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54 Titre : Two-phase connector.

57 Abrégé :

The present invention relates to a fluid connection system intended to connect two two-phase pipes consisting of two coaxial casings defining a central flow flowing into the inner casing and an annular flow flowing into the space between said inner casing and the outer casing, said coupling comprising a second connector intended to be attached to the end of one of said two-phase pipes and a first complementary connector intended to be attached to the complementary end of the other of said two-phase pipes.

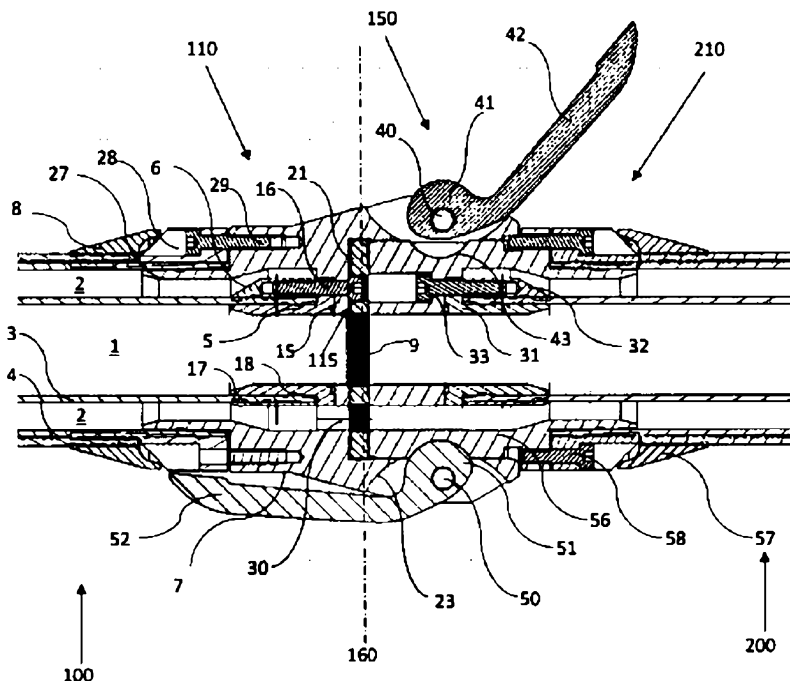


Figure 1

**DESCRIPTION****TITLE: TWO-PHASE CONNECTOR****5 FIELD OF THE INVENTION**

[0001] The present invention relates to the field of fluidics and more precisely to the connection by a connector of two ends of two-phase pipes having two coaxial ducts. Such pipes are for example intended to supply equipment with  
10 a liquid and air or a gas under pressure, or even to transfer two counter-flow liquids, in particular two liquids or a liquid and a counter-flow gas.

[0002] Such pipes are for example used to supply pressurized water and pressurized air to a spray nozzle, for applications for scouring and cleaning  
15 surfaces such as sides of walls, vehicles or industrial equipment, or even for firefighting applications, in order to increase efficiency with reduced water consumption.

[0003] It is conventional to use two ducts, one to supply pressurized air, the  
20 other to supply pressurized water which are interconnected using two separate connectors of the nozzle. "Mono-coupling" solutions have also been proposed in the prior art wherein the two phases are supplied coaxially to allow a single-step connection.

**25 PRIOR ART**

[0004] Patent US1217543 discloses a pipe seal for double pipes with an inner pipe and a concentric rigid outer pipe and a seal consisting of an annular boss, the face of the member opposite said bored boss having two different  
30 diameters, the smallest counter-bore being adapted to adapt to the inner tube. The cooling liquid circulates in the inner tube, and the cooled liquid circulates in the annular space formed between the walls of the two tubes.

[0005] Patent US4732414 discloses a coupling for coaxial pipes each having inner and outer pipes comprising:

- 5 - a male joint part having an inner part for receiving an inner pipe of one of said coaxial pipes and having an internal bore communicating with said inner pipe, an outer cylindrical part for receiving the outer pipe of said one coaxial pipe, a bored body extending integrally from said outer part, said body defining a plurality of longitudinal bores between said body and said inner part for communicating with said outer pipe;
- 10 - a female joint part having an inner part for receiving the inner pipe of the other of said coaxial pipes and having an internal bore communicating with said inner pipe of the other of said coaxial pipes, an outer cylindrical part for receiving the outer pipe of the other of said coaxial pipes, and a bored body extending integrally from said female joint bored body, said female joint bored body defining  
15 a plurality of longitudinal bores between said body and said female joint bored body to communicate with said outer pipe of the other of said coaxial pipes
- said inner parts of each of said male and female joint parts having on one end surface of the opposite protrusions and said outer parts of each of said male and female joint parts having opposite protrusions on the end  
20 surface distant from said outer cylindrical surface;
- the bored body of one of said parts having a screw thread on its outer peripheral surface and the bored body of the other part having an outer flange on its peripheral surface;
- a flat metal lining between said portions and having an internal  
25 passage connecting said internal bores of said inner parts and external passages connecting said longitudinal bores;
- and means engaging said screw thread and said flange for locking said male and female parts together with said lining therebetween such that said opposite protrusions are pushed towards each other with said lining  
30 therebetween such that said protrusions are pressed and sealed against said lining and said internal bores and the longitudinal bores are sealed from one another and the atmosphere. L

[0006] Patent DE20004675 discloses a fixed coupling for connecting a counter-coupling part, to which a pipe, in particular a fire hose, is attached, to a fixed part, in particular to a duct or a rigid coupling, the fixed coupling having a pipe side, a first ring with one to couple the counter-coupling part attached to the end face provided for the pipe, an end face, an elastic sealing ring provided on the end face and at least one claw projecting axially as part of a bayonet connection between the conjugated coupling part and the fixed coupling, characterized by a second ring which can rotate with the first ring and comprising means for fastening to the fixed part.

[0007] Patent US8197783 discloses a seal intended to be used with coupling components, the seal being made of a compressible elastomer material and having a generally annular shape with a longitudinal axis, an inner peripheral surface facing radially inwards and an outer peripheral surface facing radially outwards, longitudinally opposite side surfaces, a positioning portion substantially adjacent to the outer peripheral surface, a compression sealing part substantially adjacent to the inner peripheral surface, and a connection part between the positioning part and the compression sealing part, the connection part having a longitudinal thickness substantially less than the longitudinal thickness of the compression sealing part, wherein at least one of the side surfaces of the compression sealing part comprises two outwardly facing ridges separated by an outwardly facing groove.

## 25 DRAWBACKS OF THE PRIOR ART

[0008] The solutions of the prior art are not completely satisfactory because they comprise a large number of moving parts making the sealing of the two phases difficult, and requiring complex manipulations to ensure effective connection and locking.

[0009] Furthermore, the solutions of the prior art generally have parts that locally reduce the section of the duct, which causes pressure losses and hydraulic turbulence.

5 [0010] The solution described in patent US1217543 cannot be used with flexible pipes; the inner tube is modified to form an annular boss: this solution is therefore absolutely not applicable to a two-phase flexible hose.

[0011] Finally, the seal between the two fluid circuits is not always satisfactory  
10 in the prior art solutions.

#### **SOLUTION PROVIDED BY THE INVENTION**

[0012] In order to address these drawbacks, the invention relates, in its most  
15 general sense, to a fluid connection system intended for the connection of two flexible two-phase pipes.

[0013] The pipes consist of two coaxial casings defining a central path flowing  
20 into the inner casing and an annular path flowing into the space between said inner casing and the outer casing, said coupling comprising a second connector intended to be attached to the end of one of said two-phase pipes and a first complementary connector intended to be attached to the complementary end of the other of said two-phase pipes.

The first connector has:

- 25 - a central connecting part whose distal end is configured to ensure the sealed connection with the end of the inner casing of one of said two-phase pipes and
- a peripheral connecting part whose distal end is configured to ensure the sealed connection with the end of the outer casing of said two-phase  
30 pipe, said peripheral connecting part having an annular front inner flange, axially traversed by ports opening into said peripheral path

- said central and peripheral connecting parts being assembled to define a transverse coupling surface

The second connector has:

- a central connecting part whose distal end is configured to ensure the sealed connection with the end of the inner casing of the other of said two-phase pipes and
- a peripheral connecting part whose distal end is configured to ensure the sealed connection with the end of the outer casing of said other two-phase pipe, said peripheral connecting part having an annular front inner flange, axially traversed by ports opening into said peripheral path
- said central and peripheral connecting parts being assembled to define a second transverse front coupling surface

The first connector and second connector having a locking means in the axial direction. The connector further comprises an annular sealing disc with axial ports corresponding to the axial ports in said front inner flanges.

[0014] According to a first variant, said first and second connectors have a locking means in the longitudinal direction.

[0015] According to a second variant, said first and second connectors have a means of a locking means in the angular and axial direction by relative rotation of a coupling ring bearing alternating annular shoulders and interlayer space, with a complementary coupling ring bearing alternating claws having annular shoulders.

[0016] Advantageously, said central part of said first connector consists of an inner sleeve extended by a disc shoulder and a coaxial tubular outer sleeve having a plurality of axial threaded holes, said inner sleeve and said tubular outer sleeve being configured to enclose the end of the inner casing of one of said two-phase pipes.

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[0017] According to a particular embodiment, said peripheral part of said first connector consists of a sleeve having on the distal side a tubular lip whose

diameter corresponds to the inner diameter of said outer casing, the sleeve having a plurality of axial threaded holes, said sleeve being extended on the proximal side by an inner collar through which axial holes pass, said collar defining a central port of a section corresponding to the section of said central sleeve, said sleeve being extended on the proximal side by a locking collar defining a cavity for receiving the end of the second connector; said peripheral connecting part further comprising a coaxial tubular outer sleeve having a plurality of axial holes, said inner sleeve and said tubular outer sleeve being configured to enclose the end of the outer casing of said two-  
5 phase pipe, said inner sleeve and said tubular outer sleeve being assembled by axial screws passing through said axial holes in said tubular outer sleeve in order to fit into said axial threaded holes of said sleeve.  
10

[0018] Advantageously, said central connecting part and said peripheral connecting part being assembled by axial screws passing through said collar of the sleeve to fit into said axial threaded holes of said tubular outer sleeve of the central connecting part.  
15

[0019] According to one variant, said central part of said second connector consists of an inner sleeve extended by a disc shoulder and a coaxial tubular outer sleeve having a plurality of axial holes, said inner sleeve and said tubular outer sleeve being configured to enclose the end of the inner casing of the other of said two-phase pipes.  
20

[0020] According to a specific embodiment, said peripheral part of said second connector consists of a sleeve having on the distal side a tubular lip whose diameter corresponds to the inner diameter of said outer casing, the sleeve having a plurality of axial threaded holes, said sleeve being extended on the proximal side by an inner collar through which axial holes pass, said collar defining a central port, said sleeve being extended on the proximal side by a locking collar defining a cavity for receiving the end of the second connector; said peripheral connecting part further comprising a coaxial  
25  
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tubular outer sleeve having a plurality of axial holes, said inner sleeve and said tubular outer sleeve being configured to enclose the end of the outer casing of said two-phase pipe, said inner sleeve and said tubular outer sleeve being assembled by axial screws passing through said axial holes in said tubular outer sleeve in order to fit into said threaded holes of said sleeve.

#### **DETAILED DESCRIPTION OF ONE NON-LIMITING EXEMPLARY EMBODIMENT**

10 [0021] The present invention will be better understood on reading the following description, which concerns a non-limiting exemplary embodiment that is shown by the appended drawings, in which:

[FIG. 1] Figure 1 shows a longitudinal section view of a coupling according to a first variant of the invention

15 [FIG. 2] Figure 2 shows a perspective view of the coupling equipped with the sealing disc according to a first variant of the invention

[FIG. 3] Figure 3 shows a front view of a coupling according to a first variant of the invention

[FIG. 4] Figure 4 shows a front view of a sealing disc according to the invention.

20 [FIG. 5] Figure 5 shows a longitudinal section view of an assembly of two couplings according to a second variant of the invention

[FIG. 6] Figure 6 shows a partial perspective view of a sealing coupling according to a second variant of the invention.

25 [FIG. 7] Figure 7 shows a perspective view of a coupling according to a second variant of the invention.

[FIG. 8] Figure 8 shows a three-quarter front view - of a coupling according to a second variant of the invention.

#### **DESCRIPTION OF AN EXAMPLE COUPLING**

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[0022] Figure 1 shows a longitudinal section view of two two-phase pipes (100, 200) joined by a coupling according to the invention.

[0023] The two-phase pipes consist of two concentric tubular casings (3, 4) defining a central path (1), delimited by the inner casing (3), and a peripheral path (2), defined by the annular space between the inner casing (3) and the outer casing (4). The fluid at the highest pressure preferably circulates in the central path (1) and the fluid at lower pressure circulates in the peripheral path (2).

[0024] The ends of the two two-phase pipes (100, 200) are connected by a first connector (110) and a second coupling (210).

10

#### **DESCRIPTION OF THE FIRST COUPLING (110)**

[0025] The first connector consists of a central connecting part attached to the front end of the inner casing (3), and a peripheral connecting part attached to the front end of the outer casing (4).

15

[0026] "Front" refers to the side closest to the transverse median plane (160) corresponding to the interface of the two pipes (100, 200), and "distal" refers to the side furthest from this median plane (160).

20

[0027] The central connecting part consists of said first connector (110) and consists of an inner sleeve (5) extended by a flared disc shoulder (15) and by a coaxial tubular outer sleeve (6). This outer sleeve (6) is tapered from the distal side and may consist of tabs separated by longitudinal notches to limit disrupting the fluid flow circulating in the peripheral path (2). The outer sleeve (6) flares on the distal side to form a disc shoulder (15) having a plurality of axial threaded holes which are intended to receive the assembly screws (16) of the central connecting part and of the peripheral connecting part.

25

[0028] This inner sleeve (5) and the outer tubular sleeve (6) are configured to enclose the end of the inner casing (3) of the two-phase pipe (100). They

30

have annular grooves or splines (17, 18) intended to reinforce the anchoring of the inner casing (3) in the central connecting part.

5 [0029] The peripheral connecting part is attached to the front end of the outer casing (4).

10 [0030] The peripheral connecting part whose distal end is configured to ensure the sealed connection with the end of the outer casing (4) of said two-phase pipe (100).

[0031] It is formed by a sleeve (7) having an annular front collar (21) and a distal tubular skirt (27), solid or formed by alternating longitudinal teeth and slots. The peripheral casing (4) is wedged between this distal tubular skirt (27) and a peripheral sleeve (8) surrounding the outer end of the two-phase  
15 pipe (100) and having longitudinal holes (28) intended for the passage of screws (29) ensuring the connection with the sleeve (7).

[0032] The sleeve (7) has ports (30) passing transversely through the inner annular ring also passed through by the assembly screws (15) of the central  
20 connecting part and of the peripheral connecting part. These ports (30) are distributed over the periphery of this ring to allow the passage of fluid circulating in the peripheral path (2).

[0033] The central and peripheral connecting parts are assembled to define  
25 a transverse coupling surface (115).

[0034] The first connector (110) is mounted by sliding the tubular outer sleeve (6) around the central casing (3) and then engaging the inner sleeve (5) in the outer casing.  
30

[0035] The outer tubular sleeve (6) is then placed around the outer casing (4), and the distal tubular skirt (27) of the sleeve (7) is inserted. The assembly is

secured by the external screws (29) ensuring the tightening of the outer tubular sleeve (6) and the sleeve (7) around the outer casing (4), as well as the assembly of the central connecting part and the peripheral connecting part.

- 5 [0036] The sleeve (7) is extended, on the side opposite the distal tubular skirt (27), by a tubular ring (23) intended to receive the end of the male coupling. This tubular ring is traversed by several pivots (40, 50) extending in a transverse plane and distributed angularly around the longitudinal axis. These pivots (40, 50) constitute the articulation axis of asymmetrical cams (41, 51) extended by  
10 levers (42, 52). These cams (41, 51) engage in complementary surfaces formed by an annular groove (43) surrounding the outer surface of the male coupling.

#### **SECOND MALE COUPLING**

- 15 [0037] The second coupling is also formed by a central connecting part and a peripheral connecting part.

[0038] The central connecting part consists of an inner sleeve (31) and an outer sleeve (32) intended to enclose the central casing (3). These two  
20 sleeves (31, 32) are assembled by screwing screws (33, 58) also passing through a bore formed in the peripheral connecting part.

[0039] This peripheral connecting part is formed of a sleeve (56) extended on the distal side by a solid or split tubular skirt, which engages inside the outer  
25 casing (4), and a second sleeve (57) surrounding the outer surface of the outer casing (4).

#### **SEALING DISC**

- 30 [0040] The two female couplings and second connector define transverse surfaces traversed by a central port, allowing the flow of the central path (1) and axial ports formed in an annular part corresponding to the section

between the outer casing (4) and the central casing (3), and allowing the flow of the peripheral path (2). The inter-port seal is provided by a sealing disc (9) also having a central port (60) and peripheral ports (61 to 63).

## 5 SECOND VARIANT EMBODIMENT

[0041] The second variant embodiment shown by Figures 5 to 8 differs from the first variant embodiment mainly by the locking mode: longitudinal in the first embodiment, locking is carried out longitudinally, by locks preventing axial separation; in the second embodiment, the locking is carried out angularly, with claws preventing axial separation when said claws are inserted radially. The other features are not systematically recalled for said second embodiment when they remain unchanged, and they are then transposable to this second embodiment.

[0042] The coupling is achieved by two complementary connecting rings (60, 70), one having alternating claws (72) and hollow space and the other alternating shoulder (61, 62), and hollow space. The engagement of the two couplings is achieved by embedding the hollow spaces of the ring (60) with the claws (72) then by applying a relative rotation so that the shoulders (61, 62) of one of the couplings are positioned in the hollow of the claws (72) and maintained in one direction by the semi-annular shoulder (74) of the claws (72) and in the other direction by the peripheral edge (75) of the complementary coupling.

## Claims

1. A fluid connection system intended to connect two two-phase flexible pipes consisting of two coaxial casings (3, 4) defining a central flow (1) flowing into the inner casing (3) and an annular flow (2) flowing into the space between said inner casing (3) and the outer casing (4), said coupling comprising a second connector (210) intended to be attached to the end of one of said two-phase pipes (100) and a first complementary connector (110) intended to be attached to the complementary end of the other of said two-phase pipes (200), said first connector (110) and second connector (210) having a locking means (150) in the axial direction

Characterized in that

- Said first connector (110) has
  - a central connecting part whose distal end is configured to ensure the sealed connection with the end of the inner casing (3) of one of said two-phase pipes (100) and
  - a peripheral connecting part whose distal end is configured to ensure the sealed connection with the end of the outer casing (4) of said two-phase pipe (100), said peripheral connecting part having an annular front inner flange, traversed axially through ports opening into said peripheral flow
  - said central and peripheral connecting parts being assembled to define a transverse coupling surface
- Said second connector (210) has:
  - a central connecting part whose distal end is configured to ensure the sealed connection with the end of the inner casing (3) of the other of said two-phase pipes (200) and
  - a peripheral connecting part whose distal end is configured to ensure the sealed connection with the end of the outer casing (4) of said other two-phase pipe (200), said peripheral connecting part having an annular front inner flange, axially traversed by ports opening into said peripheral path
  - said central and peripheral connecting parts being assembled to define a second transverse front coupling surface

the system being further characterized in that said central part of said first connector consists of an inner sleeve (5) extended by a disc shoulder and a coaxial tubular outer sleeve (6) having a plurality of axial threaded holes, said inner sleeve (5) and said tubular outer sleeve (6) being configured to  
5 enclose the end of the inner casing (3) of one of said two-phase pipes (100).

2. The fluid connection system intended to connect two two-phase pipes (110, 210) according to claim 1, characterized in that the said coupling further comprising a sealing disc (9) of annular shape with axial openings  
10 corresponding to the axial openings in said front inner collars.

3. The fluid connection system intended to connect two two-phase pipes (110, 210) according to claim 1, characterized in that said first connector (110) and second connector (210) have a locking means (150) in the angular  
15 and axial direction by relative rotation of a coupling ring (60) bearing alternating annular shoulders and intermediate space, with a complementary coupling ring bearing alternating claws having annular shoulders.

4. The fluid connection system intended to connect two two-phase pipes  
20 (110, 210) according to claim 1, characterized in that said peripheral part of said first connector consists of a sleeve (7) having, on the distal side, a tubular lip whose diameter corresponds to the inner diameter of said outer casing (4), the sleeve having a plurality of axial threaded holes, said sleeve (7) being extended on the proximal side by an inner collar traversed by axial holes, said collar  
25 defining a central port in a section corresponding to the section of a central sleeve (5), said sleeve (7) being extended on the proximal side by a locking collar defining a cavity for receiving the end of the second connector; said peripheral connecting part further comprising a coaxial tubular outer sleeve (8)  
30 having a plurality of axial holes, said inner sleeve (7) and said tubular outer sleeve (8) being configured to enclose the end of the outer casing (4) of said two-phase pipe (100), said inner sleeve (7) and said tubular outer sleeve (8)

being assembled by axial screws passing through said axial holes in said tubular outer sleeve (8) in order to fit into said threaded holes of said sleeve (7).

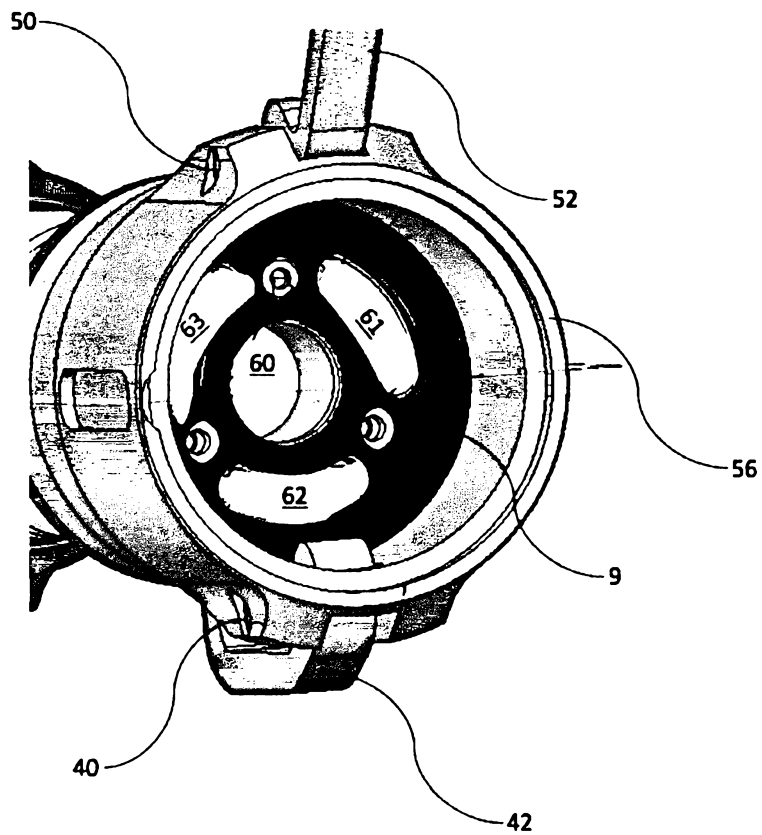
5. The fluid connection system intended to connect two two-phase pipes (110, 210) according to claims 1, 2 and 4, characterized in that said central connecting part and said peripheral connecting part being assembled by axial screws passing through said collar of the sleeve (7) in order to fit into said axial threaded holes in said tubular outer sleeve (6) of the central connecting part.

10 6. The fluid connection system intended to connect two two-phase pipes (110, 210) according to claim 1, characterized in that said central part of said second connector consists of an inner sleeve (7) extended by a disc shoulder and a coaxial tubular outer sleeve (17) having a plurality of axial holes, said inner sleeve (7) and said tubular outer sleeve (17) being configured to enclose  
15 the end of the inner casing (3) of the other of said two-phase pipes (200).

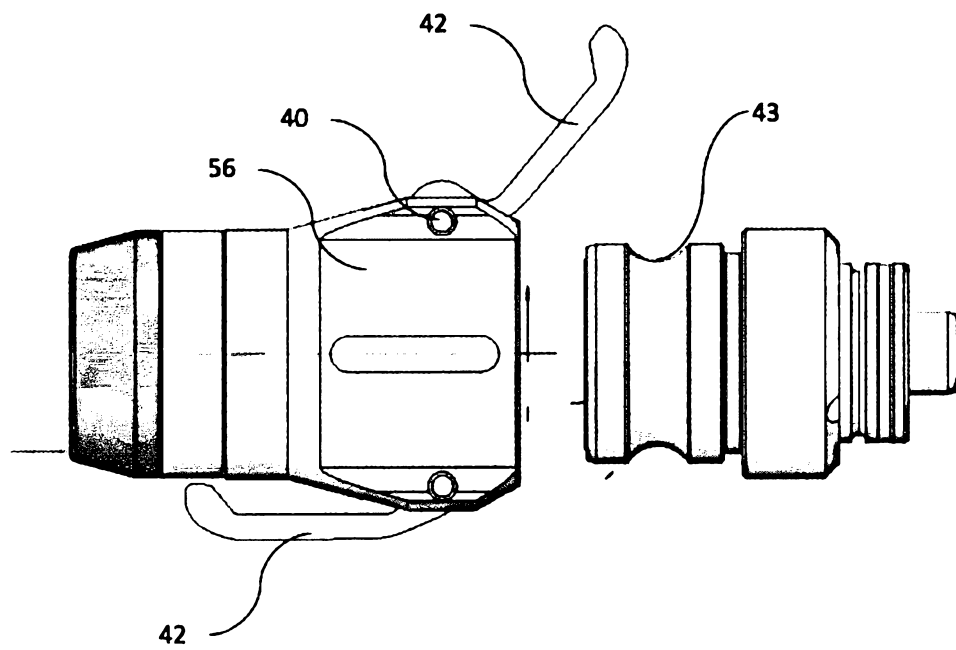
7. The fluid connection system intended to connect two two-phase pipes (110, 210) according to claim 1, characterized in that said peripheral part of said second connector consists of a sleeve having, on the distal side, a tubular lip  
20 whose diameter corresponds to the inner diameter of said outer casing (4), the sleeve having a plurality of axial threaded holes, said sleeve being extended on the proximal side by an inner collar through which axial holes pass, said collar defining a central port, said sleeve being extended on the proximal side by a locking collar defining a cavity for receiving the end of the second connector;  
25 said peripheral connecting part further comprising a coaxial tubular outer sleeve having a plurality of axial holes, said inner sleeve and said tubular outer sleeve being configured to enclose the end of the outer casing (4) of said two-phase pipe (100), said inner sleeve (7) and said tubular outer sleeve (8) being assembled by axial screws passing through said axial holes in said tubular outer  
30 sleeve (8) in order to fit into said axial threaded holes in said sleeve (7).



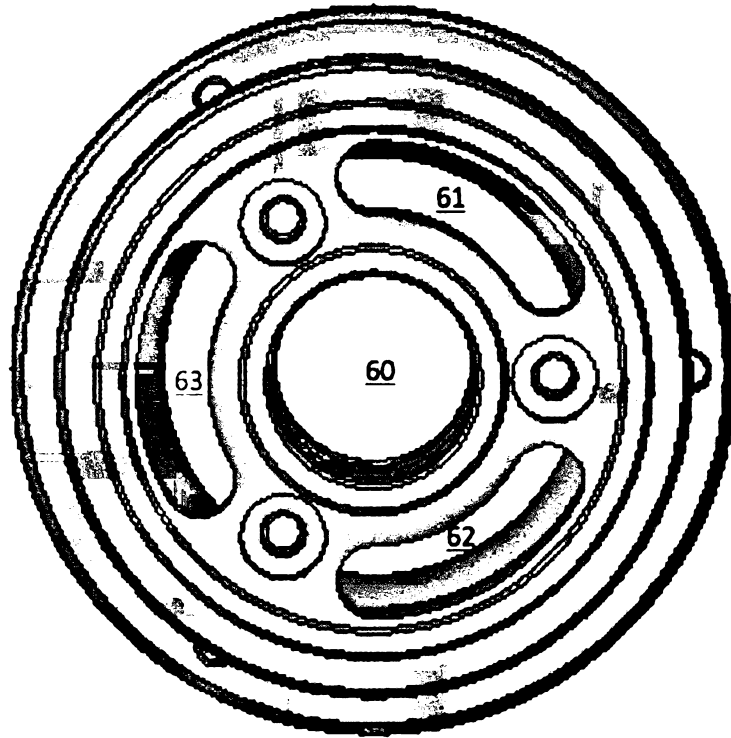
[FIG. 2]



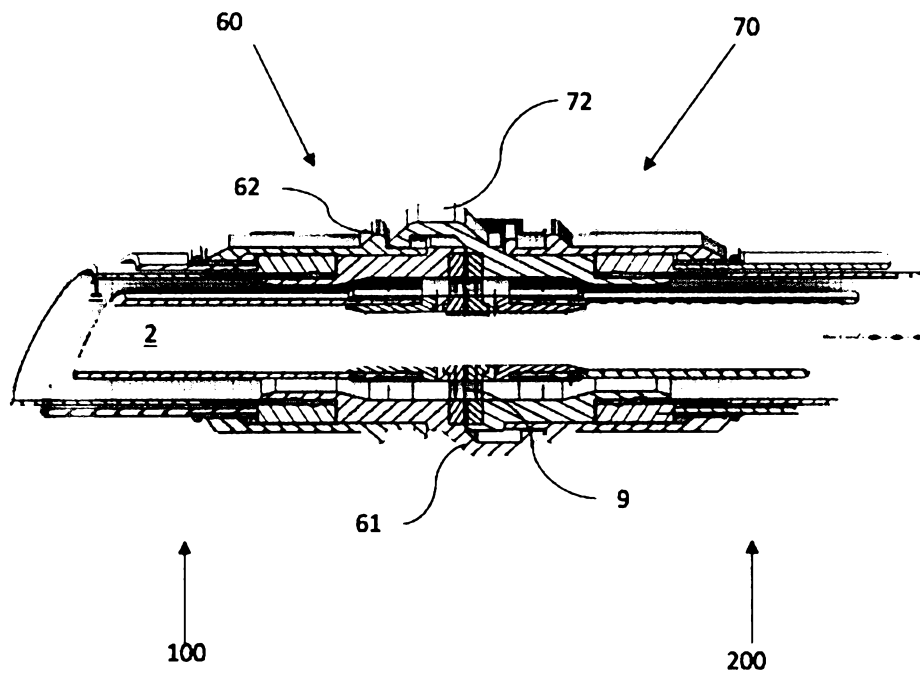
[FIG. 3]



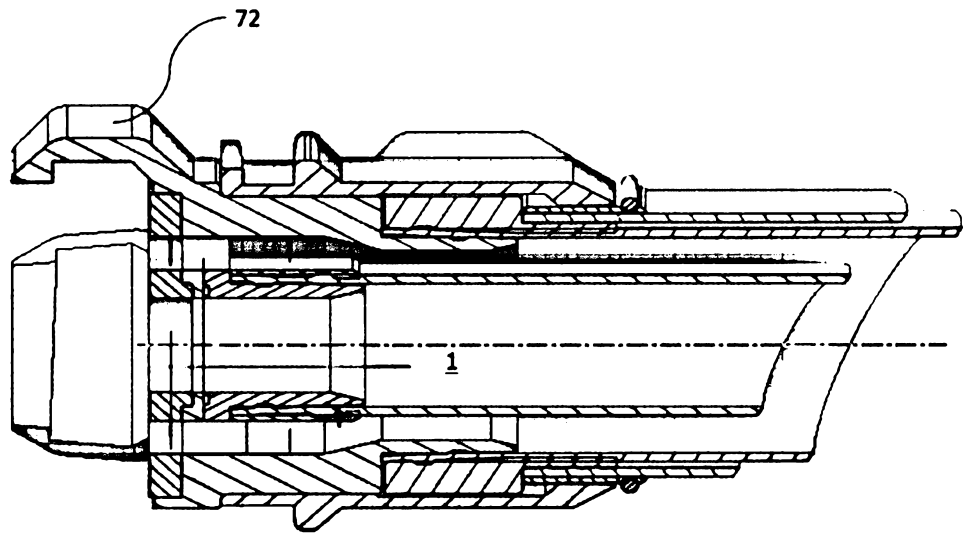
[FIG. 4]



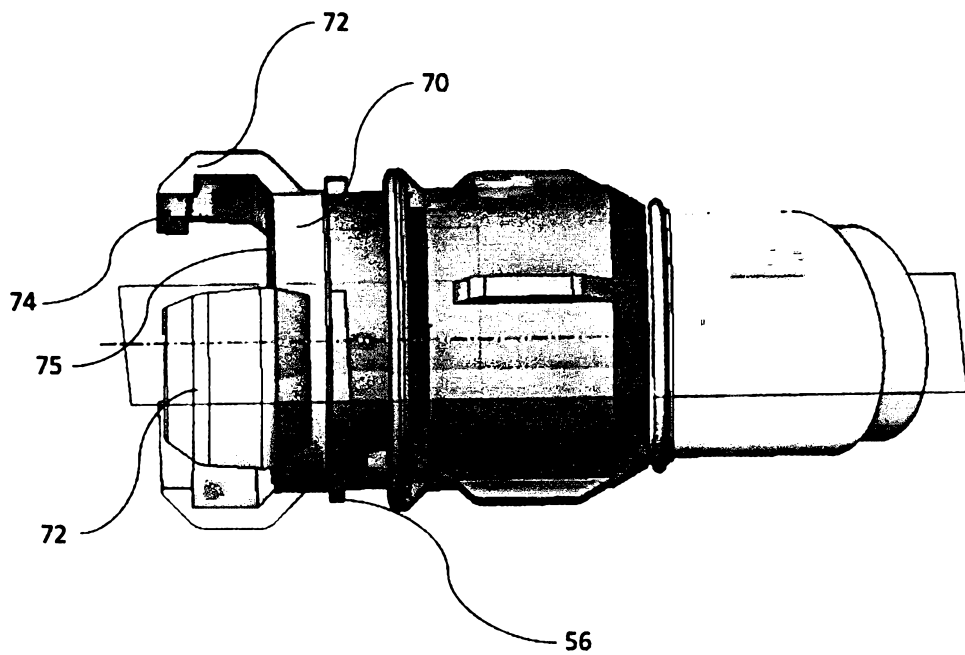
[FIG. 5]



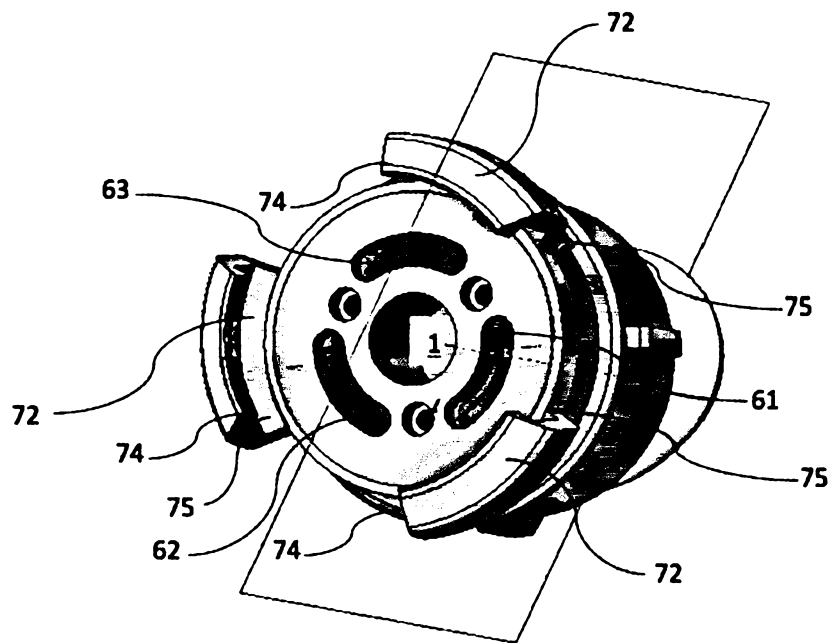
[FIG. 6]



[FIG. 7]



[FIG. 8]



**Abstract**

[0043] The present invention relates to a fluid connection system intended to connect two two-phase pipes consisting of two coaxial casings defining a central flow flowing into the inner casing and an annular flow flowing into the space between said inner casing and the outer casing, said coupling comprising a second connector intended to be attached to the end of one of said two-phase pipes and a first complementary connector intended to be attached to the complementary end of the other of said two-phase pipes.

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Figure for abstract: 1

Figure accompanying abstract

[FIG. 1]

