

PATENT SPECIFICATION (11)

1537 649

- (21) Application No. 47097/77 (22) Filed 11 Nov. 1977 (19)
(31) Convention Application No. 744 195 (32) Filed 22 Nov. 1976 in
(33) United States of America (US)
(44) Complete Specification published 10 Jan. 1979
(51) INT. CL.² F16K 24/02 1/44
(52) Index at acceptance
F2V D11A E1K2
F4B 2A2



(54) VENTILATED POPPET DAMPER

(71) We, AMERICAN AIR FILTER COMPANY, INC., a corporation organised and existing under the laws of the State of Delaware, United States of America, of 215 Central Avenue, Louisville, Kentucky 40201, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to dampers and more particularly to a ventilated damper assembly for use in metallurgical operations.

In large gas-conducting pipe systems such as those used in conjunction with metallurgical operations, it frequently is necessary to provide a damper to control gas flow through the pipe or conduit.

In the past, suitable dampers have been complicated and expensive in order to effect positive tight sealing, and in many cases, have not even then been entirely effective. Included among the past damper arrangements have been damper plates which slide into and out of a conduit in the manner of a guillotine. A problem with these damper plates is that they move in guide rails and must fit therein with sufficient clearance to compensate for expansion and contraction of the damper plate to avoid binding. However these damper plates must also be dimensioned so as to give a gas tight seal when in the closed position. A further problem with sliding damper plates is that they tend to wear the sealing surfaces of the guide rails because they slide against them in moving between opened and closed positions. Yet a further disadvantage with sliding damper plates of this type is that their use is substantially restricted to conduits or pipes having a rectangular cross section.

The present invention recognizes the problems and drawbacks of prior art dampers and provides a solution which is not only effective, but also relatively inexpensive to manufacture, install, and maintain in operation.

A damper in accordance with this inven-

tion controlling a gas stream through a gas pipe or conduit, comprises at least two spaced sealing seats disposed within the flow path through the pipe or conduit and at least two damper plates coaxially mounted on a hollow rod and spaced apart by a distance equal to the distance between the seats, the rod having a closed end and being mounted for axial movement relative to the pipe or conduit between an open position in which the damper plates are spaced from their respective sealing seats and a closed position in which the plates engage their respective sealing seats the two damper plates cooperating, in the closed position, to define a transverse chamber which can be ventilated through the hollow rod.

The damper plates and seats may be mounted directly within the pipe or conduit or within a separate housing having an inlet and outlet connected to and forming a part of the flow path through the pipe or conduit.

The invention will now be further described by way of example with reference to the accompanying drawings in which:

Figure 1 is a longitudinal cross-section of one embodiment of the present invention;

Figure 2 is a longitudinal cross-section illustrating one application of the embodiment of Figure 1;

Figure 3 is a longitudinal cross-section illustrating another application of the embodiment of Figure 1;

Figure 4 is a longitudinal cross-section illustrating a further application of the embodiment of Figure 1;

Figure 5 is a longitudinal cross-section illustrating a yet further application of the embodiment of Figure 1;

Figure 6 is a longitudinal cross-section of a second embodiment of the present invention;

Figure 7 is a longitudinal cross-section illustrating one application of the embodiment of Figure 6;

Figure 8 is a longitudinal cross-section illustrating yet another application of the embodiment of Figure 6;

2

1,537,649

2

Figure 9 is a longitudinal cross-section illustrating a further application of the embodiment of Figure 6; and

Figure 10 is a longitudinal cross-section illustrating a yet further application of the embodiment of Figure 6.

Figures 1-5 illustrate a gas conveying conduit 10 having a ventilated poppet damper assembly, generally indicated at 12, disposed therein for selectively opening and closing the conduit.

The damper assembly 12 comprises a peripheral sealing seat 14 disposed within the conduit 10 and another peripheral sealing seat 16 spaced from the sealing seat 14. A hollow close-ended activating rod 18 is coaxially disposed within the conduit 10 and is mounted for axial movement. A damper plate 20 is coaxially attached to the hollow rod 18 adjacent one end 22 for movement with the rod 18 between an open position spaced from the peripheral sealing seat 14 (see Figure 1) and a closed position engaging the peripheral sealing seat 14 (see Figures 2-5). Another damper plate 24 is also coaxially attached to the hollow rod 18, parallel to and spaced from the damper plate 20 along the axis of the rod 18. The distance by which the damper plate 24 is spaced from the damper plate 20 corresponds to the distance between the two seats 14 and 16. The damper plate 24 is attached to the rod 18 for movement therewith between an open position spaced from the peripheral sealing seat 16 (see Figure 1) and a closed position engaging the peripheral sealing seat 16 (see Figures 2-5). When the damper plates 20 and 24 are in the closed position, they cooperate to define a transverse chamber (see Figures 2-5) across the conduit 10.

The hollow rod 18 extends through the wall of the gas conveying conduit 10 to the exterior thereof through a seal 19 to create a gas tight seal to prevent gas in the conduit from leaking out around the rod 18.

Means generally indicated at 28, are provided for ventilating the transverse chamber 26 through the hollow rod 18 as well as means 30 for axially moving the hollow rod 18 and, therefore, the damper plates 20 and 24 between their open and closed positions.

The damper plates 20 and 24 have flexible margins 32 and 34, respectively, constituting peripheral sealing means. When the damper plates 20 and 24 are in their closed positions, the flexible margins 32 and 34 engage the seats 14 and 16, respectively. Preferably, the rod moving means 30 forces the damper plates against their respective sealing seats hard enough to deflect the flexible margins of the damper plates so that a tight seal is created between the flexible margins and the sealing seats.

The flexible margins 32 and 34 can be formed in any one of a number of known

ways. For example, the damper plate can be tapered so that the margin is thinner than the rest of the damper plate, or a flexible gasket material can be attached to the periphery of the damper plate to extend outwardly beyond the edge of the damper plate.

In the embodiment of Figures 1 through 5, the peripheral sealing seats 14 and 16 are connected to the interior wall surface of the conduit and comprise a lip having a free edge 38 for engagement with the flexible margins 32 and 34 of the damper plates 20 and 24.

The rod moving means 30 can be any one of a number of conventional known devices such as a pneumatic or hydraulic cylinder and piston, or a solenoid.

The ventilating means 28 comprises at least one aperture 40 formed through the side wall of the hollow rod 18 between the damper plates 20 and 24 thereby providing a gas flow path between the transverse chamber 26 and the interior of the hollow rod 18, and gas moving means 42 which is in communication with the interior of the hollow rod 18 via a ventilating conduit 44.

Figure 2 illustrates one application of the ventilated poppet damper assembly 12. In this particular application, the flow of gas in the conduit 10, indicated by the mottled arrows, is in such a direction that it first meets the damper plate 20 and subsequently the damper plate 24. Therefore, in this application the plate 20 is the upstream damper plate and the plate 24 is the downstream damper plate. When it is desired to stop the flow of gas through the conduit 10, the rod moving means 30 is actuated to axially move the rod 18 toward the sealing seats 14 and 16, thus, concurrently moving the damper plates 20 and 24 into engagement with the sealing seats 14 and 16, respectively. To further protect against gas leaks between the damper plates 20 and 24 and their respective sealing seats 14 and 16, the transverse chamber 26 is pressurized with another gas, such as air, by the gas moving means 42 which is, in this instance, a source of pressurized gas such as, an air pump. The pressurizing gas flows from the gas moving means 42, through the ventilating conduit 44 into the interior of the hollow rod 18, through the aperture 40 in the side walls of the rod and into the transverse chamber 26. The flow of this pressurizing gas is indicated by the arrows in Figure 2. The chamber 26 is pressurized to a level above the gas pressure in the conduit 10, thus, preventing the gas in the conduit from leaking between the damper plate to sealing seat interface.

The application depicted in Figure 3 differs from that depicted in Figure 2 only in the direction of flow of the gas within the conduit 10. In all respects, however, the

operation and structure of the ventilated poppet damper assembly 12 of Figure 3 is identical with that of Figure 2 and discussed above.

Figure 4 depicts a somewhat different application of the ventilated poppet damper assembly 12. The flow of gas in the conduit 10, is indicated by the mottled arrows, and is again in such a direction that it first meets the damper plate 20 and subsequently the damper plate 24. Therefore, the damper plate 20 is the upstream damper plate and the damper plate 24 is the downstream damper plate. When it is desired to stop the flow of gas through the conduit 10, the rod moving means 30 is activated to axially move the rod 18 toward the sealing seats 14 and 16, thus, concurrently moving the damper plates 20 and 24 into engagement with the sealing seats 14 and 16, respectively. To further protect against gas leaks between the damper plates 20 and 24 and their respective sealing seats 14 and 16, the transverse chamber 26 is evacuated by the gas moving means 42 which, in this instance, is, for example, a vacuum pump. Any gas from the conduit 10 which may leak past the interface between the damper plate 20 and the sealing seat 14 into the transverse chamber 26 is evacuated therefrom through the apertures 40 into the interior of the hollow rod 18, and out of the interior of the hollow rod 18 through the ventilating conduit 44 to the vacuum pump 42. This flow of gas is indicated by the arrows in Figure 4.

The application depicted in Figure 5 differs from that depicted in Figure 4 only in the direction of flow of the gas within the conduit 10. Because the flow of gas in the conduit 10 of Figure 4 is reversed from that of Figure 3, the damper plate 24 would be termed the upstream damper and the damper plate 20 and downstream damper. In all other respects, however, the operation and structure of the ventilated poppet damper assembly 12 of Figure 5 is identical with that of Figure 4 discussed immediately above.

Turning now to Figures 6-10, there is illustrated another advantageous embodiment of the present invention in which a gas conveying conduit 110 having a ventilated poppet damper assembly, generally denoted as the numeral 112, is disposed in the conduit 110 for selectively opening and closing the gas stream passageway through the conduit 110.

The ventilated poppet damper assembly 112 comprises a housing 113 having a gas stream inlet opening 115 in communication with conduit 110 and a gas stream outlet opening 117 also in communication with conduit 110. Two spaced apart peripheral sealing seats 114 and 116 are disposed within the housing 113. Sealing seat 116, is spaced

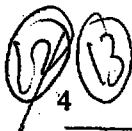
downstream, relative to the gas stream flow through the housing 113, from the other sealing seat 114. A hollow close-ended activating rod 118 is coaxially disposed to the peripheral sealing seats 114 and 116 within the housing 113, and is mounted for axial movement. A damper plate 120 is coaxially disposed with the hollow rod 118 and is attached to the rod 118 adjacent one of the rod ends 122 for movement with the rod 118 between an open position spaced from the peripheral sealing seat 114 (see Figure 6), to a closed position engaging the peripheral sealing seat 114 (see Figures 7-10). Another damper plate 124 is also coaxially disposed with the hollow rod 118, but is parallel to and spaced a distance from the damper plate 120 along the axis of the rod 118. The distance by which the damper plate 124 is spaced from the damper plate 120 corresponds to the distance that sealing seat 116 is spaced from the sealing seat 114. The damper plate 124 is attached to the rod 118 for movement therewith between an open position spaced from the peripheral sealing seat 116 (see Figure 6) and a closed position engaging the peripheral sealing seat 116 (see Figures 7-10). When the damper plates 120 and 124 are in the closed position, they cooperate to define a transverse chamber 126 (see Figures 7-10) across the housing 113.

The hollow rod 118 extends through a wall of the housing 113 to the exterior of the housing. A rod seal 119 is disposed around the rod 118 where it passes through the housing wall to create a gas tight seal to prevent the gas being conveyed in the conduit 110 from leaking out of the housing 113 past the rod 118.

The ventilated poppet damper assembly 112 further comprises means, generally denoted as the numeral 128, for venting this transverse chamber 126 through the hollow rod 118 as well as means 130 for axially moving the hollow rod 118 and, therefore, the damper plates 120 and 124 between their open position and closed position.

The damper plates 120 and 124 have a flexible margin 132 and 134, respectively, constituting peripheral sealing means. When the damper plates 120 and 124 are in their closed positions, the flexible margins 132 and 134 engage the peripheral sealing seats 114 and 116, respectively. Preferably, the rod moving means 130 forces the damper plates 120 and 124 against their respective sealing seats hard enough to deflect the flexible margins of the damper plates so that a tight seal is created between the flexible margins and the sealing seats.

The flexible margins 132 and 134 can be formed in any one of a number of known ways. For example, the damper plates can be tapered so that the margin is thinner than



the rest of the damper plate, or a flexible gasket material can be attached to the periphery of the damper plate to extend outwardly beyond the edge of the damper plate.

5 The sealing seats 114 and 116 comprise a lip 136 having a free edge 138 for engagement with the flexible margins 132 and 134 of the damper plate 120 and 124.

10 The rod moving means 130 can be any one of a number of conventional known devices such as a pneumatic or hydraulic cylinder and piston, or a solenoid.

15 The ventilating means 128 comprises at least one aperture 140 formed through the side wall of the hollow rod 118 between the damper plates 120 and 124 thereby providing a gas path between the transverse chamber 126 and the interior of the hollow rod 118, and gas moving means 142 in gas flow communication with the interior of the hollow rod 118 via a ventilating conduit 144.

20 Figure 7 illustrates one application of the ventilated poppet damper assembly 112. In this particular application, the flow of gas in the conduit 110, indicated by the mottled arrow, is in such a direction that it first meets the damper plate 120 and subsequently the damper plate 124. Therefore, in this application the plate 120 is the upstream damper plate and the plate 124 is the downstream damper plate. When it is desired to stop the flow of gas through the conduit 110, the rod moving means 130 is actuated to axially move the rod 118 toward the sealing seats 114 and 116, thus, concurrently moving the damper plates 120 and 124 into engagement with the sealing seats 114 and 116, respectively. To further protect against gas leaks between the damper plates 120 and 124 and their respective sealing seats 114 and 116, the transverse chamber 126 is pressurized with another gas, such as air, by the gas moving means 142 which is, in this instance, a source of pressurized gas such as, for example, an air pump. The pressurizing gas flows from the gas moving means 142, through the ventilating conduit 144 into the interior of the hollow rod 118, out of the interior of the hollow rod 118 through the apertures 140 in the side walls of the rod and into the transverse chamber 126. The flow of pressurizing gas is indicated by the arrows in Figure 7. The chamber 126 is pressurized to a level above the gas pressure in the conduit 110, thus, preventing the gas in the conduit from leaking between the damper plate to sealing seat interface.

55 The application depicted in Figure 8 differs from that depicted in Figure 7 only in the direction of flow of gas within the conduit 110. Therefore, the gas stream opening 117 will be the gas stream inlet and the gas stream opening 113 will be the gas stream outlet. Likewise, the damper plate 124 will be the upstream damper plate and the

damper plate 120 the downstream damper plate. However, these differences are merely nomenclature, and the operation and structure of the ventilated poppet damper assembly 112 of Figure 8 is identical with that of Figure 7 discussed above.

70 Figure 9 depicts a somewhat different application of the ventilated poppet damper assembly 112. In this application, as in the application of Figure 7, the flow of gas in the conduit 110, indicated by the mottled arrow, is in such a direction that it first meets the damper plate 120 and subsequently the damper plate 124. Therefore, the damper plate 120 is the upstream damper plate and the damper plate 124 is the downstream damper plate. When it is desired to stop the flow of gas through the conduit 110, the rod moving means 130 is actuated to axially move the rod 118 toward the sealing seats 114 and 116, thus, concurrently moving the damper plates 120 and 124 into engagement with the sealing seats 114 and 116, respectively. To further protect against gas leakage between the damper plates 120 and 124 and their respective sealing seats 114 and 116, the transverse chamber 126 is evacuated by the gas moving means 142 which, in this instance, is, for example, a vacuum pump. Any gas from the conduit 110 which may leak past the interface between the damper plate 120 and the sealing seat 114 into the transverse chamber 126 is evacuated therefrom through the apertures 140 into the interior of the hollow rod 118, and out of the interior of the hollow rod 118 through ventilating conduit 144 to the vacuum pump 142. This flow of gas is indicated by the arrows in Figure 9.

105 The application depicted in Figure 10 differs from that depicted in Figure 9 only in the direction of flow of the gas within the conduit 110. Because the flow of gas in the conduit 110 of Figure 10 is reversed from that of Figure 9, the gas opening 117 is the gas inlet into and the gas opening 115 is the gas outlet from the housing 113. Likewise, the damper plate 124 is the upstream damper plate and the damper plate 120 the downstream plate. However, these are differences in nomenclature only, and the operation and structure of the ventilated damper assembly 112 of Figure 10 is identical with that of Figure 9 discussed above.

120 It should be eminent from the various applications discussed above and illustrated in the figures that the present invention is very versatile and adaptable to various situations.

WHAT WE CLAIM IS:—

1. A damper assembly for selectively opening and closing a passageway through a pipe or conduit, comprising at least two spaced sealing seats disposed within the flow



the rest of the damper plate, or a flexible gasket material can be attached to the periphery of the damper plate to extend outwardly beyond the edge of the damper plate.

The sealing seats 114 and 116 comprise a lip 136 having a free edge 138 for engagement with the flexible margins 132 and 134 of the damper plate 120 and 124.

The rod moving means 130 can be any one of a number of conventional known devices such as a pneumatic or hydraulic cylinder and piston, or a solenoid.

The ventilating means 128 comprises at least one aperture 140 formed through the side wall of the hollow rod 118 between the damper plates 120 and 124 thereby providing a gas path between the transverse chamber 126 and the interior of the hollow rod 118, and gas moving means 142 in gas flow communication with the interior of the hollow rod 118 via a ventilating conduit 144.

Figure 7 illustrates one application of the ventilated poppet damper assembly 112. In this particular application, the flow of gas in the conduit 110, indicated by the mottled arrow, is in such a direction that it first meets the damper plate 120 and subsequently the damper plate 124. Therefore, in this application the plate 120 is the upstream damper plate and the plate 124 is the downstream damper plate. When it is desired to stop the flow of gas through the conduit 110, the rod moving means 130 is actuated to axially move the rod 118 toward the sealing seats 114 and 116, thus, concurrently moving the damper plates 120 and 124 into engagement with the sealing seats 114 and 116, respectively. To further protect against gas leaks between the damper plates 120 and 124 and their respective sealing seats 114 and 116, the transverse chamber 126 is pressurized with another gas, such as air, by the gas moving means 142 which is, in this instance, a source of pressurized gas such as, for example, an air pump. The pressurizing gas flows from the gas moving means 142, through the ventilating conduit 144 into the interior of the hollow rod 118, out of the interior of the hollow rod 118 through the apertures 140 in the side walls of the rod and into the transverse chamber 126. The flow of pressurizing gas is indicated by the arrows in Figure 7. The chamber 126 is pressurized to a level above the gas pressure in the conduit 110, thus, preventing the gas in the conduit from leaking between the damper plate to sealing seat interface.

The application depicted in Figure 8 differs from that depicted in Figure 7 only in the direction of flow of gas within the conduit 110. Therefore, the gas stream opening 117 will be the gas stream inlet and the gas stream opening 113 will be the gas stream outlet. Likewise, the damper plate 124 will be the upstream damper plate and the

damper plate 120 the downstream damper plate. However, these differences are merely nomenclature, and the operation and structure of the ventilated poppet damper assembly 112 of Figure 8 is identical with that of Figure 7 discussed above.

Figure 9 depicts a somewhat different application of the ventilated poppet damper assembly 112. In this application, as in the application of Figure 7, the flow of gas in the conduit 110, indicated by the mottled arrow, is in such a direction that it first meets the damper plate 120 and subsequently the damper plate 124. Therefore, the damper plate 120 is the upstream damper plate and the damper plate 124 is the downstream damper plate. When it is desired to stop the flow of gas through the conduit 110, the rod moving means 130 is actuated to axially move the rod 118 toward the sealing seats 114 and 116, thus, concurrently moving the damper plates 120 and 124 into engagement with the sealing seats 114 and 116, respectively. To further protect against gas leakage between the damper plates 120 and 124 and their respective sealing seats 114 and 116, the transverse chamber 126 is evacuated by the gas moving means 142 which, in this instance, is, for example, a vacuum pump. Any gas from the conduit 110 which may leak past the interface between the damper plate 120 and the sealing seat 114 into the transverse chamber 126 is evacuated therefrom through the apertures 140 into the interior of the hollow rod 118, and out of the interior of the hollow rod 118 through ventilating conduit 144 to the vacuum pump 142. This flow of gas is indicated by the arrows in Figure 9.

The application depicted in Figure 10 differs from that depicted in Figure 9 only in the direction of flow of the gas within the conduit 110. Because the flow of gas in the conduit 110 of Figure 10 is reversed from that of Figure 9, the gas opening 117 is the gas inlet into and the gas opening 115 is the gas outlet from the housing 113. Likewise, the damper plate 124 is the upstream damper plate and the damper plate 120 the downstream plate. However, these are differences in nomenclature only, and the operation and structure of the ventilated damper assembly 112 of Figure 10 is identical with that of Figure 9 discussed above.

It should be eminent from the various applications discussed above and illustrated in the figures that the present invention is very versatile and adaptable to various situations.

WHAT WE CLAIM IS:—

1. A damper assembly for selectively opening and closing a passageway through a pipe or conduit, comprising at least two spaced sealing seats disposed within the flow



* C L M S *

5

1,537,649

(12)
5
(14)

path through the pipe or conduit and at least two damper plates coaxially mounted on a hollow rod and spaced apart by a distance equal to the distance between the seats, the rod having a closed end and being mounted for axial movement relative to the pipe or conduit between an open position in which the damper plates are spaced from their respective sealing seats and a closed position in which the plates engage their respective sealing seats the two damper plates cooperating, in the closed position, to define a transverse chamber which can be ventilated through the hollow rod.

2. A damper assembly as claimed in claim 1 wherein the transverse chamber is ventilated through at least one aperture through the side wall of the hollow rod located between the first and second damper plates.

3. A damper assembly as claimed in claim 2 wherein gas moving means are provided to ventilate the chamber through a ventilating conduit in gas flow communication with the interior of the hollow rod.

4. A damper assembly as claimed in claim 3 wherein the gas moving means comprises a source of pressurized non-toxic gas to transmit non-toxic gas into the transverse chamber through the hollow rod thereby pressurizing the transverse chamber.

5. A damper assembly as claimed in claim 3 wherein the gas moving means comprises a vacuum creating means to evacuate gas from the transverse chamber through the hollow rod.

6. A damper assembly as claimed in any of the preceding claims wherein both damper plates have flexible peripheral sealing means for engaging the two peripheral seal-

ing seats, respectively, when the damper plates are in the closed position.

7. A damper assembly as claimed in any of the preceding claims wherein the hollow rod extends through the wall of the gas conveying conduit or of a housing attached thereto to the exterior thereof and a seal is disposed around the rod where the rod passes through the wall to create a gas tight seal between the hollow rod and the wall.

8. A damper assembly as claimed in claim 6 wherein both of the seats have a lip having a free standing edge for engagement with the flexible peripheral sealing means of the two damper plates, respectively.

9. A damper assembly as claimed in any of the preceding claims, wherein the hollow rod has a plurality of apertures through its side wall between the two damper plates.

10. A damper assembly as claimed in any of claims 1—9 in which the seats are formed in the wall of the pipe or conduit and the rod extends within the said conduit.

11. A damper assembly as claimed in any of the preceding claims 1—9 in which the damper plates, sealing seats and hollow rod are disposed in a housing having an inlet and outlet connected to the pipe or conduit.

12. A damper assembly substantially as hereinbefore described with reference to Figures 1—5 or 6—10 of the accompanying drawings.

For the Applicants:
LLOYD WISE, BOULY & HAIG,
Chartered Patent Agents,
Norman House,
105—109 Strand,
London, WC2R 0AE.