

Fluid pressure line

This invention relates to high pressure fluid lines, such as fuel lines for use in fuel injection systems to interconnect a fuel pump and an injection nozzle.

Fuel injection pumps employed in fuel injection systems generate extremely high hydraulic pressures which may range upwardly from several million, e.g. 4.8×10^7 to 1×10^8 Pa (approx. 7 thousand to 15 thousand pounds per square inch). The pressures are generated in pulse form to direct fuel from the pump through fuel lines to injection nozzles, typically associated with engines or other fuel burning plant. Because of rapid cycling and/or vibration associated with the power plant with which the injection system may be used, there may be a tendency for fittings to loosen and/or conduits to fracture under the pressures involved.

In the case of either, fuel spillage will occur and such spillage is particularly undesirable where an engine is operating in an enclosed area and/or substantially unattended thereby causing combustible vapours to form and/or permitting a sizable accumulation of fuel to occur in an area where it is unlikely to be discovered.

To avoid such difficulties, it has been suggested (see for example DE-C-462,273) to provide double walled fuel lines so that if the fuel carrying conduit ruptures, lost fuel will be captured by an outer conduit to prevent leakage. The end fitting of such a fuel line has parts which positively engage the ends of the inner and outer pipes and which hold the end of the pipes from movement relative to the part to which they are coupled and to themselves. This approach may eliminate leakage due to fuel line rupture and loosening of the end fittings but does not allow for any relative axial movement between the inner and outer pipes caused by bending of the pipes and the consequential different degrees of distortion of the inner and outer pipes resulting from their different sizes.

According to the present invention, a double-walled fluid pressure line comprises a first metal tube having a generally circular cross-section; a pair of nuts, one on each end of the first tube and rotatable thereon; a second metal tube generally circular in cross-section and nominally concentrically disposed about the first tube in spaced relation thereto to define an elongate annular space, one end of the second tube being captured within one of the nuts and the other end of the second tube being sealed to a fitting associated with the other of the nuts; a port in the fitting; and a bore in the fitting of larger cross-section than the first tube and receiving the first tube and the second tube other end, the port extending to the bore to establish fluid communication between the port and the annular space for venting any fluid leaking into the annular space, characterized in that a sealing sleeve is positioned on the second tube other end engaging an end of the bore; a further nut on the second tube

other end is screwed to the fitting about the bore to cause the sleeve to seal the bore to the second tube other end, the other end of the bore having an enlarged part partially receiving the other nut; and an annular seal is located at the interface of the enlarged part of the bore and the other nut.

Preferably, the first tube has a wall thickness sufficient to withstand high internal pressures and yet be bent on conventional tube bending equipment; and the second tube has a relatively thin wall so as to be bendable with the first tube on conventional tube bending equipment.

The invention also includes a fuel supply system incorporating a fluid line according to the invention.

Although applicable to other fluid carrying lines, the invention is particularly applicable to a fuel injection system between a fuel pump and a fuel injection nozzle.

In the present context high pressure means preferably greater than 5×10^7 Pa (500 kg/sq. cm).

Also in the present context conventional tube bending equipment means generally available mechanical presses utilizing air or hydraulic pressure.

An example of a fuel injection engine plant incorporating a fuel line constructed in accordance with the invention is illustrated in the accompanying drawings, in which:

Figure 1 is a schematic view of the engine plant;

Figure 2 is an axial sectional view of one fuel line;

Figure 3 is an enlarged view of one end of the fuel line; and,

Figure 4 is a cross sectional view illustrating a typical relationship of the components of the fuel line when bent.

The illustrated fuel line is associated with an engine 10 supplied with fuel from a tank 12. The tank 12 has a conduit 14 extending to a conventional fuel injection pump 16 which, in turn, provides fuel under pressure and in pulse form in a desired sequence to a plurality of fuel lines 18, to be described, which convey the fuel to conventional fuel injection nozzles 20 associated with the engine 10. As will be seen, the fuel lines 18 are double walled and are provided with means which direct leaking fuel to a conduit 24 by which it may be returned to the tank 12 or, alternatively, to the input of the injection pump 16, or to an alarm 28.

The fuel lines 18 are adapted to so return leaked fuel if the fuel leakage occurs either due to rupture or to leakage at the fittings. With the foregoing in mind, one embodiment of a fuel line will be described in greater detail with reference to Figures 2 to 4.

The fuel line includes a first, elongate, metallic rigid tube 30 which has a wall thickness sufficient to withstand the high pressures generated by the pump 16. The precise wall thickness will depend

upon the inner diameter of the tube 30 which, in turn, will be dependent upon the pressures generated as well as fuel delivery requirements and are well known in the art, forming no part of the present invention. In the overwhelming majority of cases, such criteria will result in the tube 30, while rigid, being bendable by conventional tube bending equipment.

Each end of the tube 30 is provided with a sealing surface 32 which, as illustrated, is frusto-conical such that the two surfaces 32 are opposed from each other and oppositely axially directed. They also face radially outwardly. The surfaces 32 are formed integrally on the tube 30 after other components to be described are assembled thereon. In the usual case, the surfaces 32 will be formed by cold forming as swaging. Just axially inwardly of each of the surfaces 32 is a shoulder 34, also cold formed, against which a washer 36 is abutted. The washers 36 will typically be formed of steel or iron and will not deteriorate upon exposure to petroleum products.

It will be observed from Figure 3 that each washer 36 extends radially outwardly from the radially outer extent 30 of each sealing surface 32 for purposes to be seen.

The respective ends of the tube 30 are provided with nuts 40 and 41, each having an external hexagonal head configuration (not shown) for conventional tightening purposes. The nut 40 has a interior screw threaded surface 42 by which the same may be affixed to a male fitting associated with either the pump 16 or nozzle 20, the male member being provided with a sealing surface that will mate with the sealing surface 32 at the associated end of the tube 30.

Oppositely of the screw threaded surface 42 is a radially inwardly directed shoulder 44 for purposes to be seen and intermediate the surface 42 and the shoulder 44, the nut 40 receives and houses both the associated washer 36 and the sealing surface 32.

The nut 41 is provided with a similar screw threaded surface 46 for capturing a screw threaded male member having a sealing surface designed to seal against the sealing surface 32 at the associated end of the tubing 30 as well as a radially inwardly directed shoulder 48 which abuts the washer 36 at the associated tubing end with the intermediate portion of the nut housing both the washer 36 and the sealing surface 32.

Axially inwardly of the shoulder 48 is an enlarged diameter bore 50. The end of the nut 41 remote from the internally threaded end 46 is of reduced diameter, as shown at 52, and is received within an enlarged diameter bore 54 within a fitting 56. A radially outwardly opening, peripheral groove 58 in the nut 41 receives an annular seal 60 to establish a seal at the interface between the fitting 56 and the nut 41.

The bore 54 extends to a reduced diameter bore 62 within the fitting 56. As illustrated, the tube 30 extends through both bores 62 and 50 and is of lesser diameter than either. Two radially directed ports 64 are provided with screw threads

(not shown) and extend to the small diameter bore 62. One of the bores 64 is adapted to be connected to the conduit 24 or 26, or alarm 28, while the other will typically be provided with a removable plug for purposes to be seen.

The right-hand end of the fitting 56 is provided with a screw threaded, reduced diameter section 66 which receives the nut 68 of a conventional compression fitting.

A second, elongate, metal, rigid tube 70, bendable with conventional tube bending equipment, has an end 72 extending through the nut 68 and into the reduced diameter bore 62. A conventional, sealing sleeve 74 is disposed on the end 72 and within the nut 68 partially to enter the bore 62 as well. Consequently, upon tightening of the nut 68, the sleeve 74 sealingly engages both the outer diameter of the second tube 70 and the flared end 75 of the bore 62. The outer diameter of the tube 70 is just slightly less than the diameters of the bores 50 and 62. Thus, both the nut 41 and the fitting 56 may telescope onto the tube 70 to expose the ends of the tube 30 to allow forming of the surfaces 32 and shoulders 34.

Moreover, the tube 70 is circular in cross section as is the tube 30 and has an inner diameter greater than the outer diameter of the tube 30 and is nominally concentrically disposed about the tube 30. Because of the relationship of inner and outer diameters, an elongate, annular space 76 exists between the tubes 30 and 70. The end of the tube 70 remote from the end 72 is flared slightly as at 78 and is in abutment with the washer 36 associated with the nut 40.

As a consequence of the foregoing, it will be appreciated that when the nuts 40 and 41 are secured to male members in the fuel injection system and the nut 68 is tightened, the ends of the tubes 30 and 70 will be sealed to the washers 36 so that any rupture of the tube 30 will result in leaking fuel being directed to the annular space 76 to flow therethrough to the bore 62 and then via one of the ports 64 to the return line 24 and activate the alarm 28. The presence of fuel in the annular space 76 of any of the lines may be visually observed by removing the plug (not shown) associated with the other of the ports 64 to assist in determining the leaky line.

In order to direct leaking fuel due to looseness of interengaging sealing surfaces 32 to the return line 24, one or both of the washers 36 may be provided with a small passage 80, as seen in Figure 3. The passage 80 extends generally axially through the washer 36 to establish fluid communication between the annular space 76 and a point radially outwardly of the radially outwardmost extent 38 of the sealing surface 34. Thus, any leaking fuel travelling along the surfaces 32 will ultimately reach the passage 80 to be directed to the return line 24.

In order to provide a fuel line that is bendable on conventional tube bending equipment, the tube 70 is provided with a relatively thin wall. In most cases, the wall thickness will be in the order of about 1 mm. or less and, in a highly preferred

embodiment, wherein the outer diameter of the tube 70 is slightly less than 1.02 cm., will be about 0.7 mm. The tube 70 may be formed of steel or other similar materials.

Figure 4 illustrates a typical cross section taken through the tubes 30 and 70 intermediate their ends after being bent by tube bending equipment. The surface 100 of the tube 70 engaged by the tool tends to flatten and immediately adjacent thereto, the surface bulges as at 102 on opposite sides of the tube 70. The tube 30 is substantially nondistorted and is engaged at opposite sides by the tube 70. However, areas 104 in the vicinity of the bulges 102 remain open as part of the annular space 76 to allow the flow of fuel to the return line 24 in the manner previously described.

Thus, it will be appreciated that the fuel line ensures against fuel spillage due to either rupture of the main fuel line or leakage at sealed connections. It also provides the significant advantage of being bendable with conventional tube bending equipment without fear of blocking the flow path to the return line, thereby allowing easy installation without requiring precisely fitted pipes or the like.

A highly significant feature is the absence of interengaging structure extending between the tubes 30 and 70 within the annular space 76. If such structure were present, deformation such as illustrated in Figure 4 during bending of the fuel line would not occur, but rather, the structure would tend to collapse the first, thereby decreasing its fuel carrying capacity and interfering with proper operation of the injection system.

Claims

1. A double-walled fluid pressure line comprising a first metal tube (30) having a generally circular cross-section; a pair of nuts (40, 41), one on each end of the first tube (30) and rotatable thereon; a second metal tube (70), generally circular in cross-section and nominally concentrically disposed about the first tube (30) in spaced relation thereto to define an elongate annular space (76), one end of the second tube (70) being captured within one of the nuts (40) and the other end of the second tube (70) being sealed to a fitting (56) associated with the other of the nuts (41); a port (64) in the fitting (56); and a bore (62) in the fitting of larger cross-section than the first tube (30) and receiving the first tube (30) and the second tube other end, the port (64) extending to the bore (62) to establish fluid communication between the port (64) and the annular space (76) for venting any fluid leaking into the annular space (76), characterized in that a sealing sleeve (74) is positioned on the second tube other end engaging an end of the bore (62); a further nut (68) on the second tube other end is screwed to the fitting about the bore (62) to cause the sleeve (74) to seal the bore (62) to the second tube other end, the other end of the bore (62) having an enlarged part (54) partially receiving the other nut

(41); and an annular seal (60) is located at the interface of the enlarged part of the bore (54) and the other nut (41).

2. A line according to claim 1, characterized in that the first tube (30) has a wall thickness sufficient to withstand high internal pressures and yet be bent on conventional tube bending equipment; and the second tube (70) has a relatively thin wall so as to be bendable with the first tube (30) on conventional tube bending equipment.

3. A line according to claim 1 or claim 2, characterized in that the fitting includes two ports (64) each extending to the bore (62), one arranged to be connected to a vent for the annular space (76) and the other being arranged to be selectively opened or closed to enable inspection to determine whether fluid is in the annular space (76).

4. A line according to any one of the preceding claims, characterized in that the annular space (76) is free from structure extending between the tubes (30, 70) along substantially the whole length thereof.

5. A fluid fuel supply system including a double-walled fluid pressure line (18) according to any of claims 1 to 4.

6. A fluid fuel supply system according to claim 5 having a fuel source (12, 16), characterized in that the inner tube (30) of the line (18) is connected to the source (12, 16) to receive fuel therefrom and that the part (64) is separately connected back to the source (12, 16) to return any fuel passing into the second tube (70) back to the source (12, 16).

7. A fluid fuel supply system according to claim 6, in which the source comprises a reservoir (12) and a pump (16), characterized in that the port (64) is connected to one end of a pipe (24), the other end of the pipe (24) being connected to the reservoir (12), the line (18) being connected directly to the pump (16).

Ansprüche

1. Doppelwandige Strömungsmitteldruckleitung mit einem ersten Metallrohr (30) mit einem im ganzen kreisförmigen Querschnitt, einem Paar von Muttern (40, 41), wobei eine auf jedem Ende des ersten Rohres (30) drehbar angeordnet ist; einem zweiten Metallrohr (70) von im ganzen kreisförmigem Querschnitt, und zwar nominell konzentrisch um das erste Rohr (30) herum mit Abstand gegenüber diesem angeordnet, zur Bildung eines langgestreckten Ringraums (76); wobei ein Ende des zweiten Rohres (70) innerhalb einer der Muttern (40) eingefangen ist, während das andere Ende des zweiten Rohres (70) mit einem Fitting (56) abdichtend in Verbindung steht, welches mit der anderen der Muttern (41) assoziiert ist, einer Öffnung (64) in dem Fitting (56), und einer Bohrung (62) in dem Fitting mit einem größeren Querschnitt als beim ersten Rohr (30) und zur Aufnahme des ersten Rohres (30)

embodiment, wherein the outer diameter of the tube 70 is slightly less than 1.02 cm., will be about 0.7 mm. The tube 70 may be formed of steel or other similar materials.

Figure 4 illustrates a typical cross section taken through the tubes 30 and 70 intermediate their ends after being bent by tube bending equipment. The surface 100 of the tube 70 engaged by the tool tends to flatten and immediately adjacent thereto, the surface bulges as at 102 on opposite sides of the tube 70. The tube 30 is substantially nondistorted and is engaged at opposite sides by the tube 70. However, areas 104 in the vicinity of the bulges 102 remain open as part of the annular space 76 to allow the flow of fuel to the return line 24 in the manner previously described.

Thus, it will be appreciated that the fuel line ensures against fuel spillage due to either rupture of the main fuel line or leakage at sealed connections. It also provides the significant advantage of being bendable with conventional tube bending equipment without fear of blocking the flow path to the return line, thereby allowing easy installation without requiring precisely fitted pipes or the like.

A highly significant feature is the absence of interengaging structure extending between the tubes 30 and 70 within the annular space 76. If such structure were present, deformation such as illustrated in Figure 4 during bending of the fuel line would not occur, but rather, the structure would tend to collapse the first, thereby decreasing its fuel carrying capacity and interfering with proper operation of the injection system.

Claims

1. A double-walled fluid pressure line comprising a first metal tube (30) having a generally circular cross-section; a pair of nuts (40, 41), one on each end of the first tube (30) and rotatable thereon; a second metal tube (70), generally circular in cross-section and nominally concentrically disposed about the first tube (30) in spaced relation thereto to define an elongate annular space (76), one end of the second tube (70) being captured within one of the nuts (40) and the other end of the second tube (70) being sealed to a fitting (56) associated with the other of the nuts (41); a port (64) in the fitting (56); and a bore (62) in the fitting of larger cross-section than the first tube (30) and receiving the first tube (30) and the second tube other end, the port (64) extending to the bore (62) to establish fluid communication between the port (64) and the annular space (76) for venting any fluid leaking into the annular space (76), characterized in that a sealing sleeve (74) is positioned on the second tube other end engaging an end of the bore (62); a further nut (68) on the second tube other end is screwed to the fitting about the bore (62) to cause the sleeve (74) to seal the bore (62) to the second tube other end, the other end of the bore (62) having an enlarged part (54) partially receiving the other nut

(41); and an annular seal (60) is located at the interface of the enlarged part of the bore (54) and the other nut (41).

2. A line according to claim 1, characterized in that the first tube (30) has a wall thickness sufficient to withstand high internal pressures and yet be bent on conventional tube bending equipment; and the second tube (70) has a relatively thin wall so as to be bendable with the first tube (30) on conventional tube bending equipment.

3. A line according to claim 1 or claim 2, characterized in that the fitting includes two ports (64) each extending to the bore (62), one arranged to be connected to a vent for the annular space (76) and the other being arranged to be selectively opened or closed to enable inspection to determine whether fluid is in the annular space (76).

4. A line according to any one of the preceding claims, characterized in that the annular space (76) is free from structure extending between the tubes (30, 70) along substantially the whole length thereof.

5. A fluid fuel supply system including a double-walled fluid pressure line (18) according to any of claims 1 to 4.

6. A fluid fuel supply system according to claim 5 having a fuel source (12, 16), characterized in that the inner tube (30) of the line (18) is connected to the source (12, 16) to receive fuel therefrom and that the part (64) is separately connected back to the source (12, 16) to return any fuel passing into the second tube (70) back to the source (12, 16).

7. A fluid fuel supply system according to claim 6, in which the source comprises a reservoir (12) and a pump (16), characterized in that the port (64) is connected to one end of a pipe (24), the other end of the pipe (24) being connected to the reservoir (12), the line (18) being connected directly to the pump (16).

Ansprüche

1. Doppelwandige Strömungsmitteldruckleitung mit einem ersten Metallrohr (30) mit einem im ganzen kreisförmigen Querschnitt, einem Paar von Muttern (40, 41), wobei eine auf jedem Ende des ersten Rohres (30) drehbar angeordnet ist, einem zweiten Metallrohr (70) von im ganzen kreisförmigem Querschnitt, und zwar nominell konzentrisch um das erste Rohr (30) herum mit Abstand gegenüber diesem angeordnet, zur Bildung eines langgestreckten Ringraums (76), wobei ein Ende des zweiten Rohres (70) innerhalb einer der Muttern (40) eingefangen ist, während das andere Ende des zweiten Rohres (70) mit einem Fitting (56) abdichtend in Verbindung steht, welches mit der anderen der Muttern (41) assoziiert ist, einer Öffnung (64) in dem Fitting (56), und einer Bohrung (62) in dem Fitting mit einem größeren Querschnitt als beim ersten Rohr (30) und zur Aufnahme des ersten Rohres (30)



und zur Aufnahme des ersten Rohres (30) und des anderen Endes des zweiten Rohres, wobei sich die Öffnung (64) zu der Bohrung (62) hinerstreckt, um Strömungsmittelverbindung zwischen der Öffnung (64) und dem Ringraum (76) vorzusehen, um jedwedes in den Ringraum (76) hineinleckendes Strömungsmittel abzuleiten, dadurch gekennzeichnet, daß eine Abdichthülse (74) am anderen Ende des zweiten Rohrs positioniert ist und mit einem Ende der Bohrung (62) im Eingriff steht, eine weitere Mutter (68) am anderen Ende des zweiten Rohres auf das Fitting um die Bohrung (62) herum aufgeschraubt ist, um zu bewirken, daß die Hülse (74) die Bohrung (62) mit dem anderen Ende des zweiten Rohres abdichtet, wobei das andere Ende der Bohrung (62) einen verbreiterten Teil (54) aufweist, der die andere Mutter (41) teilweise aufnimmt, und daß eine Ringdichtung (60) an der Grenzfläche des verbreiterten Teils der Bohrung (54) und der anderen Mutter (41) angeordnet ist.

2. Leitung nach Anspruch 1 dadurch gekennzeichnet, daß das erste Rohr (30) eine Wanddicke besitzt, die ausreicht, um hohen Innendruck zu widerstehen und dabei doch durch übliches Rohrbiegegerät gebogen werden kann, daß ferner das zweite Rohr (70) eine relativ dünne Wand besitzt, um so mit dem ersten Rohr (30) auf üblichem Rohrbiegegerät biegsam zu sein.

3. Leitung nach Anspruch 1 oder 2 dadurch gekennzeichnet, daß das Fitting zwei Öffnungen (64) aufweist, deren jede sich zu der Bohrung (62) erstreckt, wobei die eine Öffnung angeordnet ist um mit einem Abfluß für den Ringraum (76) verbunden zu werden, während die andere Öffnung angeordnet ist, um selektiv geöffnet oder geschlossen werden zu können, um so eine Inspektion zu ermöglichen, und zwar zur Feststellung ob Strömungsmittel in dem Ringraum (76) vorhanden ist.

4. Leitung nach einem der vorhergehenden Ansprüche dadurch gekennzeichnet, daß der Ringraum (76) frei ist von Struktur, die sich zwischen den Rohren (30, 70) erstreckt, und zwar längs im wesentlichen der gesamten Länge.

5. Strömungsmittel-Brennstoffversorgungssystem mit einer doppelwandigen Strömungsmitteldruckleitung (18) nach einem der Ansprüche 1 bis 4.

6. Strömungsmittel-Brennstoffversorgungssystem nach Anspruch 5 mit einer Brennstoffquelle (12, 16) dadurch gekennzeichnet, daß das innere Rohr (30) der Leitung (18) mit der Quelle (12, 16) verbunden ist, um Brennstoff von dort zu erhalten, und daß der Teil (64) gesondert zur Quelle (12, 16) zurückverbunden ist, um jedweden Brennstoff zur Quelle (12, 16) zurückzuführen, der in das zweite Rohr (70) läuft.

7. Strömungsmittel-Brennstoffversorgungssystem nach Anspruch 6 dadurch gekennzeichnet, daß die Quelle ein Reservoir (12) und eine Pumpe (16) aufweist, dadurch gekennzeichnet, daß die Öffnung (64) mit einem Ende eines Rohrs (24) verbunden ist, und daß das andere Ende des Rohrs (24) mit dem Reservoir (12) verbunden ist,

wobei die Leitung (18) direkt mit der Pumpe (16) in Verbindung steht.

5 Revendications

1. Conduit de fluide sous pression à double paroi, comprenant un premier tube métallique (30) ayant une section de forme générale circulaire ; deux écrous (40, 41), un à chaque extrémité du premier tube (30) et pouvant tourner sur celui-ci ; un second tube métallique (70) ayant une section de forme générale circulaire et disposé concentriquement autour du premier tube (30), à une certaine distance de celui-ci afin de délimiter un espace annulaire allongé (76), l'une des extrémités du second tube (70) étant emprisonnée dans l'un des écrous (40) tandis que l'autre extrémité du second tube (70) est scellée à une pièce de montage (56) associée avec l'autre écrou (41) ; un orifice (64) dans la pièce (56) ; et un alésage (62) réalisé dans la pièce, dont la section est plus grande que celle du premier tube (30) et qui reçoit ce premier tube (30) et l'autre extrémité du second tube, l'orifice (64) s'étendant jusqu'à l'alésage (62) afin d'établir une communication pour un fluide entre l'orifice (64) et l'espace annulaire (76) afin d'évacuer les fuites de fluide de l'espace annulaire (76), caractérisé en ce qu'un manchon d'étanchéité (74) est placé sur l'autre extrémité du second tube qui est en contact avec l'une des extrémités de l'alésage (62) ; en ce qu'un autre écrou (68) sur l'autre extrémité du second tube est vissé sur la pièce autour de l'alésage (62) afin de faire en sorte que le manchon (74) relie de façon étanche l'alésage (62) à l'autre extrémité du second tube, l'autre extrémité de l'alésage (62) ayant une partie agrandie (54) recevant partiellement l'autre écrou (41) ; et en ce qu'un joint annulaire (60) est logé à l'interface de la partie agrandie (54) de l'alésage et de l'autre écrou (41).

2. Conduit selon la revendication 1, caractérisé en ce que le premier tube (30) a une épaisseur de paroi suffisante pour résister à des pressions internes élevées, tout en pouvant néanmoins être cintré sur des équipements de cintrage de tube classique ; et en ce que le second tube (70) a une paroi relativement mince afin de pouvoir être cintré avec le premier tube (30) sur l'équipement de cintrage classique.

3. Conduit selon la revendication 1 ou 2, caractérisé en ce que la pièce comprend deux orifices (64) dont chacun s'étend jusqu'à l'alésage (62), l'un étant arrangé pour être relié à un évent pour l'espace annulaire (76) tandis que l'autre est arrangé pour être sélectivement ouvert ou fermé pour permettre une inspection pour déterminer s'il y a du fluide dans l'espace annulaire (76).

4. Conduit selon l'une quelconque des revendications précédentes, caractérisé en ce que l'espace annulaire (76) ne comporte aucune structure s'étendant entre les tubes (30, 70) pratiquement sur toute sa longueur.

5. Système d'alimentation de carburant



comportant un conduit de fluide sous pression (18) à double paroi selon l'une quelconque des revendications 1 à 4.

6. Système d'alimentation de carburant selon la revendication 5, ayant une source de carburant (12, 16), caractérisé en ce que le tube intérieur (30) du conduit (18) est relié à la source (12, 16) afin d'en recevoir du carburant et en ce que la partie (64) est séparément reliée à la source (12, 16) afin de ramener à la source (12, 16) le

carburant passant éventuellement dans le second tube (70).

7. Système d'alimentation de carburant selon la revendication 6, dans lequel la source comprend un réservoir (12) et une pompe (16), caractérisé en ce que l'orifice (64) est relié à l'une des extrémités d'un tuyau (24) dont l'autre extrémité est reliée au réservoir (12), le conduit (18) étant directement relié à la pompe (16).

15

20

25

30

35

40

45

50

55

60

65

6



* C L M S *