

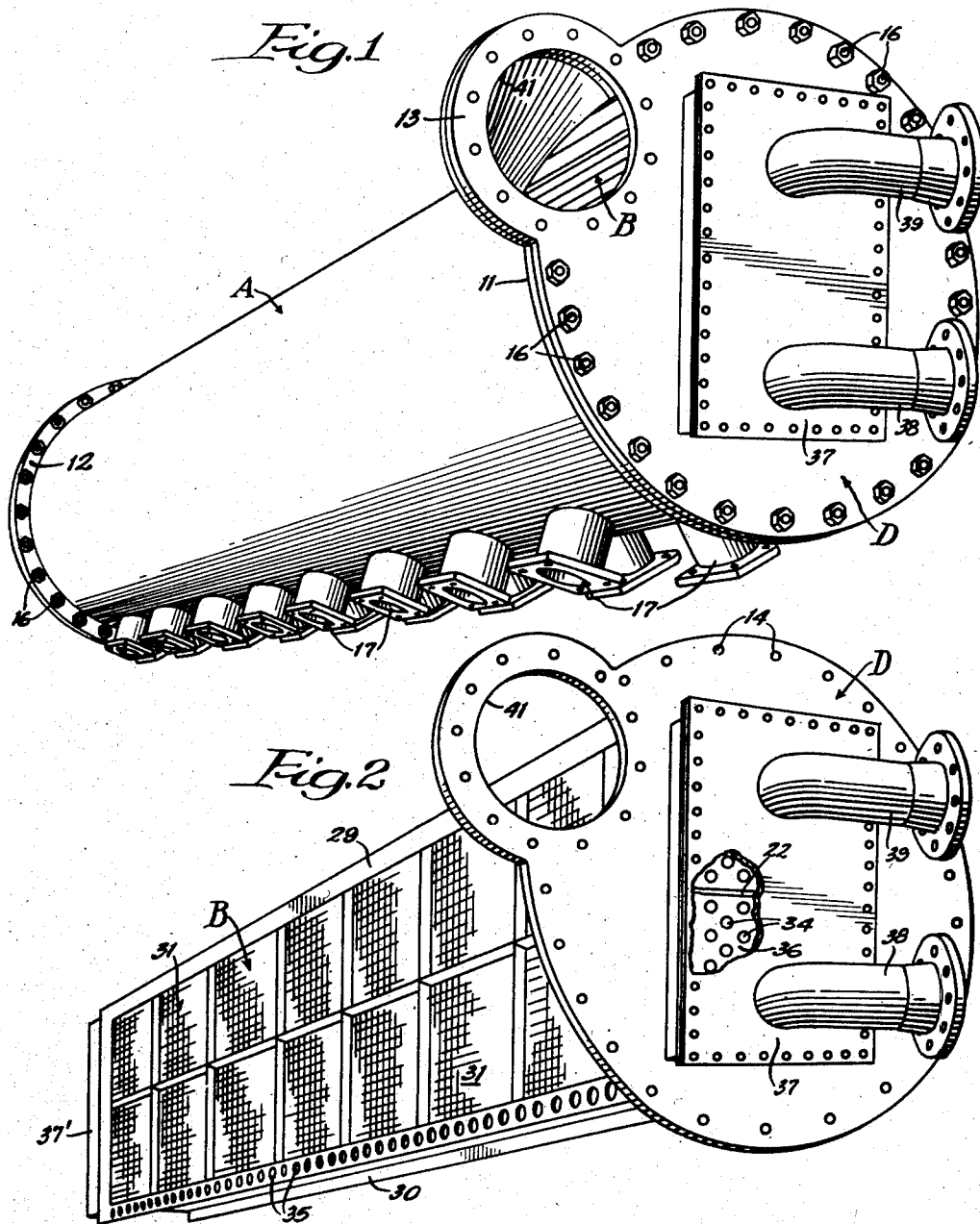
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A. D. BOGUS ET AL
HEAT EXCHANGER

2,843,367

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4 Sheets-Sheet 1



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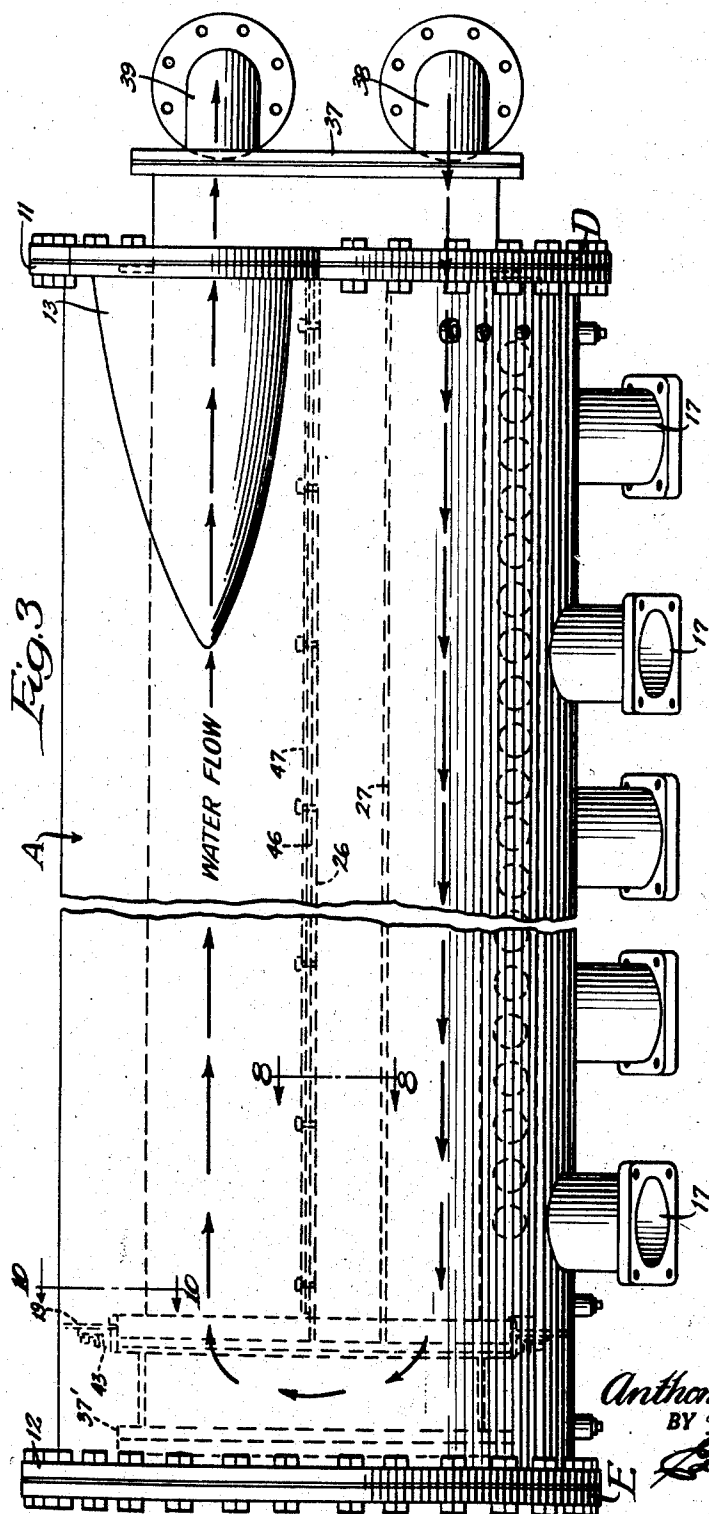
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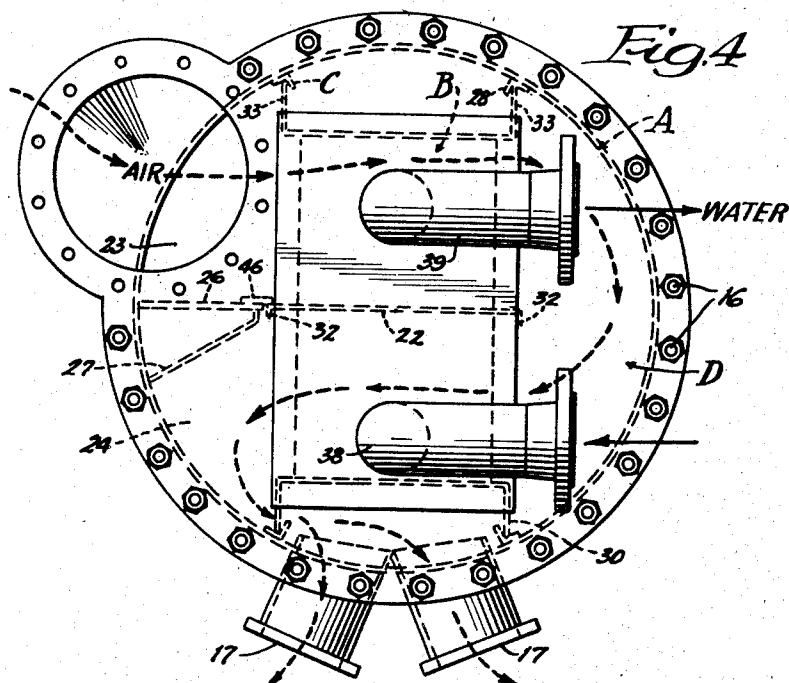
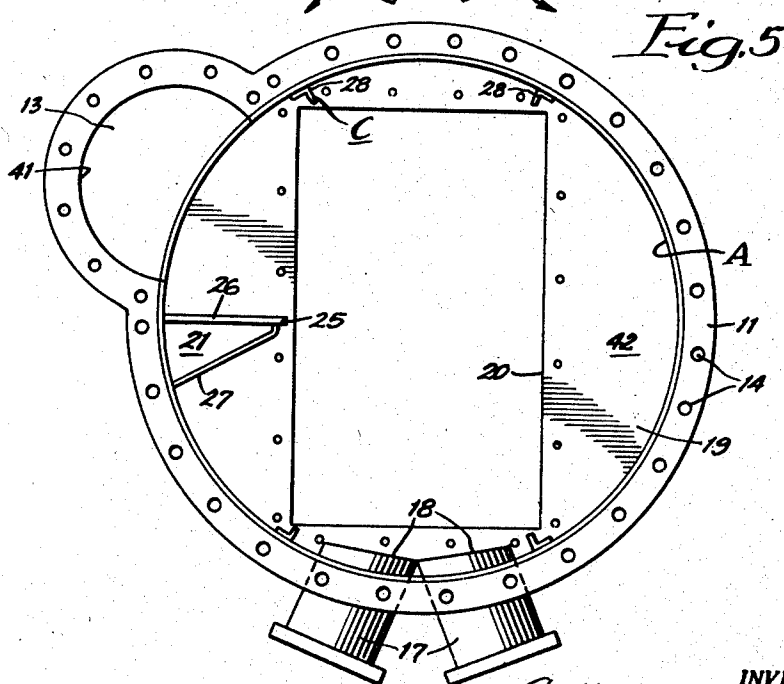
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HEAT EXCHANGER

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4 Sheets-Sheet 4

Fig. 6

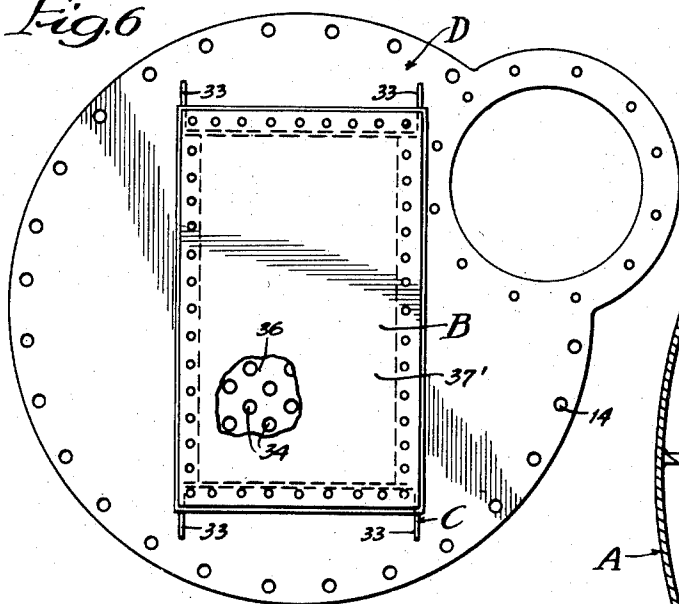


Fig. 8

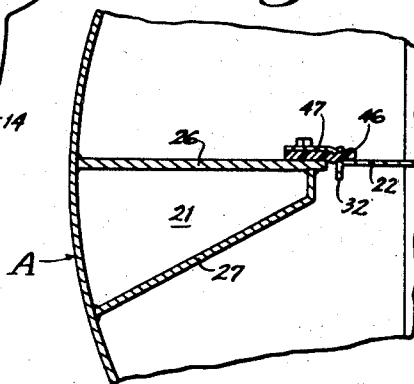


Fig. 7

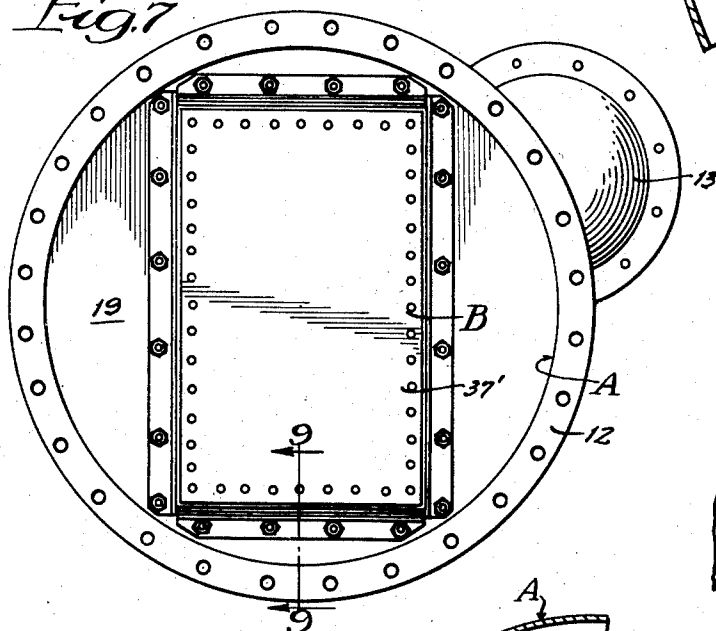


Fig. 9

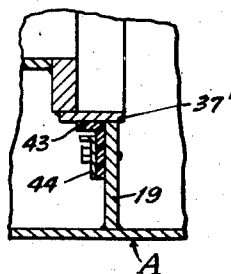
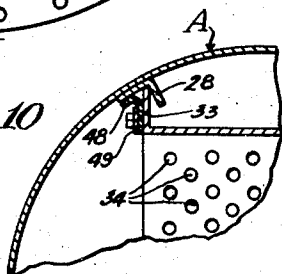


Fig. 10



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1

2,843,367

HEAT EXCHANGER

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2 Claims. (Cl. 257—239)

This invention relates to supercharger intercoolers for use with large horse-power internal combustion engines.

Horse-power development for internal combustion engines is much dependent upon the quantity of air and fuel that can be introduced into the cylinders during the charging cycle. Hence, for high horse-power engines, it is the practice to compress the air before introduction into the cylinders. However, it is imperative to the best results that the heat, induced by the compression, be dissipated. For that purpose intercoolers are interposed in the air flow from the compressor to the engine.

For engines of the multi-cylinder type, as for example those that develop around 2000 H. P., a very considerable amount of heat has to be dissipated. This calls for intercoolers comprising a heat-exchange core mounted in a distributing manifold. Generally water is circulated through the finned tubing of the core around which tubes the supercharged air is forced to travel in its passage from the compressor to the engine.

Such interchanger units often measure two or three feet in diameter and fifteen to twenty feet in length.

One of the problems in the production and use of such massive intercoolers is providing for a relative construction of the core and manifold as will permit reasonably facile initial assembly and a subsequent disassembly and re-assembly when required for occasional cleaning and/or repair.

The main objects of this invention, therefore, are to provide an improved construction of supercharger-intercoolers; to provide an improved construction of the intercooler heat-exchanger core and enclosing distributor manifold which may be facily assembled initially and subsequently disassembled and re-assembled when cleaning and/or repair or replacements are indicated; to provide an improved flange and angle-bar track mounting of the core and manifold which permits the sliding of the core axially into and out of the manifold; to provide an internal partitioning of the manifold as to coact with the heat-exchange core to provide return air-flow chamber; and to provide an improved supercharger-intercooler construction of this kind which is reasonably economical to manufacture and highly efficient in its functioning.

In the accompanying drawings:

Fig. 1 is a perspective view of an assembled intercooler unit constructed in accordance with this invention;

Fig. 2 is a perspective view of the heat-exchange core which is slidably supported in the distributor manifold;

Fig. 3 is a side elevation of the assembled unit as shown in Fig. 1;

Fig. 4 is an end view of the unit, taken from the right of Fig. 3;

Fig. 5 is an end view of the manifold itself, with the core removed, taken from the right of Fig. 3;

Fig. 6 is an opposite end view of the heat-exchange core;

Fig. 7 is a similar end view of the assembled unit, the view being taken from the left of Fig. 3;

Fig. 8 is an enlarged, fragmentary detail of the mani-

2

fold partition which divides the space at one side of the core into air-flow inlet and air-flow outlet chambers, the view being taken on the plane of the line 8—8 of Fig. 3;

Fig. 9 is an enlarged, fragmentary detail, taken on the plane of the line 9—9 of Fig. 7, showing how the inner end of the core is sealed off from the air-flow chambers at the point of an inner transverse manifold partition; and

Fig. 10 is an enlarged, fragmentary, sectional view of the manifold core-air-seal, taken on the plane of the line 10—10 of Fig. 3.

The essential concept of this invention involves a cylindrical distributor manifold and an elongated, rectangular cross-section heat-exchange core having longitudinally extending coating tracks and flanges for sliding telescopic assembly and support of the core in the manifold, with fluid-sealed partitions which provide chambers for the flow of the air through the core from inlet to outlets.

A supercharger-intercooler embodying the foregoing concept comprises a distributor manifold A and a heat-exchange core B, which is slidably mounted on track-flange means C, with the open ends of the manifold sealed by plates D and E.

The manifold A is an open-ended, cylindrical shell of a diameter approximately 2½ feet and eighteen feet long, having integral perimetrical flanges 11 and 12 adjacent or at the opposite open ends of the shell.

Adjacent one end, the manifold A has a portion formed with a radially-outward-tapering, arcuate-shaped enlargement 13 terminating at the flange 11 and constituting the air inlet to the manifold A.

The flanges 11 and 12 each have a circumferential series of holes 14 for the reception of bolts 16 for securing the manifold A and core B in operative, assembled relationship.

Circumferentially spaced from the enlargement 13 is a series of air-outlet nipples 17 extending longitudinally of the manifold from one end to the other. There would be as many of these outlet nipples 17 as there are engine cylinders on the engine wherewith this unit is to be used. As here shown there are two sets of air outlet nipples 17, thus indicating that this particular unit is for use with a sixteen-cylinder engine.

As will be observed from Figs. 4 and 5, these flanged nipples are bonded to the manifold A with the inner ends of the nipples extending an appreciable distance inwardly of the manifold wall.

Inwardly adjacent the further or inner end of the manifold A—the one remote from the end through which the core B is inserted and removed—is bonded a transverse partition 19 wherein is formed a rectangle opening 20 dimensioned to permit the entrance of the inner end of core B and coact therewith to permit sealing off the end of the air-flow chambers in the manifold A, as presently will be described more fully.

Longitudinally of the manifold A is a radially-inwardly extending V-shaped partition 21. This coacts with the partition 22 of the core B to divide the space in the manifold A, on that side of the core B, into two chambers 23 and 24 (see Fig. 4) for the air flow through the core B, as presently will be explained.

The partition 21, as here shown, comprises a pair of plates 26 and 27 both of lengths equal to the axial distance between the flange 11 and the radially-disposed partition 19. These plates 26 and 27 are angulated to form a V with the base edges of the respective plates bonded along the inner wall of the manifold A and along their abutting edges. The plate 26 is disposed radially in alinement with the apex end 25 contiguous to the partition 22 of the core B.

3

Along the inner wall of the manifold A are opposed circumferential-spaced angle bars 28 forming a part of the track-flange supporting means C presently to be described.

The heat-exchange core B is a structure of more or less conventional form. In the main it comprises a requisite frame work involving the longitudinal, medial partition 22 and opposite side plates 29 and 30. Between the partition 22 and the side plates are arranged finned sections 31. At one end the core B mounts the plate E. The partition 22 has flanges 32 formed along its lateral edges (see Fig. 4) which, when the core B is assembled in the manifold A, are juxtaposed to the apex 25 of the manifold partition 21.

The side plates 29 and 30 are channel material, providing outwardly-extending, parallel flanges 33 which coact with the angle bars 28 to provide the sliding support for the core B in the manifold A, as presently will be set forth more fully.

The finned-tube sections 31 have their tubes extending longitudinally of the support frame of the core B, the ends of the tubes 34 being bonded to conventional headers 36 within the usual tanks 37 and 37', at opposite ends of the support frame. At the forward or outer end, the tank 37 is divided into two parts by the end of the partition 22, from which parts lead the coolant inlet 38 and outlet 39 respectively. At the opposite or inner end, the tank 37' is a single chamber providing for the return flow of the coolant.

The track-flange means C, for slidably supporting the core B in the manifold A, comprises the angle bars 28 and the flanges 33, as already has been indicated.

The angle bars 28 are spaced apart horizontally, on the inside of the manifold wall, a distance practically equal to the distance between the pairs of parallel flanges 33 on the respective side plates 29 and 30. The vertical transverse distance between the angle bars 28 is substantially equal to the distance between the extremities of the flanges 33 on the respectively opposite side plates 29 and 30.

Thus the bars 28 serve as tracks to receive the ends of the flanges 33 and allow the core B to slide into and out of and be properly supported in the manifold A.

The flange 33 on the lower left side of the side plate 30, which is exposed in the chamber 24, has a series of openings 35 formed therein to permit communication between the chamber 24 and the spaces below the core side plate 30 which opens to the air outlet nipples 17.

The simple convenience of such a support means for the initial assembly and the subsequent disassembly and reassembly of these two large, bulky units is clearly obvious.

The plate D fits snugly around the tank 37 and the perimetrical contour of the plate is identical with that of the flange 11, including the air-inlet offset 13. The plate D has an opening 41 formed therein, in axial registration with the outer extremity of the offset 13, forming the air-inlet to the manifold A as previously pointed out. At this point is attached the air conduit from the compressor (not shown).

The plate E is a simple disk of a diameter conforming with that of the manifold end flange 12.

When these plates D and E are bolted to their respective manifold flanges 11 and 12, with intervening gaskets, the core B is thoroughly sealed within the manifold A.

In order to prevent air leakage from the air chambers 23 and 24 beyond the partition 19, and air outflow from the chamber 23 into the chamber 24 and to the air-flow return chamber 42, seals are provided at several points of the assembly of the core B and manifold A.

Escape of air from the chambers 23 and 24 beyond the partition 19 is prevented by gaskets 43. These are pliable or cushion material, such as rubber or synthetic substitutes. They are bolted to the partition 19 by plates 44 so that the gaskets 43 abut or fold over against the core B inner tank 37', as shown in Figs. 7 and 9.

4

Escape of air from the chamber 23 past the opposed flange 23, on the core partition 22, and the apex 25 of the manifold partition 21, is prevented by a gasket 46. Made of the above-noted material, it is pressed into the gap between these opposed parts by a plate 47 bolted along the inner edge of the V-shaped partition 21 (see Figs. 4 and 8).

Escape of air from the chamber 23 past the adjacent upper side-plate flange 33, seated in the angle-bar 28, is similarly effected by a gasket 48 and plate 49 (see Figs. 4 and 10).

The operation of an interchanger embodying this invention is briefly as follows:

The manifold A is first assembled on the engine with the outlet port nipples 17 bolted to the cylinder intakes. The core B is then hoisted into axial alinement with the manifold A and shifted inwardly to seat the inner ends of the flanges 33 in the respective angle bars 28. Thereupon the core B may be slid fully into the manifold A. As the core B starts this inward slide the end of the gasket 46 is placed over the top face of the adjacent end of the core partition 22 and the end of the gasket 48 is folded in under the inner wall of the manifold A.

After the core B has been slid fully into place in the manifold A, the gaskets 43 and plates 44 are secured in place on the partition 19 around the protruding end of the core B adjacent the inner tank 37'.

The plates D and E are bolted in place and the conduits from the coolant source are connected to the inlets 38 and 39 on the core B. Also the air-flow conduit from the compressor is connected to the plate D over the air-inlet opening 41. The unit is then ready for functioning.

As indicated by the full-line arrows in Fig. 3, the coolant flows from the inlet 38 through the lower fin-tube section 31 to the return flow tank 37', back through the upper fin-tube section 31 to the coolant outlet 39.

As indicated by broken-line arrows in Fig. 4, the compressed air from the compressor enters the inlet offset 13 and as it is forced to flow the full length of the chamber 23 it also travels transversely through the upper fin-tube section 31 of the core B. There is a return flow in the chamber 42, back through the lower fin-tube section 31 to the chamber 23 through the openings 35 in the flange 33 and out through the outlet nipples 17 to the respective engine cylinders.

Variations and modifications in the details of the structure and arrangement of the parts may be resorted to within the spirit and coverage of the appended claims.

We claim:

1. A heat exchanger comprising, an open-ended cylindrical distributor manifold having an air inlet and a circumferentially-spaced row of air outlets disposed longitudinally along the exterior of the manifold, an elongated rectangular-cross-section heat-exchanger core formed of a plurality of sections of longitudinally-disposed header-supported tubes spanning and supported on spaced end-tanks, one of which tanks is medially divided and formed with exterior fluid inlet and outlet ports, to provide reverse fluid flow through the tubes between opposite sides of the divide separating the inlet and outlet ports in the one tank and through the opposite end tank, a partition arranged longitudinally of the core medially and full-width thereof between the end tanks, pairs of angle-shaped track-bars each having the external face of one leg bonded to the inner wall of the manifold with the angles of each pair oppositely opposed on opposite sides of a manifold diameter most adjacent the row of manifold outlets, channel-shaped members sealed along the lateral sides of the core with the parallel side flanges of the side members seated in the adjacently-positioned track-bars whereby the manifold space on opposite sides of the core is sealed against intercommunication except transversely through the core around the tubes on opposite sides of the core partition, one of the channel-shaped members forming with the manifold a chamber com-

municating with the row of outlets but sealed off from the manifold space on opposite sides of the core, and a radially-disposed partition extending longitudinally along one side of the manifold in sealed relation thereto intermediate the air inlet and the row of air-outlets and in sealed coplanar relationship with the core partition to effect a reverse air flow transversely of the core around the tubes thereof between the air inlet on one side of the coplanar arranged partitions and the air-outlets on the opposite side of the coplanar partitions, the flange on the core-side member adjacent the manifold outlets having a series of openings formed therein to afford communication between the other side of the coplanar partitions and the chamber leading to the row of air outlets.

2. A heat exchanger comprising, an open-ended cylindrical distributor manifold having an air inlet formed by a longitudinal outwardly-tapering air-inlet flute the open end of which is disposed in the plane of the contiguous open end of the manifold, a circumferentially-spaced row of air outlets disposed longitudinally along the exterior of the manifold, the opposite ends of the manifold being radially flanged, an elongated rectangular-cross-section heat-exchanger core formed of a plurality of sections of longitudinally-disposed header-supported tubes spanning and supported on spaced end-tanks, one of which tanks is medially divided and formed with exterior fluid inlet and outlet ports, to provide reverse fluid flow through the tubes between opposite sides of the divide separating the inlet and outlet ports in the one tank and through the opposite end tank, a closure plate removably fastened to the manifold end flange opposite the air inlet, a second closure plate secured to the fluid inlet-outlet end of the core and contoured to conform with the flange on the fluted inlet end of the manifold, the second closure plate embracing the contiguous core tank and having an opening registering with the manifold air inlet and being removably fastened to the manifold end flange, a partition arranged longitudinally of the core medially and full-width thereof between the end tanks, pairs of angle-shaped track-bars sealed each

having the external face of one leg bonded to the inner wall of the manifold with the angles of each pair oppositely opposed on opposite sides of the manifold diameter most adjacent the row of manifold outlets, channel-shaped members sealed along the lateral sides of the core with the parallel side flanges of the side members seated in the adjacently-positioned track-bars whereby the manifold space on opposite sides of the core is sealed against intercommunication except transversely through the core around the tubes on opposite sides of the core partition, one of the channel-shaped members forming with the manifold a chamber communicating with the row of outlets but sealed off from the manifold space on opposite sides of the core, and a radially-disposed partition extending longitudinally along one side of the manifold in sealed relation thereto intermediate the air inlet and the row of air-outlets and in sealed coplanar relationship with the core partition to effect a reverse air flow transversely of the core around the tubes thereof between the air inlet on one side of the coplanar-arranged partitions and the air-outlets on the opposite side of the coplanar partitions, the flange on the core-side member adjacent the manifold outlets having a series of openings formed therein to afford communication between the other side of the coplanar partitions and the chamber leading to the row of air outlets.

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