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Brown

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[54] DRAIN RETURN FOR ENGINE

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[52] **U.S. Cl.** .....**123/73 R,** 123/DIG. 2, 123/73 A, 123/73 B, 123/73 PP, 123/119 B

[51] **Int. Cl.**.....**F02b 33/04**

[58] **Field of Search**.....123/73 R, 73 A, 73 B, 123/73 SC, 73 PP, DIG. 2, 119 B, 136

[56] **References Cited**

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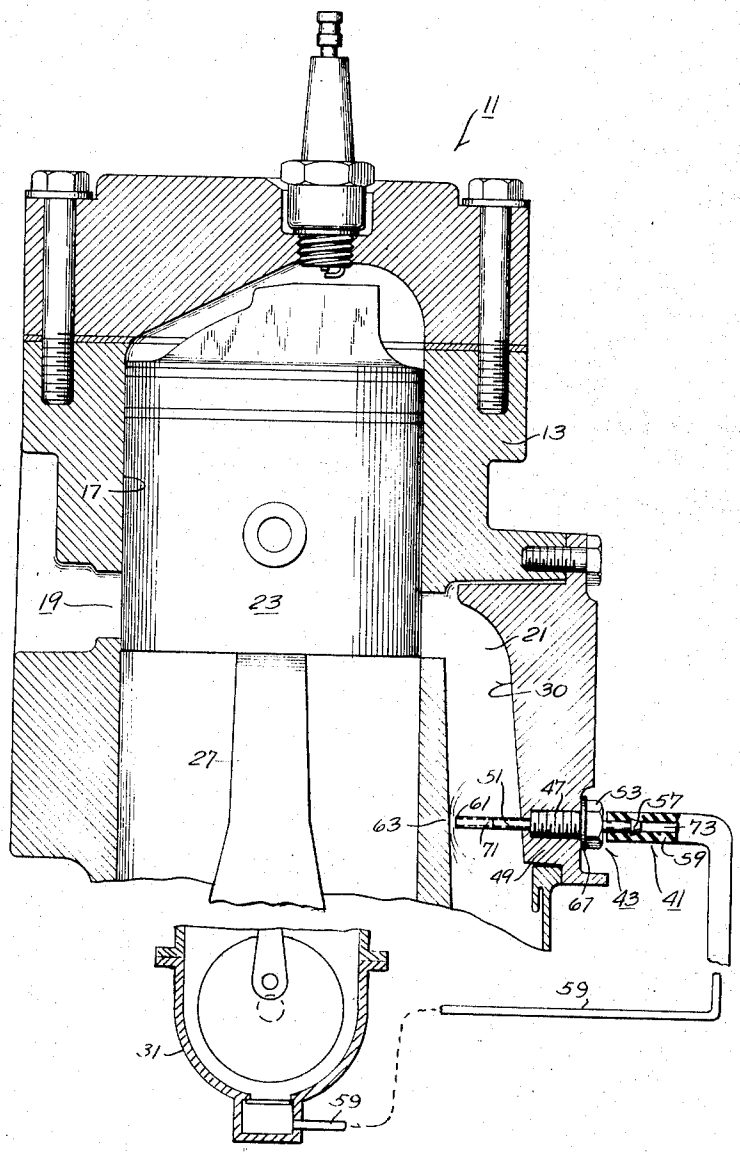
Primary Examiner—Wendell E. Burns

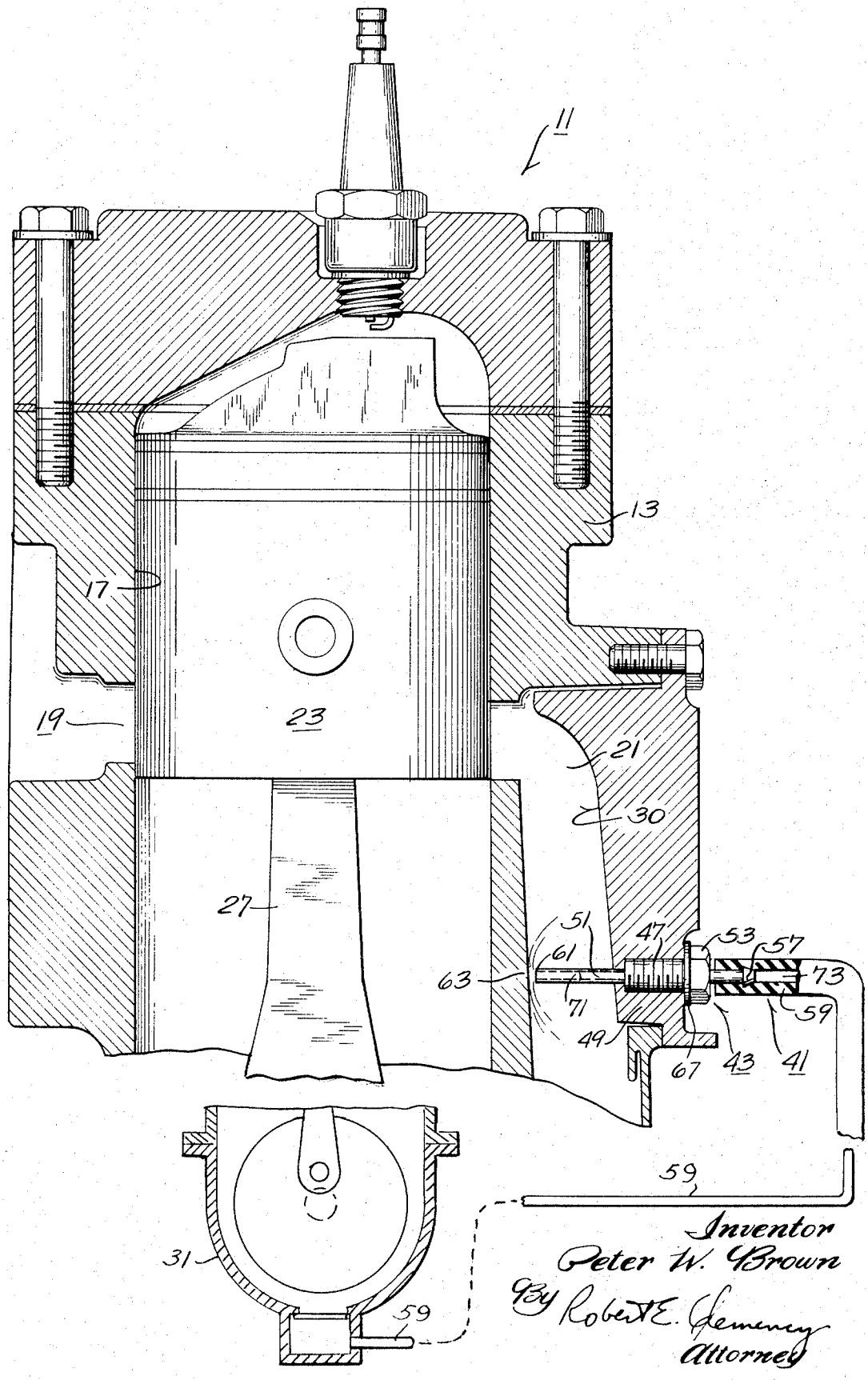
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[57] **ABSTRACT**

Disclosed herein is a two-stroke internal combustion engine with a drain return system comprising a drain return line which is supported by wall means defining a fuel supply passage and which extends from a crankcase and includes an end part terminating in adjacently spaced opposing relation to one portion of the wall means, whereby drains exiting from the drain return line splash against the wall portion and are broken into droplets for delivery to the engine cylinder.

7 Claims, 1 Drawing Figure





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DRAIN RETURN FOR ENGINE

BACKGROUND OF THE INVENTION

Two stroke engines commonly experience an accumulation of fuel and lubrication "drains" in the low point or sump of the engine crankcase. The desirability of recycling or returning such drains to the engine cylinder for ultimate combustion has been known for some time. Such recycling is especially important in avoiding pollution associated with outboard motors as, in the past, such drains have commonly been wasted overboard into the body of water in which the outboard motor was operating.

Prior arrangements for returning or recycling drains are disclosed in the U.S. Pat. No. 2,717,584 to Upton issued Sept. 13, 1955, the U.S. Pat. No. 3,128,748 to Goggi issued Apr. 14, 1964, and in the U.S. Pat. No. 3,132,635 to Heidner issued May 12, 1964.

The above identified disclosures all rely in some part on the incoming charge to carry the drains into the cylinder for combustion. However, when the drains are supplied to the charge in the form of a stream, less than maximum conditions are presented for effective transportation of the drains by the incoming charge into the cylinder for combustion.

SUMMARY OF THE INVENTION

The invention provides an arrangement for breaking up a stream of drains into droplets so as to facilitate transportation of the drains into an engine cylinder for ultimate combustion, either by way of direct transportation of the droplets by the incoming charge or by increasing the amount of vaporization of the drains, thereby to facilitate delivery of such vaporized drains to the engine cylinder.

In accordance with the invention, there is provided a drain return line which, in part, is supported by a fuel feeding passage, such as the transfer passage of a two-stroke engine, and which includes an end part terminating in closely spaced relation from an opposing portion of the wall defining the fuel feeding passage.

Also in accordance with the invention, the drain return line communicates with the crankcase of a two-stroke engine and has, for substantially the entire length of the return line, a relatively small diameter. As a consequence, the drains exiting from the end part of the drain return line are particularly responsive to the pressure pulses supplied to the return line by the crankcase and, as a result, drains exit from the end part of the drain return line in a stream having sufficient velocity to cause splashing when the stream strikes the closely spaced opposed wall portion. Such splashing is effective to break the stream up into droplets which are more readily vaporized and which can be more readily transported into the cylinder by an incoming fuel charge.

One of the principal objects of the invention is the provision of an arrangement for more effectively transporting return drains into an engine cylinder by an incoming fuel-air charge.

Another principal object of the invention is the provision of an arrangement for causing a returning stream of drains to splash into a charge of fuel-air traveling toward an engine cylinder, whereby to break the stream of drains into droplets which can be more effectively borne to the engine cylinder by the incoming charge.

Still another principal object of the invention is the provision of a drain return system including a drain return line which communicates with the engine crankcase, which has a relatively small internal bore, and which terminates in closely adjacent relation to a wall portion defining a fuel feeding passage, whereby the pressure applied to the drains by the crankcase will cause the drains to exit from the return line in a stream which splashes against the wall portion.

Another important object of the invention is the provision of a drain return system which is economical to construct and to install and which will provide a long and useful life.

Other objects and advantages of the invention will become known by reference to the following description and accompanying drawings.

DRAWING

FIG. 1 is a partially schematic fragmentary sectional view of an engine embodying various of the features of the invention.

GENERAL DESCRIPTION

Shown in the drawings is a two-stroke engine **11** including an engine block **13** defining a cylinder **17** having an exhaust port **19** and an inlet port **21**. Reciprocably movable in the cylinder **17** is a piston **23** which is joined to a connecting rod **27**. The intake port **21** comprises the terminus of a transfer passage **29** which is defined by suitable wall means **30** and which constitutes a fuel supply or feeding passage.

In the particularly disclosed construction, the transfer passage **29** communicates with a crankcase **31** which, in turn, is connected through reed valves (not shown) with a carburetor (not shown) so as to periodically pump a fuel-air mixture through the transfer passage **29** to the cylinder **17**. As above described, the construction is conventional.

As shown, for instance, in the Heidner U.S. Pat. No. 3,132,635 issued May 12, 1964, which is hereby incorporated by reference, drains which accumulate in the crankcase can be pumped, by reason of the cyclical pressure pulses occurring in the crankcase, for return to the engine cylinder and ultimate combustion. Thus, as shown in FIG. **1**, there is provided for the purpose of feeding drains into the cylinder **17** for ultimate combustion, a drain return line or duct **41** which communicates with the crankcase **31**. In accordance with the invention, the drain return line **41** includes a drain fitting **43** comprising a threaded bolt **47** which is secured into one section **49** of the wall means **30** and which includes an axial bore or aperture fixedly carrying an axially extending tube **51**. At the end of the tube **51** adjacent to the head **53** of the bolt **47**, the tube **51** is provided with a nipple **57** which is connected to a tubular conduit **59** which, in turn, connects with the crankcase **31**. The other end of the tube **51** includes an end **61** which terminates in spaced closely adjacent relation to and in opposing relation to a portion **63** of the wall means **30**. Means such as shims or washers **67** between the wall section **49** and the bolt head **53**, or other known mechanical arrangements, can be provided for adjustably locating the end **61** of the tube **51** relative to the wall portion **63** so as to obtain optimum results. In the specifically disclosed arrangement, the end **61** is spaced from the wall portion **63** by about one-sixteenth

of an inch. At least some of the advantages of the invention are believed to be obtainable with spacings of up to about approximately one-eighth of an inch.

In order to minimize the internal volume of the drain return line **41** and thereby to maximize the responsiveness of the drains in the tube **51** to the pressure pulses supplied to the drain line **41** from the crankcase **31**, and thereby also to maximize the delivery velocity of the drains from the drain tube **51**, in accordance with the invention, the respective bores **71** and **73** of the tube **51** and the conduit **59** are relatively small for substantially the entire distance from the crankcase **31** to the transfer passage **29**. In the particularly disclosed construction, the bores **71** and **73** have a diameter of approximately one-sixteenth of an inch. At least some of the advantages of the invention are believed to be obtainable with bores having diameters of up to about one-eighth of an inch.

In operation, the discharge velocity of the drains provided as a result of crankcase pressure and the relatively small diameter of the bores **71** and **73**, as well as the closely adjacent relation of the end **61** of the tube **51** relative to the wall portion **63**, cause the returning stream of drains to splash when the stream hits the wall portion **63** and thereby to break up into many small droplets which can be readily carried, either as particles or as vapor, into the cylinder **17** by the incoming charge of fuel-air mixture.

Thus, in the disclosed construction, the nozzle length is designed so as to spray the liquid fuel drainings directly against a non-water cooled portion of the cylinder wall and directly into the high velocity gaseous mixture just outside of the cylinder intake port. The fuel is thereby vaporized and carried into the cylinder where it is burned with the rest of the mixture.

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

What is claimed is:

1. A two-stroke internal combustion engine including a cylinder, wall means defining a fuel supply passage communicating with said cylinder, and a drain return line communicating with a source of fuel drains and supported by said wall means and including an end part having a bore with a diameter less than about one-eighth of an inch and terminating in spaced opposing relation to one portion of said wall means at a distance less than about one-eighth of an inch, whereby drains exiting from said return line splash against said wall portion and are broken into droplets for delivery to said cylinder.

2. An engine in accordance with claim **1** wherein said engine also includes a crankcase, wherein said fuel supply passage comprises a transfer passage communicating with said cylinder and said crankcase, and wherein said drain return line communicates with said crankcase during periods of positive pressure in said crankcase.

3. An engine in accordance with claim **2** wherein said drain return line has a bore with an internal diameter of approximately one-sixteenth of an inch extending from said crankcase to said transfer passage.

4. An engine in accordance with claim **1** wherein said end part is spaced at about one-sixteenth of an inch from said wall portion.

5. An engine in accordance with claim **1** wherein said drain return line comprises a tube including said end part and having a bore with a diameter of about one-sixteenth of an inch.

6. An engine in accordance with claim **1** wherein said drain return line includes a conduit and a fitting comprising a bolt which includes a head and an axial bore and which is threaded into one section of said wall means and a tube fixed in said bore and including, at the end opposite from said head, said end part and, at the end thereof adjacent said head, a nipple connected to said conduit.

7. A two-stroke internal combustion engine including a cylinder, a crankcase, wall means defining a fuel transfer passage communicating between said crankcase and said cylinder and a drain return line supported by said wall means and extending from and communicating with said crankcase, said drain return line including a conduit having an axial bore communicating with said crankcase and a fitting comprising a bolt which includes a head and an axial aperture and which is threaded into one section of said wall means, and a tube which is fixed in said bolt aperture, which includes at the end thereof adjacent said head, a nipple connected to said conduit, which includes, at the other end, an end part terminating in opposed relation to one portion of said wall mans at a distance therefrom of about **1/16** of an inch, and which has an axial bore communicating with said conduit axial bore, said axial bores having a diameter of about **1/16** of an inch.

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