

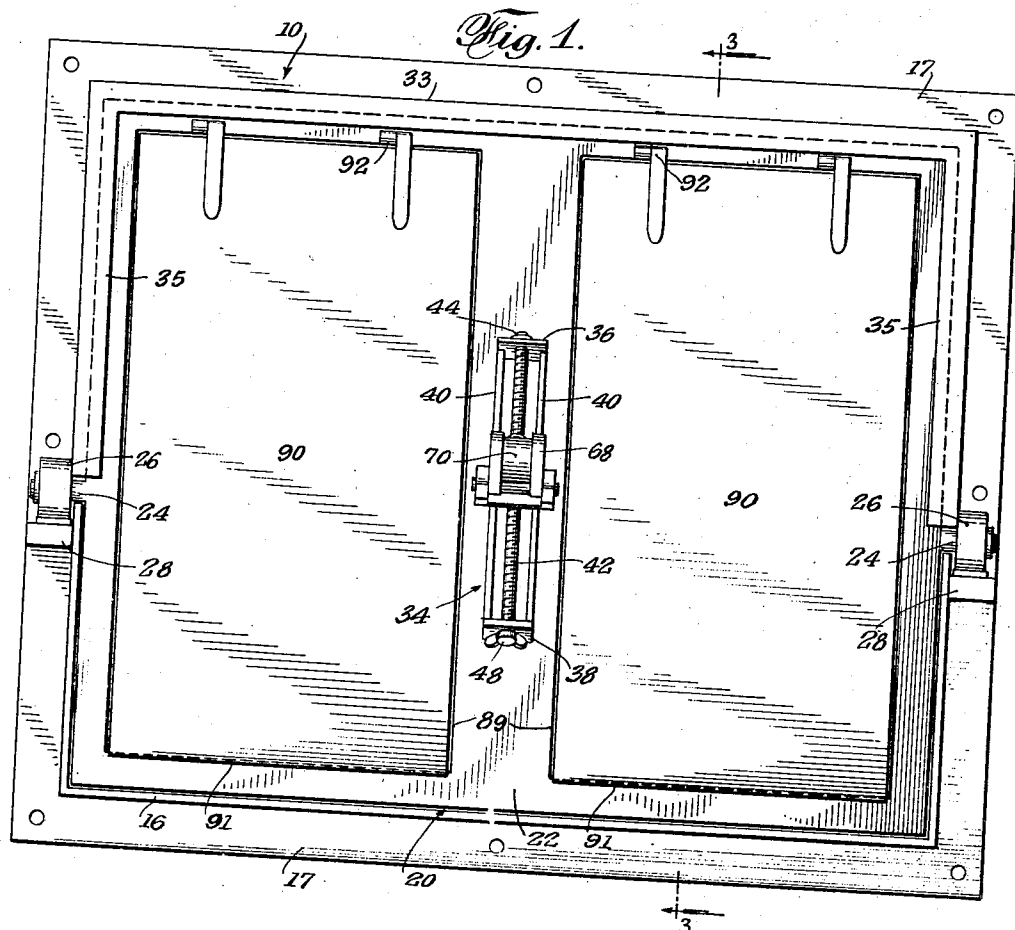
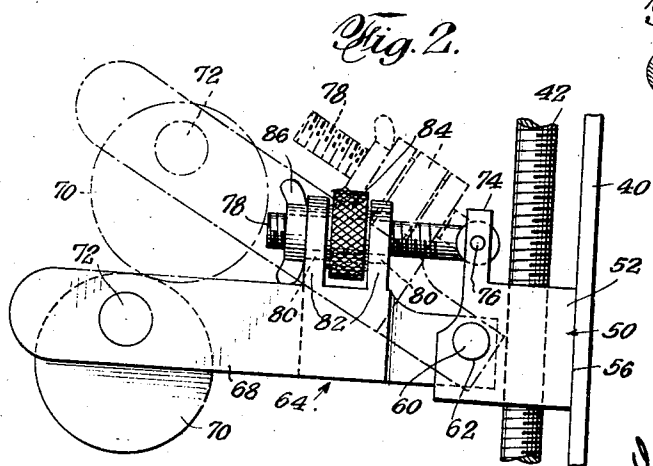
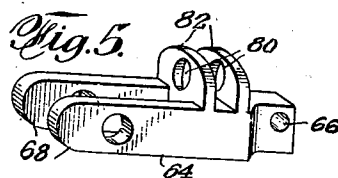
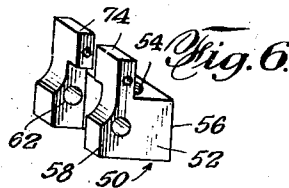
March 17, 1942.

R. JOHNSON ET AL
BAROMETRIC DAMPER

Filed April 8, 1940

2,276,728

2 Sheets-Sheet 1



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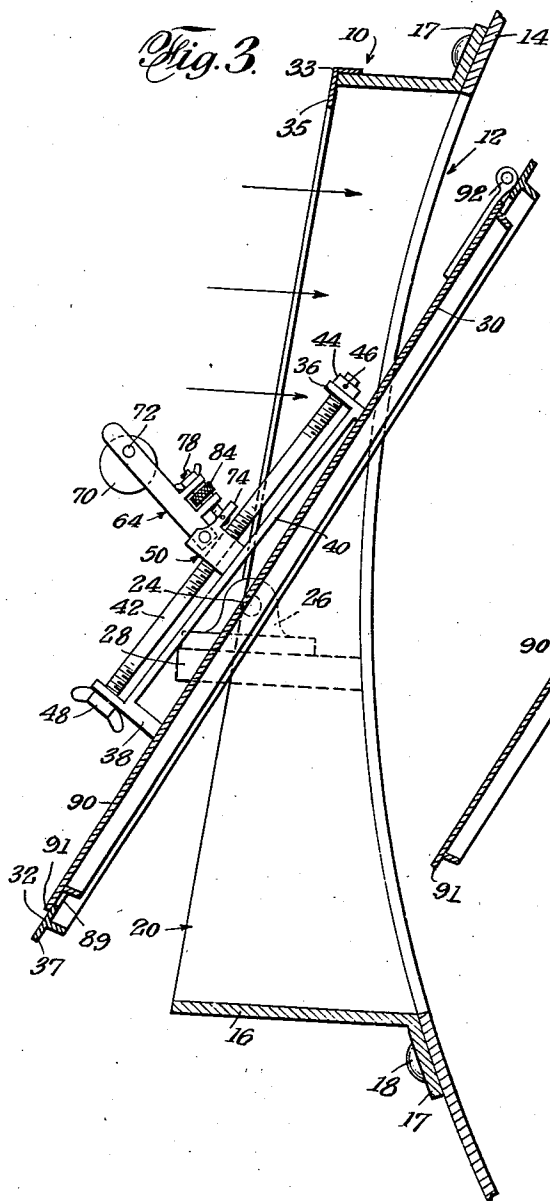
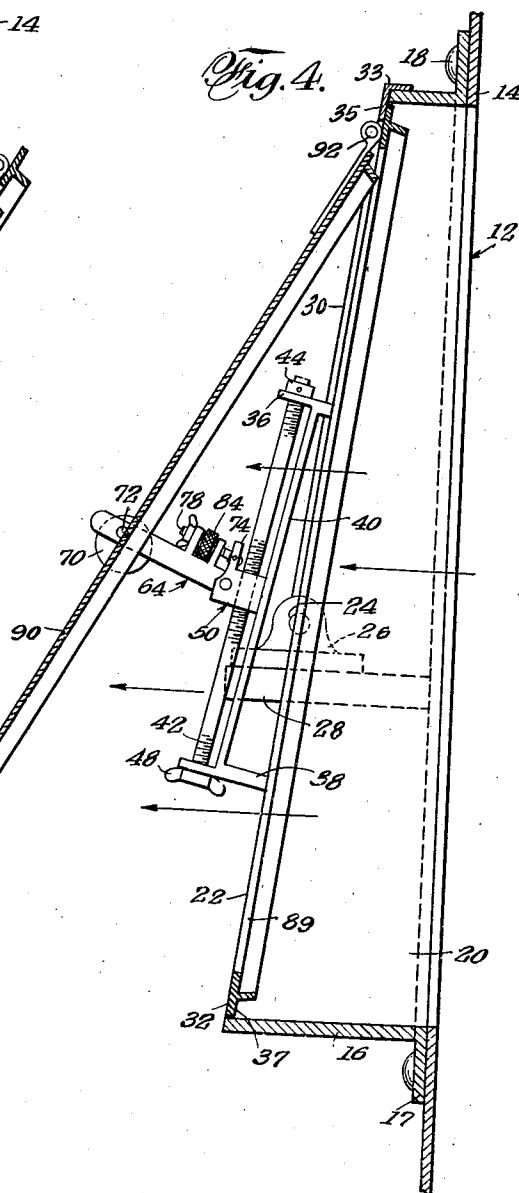
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BAROMETRIC DAMPER

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comprising Roy Johnson and John Johnson

Application April 8, 1940, Serial No. 328,536

9 Claims. (Cl. 236—45)

The present invention relates to a draft check damper for furnaces and more particularly to a barometrically controlled damper for maintaining constant the furnace draft induced by the chimney or stack.

For the most efficient operation of a furnace burning any selected fuel, such as coal, oil or gas, at a selected full combustion rate, the furnace draft induced by the chimney or stack must be maintained constant at that intensity required to efficiently burn the fuel and to remove the gases of combustion from the furnace.

Our invention, therefore, contemplates the provision of a check damper which is arranged to spontaneously open and admit atmospheric air into the breeching or flue gas outlet passage of the stack draft under the influence of the chimney to thereby check the draft.

It is further contemplated in order to maintain the furnace draft constant, irrespective of any conditions which will tend to vary it, to provide such a damper which will remain fully closed when the stack draft is below a predetermined intensity but which, under the influence of the stack draft, will be opened when the stack draft rises above such predetermined intensity and which damper will assume any fixed position up to and including that of fully open, dependent upon the magnitude of the stack draft above such predetermined draft intensity.

With different operating conditions, the desired furnace draft will, of course, change, and it is still further contemplated to provide a barometric check draft damper which can be adjusted for different ranges of response to the stack draft so that any selected furnace draft may be maintained.

It is a matter of fairly frequent occurrence in fuel burning furnaces that under certain conditions gases of incomplete combustion collect within the furnace. Under certain conditions, a mixture of gases when ignited will propagate flame quietly and slowly through the body of said gases producing comparatively little violence. The same mixture, if confined in a closed space of insufficient size and ignited when the gases are in motion or gentle turbulence, will propagate flame at a speed many times as fast as that under other conditions and develop pressures ranging up to thirty pounds or more per square inch. Thus, the violence and pressure developed by an inflammable mixture depends upon the environment and direction of flame propagation, as explained more fully in an article entitled "Inflammation limits and their practical application in

hazardous industrial operations," by D. W. Jones of the United States Bureau of Mines (Chemical Reviews, volume 22, No. 1, February, 1938).

It will, therefore, be apparent that since a furnace is a relatively confined space which may tend to have a bomb-like effect; therefore, the sudden ignition of incompletely unused gases which may have collected in certain parts of the furnace, will cause an explosion developing high damaging pressures. In actual practice, such explosions have wrecked the furnace.

To prevent such gas explosion from damaging the furnace and its breeching and to moreover attenuate the violence of said explosion by permitting the pressure thereof to be relieved, the present invention contemplates the combination with the barometric damper herewith concerned of relief gates arranged and freely swingable thereon to open, upon the development of only slight pressures within the furnace.

Prior barometric dampers, upon the initial opening movement of the damper with the air entering under a considerable velocity, were fairly sensitive to initial induced pressure fluctuation. However, as such dampers swung progressively towards their maximum open position, they tended to become less sensitive to changes in the draft. The present invention contemplates the provision of means for making the damper more sensitive as it opens to thereby prevent the damper from becoming "lazy" as it swings toward its maximum open position.

Other and further features and advantages of the present invention will become apparent from the following description and the drawings in which:

Fig. 1 is a front elevational view of a barometric damper embodying the present invention.

Fig. 2 is a detailed side view of the compensator of the barometric damper illustrated in Fig. 1.

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 1 showing the damper plate in partially open position and illustrating the damper frame modified for securing it to a round furnace breeching.

Fig. 4 is a sectional view similar to Fig. 3 showing the damper plate in closed position and the pressure relief gates in open position and illustrating the damper frame modified for securing it to a flat-walled furnace breeching.

Fig. 5 is a detailed perspective view of the counterweight supporting lever.

Fig. 6 is a detailed perspective view of the travelling member.

For arranging our barometric damper 10 to control the draft induced in a furnace (not illustrated), an opening 12 may be provided in the chimney breeching 14 of said furnace (shown fragmentarily in Fig. 3). To the portion of the chimney breeching 14 surrounding opening 12, a damper frame 16 may be secured by any suitable means, such as, for example, rivets 18. If the breeching is round or oval in contour, the portion of the frame 16 abutting the breeching is curved accordingly as illustrated in Fig. 3 to provide a saddle 17. If, however, the breeching has a straight wall, the portion of the frame 16 abutting the breeching may be straight to conform thereto as illustrated in Fig. 4. The frame 16 surrounds the breeching opening 12 and the damper is provided with the opening 20 in the frame 16 through which air may be drawn into the breeching to check the draft induced in the furnace by the chimney.

A damper plate 22, of such size and configuration as to completely shut off the frame opening when the damper is closed, is pivotally arranged intermediate its top and bottom edges on the trunnions 24 preferably provided at the sides of the damper plate 22. The trunnions 24, which, if desired, may be formed integrally with the damper plate 22, are arranged to rotate on bearing surfaces within bearing blocks 26, which bearing blocks 26 are preferably arranged on the sides of the frame adjacent the plate and may be supported by heavy metal supporting members 28 secured to the side walls of the frame 16.

It is to be noted that the trunnions 24 are not arranged equidistant from the top and bottom edges of the damper plate 22 but instead are arranged closer to the bottom edge of the damper plate, thereby providing a mechanical advantage for the portion of the damper plate extending above the trunnion 24, that is the top portion 30, over the bottom portion 32 of the damper plate 24. Thus, because of this mechanical advantage, the induced draft in the chimney breeching 14 will tend to swing the top portion 30 of the damper plate away from the frame 16 into the breeching 14 and the bottom portion 32 thereof will, therefore, move outwardly away from the frame to open the damper and check the draft. Furthermore, we prefer to arrange the damper plate 22, when in closed position, at an inclination to the vertical with the top portion 32 of the damper plate 30 closer to the chimney breeching 14. This further accentuates the tendency of the top portion 30 of the damper plate 22 to move inwardly away from the frame under the influence of induced draft.

In order to prevent the top portion 30 of damper plate 22 from swinging inwardly of its own weight, counterweighting means are provided. Such counterweighting means serve to urge the top portion 30 of the damper plate outwardly against the frame 16. In order to prevent the top portion 30 from swinging outside of the frame, however, an inverted L-shaped piece 33 may be provided at the top of the frame 16 having a leg thereof extending downwardly to form the damper stop 35, this stop 35 limiting the outward movement of the top portion 30 of the damper plate 22. The bottom edge of the damper plate is also provided with a lip or stop 37 which engages the frame adjacent to it.

The counterweighting means, since it determines the counter movement of the lower damper plate portion 32 about the trunnion pivot, limits the intensity of the draft required to open the

damper and to maintain the damper plate in any position to thereby check the draft induced in the furnace as desired.

The counterweighting means is itself provided with two further means for adjusting its effect on the damper plate under the influence of the chimney draft. The first adjustment determines the intensity of draft in a chimney breeching required to cause the initial opening of the damper plate 22 and roughly the further opening of the damper plate in response to increased or fluctuating variations in the draft after the initial opening of the damper plate to limit the induced furnace draft.

As has been pointed out hereinbefore, after the initial opening of the damper plate there is a tendency for the damper plate to be more and more sluggish in response to further increases in the chimney draft after the initial opening draft. For this reason, means have been provided for making the damper plate more sensitive to drafts after the initial opening movement of the damper plate. This is done by making the effect of the counterweight less and less as the damper plate swings further toward its fully open position. Thus, the damper plate is prevented from becoming sluggish or lazy in response to increased draft after the initial draft required to open the damper plate. The second adjustment hereinbefore mentioned selects different ranges of sensitivity or diminishing effectiveness of the counterweight with the opening of the damper plate after its initial opening. Thus, by utilizing the second adjustment, the sensitivity or laziness of the damper plate to drafts after the initial opening draft can be determined. For accomplishing the foregoing, I prefer to provide the following structure:

A rectangular frame 34 may be arranged in the center of the damper plate 22, said frame comprising an upper end piece 36, a lower end piece 38 and two comparatively long and substantially vertically arranged side rails 40. The frame 34 may be secured to the damper plate 22 by any suitable means, and serves as a support for the counterweight. It will be seen (Figures 3 and 4) that the upper end piece 36 of the rectangular frame 34 is farther away from the pivotal axis of the damper plate 22, as determined by a line drawn between the trunnions 24, than is the lower end piece 38. This arrangement may be substantially in proportion to the greater length of the top portion 30 of the damper plate 22 over the bottom portion 32 of damper plate 22.

A rod 42, threaded throughout its entire length, may be rotatably arranged within suitable openings in the end pieces 36 and 38. The rod 42 may be rotatably secured in place by means of a collar 44 arranged over the end of the rod 42 projecting out of the frame through the upper end piece 36 and secured on said rod by a set screw 46. Over the other end of the rod 42, projecting outwardly of the frame through the lower end piece 38, the collar 48, preferably being provided with wings for convenience in manual rotation thereof, is arranged. The collars 44 and 48 rotate with rod 42 and serve, by bearing against the end pieces 36 and 38, respectively, to prevent longitudinal movement of rod 42. Rotation of collar 48 and, therefore, of the threaded rod 42 serves to move a counterweight up and down along the threaded rod 42 and thereby determines the relation of the counterweight to the pivotal axis of the damper

plate 22. It will be observed that the threaded rod 42 is arranged obliquely to the surface of the damper plate 22, the upper end of the threaded rod being closer to the damper plate than the lower end thereof.

For movement with the counterweight along rod 42, a travelling member 50 is provided. The travelling member 50 has a body portion 52 with an opening 54 therein, which opening is threaded to receive the threaded rod 42. The travelling member 50 is arranged on the threaded rod 42 with the rod passed through the opening 54 so that one face of its body portion 52 slides on the side rails 40, the side rails 40 thereby serving to prevent the travelling member from rotating with the threaded rod and only permitting longitudinal movement of the travelling member along the rod 42. Two spaced shoulders 58 project from the body portion 52 of the travelling member 50. A shaft 60 is fixedly arranged within openings 62 in the shoulders 58, said shaft 60 forming a pivot for the counterweight supporting lever 64. This lever 64 is provided with an opening 66 at one end thereof through which the shaft 60 passes. The lever 64 is formed in the shape of a yoke 68 towards the portion thereof opposite the opening 66. A cylindrical counterweight 70 is pivotally suspended within the yoke 68 on a shaft 72 secured in openings in the walls of the yoke. It is to be noted that the shaft 72 does not pass through the center of the counterweight 70, but instead is arranged eccentrically near the perimeter thereof.

It will be apparent that means must be provided for holding the counterweight 70 and the counterweight supporting lever 64 at an angle to the damper plate 22 for otherwise the counterweight 70 would pull the counterweight supporting lever 64 about shaft 60 and the counterweight would drop. For this purpose, we prefer to provide a pair of lugs 74 upstanding from the travelling member 50. These lugs support a shaft 76 in suitable openings within the lugs. A threaded rod 78 is pivotally arranged on shaft 76 by means of a suitable opening within said rod 78. The threaded rod 78 is arranged within openings 80 in lugs 82 which lugs are arranged on, and may be formed integrally with, counterweight supporting lever 64. An adjusting nut 84 is arranged over the threaded rod 78 intermediate the lugs 82 and serves to adjust the angular relationship of counterweight supporting lever 64 to the damper plate 22. A winged lock nut 85 is arranged over the end of threaded rod 78 projecting outside of the lugs 82 and cooperates with the adjusting nut 84 in securing the lever 64 in fixed position against accidental slipping. The openings 80 in lugs 82 are preferably oval in outline to allow for the fact that lever 64 and threaded rod 78 are pivoted at different points.

From the foregoing description, it will be apparent that the point at which the initial opening of the damper plate 22 occurs may be selected by turning collar 48 and, therefore, rod 42, to move the travelling member 50 and the counterweight 70 attached thereto upwardly or downwardly. It will be apparent that when the counterweight is moved in a downwardly direction it will take a greater draft intensity to open the damper plate 22 than would be necessary if the counterweight is moved upwardly.

It will also be quite evident that if damper plate 22 opens and moves more and more toward its furthestmost open position the turning mo-

ment exercised by the counterweight 70 in opposition to this opening movement will become less and less, the counterweight moving farther and farther towards a vertical position directly above the pivotal axis of the damper plate 22, thereby gradually decreasing the lever arm of its effective turning moment. Thus, the counterweight will offer less and less effective resistance to further opening of the damper plate 22 as the damper plate 22 moves towards the furthestmost open position. We have thus provided means for maintaining the damper plate sensitive in response to fluctuations in chimney draft after the initial opening draft. This range of sensitivity can be varied by varying the angular relationship of counterweight supporting lever 64 to the damper plate 22. The means for doing this include adjusting nut 84 and wing lock nut 85. It will be obvious that the smaller the angle between counterweight supporting lever 64 and the top portion 30 of damper plate 22, the more sensitive will plate 22 be towards fluctuations in the chimney draft.

As stated hereinbefore, the damper plate 12 opens inwardly. As is well known, explosions of incompletely burned gas frequently occur within fuel burning furnaces. In such case, as hereinbefore pointed out, tremendous pressures may be set up, which, if not relieved, may result in extensive damage either to the furnace or to the breeching or to any damper in the breeching, as our barometric damper. To provide means for relieving the pressure of such explosion, I prefer to provide openings 89 in the damper plate 22 which openings are normally covered by relief gates 90. These gates are pivotally secured to the top of the damper plate 12 by any suitable means such as preferably frictionless hinges 92 being suspended from the top of the damper plate, the lower edges 91 of relief gates 90 preferably overlapping the edges of the damper plate thereadjacent. As stated hereinbefore, since the damper plate, even when closed, is preferably slightly inclined from the vertical, the relief gates 90 are normally closed by gravity and will stay closed even though the damper plate opens up under the influence of a draft induced within the chimney breeching.

When, however, an explosion or large pressure is built up within the furnace, such pressure will cause the damper plate 22 to slam shut against the stop 35 because of the pressures exerted on the damper plate. Such pressure will also blow the relief gates 90 outwardly about their hinges, to thereby relieve the pressure of any gas explosion. The closing of the damper plate 22 will by the inertia of its closing movement in addition tend to cause the relief gates 90 to swing open.

While we have illustrated our damper as provided with two such relief gates, it will be understood that only one or any desired greater number may be used, dependent upon existing conditions. The more relief gates that are used the less will be the resistance of the gates themselves to relief of explosion pressures.

From the foregoing description, it will be apparent that we have provided a barometric damper which can be adjusted for various conditions of operation and whose sensitivity can be selectively adjusted so that the damper will operate within any given range responsive to induced chimney draft.

It will furthermore be apparent that we have provided means in such a damper for attenuat-

ing the effects of the ignition of explosive mixtures within a furnace and for relieving any unusual pressures formed within the furnace or its breeching.

It will furthermore be apparent that we have provided a damper that is simple in construction and operation, comprised of a minimum number of parts, and which is efficient and adaptable in use. Other advantages will appear to those skilled in the art from the foregoing description.

While we have described in specific detail a preferred embodiment of the present invention, it will readily be understood that variations may be made without departing from the spirit of the present invention. It is, therefore, intended that the scope of the invention be determined by the state of the prior art and the appended claims.

We claim:

1. A barometric damper for operative association with a fuel burning furnace comprising a frame for arranging the damper on the furnace breeching in operative association therewith, said frame having an opening therein, a damper plate normally closing said frame opening, pivots arranged on the damper plate at the sides and intermediate the top and bottom edges thereof, said pivots rotatably mounted on the frame, said damper plate in closed position being inclined from the vertical with the top edge thereof toward the furnace breeching; said damper having an opening, a hinge on the damper plate adjacent the top of the damper plate opening, a gate secured to the hinge and normally maintained by gravity to rest against the damper plate to close the opening.

2. A barometric damper for operative association with a fuel burning furnace comprising a frame for arranging the damper on the furnace breeching in operative association therewith, said frame having an opening therein, a damper plate pivotably secured at the sides thereof to the frame and adapted to normally close the frame opening and to pivot in one direction into open position in response to chimney draft within the furnace breeching, said damper plate being inclined from the vertical with its upper end inclined in the direction of its motion under influence of the furnace draft, said damper plate having an opening therein, a pressure relief gate pivotably secured at the top thereof to the damper plate and arranged to normally close the damper plate opening, said relief gate under pressure within the furnace breeching being adapted to pivot away from the damper plate in a direction opposite to the direction of opening of the damper plate under influence of furnace draft.

3. A barometric damper for association with a heating furnace comprising a frame for arranging the damper on the furnace breeching in operative association therewith, said frame having an opening therein, a damper plate pivotably secured at the side thereof to the frame and adapted to normally close the frame opening and to pivot into open position in response to chimney draft within the chimney breeching, the portion of the damper plate extending above its pivotal axis being larger than the portion extending below, said damper plate having an opening therein, a pressure relief gate swingably arranged on the damper plate and adapted to normally close the damper plate opening, said gate being adapted to swing away from the damper plate under pressure within the chimney breeching.

4. A barometric damper for operative associa-

tion with a fuel burning furnace comprising a frame, a damper plate pivotably secured to the frame, said damper plate arranged to pivot in one direction into open position under influence of chimney draft, said damper plate having an opening therein, a pressure relief gate pivotably secured to the damper plate and arranged over the damper plate opening to normally close said opening, said pressure relief gate being adapted to swing open under pressure within the furnace about its pivot away from the damper plate in a direction opposed to the direction in which the damper plate is arranged to pivot into open position under influence of chimney draft.

5. A barometric damper for operative association with a fuel burning furnace comprising a frame for arranging the damper on the chimney breeching in operative association therewith, said frame having an opening therein, a damper plate pivotably secured at the sides thereof to the frame and adapted to normally close the frame opening, the portion of the damper plate extending above the pivotal axis being larger than the portion extending below the pivotal axis, the portion of said damper plate above the pivotal axis being adapted to swing inwardly within the chimney breeching under influence of chimney draft, said damper plate having an opening therein, a pressure relief gate pivotably secured at the top thereof to the top of the damper plate and arranged to normally cover the damper plate opening, said pressure relief gate arranged to normally gravitate against the damper plate to cover the opening therein, said pressure relief gate being adapted upon actuation by pressure within the chimney breeching to swing away from the damper plate into open position in a direction opposite to that in which the upper portion of the damper plate moves in response to chimney draft.

6. A barometric damper for operative association with a heating furnace comprising a frame for securing the damper in operative association with the furnace, a damper plate swingably arranged on the frame, said damper plate being swingable into open position under influence of chimney draft, said damper plate having an opening therein, a pressure relief gate pivotably secured to the damper plate, said relief gate arranged over the damper plate and normally gravitating against the damper plate to close said opening, said pressure relief gate under influence of pressure within the furnace being swingable about its pivot away from the damper plate.

7. A barometric damper for association with a heating furnace comprising a frame for arranging the damper on the furnace breeching in operative association therewith, said frame having an opening therein, a damper plate pivotably secured to the frame and adapted to normally close the frame opening and to pivot into open position in response to furnace draft within the chimney breeching, a counterweight supporting arm pivotally secured at one end thereof to the damper plate, a counterweight hung to the other end of the counterweight supporting arm, a threaded rod pivotably secured at one end thereof to the damper plate, a lug projecting from the counterweight supporting lever and having an opening therein, the threaded rod passing through said opening and an adjusting nut arranged on the threaded rod and adapted to adjust the angular relation of the counterweight supporting lever to the damper plate and means

for moving the counterweight supporting arm transverse to the pivotal axis of the damper plate.

8. A barometric damper for association with a heating furnace comprising a frame for arranging the damper on the furnace breeching in operative association therewith, said frame having an opening therein, a damper plate pivotably secured at the sides thereof to the frame and adapted to normally close the frame opening and to pivot into open position in response to furnace draft within the furnace breeching, a threaded rod rotably arranged on the damper plate, transverse to the pivotal axis of the damper plate, a movable member having an internally threaded opening therein, the threaded rod being arranged within the opening in the movable member and engaging the threads thereof, said movable member being adapted to move longitudinally along the rod upon rotation of said rod, a counterweight supporting lever pivotally secured at one end thereof to the movable member, a counterweight hung to the other end of the counterweight supporting lever, a threaded arm pivoted on the movable member, a lug projecting from the counterweight supporting lever having an

opening therein through which the threaded arm is inserted and an adjusting nut arranged on said arm abutting the lug and adapted to secure the arm in fixed relation to the lug to thereby determine the angular relationship of the counterweight supporting lever to the movable member.

9. A barometric damper for association with a heating furnace comprising a frame for arranging the damper on the furnace breeching in operative association therewith, said frame having an opening therein, a damper plate pivotably secured to the frame and adapted to normally close the frame opening and to pivot into open position in response to furnace draft within the furnace breeching, a movable member arranged on the damper plate, means for moving the movable member transverse to the pivotal axis of the damper plate, a counterweight supporting lever pivotally secured at one end thereof to the movable member, a counterweight secured to the other end of the counterweight supporting lever, and means for pivotally adjusting the angular position of the counterweight supporting lever relative to the damper plate.

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