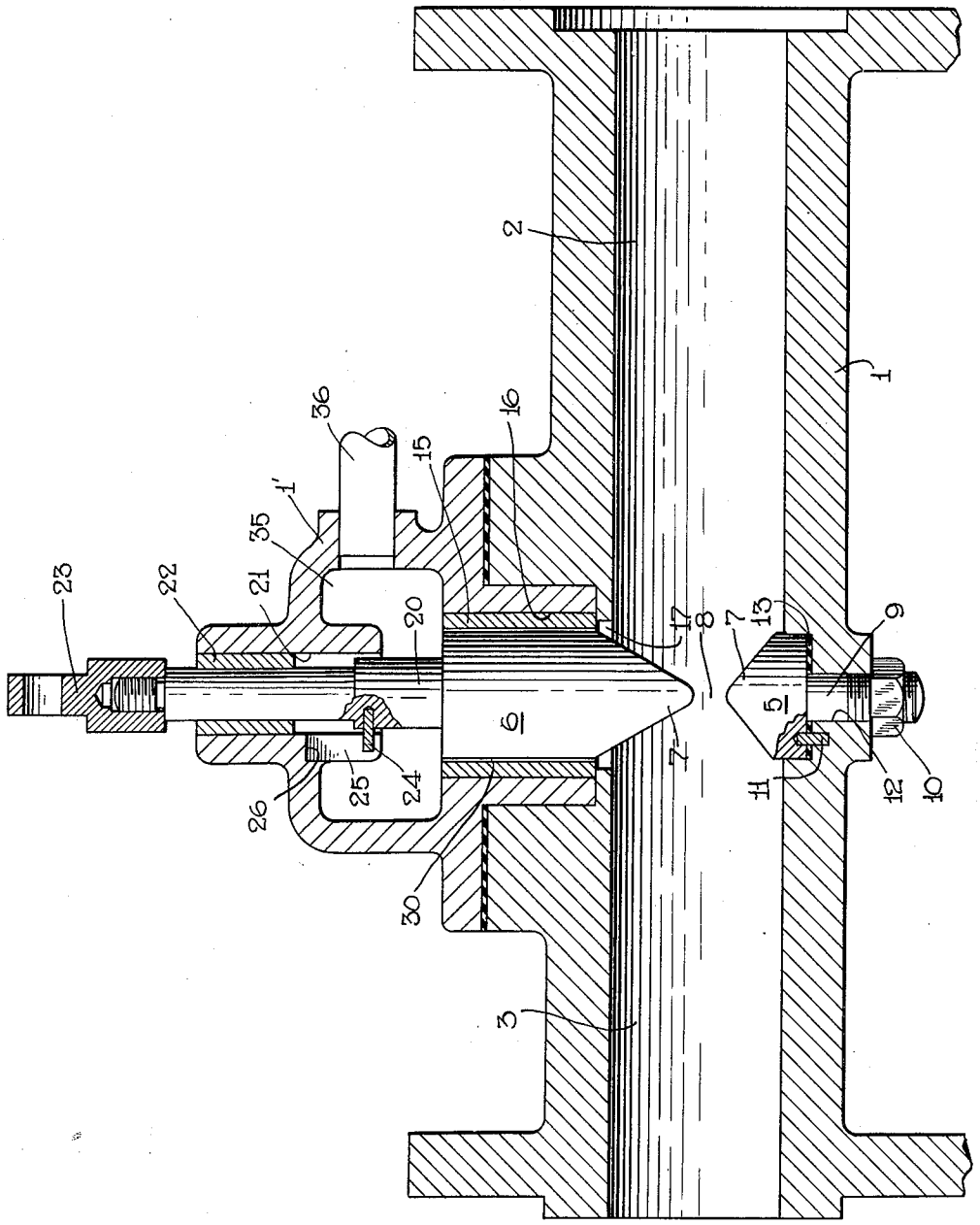
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PULVERIZED COAL ATOMIZER

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PULVERIZED COAL ATOMIZER

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This invention relates to variable area orifice devices and more particularly to a device for atomizing pulverized coal or the like.

The variable area orifice device, as a pulverized coal atomizer, may be employed in a coal burning gas turbine plant of the type described in the copending U. S. application of Harry C. May and Ellis E. Hewitt, Serial No. 22,208, filed April 20, 1948, and assigned to the assignee of the present application. The device may comprise a casing having an inlet opening adapted to be supplied with a mixture of pulverized coal and conveying air, an outlet opening adapted to be connected to a combustion chamber for supplying a mixture of atomized coal and conveying air thereto, and a fluid pressure communication extending between the above named openings for conveying coal and air therethrough. Fixed and adjustable orifice elements may project into the fluid pressure communication in the path of flow of the coal and air mixture to define a restricted flow area through which said mixture must flow. The coal and air mixture entering the inlet opening at a relatively high pressure suddenly expands in passing through the restricted flow area defined by the fixed and adjustable orifice elements to the outlet opening. Due to this sudden expansion of the coal and air mixture, the compressed air that has permeated into the pores of the coal entering the device cannot escape rapidly enough to attain the pressure in the outlet opening, so that the coal is exploded into extremely small powder-like particles. The flow area is made variable by adjustment of the adjustable orifice element to assure that a desired pressure drop through the device may be attained for various pressure conditions in the inlet opening.

The adjustable orifice element may be in the form of a cylindrical shaped member slidable in a bore or sleeve in a direction transversely of the fluid pressure communication and having a tapered wedge-shaped end portion projecting into said communication for regulating flow therethrough. A rod or actuating stem is attached to the adjustable orifice element through the medium of which position of the tapered portion of said orifice element may be adjusted in the communication. The stem must extend through an opening in the casing to allow for adjustment from without, the outer end of said stem being adapted for connection with a positioning device or the like. Due to the slidable relationship between the adjustable orifice element and the stem with its guiding surface, sufficient clearance must be provided to allow for a certain degree of freedom of movement in order that said orifice element may be positioned easily and accurately. Such clearance, even though only in the order of several thousandths of an inch, inherently affords a path through which extremely fine powder-like particles of pulverized or atomized coal from the fluid pressure communication might escape from the device to the atmosphere and, due to the potential explosive nature of a mixture of powdered coal and air, present a hazard to the safety of men and equipment.

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It is therefore one object of this invention to provide a variable area orifice device of the above type for use in atomizing pulverized coal which will not allow unintentional escape of atomized coal therefrom.

At the same time, clearance around the cylindrical portion of the adjustable orifice element open to the fluid pressure communication also affords a space in which the extremely fine particles of pulverized or atomized coal may accumulate and pack to cause an undesirable resistance to positioning adjustment of said element as well as causing undue wear to related parts due to abrasive properties of said coal, and it is therefore another object of the invention to provide means which will assure that such clearance will remain free of coal.

Other objects and advantages will become apparent from the following detailed description of the invention.

In the accompanying drawing, the single figure is a diagrammatic view, partly in outline but substantially in section, of a variable area orifice device particularly adapted for use as a pulverized coal atomizer and embodying the invention.

Description

As shown in the drawing, the pulverized coal atomizer may comprise a casing 1 having an inlet chamber 2 for connection with a source of pulverized coal and conveying air (not shown), and an outlet chamber 3 for connection to a pipe or device to which it is desired to supply atomized coal, such as a combustion chamber or the like (not shown). Intermediate the chambers 2, 3 are disposed two aligned orifice elements 5, 6. Both elements 5, 6 may be substantially cylindrical in shape and provided with a wedge-shaped end portion 7 for projection into the path of flow of coal and air to define a restricted opening 8 through which the mixture of pulverized coal and conveying air supplied to

chamber 2 must flow to reach chamber 3. Due to the restriction imposed by elements 5, 6 to flow of pulverized coal and conveying air supplied to chamber 2, a sudden drop in pressure is realized as said coal and air flows through opening 8 into chamber 3. Through the tendency for the air trapped in the pores of the coal to expand to equalize with the reduced pressure in chamber 3, such coal is "exploded" or "atomized."

Element 5 is fixed, being removably secured to casing 1 by means of an integral threaded stem 9 and a nut 10. An annular recess in casing 1 is provided to accommodate element 5 which may be aligned therein by means of a pin 11, and to allow said element to be easily removed from the casing, a bore 12 is provided through which stem 9 may extend to allow nut 10 to be disposed outside the casing. An annular sealing element 13 encircling bore 12 and arranged to be clamped between the element 5 and the casing is provided to prevent escape of atomized coal and air around said element and through said bore to the atmosphere.

The orifice element 6 is adjustable to positions toward or away from the element 5 to adjust the size of the restricted area 8 in order to assure that drop in pressure experienced by the coal and air in passing therethrough from chamber 2 into chamber 3 will be adequate to cause "explosion" of the pulverized coal particles for various conditions of pressure in chamber 3. The cylindrical portion of element 6 may be slidably guided in a sleeve member 15 having a press fit in a bore 16 in a casing portion 1' of the casing 1. An opening 17 in the casing may allow for projection of element 6. A stem 20 formed integrally with element 6 may be provided as a medium through which said element may be adjusted, said stem extending outwardly through a bore 21 in casing portion 1'. Stem 20 may be of lesser diameter than that of the bore 21 and may be slidably guided in a bushing 22, press fit into said bore. An eye bolt 23 or the like is attached to the outer projecting end of stem 20 by a screw-threaded connection to provide for connection of said stem to actuating or positioning means (not shown) for adjusting the position of element 6 through inward and outward movement of said stem. A pin 24 may be provided in stem 20, arranged to ride in a groove 25 to guide element 6 and to cooperate with a shoulder 26 to define a stop limit for movement of said stem and element in one direction.

The fit between the element 6 and sleeve 15 and between the stem 20 and bushing 22 must be relatively loose to allow said element and stem to be positioned easily. Thus a clearance space 30 is provided between element 6 and sleeve 15. Actually, the clearance space 30 may be in the order of several thousandths of an inch and therefore for sake of illustration said clearance space is greatly exaggerated in the drawing.

According to the invention a fluid pressure chamber 35 is provided in casing portion 1' at one end of the clearance space 30, the opposite end of which space is open to chambers 2 and 3 in which the mixture of coal and conveying air at relatively high pressures may flow. The fluid pressure chamber 35 is connected to a fluid pressure conduit 36 which may in turn be connected to a source of fluid at a greater pressure than the pressure of fluid in chamber 2.

The fluid in chamber 35, being of greater pressure than that in chambers 2 or 3, will tend to flow through clearance space 30 into said chambers and maintain said clearance space free of the extremely fine particles of coal traveling through the atomizer. Such flow of air from the chamber 35 through clearance space 30 into chambers 2, 3 will thus prevent leakage of a highly explosive mixture of coal dust and air to chamber 35 and thence to the atmosphere around stem 20 as well as preventing excessive wear of sleeve 15 and element 6 which otherwise might occur should fine particles of coal be allowed to accumulate or pack in said clearance space. Since air supplied to chamber 35 will also tend to leak around stem 20 through bushing 22 to atmosphere, said bushing is also kept free of dust and dirt which otherwise might tend to accumulate and/or pack therein. Therefore, freedom of movement of both the element 6 and the stem 20 is maintained, so that said element may be positioned easily at all times.

Summary

It will now be seen that I have provided an improved variable area orifice device particularly adapted for atomizing pulverized coal or the like which will not allow unintentional escape of even the finest particles of said coal to the atmosphere. Further, in the improved variable area orifice device, the fine particles of coal are prevented from entering the clearance spaces between sliding elements, so that said elements are not subjected to the abrasive or restraining action of such coal.

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

1. A pulverized coal atomizer comprising a casing having an inlet chamber adapted to be supplied with a mixture of pulverized coal and conveying air under pressure and an outlet chamber adapted to be connected to receiving means, fixed and adjustable orifice elements interposed between said inlet chamber and said outlet chamber to define a restricted opening through which said pulverized coal and conveying air from said inlet opening must pass to reach said outlet opening, said fixed orifice element being mounted in a recess in said casing, means for locating said fixed element within said recess, a threaded stem attached to said fixed orifice element extending outwardly through an opening in said casing, a nut attached to said stem, and sealing means cooperable with said fixed element and with said casing to prevent leakage of coal particles from said inlet and outlet chambers to the atmosphere.

2. A pulverized coal atomizer comprising a casing having a fluid pressure communication adapted to receive pulverized coal and conveying air under pressure at one end and to deliver atomized coal and conveying air at its opposite end, fixed and adjustable orifice elements projecting transversely into said fluid pressure communication to define a restricted opening through which coal and air traveling through said communication must pass, said adjustable orifice element comprising a cylindrical portion slidably mounted within a casing bore with clearance opening at its one end into said fluid pressure communication, a fluid pressure chamber formed in said casing at the opposite end of said clearance and adapted to be supplied with air at a pressure greater than said conveying air pressure, a stem attached to said adjustable orifice element extending outwardly through an opening in said casing, a stop element secured to said stem and projecting transversely therefrom into a groove in said casing to slidably guide longitudinal move-

ment of said stem, and a link element secured to the outer end of said stem adapted for pivotal connection with actuating means for adjusting position of said adjustable orifice element through said stem.

ELLIS E. HEWITT.

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