Nov. 16, 1954 C. R. TAYLOR 2,694,358

EXHAUST PIPE COVER

Filed Aug. 1, 1950

Fig. 1.

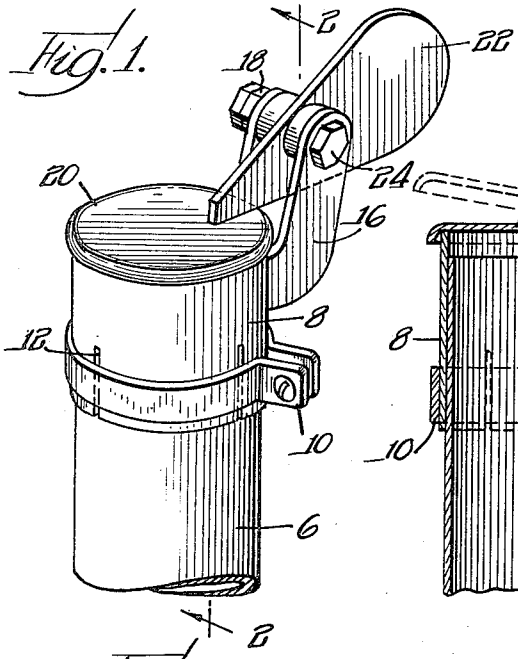


Fig. 2.

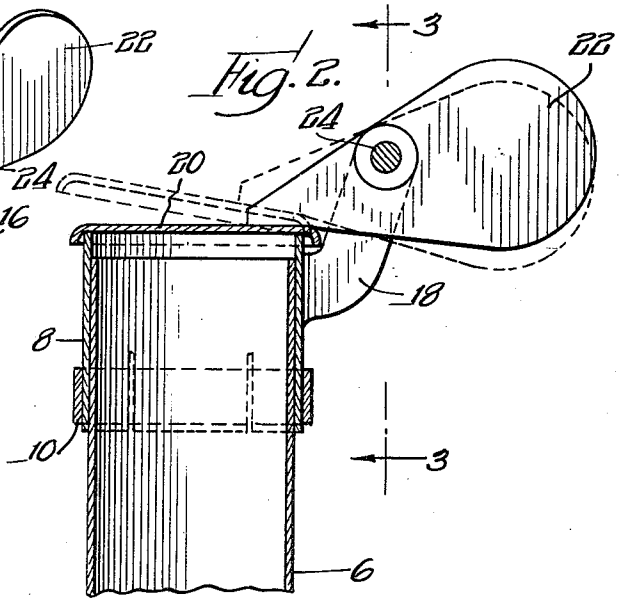


Fig. 3.

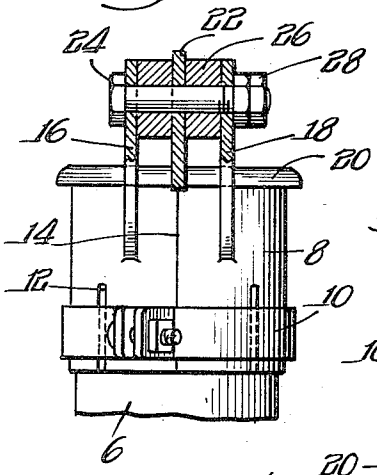


Fig. 4.

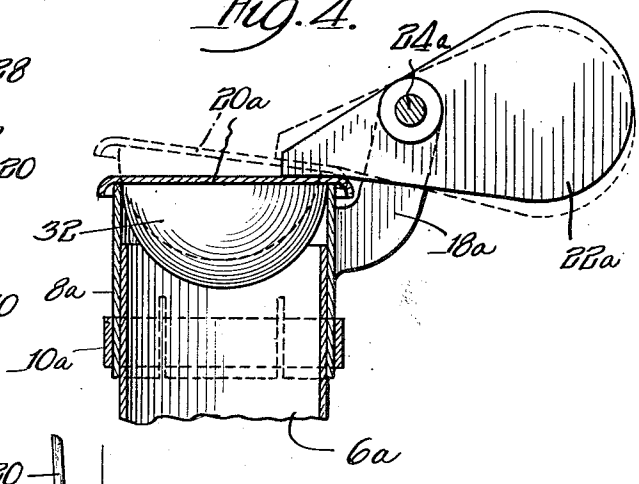
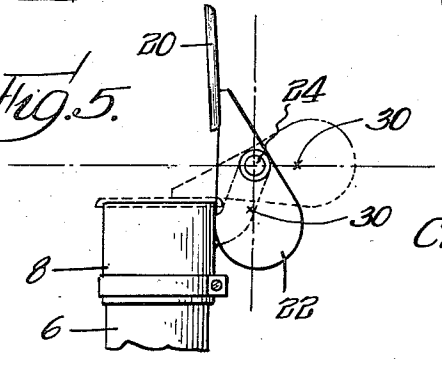


Fig. 5.



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EXHAUST PIPE COVER

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4 Claims. (Cl. 98—59)

This invention is concerned with a closure structure for an upright exhaust on a tractor or the like, and is particularly concerned with a cap which will automatically open when the engine is running and which will automatically close when the engine is shut off.

Many vehicles, of which a farm tractor is a prime example, are powered by internal combustion engines and have upright exhaust pipes extending above the driver to discharge exhaust gases into the atmosphere. Often such vehicles are left in the open, and rain or snow falls into the open exhaust pipe. This causes the exhaust pipe and muffler, if there is one, to rust internally and seriously shortens their lives. Products of combustion may combine with the rain water to form corrosive liquids to speed the damage of the inside of the exhaust pipe and muffler and may even damage the engine. It has been recognized that a protective cover over the top of the exhaust pipe, which could be closed when the motor is not running and opened when the motor is running, would protect the interior of the exhaust pipe and muffler. A cap could be produced utilizing a mechanical linkage to open and close the cap, but there is ever present the danger of forgetfulness on the part of the operator or failure of the linkage. If the cap should remain open, its purpose would not be fulfilled, and should it be left closed, back pressure would be built up which would stall the engine or cause damage somewhere in the exhaust system.

It has been proposed that an exhaust pipe and cover should be produced which would be opened automatically by pressure of the exhaust gases on the under side of the cap. To prevent building up of excessive back pressure and to prevent fluttering and other erratic operation, it has been found necessary to counterbalance the cap or cover member. Prior devices of this sort with which I am familiar utilize a pivoted cap or cover member counterbalanced by a weight disposed on the opposite side of the pivot from the cap. Several defects have been prevalent in such devices. When the engine runs slowly, there is little exhaust pressure and the caps of previous devices have been opened only part way as their greatest restoring force has been present when the cap has been nearly closed. This unduly restricts the flow of exhaust gases. Furthermore, the restoring force is reduced as the cap approaches a fully opened position and is substantially non-existent when the cap is fully opened so that it often will fail to close properly.

Farm tractors on which exhaust pipe covers find great use are often used in hilly country. Prior caps have often failed to close when used on a tractor going uphill, and in fact tend to open farther as the centers of gravity of the cap and balancing arm may pass beyond a vertical projection through the pivot point. Prior caps have also failed to close when going downhill at a very steep angle as the cap and balance arm tend to balance in a substantially horizontal position. When the caps have been tipped sideways, the pivots have tended to bind to restrict the movement of the caps.

Still further difficulty which has been present in exhaust pressure opening caps has been apparent when the engine has been idling. When an engine idles, the exhaust issues from the exhaust pipe or stack in discrete pressure bursts rather than in a substantially constant stream. This has caused prior caps to bounce up and down and rattle against the top of the exhaust pipe or other abutment in a most unpleasant fashion.

Among the important objects of this invention is the

provision of a closure member for the top of an upright exhaust pipe, said closure member opening under exhaust pressure and having a restoring force which is least when in nearly closed position and which is greatest in fully opened position.

Another object of this invention is the provision of an exhaust pipe cap which will close satisfactorily when the tractor or other vehicle on which it is used is going uphill at an angle of as much as 35°.

A further object of this invention is the provision of an exhaust pipe cap which will close when the vehicle on which it is used is going downhill at an angle of as much as 35°.

Yet another object of this invention is the provision of an exhaust pipe cap which will move freely about its pivot to open and close without binding when the vehicle on which it is used is tipped sideways.

Yet another object of this invention is the provision of an exhaust pipe cap opening under exhaust pressure which will not rattle and bang against abutting surfaces when the engine is idling.

Several of my objects are carried out by the provision of a cap secured to a pivoted counterbalancing arm which does not quite counterbalance the cap. The centers of gravity of the cap and arm are arranged relative to the pivot in such a manner that the counterbalancing effect of the arm becomes less as the cap is opened and becomes substantially zero when the cap is in fully opened position. When the vehicle on which the cap is used is going uphill, the center of gravity of the counterbalancing arm passes beyond a vertical line through the pivot so that the effect of the arm is in a direction opposite to its normal effect and provides a restoring force when the cap is opened so that the cap will close satisfactorily. The pivot is prevented from binding by the provision of an elongated support and bearing arranged transversely of the closure structure to preclude lateral tilting of the cap relative to the exhaust pipe on which it is used.

The cap is prevented from rattling when the engine is idling by the provision of a depending hemisphere on the bottom of the cap which causes the cap to open farther at low exhaust pressures to provide an escapement area sufficient to exhaust the gases.

Other and further objects and advantages of the present invention as well as constructional details embodying the foregoing general description will be understood by an inspection of the following description when taken in conjunction with the accompanying drawings in which:

Fig. 1 is a perspective view of a preferred form of my exhaust pipe cap in place on top of an upright exhaust pipe;

Fig. 2 is a longitudinal sectional view taken along the line 2—2 in Fig. 1;

Fig. 3 is a view partially in section taken along the line 3—3 in Fig. 2;

Fig. 4 is a view similar to Fig. 2 showing a modified form of my invention; and

Fig. 5 is a schematic view on a reduced scale illustrating the principles of my invention.

In Fig. 1 an upright exhaust pipe 6, as on a farm tractor, has a tubular member 8 comprising the mounting structure of my invention secured to it by means such as a C-clamp 10. The lower portion of the member 8 is preferably slotted at spaced intervals as at 12 to provide resiliency so that the tubular member may be secured against the exhaust pipe. The tubular member may be seamless or it may be a piece of sheet metal folded into a cylinder and secured as by welding along the juncture 14. A pair of upstanding ears 16 and 18 are secured to the tubular member 8 by means such as welding.

A closure member or cap 20 comprising a substantially flat circular plate having a depending peripheral flange fits atop the tubular member 8 with the depending flange extending downward beyond the top of this member. A counterbalancing arm 22, which in the present example is made of sheet material and is substantially tear drop in shape, is secured to the top of the cap as by welding, and is disposed radially relative to the cap. The counterbalancing arm is pivotally secured in the bracket

formed by the upstanding ears **16** and **18** by means of a bolt **24** passing through the ears and the counterbalancing arm **22**. Lateral tilting of the cap **20** relative to the ears is prevented by an elongated bushing **26** which fits over the bolt **24** and may be formed of two pieces, as shown, and welded to the counterbalancing arm or may be a single piece extending through the arm. The bolt **24** is secured in position by a nut **28** threaded on its free end. I have found the use of the nut to be far superior to a cotter pin, as the ears **16, 18** can be drawn somewhat together by threading the nut on the bolt, and the space between the ears need not be held to a close tolerance when welding them in position.

The position of the pivotal connection on the counterbalancing arm relative to the centers of gravity of the cap and arm is of utmost importance, as may be seen in Fig. 5 wherein my invention is illustrated somewhat schematically, and the center of gravity of the arm is marked with a small cross **30**. The center of gravity of the arm as marked by the cross **30** is not sufficiently away from the pivot point to exactly counterbalance the cap when the cap is in closed position, as indicated in dashed lines in Fig. 5. The cap and arm thus have a tendency to rotate counterclockwise, as shown in this figure, to maintain the cap in closed position when no exhaust pressure is present beneath the cap. The center of gravity **30** may be seen to lie substantially in a horizontal line through the pivot point when the cap is in closed position so that the weight of the pivot arm acts perpendicular to the radius arm between the pivot point and center of gravity to provide the greatest possible counterbalancing effect. When the engine discharging exhaust gases through the exhaust pipe **6** is started, the pressure of the gases builds up a force against the under side of the cap **20**. As the counterbalancing arm very nearly counterbalances the cap, this force immediately raises the cap and causes the cap and arm to pivot about the bolt **24**. The center of gravity **30** of the arm much more nearly approaches a vertical line through the pivot point than does the center of gravity of the cap so that the counterbalancing arm loses much of its force. When the cap is in fully opened position, the bottom of the arm **22** strikes against the tubular member **8** between the ears **16** and **18** to prevent further movement. In this position, shown in full lines in Fig. 5, the center of gravity **30** may lie on or slightly beyond a vertical line through the pivot point so that it exerts no pivotal force whatsoever. The cap may be seen to lie to the left of this vertical line, as it normally does at all times so that its weight provides a restoring force. As this weight is not counterbalanced, the restoring force in this position is greater than in any other position so that the cap has no tendency to stick in opened position as prior caps have.

If the cap is mounted on the exhaust pipe of a tractor, which is pointed to the left in Fig. 5, this being the preferred mounting position, it may be ascertained by inspection that the cap will close satisfactorily when the tractor is proceeding uphill when the motor is shut off. It has been found in actual practice that the tractor and cap may be tilted uphill as much as 35° and the cap will still close. This is due to the fact that as the tractor is pointed uphill the center of gravity **30** passes beyond a vertical line through the pivot point and acts as a restoring force rather than as a counterbalancing force. Eventually the center of gravity of the cap **20** will pass to the right of this vertical line, and its effect due to its being spaced a greater distance from the pivot point will overcome that of the arm when the closure structure is tilted at an angle substantially greater than 35° so that the cap will not close. Conditions under which any vehicle would be tilted to such a degree are practically non-existent, and my cap will close when the vehicle is running up any slope which it may practically encounter.

As mentioned previously, the arm **22** does not completely counterbalance the cap **20** so that when the cap is in closed position there is a counterclockwise pivotal force as may be seen in Fig. 5. If the tractor or other vehicle on which the cap is used is tilted downhill to the left, the center of gravity of the cap approaches a vertical line through and below the pivot point more rapidly than does the center of gravity **30** approach the vertical line through and above the pivot point so that when the vehicle and structure have been tilted beyond a certain point, which in practice has been found to be 35° or more, the arm **22** will exert a slightly greater pivotal force than will the cap, and the cap will not close entirely. This is far superior to prior caps, however, which have been conventionally counterbalanced and have refused to close when the tractor has been tilted downhill more than a few degrees.

As noted heretofore, when an engine is idling, the exhaust comes in discrete bursts and causes a closure cap to bounce up and down with an unpleasant rattle. In Fig. 4 I have shown a structure which ameliorates this condition. Most of the structure is identical with that heretofore disclosed and is numbered similarly with the addition of the subscript *"a."* The modification consists of a hemisphere **32** of substantially the same diameter as the inner diameter of the tubular member **8***a*, and the additional weight of the hemisphere may require shifting the pivot slightly to the left on the arm **22***a*. It is not necessary that the hemisphere be a true hemisphere as it may be flattened somewhat to provide greater clearance for exhaust gases so as not to introduce unwarranted back pressure and to provide clearance of the tubular member **8***a* when opening and closing. The hemisphere **32** is preferably formed of sheet metal and is secured to the bottom of the cap **20***a* by any desirable means such as welding. The cap **20** and arm **22** are shown in Fig. 2 in dashed lines in substantially the position they would assume with an idling motor. The structure shown in Fig. 4 is shown in dotted lines in the same position as that in Fig. 2, and it may be seen that there is much less clearance between the hemispherical member **32** and the tubular member **8***a* than there is between the cap **20** and tubular member **8**. Thus, to allow an equal volume of exhaust gas to escape, the modification shown in Fig. 4 must open considerably farther than that shown in Fig. 2. Before the cap **20***a* can swing closed to bang against the top of the tubular member **8***a* following a burst of exhaust pressure, it will encounter another burst of exhaust pressure and be partially reopened. Thus, the modification shown in Fig. 4 will have the cap bouncing on top of a gas cushion rather than atop the exhaust pipe or other abutting structure as will occur with prior caps and may occur with that shown in Fig. 2.

Although the present invention has been described with regard to a tractor in which installation it may find its greatest use, it is apparent that it is well adapted for use on a substantially upright exhaust pipe of any automotive vehicle or on stationary engines. It is to be understood that this invention is not to be limited to the specific structure shown and described, but is to be limited only by the spirit and scope of the appended claims.

I claim:

1. An end cover device for a substantially upright exhaust pipe of an engine comprising, a cover member movable between a substantially horizontal closed position and a substantially vertical open position for closing and opening the exhaust pipe, a substantially teardrop shaped counterbalancing arm secured to and extend upwardly and outwardly from the cover member for supporting the same and for limiting opening movement of the cover member to the substantially vertical open position thereof, a substantially horizontally arranged pivot for pivotally mounting said counterbalancing arm and means carried by the exhaust pipe and extending upwardly and outwardly therefrom for mounting the pivot upwardly and outwardly from said cover member, the center of gravity of the cover member lying below a horizontal plane through the pivot, the center of gravity of the counterbalincing arm lying substantially in said horizontal plane through the pivot and the moment arm of the cover member being slightly greater that the moment arm of the counterbalancing arm when the cover member is closed, and the center of gravity of the cover member lying to the cover side of a vertical plane through the pivot, the center of gravity of the counterbalancing arm lying substantially in a vertical plane through the pivot and the moment arm of the cover being considerably greater than the moment arm of the counterbalancing arm when the cover member is opened, whereby a closing force at all times acts on the cover member and increases as the cover member is opened.

2. An end cover device for a substantially upright exhaust pipe of an engine comprising, a substantially cylindrical member adapted to be secured to the upper end of the exhaust pipe and having a bracket extending upwardly and outwardly therefrom, a horizontally ar-

ranged pivot carried by the bracket adjacent the outer end thereof, a cover member movable between a substantially horizontal closed position against the cylindrical member and a substantially vertical open position for closing and opening the exhaust pipe, and a substantially teardrop shaped counterbalancing arm secured to and extending upwardly and outwardly from the cover member for supporting the same and pivotally carried by the pivot of the bracket and engaging the substantially cylindrical member when the cover is moved to the substantially vertical open position, the center of gravity of the cover member laying below a horizontal plane through the pivot, the center of gravity of the counterbalancing arm lying substantially in a horizontal plane through the pivot and the moment arm of the cover member being slightly greater than the moment arm of the counterbalancing arm when the cover member is closed, and the center of gravity of the cover member lying to the cover side of a vertical plane through the pivot, the center of gravity of the counterbalancing arm lying substantially in a vertical plane through the pivot and the moment arm of the cover being considerably greater than the moment arm of the counterbalancing arm when the cover member is opened, whereby a closing force at all times acts on the cover member and increases as the cover member is opened.

3. An end cover device for a substantially upright exhaust pipe of an engine comprising, a cover member movable between a substantially horizontal closed position and a substantially vertical open position for closing and opening the exhaust pipe and having a substantially semi-spherical member depending therefrom in alignment with the exhaust pipe when the cover member is in closed position to impart greater opening force to the cover member from the pressure of the exhaust gases, a counterbalancing arm secured to and extending upwardly and outwardly from the cover member for supporting the same and having a part thereof engaging the exhaust pipe when the cover is moved to a substantially vertical open position, a substantially horizontally arranged pivot for pivotally mounting said counterbalancing arm and means carried by the exhaust pipe and extending upwardly and outwardly therefrom for mounting the pivot upwardly and outwardly from said cover member, the center of gravity of the cover member lying below a horizontal plane through the pivot, the center of gravity of the counterbalancing arm lying substantially in a horizontal plane through the pivot and the moment arm of the cover member being slightly greater than the moment arm of the counterbalancing arm when the cover member is closed, and the center of gravity of the cover member lying to the cover side of a vertical plane through the pivot, the center of gravity of the counterbalancing

arm lying substantially in a vertical plane through the pivot and the moment arm of the cover being considerably greater than the moment arm of the counterbalancing arm when the cover member is opened, whereby a closing force at all times acts on the cover member and increases as the cover member is opened.

4. An end cover device for a substantially upright exhaust pipe of an engine comprising, a substantially cylindrical member adapted to be secured to the upper end of the exhaust pipe and having a bracket extending upwardly and outwardly therefrom, a horizontally arranged pivot carried by the bracket adjacent the outer end thereof, a cover member movable between a substantially horizontal closed position against the cylindrical member and a substantially vertical open position for closing and opening the exhaust pipe and having a substantially semi-spherical member depending therefrom in alignment with the exhaust pipe when the cover member is in closed position to impart greater opening force to the cover member from the pressure of the exhaust gases, and a counterbalancing arm secured to and extending upwardly and outwardly from the cover member for supporting the same and pivotally carried by the pivot of the bracket and having a part thereof engaging the substantially cylindrical member when the cover is moved to the substantially vertical open position, the center of gravity of the cover member lying below a horizontal plane through the pivot, the center of gravity of the counterbalancing arm lying substantially in a horizontal plane through the pivot and the moment arm of the cover member being slightly greater than the moment arm of the counterbalancing arm when the cover member is closed, and the center of gravity of the cover member lying to the cover side of a vertical plane through the pivot, the center of gravity of the counterbalancing arm lying substantially in a vertical plane through the pivot and the moment arm of the cover being considerably greater than the moment arm of the counterbalancing arm when the cover member is opened, whereby a closing force at all times acts on the cover member and increases as the cover member is opened.

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