Nov. 9, 1965 R. S. FARR 3,216,343

EXHAUST CAP

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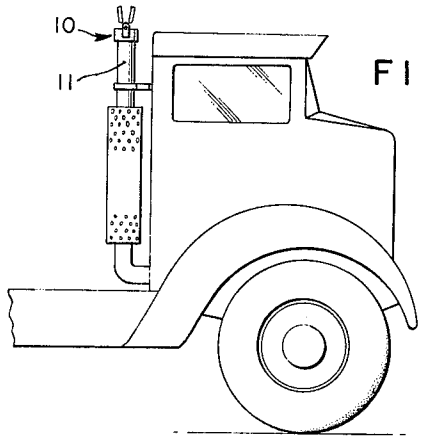


FIG. 1.

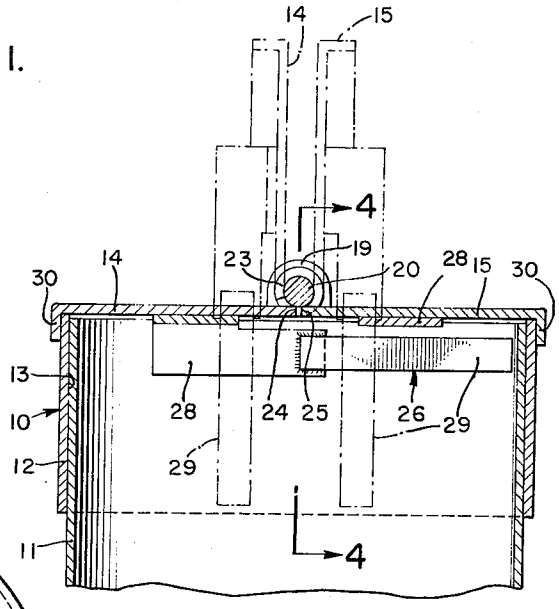


FIG. 3.

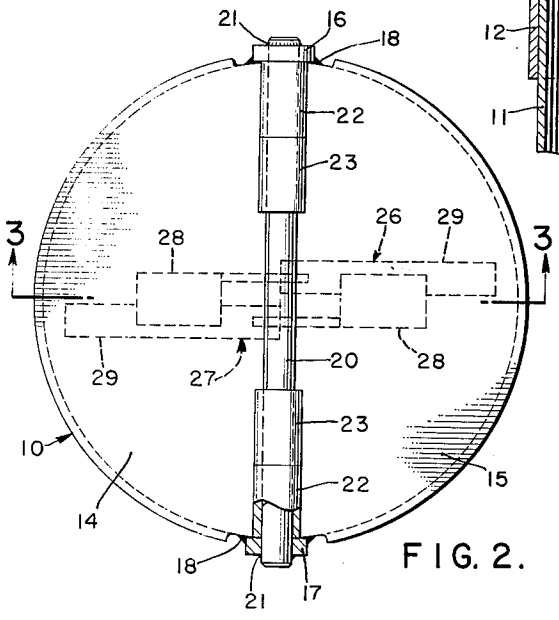


FIG. 2.

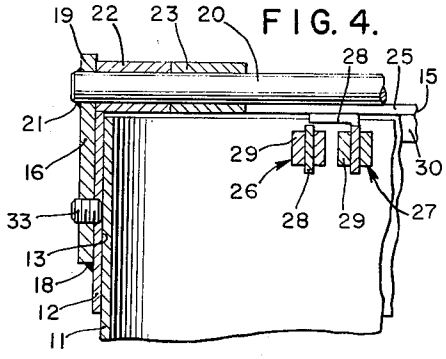


FIG. 4.

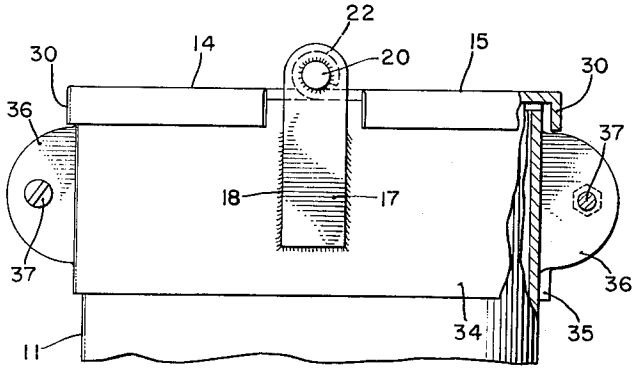


FIG. 6.

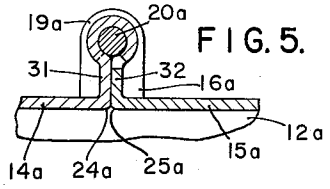


FIG. 5.

INVENTOR.
RICHARD S. FARR

BY Lyon & Lyon

ATTORNEYS.

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Fig. 8.

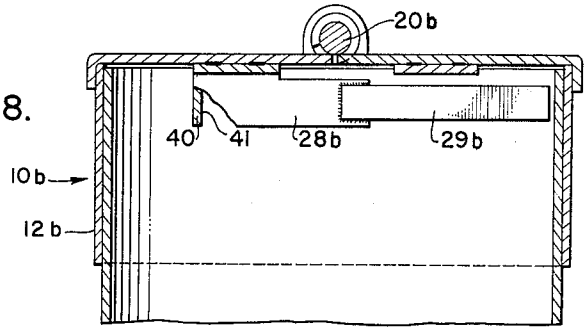


Fig. 7.

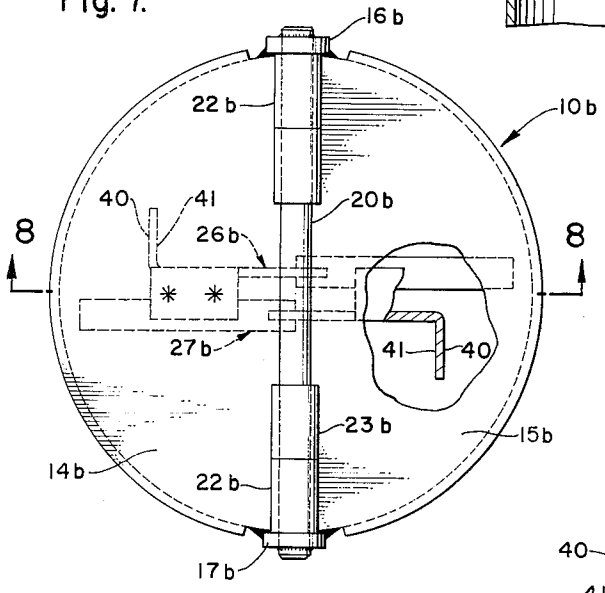


Fig. 9.

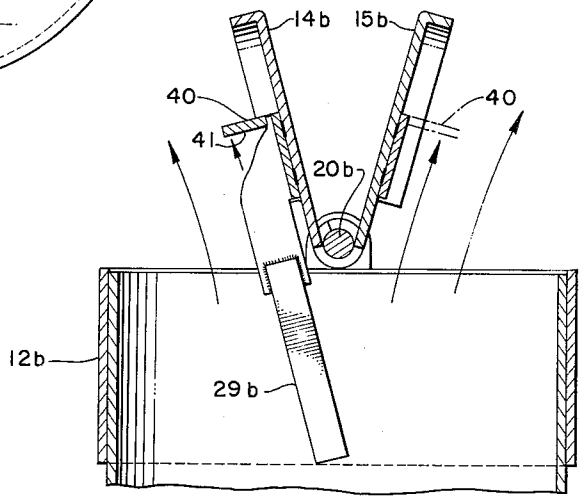
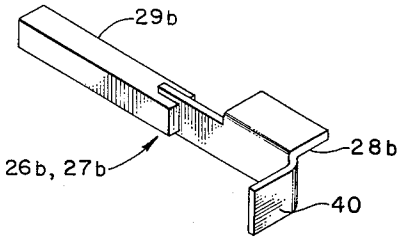


Fig. 10.



INVENTOR.
RICHARD S. FARR

BY Lyon & Lyon

ATTORNEYS

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EXHAUST CAP

Richard S. Farr, Los Angeles, Calif., assignor to Farr Company, El Segundo, Calif., a corporation of California

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8 Claims. (Cl. 98—59)

This is a continuation-in-part of application Serial No. 120,067 filed June 27, 1961 and now abandoned.

This invention relates to closures for exhaust pipes and, in particular, is directed to a cap which may be installed on the upstanding end of a vertical exhaust pipe.

It has generally been found advantageous to close the open end of an internal combustion engine exhaust pipe for various reasons. For example, in many installations such as tractors or large trucks, the exhaust pipes are mounted in a vertical position with their open ends projecting upwardly. Without any cap on such an upwardly facing open end rain, snow or foreign objects may enter the exhaust pipe with resultant possible damage to the engine or exhaust system. This hazard is particularly a problem when the engine is not running since, for instance, any rain entering the exhaust pipe while the engine is running would be vaporized immediately and exhausted without appreciable damage to the system.

For proper protection an exhaust pipe cap should close immediately upon stopping of the engine but for operation it should open immediately upon starting of the engine. Further, it is preferable that the cap open and close without any special or additional effort on the part of the operator. Also, the exhaust cap should offer a very minimum of resistance to the flow of exhaust gases while the engine is running since any increase in resistance results in a decrease in efficiency of the engine.

In the common type of exhaust pipe cap a circular cover fits over the end of the pipe and is hinged at the edge of the pipe for swinging upward to an open position when gases are exhausted from the pipe. A counterweight is usually attached to the cover and projects outwardly from the exhaust pipe beyond the axis of the hinge so that the weight of the cover is counterbalanced for ease of opening. With such a construction the amount of force required from the exhaust gases to open the cover is greater than the force required to keep the cover open. However, the forces developed by the exhaust are greater when the engine is running fast than when it is idling and therefore when the engine is idling the cover tends to close. This has been found objectionable with conventional covers since the cover actually vacilates between the open and closed positions when the engine is idling thereby causing a fluctuation in the back pressure on the exhaust system as well as a clattering noise. This repeated opening and closing also objectionably increases the wear on the hinge.

In some intake air filtering systems, the exhaust manifolding is modified to form an aspirator whereby the exhaust gases act to draw or bleed air and dirt out of the air filter. For proper operation the flow of exhaust gases and back pressure on the system must be relatively uniform. With a common type of exhaust pipe cap this is not possible when the engine is idling.

Accordingly, it is a principal object of this invention to provide an improved exhaust pipe cap for the upstanding open end of a vertical exhaust pipe of the type wherein the cap is normally closed and may be opened by the mere flow of exhaust gases out of the exhaust pipe.

Another object of this invention is to provide an exhaust cap for a vertical exhaust pipe wherein two semi-circular cover members are pivoted about an axis across the top of the cap whereby the members each swing upwardly and inwardly to an open position upon the flow of exhaust gases out of the pipe.

A further object of this invention is to provide an exhaust cap for a vertical exhaust pipe wherein the cover is normally closed, may be opened with a minimum of exhaust gas flow, and requires a very minimum flow of exhaust gases to maintain the cover in a full open position.

Another and more detailed object is to provide an exhaust cap for a vertical exhaust pipe wherein two semi-circular members close the top of the exhaust pipe and are pivoted on a diametric edge to swing upwardly and inwardly to an open position, and are provided with counterweights for promoting ease of opening but insuring closing upon the stopping of the flow of exhaust gases.

Still another object of this invention is to provide a pivoted and counterbalanced type exhaust cap for a vertical exhaust pipe wherein the counterbalance weights are positioned in the stream of exhaust gases when the cap is open to produce an aerodynamic drag on the weights tending to maintain the cap in open position.

A still further object of this invention is to provide a pivoted type exhaust cap with a surface projecting into the stream of exhaust gases when the cap is in open position for assisting in maintaining the cap open, particularly under low rates of exhaust gas flow, without imposing a substantial restriction on exhaust gas flow.

Other and more detailed objects and advantages of this invention will appear from the following description and the accompanying drawings.

In the drawings:

FIGURE 1 is an elevation view showing the device of this invention installed on a vertical exhaust pipe of a truck.

FIGURE 2 is a plan view of the device of this invention with portions sectioned for clarity.

FIGURE 3 is a sectional elevation view taken substantially on the line **3—3** and showing the open position of the device in phantom lines.

FIGURE 4 is a fragmentary sectional elevation view taken substantially on the line **4—4** of FIGURE 3.

FIGURE 5 is a fragmentary sectional elevation view similar to FIGURE 3 showing a modified form of hinge construction of this invention.

FIGURE 6 is an elevation view similar to FIGURE 3 illustrating a modified means for clamping the device to an exhaust pipe.

FIGURE 7 is a plan view of a modified form of the device of this invention.

FIGURE 8 is a sectional elevation of the modified form of FIGURE 7 taken substantially on the line **8—8** of FIGURE 7.

FIGURE 9 is a view similar to FIGURE 8 illustrating the device in open position under a very low rate of exhaust gas flow.

FIGURE 10 is a perspective view of a counterweight assembly that is attached to each of the two cover members of the modified form of device shown in FIGURES 7, 8 and 9.

Referring now more particularly to FIGURES 1–4, the exhaust cap assembly, generally designated **10**, is installed

on the upper end of the exhaust pipe **11** by any convenient means, such as hereinafter described. The assembly **10** is comprised of a cylindrical housing **12** having an inner surface **13** fitting the external surface of the exhaust pipe **11** and a pair of semi-circular cover members **14** and **15** pivotally mounted on the upper end of the housing **12**.

In order to provide a pivotal support for the cover members **14** and **15**, a pair of tabs **16** and **17** are mounted on the exterior of the housing **12** by any convenient means such as weld **18**. The tabs **16** and **17** are circumferentially equally spaced and have upper portions **19** projecting axially beyond the upper end of the housing **12** to rigidly support a shaft **20**. The shaft **20** is fixedly mounted in the tabs **16** and **17** such as by weld **21** and is so oriented as to be perpendicular to and pass through the axis of the cylindrical housing **12**.

The cover members **14** and **15** are each provided with a pair of hinge elements **22** and **23** along their diametric edges **24** and **25**, respectively, for encircling the shaft **20**.

In order to promote the ease of opening of the cover members, counterweight assemblies **26** and **27** are mounted on the lower side of the cover members **14** and **15**, respectively. The counterweight assemblies each are comprised of an element **28** fixed to the underside of the cover member and extending toward the underside of the other cover member and a weight **29** fixed to the element **28** and positioned directly beneath the other cover member. As can best be seen in FIGURES 2 and 4, these counterweight assemblies **26** and **27** are offset from each other to avoid interference therebetween upon opening and closing of the cover members.

Each of the cover members may be provided with a downwardly extending lip portion **30** for rigidity and maximum effectiveness against the intrusion of rain, snow or foreign objects into the exhaust pipe.

As illustrated by the phantom lines in FIGURE 3, when exhaust gases are discharged from the exhaust pipe **11**, the cover members **14** and **15** pivot about the shaft **20** and assume a vertical position to permit escape of the gases. When in a vertical position, each of the cover members and their attached counterweight assemblies are totally on one side of the axis of the shaft **20**, thereby tending to pivot about the shaft **20** to close against the upper end of the housing **12** when the exhausting of the gases is discontinued. The counterweight assemblies and semi-circular cover members are each of a magnitude of weight and so oriented relative to the axis of shaft **20** as to cause the cover members **14** and **15** to be in a normally closed position against the upper end of the housing **12** when the axis of that housing is in a vertical position. The weight of the cover members are sufficiently counterbalanced by weights **29** to promote ease of opening of the cover members when gases are being exhausted from pipe **11**.

The opening of the cover members **14** and **15** by the flow of exhaust gases causes the counterweights **29** to be positioned within the stream of upwardly flowing gases thereby producing an aerodynamic drag force on the counterweights in an upward direction. This upwardly drag force on each counterweight is in a direction tending to open the attached cover member or maintain the cover member in open position. Or, in other words, this upward aerodynamic drag force opposes and tends to counteract the gravity force urging the cover member in a closed direction by reason of the cover member and counterweight being on the same side of the pivot shaft **20**. Thus, it has been found that the cover members **14** and **15** will be maintained in open position under low rates of exhaust gas flow, such as under engine idling conditions, but will close when gas flow discontinues. Moreover, the cover members open and close smoothly due to the aerodynamic effects thereby avoiding abrupt changes in back pressure or clattering caused by the cover members.

The modified form of my invention shown in FIGURE 5 is similar to the heretofore described form except that the tabs **16***a* have longer projecting portions **19***a* and therefore the shaft **20***a* is located at a greater axial distance from the end of the cylindrical housing **12***a*. In addition, upwardly projecting lip portions **31** and **32** are provided on the cover members **14***a* and **15***a* along their diametric edges **24***a* and **25***a*, all respectively. These upstanding lips **31** and **32** further inhibit any intrusion of rain, snow or foreign objects into the exhaust pipe **11**.

The exhaust cap assembly **10** is removably secured to the exhaust pipe **11** by any convenient means such as by a set screw **33** threadedly received in the housing **12** and tab **16** and engaging the outer surface of the exhaust pipe **11**. In the modified form of my invention, shown in FIGURE 6, the cylindrical housing of the exhaust cap assembly **10** is constructed of two halves **34** and **35** each having a pair of radially extending projections **36** with holes therethrough and a pair of bolt assemblies **37** extended through such holes in the projections to clamp the two halves onto the exterior of the exhaust pipe **11**. In all other respects the modified form of this invention shown in FIGURE 6 may be identical to either the preferred form illustrated in FIGURES 2, 3 and 4 or the modified hinge form shown in FIGURE 5.

Referring now to the modified form of my invention shown in FIGURES 7–10, the general construction of the exhaust cap assembly, generally designated **10***b*, may be substantially similar to exhaust cap assembly **10** or the modifications illustrated in FIGURES 5 and 6. Tabs **16***b* and **17***b* are mounted on the cylindrical housing **12***b* and extend upwardly to support the diametric shaft **20***b*. The semi-cylindrical cover members **14***b* and **15***b* are pivotally mounted on shaft **20***b* by hinge elements **22***b* and **23***b*. A pair of aerodynamic counterweight assemblies, generally designated **26***b* and **27***b*, are mounted on the underside of cover members **14***b* and **15***b*, respectively. Each counterweight assembly includes an element **28***b* secured to the cover member and a weight **29***b* secured to element **28***b*. As with exhaust cap assembly **10**, the aerodynamic counterweight assemblies **26***b* and **27***b* are positioned below the cover members and below the pivot shaft **20***b* and the weights **29***b* of each extend below the other cover member. Each element **28***b* is provided with an aerodynamic tab **40** positioned to extend downwardly from the underside of the cover member and approximately parallel to the shaft **20***b*. Thus, as exhaust gases escape through the open or partially open cover members **14***b* and **15***b* the gases confront a surface **41** of each tab **40** thereby producing an aerodynamic force on each cover member tending to hold the cover member open. The tabs **40** are spaced from pivot shaft **20***b* as shown so that the tabs **40** are above the top or open end of the cylindrical housing **12***b* when the cover members **14***b* and **15***b* are open thereby causing negligible back pressure on the exhaust gases and yet keeping the cover members open. In this embodiment, as in assembly **10**, the weights are positioned in the stream of exhaust gases to produce an aerodynamic drag tending to maintain the cover members in open position.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details herein set forth or to the details illustrated in the the drawings, but my invention is of the full scope of the appended claims.

I claim:

1. In a cap for the upstanding open end of a vertical exhaust pipe, the combination of: a cylindrical housing having upper and lower open ends, the said lower end for mounting on the open end of the exhaust pipe, a pair of tabs mounted on the exterior of said housing, said tabs being diametrically spaced and having a portion projecting axially beyond said upper end, a shaft mounted on said projecting portion of the

tabs perpendicular to the axis of the housing, a pair of semi-circular members fitted over said upper end of the housing, each said member having a diametric edge, said edges being adjacent each other and parallel to said shaft, hinge means along each of said edges projecting upwardly for pivotally mounting said members on said shaft, and a counterweight means on each member within said housing and extending past the said diametric edge of that member whereby the members are normally substantially horizontal for closing the upper end of the housing and may be pivoted to a vertical or open position.

2. In a cap for the upstanding open end of a vertical exhaust pipe, the combination of: a cylindrical housing having upper and lower open ends, the said lower end for encircling the open end of the exhaust pipe, means for clamping said housing on the exhaust pipe, a pair of tabs mounted on the exterior of said housing, said tabs being diametrically spaced and having a portion projecting upward beyond said upper end, a shaft mounted on said projecting portion of the tabs perpendicular to the axis of the housing, a pair of semi-circular members fitted over the said upper end of the housing, each said member having a diametric edge with an upwardly extending lip, said edges being adjacent each other and parallel to said shaft, hinge means along each of said edges projecting upwardly from said upwardly extending lips for pivotally mounting said members on said shaft, and a counterweight means mounted on each member within said housing and extending past the said diametric edge of that member whereby the members are normally substantially horizontal for closing the upper end of the housing and may be pivoted to a vertical or open position.

3. In a cap for the upstanding open end of a vertical exhaust pipe, the combination of: a cylindrical housing having upper and lower open ends, the said lower end for mounting on the open end of the exhaust pipe, a pair of tabs mounted on the exterior of said housing, said tabs being diametrically spaced and having a portion projecting upward beyond said upper end, a shaft mounted on said projecting portion of the tabs perpendicular to the axis of the housing, a pair of semi-circular members fitted over said upper end of the housing, downwardly projecting lips around the periphery of each member outside of the said housing, each said member having a diametric edge with an upwardly projecting lip, said edges being adjacent each other and parallel to said shaft, hinge means along each of said edges projecting upwardly for pivotally mounting said members on said shaft, and a counterweight means mounted on each member and extending within said housing past the said diametric edge of that member whereby the members are normally substantially horizontal closing the upper end of the housing and may be pivoted to a vertical or open position.

4. In a closure for the upstanding open end of a vertical exhaust pipe, the combination of: a pair of semi-circular members cooperating to form a circular cover over the open end of the exhaust pipe, each member having a diametric edge adjacent such edge of the other member, means pivotally mounting said members on the exhaust pipe for pivoting about an axis substantially parallel to and above the said diametric edges and counterweight means mounted on each said member having a weight positioned for nearly balancing said member when said member is in a closed position and for being positioned in the upwardly flowing exhaust gas stream when said member is in an open position to cause an aerodynamic drag force on said weight tending to maintain said member in open position.

5. In a closure for the upstanding open end of a vertical exhaust pipe, the combination of: a pair of semi-circular members cooperating to form a circular cover over the open end of the exhaust pipe, each member

having a diametric edge adjacent such edge of the other member, means pivotally mounting said members on the exhaust pipe for pivoting about an axis substantially parallel to and above the said diametric edges, counterweight means mounted on each said member having a weight positioned for nearly balancing said member when said member is in a closed position and for being positioned in the upwardly flowing exhaust gas stream when said member is in an open position to cause an aerodynamic drag force on said weight tending to maintain said member in open position, and means on each said semicircular member having a surface extending downwardly from the underside of the member and positioned relatively parallel to said axis for confronting exhausting gases to produce an aerodynamic force tending to open said member.

6. In a closure for the upstanding open end of a vertical exhaust pipe, the combination of: a pair of semi-circular members cooperating to form a circular cover over the open end of the exhaust pipe, each member having a diametric edge adjacent such edge of the other member, means pivotally mounting said members on the exhaust pipe for pivoting about an axis substantially parallel to and above the said diametric edges, counterweight means mounted on each said member having a weight positioned for nearly balancing said member when said member is in a closed position and for being positioned in the upwardly flowing exhaust gas stream when said member is in an open position to cause an aerodynamic drag force on said weight tending to maintain said member in open position, and means on each said semi-circular member having a surface extending downwardly from the underside of the member and positioned relatively parallel to said axis for confronting exhausting gases to produce an aerodynamic force tending to open said member, said surface being positioned a substantial radial distance from said axis and next to said member for causing said surface to be substantially above the open end of the exhaust pipe when said member is in the open position.

7. In a closure for the upstanding open end of a vertical exhaust pipe, the combination of: a pair of semi-circular members cooperating to form a circular cover over the open end of the exhaust pipe, each member having a diametric edge adjacent such edge of the other member, means pivotally mounting said members on the exhaust pipe for pivoting about an axis substantially parallel to the said diametric edges, counterweight means mounted on each said member for nearly balancing said member in the closed position and producing substantial force tending to close said member in the open position, and said counterweight means having means positioned in the stream of exhaust gases when in open position to produce aerodynamic forces tending to maintain said members in open position.

8. In a closure for the upstanding open end of a vertical exhaust pipe, the combination of: a pair of semi-circular members cooperating to form a circular cover over the open end of the exhaust pipe, each member having a diametric edge adjacent such edge of the other member, means pivotally mounting said members on the exhaust pipe for pivoting about an axis substantially parallel to and above the said diametric edges, an element mounted on the underside of each said member and having a tab positioned with a surface thereof extending downwardly and positioned relatively parallel to said axis for confronting gases exhausted past that said member, and an elongated weight secured to each said element and extending laterally beyond said axis for nearly balancing said member, said weight and said surface being urged upwardly by said exhaust gases for maintaining said member in the open position.

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ROBERT A. O'LEARY, *Primary Examiner.*