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[33] **Germany**
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[54] **MULTICYLINDER INTERNAL COMBUSTION ENGINE**
6 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... 123/52 M, 123/59, 123/73
[51] **Int. Cl.** **F02b 75/18**, F02b 33/04, F02b 75/20
[50] **Field of Search** ..... 123/52 M, 59 B, 73 A, 74, 74 A

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ABSTRACT: An internal combustion engine having two or more cylinders vertically disposed, one relative to the other or others, the fuel for the vertically disposed cylinders being supplied through a single main induction pipe, the conduit being in fluid communication with a horizontally divided cylinder induction conduit, a portion of the divided cylinder induction conduit being utilized for each of the plurality of cylinders for feeding fuel mixture thereto.

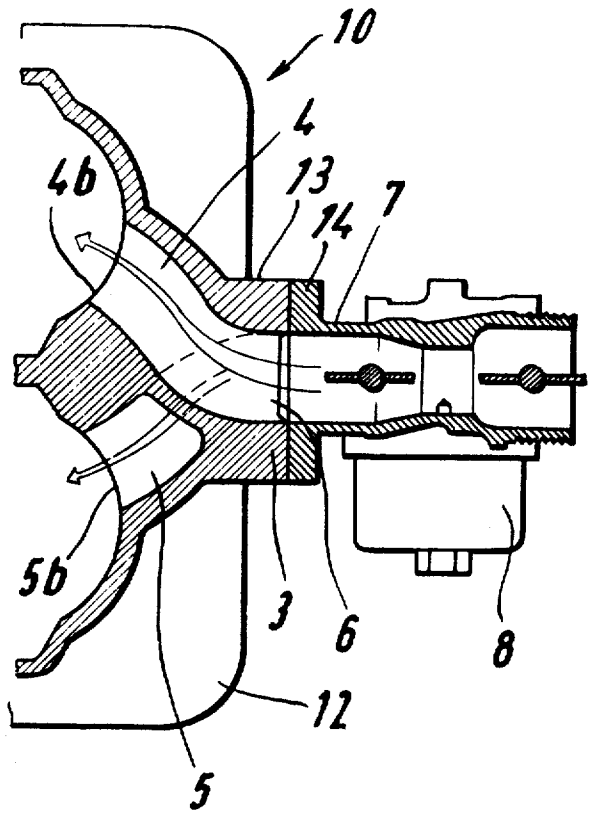


Fig. 1

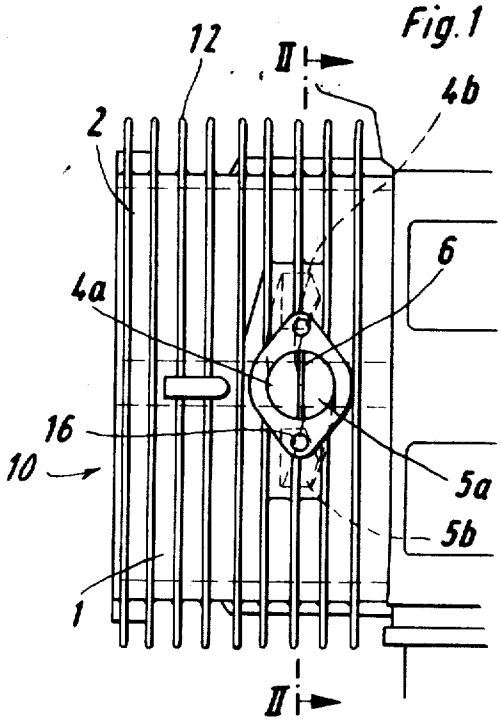
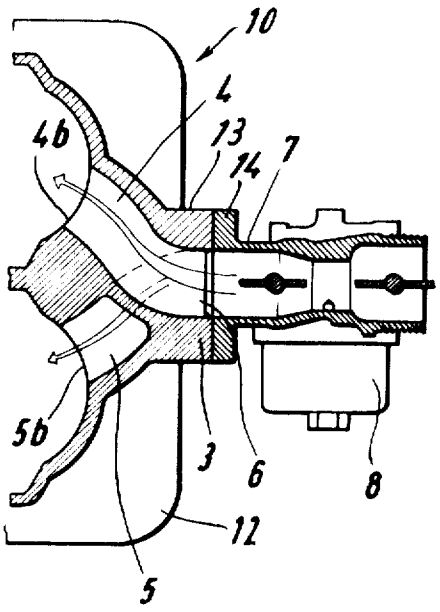


Fig. 2



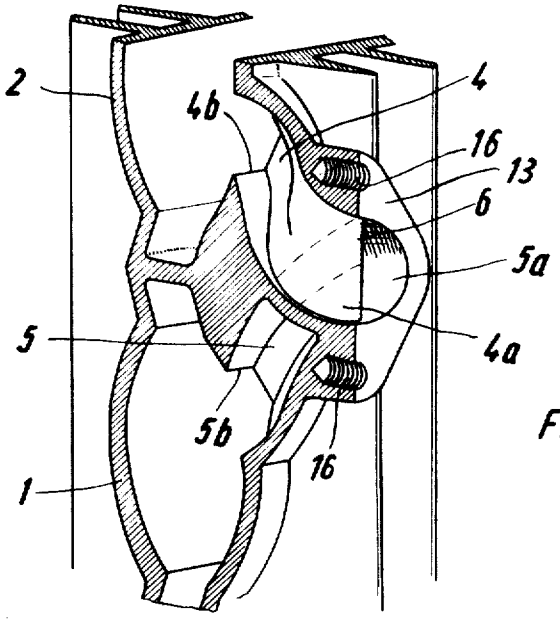


Fig. 3

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MULTICYLINDER INTERNAL COMBUSTION ENGINE

BACKGROUND AND SUMMARY OF THE DEVELOPMENT

This invention relates generally to a multicylinder fuel burning engine, and more particularly to a fuel burning engine having at least two superposed or vertically aligned cylinders, each of the cylinders being supplied with an air-fuel or air-fuel-lubricating oil mixture through a common main induction pipe and successively through branched-off portions of a cylinder fuel induction conduit, the branched-off portions being horizontally positioned, one relative to the other, relative to gravity.

One important requirement in the case of multicylinder fuel-burning engines is the qualitative distribution of the fuel mixture to the cylinders, to the extent that the proportion of fuel, and lubricating oil in the case of two cycle internal combustion engines, shall be equal in the volume of air inducted into all of the cylinders. In this situation, the engine is more smooth running, the life of the engine is increased and an optimum use of the consumed fuel is made.

Difficulties, with regard to the equal qualitative inducted mixture for each individual cylinder, have arisen in the case of fuel burning engines having a plurality of superposed or generally vertically aligned cylinders, the cylinders being connected to a common main induction pipe. Under these circumstances, an undesirable condition is created wherein the upper cylinder is charged with a mixture which is relatively thin as compared to the lower cylinder. Thus, the upper cylinder runs hot due to the lean mixture and the lower cylinder rapidly collects deposits within the cylinder to decrease the efficiency thereof. In these engines, the carburetor is connected to one end of the pipe while individual induction pipes having generally horizontally directed partitions or vertically directed branch pipes are connected to the individual cylinders.

The reason for this condition has been found to be due to the force of gravity acting on the charged fuel. In this situation, wherein a cylinder induction pipe is disposed one above the other, the fuel has a tendency to fall to the lower cylinder thus causing a deposit of fuel and lubricating oils in the individual cylinder pipe walls. During subsequent charges of fuel into the cylinder this excess of fuel and lubricant is picked up by the fuel vapor flow to greatly enrich the lower cylinder. Due to the action of gravity, the excess fuel in the lower cylinder is derived from the fuel which would normally be applied to the upper cylinder, the upper cylinder thus being fuel starved or charged with a thinner mixture than would normally be required. Thus, the upper cylinder would run hotter than normal due to the leaner mixture.

Certain prior systems for eliminating this undesirable feature in vertically stacked cylinders have been provided, but have certain drawbacks. For example, certain systems employ complicated diaphragm systems beyond the carburetor, certain other systems dispose the carburetor eccentrically, and other systems employ drip holes in the region of the lower cylinder. It is seen that these solutions to the problem are either expensive to construct or the systems do less than a perfect job.

With the system of the present invention, these conditions are alleviated due to the creation of an induction system for a fuel burning engine in which the cylinders are provided with generally uniform flow conditions and qualitatively equal induction mixtures are obtained for each of the cylinders. The features of the present invention solve the aforementioned problems by providing an individual cylinder induction system, the intakes to each of the vertically stacked cylinders being generally horizontally aligned and having a configuration to enhance the possibility that the cylinders will be supplied with an equal charge of fuel. Particularly, an individual branch is provided for the individual cylinders and connected to the main induction pipe, the intake pipe having a vertical separating wall in the case of two cylinders, or having a plurality of separating walls in the case of more than two cylinders to divide the fuel charge. Further, the adjacent and horizontally aligned individual cylinder induction conduits connected to the main induction pipe are curved in such a way that the cylinder end openings are situated in a common transverse plane through each of the cylinders.

Through the use of the horizontally aligned arrangement of inlet openings of the individual cylinder induction conduits, equal flow conditions are obtained for each of the individual cylinder induction conduits over their cross section. Thus, there is obtained equal qualitative and quantitative charging of the individual cylinders with fuel and lubricating oil due to the vertical dividing up of the main opening of the main induction pipe into the generally equal openings of the individual cylinder induction pipes and the general horizontal alignment of the input portions of the individual cylinder induction pipes. Thus, the unequal vertical distribution of the fuel and lubricating oil inducted flow can no longer divide differently, depending on the vertical disposition of the individual cylinder pipe.

Accordingly, it is one object of the present invention to provide an improved fuel induction system for an internal combustion engine.

It is another object of the present invention to provide an improved fuel induction system for use with an internal combustion engine having generally vertically aligned cylinders.

It is still a further object of the present invention to provide an improved input induction system for the individual cylinders of an internal combustion engine wherein the individual cylinder conduits equally divide up the fuel charge from the main induction pipe.

It is still a further object of the present invention to provide an improved individual cylinder induction system so that the output of the individual cylinder induction conduit is generally positioned at approximately the same point in the cylinder as the other exit positions of the other individual cylinder induction conduits in their respective cylinders.

It is still another object of the present invention to provide an improved system for equalizing the fuel charge to vertically disposed individual cylinders of an internal combustion engine.

It is still a further object of the present invention to provide an improved individual cylinder induction system wherein the inlet for the various intake induction systems are divided by a vertical partition so that the individual portions of the induction system are horizontally aligned.

Further objects, features and advantages of this invention will become apparent from a consideration of the following description, the appended claims and the accompanying drawing in which:

FIG. 1 illustrates a partial side view of an air-cooled, two-cylinder, fuel-burning engine having two vertically, superposed cylinders:

FIG. 2 is a section of the engine of FIG. 1, taken along the line II–II thereof; and

FIG. 3 is a partial perspective view of the section of FIG. 2 illustrating the division and the course of the cylinder induction channels of the system of the present invention.

The invention has been representatively illustrated in connection with a two-cylinder internal combustion engine 10. However, it is to be understood that the invention is equally applicable to engines having more than two cylinders, radial engines and other engines having fuel feeding problems similar to those described above. Referring more particularly to the drawing, the engine 10 includes a first cylinder 1 and a second cylinder 2, the second cylinder 2 being vertically superposed on the first cylinder 1. The engine 10 is illustrated as being of the air-cooled type and includes a plurality of heat radiating fins integrally cast with the main body portion of the engine.

The cylinders 1 and 2 are provided with a fuel-air mixture from a carburetor device 8 through a main induction pipe 7 to

the inlet portion of a common, individual cylinder neck portion **13** of an intake conduit assembly **3**. The carburetor **8** may be of a conventional type and is adapted to provide a mixture of fuel and air in the case of four-cycle engines and fuel, air and lubricating oil in the case of two-cycle engines. The main induction pipe **7** is provided with a flange portion **14** which is adapted to be bolted to the inlet part **13** of the individual cylinder conduit assembly **3**. For this purpose, a pair of threaded holes **16** (FIG. 3) are provided.

As was stated above, in the prior systems, the individual cylinder induction system included a main induction pipe which was connected to a Y-section induction pipe, the fuel mixture being caused to divide for providing a fuel charge into the upper and lower cylinders. In this situation, the divided fuel had a tendency to favor the lower cylinder and provide the lower cylinder with an extra charge of fuel, with the attendant difficulties noted above. In accordance with the system of the present invention, the inlet section of the individual cylinder pipe **3** is provided with a divider element **6** which is generally vertically disposed to divide the inlet chamber of the pipe **3** into two equal sections **4***a*, **5***a*. The two sections **4***a*, **5***a* are of generally equal cross section to preclude the possibility of the fuel charge favoring one side or the other of partition **6**. The inlet openings **4***a*, **5***a* provide a fuel charge for the respective induction channels **4**, **5** which are cast into the body portion of the engine **10**. The cylinder induction channels **4**, **5** are provided to introduce fuel from the main induction pipe **7**, through the individual induction channels **4** and **5**, to the interior portion of the cylinders **1** and **2**.

It is to be noted that the cylinder induction channels **4** and **5** are curved, as best illustrated in FIG. **3**, in an area intermediate the input and output sections of the individual induction channels. The surfaces of the channels are curved in such a way that the output cylinder openings **4***b* and **5***b* are situated in a common plane which is generally vertical and transverse through the cylinders **1** and **2**. In this way the fuel enters the cylinder at approximately the same point for each cylinder to further enhance the equal characteristics of the fuel charge and its combustion for each cylinder.

While it will be apparent that the preferred embodiments of the invention disclosed are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

I claim:

1. A fuel intake system for supplying a fuel charge mixture to at least one combustion chamber of an internal combustion engine, the intake system being under the influence of the force of gravity to affect the mixture of the charge due to the force of gravity, the intake system comprising a common intake conduit, individual conduit means in fluid communication with said common conduit and downstream of said common conduit relative to the direction of flow of the fuel charge, said individual conduit means having portions arranged to direct the fuel charge upwardly and downwardly relative to the direction of the force of gravity, and apportioning means positioned between said individual conduit means portions and at least a portion of said common conduit for apportioning, free of the effects of the force of gravity, the fuel charge to said individual conduit means.

2. The improvement of claim **1** wherein said apportioning means has an intake opening, and divider means positioned in said intake opening and extending in a direction parallel to a line along the force of gravity.

3. The improvement of claim **2** wherein the internal combustion engine includes a plurality of combustion chambers which are superposed and said divider means is vertically disposed and generally parallel to a line through the superposed chambers.

4. The improvement of claim **3** wherein said intake opening divider means forms two chambers in side-by-side relationship, one relative to the other.

5. The improvement of claim **4** wherein said individual conduit means includes at least two individual conduit portions having outlet openings into at least one combustion chamber, the conduits being curved such that the outlet openings are superposed vertically.

6. The improvement of claim **5** wherein said outlets of said individual conduit portions for each superposed combustion chamber are connected to the combustion chamber in the same relative position.