Sept. 21, 1954 K. F. FROEHLICH 2,689,451

EXHAUST HEADER

Filed Aug. 23, 1949

Fig. 1.

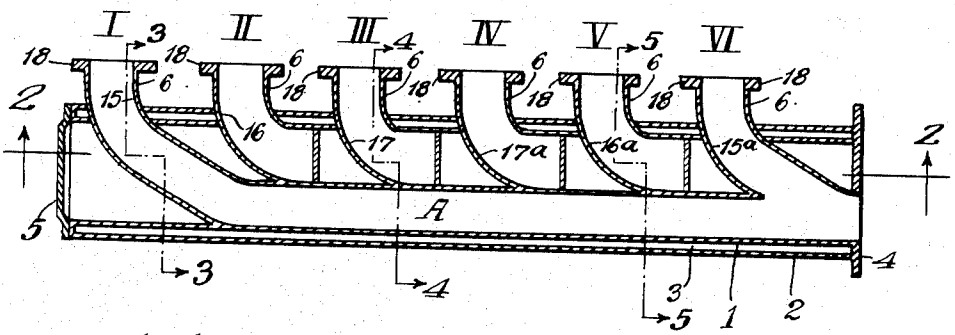


Fig. 2.

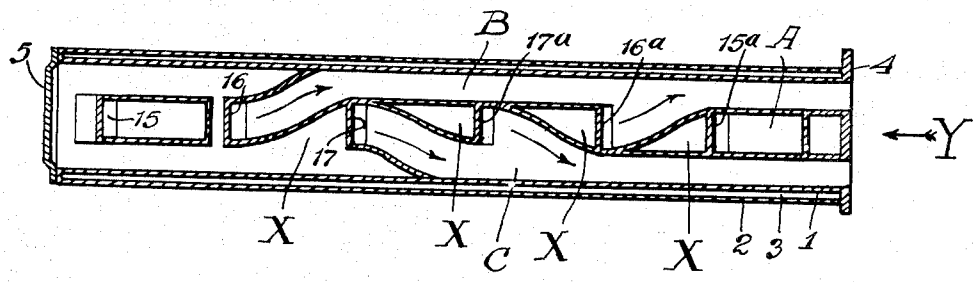


Fig. 3.

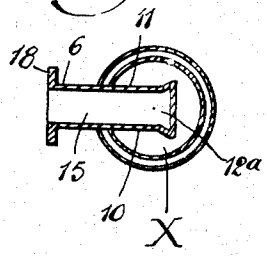


Fig. 4.

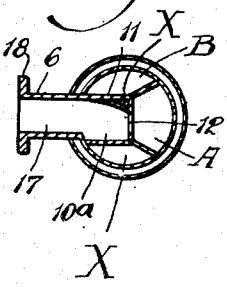


Fig. 5.

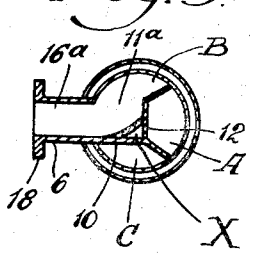
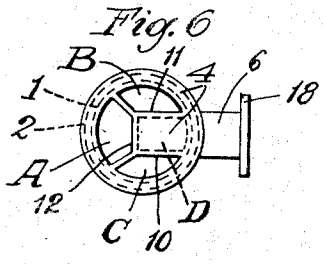


Fig. 6



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2,689,451

EXHAUST HEADER

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Application August 23, 1949, Serial No. 111,849

1 Claim. (Cl. 60—29)

1

My invention relates to an improvement in exhaust headers and has for one purpose to provide a watercooled exhaust header structure.

Another purpose is to provide a header with separate ducts.

Another purpose is to provide a header structure with straight ducts.

Another purpose is to provide a header structure readily adaptable to engines having different firing orders.

Another purpose is to provide a smooth and continuous passage for exhaust gases.

Other purposes will appear from time to time in the course of the specification and claim.

I illustrate the invention more or less diagrammatically in the accompanying drawing wherein:

Figure 1 is a longitudinal axial section;

Figure 2 is a section on the lines 2—2 of Figure 1;

Figure 3 is a section on the lines 3—3 of Figure 1;

Figure 4 is a section on the lines 4—4 of Figure 1;

Figure 5 is a section on the lines 5—5 of Figure 1; and

Figure 6 is an end view in direction Y of Figure 2.

Like parts are indicated by like symbols throughout the specification and drawing.

Referring to the drawing, it will be understood that the structure indicates an exhaust header for use with a six cylinder in-line four-cycle Diesel engine. The location of the cylinder is illustrated in Figure 1 by Roman numerals I to VI inclusive.

Numeral 1 indicates an inner tube of the header structure and 2 an outer tube, the space between, 3, being usable as a water space for water-cooling the header. No water connections are shown, since the details of the cooling circulation do not of themselves form part of the present invention.

Numeral 4 generally indicates a plate or flange with openings as shown in Figure 6 which lead to the atmosphere or may be connected to an exhaust turbine. The opposite end is closed by a blind flange 5. There are six nozzles 6 on the side of the exhaust header to which the engine cylinders are connected.

In considering the general functions and details of the header, I find it desirable to provide, within the above-described water-jacketed outer casing or tube 1, a plurality of runs or ducts which are, so far as possible, straight-sided. If we assume the exhausts to be 360° apart, for the

2

engine described, three ducts are necessary, two cylinders being connected together to each single duct. The structure thus provided may be employed in connection with an exhaust turbine, although advantages also accrue when the engine is directly exhausted to the atmosphere, inasmuch as there is no interference from exhaust impulses entering a common header at a time when scavenging might be taking place. The header may be used for both two and four-cycle engines and in the case of four-cycle engines, it is generally to be applied where a Büchi supercharger is employed.

The Büchi system requires separating certain sets of cylinders. In the structure herein shown, the discharge end surrounded by the flange 4 will have a plurality of independent outlets, all ending at the discharge flange or ring 4 of the header. The outlets shown in Figure 6 are only approximately in the same location as the turbine inlets provided for on the standard Büchi turbine. The matching of the openings in the exhaust can be obtained by modifying the last portion of the ducts in the exhaust header, by modifying the turbine inlet or by providing a distance piece, which is usually provided for anyway to take care of heat expansion.

In my system it also follows that if smooth, continuous passages are to be provided from the exhaust flange of the cylinder head of the engine through a suitable duct in the header, there will result certain dead or unused portions of the header which will remain idle and completely surrounded by metal walls. Sudden changes in the area of the ducts are detrimental to the flow of gas therethrough, which is the reason for creating such dead spaces, rather than leaving openings to encourage pressure losses.

Referring to Figure 1, it will be understood that cylinders I and VI are connected to a common duct space indicated at A. Cylinders III and IV are interconnected and cylinders II and V are interconnected.

The underlying scheme can best be pictured by assuming the exhaust header to be made of three longitudinal plates extending uninterruptedly from end to end of the header, these plates being, for example, the bottom plate 10 of Figures 3 and 5, the top plate 11 of Figures 3 and 4 and the side plate 12 of Figures 4 and 5. These plates may be solidly welded to the interior of the tube or pipe 1, which forms the header.

Wherever necessary, a hole is formed or burned through the outer pipe 1 in the proper location and ducts 15, 15*a*, 16, 16*a* and 17, 17*a* are inserted,

each such duct being separately flanged, as at 18, for proper securing in relation to the exhaust of one of the engine cylinders.

To give proper access for the individual cylinders, gaps may be formed in the above-described longitudinal plate structure. The gaps may be in the side plate 12, as shown at 12a in Figure 3, or may be in the bottom plate as shown at 10a in Figure 4, or may be in the top plate as shown at 11a in Figure 5. The six-cylinder structure shown, therefore, will have three main ducts extending longitudinally and in parallelism along the header structure. These will face the duct A which receives the ducts 15 and 15a from the cylinders I and VI respectively. The main duct B receives the ducts 16 and 16a from the cylinders II and V. The third main duct C receives the ducts 17 and 17a from the cylinders III and IV. The result is that at the discharge end of the header there are four openings of which three are useful and one is dead. The opening of dead duct D is covered by plate 4 as shown in Figure 6.

It will be clear from the above that no internal change in the welded structure is necessary to accommodate any firing order that may be desirable in the engine. Although I have described and shown a typical arrangement, any combination of cylinders may be chosen without any change in the basic structure of the header, depending upon where the openings are made in the longitudinal plates 10, 11 and 12. This advantage is not found in any other header known to me and is obtained by sacrificing some dead space in the area of the header. I illustrate such dead space area, for example, at various points at X in Figure 2.

It will be realized that, whereas, I have described and illustrated a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. Especially, the invention is not limited to number of cylinders of the engine nor to the number of ducts in the exhaust header. I therefore wish my description and drawing to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my specific disclosure herein.

The use and operation of my invention are as follows:

I have illustrated my invention as applied to an engine having the firing order of 1, 4, 2, 6, 3, 5. My header is shown as applied to a six-cylinder in-line engine, the cylinders being indicated I to VI. In considering my duct structure, I provide, basically, a distributing duct generally indicated at D which is shown as including parallel plate walls 10, 11 and 12. These walls are suitably breached to admit the cylinder ducts above described and to provide outlets for the cylinder ducts to the main exhaust ducts A, B and C. At the discharge end of the header, the space occupied by the distributing duct D is waste or dead space, the ducts A, B and C serving as live exhaust area.

I claim:

An exhaust manifold for use with and adapted for connection to a multicylinder engine including a generally elongated housing adapted to extend longitudinally along an engine when mounted thereon, a plurality of rectilinear passages spaced about and extending longitudinally within the housing of the manifold, one of the longitudinal passages being a distributor passage and the others being exhaust passages, the exhaust passages being formed and adapted to convey the exhaust gases from the engine cylinders, the distributor and exhaust passages being defined by a plurality of generally longitudinally extending interior walls, each wall being common to one exhaust passage and to the distributor passage, the distributor passage being disposed adjacent the exterior of the housing and having an outwardly disposed wall uncommon to any of the exhaust passages, and a plurality of exhaust ducts adapted for connection to individual cylinders in the engine and extending through the housing at the uncommon outwardly disposed wall into the distributor passage, at least two of the exhaust ducts being assigned to each of the exhaust passages in the housing and passing through the wall common to the distributor passage and their assigned exhaust passage, the interior walls of the exhaust passages being generally uninterrupted except at the exhaust duct opening, whereby the longitudinal flow of the exhaust gases in each of the exhaust passages is not interrupted by the exhaust ducts.

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