

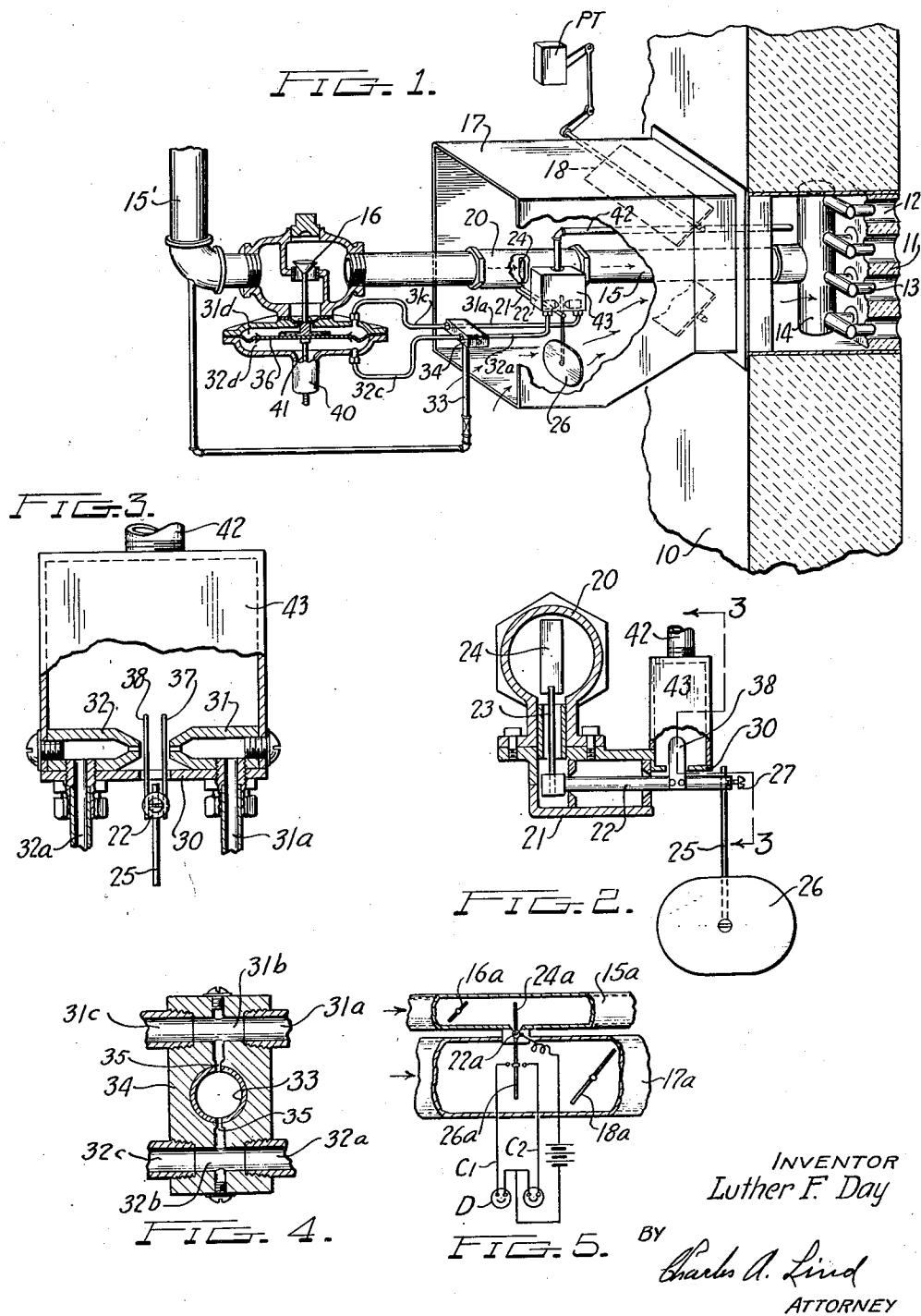
Feb. 11, 1936.

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2,030,140

APPARATUS FOR PROPORTIONING THE FLOW OF GASES

Filed April 3, 1935



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2,030,140

APPARATUS FOR PROPORTIONING THE
FLOW OF GASESLuther F. Day, Tulsa, Okla., assignor to Webster
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Application April 3, 1935, Serial No. 14,397

15 Claims. (Cl. 137—164)

The present invention is a continuation in part of my application filed April 4, 1934, Serial No. 719,050; and it relates to apparatus for main-
taining proportional flow of two different gases
5 flowing in separate conduits.

The invention has among its objects to provide for the control of proportional flow of two gaseous streams by means including a device which shall be responsive to variations in ratio
10 of the dynamic forces of the two streams; to provide simple and practical means adapted to be controlled by said device for automatically maintaining proportional flow of the two streams irrespective of the difference in pressure of the
15 two streams; and to provide apparatus of the character indicated which shall be particularly well adapted for controlling delivery of air and fuel gas to gas-fired furnaces in cases where the fuel gas is under pressure and the air flows
20 to the furnace by induced draft as by stack draft.

According to the present invention, the device which is responsive to variation in ratio of the dynamic forces of the two streams comprises a pivoted vane member provided with two vanes
25 that severally extend within the two conduits and across the streams flowing therein, the areas of the vanes being severally less than the cross sectional areas of the conduits whereby the streams flow in continuous courses through the conduit
30 and around the vane and variations in ratio in the dynamic forces effect turning of the vane member.

The manner of utilizing said device for automatically maintaining proportional flow of the
35 two gases will more fully appear from the detailed description taken in connection with the accompanying drawing wherein the various features of novelty and invention are shown.

Fig. 1 shows the invention applied to a gas-
40 fired furnace;

Fig. 2 is a detail sectional view of certain features of the invention;

Fig. 3 is a detail sectional view on line 3—3 of Fig. 2;

45 Fig. 4 is a detail sectional view of parts shown in Fig. 1, and

Fig. 5 is a diagrammatic showing of certain features of the invention.

Referring to Fig. 1, 10 indicates the wall of a
50 gas-fired furnace, such as a boiler furnace, for example. Mounted in the furnace wall is a burner block 11 having ports 12 for the admission of air and gas to the furnace chamber. The gas is discharged from nozzles 13 in alignment with
55 the several ports, the nozzles forming part of a

header 14 to which gas under pressure is supplied by a conduit 15 provided with a flow controlling valve 16. The main gas supply pipe is indicated at 15'. The burner arrangement thus far described is well known in the art and is intended
5 to be illustrative of any preferred type of industrial gas burner.

Extending from the front side of the furnace wall 10 is an air box or conduit 17 through which air for supporting combustion of the gas flows to the burner. In the conduit is positioned any
10 preferred flow adjusting device shown as louvers 18. In steam boiler practice, the position of the louvers will ordinarily be controlled by a device PT which is responsive to steam pressure, as will
15 be readily understood by those skilled in the art. Insofar as the present invention is concerned, it is immaterial whether the air is delivered to the air box by a blower or whether it flows to the box
20 under the influence of stack draft.

A portion of the gas conduit 15 inside of the air box 17 comprises a special fitting 20 to the underside of which is secured a detachable support or bracket 21. Rotatably supported in this
25 bracket is a horizontally disposed rotatable shaft 22. Secured to one end of the shaft and extending upwardly therefrom into the fitting 20 is an arm 23 to the upper end of which is secured a vane 24 of substantial but sufficiently small area to permit the free flow of gas past the vane.
30 Secured to the other end of the shaft and depending therefrom into the air box 17 is an arm 25 to the lower end of which is secured a vane 26 of substantial but sufficiently small area to permit the free flow of air past the vane. The
35 effective length of the arm 25 may be varied as circumstances require by releasing a set screw 27 in the end of the shaft.

The relative areas of the vanes 24 and 26 and the distance of the vane 26 from the shaft 22
40 are such that when the flows of air and fuel gas are in proper proportional relation, the arm 25 hangs vertically. When the arm is in that position, the shaft 22 may be said to be in neutral or normal position. It will, of course, be readily
45 appreciated that increase or decrease in the flow of one of the fluids without corresponding change in the flow of the other fluids will cause the shaft to turn.

Supported on the bracket 21, as on a ledge 30
50 extending therefrom, are two opposed jet-orifice nozzles 31 and 32. These nozzles are connected by pipes 31a and 32b respectively to a common supply pipe 33 for gaseous fluid under pressure. As a matter of convenience, the said fluid will
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ordinarily be gas from the main supply pipe 15' ahead of the valve 16. The connection between the pipe 33 and the two pipes 31a and 32a preferably comprises a block 34 having two separate passages 31b and 32b, each of which is in open communication with the supply pipe 33 through a relatively restricted passage 35. Extending from the passages 31b and 32b are pipes 31c and 32c respectively. The pipe 31c leads to a pressure chamber 31b at one side of a diaphragm 36, and the pipe 32c leads to a similar chamber 32d at the other side of the same diaphragm.

The flow of the gas from the nozzles 31 and 32 is controlled by means positioned between the nozzles and movable with the vane shaft 22. This means may comprise one but preferably comprises two spring fingers 37 and 38, one for each nozzle, secured to and projecting upwardly from said shaft. These fingers are so arranged that when the vane arm 25 hangs vertically, they are equally remote from their respective nozzles, thus permitting equal flow of gas from both nozzles; it being understood that as long as the flows are equal, the pressures at opposite sides of the diaphragm 36 will be equal, since both sides are in connection with the common pressure pipe 33. When, however, the fingers are moved out of vertical position by the shaft 22, that finger which is closest to its nozzle will restrict the flow of gas therefrom and thus cause a difference in pressure at the diaphragm with the obvious result of causing the diaphragm to move in the direction of low pressure. The gas vented from the nozzles 31 and 32 is conveniently conducted toward the burner by a vent pipe 42 leading from a cover 43 over the nozzle.

The function of the diaphragm is to effect change in position of the gas control valve 16 in accordance as more or less gas is required to flow to the burner to maintain the desired air-gas ratio under changing conditions of air due, for example, to a change in position of the louvers 18 or to a change in furnace draft or to other conditions affecting the flow of air to the burner. Ordinarily the valve 16 will be coupled directly to the diaphragm for movement therewith; but, it is within the spirit of the invention to control the operation of the valve by electrical means under the control of the same member, the fingers 37 and 38 of the latter in such case serving as switches for controlling the electrical circuit.

In burner operation, it is not desirable that the flow of gas to the burner be entirely cut off by the operation of the controlling device and the valve 16 is therefore prevented from fully closing by any suitable means such as an adjustable stop 41 supported in a depending portion 40 of the diaphragm case.

Fig. 5 is a diagrammatic showing of how the vane member may be combined with electrical means for indicating change in proportional flow of the two gases flowing in the same direction in separate conduits 15a and 17a. The vanes are indicated at 24a and 26a and the supporting shaft therefor at 22a. The same member serves as a switch for controlling two circuits C1 and C2 in each of which is a lamp or other device D which when energized will give notice of change from normal position of the vane member. 16a and 18a indicate valves or dampers for controlling the flow of one or the other of the gases as may be necessary to maintain the desired proportional flow of the gases.

What I claim as new and desire to secure by Letters Patent is:

1. In apparatus of the class described, the combination comprising two conduits, a turnable member provided with two vanes that severally extend within the two said conduits and athwart the streams flowing therein, the areas of the vanes being severally less than the cross-sectional areas of the conduits, whereby the streams flow in continuous courses through the conduits and around the vanes and variation in the dynamic forces effects turning of the said member.

2. In the combination specified in claim 1, said vanes being adjustable with respect to each other.

3. In the combination specified in claim 1, one of said vanes being radially adjustable with respect to the axis of rotation of the said member.

4. In apparatus of the class described, the combination comprising two conduits, a turnable member provided with two vanes that severally extend within the two said conduits and athwart the streams flowing therein, the areas of the vanes being severally less than the cross-sectional areas of the conduits, whereby the streams flow in continuous courses through the conduits and around the vanes and variation in the dynamic forces effects turning of the said member, and flow-regulating means in one of the conduits.

5. In apparatus of the class described, the combination comprising two conduits, a turnable member provided with two vanes that severally extend within the two said conduits and athwart the streams flowing therein, the areas of the vanes being severally less than the cross-sectional areas of the conduits, whereby the streams flow in continuous courses through the conduits and around the vanes and variation in the dynamic forces effects turning of the said member, flow-regulating means in one of the conduits, and means operable by said member for controlling the operation of the said means.

6. In apparatus of the class described, the combination comprising two conduits, a turnable member provided with two vanes that severally extend within the two said conduits and athwart the streams flowing therein, the areas of the vanes being severally less than the cross-sectional areas of the conduits, whereby the streams flow in continuous courses through the conduits and around the vanes and variation in the dynamic forces effects turning of the said member, flow-regulating means in both of said conduits, and means operable by said member for controlling the operation of one of said means.

7. In apparatus of the class described, the combination comprising two conduits, a rotatable member provided with vanes that severally extend within the two said conduits and athwart the streams flowing therein, the areas of the vanes being severally less than the cross-sectional areas of the conduits, whereby the streams flow in continuous courses through the conduits and around the vanes and variations in ratio in the dynamic forces effect turning of said rotatable member, flow-regulating means in one of said conduits, and means for controlling the operation of said means including means through which a stream of fluid is normally free to flow and also including a member carried by said rotatable member for throttling the flow of the last named fluid.

8. In apparatus of the class described, the combination comprising two conduits, a rotatable member provided with vanes that severally extend within the two said conduits and athwart the streams flowing therein, the areas of the

vanes being severally less than the cross-sectional areas of the conduits, whereby the streams flow in continuous courses through the conduits and around the vanes and variations in ratio in the dynamic forces effect turning of said rotatable member, flow-regulating means in one of said conduits, and means for controlling the operation of said means including two fluid pressure pipes each having an outlet for the discharge of fluid therefrom and also including means operable by said rotatable member for controlling the discharge of fluid through said outlets.

9. In apparatus of the class described, the combination comprising two conduits, a rotatable member provided with vanes that severally extend within the two said conduits and athwart the streams flowing therein, the areas of the vanes being severally less than the cross-sectional areas of the conduits, whereby the streams flow in continuous courses through the conduits and around the vanes and variations in ratio in the dynamic forces effect turning of said rotatable member, a valve in one of said conduits, means including a diaphragm for operating said valve, and means including a member movable with said rotatable member for applying fluid pressure on one side or the other of said diaphragm.

10. In apparatus of the class described, the combination comprising two conduits, a rotatable member provided with vanes that severally extend within the two said conduits and athwart the streams flowing therein, the areas of the vanes being severally less than the cross-sectional areas of the conduits, whereby the streams flow in continuous courses through the conduits and around the vanes and variations in ratio in the dynamic forces effect turning of said rotatable member, a valve in one of said conduits, means including a diaphragm for operating said valve, two fluid pressure pipes leading from opposite side of said diaphragm and each having an outlet from which fluid is normally free to flow, and means movable with said rotatable member for controlling the discharge of fluid from said pipes.

11. In apparatus of the class described, the combination comprising a conduit open at one end to the inflow of air from the atmosphere, a second conduit in communication with a supply of fuel gas under pressure, a turnable member provided with two vanes that severally extend within the two conduits and athwart the streams flowing therein, the areas of the vanes being severally less than the cross-sectional areas of the conduits, whereby the streams flow in continuous courses through the conduits and around the vanes and variation in the dynamic forces effects turning of the said member, a flow-regulating means in the second conduit, and means operable by said member for controlling the operation of the said means.

12. In apparatus of the class described, the combination comprising a conduit in communication with a source of gas under pressure, a valve in said conduit, means including a diaphragm in a pressure case for operating said valve, means including two opposed fluid discharge means for controlling the delivery of fluid under pressure to opposite sides of said diaphragm, movable means arranged between said fluid discharge means and adapted when moved towards the latter to oppose the flow of fluid therefrom, a second conduit for gaseous fluid, and means for moving said movable means including means responsive to variations in ratio in the dynamic forces of the two streams flowing in the two conduits.

13. In combination, two conduits, a flow-controlling device for at least one of said conduits, a movable member for controlling the operation of said device, means exposed to the dynamic force of the stream flowing through one of the conduits and tending under the influence of such force to move said member in one direction, means exposed to the dynamic force of the stream flowing through the other conduit and tending under the influence of such force to move said member in the opposite direction, neither of said means being effective to move said member so long as the difference between said forces remains constant.

14. In combination, two conduits, a flow-restricting device for at least one of said conduits, mechanism including a rotatable shaft for controlling the operation of said device, means exposed to the dynamic force of the stream flowing through one of said conduits and tending under the influence of such force to turn said shaft in one direction, means exposed to the dynamic force of the stream flowing through the other conduit and tending under the influence of such force to turn said shaft in the opposite direction, neither of said means being effective to turn said shaft so long as the difference between said forces remains constant.

15. In combination, two conduits, a flow-restricting device for at least one of said conduits, a power-operated mechanism for controlling the operation of said device, a movable member for controlling the application of power to said mechanism, means exposed to the dynamic force of the stream flowing through one of said conduits and tending under the influence of such force to turn said shaft in one direction, means exposed to the dynamic force of the stream flowing through the other conduit and tending under the influence of such force to turn said shaft in the opposite direction, neither of said means being effective to turn said shaft so long as the difference between said forces remains constant.

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