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(56) Documents Cited:
EP 1249657 A **FR 002924482 A**
US 4641861 A **US 2421228 A**
US 1845882 A
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INT CL **F01N, F16B, F16L**
Other: **Online: WPI & EPODOC**

(54) Title of the Invention: **Exhaust system connection arrangement**
Abstract Title: **Exhaust system connection arrangement for a turbocharged engine**

(57) A connection arrangement 180 for interconnecting first and second tubular passageways, the arrangement comprises a first 126 and second 186 annular connector component surrounding their respective passageways where the connector components are configured to be interconnected by a partial turn between them. Preferably the first connector component has a plurality of L-shaped raised portions 182 around its outer circumference and the second connector component has projections 184 around its inner circumference, where the projections start between the L-shaped projections when the two members are together and hove towards the corner of the L-shapes when turned. One of the connector components may have an outer lug 190 to allow the connection to be secured and one of the tubular passageways may have a flange which is received between the two components. Preferably the first connector component is connected to the outlet of an internal combustion engine turbo housing and the second connector component is connected to a flanged end of an exhaust pipe.

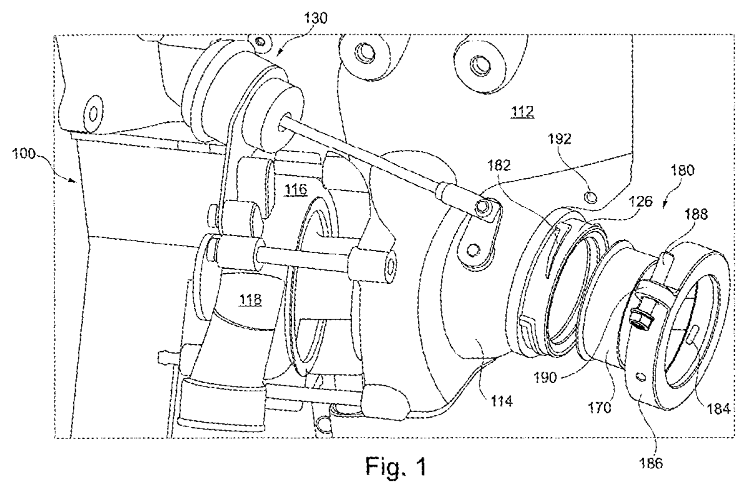

Fig. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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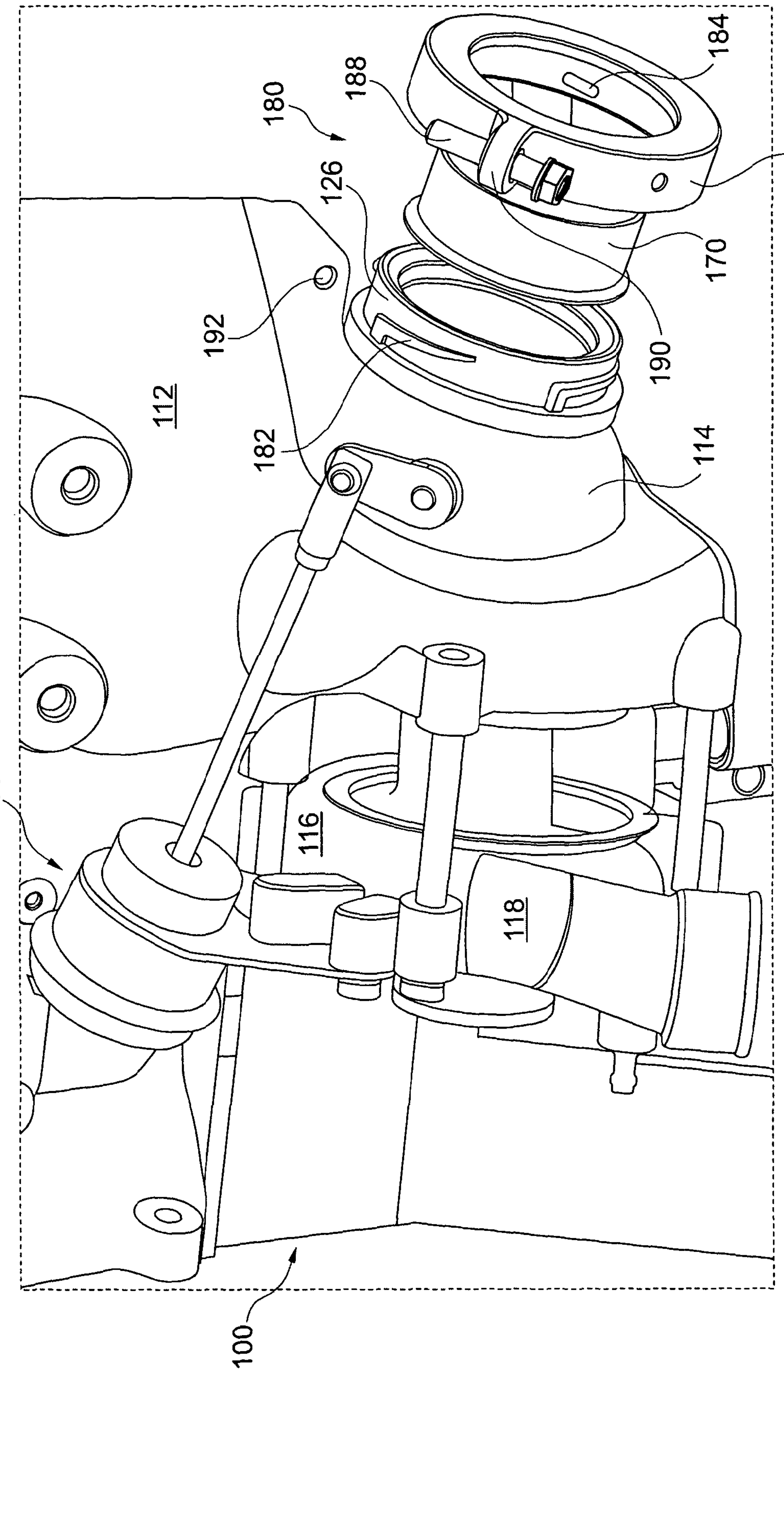

Fig. 1

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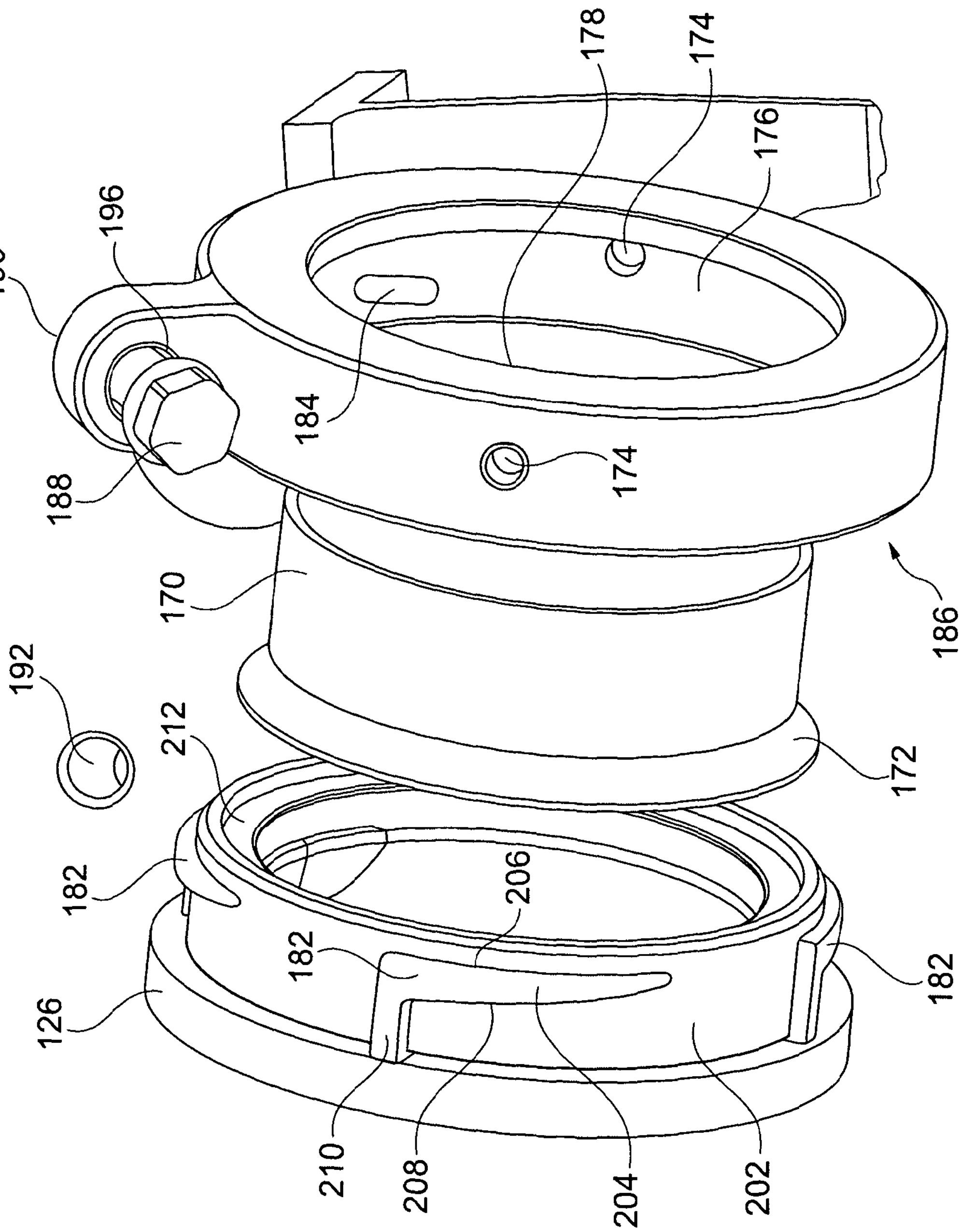
178
174
176
190
196
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188
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192
212
186
172
182
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182
182
126
210
208
204
202

Fig. 2

EXHAUST SYSTEM CONNECTION ARRANGEMENT

The present invention relates to an exhaust system connection arrangement, particularly to the exhaust outlet of internal combustion engines, especially for vehicles. The connection can be employed with turbocharged engines and with non-turbo (i.e. naturally - aspirated) engines.

Existing turbocharged internal combustion engines comprise a cylinder block and a cylinder head. The cylinders receive compressed air from a compressor and discharge exhaust gases via an exhaust manifold. The exhaust manifold supplies hot exhaust gases to an exhaust turbine housing, in which the gases are accelerated, and are then passed to a turbine wheel. The wheel is attached to an output shaft and the kinetic energy of the exhaust gases and some of their thermal energy is converted into an output drive torque at the shaft. The shaft is connected to a compressor wheel in the compressor to compress the air therein.

The exhaust gases leave the turbine housing at an outlet to the exhaust system and, in particular to a catalytic converter therein. The outlet of the turbine housing usually has a flange with through holes, by means of which the flange is connected by bolts or studs to the end of an exhaust pipe of the exhaust system. Numerous types of components are necessary for such connections, such as screws, nuts, gaskets and/or V-band clamps. The tools used to secure this connection need a considerable space in which to operate. Also, to ensure adequate sealing, the engaging parts of the connection fittings need to be manufactured with high tolerances.

Aspects of the present invention seek to overcome or at least reduce one or more of the above problems.

According to a first aspect of the present invention, there is provided a connection arrangement for interconnecting first and second tubular passageways, the arrangement comprising first and second annular connector members respectively surrounding the passageways, the members being configured to be interconnected by a partial turn between them.

By configuring the members to be interconnected by a partial turn, the advantage results that numerous connection components such as screws, nuts, gaskets and/or V-band clamps are no longer required. Since only a partial turn is required, the parts being connected, e.g. a turbine housing and an exhaust pipe, can be fully installed before they are interconnected. The connection can be quickly effected manually or with simple tools and requires only a small surrounding space for access. The arrangement itself is also compact.

Preferably the first connection member has a plurality of generally L-shaped raised members disposed spaced apart around the circumference thereof, with a first arm of each L-shape extending generally circumferentially and a second arm extending axially away from the second connector member, and wherein the second connector member comprises a like plurality of projections spaced around the circumference thereof and configured, upon relative axial movement of the connectors towards each other, to enter a respective spacing between the L-shaped members on the first connector member and, upon subsequent relative rotation of the connector members, to move towards the junction of the first and second arms of a respective L-shaped member so as to engage behind the first arm, whereby to attach the connector members to each other.

The raised members and projections may be replaced by any other suitable part-turn interconnection which may incorporate grooves, recesses etc. Whatever formations are used, only relatively low tolerances are required compared to the prior art. Accordingly the connectors can be moulded or cast and do not require the expensive machining operations necessary to produce the prior art arrangements.

The relative angle of rotation during the partial turn preferably lies within the range 15° to 45° and most preferably within the range 20° to 30°. This permits easy assembly of the connection arrangement.

In preferred arrangements, one of the tubular passageways is defined by a pipe member having a circumferential end flange, and the connector members have respective axially-facing circumferential faces arranged to receive the flange between them. An annular sealing gasket may be provided between the end flange and one or both circumferential faces. The pipe member may be an exhaust pipe, and a first of the connector members may, before assembly, loosely surround the exhaust pipe. Thus the exhaust pipe may be located precisely relative to the other connector member before the first connector member is moved into substantially its final axial position before being rotated through a partial turn to attach the connector members together. The other connector member may be formed at the outlet of a turbine housing and the exhaust pipe may connect the turbine housing outlet to a catalytic converter.

According to a second aspect of the present invention, there is provided an exhaust system connection arrangement comprising an engine side annular connector member and an exhaust pipe side annular connector member wherein the members are configured to be mutually-interconnected by a relative partial rotation.

In preferred arrangements the exhaust pipe side member has a radially-outwardly projecting lug configured to allow the connection to be secured.

Thus a secure and gas-tight connection arrangement can be provided.

According to a third aspect of the present invention, there is provided an internal combustion engine having a connection arrangement according to the first or second aspect of the invention and having such a lug, wherein a part of the engine is provided with a threaded bore and the lug has a through hole for receiving the shaft of a screw member before it is screwed into the bore.

This provides a convenient way to tighten the connection arrangement by using a threaded bore in an engine part which is already present, thus not requiring an extra component.

Connection arrangements according to the present invention are particularly suitable for use in internal combustion engines as disclosed in co-pending application filed on even date and entitled "Internal combustion engine with turbo installation", the contents of which are hereby incorporated by reference. The use of an aluminium monoblock construction for the cylinder head and turbo housing permits lower engine operating temperatures, and thus the connection arrangement does not need to be made of high quality stainless steel.

Even with high quality steel being used as the exhaust pipe side connection member in existing engines, it frequently happens that they become effectively welded to the adjacent components after a long period of use. However, the feature of lower operating temperature means that relatively cheap steel can be employed for the connector members of connection arrangements according to the present invention.

A preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings of which:

Fig. 1 shows a front view of an internal combustion engine incorporating a connection arrangement in accordance with an embodiment of the present invention; and

Fig. 2 shows an enlarged exploded view of the connection arrangement of Fig. 1.

The expression "partial turn" is intended to cover any connection arrangement which involves a relative rotation of two parts up to 360°. It covers partially threaded arrangements, whether the thread is continuous or intermittent and whether both parties are threaded or only one of the parts is threaded. It covers rotational movements alone and also rotational movements preceded by, accompanied by, and/or followed by one or more relative axial movements. It covers quarter-turn fasteners, turn-to-close fasteners and bayonet type connection arrangements.

Referring now to the drawings, an internal combustion engine 100 for a vehicle comprises a cylinder head 112 integrally formed of aluminium with an exhaust turbine housing 114. A turbine wheel within housing 114 drives a compressor wheel in a compressor housing 116 by means of a shaft mounted in a central bearing housing 118. The turbine has a control arrangement 130. Further details of the engine

100 are disclosed in the above-mentioned co-pending application.

When exhaust gases have passed through the turbine housing 114, they are fed via outlet 126 to an exhaust pipe 170 of an exhaust system, e.g. to a catalytic converter thereof. Only an end portion of exhaust pipe 170 is shown in the drawings, the remainder being omitted for reasons of clarity.

The exhaust pipe 170 is secured to outlet 126, which is of aluminium, by means of a connection arrangement 180 comprising a connector ring 186. The ring is of steel, but does not need to be of high-quality steel.

The outlet 126 is formed with four generally L-shaped raised members 182 which are equally-spaced around the radially outward surface 202 of the end of the outlet. The longer arm 204 of the L-shape extends generally circumferentially and subtends an angle of substantially 30° at the centre of the outlet. The front edge 206 of arm 204 is substantially parallel to the end of the outlet 126, whereas the rear edge 208 slopes slightly so that arm 204 tapers from a wide portion adjacent shorter arm 210 towards a narrow portion at its other end. Shorter arm 210 extends substantially axially.

At its interior, the outlet 126 is provided with an annular axially-facing surface against which sits an annular sealing gasket 212. When the connection arrangement is assembled, one face of a circumferential flange 172 of the exhaust pipe is firmly held against gasket 212.

The other face of flange 172 is engaged by an annular axially-facing surface (not shown) of a flange 178 of the connector ring 186. A radially inner surface 176 of the ring has four equally-spaced projections 184. Two radially-extending through holes 174 are provided at diametrically-opposed positions on the ring 186. On the radially outer periphery 194 of the ring there is provided an outwardly projecting lug 190 having a through hole 196. The hole is sized so as to allow passage of the shaft but not the head of a screw member 188. The end of the shaft of screw member 188 is threaded and is arranged to engage with a threaded hole or bore 192 in the cylinder head of the engine.

The connection arrangement is assembled as follows. Ring 186 is placed around exhaust pipe 170 and the combination is moved towards outlet 126. Projections 184 are first moved axially through the four spaces between raised members 182. Once the projections 184 have moved beyond the narrow ends of the raised members 182, ring 186 is rotated clockwise. The rotation is effected by engaging one or more suitable tools in holes 174 and applying torque thereto. During the rotation, projections 184 move behind respective members 182 and, as they do so, they are urged by sloping rear edges 208 to undergo a slight further axial movement to bring ring 186 slightly closer to outlet 126. The total amount of rotation of ring 186 to produce a firm engagement amounts to 20° to 30°.

At the end of this rotation, hole 196 is located adjacent to and substantially aligned with bore 192. Screw member 188 is now inserted through hole 196 and into bore 192 and tightened. The tightening procedure is accompanied by a slight further rotation of ring 186 to produce a secure engagement of the ring and hence exhaust pipe 170 with the outlet 126. Compression of gasket 212 ensures that the connection is gas tight.

The above-described arrangement has numerous advantages. It is compact and requires little surrounding space to enable the connection to be effected. Only relatively few components are required. Since the components are of relatively simple shape and can be made with low tolerances they can be easily produced in a casting or moulding operation. Although a twisting action needs to be applied to the ring 186, the exhaust pipe 170 does not rotate during connection, so the exhaust pipe can be accurately located in advance against gasket 212.

Various modifications can be made to the above-described arrangement. There may be two, three or five or more raised members 182 and a corresponding number of projections 184. The edges 206, 208 of the raised member 182 may be parallel to each other, rather than mutually inclined; they may both be parallel to the end of outlet 126 (like edge 206 in Fig. 2) or they may both be inclined to the end of outlet 126 (like edge 208 in Fig. 2).

The spacings between the raised members 182 may be different, e.g. to ensure that the ring can be attached in only a single circumferential position relative to the outlet to ensure that lug 190 is correctly located. In this case, projections 184 have matching different spacings.

The raised members 182 can be located on the inner surface 176 of the ring, with the projections 184 on the outer surface 202 of the outlet.

A wide range of alternative partial turn devices can be used to make the connection. For example the raised member 182 can be replaced or supplemented by grooves or recesses in surface 202. One of outlet 126 and ring 186 may have two or more spigots for engaging slots or grooves in the other, in the manner of a bayonet-fitting for a light bulb.

Holes 174 can be omitted and ring 186 can be arranged to be attached manually.

Lug 190 and screw member 188 may be omitted, but this results in a less secure connection. Alternatively, a lug 190 may be provided which is rotated through 90° from that shown in the Figures, so that the axes of hole 196 and bore 192 are parallel to that of the tubular passageway; in this case tightening of the screw member 188 does not cause rotational movement of ring 186 but an axial movement to tighten the connection and compress the gasket 212.

Although described in connection with an aluminium turbine housing 114, the connection arrangement can be used with conventional steel turbine housings; here though it might be necessary to use higher quality steel for the components of the connection arrangement to withstand the higher operating temperatures.

The passageways being connected may have a non-circular cross-section. If the engine 100 does not have a turbine, the connector arrangement 180 is provided at the normal exhaust output of the engine, i.e. at the output of the exhaust manifold.

Reference Numerals

Internal combustion engine	100
Cylinder head	112
Turbine housing	114
Compressor housing	116
Bearing housing	118
Turbine housing outlet	126
Control arrangement	130
Exhaust pipe	170
Exhaust pipe flange	172
Through holes	174
Inner surface of ring	176
Flange of ring	178
Connection arrangement	180
Raised member	182
Projection	184
Connection ring	186
Screw member	188
Lug	190
Threaded bore	192
Through hole	196
Outer surface of turbine outlet	202
Long arm	204
Front edge	206
Rear edge	208
Short arm	210
Gasket	212

CLAIMS

1. A connection arrangement (180) for interconnecting first and second tubular passageways, the arrangement comprising first and second annular connector members (126, 186) respectively surrounding the passageways, the members being configured to be interconnected by a partial turn between them.

2. A connection arrangement according to claim 1 wherein the first connector member (126) has a plurality of generally L-shaped raised members (182) disposed spaced apart around the circumference (202) thereof, with a first arm (206) of each L-shape extending generally circumferentially and a second arm (210) extending axially away from the second connector member, and wherein the second connector member comprises a like plurality of projections (184) spaced around the circumference (176) thereof and configured, upon relative axial movement of the connectors towards each other, to enter a respective spacing between the L-shaped members on the first connector member and, upon subsequent relative rotation of the connector members, to move towards the junction of the first and second arms of a respective L-shaped member so as to engage behind the first arm, whereby to attach the connector members to each other.

3. A connection arrangement according to claim 1 or 2, wherein the L-shaped raised members (182) are on a radially outer surface (202) at the first connector member and the projections are on a radially inner surface (176) of the second connector member.

4. A connection arrangement according to claim 2 or 3, wherein there are four L-shaped raised members (182) equally spaced around the circumference of the first connector member.

5. A connection arrangement according to any preceding claim, wherein the angle of rotation during the partial turn lies within the range 15° to 45°.

6. A connection arrangement according to any preceding claim wherein a radially outer one (186) of the connector members has a lug (190) configured to allow the connection arrangement to be secured.

7. A connection arrangement according to any preceding claim wherein one of the tubular passageways is defined by a pipe member (170) having a circumferential end flange (172), and the connector members have respective axially-facing circumferential faces arranged to receive the flange between them.

8. A connection arrangement according to any preceding claim, wherein one of the connector members (126) is attached to an engine side component and the other connector member (186) is attached to an exhaust pipe side component (170).

9. An exhaust system connection arrangement comprising an engine side annular connector member (126) and an exhaust pipe side annular connector member (186), wherein the members are configured to be mutually-interconnected by a relative partial rotation.

10. A connection arrangement according to claim 9, wherein the engine side member (126) is an outlet of a turbine housing (114) with a connection formation means (182) on a radially outer surface (202) thereof, and the exhaust pipe side member is arranged to surround a circumferentially-flanged end (172) of an exhaust pipe (170) and has connection formation means (184) on a radially inner surface (176) thereof.

11. A connection arrangement according to claim 10, wherein the connector members (126, 186) have respective axially-facing circumferential faces arranged to receive the flanged end (172) between them.

12. A connection arrangement according to any of claims 9 to 11, wherein the exhaust pipe side member (186) has a radially-outwardly projecting lug (190) configured to allow the connection to be secured.

13. A connection arrangement according to claim 12, wherein the lug (190) is configured to enable a torque to be applied to the exhaust pipe side member (186).

14. An internal combustion engine (100) having a connection arrangement (180) according to any of claims 6, 12 or 13, wherein a part (112) of the engine is provided with a threaded bore (192) and the lug has a through hole (196) for receiving the shaft of a screw member (188) before it is screwed into the bore.

Application No: GB1003052.6 **Examiner:** Mr Robert Arnold
Claims searched: 1-8 & 14 **Date of search:** 23 June 2010

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X,Y	X: 1-8 Y: 14	US4641861 A (OEM TECHNICAL SALES INC) - See whole document, especially column 5 lines 9-46.
X	1, 6 & 7	US2421228 A (WHITE) - See whole document, especially column 1 line 41 to column 2 line 1.
X	1	US1845882 A (LITSCHGE) - See whole document, especially figure 2.
X	1	KR20090091395 (SEO BONG KEE) - See whole document, especially figure 1.
Y	14	FR2924482 A (RENAULT SAS) - See whole document, especially figure 2.
A	-	EP1249657 A (FLEX TUBI S R L) - See whole document, especially figure 1.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

F01N; F16B; F16L

The following online and other databases have been used in the preparation of this search report

WPI & EPODOC

International Classification:

Subclass	Subgroup	Valid From
F01N	0013/18	01/01/2010
F01N	0013/08	01/01/2010
F16L	0015/00	01/01/2006