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(54) **Lubrication arrangement for a turbocharger**

(57) A lubrication arrangement for a supercharger (16) of an engine (10) is disclosed. The arrangement includes a lubricant feed conduit (44) adapted to connect between a lubricant supply port (48) associated with the engine (10) and a lubricant inlet (56) associated with the supercharger (16) and a lubricant return conduit (46) adapted to connect between a lubricant outlet (58) associated with said supercharger and a lubricant return port (60) associated with the engine 10. The lubricant feed (44) and return (46) conduits are fixed together at one or more points into a one-piece conduit assembly (42), the assembly (42) having integrated therewith a heat shield (64) that screens at least one and preferably both of the conduits (44, 46) along at least a part of their respective lengths.

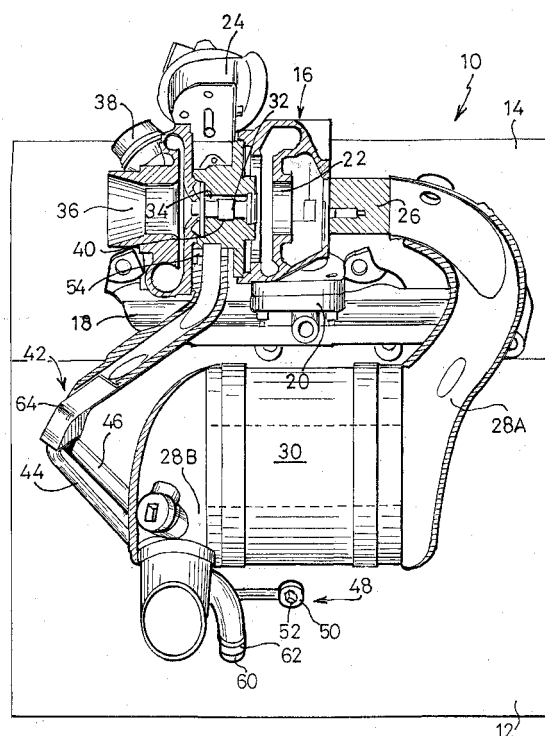


FIG.1

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Description

[0001] The present invention relates to lubrication arrangements for engine assemblies and in particular to a lubrication arrangement for a supercharger of an engine.

[0002] it is known to provide lubrication systems for engine superchargers, such as exhaust driven turbochargers. Many such systems are closed circuits using engine oil as a lubricant and include an oil feed conduit and an oil return conduit. The oil feed supplies oil under pressure from an oil pump of the engine to the supercharger concerned and the oil return comprises a conduit adapted to drain the oil away towards a collection area such as an oil sump of the engine.

[0003] Life expectancy of a turbo-charger relies considerably on a steady flow of clean oil supplied to its bearings under pressure from the engine's lubrication system and on the free exit of that oil for its return back to the engine sump. Examples of prior art proposals relating to lubrication arrangements for turbo-chargers can be found in EP-0662581, US-3740170 and in US-4559782.

[0004] Recent advances in emissions reduction have led to catalytic converters being positioned ever closer to the exhaust ports of their engine, so as to reduce the light-off time of the catalyst brick. These arrangements may be referred to as close-coupled catalytic converters and may be used in advance of a further catalytic converter that is positioned further downstream and in a more convenient position for performing its part in the conversion process. If such a close-coupled catalyst/catalytic converter is fitted to an arrangement similar to that disclosed in EP-0662581 or in US-4559782, a situation may arise in which turbo-charger lubrication pipes are routed near to the close-coupled catalyst. Heat radiated by an exhaust system component such as the turbo-charger, exhaust manifold or catalytic converter may then affect the efficiency of lubrication of the turbo-charger. This problem may be further exacerbated in some current installations by boxing in of the engine to meet other requirements such as under-bonnet styling or pass-by noise regulations.

[0005] It is an object of the present invention to provide an improved lubrication arrangement for an engine assembly and in particular to provide an improved lubrication arrangement for a supercharger of an engine.

[0006] Accordingly, the present invention provides a lubrication arrangement for a supercharger of an engine, the arrangement including a lubricant feed conduit adapted to connect between a lubricant supply port associated with said engine and a lubricant inlet associated with said supercharger and a lubricant return conduit adapted to connect between a lubricant outlet associated with said supercharger and a lubricant return port associated with said engine, characterised in that said lubricant feed and return conduits are fixed together at one or more points into a one-piece conduit assembly,

said assembly having integrated therewith a heat shield that screens at least one and preferably both said conduits along at least a part of their respective lengths.

[0007] An arrangement according to the present invention has the advantage that a one-piece assembly is generally easier to fit on the production line, requiring less operator actions and connections than fitting all the constituent parts separately. In addition, its production will be cheaper due at least in part to the integration of the heat shield which, as a stand-alone component, would otherwise prove a high cost item.

[0008] Said conduit assembly may include a joint member, such as a mounting flange, to which a portion of each of said lubricant feed and return conduits is fixed. Said joint member may be positioned in the region of an end portion of each of said feed and return conduits.

[0009] Said conduit assembly may be adapted to be connected to said supercharger via a single connection that provides fluid communication between said lubricant feed and return conduits and said supercharger lubricant inlet and outlet respectively.

[0010] Said heat shield may stop short of end portions of said feed and return conduits that are distal to said supercharger. End portions of said feed and return conduits that are distal to said supercharger may be separated or separable from each other. Said distal portions of said feed and return conduits may be connectable substantially independently to said lubricant supply and return ports respectively.

[0011] Said lubricant feed and return conduits may run substantially parallel to each other along at least a part of said conduit assembly.

[0012] Said heat shield may be joined to each of said feed and return conduits at one or more points along their respective lengths and in such a manner as to substantially brace said feed and return conduits against each other over at least a part of their respective lengths. Said heat shield may extend around at least part of the outer wall of at least one and preferably each of said feed and return conduits and preferably in such a manner as to constrain lateral movement in at least one direction of the or each of said feed and return conduits.

[0013] Said heat shield may comprise a sheet material, such as a sheet steel. Said heat shield may further comprise an integral bracket that is positioned part way along its length and is adapted for attachment to a fixing point. Said fixing point may comprise part of an engine component, such as an exhaust system component.

[0014] Said heat shield may be adapted to screen at least one and preferably both of said feed and return conduits against heat radiated from at least one of said supercharger and a portion of an exhaust system, such as an exhaust manifold or a catalytic converter. In the case of a catalytic converter, said catalytic converter may comprise a close-coupled or preliminary catalytic converter.

[0015] The present invention also provides a method

of producing a lubricant conduit assembly suitable for use in association with a supercharger of an engine, the method including :

- a) providing a lubricant feed conduit and a lubricant return conduit ;
- b) providing a heat shield for screening at least one and preferably both of said lubricant feed and return conduits along at least a part of their respective lengths ; and
- c) joining said lubricant feed and return conduits and said heat shield so as to form therefrom a one-piece conduit assembly including an integrated heat shield.

[0016] The method may include providing a joint member integrated into said conduit assembly and fixing an end portion of each of said feed and return conduits to said joint member.

[0017] The method may include adapting said joint member for connecting said conduit assembly to said supercharger via a single connection that provides fluid communication between said feed and return conduits and a lubricant inlet and a lubricant outlet respectively of said supercharger.

[0018] The method may include stopping said heat shield short of end portions of said feed and return conduits that are distal to said supercharger. The method may include running said feed and return conduits substantially parallel to each other along at least a part of said conduit assembly.

[0019] The method may include joining said heat shield to said feed and return conduits at one or more points along their respective lengths. The method may include joining said heat shield to said feed and return conduits in such a manner as to brace said feed and return conduits against each other over at least a part of their respective lengths. The method may include extending said heat shield around at least a part of the outer wall of each of said feed and return conduits and preferably in such a manner as to constrain lateral movement in at least one direction of each of said feed and return conduits.

[0020] Said heat shield may comprise a sheet material such as a sheet steel and may be extended around said feed and return conduits using a deformation technique, e.g. rolling, bending or folding. The method may include integrating a bracket into said heat shield, preferably part way along its length and of such a form as to enable bracing of said heat shield against an engine component, such as an exhaust system component.

[0021] The method may include forming and/or joining said heat shield in such a manner that, when said conduit assembly is in an in-use position, said heat shield screens at least one and preferably both of said feed and return conduits against heat radiated from said super charger or from a portion of an exhaust system, such as an exhaust manifold or a catalytic converter.

[0022] The present invention will now be described by way of example only and with reference to the accompanying drawings, in which :

Figure 1 is a schematic diagram of an engine assembly including a lubrication arrangement according to the present invention ;

Figure 2 is a front view of the lubrication arrangement of the present invention as depicted in Figure 1 but illustrated separated from the engine assembly;

Figure 3 is a rear view of the lubrication arrangement of Figure 2 ;

Figure 4 is a front view of a heat shield of the lubrication arrangement of Figures 1 to 3 ; and

Figure 5 is an illustration of a bracket arrangement of the lubrication arrangement of Figures 1 to 4.

[0023] Referring to the drawings, an engine assembly 10 is based around an engine cylinder block 12 and a cylinder head 14. Charge air is supplied towards inlet ports of the cylinder head 14 via an inlet manifold (not shown). The charge air is provided at least in part by forced induction using a supercharger. The supercharger may be embodied in the form of an exhaust driven turbo-charger 16, mounted for example on an exhaust manifold 18 from which the turbo-charger 16 is driven.

[0024] Exhaust gases enter the turbo-charger via a flanged connection 20 and drive the turbo-charger exhaust turbine 22. The level of boost may be controlled by means of a waste-gate apparatus 24. After driving the exhaust turbine 22, the gases pass down a short exhaust duct 26 into an entry cone 28A of an exhaust gas after-treatment apparatus such as a close-coupled catalytic converter 30. The catalytic converter 30 may be the only catalytic converter in the exhaust system or may be a preliminary catalyst upstream of one or more further exhaust gas after-treatment apparatus. Exhaust gases leave the catalytic converter 30 via an exit cone 28B. The catalytic converter may be disposed with its longitudinal axis running substantially parallel to a longitudinal axis running through the cylinder block 12. It will be appreciated, however, that the or each exhaust gas after-treatment apparatus 30 may be positioned further downstream than the exemplary close-coupled position and/or at different angles.

[0025] The exhaust turbine 22 is mounted on a turbine shaft 32 common with a compressor turbine 34 of the turbo-charger 16, the common mounting being adapted to transmit drive from the exhaust turbine 22 to the compressor turbine 34. While the turbo-charger 16 is on boost, driving of the compressor turbine 34 compresses inlet air entering the turbo-charger 16 via an inlet channel 36 such that it leaves a charge-air exit 38 of the turbo-charger 16 under pressure for forced induction. The turbo-charger charge-air exit 38 is connected to the inlet manifold, optionally via an inter-cooling arrangement.

[0026] The turbo-charger 16 includes a set of bearings

40 adapted to support the turbine shaft 32. The turbo-charger bearings 40 are provided with lubrication by a lubricant conduit assembly 42 that includes a lubricant feed conduit 44 and a lubricant return conduit 46.

[0027] Lubricant is supplied in the form of engine oil under pressure from the lubrication system of the engine 10. The oil supplied to the turbo-charger 16 will preferably have been recently filtered and more preferably also cooled so, as to provide optimum protection to the bearings 40.

[0028] The oil may be pressurised by an engine oil pump (not shown) and is supplied to a lubricant supply port 48 associated with the engine 10, which supply port 48 may take the form of a pressurised oil outlet low down on the cylinder block. The lubricant feed conduit 44 may comprise a tube, such as a pipe, provided with a high pressure fitting at each end. At the end of the feed conduit 44 distal from the turbo-charger 16, the high pressure fitting 50 may comprise a banjo-type fitting attachable to the high pressure lubricant supply port 48 by means of a banjo-bolt 52 and associated sealing washers.

[0029] In use, the lubricant feed conduit 44 is adapted to run up the outside of the cylinder block 12 and up towards the turbo-charger 16. At the turbo-charger end of the lubricant feed conduit 44, the conduit 44 is attached to the turbo-charger 16 via a joint member in the form of a flange 54 to which the feed conduit 44 is fixed. A lubricant feed hole 56 is defined through the flange 54 and provides fluid communication from the feed conduit 44 towards a lubricant inlet that is associated with the turbo-charger and preferably connected to the turbine-shaft bearings 40.

[0030] Also fixed to the flange 54 is one end of the lubricant return conduit 46, with an associated lubricant return hole 58 defined therethrough. The lubricant return hole 58 provides fluid communication between a lubricant outlet associated with the turbo-charger 16 and the lubricant return conduit 46. The lubricant outlet is preferably part of a lubricant drain arrangement of the turbo-charger 16 adapted to drain spent lubricant away from the turbo-charger bearings 40. It will be noted that the lubricant return conduit 46 and its associated return hole 58 through the flange 54 are preferably of a larger diameter/cross-sectional area than the lubricant feed conduit 44 and its lubricant feed hole 56.

[0031] The lubricant return conduit 46 may comprise a tube, such as a pipe, and is formed with a large diameter of such proportions as to ensure drain-down of spent lubricant without the build-up of back pressure and able to cope with potential foaming of the returning lubricant. The return conduit 46 connects between the lubricant outlet of the turbo-charger and an lubricant return port 60 associated with the engine 10. The lubricant return port 60 may be defined in the assembly of the engine block 12 and is connected to the end of the lubricant return conduit 46 that is distal to the turbo-charger 16. The connection may be made by means of a flex-

ible conduit 62, such as a short length of rubber hose.

[0032] The lubricant feed and return conduits 44, 46 preferably run substantially parallel to each other along at least a part of their respective lengths. Such parallel running may commence in the region of the flange 54 to which they are both fixed and may take the form of a parallel route downwards away from the turbo-charger 16 and circumventing the close-coupled catalytic converter.

[0033] A heat shield 64 is provided that is integrated into the conduit assembly 42. The heat shield may comprise a sheet material, such as a sheet steel, and may be shaped at least in part by a deformation technique such as rolling, bending or folding. The heat shield 64 is disposed across portions of the feed and return conduits 44, 46 in such a manner that it is interposed between them and the catalytic converter 30 and provides screening against it.

[0034] The heat shield 64 is integrated into the one-piece conduit assembly by being joined to the feed and return conduits 44, 46 along at least a part of their respective lengths and in such a manner as to substantially brace the feed and return conduits 44, 46 against each other over at least a part of their respective lengths. To achieve this, the heat shield 64 may be attached to the conduits 44, 46 by a heat technique such as welding, brazing or soldering. The heat shield 64 may extend around at least part of the outer wall of one and preferably each of the feed and return conduits 44, 46 and in such a manner as to constrain lateral movement in at least one direction of the or each conduit 44, 46 so enveloped.

[0035] The heat shield 64 preferably stops short of the ends of the feed and return conduits 44, 46 that are distal from the turbo-charger 16. This is so that the distal end portions of those conduits 44, 46 are separated or separable from each other so that they can be connected substantially independently to the lubricant supply port 48 and lubricant return port 60 as appropriate.

[0036] The heat shield 64 may also be provided with an integral bracket 66 part way along its length for bracing the heat shield 64 against a fixing point. The fixing point may comprise an engine component and in one embodiment the bracket may brace the heat shield 64 against an exhaust system component such as the exhaust manifold. By so bracing the heat shield 64, through its connection or connections to the rest of the conduit assembly 42, the overall rigidity of the lubricant supply arrangement in its in use position is improved. This augments the rigidity already imparted to the conduit assembly 42 by the heat shield 64 alone and further increases resistance to vibration.

[0037] The heat shield 64 screens at least one and preferably both of the feed and return conduits 44, 46 along at least a part of their respective lengths against the influence of factors that might disturb the efficiency of lubrication provided therethrough to the turbo-charger 16. To do this, the heat shield is disposed around the

feed and return conduits along portions thereof that in the installed position of the conduit assembly 42 face the hazard or hazards of concern, e.g. the close coupled catalytic converter 30. Protection may be more important for the lubricant feed conduit 44, as it is carrying lubricant that has not yet been used and a degradation in its quality may have severe effects on the turbo-charger bearings 40. In addition, the lubricant it is carrying is under high pressure and damage to its conduit 44 may result in the lubricant leaking onto or into hot areas.

[0038] Such disturbing factors may include, but are not limited to, heat radiated from for example the turbo-charger 16, the exhaust manifold 18 or the catalytic converter 30. Other disturbing factors may include infrared radiation caused by raised temperatures of the exit cone 28B. A still further example of a disturbing effect may comprise an eventual failure of another possibly neighbouring component, such as for example a failure in a welded joint on the exit cone 28B of the catalytic converter 30. A weld failure in the exit cone 28B of the catalytic converter 30 may result in the escape of flames and these may appear almost as if they were from a blow torch. A jet of flame near to or hitting an unprotected lubricant supply conduit 44 might overheat or break down the lubricant being supplied therethrough to the turbo-charger bearings 40.

[0039] On the other hand, the heat shield may also provide some protection against leakage of lubricant from either the feed or return conduits 44, 46. A leakage of lubricant may hit a hot part of the catalytic converter 30 with undesirable consequences. By screening the feed and return conduits 44, 46 with the integral heat shield 64, the corollary is that the hot parts are also screened from failure of fluid integrity of the same conduits 44, 46 or leakage of lubricant in the region of the flange 54. Under such circumstances, the heat shield 64 channels leaking lubricant down away from hot components and towards a safer area such as the bottom of the engine block 12 where there is a reduced risk of fire.

[0040] Furthermore, a one-piece arrangement according to the present invention has the advantage that a one-piece assembly is generally easier to fit on the production line, requiring less operator actions and connections than fitting all the constituent parts separately. In particular, connecting the conduit assembly 42 to the turbo-charger 16 via a single connection at the flange 54 is simpler than separate screw in fixings used in some prior art arrangements for each of a feed and a return conduit. In addition, production of the lubrication arrangement in one piece will be cheaper due at least in part to the integration of the heat shield 64 into the conduit assembly which, as a stand-alone/separate heat shield, would otherwise prove a high cost item.

Claims

1. A lubrication arrangement for a supercharger (16) of an engine (10), the arrangement including a lubricant feed conduit (44) adapted to connect between a lubricant supply port (48) associated with said engine and a lubricant inlet (56) associated with said supercharger and a lubricant return conduit (46) adapted to connect between a lubricant outlet (58) associated with said supercharger and a lubricant return port (60) associated with said engine, **characterised in that** said lubricant feed (44) and return (46) conduits are fixed together at one or more points into a one-piece conduit assembly (42), said assembly having integrated therewith a heat shield (64) that screens at least one and preferably both said conduits along at least a part of their respective lengths.
2. An arrangement according to claim 1, wherein said conduit assembly (42) includes a joint member, such as a mounting flange (54), to which a portion of each of said lubricant feed (44) and return (46) conduits is fixed, said joint member preferably being positioned in the region of an end portion of each of said feed and return conduits.
3. An arrangement according to claim 1 or claim 2, wherein said conduit assembly (42) is adapted to be connected to said supercharger (16) via a single connection (54) that provides fluid communication (56, 58) between said lubricant feed (44) and return (46) conduits and said supercharger lubricant inlet and outlet respectively.
4. An arrangement according to any preceding claim, wherein said heat shield (64) stops short of end portions of said feed (44) and return (46) conduits that are distal to said supercharger (16).
5. An arrangement according to any preceding claim, wherein end portions of said feed (44) and return (46) conduits that are distal to said supercharger (16) are separated or separable from each other, preferably in such a manner that said distal portions (50, 62) of said feed and return conduits are connectable substantially independently to said lubricant supply (48) and return (60) ports respectively.
6. An arrangement according to any preceding claim, wherein said lubricant feed (44) and return (46) conduits run substantially parallel to each other along at least a part of said conduit assembly (42).
7. An arrangement according to any preceding claim, wherein said heat shield (64) is joined to each of said feed (44) and return (46) conduits at one or more points along their respective lengths and in

such a manner as to substantially brace said feed and return conduits against each other over at least a part of their respective lengths, said heat shield optionally extending around at least part of the outer wall of each of said feed and return conduits and preferably in such a manner as to constrain lateral movement in at least one direction of at least one and preferably each of said feed and return conduits.

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8. An arrangement according to any preceding claim, wherein said heat shield (64) comprises a sheet material, such as a sheet steel, and preferably further comprises an integral bracket (66) that is positioned part way along its length and is adapted for attachment to a fixing point.

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9. An arrangement according to any preceding claim, wherein said heat shield (64) is adapted to screen at least one and preferably both of said feed (44) and return (46) conduits against heat radiated from at least one of said supercharger (16) and a portion of an exhaust system, such as an exhaust manifold (18) or a catalytic converter (30).

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10. A method of producing a lubricant conduit assembly (42) suitable for use in association with a supercharger (16) of an engine (10), the method including :

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- a) providing a lubricant feed conduit (44) and a lubricant return conduit (46);
- b) providing a heat shield (64) for screening at least one and preferably both of said lubricant feed and return conduits along at least a part of their respective lengths ; and
- c) joining said lubricant feed and return conduits and said heat shield so as to form therefrom a one-piece conduit assembly (42) including an integrated heat shield.

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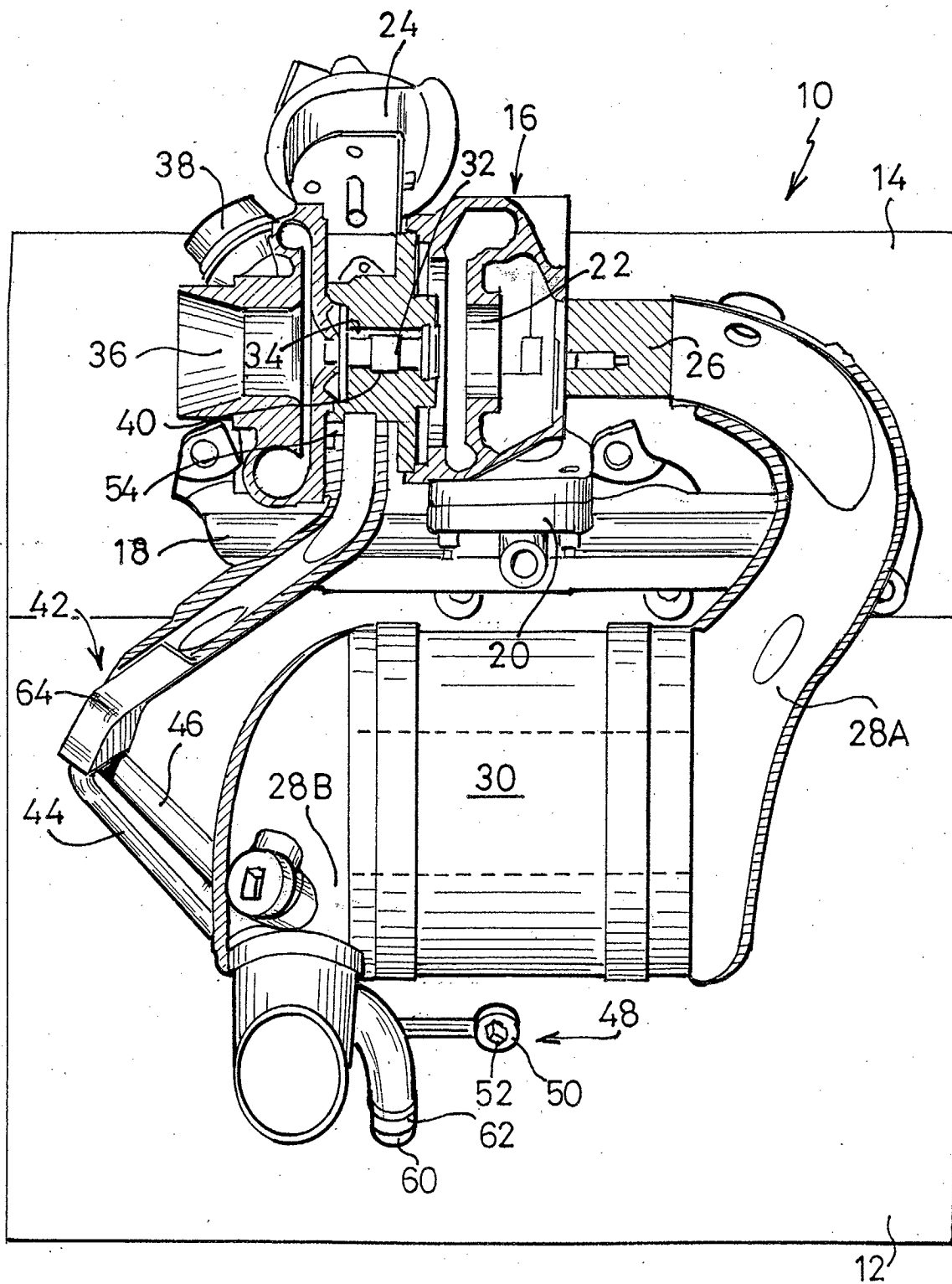


FIG.1

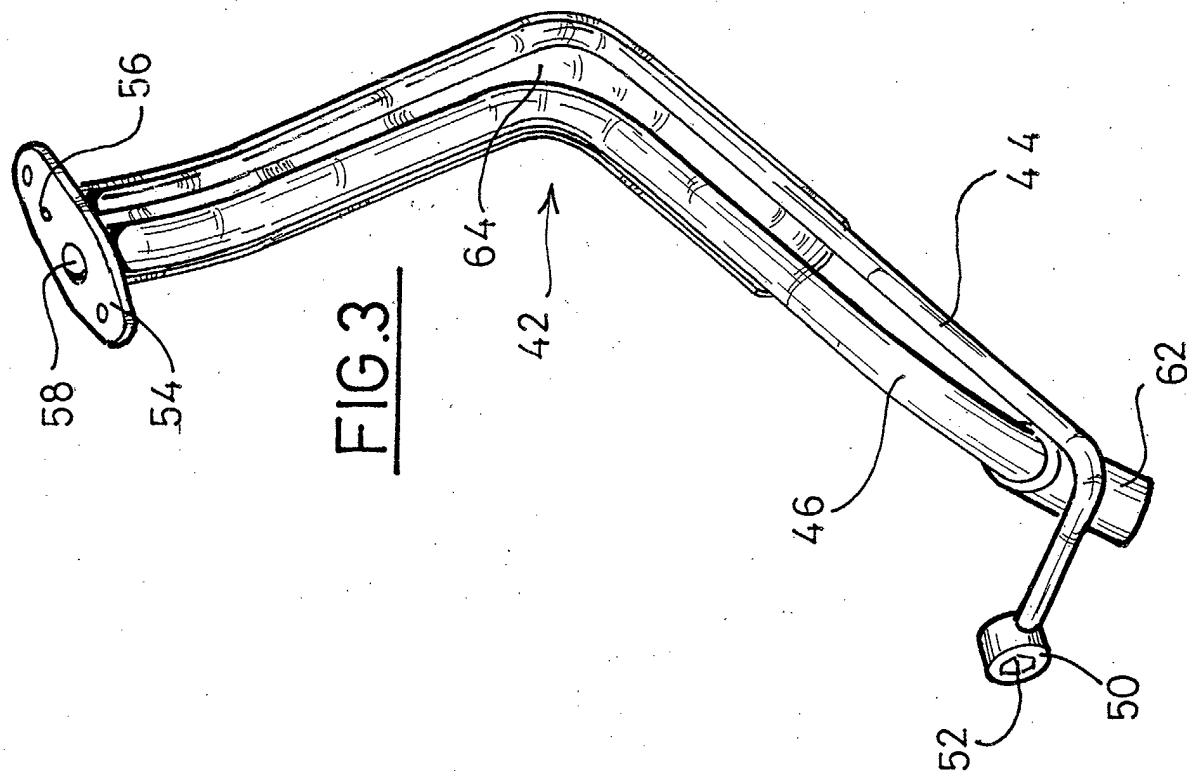
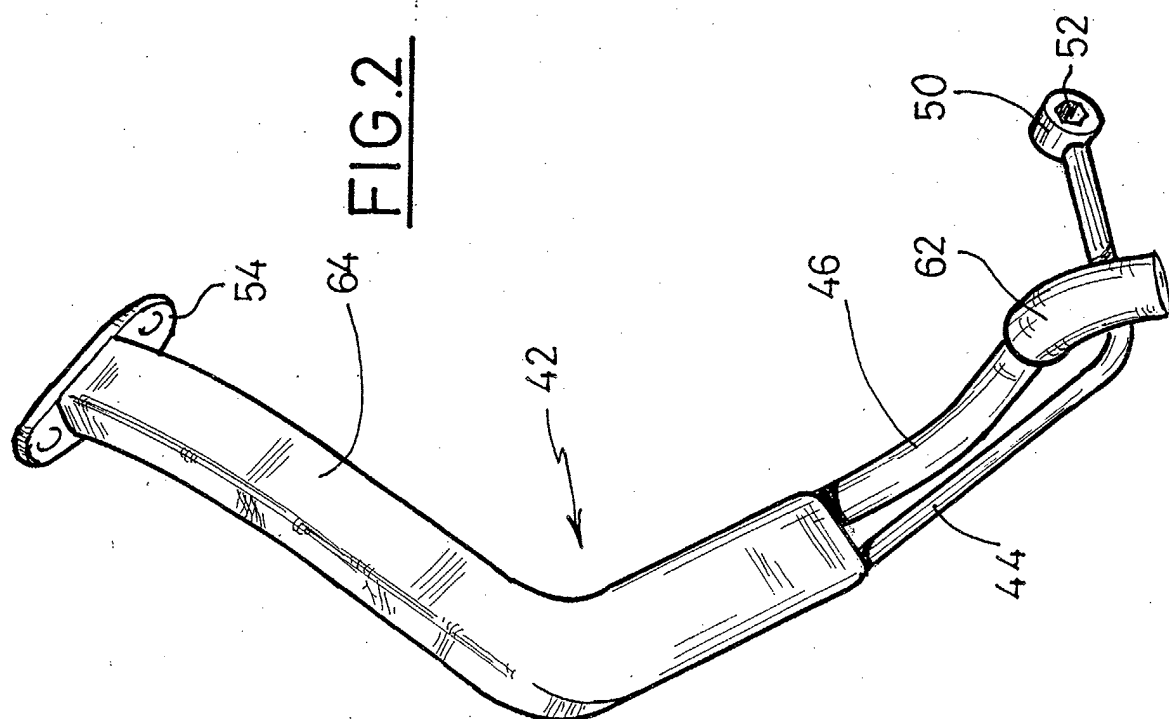


FIG.4

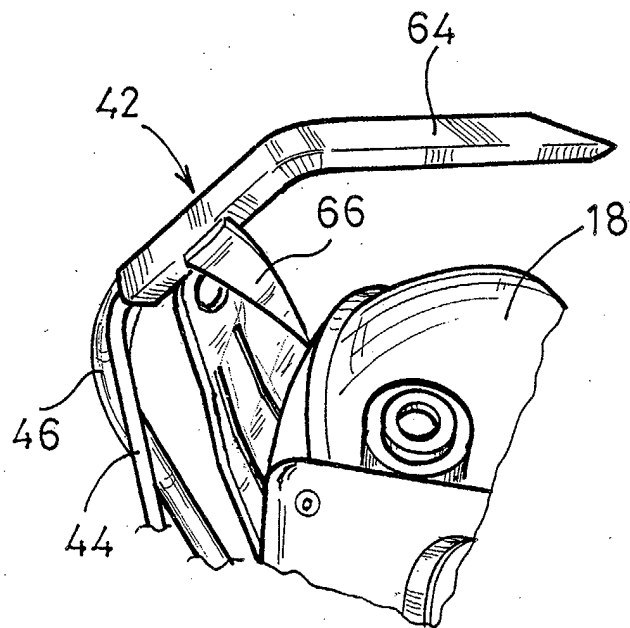
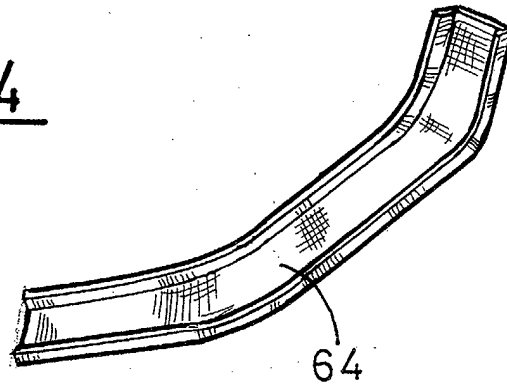


FIG.5



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 02 29 3218

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 14 May 2003	Examiner Vedoato, L
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ON EUROPEAN PATENT APPLICATION NO.**

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