Nov. 24, 1953 F. C. TROMEL 2,660,031

EXHAUST MANIFOLD FOR INTERNAL-COMBUSTION ENGINES

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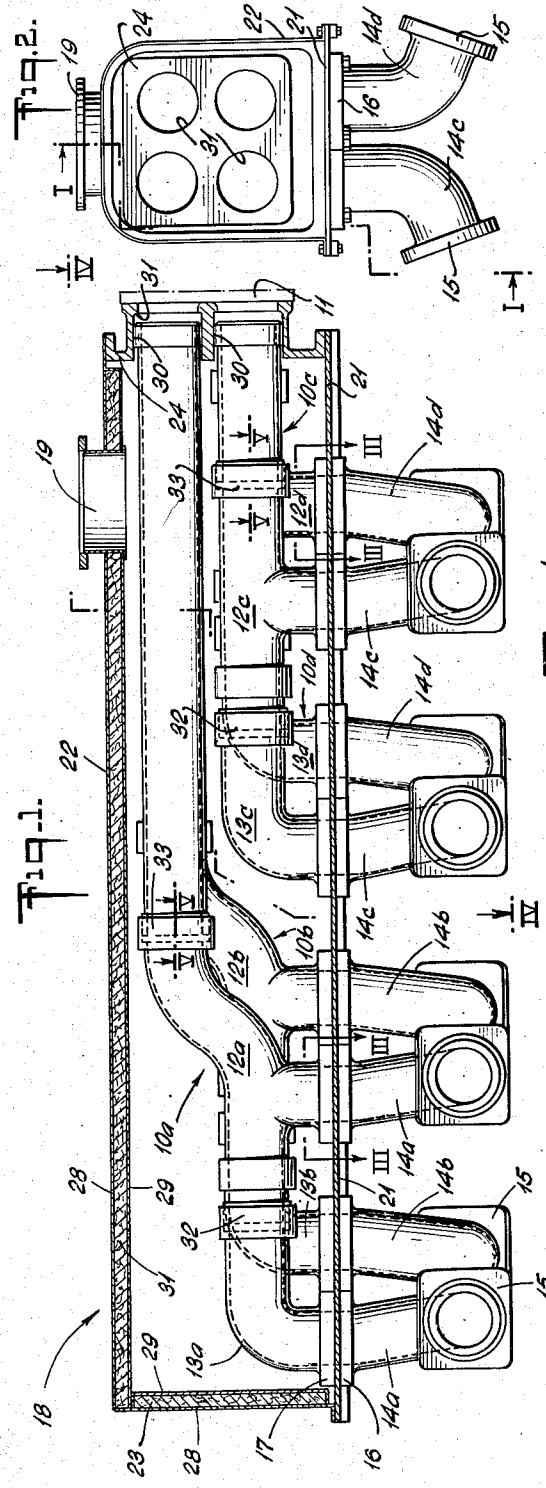

Fig. 1.

Fig. 2.

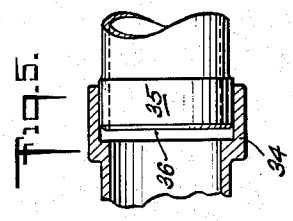

Fig. 5.

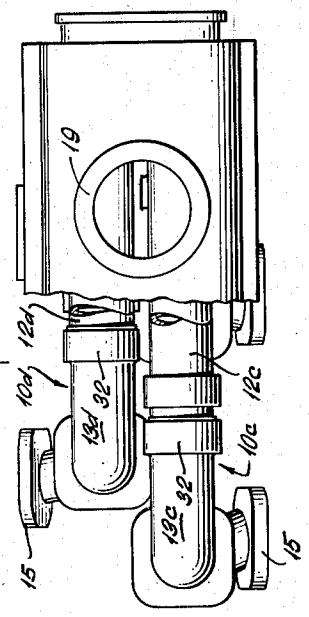

Fig. 4.

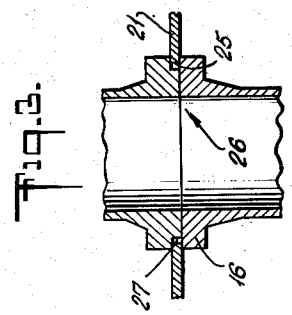

Fig. 3.

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EXHAUST MANIFOLD FOR INTERNAL-COMBUSTION ENGINES

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2 Claims. (Cl. 60—29)

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This invention relates to exhaust manifolds for internal combustion engines.

In the operation of turbo-supercharged diesel engines of the type used to drive the generator of electromotive locomotives, it is well known that the intense heat of the exhaust gases causes warping, buckling, and other forms of distortion in the exhaust manifold. Such manifolds are of considerable length which, in large locomotives, is in the order of 8 to 9 feet. Manifolds of such length, if the main conduit and the branches are of unitary construction, become misaligned with respect to the exhaust ports due to thermal expansion. Furthermore, there is frequently cracking of the pipes, particularly at the joints; and the escaping gases are annoying and hazardous to the health of the operating crew. Flexible couplings have been found to be impractical since the materials required to withstand the heavy duty incident to such constructions are too expensive for competitive use. Means to cool the manifold are undesirable in supercharged engines because the consequent drop in the heat of the exhaust gas diminishes its effectiveness in driving the turbocharger. In fact, lagging is ordinarily provided to enclose the manifold to prevent the loss of heat.

The principal object of the invention is, therefore, to provide an exhaust manifold assembly so constructed that the linear expansion of its main conduit members will be absorbed by a unique slip joint arrangement in such members and so that the gases escaping through the slip joints will be captured in a collector and thence discharged outside the locomotive superstructure. Another object is to provide such a manifold enclosed by a gas collector, the manifold being constructed of cast iron elements with slip joints therein which are adapted to permit longitudinal thermal expansion of such elements, thereby to avoid misalignment of the branches at the exhaust ports. Other and further objects of the invention will appear from the foregoing description, the accompanying drawing, and the appended claims.

Referring to the accompanying drawing, Fig. 1 illustrates an embodiment of the invention in an exhaust manifold assembly shown in elevation with an escape gas collector shown in section, the section being taken along the line I—I of Fig. 2; Fig. 2 is an end view of the manifold and gas collector of Fig. 1; Fig. 3 is a section view of the joint between a branch and main conduit taken along the line III—III of Fig. 1; Fig. 4 is a top view of a part of the manifold assembly with a fragmented portion of the gas collector substantially as viewed from the line IV—IV of Fig. 1; and Fig. 5 is a section view of a slip joint in a main conduit unit taken along the line V—V of Fig. 1.

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In the drawing, the exhaust manifold assembly of the invention is shown in Fig. 1 as applied to an eight cylinder engine and comprises four cast iron units 10*a*, 10*b*, 10*c*, and 10*d*, each of which conducts the exhaust from two power cylinders (not shown) to the turbocharger flange 11. Each unit comprises a main conduit, correspondingly numbered 12*a*, 12*b*, 12*c*, and 12*d*, an elbow member, correspondingly numbered 13*a*, 13*b*, 13*c*, and 13*d*, and two branches, correspondingly numbered 14*a*, 14*b*, 14*c*, and 14*d*. Each branch has a flange 15 at its intake end adapted to form a joint with a corresponding flange (not shown) on the exhaust ports of a power cylinder head. The delivery end of each branch also has a flange 16 adapted to form a joint with a corresponding flange 17 on the receiving end of an elbow member (see Fig. 3).

A gas collector, generally indicated as 18, is provided to completely enclose the manifold and to capture any leakage of exhaust gas that may escape therefrom. A vent 19 is adapted for connection with means (not shown) to conduct leaking exhaust gas outside and away from the locomotive superstructure. Collector 18 comprises a flat base sheet 21, preferably of $\frac{3}{16}$'' mild steel, to which is bolted (see Fig. 2) a hood 22 extending substantially the full length of the manifold. The rear end of the collector is closed by a wall 23 and the forward end is closed by a wall 24. Base sheet 21 is formed with openings 25 (see Fig. 3) in which are disposed the joints 26 connecting the branches and the main conduit. Flange 17 at the intake end of each elbow member has an annular recess 27 to allow for the termal expansion of base sheet 21. Hood 18 and rear wall 23 are formed of spaced sheets 28 and 29 between which is disposed heat insulating material such as glass wool. Outer sheet 28 is fabricated preferably of #14 mild steel and inner sheet 29 is preferably of #20 stainless steel. Front end wall 24 is an iron casting and has tubular openings 30 extending in the direction of the turbocharger for the reception of the forward ends of the main conduits of the manifold, such ends being normally spaced from shoulders 31 on the tubes to allow for the longitudinal thermal expansion of the conduits 12*a*, 12*b*, 12*c*, and 12*d*.

Each conduit unit has two slip joints 32 and 33, one arranged in the elbow between the two branches to which the conduit is connected and

one arranged between the forward branch and the delivery end of the conduit. The construction of such joints is best illustrated in Fig. 5. The leading end of the elbow portion and the leading end of the conduit portion forming part of the respective joints are provided with annular flanges **34** within which are disposed the trailing ends **35** of the adjacent conduit portions, such trailing ends being spaced from the delivery opening of the cooperating member, as at **36** to allow for the longitudinal thermal expansion of the conduits.

While there have been hereinbefore described approved embodiments of this invention, it will be understood that many and various changes and modifications in form, arrangement of parts and details of construction thereof may be made without departing from the spirit of the invention, and that all such changes and modifications as fall within the scope of the appended claims are contemplated as a part of this invention.

What I claim is:

1. An exhaust manifold for a compression ignition engine of the class which has a turbocharger driven by the engine exhaust gases comprising a plurality of main conduits, a plurality of branch conduits to receive the exhaust gases from the power cylinders of the engine, a plurality of intermediate conduits rigidly connected to the branch conduits on one end and to the main conduits in slip joint relation on the other end, a gas collector enclosing the main and intermediate conduits and movable relative to the latter to capture any exhaust gases escaping through the slip joints, and means to conduct such escape gases from the collector to the atmosphere.

2. An exhaust manifold for a compression ignition engine of the class which has a turbocharger driven by the engine exhaust gases comprising a plurality of main conduits, a plurality of branch conduits to receive the exhaust gases from the power cylinders of the engine, a plurality of intermediate conduits rigidly connected to the branch conduits on one end and to the main conduits in slip joint relation on the other end, a gas collector enclosing the main and intermediate conduits to retain the exhaust gas heat within the conduits, said collector passing through the rigid connection between the intermediate and branch conduits in a gas tight seal therewith and being movable relative to the connection in the same direction as the movement at the slip joints thereby to capture and retain the exhaust gases escaping through the slip joints while permitting expansion of the structure as a whole, and means to conduct such escape gases from the collector to the atmosphere.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
917,081	Krygowski	Apr. 6, 1909
1,808,165	Harris	June 2, 1931
2,110,395	Fluor, Jr., et al.	Mar. 8, 1938
2,295,907	Lewis	Sept. 15, 1942
2,388,924	Mercier	Nov. 13, 1945
2,423,602	Magdeburger	July 8, 1947
2,479,318	Cramer, Jr.	Aug. 16, 1949

FOREIGN PATENTS

Number	Country	Date
24,104	Great Britain	Oct. 31, 1907