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AUTOMATIC AIR CONTROL VALVE

Filed Aug. 29, 1938

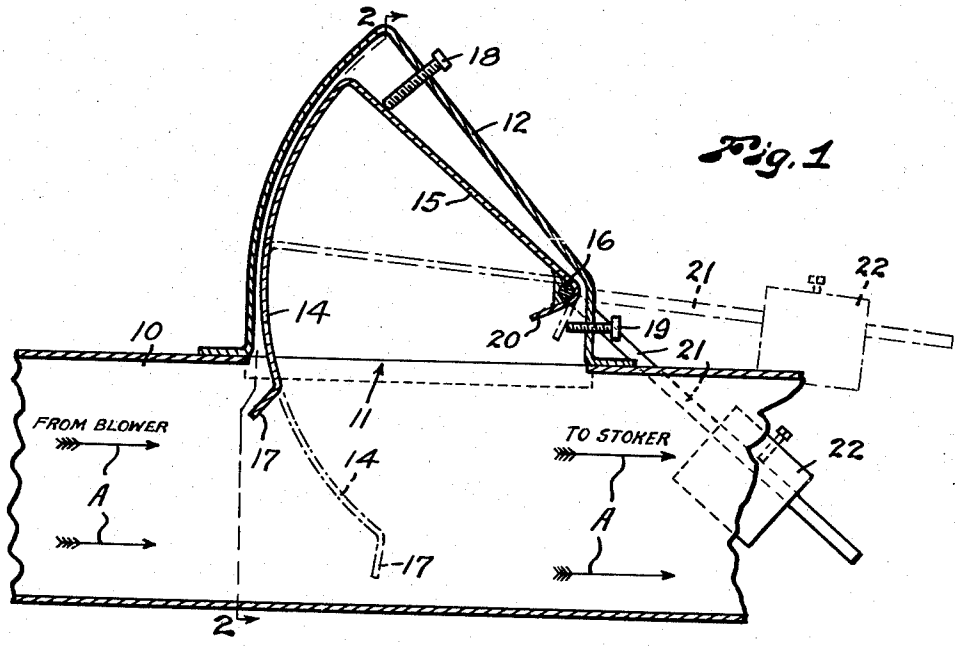


Fig. 1

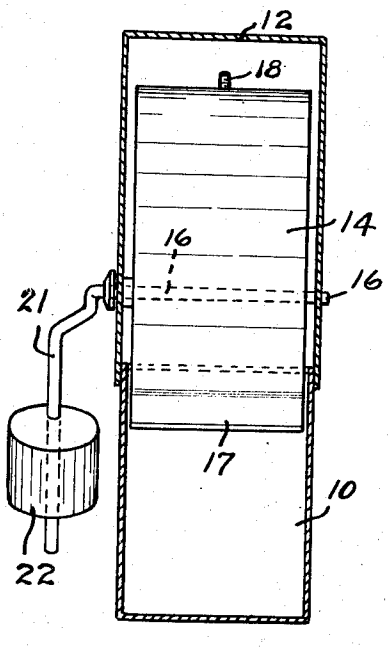


Fig. 2

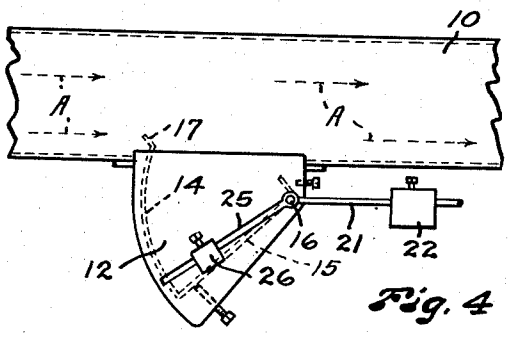


Fig. 4

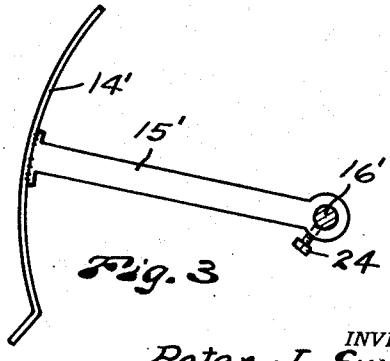


Fig. 3

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AUTOMATIC AIR CONTROL VALVE

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4 Claims. (Cl. 236—45)

This invention relates to automatic air control valves and the object of this invention is to provide an air control valve which will automatically control the flow of air through an air conduit in proportion to the velocity of air in the conduit to thereby provide for the passage through the conduit of the correct volume of air.

Another object is to provide an automatic air control valve which is adapted to be used in connection with the air supply to a coal stoker to control the supply of air delivered to the stoker in proportion to the combustion requirements of the stoker.

Coal stokers are usually arranged to feed coal at a predetermined rate when they are in operation. This rate of feed can usually be varied by manual adjustment to conform to different requirements. After this rate of feed has been adjusted, the stoker, which is usually thermostatically controlled, will be started and stopped by the thermostatic control means in accordance with the demand for heat and will feed coal at the predetermined rate when in operation. To most efficiently consume this coal, which is being fed at a predetermined rate, it is necessary to supply air at the correct rate. This air is ordinarily supplied under comparatively low pressure by air propelling means, such as a fan or blower. The amount of air required will vary for different rates of feed of the coal and may vary for different kinds and grades of coal. The fan or blower may be adjusted to conform to the rate of feed and kind of coal used but even after this adjustment is made the amount of air supplied by the fan or blower will vary due to variations in draft conditions and variations in the thickness and density of the bed of coal in the stoker. If this bed of coal becomes thicker it will usually offer more resistance to the passage of air therethrough with the result that the air supply to the combustion area will be reduced, thus reducing efficiency, decreasing the rate of combustion and tending to build up a still thicker coal bed to offer still greater resistance to the air. Conversely, if this bed of coals becomes thinner resistance to the passage of air therethrough will ordinarily be reduced and too much air will be supplied thus tending to burn the coal faster and aggravating this condition by further reducing the thickness of the coal bed.

It is an object of this invention to provide an automatic air control valve which is responsive to the velocity of the air passing through an air conduit to control the volume or amount of air which passes through the conduit.

Other and more specific objects of this invention will be apparent from the following description taken in connection with the accompanying drawing.

In the drawing Figure 1 is a view in longitudinal section of an automatic air control valve constructed in accordance with this invention.

Fig. 2 is a view in cross section of the same taken substantially on broken line 2—2 of Fig. 1, parts being shown in elevation.

Fig. 3 is a detached side elevation of a modified form of air valve adapted to be used in my device.

Fig. 4 is a side elevation of my air control valve, showing the same installed on a conduit in an inverted or up side down position.

Like reference numerals designate like parts throughout the several views.

Referring to Figs. 1 and 2, I show an air conduit 10 through which air is caused to travel in the direction indicated by the arrows A. In using this device in connection with a coal stoker the stoker mechanism, not shown, is connected with the end of the conduit 10 shown at the right in Fig. 1 and a fan or blower or equivalent means, not shown, for supplying a forced blast of air is connected with the end of the conduit 10, at the left in Fig. 1.

An opening 11 is provided in one side of the conduit 10. A valve housing 12 is secured to the exterior of the conduit 10 with an open portion of the valve housing 12 in registration with the opening 11.

Preferably the end of the valve housing 12 toward the fan is curved and the other end thereof is formed of a longer inclined portion and a shorter portion positioned perpendicular to the conduit 10. The sides of the housing 12 may be substantially flush with the sides of the conduit 10, as shown in Fig. 2. Obviously the shape of this housing 12 may be varied.

The automatic air valve comprises a curved valve member 14 connected by an arm portion 15 with a pivot 16. The valve member 14 is substantially a cylindrical segment having a center of curvature which lies in, or substantially adjacent to, the pivot 16 and a convex side directed toward the incoming air. This valve member is movably and adjustably supported with one portion thereof in the valve housing 12 and another portion thereof in the conduit 10 and said valve member is movable through the opening 11 to increase or restrict the area of

the air passageway through the conduit 10. The end portion of the valve member 14 within the conduit 10 carries a vane 17 of narrow width which extends at an angle from the valve member 14 and toward the direction from which the air enters, substantially as shown in Fig. 1. This vane 17 provides a surface against which the air that tends to follow along the curved wall of the valve will impinge, and said vane makes the valve more sensitive and more responsive to changes in the velocity of the air in the conduit 10. This vane 17 is always within the conduit 10 for all positions of the valve member 14 and the action of this vane in catching the air when the valve member 14 is in or near the fully open position, shown by full lines in Fig. 1, makes the valve responsive to air moving at relatively low velocity.

An adjustable stop screw 18 is threaded through the inclined wall of the housing 12 in a suitable position to engage with the arm member 15 and limit movement of the valve member 14 in the direction in which said valve member moves when it is retracted toward a fully open position. Another adjustable stop screw 19 in the wall of housing 12 near pivot 16 is positioned for engagement with a lug 20 on the arm member 15 to limit movement of the valve member 14 in the direction in which it moves to restrict the air passageway through conduit 10. These stop screws limit the movement of the valve so that said valve is never entirely out of the conduit 10 and never entirely closed.

The vane 17 and adjacent portion of the valve member 14 will always be positioned within the conduit 10 even when the valve is in its maximum open position and adjustment of the stop screw 18 will determine the distance which the valve member 14 and vane 17 will protrude into the air passageway when the valve member 14 is fully open. In a similar manner adjustment of the stop screw 19 will regulate the minimum opening between the tip of the vane 17 and the wall of conduit 10 to be left when the valve member 14 is in fully closed position.

A lever arm 21 is secured to the pivot member 16 external to the housing 12 and a weight 22 is adjustably connected with the lever arm 21. The lever arm 21 preferably extends outwardly from the pivot member 16 in substantially the direction shown in Fig. 1, so that when the valve is in the closed position shown by dot and dash lines the lever arm 21 will be approximately horizontal and the leverage through which the weight 22 is acting will be at a maximum. When the valve 14 is in the open position shown by full lines in Fig. 1, the lever arm 21 will be inclined downwardly from the horizontal and the leverage through which the weight 22 is acting will be less than the maximum.

In the operation of this device the variable factors which will tend to affect the flow of air through the conduit 10 will be the varying thickness of the bed of coals through which the air must pass and the variable draft conditions in the flue or stack. The density of this coal bead may also affect the resistance which it will offer to the passage of air therethrough. This damper is designed to operate automatically to supply the correct amount of air for combustion purposes irrespective of variations in the resistance offered by the fuel bed or variations in draft conditions.

The weight 22 will be adjusted so that when no air is being moved through conduit 10 the weight will be just sufficient to hold the valve member 14 in the maximum open position shown by full lines in Fig. 1. Under normal operating conditions the air moving through conduit 10 in the direction indicated by the arrows A, Fig. 1, will impinge against the vane 17 and lower portion of valve member 14 and move the valve member 14 into the conduit 10 from the position shown by full lines in Fig. 1, toward the position shown by dot and dash lines to partially close the passageway through the conduit 10. As the valve member 14 moves into the conduit 10 the weight 22 will move upwardly and the lever arm through which said weight acts on the pivot 16 will be gradually increased so that the weight will offer a gradually increasing resistance to the movement of the valve member 14 into the conduit 10 and said valve member will be brought to rest in a position in which the forces on said valve member are balanced, the weight 22 having been adjusted to provide a balanced condition when the correct amount of air is being delivered to maintain proper combustion of the coal. If the thickness of the bed of coal decreases and resistance to the flow of air decreases the pressure of the air in conduit 10 is reduced and air will flow more freely through the conduit 10 and the velocity of the air will be increased. This increased air velocity will act on the vane 17 and air valve 14 tending to further close them thus reducing the area of the conduit 10 and reducing the volume of air supplied to the stoker. This permits the thickness of the bed of coals in the stoker to build up. As this thickness builds up air resistance will increase and pressure in conduit 10 will build up and the velocity of the air in the conduit 10 will be retarded and the valve will be moved toward an open position so as to admit more air. In this way the air will be automatically regulated in proportion to the demands of the stoker and the coal bed will be maintained at a substantially constant thickness.

In Fig. 3, I have shown a valve member 14' which is identical with the valve member 14 but is connected by a different type of arm 15' with a pivot member 16'. Preferably a set screw 24 is provided for securing the arm 15' in different adjusted positions on the pivot 16' to provide for adjustment. The valve 14' and arm 15' are two separate pieces welded or otherwise secured together while the valve 14 and arm 15 shown in Figs. 1 and 2 are made of a single piece of metal and have some advantage in cheapness and simplicity of construction. The operation of the two valves is the same.

Fig. 4, shows this automatic air valve installed below the air conduit 10 in an inverted position from that shown in Figs. 1 and 2. When this is done the lever arm 21 is positioned so that the weight 22 will be acting through a maximum leverage when the valve is fully open and another lever arm 25 extending in an opposite direction and provided with an adjustable weight 26 is preferably provided. The weight 22 is adjusted longitudinally of the lever arm so that the combined weight of the valve 14—15—17 and weight member 26 will be just enough to overbalance the pull of the weight 22 and hold the valve in the wide open position when the stoker is not operating. When air is passing through the conduit 10 in the direction indicated by the arrow this air will exert a pressure against the valve 14—17 and will move said valve toward a closed position. As the valve 14 in the Fig. 4, moves toward a closed position the leverage through

which the weight 22 is acting on the pivot 16 will decrease while the leverage through which the weight 26 and the weight of the valve 14—15—17 are acting on pivot member 16 will decrease less rapidly or will increase with the result that the valve will come to a balanced position depending on the velocity of the air in the conduit and the flow of the air will be regulated in the same manner as when the valve is installed above the conduit 10. The lever arm 21 is preferably formed of a wire or light rod so that it can be adjusted to different positions by bending the same.

The foregoing description and accompanying drawings clearly disclose a preferred embodiment of my invention but it will be understood that this disclosure is merely illustrative and that changes may be made which are within the spirit and scope of the following claims.

I claim:

1. Automatic air control means for use in connection with an air conduit having an opening in one side thereof and adapted to have air propelled therethrough, comprising a valve member movable through said opening in a direction generally crosswise of said conduit, the side of said valve member toward the incoming air being convex; housing means for said valve member external to said conduit preventing escape of air from said conduit; a pivot for said valve member positioned external to and adjacent to said conduit, and supporting said valve member for pivotal movement from a position almost wholly without said conduit to one almost wholly within, the convex surface of said valve member which is presented toward the incoming air having a center of curvature substantially adjacent to said pivot, whereby the flow of air against and past said valve member will tend to move it toward a partially closed position; stop means limiting movement of said valve member in both directions; and counterbalance means connected with said valve member and providing a gradually increasing resistance to movement of said valve member into said conduit.

2. Automatic air control means for use in connection with an air conduit having an opening in one side thereof and adapted to have air propelled therethrough, comprising a valve member movable through said opening in a direction approximately crosswise of said conduit, the side of said valve member toward the incoming air being convex; a vane on the end portion of said valve member which is positioned within said conduit, said vane being inclined from said valve member toward the direction of the incoming air; housing means for said valve member external to said conduit preventing escape of air from said conduit; a pivot for said valve positioned external to and adjacent to said conduit and supporting said valve member for pivotal movement from a position almost wholly without said conduit to one almost wholly within, the convex surface of said valve member which is presented toward the incoming air having a center of curvature substantially adjacent to said pivot, whereby the flow of air against and past said valve member will tend to move it toward a partially closed position; stop means limiting movement of said valve member in both directions; and counterbalance means connected with said valve member and providing a gradually increasing resistance to movement of said valve member into said conduit.

3. Automatic air control means for use in connection with a conduit through which air is propelled comprising a valve housing positioned external to the conduit and communicating with the conduit through registering openings in the housing and the side of the conduit; a valve member disposed in said housing and said conduit; a valve supporting arm connected with said valve member and extending outwardly therefrom in the general direction of flow of the air; pivot means positioned external to said conduit and adjacent said conduit and connected with the end of said valve supporting arm remote from the valve and supporting said valve for pivotal movement from a position almost wholly without said conduit to one almost wholly within, said valve having a convex surface presented toward the incoming air and having a center of curvature substantially adjacent to the pivot thereof whereby the flow of air against and past said valve will tend to move it toward partially closed position; stop means limiting the opening movement of said valve and preventing complete withdrawal of said valve from said conduit; other stop means limiting the movement of said valve in an opposite direction preventing said valve from passing entirely into said conduit and preventing complete closing of said conduit by said valve; a lever arm connected with said pivot means and extending outwardly from said pivot means in a direction approximately opposite to said valve; and a weight adjustably mounted on said lever arm.

4. Automatic air control means for use with a coal stoker to which air is supplied by blower means comprising an air conduit connected at one end with the stoker and at the other end with the blower means and having an opening in one side thereof; an air valve housing external to said conduit and having an open side which registers with the opening in the conduit; a valve member movable through the opening between said housing and said conduit; a valve supporting arm connected with said valve member and extending toward the stoker; pivot means positioned external to said conduit between said air valve and the stoker and supporting the end of said arm remote from said air valve and supporting said valve for pivotal movement from a position almost wholly without said conduit to one almost wholly within, said valve having a convex surface presented toward the incoming air and having a center of curvature substantially adjacent to the pivot thereof whereby the flow of air against and past said valve will tend to move it toward partially closed position; a vane member on the end portion of said valve member which is positioned within said conduit extending at an angle to the valve member and toward the blower; stop means limiting movement of said valve member in both directions; a lever arm connected with said pivot means and extending outwardly therefrom in the opposite direction from said valve; and a weight adjustably mounted on said lever arm.

PETER J. SWANSON.