June 13, 1967 L. G. WATTEAU 3,324,533

METHOD OF MAKING WATER JACKETED EXHAUST MANIFOLD

Filed June 2, 1965

3 Sheets-Sheet 1

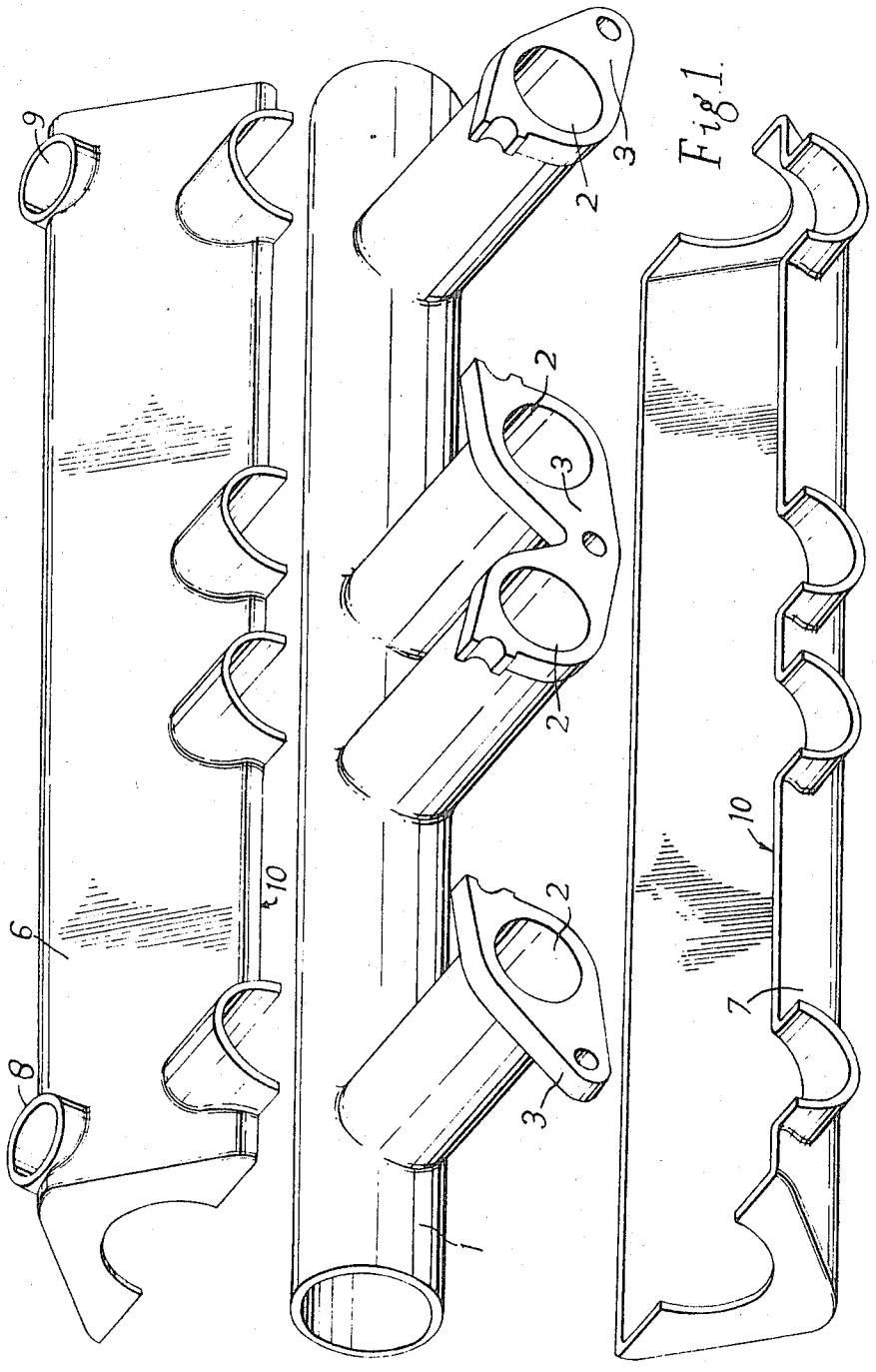


Fig. 1.

INVENTOR:
LEWIS G. WATTEAU

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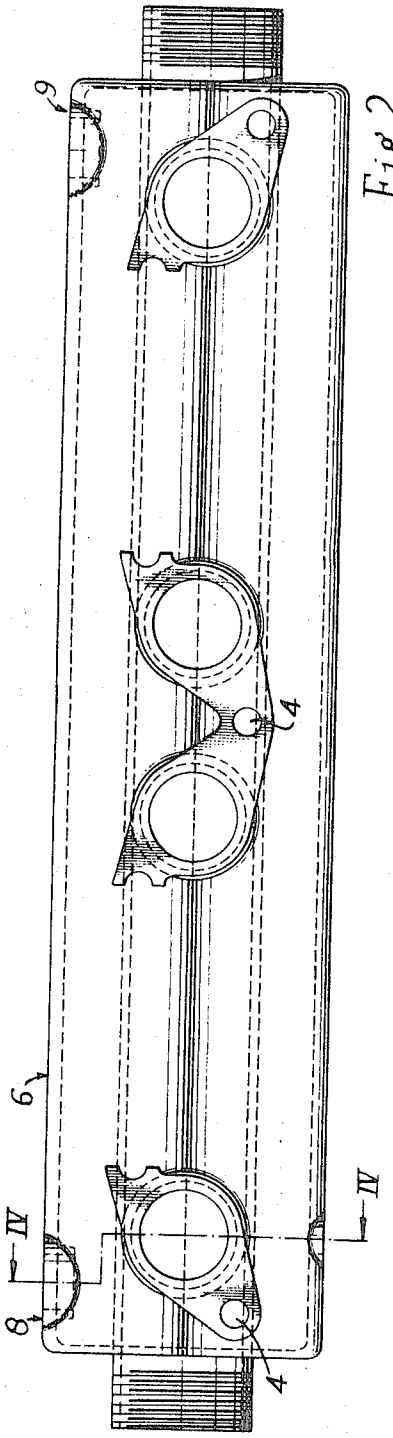


Fig. 2

INVENTOR:
LEWIS G. WATTEAU

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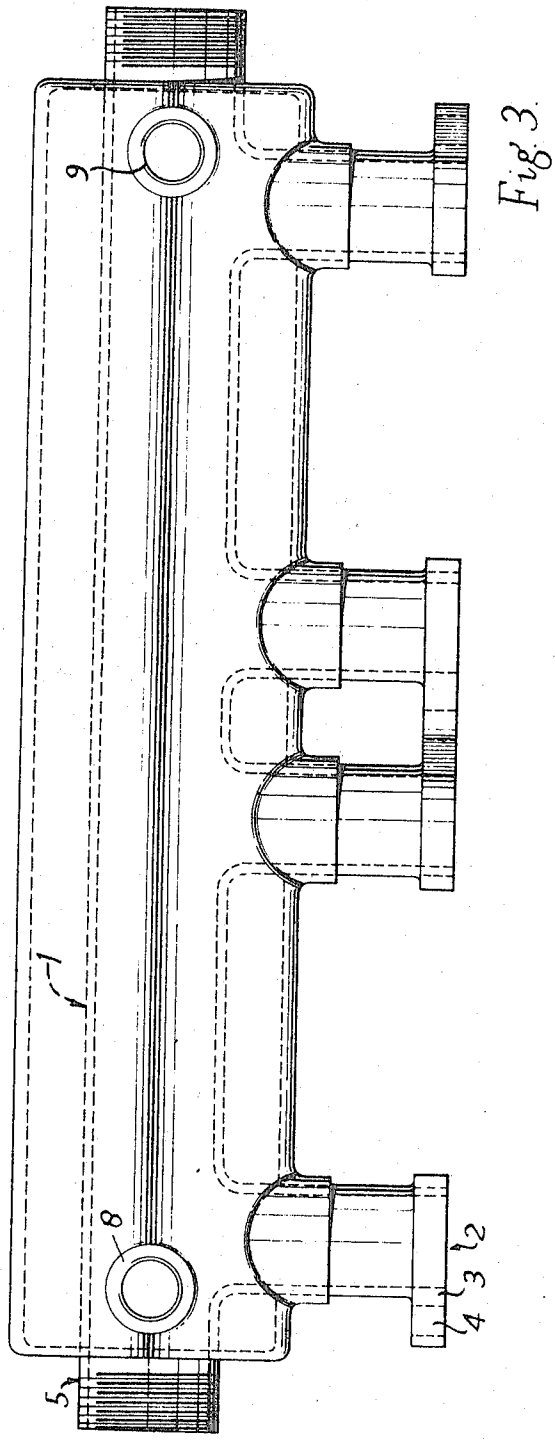


Fig. 3.

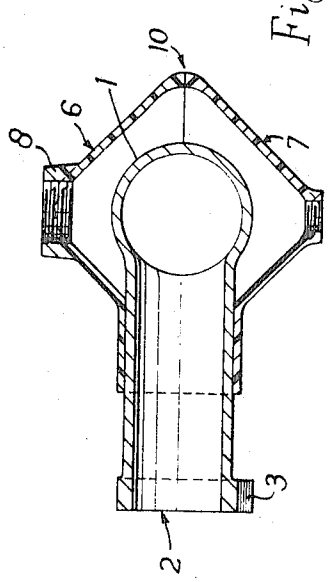


Fig. 4.

INVENTOR:
LEWIS G. WATTEAU

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METHOD OF MAKING WATER JACKETED EXHAUST MANIFOLD

Lewis Guy Watteau, Sussex, England, assignor to Sutton Power (Equipment) Limited, Burgess Hill, England, a corporation of Great Britain

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2 Claims. (Cl. 29—156.4)

This invention relates to water-jacketed exhaust manifolds, particularly for marine engines.

Hitherto the conventional water-jacketed marine exhaust manifold has most commonly been made as a metal casting of, for example, grey iron. The casting consists essentially of an inner chamber for passage of the hot exhaust gases, and an outer chamber or jacket for throughflow of cooling water. Such a casting necessarily has variations in wall thickness and this factor commonly leads to distortion in the finished product. Further, the castings are liable to porosity of the material. The production of such castings is comparatively laborious and time-consuming and accordingly tends to be comparatively costly, and the position is further aggravated by a high rejection rate due to the faults referred to.

The object of the present invention is to provide an improved form of water-jacketed exhaust manifold, and a method for its production, whereby the above drawbacks are avoided, and whereby other advantages such as extension of useful life and reduction of overall weight are achieved.

According to the present invention a water-jacketed exhaust manifold for an internal combustion engine comprises a hollow inner core to serve as an exhaust gas chamber, and a jacket disposed about and in sealing engagement with the core to serve as a cooling water chamber, said jacket being made wholly or substantially wholly of synthetic resinous plastics material or of material in which synthetic resinous plastics serves as a bonding agent.

The inner core may conveniently be cast iron, and the jacket may be of a single plastics material or of a mixture of plastics materials. In a preferred form the jacket is reinforced with a filler material, or is constituted by a fibrous material bonded with the resin, e.g. resin-bonded fibre-glass.

Considerable temperatures are involved, at least at the areas of contact between the core and jacket, and in particular relatively high local temperatures are found at and adjacent to the entry of exhaust ports into the core. It is accordingly preferred to use a compound resin-bonding material particularly selected to withstand such temperatures and consisting essentially of a mixture of polyester and epoxy resin.

Inlet and outlet ports may readily be provided in the jacket, and threads may be moulded in the plastics material or threaded inserts of metal or other material may be incorporated during this moulding.

Exhaust gas connections may be obtained by providing external threading on protruding ends of the core, e.g. during casting of a cast-iron core, and any blind ends of the core may be blanked off in conventional manner with an end cap or otherwise conveniently.

In a preferred embodiment, the jacket is formed as a plurality of portions subsequently assembled to constitute a whole, e.g. as two halves defined by division in a central longitudinal plane, said halves being jointed, e.g. cemented, together along their meeting surfaces with the same or another suitable material such as a binding agent to give a strong and completely water-tight joint.

In accordance with the invention, a method of making a water-jacketed manifold for an internal combustion engine

comprises the steps of providing a hollow inner core to serve as an exhaust gas chamber, preparing portions of a jacket made wholly or substantially wholly of synthetic resinous plastics material or of material in which synthetic resinous plastics serve as a bonding agent, disposing said portions of the jacket about the core in sealing engagement with the core, and jointing said portions together to serve as a cooling water chamber.

Conveniently, two counterpart portions of the jacket are halves defined by division in a central longitudinal plane of the jacket.

The jacket may be produced initially by the methods known in the art as (i) hand lay-up (contact), or (ii) pre-mix (DMC) moulding. With either of these methods, the portions are clamped over the core and subsequently cemented or bonded together.

Preferably at least those portions of the external surface of the core which will be exposed within the jacket after the fittting thereof are treated against corrosion prior to disposing of the portions of the jacket about the core.

In order to simplify the obtaining of a perfect fit of the portions of the jacket onto the core, the portions may be moulded using the core as a mould or mould part.

Threaded ports may be formed in one or more portions of the jacket by providing moulding inserts therein at the time of moulding and subsequently removing them, or by incorporating threaded permanent inserts during moulding.

In order that the nature of the invention may be readily ascertained, an embodiment of jacketed marine exhaust manifold and its method of manufacture in accordance therewith are hereinafter particularly described with reference to the accompanying drawings, wherein:

FIG. 1 shows in perspective an exhaust manifold and two halves of a water jacket therefor, seen in separated position.

FIG. 2 is a side elevation of the assembled jacketed manifold.

FIG. 3 is a plan view of the assembled jacketed manifold.

FIG. 4 is a transverse section taken on the line IV—IV of FIG. 2.

The manifold is prepared as a core and a surrounding water jacket. The core **1** is moulded by conventional methods from a suitable casting metal such as grey cast iron and including all the necessary ports **2**, mounting lugs **3**, bolt holes **4**, and threading **5**. That part of the external surface of the core which will subsequently be contacted by the cooling water and thus liable to corrosion, and particularly salt water corrosion, is then treated with a suitable corrosion-resistant surfacing material as well known in the art. As the external surface of the core is exposed it can readily be treated with adequate inspection over the exact area required and to an exact depth required, leading to prolonged resistance to corrosion coupled with a saving in the material used to resist corrosion. Hitherto, the corrosion resistant material was necessarily applied additionally to the entire internal surface of the jacket, and this step is now eliminated by the use of a naturally corrosion-resistant material for the jacket itself.

A moulded jacket of resin-bonded fibre-glass is then produced in two parts **6** and **7** to conform exactly to the exterior of the core. This may be achieved most conveniently in practice by utilising the core itself as part of the mould in which the fibre-glass is set, thereby ensuring perfect fitting of the jacket to the core. A water inlet port **8** and outlet port **9** are provided in the jacket by incorporating threaded metal inserts in the jacket at the time of moulding it, such inserts being subsequently removed. Alternatively metal inserts may be left perma-

nently in position in the moulding. The two longitudinal halves of the jacket are applied to the core and these are temporarily clamped in position about the core, by any suitable clamping means or encircling bands (not shown), and then cemented or bonded together along their surfaces **10** to form a strong water-tight joint between the two.

Such a manifold has its water-jacket completely sealed (other than at the ports **8** and **9**) and all the machining operations and potential sources of leaks hitherto attendant on all metal manifolds are eliminated.

To obtain the required high heat-rejection characteristics the conventional all-metal cast manifolds have hitherto needed to be of comparatively large dimensions and, being of a heavy material, have caused the weight of the manifold to be comparatively high in relation to the heat removed. By utilisation of the improved jacket of the present invention the weight of the manifold and therefore the all-up weight of the engine can be reduced, and this together with reduction of cost is an important factor in the choice of engine in normal circumstances where both weight and price are criteria.

The improved manifold can be applied to any marine diesel or petrol engine by a suitable selection of mix, or type of resin or resins used, to allow for variations in exhaust gas temperature peculiar to individual makes and types of engines.

In a practical example a polyester resin made by the firm of Mitchell & Smith, England, and known as Polymaster 552 is used with a reinforcement of fibreglass known commercially as "E-type" glass, the proportions being 2½ parts by weight of the resin to 1 part by weight of the fibreglass. The mixture is cured at a temperature of 120° C. for a period of 12 hours, followed by a further 12 hours at atmospheric temperature.

I claim:

1. The method of making a water-jacketed exhaust manifold for an internal combustion engine which comprises the steps of:

(a) providing a hollow metal exhaust gas chamber,

(b) using external areas of said gas chamber as portions of a mould, forming from fibreglass bonded with synthetic resinous plastics material two complementary portions of a jacket adapted to define a cooling water chamber with said gas chamber,

(c) disposing said portions of jacket in gas-tight sealing engagement with each other and with the gas chamber, and jointing said jacket portions to form a unitary whole.

2. The method of making a water-jacketed exhaust manifold for an internal combustion engine which comprises the steps of:

(a) providing a hollow metal exhaust gas chamber,

(b) using external areas of said gas chamber as portions of a mould, forming from fibreglass bonded with synthetic resinous plastics material two complementary portions of a jacket adapted to define a cooling water chamber with said gas chamber,

(c) treating with corrosion-resistant material those portions of the external surface of the chamber which remain exposed to water within the jacket,

(d) disposing said portions of jacket in gas-tight sealing engagement with each other and with the gas chamber, and jointing said jacket portions to form a unitary whole.

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ROBERT A. O'LEARY, *Primary Examiner.*

A. W. DAVIS, *Assistant Examiner.*