May 15, 1934. H. S. MESSING 1,959,106

REVERSIBLE FLOW GAS PROPELLING DEVICE

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FIG. 1.

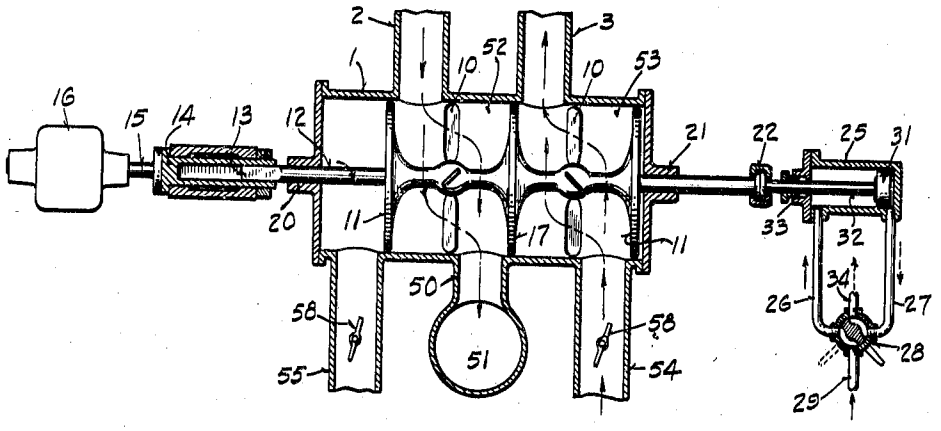

FIG. 2.

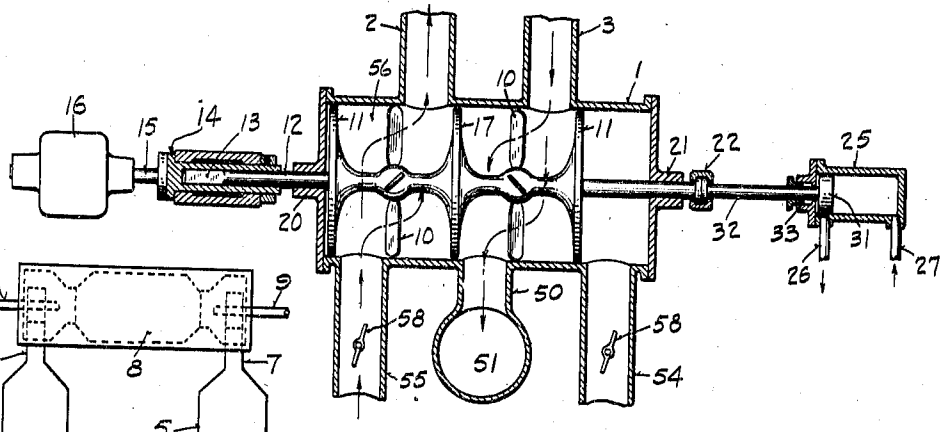

FIG. 5.

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FIG. 3.

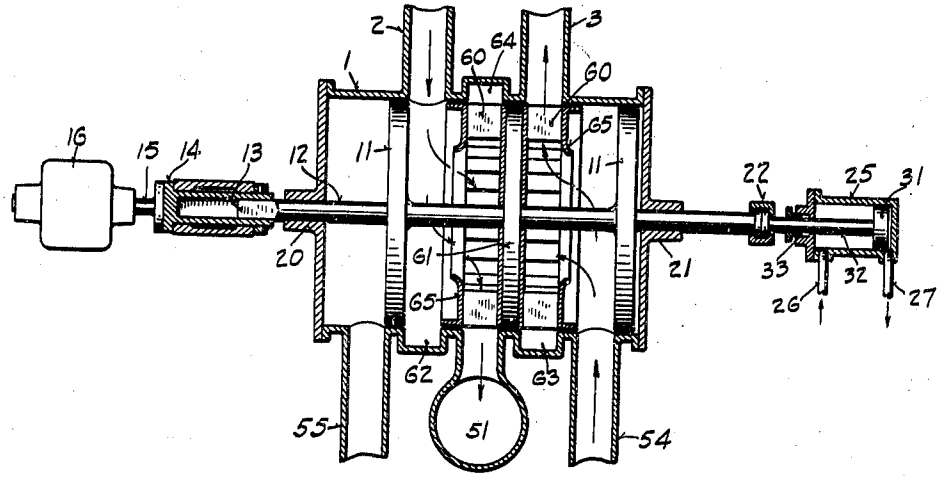
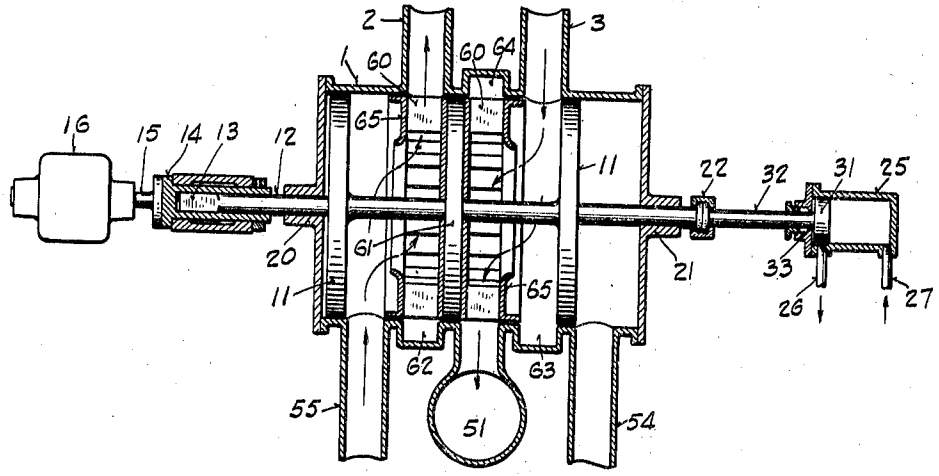


FIG. 4.



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UNITED STATES PATENT OFFICE

1,959,106

REVERSIBLE FLOW GAS PROPELLING DEVICE

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Application May 16, 1932, Serial No. 611,659

8 Claims. (Cl. 230—42)

The invention relates to gas propelling devices and especially to devices for reversing the flow of gas as well as for propelling the gas.

It is among the objects of the invention to provide blowing devices which will operate to force gas into one part of a gas system and withdraw the gas from another part of the system. Another object of the invention is to provide for reversing the direction of flow through the system without stopping or changing the direction of rotation of the blower. Other objects of the invention will be apparent from the description.

Devices embodying the invention are especially useful in the operation of closed gas systems, such as ventilating systems or in metallurgical furnaces in which a forced draft of air is used in combustion burners, and the hot gases which are discharged from the furnace are conducted through regenerators or heat exchangers to heat the air for the burners. Although the invention can be embodided in devices for various purposes of the kind, it will be described with reference to metallurgical furnaces such as open hearth furnaces which are operated with a forced draft of heated air.

Accordingly, the reversible blower comprises a plurality of gas driving units, such as blowers or propellers, mounted to be turned on a shaft. The blowers are adapted to be shifted axially of the mounting to bring them in cooperative relation with inlets and outlets and one or the other of them in cooperative relation with a suitably disposed stack. Disk partitions or valve members are mounted to turn with the blowers and are disposed on the mounting at the ends and between the blowers so that in one position, one blower and the valve members will be brought into a feeding position with respect to a supply conduit and a delivery pipe, and the other will be brought into a discharging position with respect to another supply conduit and the stack. Upon a predetermined axial displacement of the blowers and valves on the mounting, they are brought into discharging and feeding positions respectively with respect to the same conduits and the blow of gas becomes reversed thereby.

In the drawings constituting a part hereof,

Fig. 1 is a plan view of a reversing blower with parts of the casing broken away,

Fig. 2 is a similar view of the device shown in Fig. 1 with the blower and valve members shifted for reversing the flow of gas,

Fig. 3 is a plan view of a blower with parts broken away showing a modification of the device shown in Fig. 1,

Fig. 4 is a similar view of the device shown in Fig. 3 with the blower and valve members shifted for reversing the flow of gas, and

Fig. 5 is a diagrammatic representation of a regenerative furnace showing the arrangement thereof in accordance with the present invention.

Referring to the drawings, a blower casing 1 is provided with delivery pipes 2 and 3 which are connected to regenerators 4 and 5 which may be constructed in accordance with well known design. The regenerators are connected through conduits 6 and 7 to the opposite ends of an open hearth furnace 8. Fuel nozzles 9 are disposed at the ends of the furnace to inject fuel into the heated air which enters the furnace through the conduit 6 or 7 as the case may be. When the direction of the gas flow is such that the conduit 6 or 7 constitutes a conductor for discharged gas, the corresponding fuel injector is closed.

The propellers 10 and disks or barriers 11 and 17 are mounted on a shaft 12 which is splined or squared at one end 13 to provide a sliding fit in a complementary connection member 14 on the motor shaft 15 of the driving motor 16. Clearance is provided in the connection 14 at the end of the shaft to permit the necessary axial displacement of the shaft 12.

The shaft 12 is mounted in the boxings 20 and 21 in the ends of the casing 1 and the other end of the shaft is extended through the casing sufficiently to permit the necessary displacement of the blowers. The end of the shaft is connected through a thrust bearing 22 with a control device which axially actuates the shaft and blowers to give them the desired displacement for effecting a reversal of the flow of gas.

The thrust control consists of a cylinder 25 with pipes 26 and 27 connected through a control valve 28 and a pipe 29 to a source of air under pressure. A piston 31 is mounted in the cylinder 25, and the piston rod 32, which extends through the packing 33, is attached to the thrust bearing 22 so that the piston rod 32 may thrust the shaft 12 axially without turning the piston and rod 32.

The valve 28 is suitably provided with passages so that in one position of the valve, one side of the piston 31 will be connected with the pressure source and the other side will be connected with the atmosphere through the exhaust pipe 34 to thrust the piston and shaft to one side. The shaft is actuated into its opposite extreme position by turning the valve 28 so as to connect the other side of the piston to the pressure source and the space in back of the piston to the exhaust pipe 34.

The propellers 10 are spaced apart on the shaft 12. The propellers are biased to draw the gas from opposite directions when they are rotated in the same direction. The arrangement shown in the drawings is for propelling the gas streams toward each other. An intermediate circular barrier or valve member 17 is fitted with a small clearance between its peripheral edge and the cylindrical wall of the casing so that only small amounts of gas can pass around the barrier. The sides of the barrier 17 are preferably, but not necessarily, given a spiral or curved surface to offer the least resistance to the flow of the gas. End barriers 11 are spaced from the propellers and mounted in the casing similarly to barrier 17. These barriers may desirably have curved inner surfaces shaped to offer minimum resistance to the flow of gas. The outer surfaces of the barriers 11 are desirably planed to conform to the end walls of the casing when they are in extreme end positions to avoid circulation of air at the ends of the casing near the bearings. The barriers and propellers may desirably be spaced equally but other spacing can be used by making corresponding changes in the outlets in the casing.

With the propellers and barriers in an extreme end position, such as the extreme right end position shown in Fig. 1, the delivery pipe 2 from the furnace is disposed to open into the casing between the left barrier 11 and the left propeller 10, and the pipe 50 to the stack 51 opens into the casing between the propeller 10 and the intermediate barrier 17 so that by turning the shaft in the direction indicated by the arrow in Fig. 1, the gas will be drawn from the furnace through the pipe 2 and propelled through the casing 1 and stack pipe 50 into the stack 51. In this position of the propellers, the air supply conduit 55 is disposed to open into the casing in the clearance space at the left end of the casing as shown in Fig. 1 and so that there will be a substantial clearance between the opening into the casing and the left end barrier 11. The delivery pipe 3 is disposed to open into casing 1 so that the peripheral edge of the intermediate barrier 17 will overlap the casing and constitute a barrier between the gas discharge space 52 and the space 53.

The propeller 10 in the feed gas space 53 is biased to take air from the feed conduit 54 and discharge it into the delivery pipe 3 when it is rotated in the described direction. The fresh air conduit 54 is disposed to open into the casing to the right of propeller 10 a distance such that the right end barrier 11 will be disposed a little to the left of the opening when it is moved into its opposite end position as shown in Fig. 2. In the position shown in Fig. 1, it will be observed that the gas pressure in the fresh air space 53 will tend to be slightly higher than the pressure in the exhaust gas space 52. Consequently, the gas which may leak around the peripheral edges of the barriers 11 and 17 will tend to pass into the exhaust gas, and the air which is propelled into pipe 3 will not be vitiated with exhaust gas. Furthermore, the cool air entering through conduit 54 and around the end bearing will cool the end barrier and the bearing. The bearing on the opposite end will be cooled by cool air which tends to be drawn therearound.

In the opposite end position of the propellers as shown in Fig. 2, the right end barrier 11 is disposed to close communication between the air conduit 54 and the pipe 3. The intermediate barrier 17 is disposed to open communication between pipe 3 and stack 51, and to close communication between pipe 2 and stack 51. The left end barrier 11 will have been moved into an extreme left end position in which communication is established between air conduit 55 and the pipe 2. The above described direction of rotation of the propellers causes air to flow from conduit 55 through the space 56 into the supply pipe 2 which leads to the regenerators or the furnace, as the case may be. The air conduit 54 is disconnected from the system and the right propeller 10 becomes disposed between pipes 3 and 50 so that the gas flow in pipes 2 and 3 becomes reversed. Thus, by biasing the propellers so that they draw the gas toward the intermediate barrier, disposing the openings into the blower casing in staggered relation in the order air-delivery-stack-delivery-air, and arranging the axial throw of the barriers so that all of the openings will be traversed by the barriers in changing from one extreme to the other extreme position, the direction of flow is reversed without changing the direction of rotation of the propellers.

The quantity of air delivered by the blowers may be regulated by a cut-off, such as the butterfly valves 58 in the air conduits 54 and 55.

Gas systems which provide regenerators between the blower and the furnace require a delivery of more or less highly heated gas to the blower. In the described arrangement the propellers alternately handle hot and cold gases so that they are alternately heated and cooled and the average temperature of these parts is automatically maintained below the temperature of a fan which handles only heated gas.

In the arrangement shown in Fig. 3, blowers of the centrifugal runner type having vanes 60 are mounted on the opposite sides of the intermediate barrier 61 with their central intakes facing outwardly. In this modification, the sections of the casing outside of the runner which constitute the discharge ducts for the runners are made in the form of spirals. The spiral ducts 62 and 63 lead to the pipes 2 and 3 respectively and spiral duct 64 leads to the stack 51. The intermediate barrier carries the vanes 60 and plates 65 which plates are mounted on the outside ends of the vanes. The plates 65 have central openings which provide intake ports for the runners and outer peripheral flanges which are spaced with a small clearance from the wall of the casing to provide the inner wall of the duct around the runner. The end barriers 11 may be flat disks as shown in Fig. 3 but the inner surfaces of the barriers may desirably be formed to avoid turbulence in the gas as shown in Fig. 1.

In operation, the runners and barriers are shifted axially to reverse the flow of gas in the same manner as the propellers and barriers shown in Fig. 1. It will be observed that the modification shown in Fig. 3 provides a compact structure which may be assembled in a small space.

Although the invention has been described with reference to two specific embodiments thereof, it is to be understood that various other modifications can be made without departing from the invention, and no limitations are intended except those which are specifically recited in the appended claims or imposed by the prior art.

I claim:

1. A gas propelling device which comprises a blower casing, supply conduits opening into the casing, a stack connection disposed to open into the enclosure of the casing between the conduits, delivery pipes disposed to open into the casing al-

ternately with respect to the conduits and stack openings, a shaft carrying blowers, one of said blowers being disposed in the casing for taking gas from one of said conduits and delivering it to one of said pipes, the other blower being operable to take gas from the other pipe and deliver it to the stack, and means coacting with said blowers for closing the communication between the other of said conduits and a blower.

2. A gas propelling device which comprises a blower casing, supply conduits opening into the casing, a stack connection disposed to open into the enclosure of the casing between the conduits, delivery pipes disposed to open into the casing alternately with respect to the conduit and stack openings, a shaft carrying blowers, one of said blowers being disposed in the casing for taking gas from one of said conduits and delivering it to one of said pipes, the other blower being operable to take gas from the other pipe and deliver it to the stack, means coacting with said blowers for closing the communication between the other of said conduits and a blower, and means for shifting said blowers with respect to said openings to reverse the flow of gas in said pipes and establish communication between a blower and said other conduit.

3. A gas propelling device which comprises a casing, supply conduits opening into the casing, a stack connection disposed to open into the casing between the conduits, delivery pipes along the casing arranged to open thereinto alternately with respect to the conduit and stack openings, a plurality of gas propellers, a longitudinally disposed driving shaft for rotatably mounting the propellers, and means to shift the propellers axially of the shaft across the openings of the delivery pipes to reverse the flow of gas in said pipes and maintain communication to the stack from one of said pipes.

4. A gas propelling device which comprises a casing having supply conduits opening into the casing, a stack connection disposed to open into the casing between the conduits, delivery pipes along the casing arranged to open thereinto alternately with respect to the conduit and stack openings, a longitudinally disposed driving shaft rotatably mounted in the casing, opposed propellers spaced on the shaft so as to dispose one propeller between a conduit and a delivery pipe and to dispose another propeller between another delivery pipe and a stack, barriers disposed on both sides of the propellers to prevent communication between said conduits and stack, and means for shifting the propellers and barriers axially of the shaft to dispose them on diametrically opposite sides of said openings.

5. A gas propelling device which comprises a casing having supply conduits opening into the casing, a stack connection disposed to open into the casing between the conduits, delivery pipes along the casing arranged to open thereinto alternately with respect to the conduit and stack openings, a longitudinally disposed driving shaft rotatably mounted in the casing, a plurality of gas driving means spaced on the shaft so as to dispose one of said means between a conduit and a delivery pipe and another of said means between another delivery pipe and a stack, barriers carried on both sides of said driving means and integrally operable therewith to close communication between said conduits and stack, and means to shift the gas driving means and barriers transversely across the openings.

6. A gas propelling device which comprises a casing having supply conduits opening into the casing, a stack connection disposed to open into the casing between the conduits, gas delivery pipes along the casing arranged to open thereinto alternately with respect to the conduits and stack, a longitudinally disposed driving shaft rotatably mounted in the casing, means for axially displacing the shaft and retaining the same in predetermined displaced positions, driving means for rotating the shaft, a plurality of propellers mounted to turn with the shaft and biased to induce gas flow in opposite directions, one of said propellers being disposed between a conduit and a delivery pipe and another being disposed between another delivery pipe and a stack when the shaft is displaced into one of said predetermined positions, and barriers on both sides of the propellers integrally shiftable therewith to close communication between said conduits and stack, said axial displacement being arranged to shift the propellers to the opposite sides of said delivery pipes and gas conduits.

7. A gas propelling device which comprises a casing having supply conduits opening into the casing, a stack connection disposed to open into the casing between the conduits, gas delivery pipes along the casing arranged to open thereinto alternately with respect to the conduits and stack, a longitudinally disposed driving shaft rotatably mounted in the casing to shift to predetermined end positions, an intermediate barrier mounted to turn with the shaft and form a sealing means with the casing to alternately close communication between the stack and a pipe as it is shifted to end positions and to open communication with the other pipe, centrifugal blowers including vanes mounted on opposite sides of the intermediate barrier and partitions having central supply ports on the outside ends of the vanes to drive the gas and confine the flow thereof, end barriers on the shaft spaced from the blowers to alternately open communication with said pipe and a conduit and close communication with said other pipe and another conduit when the blowers are shifted to end positions, means to rotate the shaft, and means to shift the blowers and barriers axially.

8. A gas propelling device which comprises a casing having supply conduits opening into the casing, a stack connection disposed to open into the casing between the conduits, gas delivery pipes along the casing arranged to open thereinto alternately with respect to the conduits and stack, a longitudinally disposed driving shaft rotatably mounted in the casing to shift to predetermined end positions, means carried by the shaft to drive air from a conduit into a supply pipe when the shaft is in one of said positions and from another conduit to another pipe when the shaft is in the other end position, means for rotating the shaft, and means for shifting the shaft and said driving means into said end positions.

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