VALVE ARRANGEMENT FOR REGENERATIVELY HEATED FURNACE

FIG. 1

INVENTOR
Fritz Wittler

ATTORNEYS
The invention relates to valve arrangements for air and flue gases in regeneratively heated industrial furnaces, in particular SM furnaces. Various systems for this purpose are known. The slide valve system has two slide valves for gas and two dampers for air, the latter of throttling type. In the so-called gas control operation, the vertical posts to which the air dampers are installed must always be placed perpendicular to the passages. The resulting unavoidable changes of direction in the combustion air line and in the passage involve substantial pressure losses. To this is added the fact that in the part of the combustion air line shut off after actuation, a pressure cushion must be formed before flow of combustion air to the combustion chamber becomes possible. In case of any electric power failure, such a system must be actuated by emergency manual mechanisms. These, unlike the electrical controls, do not ensure that the switchover process will take place in proper sequence. Such a system has the additional disadvantage of being very expensive because of its heavy gas slide valve. Exhaust gas flow, on the other hand, is advantageous. Use of air interchange flaps such as the Siemens or Simplex type is desirable for reasons of price. Aerodynamically, these have major disadvantages in comparison to slide controls because both exhaust gases and combustion air are subject to considerable pressure and draft losses due to sharp turns. Besides, fresh air always enters the exhaust or stack passage during the switchover operation. The disadvantages enumerated also apply to known twin-deck slide valves.

The invention addresses itself to the problem of eliminating these disadvantages and difficulties by simple means. It may be said to consist essentially in that the air and gas branchings, located separate from each other, are close together, and their corresponding valve means have a common mechanism.

The object of this invention is to provide in a regeneratively heated furnace having two air passages and two exhaust passages a valve means which effectuates a switchover from one path for air and exhaust gases to the other path in proper sequence and where the switchover is effectuated by a single control for the valve means.

A further object is to provide in a regeneratively heated furnace having two air passages and two exhaust passages a valve means which prevent fresh air from entering either stack passage when the switchover from one exhaust passage to the other is effectuated.

The object of the invention is illustrated in the drawings, in which:

Fig. 1 is a plan view of the furnace and the valve arrangement therefor according to the invention, with parts broken away, and

Figs. 2-5 are views of the valve arrangement, on a larger scale and with parts broken away, illustrating the various positions thereof.

The two passages 2 and 3 in Fig. 1 open at reference numeral 4 into the flue or stack passage 1. At branching 4, there is a flap 5 serving to control the flue gas. Outside the passage, a compression spring 6 rotatable about a fixed point Q is provided, whose free end e is positively connected to the mechanism of the gas flap in such manner that in each extreme position, a pressure tends to hold the flap tightly against the seat. The combustion air supply line is designated 6; it has two branches 7 and 8, merging obliquely into passages 2 and 3 at 9 and 10. Beyond 9 and 10, where passages 7 and 8 merge into passages 2 and 3, passages 2 and 3 each proceed into the flue 22 at its respective opposite heads 20 and 21. At the branching 11 of the air duct, in the form of a V, there are two flaps 12 and 12a. These two control flaps 12 and 12a tend to push away from each other under the action of a spring provided at pivot p.

This arrangement of the air duct makes it possible to place branchings 4 and 11 close together so that their control means 5, 12, 12a may be actuated by a common mechanism, that will positively switch the control means even when operated by emergency manual action; that is, no fresh air will enter the departing flue gas during the operation, thereby avoiding explosion hazard, even though the contents of the gas chamber pass off to the stack after switchover.

In the embodiment shown in the drawings, the exhaust line leading to the stack bears reference numeral 1. Lines 2 and 3 coming from the furnace open into it. These two lines 2 and 3, at branching 4, are connected to or disconnected from the exhaust line 1 by means of flap 5. Above exhaust line 1 there is an air supply line 6 branching at 11 into lines 7 and 8. Branches 7 and 8 open into lines 2 and 3 leading to the furnace.

In the embodiment shown, the shut-off means at the air branching 11 consists of two control flaps 12 and 12a. These two air control flaps tend to push away from each other under the action of a spring S placed at pivot p.

The control system as a whole is actuated from the shaft at pivot p. This brings about partial revolutions of a disc 13 or the like. Disc 13 has a gear sector 14 engaging a gear sector 15 of a disc 16. Disc 16 is mounted on a shaft 17 for control flap 5 in the gas branching 4.

In the position of the control system as represented in Fig. 2, the control flaps 12 and 12a of air line 6, 7, 8 and 11 are close together so as to shut off all communication between air supply line 6 and branch 7 while allowing free passage of air from supply line 6 to branch 8. Control flap 5 at branching 4 shuts off all communication between exhaust line 1 and exhaust line 2 while allowing free passage of exhaust gases from line 3 to line 1 which leads to the stack. The operating cycle for Fig. 2 is thus as follows: air flows through line 6 into line 8; from line 8 it merges into line 2 which extends into the furnace 22 at head 21. The exhaust gases leave the opposite head 20 of the furnace through exhaust line 3 into exhaust line 1, leading to the stack.

For switching the air and exhaust lines, shaft p is first turned. This leaves flap 12 stationary, while flap 12a shuts off line 8. As a result, air line 6 is shut off. During rotation of shaft p, sector 14 engages 15 disc 16, which effects the passage of air from line 6, 7, 8 and 11 into the opposite control position. In this position, the exhaust passages from the outer furnace head 21 through line 2 into stack line 1. The air line 6 is still closed. This phase of the process is illustrated in Fig. 3.

If shaft p is rotated farther, control flaps 12 and 12a remain in closed position. Gears 14 and 15 engage, so that flap 5 at branching 4 moves into the opposite control position. In this position, the exhaust passage from the outer furnace head 21 through line 2 into stack line 1. The air line 6 is still closed. This phase of the process is shown in Fig. 4.

This is followed by further rotation of shaft p as shown in Fig. 5. During such continuing rotation, control flap 12a swings against flap 12a. This allows free passage of air from supply line 6 to line 7. The operating cycle for Fig. 5 is thus as follows: air flows through line 6 into line 7;
from line 7 it merges into line 3 which extends into the furnace at 20. The exhaust gases leave the furnace at 21 through exhaust line 2, into exhaust line 1, leading to the stack.

The control flap 5 at branching 4 is held in its extreme positions by an accumulator such as spring d. One end e of this accumulator, in the embodiment shown in the drawing, is articulated to disc 16, while the other end Q has a fixed pivot. During the partial rotation of disc 16 from one extreme position to the other, the accumulator d is wound up until the distance between joints e and Q has attained its minimum. Upon further rotation, the accumulator d unwinds so that flap 5, upon reaching its extreme position, is pressed tightly on the seat.

The design and arrangement of components according to the invention embodies the advantage that during switchover, air supplied to one furnace head cannot come in contact with the exhaust flowing to the passage. This is accomplished in that the air line is first closed, and the exhaust line switched over with the air line in that condition. Only then is the air line opened.

While I have shown and described the preferred embodiments of my invention, it will be understood that variations and modifications may be made in the idea or principles of the invention within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a regeneratively heated furnace, a main air conduit having branch conduits in fluid communication therewith at a first junction, a main flue conduit having branch conduits in fluid communication therewith at a second junction, said main and branch air conduits being in substantial juxtaposed relation with the corresponding flue conduits, respectively, said air branch conduits having end portions convergingly disposed relative to said flue branch conduits and said main and branch air conduits communicating with their corresponding flue conduit branch conduit, respectively, a common conduit extending from each of said third and fourth junctions into opposite ends, respectively, of said fourth, first valve means for said air branch conduits disposed at the first junction, second valve means for said flue branch conduits disposed at the second junction, and common operating mechanism for said first and second valve means whereby to place the latter in different positions with respect to their companion branch conduits.

2. In a regeneratively heated furnace, a main air conduit having branch conduits in fluid communication therewith at a first junction, a main flue conduit having branch conduits in fluid communication therewith at a second junction, said main and branch air conduits being in substantial juxtaposed relation with the corresponding flue conduits, respectively, said air branch conduits having end portions convergingly disposed relative to said flue branch conduits and said main and branch air conduits communicating with their corresponding flue conduit branch conduit, at a third and fourth junction, respectively, a common conduit extending from each of said fourth junctions into opposite ends, respectively, of said fourth, first valve means for said air branch conduits disposed at the first junction, second valve means for said flue branch conduits disposed at the second junction, and common operating mechanism for said first and second valve means whereby to place the latter in different positions with respect to their companion branch conduits.

3. In a regeneratively heated furnace, a main air conduit having branch conduits in fluid communication therewith at a first junction, a main flue conduit having branch conduits in fluid communication therewith at a second junction, said main and branch air conduits being in substantial juxtaposed relation with the corresponding flue conduits, respectively, said air branch conduits having end portions convergingly disposed relative to said flue branch conduits, each air branch conduit communicating with its corresponding flue conduit branch conduit at a third and fourth junction, respectively, a common conduit extending from each of said third and fourth junctions into opposite ends, respectively, of said furnace, first valve means for said air branch conduits disposed at the first junction, second valve means for said flue branch conduits disposed at the second junction, and common operating mechanism for said first and second valve means whereby to place the latter in different positions with respect to their companion branch conduits.

4. In a regeneratively heated furnace, a main air conduit having branch conduits in fluid communication therewith at a first junction, a main flue conduit having branch conduits in fluid communication therewith at a second junction, said main and branch air conduits being in substantial juxtaposed relation with the corresponding flue conduits, respectively, said air branch conduits having end portions convergingly disposed relative to said flue branch conduits, each air branch conduit communicating with its corresponding flue conduit branch conduit, at a third and fourth junction, respectively, a common conduit extending from each of said third and fourth junctions into opposite ends, respectively, of said furnace, first valve means for said air branch conduits disposed at the first junction, second valve means for said flue branch conduits disposed at the second junction, and common operating mechanism for said first and second valve means whereby to place the latter in different positions with respect to their companion branch conduits, said first valve means comprising a valve member for each of said flue branch conduits in direct fluid communication with said main flue conduit and the other of said flue branch conduits is closed to a second position in which the other of said flue branch conduits is in direct fluid communication with said main flue conduit and the other of said branch conduits is closed, a shaft member pivotally movable, and resilient means mounted on said shaft and blasing said air valve members away from each other.
2,910,284 conduits is in direct fluid communication with said main flue conduit and the one of said branch conduits is closed, a shaft pivotally mounting said air valve members, and resilient means mounted on said shaft and biasing said air valve members away from each other, a shaft mounting said single flue valve member for pivotal movement between the two positions thereof, and means for biasing said flue valve member in said different positions thereof, and means operatively connecting said shafts for moving said single flue valve member to a different position subsequent to the positioning of said air valve members in air branch conduit closing positions.

5 In a regeneratively heated furnace, a main air conduit having branch conduits in fluid communication therewith at a first junction, a main flue conduit having branch conduits in fluid communication therewith at a second junction, said main and branch air conduits being in substantial juxtaposed relation with the corresponding flue conduits, respectively, said air branch conduits having end portions convergingly disposed relative to said flue branch conduits, each air branch communicating with its corresponding flue branch conduit, at a third and fourth junction, respectively, a common conduit extending from each of said third and fourth junctions into opposite ends, respectively, of said furnace, first valve means for said air branch conduits disposed at the first junction, second valve means for said flue branch conduits disposed at the second junction, and common operating mechanism for said first and second valve means whereby to place the latter in different coordinated fluid controlling positions with respect to their companion branch conduits, said first valve means comprising a valve member for each of said air branch conduits for controlling the air flow through the latter, and said second valve means comprising a single flue valve member pivotally movable from a first position in which one of said flue branch conduits is in direct fluid communication with said main flue conduit and the other of said flue branch conduits is closed to a second position in which the other of said flue branch conduits is in direct fluid communication with said main flue conduit and the one of said branch conduits is closed, a shaft pivotally mounting said flue valve member, and resilient means mounted on said shaft and biasing said flue valve member away from each other, a shaft mounting said single flue valve member for pivotal movement between the two positions thereof, and means for biasing said flue valve member in said different positions thereof, and means operatively connecting said shafts for moving said single flue valve member to a different position subsequent to the positioning of said air valve members in air branch conduit closing positions.

References Cited in the file of this patent

UNITED STATES PATENTS

1,814,567 Merkt July 14, 1931
1,825,815 Nye Oct. 6, 1931
2,098,553 Reiner Nov. 9, 1937

FOREIGN PATENTS

114,589 Great Britain Apr. 11, 1918