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EXHAUST HEADER

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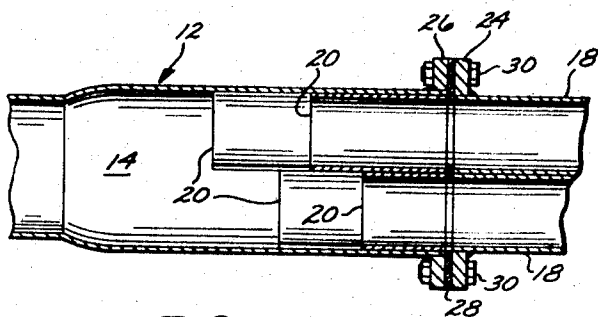


FIG. 4

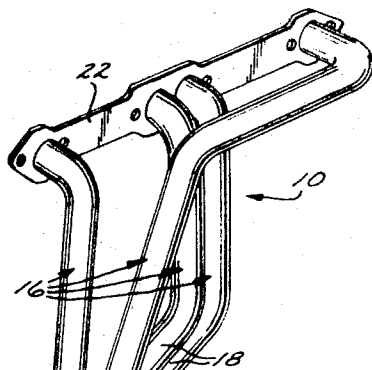


FIG. 1

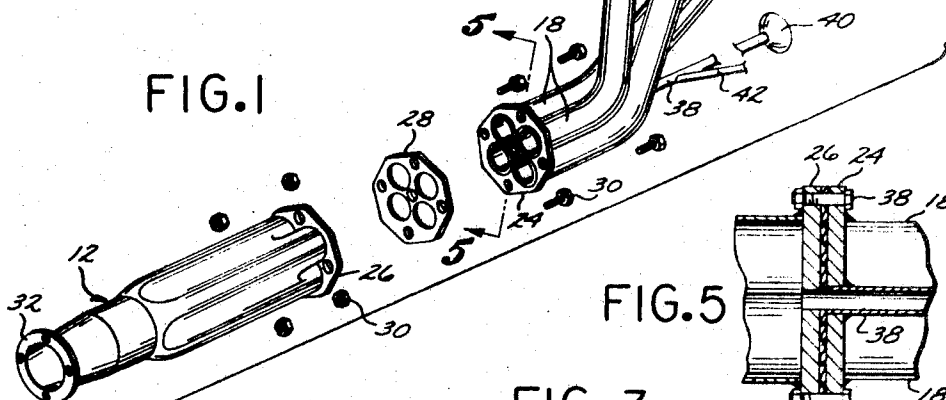


FIG. 5

FIG. 3

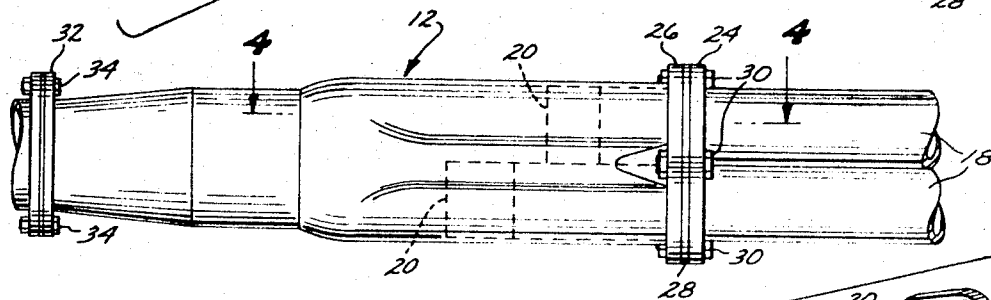
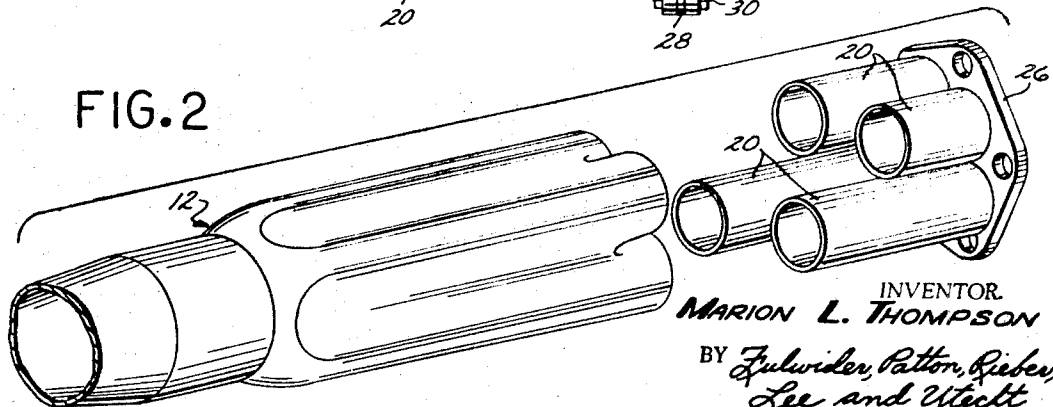


FIG. 2



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EXHAUST HEADER

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9 Claims

ABSTRACT OF THE DISCLOSURE

An exhaust header having tubes for connection between the exhaust ports of an engine and the interior chamber of the exhaust collector, and characterized in that the downstream ends of the tubes are arranged within the collector chamber such that the effective lengths of the air columns defined by the tubes is approximately equal.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to an exhaust header for collecting and carrying away the exhaust products of an engine.

Description of the prior art

Specially designed exhaust headers are used in high performance racing and sports vehicle engines to improve the efficiency of such engines. More particularly, it has been established that improved engine performance is achieved when the individual exhaust lines or tubes passing from the engine exhaust ports to the exhaust collector are made substantially equal in length. However, this is extremely difficult to accomplish. The tubes must fit between and around the various engine components and accessories as they pass from the exhaust ports to the collector, and this often means that the bends required in one tube make that tube longer than the others. To compensate for this disparity the designer must provide unnecessary bends in the other exhaust tubes. This provides the desired equal length exhaust header system, but a great deal of time and expense is necessary to design the exact bends in the tubes, and in a manner which will fit the bends to the equipment clutter around a particular engine. Each exhaust header is thus a relatively expensive, highly individualized item.

SUMMARY OF THE INVENTION

The present invention relates to an exhaust header in which the exhaust gas conduits between the engine exhaust ports and the exhaust collector project different distances into the interior chamber of the exhaust collector.

It is theorized that the balance or "tuning" of an engine to provide optimum efficiency or performance is dependent upon the degree to which the designer is successful in equalizing the respective contributions to such performance by the several cylinders. For example, in an internal combustion engine utilizing a carburetor, the air entering the carburetor, the air-fuel mixture entering the cylinders, and the exhaust discharged from the cylinders, collector, muffler and exhaust pipe are all part of a complex system of air columns defined by the respective components through which these various fluids flow.

Disturbances in these air columns are propagated as condensations and rarefactions, a disturbance at one end traveling to the other end, being reflected, traveling back, and so on. Stationary waves are set up in the columns. If the lengths of the air column are not properly tuned, the engine designer may find, for example, that at certain frequencies of inlet valve operation the air-fuel mixture is thrust out of the carburetor, or he may find that at

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certain frequencies of exhaust valve operation the exhaust gases pass freely through certain of the exhaust lines or tubes but that the lengths of the other tubes are such that passage of exhaust gases into such tubes is "bucked" or resisted.

The present invention is concerned with adjustment of the lengths of the air columns downstream of the engine exhaust ports. Ideally, such lengths are adjusted so that the air columns vibrate at a frequency providing rarefactions at the engine exhaust ports approximately at the times of opening of the exhaust valves. Moreover, such lengths should be adjusted so that the exhaust tubes each have an approximately equal effect in carrying away the exhaust gases. Of course, the invention also enables adjustments providing unequal lengths if such is desirable for any reason.

An object of the invention is to permit the exhaust tubes of an exhaust header to be formed or configured in a manner best suited to connect the tubes to the engine and fit them in and about the engine components and accessories, and without regard to the disparate physical length of the air columns defined by the irregularly shaped tubes. Then, the lengths of the air columns are adjusted by adjusting the distance which each tube projects into the interior chamber of the exhaust collector.

The collector chamber is of relatively large volume compared to that of each exhaust tube so that discharge of gases into the chamber is generally equivalent to discharge of such gases into open space. Consequently, once the tubes have been fitted in optimum fashion to the engine, the disparities in length are corrected by projecting the tubes into the collector chamber the requisite distances.

Another object of the invention is to provide a set of adapter tubes of proper lengths to "tune" the air columns of the main exhaust tubes, and detachably mount these to the main tubes. This permits a dealer, for example, to stock various sets of adapter tubes for tuning "stock" or off-the-shelf sets of main tubes for various engines. The set of adapter tubes is preferably made an integral part of the collector so that installation of a set of adapter tubes is simply a matter of removing the existing collector and installing the "equal-length" collector.

Other objects and features of the invention will become apparent from consideration of the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an exhaust header according to the present invention;

FIG. 2 is an enlarged and exploded perspective view of the exhaust collector of the header of FIG. 1;

FIG. 3 is an enlarged side elevational view of the central portion of the header of FIG. 1;

FIG. 4 is a sectional view taken along the lines 4—4 of FIG. 3; and

FIG. 5 is a sectional view taken along the lines 5—5 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, there is illustrated an exhaust header 10 according to the present invention which is adapted for connection to the exhaust ports of an engine (not shown). The header 10 comprises, generally, an elongated collector 12 having an internal chamber 14; and a plurality of tubular conduits or assemblies 16.

As best illustrated in FIG. 1, each tubular conduit or assembly 16 includes an elongated, irregularly configured main tube 18 and an adapter tube 20 which fits and projects within the collector 12. Each main tube 18 is welded or otherwise rigidly connected at its upper or upstream

end to a mounting bracket 22. The bracket 22 is adapted to be bolted to the engine in overlying relation to the engine exhaust ports, and includes a plurality of openings to permit the exhaust gases from the engine exhaust ports to pass into the main tubes 18.

The tubes 18 are configured in a manner best adapted to fit the tubes 18 in the space available within the engine compartment. The downstream ends of the main tubes 18 are welded or otherwise rigidly secured to a plate or flange 24 provided with a plurality of apertures aligned with the ends of the tubes 18. The flange 24 includes openings for fasteners to facilitate securement of the collector 12 and tubes 20 to the tubes 18, as will be seen. The lengths of the tubes 18, by virtue of the irregular configurations thereof, generally are not of equal length. Consequently, the air columns defined by the main tubes 18 are also of unequal length.

As previously indicated, it has been found to be desirable to provide exhaust gas conduits or tubular assemblies 16 of substantially equal length to enhance the efficiency of performance of the engine with which the exhaust header 10 is associated. In this regard, the phrase "air column" is intended to include the gaseous or fluid column defined by the interior walls of each tube 18, for example, and which terminates substantially at the ends of such tube 18.

The plurality of adapter tubes 20, which are part of the tubular assemblies 16, are usually of unequal length, as best shown in FIGS. 2, 3, and 4. The adapter tubes 20 are wholly located within the collector chamber 14 and are secured at their upstream ends to a plate or flange 26 having apertures in alignment with the ends of the tubes 20.

The opposite or downstream ends of the adapter tubes 20 empty into the relatively large volume of the chamber 14, as best seen in FIG. 4, so that the effect is analogous to termination of the adapter tubes 20 in open space. As can be seen from the drawing, the axes of the tubes 20 are generally parallel to the longitudinal axis of the chamber 14, so that exhaust gases are discharged in the same general direction through the tubes 20 and through the chamber 14.

The flanges 24 and 26 to which the tubes 18 and 20 are welded, respectively, are engaged upon the opposite faces of a conventional sealing gasket 28 which is suitably apertured to permit the flow of exhaust gases from the tubes 18 into the tubes 20. The flanges 24 and 26 are rigidly bolted together in fluid-tight relation by a plurality of usual nut and bolt assemblies 30. The assembled main tubes 18 and adapted tubes 20 constituting the tubular assemblies 16 define air columns which are preferably of substantially equal length. The generally unequal lengths of the tubes 18 are effectively made equal by coupling to them adapter tubes 20 of appropriate length.

Preferably the tubes 20 which are welded to the flange 26 are made an integral part of the elongated collector 12 by welding of the upstream end of the collector 12 to the downstream face of the flange 26, as best seen in FIG. 4. With this arrangement, the disparate lengths of the main tubes 18 for various types of engines can quickly and easily be adjusted by substitution of a collector 12 incorporating adapter tubes 20 of the proper length. This greatly simplifies the stocking of parts and up-dating of existing engines.

The walls of the collector 12 defining the interior chamber 14 are preferably dished or formed inwardly to occupy as much of the space as possible which is defined by the exterior profile of the bunched or closely arranged adapter tubes 20 which extend in parallel relation and axial alignment with the collector 12.

The downstream extremity of the collector 12 is of circular cross section and terminates in a plate or flange 32 similar to the flanges 24 and 26. The flange 32 is adapted for securement by a plurality of fastener assemblies 34 to a complementary flange 36 forming a part of

the exhaust system leading to the muffler and tail pipe (not shown).

The foregoing arrangement also greatly facilitates welding of the tubular assemblies 16 to the collector 12. That is, by separating each tubular assembly 16 into a main tube 18 and an adapter tube 20, the main tube 18 can quickly be welded to its flange 24, and the adapter tube 20 welded to its flange 26. Weldment of the collector 12 to the flange 26 is also a simple matter. All that remains is to secure together the assembly with the fastener assemblies 30. However, as previously indicated, the primary object of the invention is the provision of tubular assemblies 16 extending or projecting different predetermined distances into the collector chamber 14 to thereby provide lengths of tubular assemblies 16 which heretofore were possible only by incorporating extra bends in certain of the tubes.

The adapter tubes 20 can be used not only to tune the exhaust side of the engine, that is, adjust the effective lengths of the conduits on the exhaust side, but also can be used to tune the intake side of the engine. For example, if an intake runner, which term is used to indicate the air-fuel line from the carburetor to the intake port of a particular cylinder, is pinched or sharply bent or for some reason is not providing the same fluid flow as the other intake runners, the adapter tube 20 corresponding to that runner can be adjusted in length to correct the malfunction of the intake runner. In this regard, it has been found that shortening such an adapter tube 20 provides an eductor effect tending to encourage an increase in the rate of fluid flow through the associated main tube 18 and also through the associated intake runner.

Although the present invention has been referred to in connection with racing and sports vehicle engines, the invention is adapted for use with various other types of engines, including stationary and aircraft engines, as will be immediately apparent to those skilled in the art.

Referring now to FIGS. 1 and 5, an elongated air tube 38 having a bell mouth or flared end 40 is welded at its downstream end to the flange 24. This downstream end is in communication with complementary openings in the flanges 24 and 26 and in the gasket 28. Fresh air entering the upstream end 40 of the air tube 38 can thus flow into the collector chamber 14. The tube 38 can be configured (not shown) to locate the end 40 in optimum position for receiving a flow of air.

The air tube 38 provides additional oxygen to the chamber 14 and other downstream exhaust components so that unburned charges present in the exhaust can be burned. Thus, with the addition of the tube 38, the collector 12 can function as an afterburner. Moreover, a fuel line 42 can also be attached to the tube 38, as illustrated, to feed or inject fuel into the tube 38 for mixture with incoming air, thereby enhancing the combustion and afterburner effect. Afterburning not only improves the completeness of combustion, which is important in smog control, but also appears to have an eductor effect on the exhaust emanating from the adapter tubes 20. That is, a low pressure area appears to be created downstream of the tubes 20, which desirably facilitates discharge of exhaust gases.

I claim:

1. An exhaust header for receiving gases from the exhaust ports of an engine, said header comprising:
 - a collector having an elongated internal chamber; and
 - a plurality of tubular means adapted at their upstream ends to receive exhaust gases from separate ones of the engine exhaust ports, the downstream ends of said tubular means being connected to said collector in communication with said chamber, a plurality of said downstream ends projecting into said chamber for discharge of said exhaust gases along axes generally parallel to the longitudinal axis of said chamber, the projecting portions being of predetermined

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lengths and forms such that said plurality of tubular means are characterized by air columns of approximately equal effective lengths.

2. An exhaust header according to claim 1 wherein said tubular means comprise a plurality of main tubes for connection at their upstream ends to said engine exhaust ports; a plurality of adapter tubes of different lengths; and coupling means connecting said adapter tubes to said collector and to said main tubes, said adapter tubes being located within said chamber, and forming a continuation of said main tubes.

3. An exhaust header according to claim 2 wherein said coupling means includes: mating flanges on said main tubes and said adapter tubes; and means detachably fastening together said flanges whereby said adapter tubes can be quickly attached to said main tubes to adjust the lengths of said air columns according to the lengths of said adapter tubes.

4. An exhaust header according to claim 1 wherein said projecting portions of said downstream ends project different predetermined distances into said chamber.

5. In an exhaust header for receiving gases from the exhaust ports of an engine, wherein said header includes a collector having an elongated internal chamber, and further includes a plurality of main tubes defining a corresponding plurality of air columns and adapted for connection at their upstream ends to separate ones of the exhaust ports, the improvement comprising:

a plurality of adapter tubes of different lengths; and coupling means connecting said adapter tubes to one extremity of said collector and to said main tubes, said adapter tubes being located within said chamber, and forming a continuation of said main tubes, the

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axes of said adapter tubes being generally parallel to the axis of said chamber.

6. The exhaust header improvement according to claim 5 wherein said coupling means includes: mating flanges on said main tubes and said adapter tubes; and means detachably fastening together said flanges whereby said adapter tubes can be quickly attached to said main tubes to adjust the lengths of said air columns according to the lengths of said adapter tubes.

7. The exhaust header improvement according to claim 5 wherein said adapter tubes are immediately adjacent one another.

8. The exhaust header according to claim 1 and including a conduit in communication with said internal chamber and the atmosphere to thereby enable a flow of air into said internal chamber.

9. The exhaust header according to claim 8 and including means for feeding combustible fuel into said internal chamber.

References Cited

UNITED STATES PATENTS

2,940,249	6/1960	Gospodar	60—32
3,287,900	11/1966	Soltau	60—30

FOREIGN PATENTS

182,583	12/1954	Austria.
971,405	9/1964	Great Britain.

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