United States Patent

[11] 3,530,841

[72] Inventors **Gerald Haft**
Brookfield, Wisconsin;
Robert W. Schultz, Menominee, Michigan

[21] Appl. No. **710,863**
[22] Filed **March 6, 1968**
[45] Patented **Sept. 29, 1970**

[73] Assignee **Outboard Marine Corporation**
Waukegan, Illinois
a corporation of Delaware

---

[54] **IDLE AIR INLET VALVE**
9 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **123/119,**
123/73, 123/124, 137/479, 261/41

[51] **Int. Cl.** **F02m 3/00,**
F02m 23/04, F02d 9/00

[50] **Field of Search** 137/479–483;
123/119D, 732, 124; 123/182; 261/41.4

[56] **References Cited**

UNITED STATES PATENTS

927,529	7/1909	Harrington	137/480
1,420,288	6/1922	Scalco	123/119(D)UX
2,883,112	4/1959	Stoltman	123/119(D)UX
3,287,899	11/1966	Bintz	123/119(D)UX

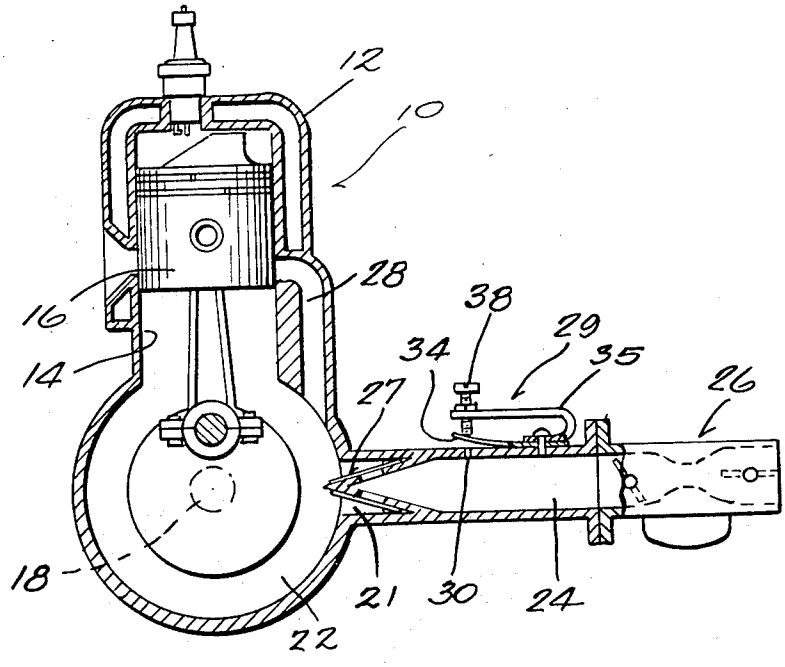
FOREIGN PATENTS

102,826	3/1926	Germany	123/119(D)UX
834,369	8/1938	France	123/119(D)UX

Primary Examiner—Wendell E. Burns
Attorneys—Wheeler, Wheeler, House and Clemency and Robert K. Gerling

---

ABSTRACT: Disclosed herein is an engine provided with an idle air intake port located in the intake manifold connecting a carburetor to an engine for supplying fuel free air for idle engine operation. Air flow through the intake port is controlled by a pressure responsive valve including a valve member in the form of a flexible member or diaphragm having a portion which is located over the intake port and which is biased to an open position to uncover the intake port. Upon increase in engine speed and increase in engine vacuum during idling operation the reduced pressure in the manifold causes the valve member portion to close the idle air intake port.



Patented Sept. 29, 1970

3,530,841

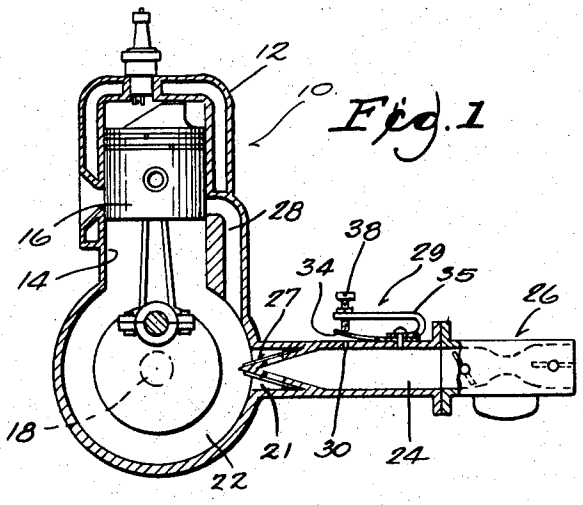


Fig. 1

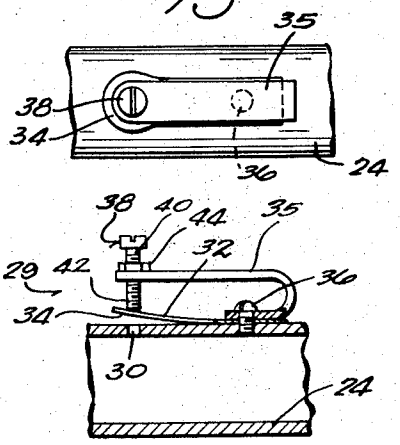


Fig. 3

Fig. 2

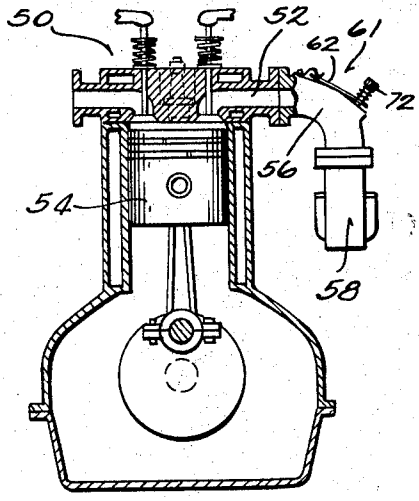


Fig. 4

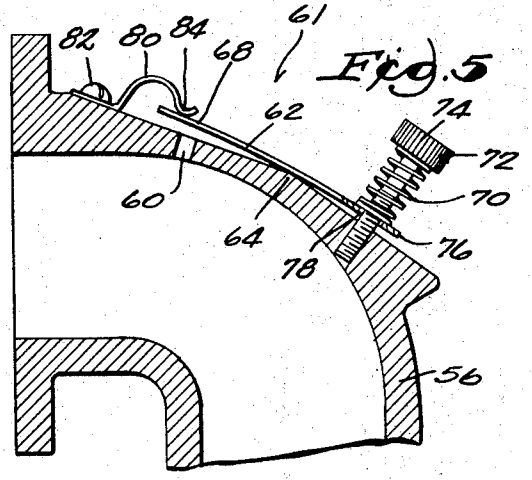


Fig. 5

INVENTORS
GERALD HAFT
ROBERT W. SCHULTZ

BY Wheeler, Wheeler, Homer & Clemency
ATTORNEYS

IDLE AIR INLET VALVE

BACKGROUND OF INVENTION

The present invention relates to fuel free idle air sources for internal combustion engines and more particularly to an idle air inlet valve which is responsive to engine vacuum. In operation of an internal combustion engine it is desirable to provide fuel free air to prevent the idle mixture from becoming too rich and decreasing the idle r.p.m. Upon increase in engine speed during idling operation it is desirable to close the idle air intake port so that engine speed is under complete control of the throttle and so that all air requirements are served by air passing through the carburetor and air filter.

SUMMARY OF INVENTION

The invention provides a pressure responsive valve for an idle air intake port located in the intake manifold connecting the carburetor to the engine and downstream from the carburetor throttle shutter to provide air for idling operation of the engine. The valve for controlling idle air flow is normally open during engine idle and closes responsive to increase in engine vacuum which occurs during increase in engine speed and while the engine throttle setting remains essentially the same.

One embodiment of the valve comprises a valve member formed from a strip of thin, flat spring material which is anchored to the manifold and which has a valve portion located over the idle air intake port. The valve portion is bent away from the port so that it is normally open at engine idling, and is closed upon increase in engine speed and increase in engine vacuum during idling operation.

An adjustable stop located over the valve portion and adjacent the intake port, controls the spacing of the valve member from the port and affords adjustment of the valve for opening and closing of the valve at different engine speeds.

In a further embodiment of the invention, the valve member comprises a length of flat flexible spring material which is pivoted intermediate its length about a raised portion on the manifold housing. The valve member is adjustably spring biased against a stop located near the intake port by a spring located between the valve member and a stop in the form of the head of a bolt threaded into the manifold housing.

Either embodiment can be used with two or four cycle engines. In a two cycle engine, the valve is located in the manifold connecting the carburetor to the engine crankcase. In a four cycle engine, the valve is located in the air intake manifold connecting the carburetor to the cylinder air intake port.

Further objects and advantages of the invention will become apparent from the following description and accompanying drawings.

DRAWINGS

FIG. 1 is a vertical sectional view of a two cycle engine embodying the idle air inlet valve of the invention.

FIG. 2 is an enlarged view of the air inlet valve shown in FIG. 1.

FIG. 3 is a top view of the valve shown in FIG. 1.

FIG. 4 is a vertical sectional view of a four cycle engine with an additional embodiment of the valve of the invention.

FIG. 5 is an enlarged view of the idle air inlet valve shown in FIG. 4.

DETAILED DESCRIPTION

In the drawings, FIG. 1 discloses a two cycle engine which is generally designated 10 and which includes an engine block or powerhead 12 with a cylinder 14 and a piston 16 operatively disposed in the cylinder 14 and connected to a crankshaft 18 by a connecting rod 20. Fuel-air mixture is introduced into an inlet 21 in the crankcase 22 through an intake manifold 24 connecting the crankcase 22 to a carburetor 26. Reed valves 27 are conventionally located in the inlet 21 to control admission of the fuel-air mixture into the crankcase 22. The fuel-air mixture is conveyed from the crankcase 22 to the firing chamber above the piston 16 by a passage 28 in the engine block 12.

An idle air inlet port 30 is provided in the intake manifold 24 between the crankcase 22 and the carburetor 26. In accordance with the invention, valve means are provided for controlling air flow through the idle air inlet port 30, said valve means being operative in response to pressure variations which occur in the manifold 24 and which take place notwithstanding that the engine throttle setting remains at an idle setting, *i.e.*, to increasing and decreasing engine vacuum upon increase and decrease in the rate of reciprocation of the piston or rate of rotation of the crankshaft. In the construction disclosed in FIGS. 1, 2 and 3, the valve means 29 comprises a valve member 32 formed from a strip of flat resilient and flexible material which is anchored or secured at one end to the manifold 24 by a fastener 36. The valve member 32 has a valve portion 34 located over the idle air inlet port 30. The valve member 32 is formed with a slight curve so that the portion 34 is in a normally open position spaced from the idle air intake port when the engine is inoperative or during idle operation below a predetermined engine speed. Upon increase in engine speed and increase in the engine vacuum occurring without substantial change in the throttle setting, the valve member 34 will be drawn toward the air inlet port 30 to seal the idle air intake port 30.

In accordance with the invention, an adjustable stop 38 is provided to vary the distance of the valve portion 34 from the air inlet port 30 and vary the responsiveness of the valve portion 34 to engine vacuum and thus enable change in the speed at which the valve portion 34 closes. In the construction disclosed in FIG. 2, the adjustable stop comprises a bolt 40 threaded into a bracket 35 which is secured to the manifold by a bolt 36. The bolt has a lower end 42 which engages the valve portion 34. A lock nut 44 secures the bolt in the desired position.

Referring to FIG. 4, there is shown a four cycle engine 50 provided with a fuel-air inlet port 52 located above a piston 54 and a fuel-air mixture intake manifold 56 which communicates with the air inlet port 52 and a carburetor 58 and which has an idle air inlet port 60.

In accordance with the invention the engine shown in FIGS. 4 and 5 incorporates a further embodiment of valve means 61 comprising a valve member 62 in the form of a length or strip of flat material pivotally supported intermediate its length by a raised portion 64 which is located on the manifold and which functions as a fulcrum. The valve member 62 has a free end or valve portion 68 located over the air inlet port 60. The free end 68 is biased away from the air inlet port 60 by a spring 70 which is arranged around a bolt 72 and located between the head 74 of the bolt 72 and the opposite end 76 of the valve member 62. The bolt extends through an aperture 78 in the valve member 62 and is threadably received in the intake manifold 56.

To limit movement of the free end 68 from the inlet port 60 there is provided a fixed stop 80 which is secured to the intake manifold by a fastener 82. The stop 80 has a curved portion 84 adapted to engage the free end 68 of the valve member 62. Adjustment of the degree of compression of the spring 70 will vary the bias of the free end 68 against the stop 80 and thus vary the responsiveness of the free end or valve portion 68 to the engine vacuum to enable change in the speed at which the valve closes. In the embodiment disclosed in FIGS. 1 and 2, the responsiveness of the valve member portion 34 to engine vacuum is varied by changing the distance of portion 34 from the inlet port 30.

In operation of the engines embodying the valve means 29 and 61, the valves will remain open to provide fuel free air for idle. However, when engine speed increases beyond a predetermined range while the engine throttle setting remains essentially constant, the increase in engine vacuum and the resulting low pressure beneath the valve portions 34 and 68

will cause the atmospheric pressure to close the valve portions **34** and **68** against the manifold to seal the idle air intake ports **30** and **60**.

Various features of the invention are set forth in the following claims.

We claim:

1. In combination an engine, a carburetor, an intake manifold connecting said engine to said carburetor, an idle air inlet port in said manifold, and normally open valve means for closing said inlet port in response to decrease in pressure in said intake manifold.

2. The combination of claim **1** wherein said valve means is normally closed above a predetermined engine speed to prevent air flow through said idle air intake port and wherein said valve means opens to afford air flow through said idle air intake port when the rate of rotation of said engine is less than said predetermined speed.

3. The combination of claim **1** wherein said valve means comprises a flexible member having a portion secured to said intake manifold, and a valve member portion located above said idle intake port.

4. The combination of claim **3** including means to vary the responsiveness of said valve means to pressure variations.

5. The combination of claim **4** wherein said means to vary the responsiveness of said valve to pressure variations comprises a bracket secured to said intake manifold, a bolt threaded into and extending through said bracket and said bolt having an end adapted to engage said flexible member to adjustably vary the distance of said flexible member from said idle air inlet port.

6. The combination of claim **3** wherein said flexible member is pivotally supported on said manifold by a raised portion on one of said manifold and said flexible member at a point intermediate the length of said flexible member, a stop adapted to limit movement of said flexible member away from said intake port, and means for varying the responsiveness of said flexible member to pressure variation in said manifold.

7. In combination, an engine, a carburetor, an intake manifold connecting said engine to said carburetor, an idle air inlet port in said manifold, valve means operative to close said inlet port in response to variations in pressure in said intake manifold, said valve means including a flexible member having a valve member portion located above said idle intake port, said flexible member being pivotally supported on said manifold by a raised portion on one of said manifold and said flexible member at a point intermediate the length of said flexible member, a stop adapted to limit movement of said flexible member away from said intake port, a bolt extending through said flexible member and threaded into said manifold, and a spring arranged around said bolt and located between the head of said bolt and said flexible member.

8. An engine comprising a powerhead, a carburetor, an intake manifold connecting said carburetor to said powerhead, an idle air inlet port in said manifold between said carburetor and said engine powerhead and valve means on said manifold for closing said inlet port, said valve means being normally open during low speed engine operation and closed at greater engine speeds.

9. An engine comprising a powerhead, a carburetor, an intake manifold connecting said powerhead to said carburetor, an idle air inlet port in said manifold, valve means operative to close said inlet port in response to variations in pressure in said intake manifold, said valve means including a flexible member having a valve member portion located above said idle intake port, said flexible member being pivotally supported on said manifold by a raised portion on one of said manifold and said flexible member at a point intermediate the length of said flexible member, a bolt extending through said flexible member and threaded into said manifold, and a spring arranged around said bolt and located between the head of bolt and said flexible member.