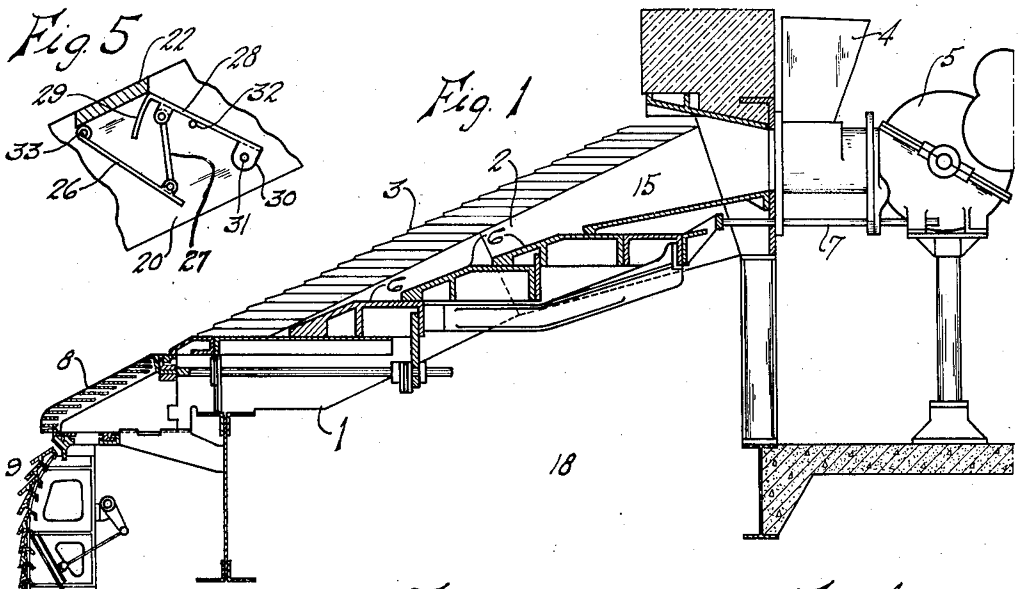
FLUID CONTROL SYSTEM

Original Filed May 18, 1935

Fig. 5

Fig. 1



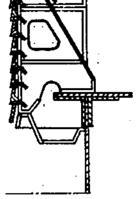


Fig. 3

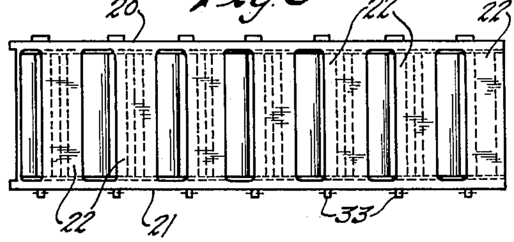


Fig. 4

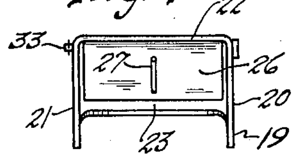
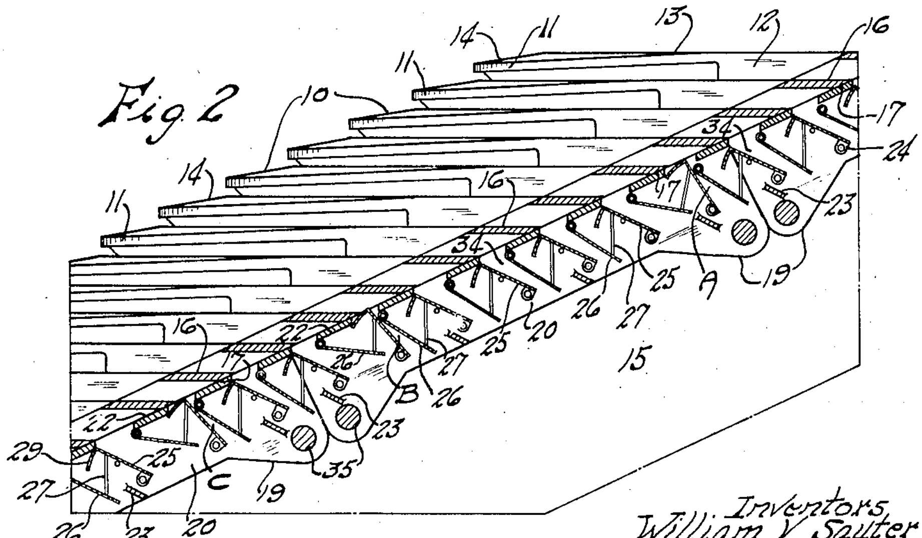


Fig. 2



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FLUID CONTROL SYSTEM

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Original application May 18, 1935, Serial No. 22,217, now Patent No. 2,173,884, dated September 26, 1939. Divided and this application June 11, 1938, Serial No. 213,151

3 Claims. (Cl. 137—152)

This application is a division of our co-pending application Ser. No. 22,217, filed May 18, 1935, and now Patent No. 2,173,884, granted Sept. 26, 1939, and the invention herein involved relates to fluid control units adapted for assembly beneath the tuyère blocks of stoker furnaces.

It is the primary object of the present invention to provide a generally improved fluid control system for stoker furnaces which prevents an excess of air from flowing through the tuyères thereof upon a reduction in the fuel bed resistance.

Another object is to provide a fluid control system for stoker furnaces which improves the distribution of air to the fuel bed whereby the latter is maintained normally uniform under all conditions of operation.

A further object is to provide an air control system for stoker furnaces consisting of one or more brackets adapted to be inserted beneath the tuyère blocks thereof, said brackets having mounted thereon a series of automatically operable dampers.

A still further object is to provide a simplified control device for regulating the flow of air through the tuyère blocks of a stoker furnace, which is highly efficient in operation, as well as economical in manufacture.

Other and further objects will become apparent as the description of the invention progresses.

Of the drawing, Fig. 1 is a longitudinal sectional view taken through one of the retorts of a stoker furnace.

Fig. 2 is a side view partly in section, and diagrammatic in part, of a series of tuyère blocks showing the fluid control units comprising the present invention disposed therebeneath.

Fig. 3 is a plan view of one of the fluid control units shown in Fig. 2.

Fig. 4 is an end view of the control unit shown in Fig. 3; and

Fig. 5 is a fragmentary side view partly in section of one of the automatically operable dampers provided in each of the fluid control units.

The present invention, for the purpose of illustration, is shown applied to a stoker of the underfeed type, although it is apparent that the invention is equally applicable to other types of stokers, as well as other apparatus wherein control of a fluid is desired. In the present instance the damper controlling the air flow to one tuyère overlaps with the damper controlling the air flow to an adjacent tuyère, and thus these overlapping dampers form communicating passages to the tuyères. In cases where the area of each of these communicating passages is substantially the same as the area of the tuyère openings the pressure of the air therein is substantially the same as that flowing through the tuyères. Air is supplied to each of the tuyères from a common pressure or plenum chamber wherein the pressure remains substantially constant during operating periods of the furnace at any given rating. It therefore will be observed that should the fuel bed over any of the tuyères develop a blow hole, or become abnormally porous, so as to cause the velocity of the air supplied thereto to increase, while the fuel fed over an adjacent tuyère block remains normal, thereby imposing the normal resistance to the air flowing thereto, the damper associated with the first tuyère will be subjected to a greater pressure at one side than at the other, and obviously will tend to move in the direction of the lesser pressure. As the velocity of the air past a damper increases the static pressure decreases, and as a result the damper will be urged to closed position to throttle the air supply to the abnormally thin or porous portion of the fuel bed. Therefore, by this arrangement of overlapping dampers the flow of air through one tuyère is controlled, to a certain extent, by the flow of air through an adjacent tuyères.

It therefore is seen that should thin or extremely porous spots develop in the fuel bed the damper or dampers controlling the air thereto will close. The fuel feeding elements will then have the opportunity to build up such thin portions of the fuel bed before damage can occur to the underlying grates. As the fuel bed builds up, and therefore offers a greater resistance to the flow of air through the associated tuyères, the differential pressure acting upon the damper or dampers controlling the air thereto will be reduced, and as a result they will move toward open position and again permit a normal quantity of air to flow to those portions of the fuel bed. The dampers, therefore, tend to maintain the fuel bed normally uniform throughout and thus prevent blowing of the fuel, as well as damage to the grates, in the event abnormally thin spots occur therein.

Referring to the drawing, the numeral 1 designates a stoker of the underfeed type having alternately disposed retorts 2 and tuyère rows 3. Fuel is supplied to retorts 2 from a hopper 4, and any suitable feeding device driven by a power mechanism indicated at 5 feeds the fuel gravitating in hopper 4 to the retorts 2. A series of pushers 6 mounted in the bottom of each retort 2 is also operated by the power mechanism 5 through the connections 7. These pushers underfeed the fuel along the retorts and tuyères to an extension grate 8, which in turn overfeeds the fuel to an ash pocket 9 disposed at the rear of the stoker. It is to be understood that the invention hereinafter described is not limited to underfeed stokers, since it is equally adaptable for use in connection with other types of stokers, as well as other apparatus wherein flow control is desired.

When the terms "front" and "rear" are hereinafter used in connection with the description of the elements of the stoker 1 and the associated fluid control, it will be understood that the portions of such parts extending toward the rear or ash pocket 9 of the stoker will be designated as "rear" and those portions thereof extending toward the front or the driving mechanism 5 of the stoker will be designated as "front".

Referring more particularly to Figs. 1 and 2, each tuyère row 3 comprises a series of superimposed tuyère blocks 10, each having a rounded nose or rear portion 11, and a substantially rectangular front portion 12. The upper surface 13 of each tuyère block is substantially flat and has a slightly beveled portion 14 extending around the nose portion thereof.

The tuyère blocks 10 are supported in the usual manner upon the side plates 15 of adjacent retorts 2, as shown in Figs. 1 and 2. The forwardly disposed ends 16 of the tuyère blocks 10 extend between adjacent side plates 15 and terminate in a transversely disposed beveled portion 17. Draft air enters the tuyère blocks from a common pressure or plenum chamber 18 disposed beneath the stoker, which in turn supplied with air from any suitable fan mechanism (not shown) in a well known manner.

The mechanism for controlling the flow of fluid from plenum chamber 18 to the tuyère blocks 10 comprises a series of independent units 19 disposed in end to end relation beneath the said tuyère blocks. Each unit 19 comprises a pair of substantially vertical side members 20 and 21, which are jointed at their upper edges by a series of substantially flat cross members 22. A series of transverse brace members 23 also extend between side members 20 and 21, to give greater rigidity to the structure. The flat cross members 22 are arranged in spaced relation in accordance with the spacing of the forwardly disposed ends 16 of the tuyère blocks 10. As shown in Fig. 2, the cross members 22 abut the forwardly disposed beveled ends 17 of the tuyère blocks 10, and the spaces therebetween constitute the inlet openings for draft air. Each of the fluid control units 19 has pivotally mounted therein a series of damper units 24, one of said units being disposed adjacent each of said cross members 22. Each of the damper units 24 comprises a pair of damper elements 25 and 26 which extend between the side walls 20 and 21 of the associated unit, and which are connected for simultaneous movement by a link 27 of any suitable construction.

Each damper element 25 comprises a relatively flat portion 28 terminating at its rearwardly disposed end in an arcuate portion 29. The arcuate portion 29 makes an angle of substantially 90 degrees with the flat portion 28, and the rear surface of the former engages or is slightly spaced from the front edge of its associated cross member 22. The front end of each damper 25 is provided with a pair of depending apertured ears 30, the apertures of which in assembly align with apertures provided in the side members 20 and 21 of the units 19. Pins 31 extending through these apertures pivotally support the damper elements 25. The damper elements 25 are supported in open position by pins 32 extending inwardly from the side members 20 and 21 of each of the units. Damper elements 26 are also pivotally supported in any suitable manner, such as by pins 33 extending through apertures provided in the side members 20 and 21 of the units 19.

Referring more particularly to Fig. 2, it will be observed that the upper surface of each damper element 25 forms with the damper element 26 of the next higher unit, and with the side members 20 and 21 of a fluid control unit 19, an inlet passage 34 which communicates with the passage between a corresponding pair of tuyère blocks 10. By this construction all of the air entering the tuyère blocks must pass through the inlet passages 34 before entering the fuel bed.

From the foregoing description it will be observed that the lower surfaces of the damper elements 25, and the upper surfaces of elements 26 are subjected to the pressure in penum chamber 18. However, since the areas of these surfaces are substantially the same, it is apparent that no movement will be imparted to said elements by this pressure. It will also be observed that the upper surface of each damper element 25 is disposed in substantially overlapping arrangement with the lower surface of an element 26 of the next higher damper unit of the series. It is also seen that since the damper elements 25 and 26 of each unit are interconnected by a link element 27, any movement imparted to one of said elements is also imparted to the other. Therefore, should the velocity of the air in one inlet passage 34 increase, thereby reducing the static pressure operating against the upper surface of the associated damper element 25, while the velocity of the air in the next lower chamber 34 remains the same, thereby imposing the normal pressure against the lower surface of the associated damper element 26, it will be readily seen that since the pressure acting against the lower surface of element 26 is greater than the pressure acting against the upper surface of the element 25, both of said elements of the unit will tend to move upwardly. These damper elements may be so designed that the dead weight thereof will be sufficient to hold them open for a predetermined differential pressure, or they may have weights or springs associated therewith for that purpose. When this differential pressure increases due to a decrease in the fuel bed resistance, the associated damper element 25 will move upwardly into engagement with the damper element 26 of the next higher unit of the series, to throttle the air flow to that portion of the fuel bed. When a damper element 25 has thus been actuated to closed position a slight leakage of air occurs, and as a result the damper elements of the unit are subjected to differential pressure of sufficient intensity to maintain them in closed position. If no leakage occurs under these conditions the damper element 25 would drop slightly from its fully closed position and would then be instantly actuated to closed position again. This action would be repeated until the fuel bed overlying the associated tuyère block imposes a greater resistance to the flow of air and the weight of the damper elements 25 and 26 is sufficient to overcome the resulting change in differential pressure. In either case the air flow to the thin or porous portions of the fuel bed is throttled sufficiently to prevent the formation of blow holes, or damage to the tuyère blocks. Thus, when the air is so throttled the combustion rate will decrease, thereby enabling the fuel feeding elements to build up such abnormally thin or porous portions of the fuel fed until they again become normally uniform. This change in the fuel bed density creates a greater resistance to the flow of air through the associated passages 34 thereby decreasing the differential pressure acting on the associated damper elements, and as a result the damper elements will move downwardly to open position to permit more air to flow through the associated tuyère blocks.

Referring to Fig. 2, the damper elements shown at A, B and C, are in closed position, thereby shutting off the flow of air to the associated tuyère blocks. The arcuate portions 29 provided on each damper element 25 act as seals to prevent leakage of air past the dampers when the latter are in closed position.

It therefore is apparent that the damper elements 25 and 26 associated with the tuyère blocks beneath the lighter or more porous portions of the fuel bed are operated automatically to close, or partially close the inlet openings thereto, while those associated with the tuyère blocks beneath the heavier portions of the fuel bed will remain open, and as a result proper distribution of air to all portions of the fuel bed is assured under all conditions of operation.

To assemble the fluid control units 19 in position beneath the tuyère blocks, it is only necessary to arrange them as shown in Fig. 2, and then secure them in place in any suitable manner, such as by bolts 35, which may pass through apertures provided in side plates 15 of adjacent retorts.

This construction, it is apparent, is equally adapted for use on new stoker installations as well as those already in service. The units 19 may readily be installed without modifying the stoker in general. In this construction it will also be observed that the dampers are disposed substantially longitudinally in respect to the direction of air flow. Thus the impact head of the air flowing past the dampers has little or no effect upon the operation thereof.

While the embodiment herein shown is admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to limit the invention thereto since it may be embodied in other forms, all coming within the scope of the claims which follow:

What is claimed is:

1. In a device of the class described, an air control unit adapted for assembly beneath the tuyère blocks of a stoker, said unit comprising a framework consisting of a pair of side walls and a series of cross members extending between said side walls in slightly spaced relation defining a series of relatively narrow passages, a series of damper units mounted adjacent said passages and forming with said side walls communicating passages to said first mentioned passages, each of said damper units comprising a pair of interconnected damper elements, one of the elements of each of said pairs of damper elements forming one wall of its associated communicating passage and being subjected to the pressure of the air therein, while the other of said elements forms one wall of the communicating passage to an adjacent one of said first mentioned passages and is subjected to the pressure therein, whereby said damper units will be actuated to open or closed position, depending upon the intensity of the pressures acting at the opposite sides thereof.

2. In a device of the class described, an air control unit adapted for assembly beneath the tuyère blocks of a stoker, said unit comprising a framework consisting of a pair of side walls, and a series of cross members extending between said side walls in slightly spaced relation defining a series of relatively narrow passages, damper units disposed adjacent said passages and forming with the said side walls a series of communicating passages to said first mentioned passages, one side of each of said damper units forming one wall of its associated communicating passage and being subjected to the pressure of the air in said communicating passage, while the other side of each of said damper units forms one wall of an adjacent communicating passage and is subjected to the pressure of the air therein, whereby said damper units will be actuated to open or closed position, depending upon the intensity of the pressures acting at the said sides thereof.

3. In a device of the class described, an air control unit adapted for assembly beneath the tuyère blocks of a stoker, said unit comprising a framework consisting of a pair of side walls and a series of cross members extending between said side walls in slightly spaced relation defining a series of relatively narrow passages, a damper unit mounted adjacent each of said passages and extending in an upstream direction therefrom, said damper units forming with the said side walls communicating passages to said first mentioned passages, said damper units being disposed in substantially overlapping relation, one side of each of said damper units forming one wall of its associated communicating passage and being subjected to the pressure of the air therein, while the opposite side thereof forms a wall of an adjacent communicating passage and is subjected to the pressure of the air therein, whereby said dampers will move to open or closed position, depending upon the intensity of the pressures acting at the opposite sides thereof.

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