United States Patent

Bennett

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[54] CRANKCASE VENTILATING VALVE

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[52] **U.S. Cl.**.....**123/119 B,** 137/480, 137/515.7, 251/361, 251/368

[51] **Int. Cl.**.....**F02f 9/02,** F16k 15/02

[58] **Field of Search**.....123/119 B; 137/480, 515.7; 251/361, 368

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[57] **ABSTRACT**

A valve for controlling the crankcase ventilation for an internal combustion engine constructed to be much less expensive than prior valves but to have better performance characteristics due to a unique flow control.

5 Claims, 5 Drawing Figures

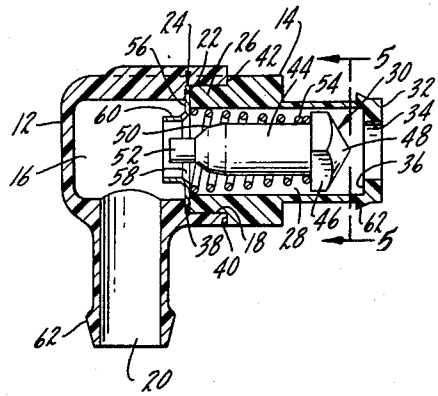


fig.1.

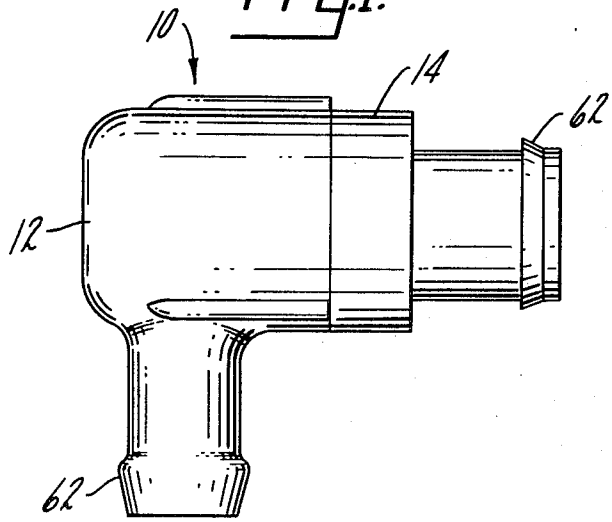
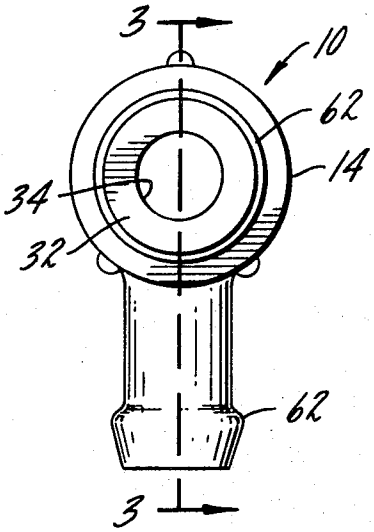


fig.2.



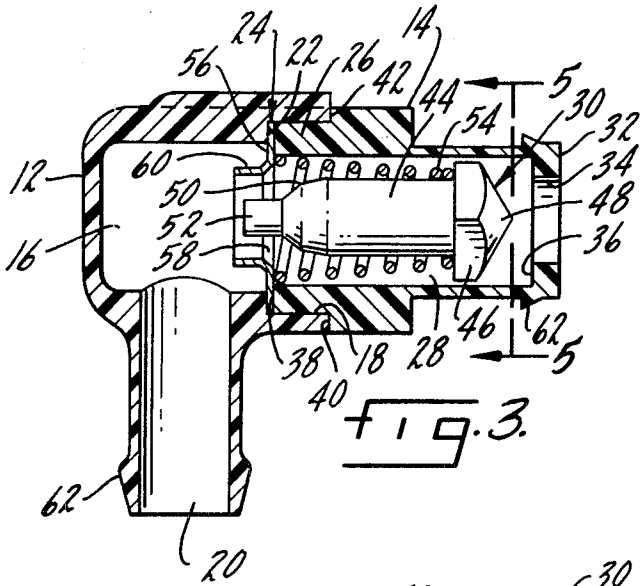


fig.3.

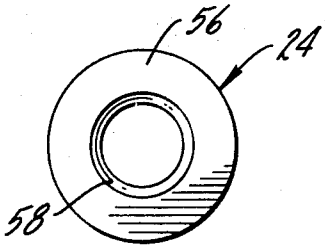


fig.4.

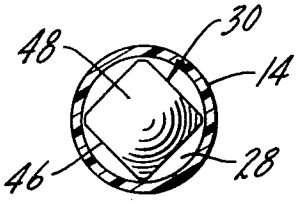


fig.5.

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CRANKCASE VENTILATING VALVE

SUMMARY OF THE INVENTION

This invention is in the field of crankcase ventilating valves for use with internal combustion engines and is concerned with a valve structure for controlling the air flow for ventilating the crankcase of an internal combustion engine.

A primary object is a crankcase ventilating valve which provides positive crankcase ventilation with smooth even flow through the valve.

Another object is a valve structure of the above type which is less expensive than prior units but, at the same time, is more uniform in flow characteristics.

Another object is a valve structure of the above type which avoids any fluttering or burbling.

Another object is a valve structure of the above type in which the housing is entirely of plastic with a metering pin of metal and a metal orifice which prevents contact with the housing so the plastic will not wear.

Other objects will appear from time to time in the ensuing specification and drawings:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the valve;

FIG. 2 is an end view;

FIG. 3 is a sectional view taken on line 3—3 of FIG. 2, with parts in full;

FIG. 4 is an end view of the orifice; and

FIG. 5 is a section along line 5—5 of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, the valve or metering element has been indicated generally at **10** and includes a body or valve housing composed of two main elements. The first **12** is what is referred to as the lower element and the second **14** as the upper element. This is not to say that one is above the other and, in fact, the device may be used and operated sideways, as in FIGS. 1 and 3, or in any position. The terms top, bottom, upper, lower, etc. may be used herein merely for purposes of designation and orientation, and it should be understood that the valve will operate satisfactory in a horizontal or upside down position, vertical or otherwise; in fact, in any position.

The lower element **12** includes a generally cylindrical socket **16** stepped at **18** with an offset outlet or branch **20** on one side. The step **18** provides an annular shoulder **22** against which a flow orifice **24** is positioned, which is in the nature of a washer.

The upper element **14** has a generally cylindrical exterior with a pilot portion **26** at one end shaped and dimensioned to fit into the recessed portion **18** of the lower element. Element **14** has an opening or channel **28** through it of a diameter to accept a pin **30**. The inlet end **32** of element **14** is reduced to a somewhat smaller orifice **34** to keep the pin in and provides a backfire shoulder **36** as explained hereinafter. Otherwise, the interior of the channel **28** may be considered to have a constant diameter. The dimensioning is such that the forward surface **38** of the pilot portion **26** abuts the orifice or washer **24** before the enlarged shoulder **40** hits the end flat face **42** on the lower section. The two parts may be made entirely of plastic, for example nylon, and the abutting surfaces **40** and **42** may be glued or heat sealed or the cylindrical surfaces, as at **18**, may have a shrink fit by heating the projecting or outside end of the main body section and allowing it to cool around the pilot portion **26** which, for this purpose, might be slightly oversize in O.D. In any event, it is considered important that the projecting surface **38** of the pilot portion firmly abut the washer **24** and hold it against the shoulder **22** in a firm, tight, gripping contact when the units are secured.

The pin **30** may be of metal, such as steel, and may have a shank **44** with a square head **46** and seating taper **48** at one end and a tailored or contoured portion **50** at the other terminating in a projecting guide or finger **52**, the portion **50** being tailored to the blowby characteristics of the engine. The

pin may be surrounded by a generally tapered spring **54** which, at one end, engages the head **46** and at the other engages part of the washer **24**.

The orifice **24** may be in the form of a metal washer with an outer annular flange **56** merging smoothly into a miter **58** directed downstream, in the direction of air flow, followed by a cylindrical horn **60** which projects a predetermined distance downstream into the channel or socket **16** of the lower body member.

The exterior of both the inlet and the outlet may be shaped, as at **62**, to accept a hose connection. While the outlet **20** has been shown on the side, it might be on the end wall **12** in a straight-through unit.

The use, operation and function of the invention are as follows:

The valve is specifically intended to be used for ventilating the crankcase of an internal combustion engine and is positioned in a hose or line connection between the crankcase and the inlet manifold, the object being that when the vacuum in the inlet manifold is high, as at low loads, the vacuum will be communicated through opening **20** to draw the tailored pin **30** down into the orifice **24** thereby restricting or reducing the flow of crankcase vapor or blowby from the crankcase to the inlet. But at high loads, when the vacuum in the inlet manifold is least, the pressure differential across the valve will be the least, which will allow the spring to move the pin back to generally the position shown in FIG. 3 opening up the orifice and allowing the greatest flow. All of this is old and well known.

Prior valves of this type have been made entirely of metal which has the disadvantages of expense, wear, and corrosion.

In the present structure, the housing itself, including both parts **12** and **14**, is made entirely of plastic. And while nylon has been mentioned as a possibility, it should be understood that any suitable plastic may be used, for example polyvinylchloride, polystyrene or the like. At the same time, the pin **30** is of metal so that its exterior will not change shape in use which might otherwise happen when the unit is vibrated and banged around.

The orifice **24** is in the form of a washer, preferably of metal, again so that its flow characteristics will not change in use. The washer or orifice is rigidly held between the two housing parts and is specifically shaped to prevent any burbling or fluttering in the air flow pattern through the valve. It will be realized that the air flow will be controlled by the exterior of the pin and the interior of the orifice, the housing itself serving merely as a conduit and enclosure.

The operative end of the pin, referring to the tailored part **50** and shank **44**, are drawn from time to time into the orifice structure, depending upon the engine's operating condition so that a greater or lesser cross section will be presented to and inside of the orifice. The miter **58** of the orifice will prevent or eliminate any eddy currents in the air flow which might otherwise occur at a sharp edge orifice. Following this is the cylindrical horn **60** which insures that the air flow does not drag or break away from the wall surface as it goes through the orifice. Further, the opening through the washer or orifice may be considered to be in the form of a bell which may be extruded or punched so that the inside diameter, which determined air flow, can be accurately controlled. The flow pattern through the variable annular space between the exterior of the pin and the interior of the washer should be smooth and non-turbulent at all loads on the engine. In the orifice itself and the tubular horn **60**, there should be no contraction of the air flow and the orifice should flow full at the downstream end. And this cannot be accomplished with a sharp edge washer or orifice. The horn **60** with the miter **58** bounding the entrance guarantees a non-fluttering flow pattern which, if it were to occur, can have a fluttering or chattering effect on the pin itself due to its suspended condition in the housing. Thus, the air flow is greatly stabilized.

In the event of backfire which will create a greater pressure in what would otherwise be the outlet **20**, the pin may move to

the right in FIG. 3 so that the taper 48 will seat against the annulus 36 thereby preventing any flames or sparks from getting into the crankcase.

One of the advantages of the present structure is that while the housing is made entirely of plastic and, therefore, inexpensive, the operative parts, the pin and orifice, are of metal. And any contact between them due to vibrations or handling will not result in wear or nicks on the housing.

While the preferred form and several variations have been suggested, it should be understood that suitable additional modifications, changes, substitutions and alterations may be made without departing from the invention's fundamental theme.

I claim:

1. For use in an engine crankcase ventilating system, a metering valve adapted to be positioned in a conduit between the crankcase and the inlet manifold, the valve including a two-part housing with a passage through it for the flow of crankcase vapors, a pin having a small end in the passage in the housing having an exterior which is tailored to the blowby characteristics of the engine, a spring biasing said pin, and an orifice in the housing in the form of a washer having a passage therethrough surrounding the small end of the pin when the pin is in its free state and having an outstanding flange held between the two parts of the housing and the passage through said orifice being tapered and extending downstream to form a cylindrical flow regulator defining an annular flow orifice with the exterior of the pin, the various cross sections of the pin being less than the passage through the orifice and flow regulator in all normal positions of the pin.

2. The structure of claim 1 further characterized in that the two parts of the housing are socketed together, one part being piloted into the other, with the opposed surfaces clamping the outstanding flange on the orifice between them in a tight joint.

3. The structure of claim 1 further characterized in that the spring surrounding and positioning the pin, at its large end, engages the outward flange on the orifice.

4. The structure of claim 1 further characterized by and including an inlet and outlet at each end of the passage through the housing, the inlet being aligned with the longitudinal direction of movement of the pin and the outlet being disposed at generally 90° thereto.

5. The structure of claim 1 further characterized in that the housing is made of plastic and the pin and orifice are made of metal.

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