April 24, 1956 R. L. HUBBARD 2,743,056

AUTOMATIC DRAFT REGULATOR

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Fig. 1

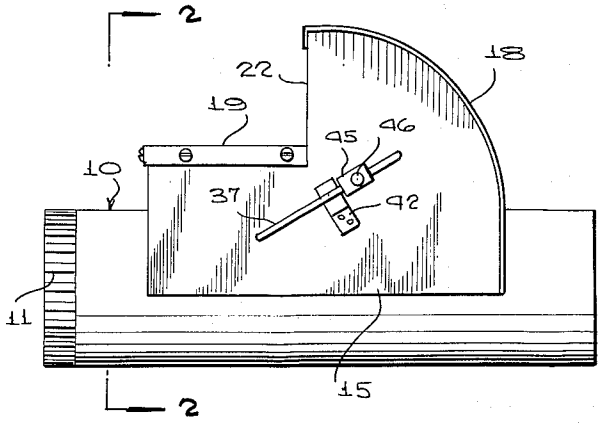


Fig. 2

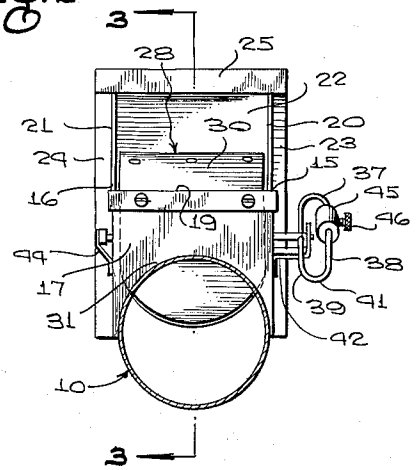


Fig. 3

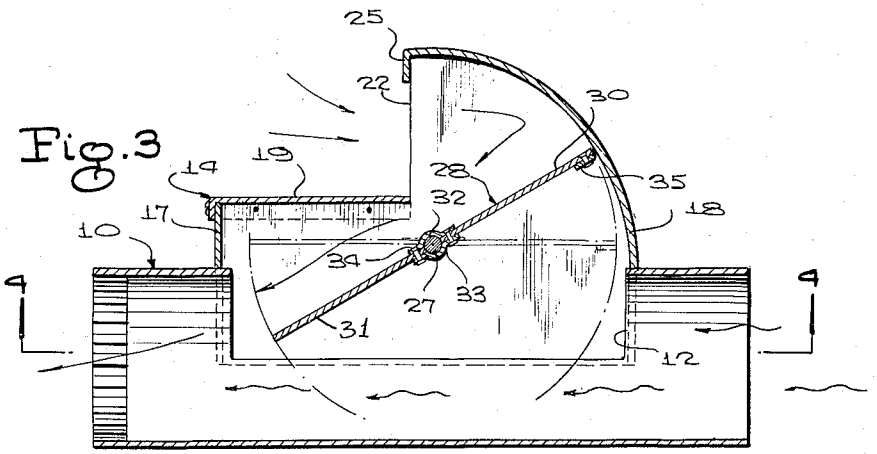
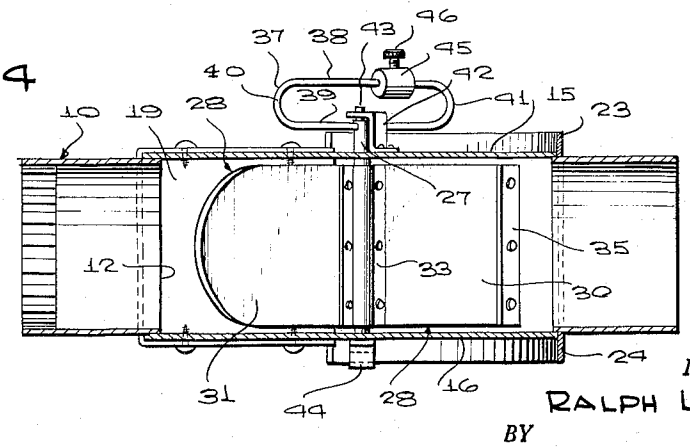


Fig. 4



INVENTOR.
RALPH L. HUBBARD
BY

McMorrow, Berman & Davidson
ATTORNEYS

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AUTOMATIC DRAFT REGULATOR

Ralph L. Hubbard, Baileys Harbor, Wis.

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2 Claims. (Cl. 236—45)

This invention relates to automatic draft regulators and more particularly to a combined check draft and damper assembly adapted to be connected into a conduit, such as a furnace flue pipe or stack, for maintaining the rate of fluid flow or draft at a predetermined rate through the conduit.

It is among the objects of the invention to provide an improved flow regulator which is incorporated in a section of fluid conduit or pipe which can be incorporated into a conduit such as the flue pipe line of a furnace between the furnace and an associated chimney or flue; which is responsive to the velocity and pressure of flue gases passing through the pipe section and to the pressure of the surrounding air to maintain the draft substantially at a predetermined rate; which regulated the rate of fluid flow through the conduit by variably restricting the fluid passage through the conduit section and by the admission of outside air in regulated quantities to the interior of the conduit; and which is simple and durable in construction, economical to manufacture, easy to install, and effective and efficient in operation.

Other objects and advantages will become apparent from a consideration of the following description and the appended claims in conjunction with the accompanying drawing, wherein:

Figure 1 is a side elevational view of a draft regulator illustrative of the invention;

Figure 2 is a transverse cross sectional view on the line 2—2 of Figure 1;

Figure 3 is a longitudinal cross sectional view on the line 3—3 of Figure 2; and

Figure 4 is a longitudinal cross sectional view on the line 4—4 of Figure 3.

With continued reference to the drawing, the numeral 10 generally indicates a flue pipe section of cylindrical shape having one end slightly reduced in diameter by corrugations 11 so that this end will fit into the adjacent end of an associated pipe section or elbow and having an opening 12 of elongated, rectangular shape therein and extending longitudinally thereof with the ends of the opening spaced substantially equal distances from the respectively opposite ends of the pipe section.

The numeral 14 generally indicates a housing disposed on the pipe section 10 in covering relationship to the opening 12. This housing is of rectangular cross sectional shape and includes a pair of substantially parallel side walls 15 and 16 spaced apart a distance substantially equal to the diameter of the pipe section 10 and each having one edge extending along the corresponding longitudinal edge of the opening 12 in the pipe section. The housing further includes a front wall 17 having in one end an arcuately curved recess receiving the portion of the pipe section 10 at one end of the opening 12. This front wall projects perpendicularly from the open side of the associated pipe section and is joined at its opposite ends to the corresponding ends of the side walls 15 and 16. The housing also includes a rear wall 18 and a top wall 19. The rear wall 18 has in one end a recess of

substantially semicircular shape receiving the portion of the pipe section 10 at the corresponding end of the opening 12 and has its remaining portion arcuately curved longitudinally thereof about an axis extending transversely of the housing adjacent the midlength location of the housing and adjacent a plane parallel to the longitudinal center line of the pipe section 10 and including the edge of the front wall 17 remote from the pipe section. The end of the rear wall 18 remote from the pipe section 10 is spaced outwardly from the outer edge of the front wall 17 relative to the pipe section 10 and the side walls 15 and 16 are provided with sector shaped portions 20 and 21 which extend outwardly of the pipe section 10 substantially from the plane parallel to the longitudinal center line of the pipe section and including the outer edge of the front wall 17 to the inner surface of the longitudinally curved portion of the rear wall 18.

The sector shaped portions 20 and 21 of the side walls and the curved rear wall 18 together provide a structure which constitutes a portion of the housing and has an open end 22 of rectangular shape disposed substantially in a plane which is perpendicular to the longitudinal center line of the pipe section 10 and disposed substantially midway of the length of the housing 14.

The rear wall 18 is somewhat wider than the distance between the side walls 15 and 16 providing flanges 23 and 24 extending outwardly of the corresponding side walls of the housing one along each longitudinal edge of the rear wall 18 and this rear wall is also provided at its end remote from the pipe section 10 with a flange 25 directed from the outer edge of the open end 22 of the corresponding structural portion of the housing toward the pipe section 10.

The top wall 19 is a flat plate extending over the space between the portions of the side walls 15 and 16 between the open end 22 of the rear wall structure and the front wall 17 and is provided with marginal flanges overlapping and secured to the adjacent edge portions of the side and front walls of the housing. This front wall 19 is substantially in a plane parallel to the longitudinal center line of the pipe section 10 and to the axis of curvature of the rear wall 18 and the portion of the housing covered by the top wall 19 provides a space for the reception of one end portion of a damper plate presently to be described.

The rear edge of the top wall 19 extends across the lower edge of the open end 22 of the back wall structure of the housing and a shaft 27 extends transversely through the housing 14 adjacent the rear edge of the top wall 19 of the housing and is journaled near its opposite ends in bearing apertures provided in the housing side walls 15 and 16.

A damper plate, generally indicated at 28, extends transversely of the housing between the side walls 15 and 16 and is mounted intermediate its length on the shaft 27. This damper plate may conveniently comprise flat plates 30 and 31 and disposed at respectively opposite sides of the shaft 27 and in longitudinal alignment with each other and trough shaped clamp members 32 and 33 each extending around approximately one-half of the shaft 27 and having flanges along its longitudinal edges projecting outwardly from the shaft. The plates 30 and 31 have their end portions adjacent the shaft disposed between the opposed flanges of the clamp members 32 and 33 and secured to these flanges by suitable means, such as the rivets 34 extending through registering apertures in the clamp member flanges and the corresponding plates to rigidly secure the plates to the shaft.

The plate 30 has a length such that it extends from the shaft 27 to the inner surface of the curved rear wall 18 of the housing near the end flange 25 of the rear wall and the plate 31 has a transversely curved end re-

mote from the shaft **27** and a length such that it extends from the shaft substantially to the side of the pipe section **10** remote from the housing **14** when this plate is disposed substantially perpendicular to the longitudinal center line of the pipe section.

The end plate **30** remote from the shaft **27** is straight to extend transversely of the inner side of the housing back wall **18** and is reinforced by a bar **35** extending along this end of the plate and riveted thereto.

The axis of curvature of the rear wall **18** of the housing is displaced from the axis of the shaft **27** in a direction such that as the end of the plate **30** remote from the shaft **27** moves from the end flange **25** of the rear wall toward the end of the rear wall adjacent the pipe section **10** a gradually increasing space is provided between the outer end of the plate **30** and the inner surface of the rear wall **18** of the housing to admit a gradually increasing quantity of draft checking air through the open end **22** of the housing structure and past the outer end of the check damper plate **30** into the pipe section **10** as the damper plate moves away from the open end of the housing structure.

A weight carrier **37** is mounted on the shaft **27** adjacent one end of this shaft and outside of the corresponding side wall of the housing and includes a pair of substantially straight bars **38** and **39** disposed in spaced apart and parallel relationship to each other and arcuately curved end portions **40** and **41** interconnecting the bars **38** and **39** at the respectively opposite ends of the carrier **37**. The bar **39** extends through a transverse aperture in the shaft **27** near the corresponding end of the shaft and is secured in position relative to the shaft so that it extends substantially equal distances to opposite sides of the shaft and so that the bar **38** is disposed outwardly of the adjacent end of the shaft with its center line substantially intersecting the extended longitudinal center line of the shaft **27**.

An angle bracket **42** is secured to the adjacent side wall of the housing at one end and has in its other end an aperture receiving a reduced end portion **43** of the shaft **27** to provide an outboard bearing for the corresponding end of the shaft and a complementary angle bracket **44** is secured to the opposite side wall of the housing and provided with an aperture receiving the adjacent end of the shaft to also provide a shaft bearing.

A weight **45** is slidably mounted on the bar **38** of the weight carrier **37** and a set screw **46** is threaded through a tapped hole in this weight and engages the bar **38** to releasably secure the weight in selected positions of angular adjustment longitudinally of the bar.

When the draft regulator is operatively connected to a furnace the pipe section **10** is substantially horizontally disposed with the housing **14** on its upper side and the end of this pipe section **10** nearest the rear wall **18** of the housing is disposed nearest the furnace and the corrugated end **11** of the pipe section **10** furthest from the furnace so that the flue gases will flow through the pipe section **10** in a direction from the uncorrugated end of this pipe section adjacent the rear wall **18** of the housing to the corrugated end of the pipe section and outside air will flow through the open end **22** of the housing structure and by virtue of its impingement against the upper sides of the damper plates **30** and **31** will be directed into admixture with the flue gases adjacent the corrugated end **11** of the pipe section **10**. The pressure of the flue gases in the pipe section **10** will act against the under sides of the plates **30** and **31** and the outside atmospheric pressure acting through the open end **22** of the housing structure and through the space between the shaft **27** and the adjacent end of the top wall **19** of the housing will act on the opposite or upper sides of the damper plates **30** and **31**, the pressure of the fine gases and the pressure of the atmosphere being substantially balanced at opposite sides of the shaft **27**. If the rate of flow of flue gases through the pipe section **10** increases, however, beyond a predetermined rate, the velocity of the flue gases will cause an unbalancing pressure to be exerted against the underside of the plate **31** causing the damper structure **28** to turn about the axis of shaft **27** to reduce the restriction caused by the plate **31** in the pipe section **10** and at the same time moving the outer end of plate **30** away from the inner surface of the rear wall **18** to admit an additional regulated quanity of draft checking air between the outer end of the plate **30** and the rear wall **18** and admix with the flow of flue gases adjacent the rear wall **18** which air increases the pressure of the flue gases within the pipe section and reduces the rate of flow of the flue gases through the pipe section to hold the rate of the draft at a predetermined maximum value with the furnace drafts open. If the rate of flow of the flue gases be reduced, as by closing the furnace drafts, the pressure on the underside of the plate **31** will be reduced and the damper plate assembly will tend to swing about the axis of shaft **27** in a direction to cut off the flow of draft reducing air into the pipe section **10** and also move the plate **31** in a direction to restrict the flue gas passage through the pipe section to maintain the rate of draft at a predetermined minimum value.

When the damper plate assembly is moved to its maximum draft rate position, as shown in broken lines in Figure 3, the portion of the housing **14** immediately within the top wall **19** of the housing receives the plate **31** of the damper assembly so that the entire damper plate assembly is then disposed outside of the cross sectional area of the pipe section **10**, enabling the flue gases to flow freely through the pipe section **10** below the damper plates **30** and **31** and the outside air to flow inwardly through the open end **22** of the housing structure, with a part of the air flow moving along the upper side of the damper plates **30** and **31** and thence downwardly and admixing with the flue gases adjacent the corrugated end **11** of the pipe section **10** and the other part of the air flow moving between the outer end of the plate **30** and the rear wall **18** and admixing with the flue gases adjacent the end of the pipe section opposite the corrugated end **11**.

It is to be noted that the setting of the weight **45** which is adjustably connected to the shaft **27** controls the initiation of the rotational movement of the shaft in the direction to shift the end edge of the part or plate **30** of the damper out of contact with the rear wall **18** in response to a pressure of the flue gases in the conduit **10** in excess of a predetermined pressure, and also, causes the rotational movement of the shaft in the opposite direction upon restoration of the pressure of the flue gases to the predetermined pressure.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the range of equivalency and meaning of the claims are, therefore, intended to be embraced therein.

What is claimed is:

1. A draft regulator comprising a hollow conduit section for the flow of flue gases therethrough, an upstanding housing having a front wall, a top wall supported on said front wall, and an open lower end, positioned upon said section intermediate its ends and having the lower end in communication with the interior of said conduit section, said housing having a rear wall rising above and spaced from said top wall, the space between said rear wall and top wall forming an open inlet end for air, a horizontally disposed rotatable shaft extending transversely of said housing intermediate the front and rear walls and below said top wall, and a damper disposed within said housing and connected intermediate its ends to said shaft for rotation therewith, the part of said damper on one side of said shaft being adjacent said open end with

the adjacent end edge in contact with said rear wall and the part of said damper on the other side of said shaft being wholly within said housing and below said top wall and spaced from the lower open end thereof with the adjacent end edge spaced from the front wall of said housing, said damper being movable upon rotation of said shaft in the direction to shift the end edge of said first named damper part out of contact with the rear wall in response to a pressure of said flue gases in excess of a predetermined pressure to cause movement of the end edge of said first named damper part out of contact with said rear wall and permit flow of air to said conduit section below said damper and simultaneous movement of the said second named damper part toward said top wall and restrict the flow of air to said conduit section below said damper.

2. A draft regulator comprising a hollow conduit section for the flow of flue gases therethrough, an upstanding housing having a front wall, a top wall supported on said front wall, and an open lower end, positioned upon said section intermediate its ends and having the lower end in communication with the interior of said conduit section, said housing having a rear wall rising above and spaced from said top wall, the space between said rear wall and top wall forming an open inlet end for air, a horizontally disposed rotatable shaft extending transversely of said housing intermediate the front and rear walls and below said top wall, a damper disposed within said housing and connected intermediate its ends to said shaft for rotation therewith, the part of said damper on

one side of said shaft being adjacent said open end with the adjacent end edge in contact with said rear wall and the part of said damper on the other side of said shaft being wholly within said housing and below said top wall and spaced from the open lower end thereof with the adjacent end edge spaced from the front wall of said housing, said damper being movable upon rotation of said shaft in a direction to shift the end edge of said first named damper part out of contact with said rear wall in response to a pressure of said flue gases in excess of a predetermined pressure to cause movement of the end edge of said first named damper part out of contact with said rear wall and permit flow of air to said conduit section below said damper and simultaneous movement of said second named damper part toward said top wall and restrict the flow of air to said conduit section below said damper, and a weight adjustably connected to said shaft for controlling the initiation of the rotational movement of said shaft in said direction and for causing the rotational movement of said shaft in the opposite direction upon restoration of the pressure of the flue gases to the predetermined pressure.

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