(12) STANDARD PATENT APPLICATION (11) Application No. **AU 2003200886 A1**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
A heat exchange assembly

(51)[7] International Patent Classification(s)
F02B 029/04 **F01P 003/18**

(21) Application No: **2003200886** (22) Date of Filing: **2003.03.06**

(43) Publication Date: **2004.09.23**
(43) Publication Journal Date: **2004.09.23**

(71) Applicant(s)
Starr Performance Pty Ltd

(72) Inventor(s)
Starr, Peter

(74) Agent / Attorney
Davies Collison Cave, Level 15 1 Nicholson Street, MELBOURNE, VIC, 3000

ABSTRACT

A heat exchange assembly (12) for engines (10) having cylinders arranged in two banks forming a V-configuration and having inlet ports (18) from each bank of cylinders (16) opening toward each other. The assembly (12) including a generally rectangular housing (34) having a top (36) and a bottom (38) extending between two opposed longitudinal sides (40,42). The opposed longitudinal sides (40,42) include openings (46) for communication with the inlet ports (18) of the engine (10). An inlet (44) in the top (36) receives a pressurised airflow from a compressor (24). A heat exchanger (56) formed by at least two mutually inclined components (58,60) each also inclined with respect to the top (36) and bottom (33) of the housing (34) extends across and along the housing (34) to define an inlet region (62) adjacent the top (36) of the housing and one or more outlet region(s) (64,66) adjacent the bottom (33) of the housing (34) and the openings (46). Air passing from the inlet (62) to the openings (46) passes through the heat exchange element (56).

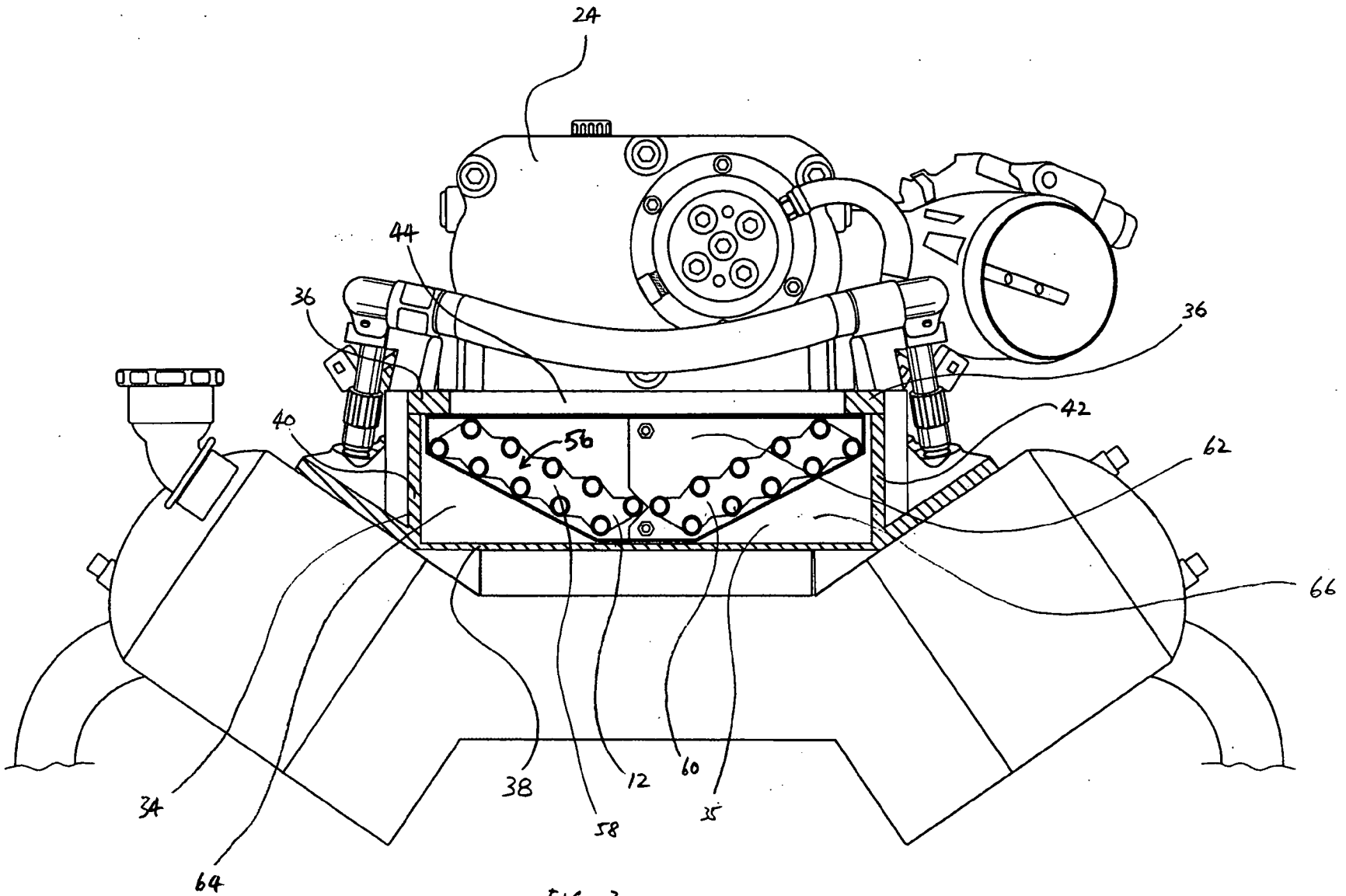

FIG 3

Regulation 3.2

AUSTRALIA

Patents Act 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

(ORIGINAL)

Name of Applicant(s): Starr Performance Pty Ltd, A.C.N.074 649 362, of 13A Ceylon Street, Nunawading, Victoria 3131

Actual Inventor(s): Peter Starr

Address for Service: **DAVIES COLLISON CAVE**, Patent Attorneys, of 1 Little Collins Street, Melbourne, Victoria 3000, Australia

Invention Title: **"A HEAT EXCAHNGE ASSEMBLY"**

The following statement is a full description of this invention, including the best method of performing it known to us.

A HEAT EXCHANGE ASSEMBLY

This invention relates to heat exchange system for cooling of intake air of internal combustion engines. More particularly it relates to a heat exchange assembly for V-configuration engines.

It is recognised that the cooling of intake air for an internal combustion engine can dramatically improve the efficiency of operation of the engine and the power output as a result of the increased density of the air being admitted to the cylinders. This is particularly the case with supercharged or turbocharged engines where the intake air is pressurised by a mechanical operation. In both cases the supercharger or turbocharger results in a mechanical heating of the air during the process of compressing the air to provide an elevated pressure to the engine intake. The heat exchange assembly of the present invention has application to both supercharged and turbocharged engines and the term "compressor" will be used in the specification to refer to both such devices.

Many engines, particularly those of higher capacity are constructed in the so-called V-configuration. In this configuration two banks of cylinders are arranged in a V-configuration so as to reduce the physical length of the engine. Configurations such as V-6, V-8 and V-12 are common and V-4 engines are also produced. Whilst the V–configuration reduces the overall length of the engine they do tend to result in a relatively tall engine. This is because it is normally convenient to have the intake manifold positioned in the V or valley between the banks of the cylinders so as to provide the intake air and or air/fuel mixture directly to the ports in the cylinder head. The exhaust ports are normally arranged on the remote sides of the cylinder heads for convenient connection to the exhaust system. Where it is desired to incorporate a heat exchange unit between a supercharger or turbocharger and an intake manifold in the valley between the cylinder heads space restrictions can be encountered. This can frequently result in the space between the top of the engine and the bonnet or hood of the car being insufficient for the necessary hardware. Consequently, modification of the bonnet or hood

can become necessary. This is undesirable from a cost and aesthetic point of view.

It is accordingly an object of this invention to provide a heat exchange assembly that will provide efficient cooling of the intake air without occupying a significant amount of space above a V-configuration engine.

In one aspect this invention provides a heat exchange assembly for engines having cylinders arranged in two banks forming a V-configuration and having inlet ports from each bank of cylinders opening toward each other, said assembly including a generally rectangular housing having a top and a bottom extending between two opposed longitudinal sides, said opposed longitudinal sides including openings for communication with the inlet ports of said engine, an inlet in said top to receive a pressurised airflow from a compressor, and a heat exchanger formed by at least two mutually inclined components each also inclined with respect to the top and bottom of said housing to extend across and along said housing to define an inlet region adjacent said top of the housing and one or more outlet region(s) adjacent the bottom of the housing and said openings in each of said longitudinal sides, whereby air passing from said inlet to said openings passes through said heat exchange element.

Preferably the components of the heat exchange element define a V-shape with the adjacent ends of the components located toward the bottom of the housing. It is further preferred that each of the components is inclined at about 30° to the bottom of the housing. Preferably the components extend adjacent to the bottom of the housing to substantially define two outlet regions each respectively adjacent one of the longitudinal sides. It is also preferred that the components of the heat exchange element are interconnected to form a single unit.

Each component of the heat exchange element preferably includes respective heat exchange fluid flow paths. In a preferred form of the invention the respective fluid flow paths are configured to direct incoming heat exchange fluid to a central region of the housing. Preferably, the fluid flow paths subsequently direct the

exchange fluid towards respective regions adjacent the longitudinal sides.

In this preferred form of the invention the fluid flow configuration initially directs the coolest heat exchange fluid to the central region of greatest airflow.

The housing is adapted to cylinder heads of the engine. That is, the housing takes the place of the intake manifold and extends substantially across the valley between the banks of cylinders. This results in a minimising of the overall height of the housing making it possible to mount a supercharger unit directly on top of the housing and still allow clearance for the conventional bonnet or hood.

The invention will now be described, by way of example only with reference to the accompanying drawings in which:

Figure 1 is a front view of part of a supercharged V-8 engine incorporating the heat exchange assembly of the present invention;

Figure 2 is a side view of the heat exchange assembly of this invention to which a supercharger and other ancillary components are mounted;

Figure 3 is a view similar to Figure 1 in which the heat exchange of this invention has been sectioned;

Figure 4 is a plan view of part of the heat exchange assembly according to the present invention;

Figure 5 is a section view along the line 5-5 of Figure 4; and

Figure 6 is a perspective view of a heat exchange element used in the heat exchange assembly of the present invention.

Figure 1 generally ~~states~~ shows the layout of a supercharged V-8 engine 10 fitted with the heat exchange assembly 12 of the present invention. The V-8 engine 10 is otherwise of substantially conventional type and will not be described in detail. The engine 10 has cylinders schematically shown at 14 arranged in the well

known V configuration. Cylinder heads 16 are provided with inlet ports 18 which open toward each other. Exhaust ports 20 are connected with exhaust pipes on the remote sides of cylinder heads 16 in the conventional manner. The heat exchange assembly 12 fits between the cylinder heads in the so-called valley of the engine and the supercharger 24 is mounted to the heat exchange assembly 12. The supercharger 24 is substantially conventional and is driven in the known manner by a belt drive (not shown) via pulley 26. A throttle body 28 controls emission of air to the supercharger in the conventional manner. Fuel supply to the engine is controlled by fuel injectors 30 and fuel supply lines 32 which also operate in the conventional manner. The fuel injectors 30 are fitted to the heat exchange assembly 12 immediately adjacent the connection with inlet ports 18 in cylinder head 16.

The heat exchange assembly 12 is formed as a generally rectangular housing 34 having a top 36, bottom 38 and opposed longitudinal sides 40 and 42. The top 36 is preferably removable from the housing 34 to provide access to the interior of the housing 34. Suitable fasteners such as bolts (not shown) and appropriate gaskets of conventional type can be provided to mount the heat exchange assembly 12 in place. In the form of the invention illustrated, the supercharger 24 is mounted to the removable top 36. The top 36 includes an inlet 44 through which pressurized airflow from the supercharger 24 is directed to the interior of the housing 34. The opposed longitudinal sides 40,42 include openings 46 for communication with the inlet ports 18. This is achieved by connecting portions 48 and 50 along each side of housing 34 which include ducts 52 each extending through a flange 54 which is secured to the adjacent cylinder head 16. The fuel injectors 30 described above are mounted so as to inject fuel into the ducts 52. A V-shaped heat exchange element 56 is placed in the housing 34. The heat exchange element 56 is formed by two mutually inclined components 58,60 which are inclined with respect to the top 36 and bottom 38 of the housing 34. The components 58,60 respectively extend across and along the housing 34 to define an inlet region 62 adjacent the top 36 of the housing 34 and outlet regions 64,66 adjacent the bottom of the housing 34 and respectively adjacent the openings 46 in the longitudinal sides

40,42. In this way, air passing from the inlet 44 in the top 36 of housing 34 to the openings 46 must pass through the heat exchange element 56. Each component 58,60 of the heat exchange element 56 has a heat exchange fluid path defined by tubing 68. The respective fluid flow paths extends between an inlet 70 and an outlet 72 provided for each fluid flow path. The inlets 70 and outlets 22 are connected to a cooling heat exchange element positioned at an appropriate place in the airflow of the vehicle. The cooled heat exchange fluid is directed to the inlets 70 so that the incoming heat exchange fluid goes to the central region of the housing 34. The fluid flow passage subsequently directs the fluid through the fluid flow passage to adjacent the longitudinal sides 40,42 and to the outlets 72.

In this way the cooled heat exchange fluid is directed to the central region of greatest airflow.

It will be apparent that the housing 34 of the heat exchange assembly 12 takes the place of the inlet manifold conventionally positioned between the cylinder heads of a V-configuration engine. Because the heat exchange element 56 is mounted within the space normally occupied by a conventional manifold a considerable height saving is achieved. This makes it possible to mount the supercharger unit directly on top of the housing and to still allow clearance for a conventional bonnet or hood.

The foregoing describes only one embodiment of the present invention and modifications can be made without departing from the scope of the invention. For example, although the heat exchange element described is a single unit it can be formed from two independent components each extending in the inclined manner described.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A heat exchange assembly for engines having cylinders arranged in two banks forming a V-configuration and having inlet ports from each bank of cylinders opening toward each other, said assembly including a generally rectangular housing having a top and a bottom extending between two opposed longitudinal sides, said opposed longitudinal sides including openings for communication with the inlet ports of said engine, an inlet in said top to receive a pressurised airflow from a compressor, and a heat exchanger formed by at least two mutually inclined components each also inclined with respect to the top and bottom of said housing to extend across and along said housing to define an inlet region adjacent said top of the housing and one or more outlet region(s) adjacent the bottom of the housing and said openings in each of said longitudinal sides, whereby air passing from said inlet to said openings passes through said heat exchange element.

2. A heat exchange assembly wherein the components of said heat exchange element define a V-shape with the adjacent ends of the components located toward the bottom of the housing.

3. A heat exchange assembly as claimed in either claim 1 or claim 2 wherein each of said components is inclined at about 30° to the bottom of said housing.

4. A heat exchange assembly as claimed in any one of claims 1 to 3 wherein the components of said heat exchange element extend adjacent the bottom of said housing to substantially define two outlet regions each respectively adjacent one of said longitudinal sides.

5. A heat exchange assembly as claimed in claim 4 wherein the components of said heat exchange element are interconnected to form a single unit.

6. A heat exchange assembly as claimed in any one of claims 1 to 5 wherein each component of said heat exchange element includes a respective heat exchange fluid flow path.

7. A heat exchange assembly as claimed in claim 6 wherein said respective fluid flow paths are configured to direct incoming heat exchange fluid to a central region of said housing and said fluid flow paths subsequently direct flow of heat exchange fluid toward respective regions adjacent said longitudinal sides.

8. A heat exchange assembly as claimed in any one of claims 1 to 7 wherein said housing is adapted to mount directly to one or more cylinder heads of said engine.

9. A heat exchange assembly as claimed in claim 8 wherein said housing does not extend substantially beyond the volume between the banks of cylinders.

10. A heat exchange assembly as claimed in any one of claims 1 to 9 wherein said compressor mounts directly to the top of said housing.

11. A heat exchange assembly as claimed in claim 10 wherein said compressor is a supercharger.

DATED this 6th day of March, 2003.

Starr Performance Pty Ltd

by DAVIES COLLISON CAVE

Patent Attorneys for the Applicant

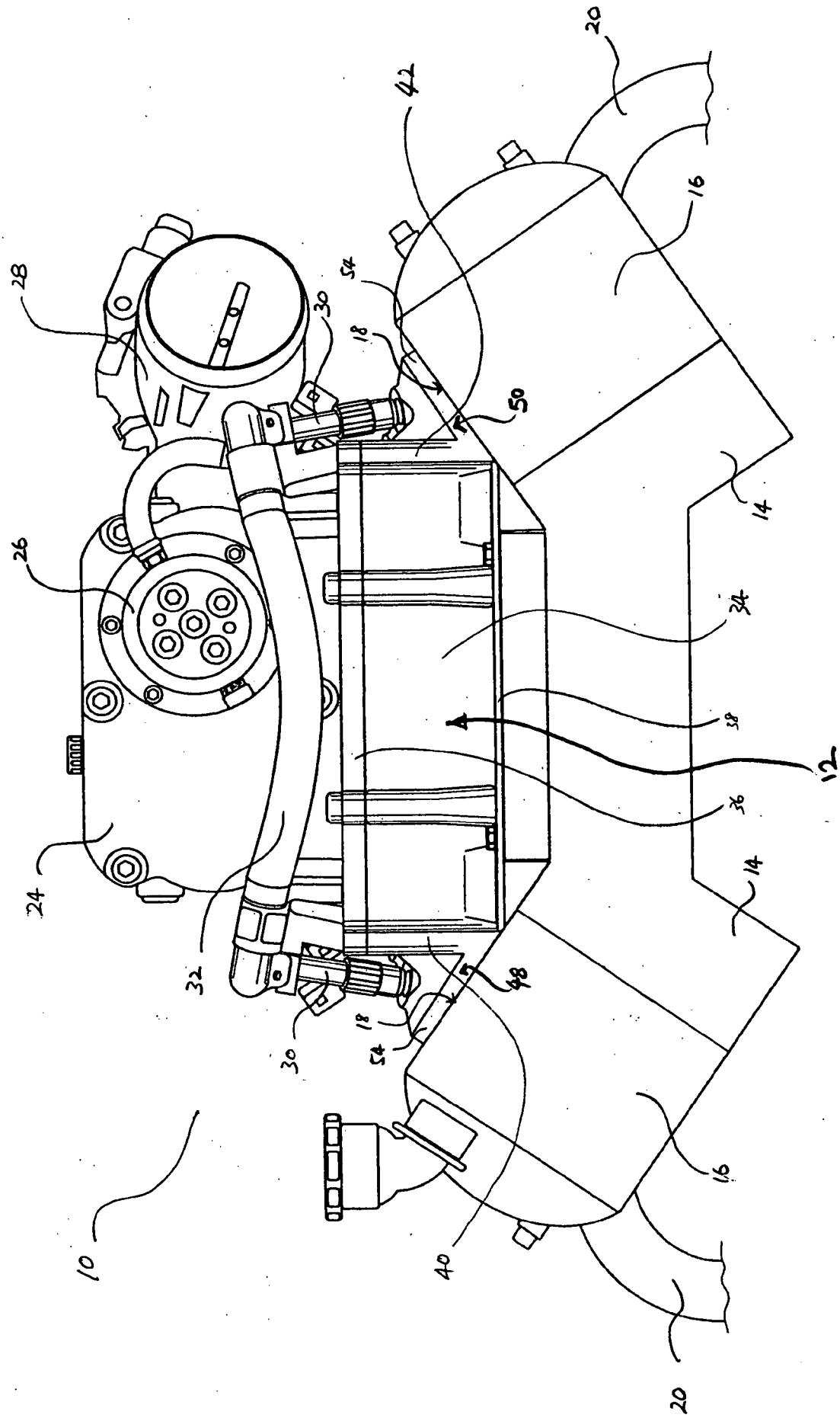

FIG 1

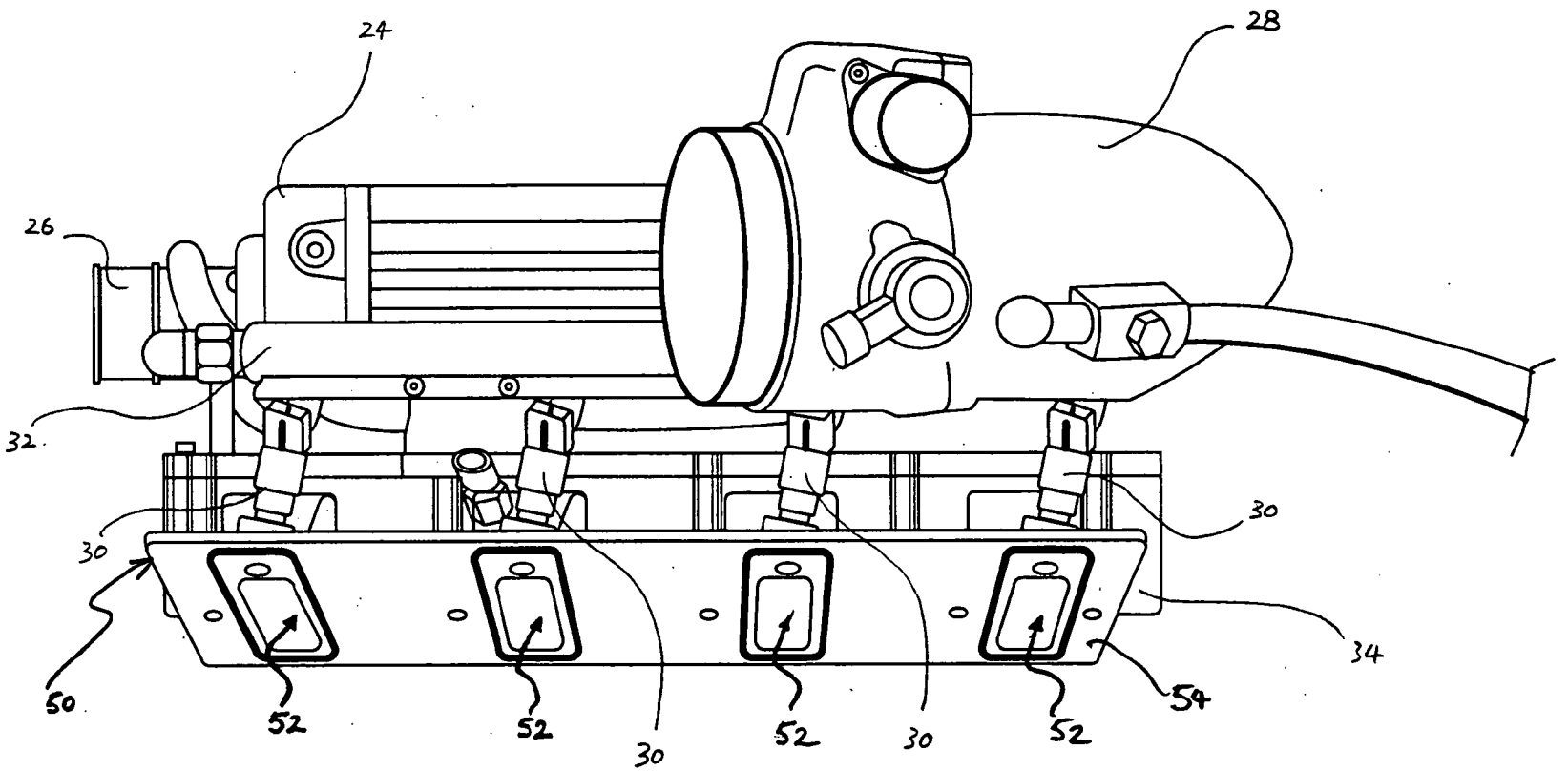

FIG 2

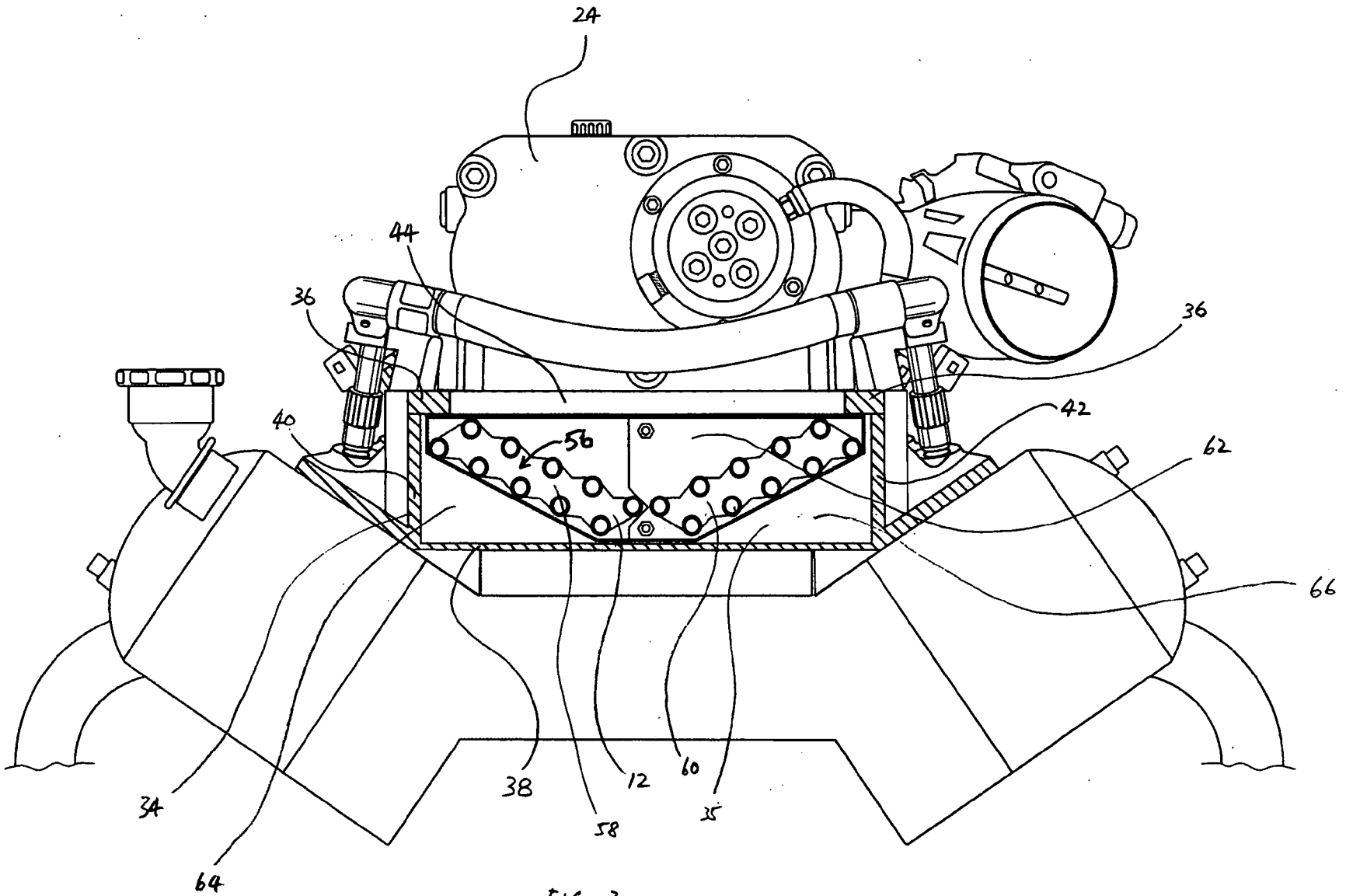

FIG 3

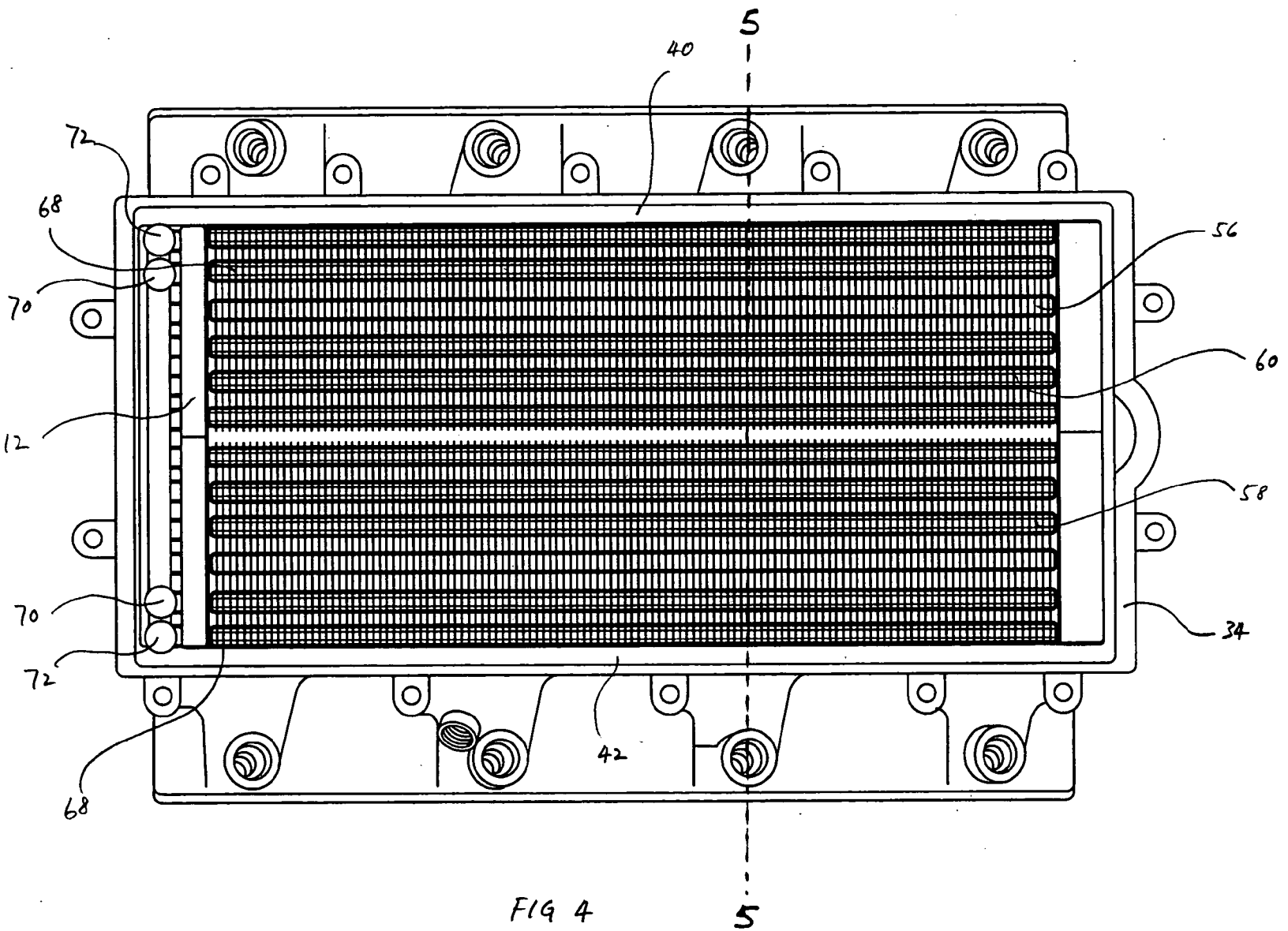

FIG 4

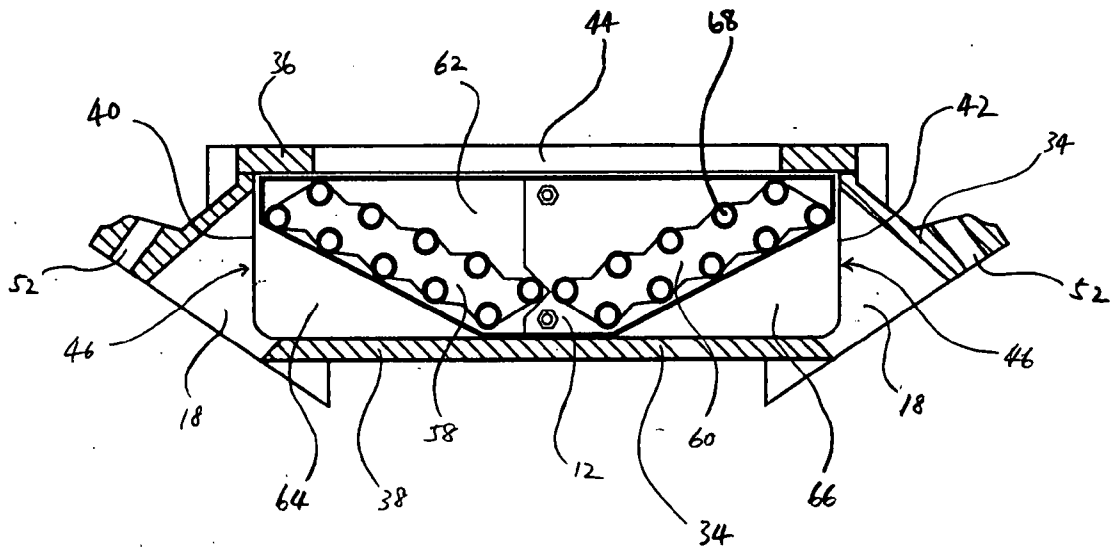

FIG 5

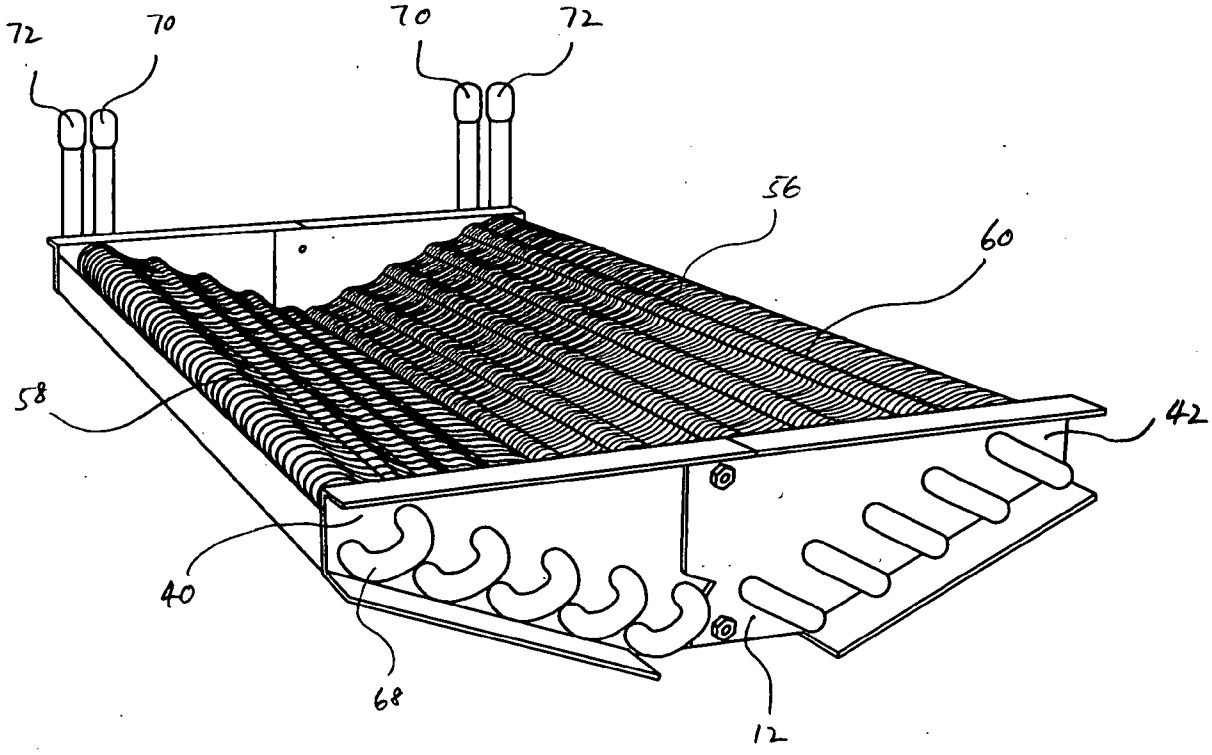

FIG 6