid distributor 14, there are a number of oblique passages 12 through the tube wall. When the soot blower drive mechanism 1 and the soot blower supply tube 27 are removed from the access tube 26 by disconnecting flange 8, high pressure fluid is introduced by pipe 3 into the packing chamber 19, through the fluid distributor 14 and thence through the series of apertures 12. This causes high velocity jets of fluids to converge along the central axis of the support tube 26. The converging jets form a high pressure area which prevents the heating gases of the vapor generator pass 32 from escaping to atmosphere.

The vapor generator during its operation will expand in all directions proportional to the temperature of the cooling surfaces such as the division walls 24 and pressure casing cooling walls 22. The soot blower access tube 26 being heated by the heating gases in the convection pass 31 will expand proportional to the temperature of the heating gases in the convection pass 31. Because the access tube 26 will seldom be the same temperature as the vapor generator cooling surface, the access tube 26 will not have the same length as the distance between the division wall 24 and the casing wall 22. Further, because the support tube 26 is attached rigidly to the division wall 24, the differential thermal expansion caused by the temperature difference must be taken where the access tube 26 passes through the pressure casing 21. This movement is absorbed by the packing joint composed of packing 13, retainer ring 10, and seat ring 18 without allowing heating gas leakage to atmosphere from the convection pass 31. The sealing air which is introduced through tube 2 enters the sealing chamber 15 constantly and causes a flow of lower temperature air into a convection pass 31. This maintains the packing 13 at the temperature of the forced draft air. Also the sealing air keeps the chamber free of soot and slag, and other solid particles which would impair the operation of the packing gland.

The fluid introduced by pipe 3 to the packing gland may be forced draft air as a constantly flowing supply of fluid whose purpose would be to keep the supply tube free of slag, soot, and other solid particles. However, when the soot blower drive mechanism is removed by disconnecting flange 8, a high pressure fluid is supplied from line 7 through pipe 3 and valve 5 so that the jets may perform the function of sealing the support tube against heating gas leakage to atmosphere. The high pressure fluid is supplied from an external source by conduit 7, through a three-way cock 4, and into conduit 3. The forced draft air to the sealing chamber 15 is supplied through conduit 6 thence into conduit 2. This air is also available through the 3-way cock during normal operation of the vapor generator to the packing chamber through pipe 3 to maintain the access tube free of soot, slag and other particles.

The improved form of access and sealing means herein described is not limited in application to vapor generators operating under low positive heating gas pressure, but is also applicable to gas turbine systems operating at presure up to 600 p.s.i. Further, the invention would be applicable to any access installation attached to a pressurized chamber.

While in accordance with the provisions of the statutes I have illustrated and described herein a specific form of the invention now known to me, those skilled in the art will understand that changes may be made in the form of the apparatus disclosed without departing from the spirit of the invention covered by my claims, and that certain features of the invention may sometimes be used to advantage without a corresponding use of other features.

What is claimed is:

1. In a fluid heater, an outer pressure tight casing enclosing said heater, walls forming a furnace and a laterally adjoining gas pass in said heater, one of said walls being a division wall between and common to said furnace and said gas pass, means for flowing a gas in said furnace under superatmospheric pressure, means forming a soot blower access opening including an outer tubular member rigidly attached at its inner end to said casing and having its outer end protruding from the casing a substantial distance and having an internal packing seat ring adjacent but spaced from the outer end of said tubular member, an inner soot blower access tube radially spaced from and coaxial with the outer member extending across said gas pass and slidably contacting said seat ring, said access tube being fastened to said division wall, a soot blower sealing the outer end of the access tube, the inner surface of the outer tubular member and the outer side of the packing ring in conjunction with the outer surface of the access tube so constructed and arranged as to form a packing chamber external of said casing, a packing retainer of an annular shape slidably fitting into said packing chamber, pliable packing disposed in said chamber, a fluid distributor means arranged annularly of said access tube and having its inner wall portion in common with the outer surface of the access tube, means in communication with said distributor means for controllably and intermittently supplying a high pressure fluid thereto, and means in communication with said distributor means for directing said high pressure fluid through the access tube in a series of high velocity jets converging along the central axis of the access tube in a direction opposing the flow of heating gas outwardly when the soot blower means is removed from the access tube.

2. In a fluid heater, an outer pressure tight casing enclosing said heater, walls forming a furnace and a laterally adjoining gas pass in said heater, one of said walls being a division wall between and common to said furnace and said gas pass, means for flowing a gas in said furnace under superatmospheric pressure, means forming a soot blower access opening including an outer tubular member rigidly attached at its inner end to said casing and having its outer end protruding from the casing a substantial distance and having an internal packing seat ring adjacent but spaced from the outer end of said tubular member, an inner soot blower access tube radially spaced from and coaxial with the outer member, said access tube extending across said gas pass and slidably contacting said ring, said access tube being fastened to said division wall, a soot blower sealing the outer end of the access tube, the inner surface of the outer tubular

member and the outer side of the packing ring in conjunction with the outer surface of the access tube being so constructed and arranged as to form a packing chamber external of said casing, a packing retainer of an annular shape slidably fitting into said packing chamber, means in communication with said packing chamber for controllably supplying a high pressure fluid thereto, pliable packing and a fluid distributor means disposed in said chamber, and means in communication with said packing chamber for directing said high pressure fluid through the access tube in a series of high velocity jets converging along the central axis of the access tube in a direction opposing the flow of heating gas outwardly when the soot blower means is removed from the access tube.

3. In a fluid heater, an outer pressure tight casing enclosing said heater, walls forming a furnace and a laterally adjoining gas pass in said heater, one of said walls being a division wall between and common to said furnace and said gas pass, means for flowing a gas in said furnace under superatmospheric pressure, means forming a soot blower access opening including an outer tubular member rigidly attached at its inner end to said casing and having its outer end protruding from the casing a substantial distance and having an internal packing seat ring adjacent but spaced from the outer end of said tubular member, an inner soot blower access tube radially spaced from and coaxial with the outer member extending across said gass pass and slidably contacting said seat ring, said access tube being fastened to said division wall, a soot blower sealing the outer end of the access tube, the inner surface of the outer tubular member and the outer surface of the access tube in conjunction with the inner side of the packing ring being so constructed and arranged as to form an annular chamber in communication with the heating gases, means communicating with said chamber adapted to introduce sealing and cleaning air from a forced draft means, the inner surface of the outer tubular members and the outer side of the packing ring in conjunction with the outer surface of the access tube so constructed and arranged as to form a packing chamber external of said casing, a packing retainer of an annular shape slidably fitting into said packing chamber, pliable packing disposed in said packing chamber, a fluid distributor means arranged annularly of said access tube and having its inner wall portion in common with the outer surface of the access tube, means in communication with said distributor means for controllably and intermittently supplying a high pressure fluid thereto, and means in communication with said distributor means for directing said high pressure fluid through the access tube in a series of high velocity jets converging along the central axis of the access tube in a direction opposing the flow of heating gas outwardly when the soot blower means is removed from the access tube.

4. In a fluid heater, an outer pressure tight casing enclosing said heater, walls forming a furnace and a laterally adjoining gas pass in said heater, one of said walls being a division wall between and common to said furnace and said gas pass, means for flowing a gas in said furnace under superatmospheric pressure, means forming a soot blower access opening including an outer tubular member rigidly attached at its inner end to said casing and having its outer end protruding from the casing a substantial distance and having an internal packing seat ring adjacent but spaced from the outer end of said tubular member, an inner soot blower access tube radially spaced from and coaxial with the outer member, said access tube extending across said gas pass and slidably in contact with said ring, said access tube being fastened to said division wall, a soot blower sealing the outer end of the access tube, the inner surface of the outer tubular member and the outer surface of the access tube in conjunction with the inner side of the ring being so constructed and arranged as to form an annular chamber in communication with the heating gases, means communicating with said chamber adapted to introduce sealing and cleaning air from a forced draft means, the inner surface of the outer tubular member and the outer side of the packing ring in conjunction with the outer surface of the access tube being so constructed and arranged as to form a packing chamber external of said casing, a packing retainer of an annular shape slidably fitting into said packing chamber, and pliable packing disposed in said packing chamber.

5. In a fluid heater, an outer pressure tight casing enclosing said heater, walls forming a furnace and a laterally adjoining gas pass in said heater, one of said walls being a division wall between and common to said furnace and said gas pass, means for flowing a gas in said furnace under superatmospheric pressure, means forming an access opening including an outer tubular member rigidly attached at its inner end to said casing and having its outer end protruding from the casing a substantial distance and having an internal packing seat ring adjacent but spaced from the outer end of said tubular member, an inner access tube radially spaced from and coaxial with the outer member, said access tube extending across said gas pass and slidably contacting said ring, said access tube being fastened to said division wall, a removable closure means sealing the outer end of the access tube, the inner surface of the outer tubular member and the outer surface of the access tube in conjunction with the inner side of the ring being so constructed and arranged as to form an annular chamber in communication with the heating gases, means communicating with said chamber adapted to introduce sealing and cleaning air from a forced draft means, the inner surface of the outer tubular member and the outer side of the packing ring in conjunction with the outer surface of the access tube being so constructed and arranged as to form a packing chamber external of said casing, a packing retainer of an annular shaped slidably fitting into said packing chamber and having a connection to the outer tube to position said retainer, and pliable packing means disposed in said packing chamber.

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