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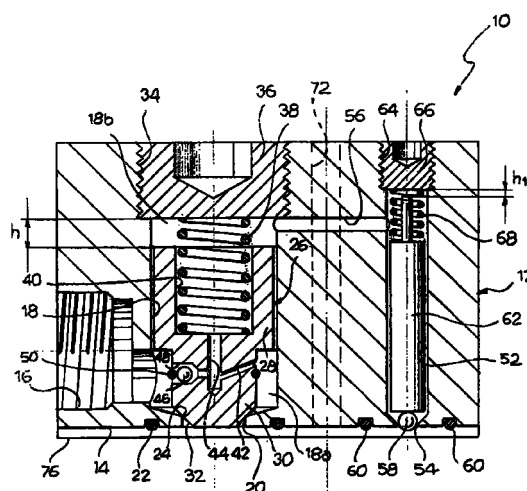
(54) **Press-block coupling for fluid circuits**

(57) A press-block coupling for fluid circuits, comprising:

- a base body (12) provided with a first opening (16), designed to be connected to a branch of a fluid circuit, and with a second opening (20), designed to establish a fluid connection with a corresponding opening of a complementary coupling; and
- at least one main valve element (26) which can slide in the base body (12) and co-operates with a valve seat (24) designed to activate or interrupt fluid connection between the first opening (16) and the second opening (20).

The press-block coupling comprises an auxiliary valve element (58) with mechanical opening, set in such a way that, in use, following upon mechanical opening of the auxiliary valve element (58), a variation in pressure is produced in said main chamber (18) such as to bring about opening of the main valve element (26) under the action of the pressure of the fluid.

Fig. 1



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Description

[0001] The present invention relates to a press-block coupling for fluid circuits.

[0002] Press-block couplings enable activation or interruption of connection of two branches of a fluid circuit without requiring particular ancillary operations. A press-block coupling is made up of two half-couplings in each of which is mounted a valve element elastically pushed towards a closed position. In known solutions, when two complementary couplings are coupled together, the respective valve elements are pressed one against the other towards a position of opening of the respective valve seats. When the two couplings are moved apart, the respective valve elements automatically close as a result of the thrust of the springs. Generally, press-block couplings of a known type comprise a male connection which fits into a female connection. These couplings are frequently employed in very dirty environments, and the presence of cavities within which dirt can collect forces the operator to carry out difficult cleaning operations whenever two complementary couplings are engaged together. This problem is particularly serious because, if cleaning is inadequate, particles of dirt could enter into circulation in the hydraulic circuit and damage hydraulic components.

[0003] A first purpose of the present invention is to provide a press-block coupling that is without cavities and can be cleaned easily.

[0004] A second purpose of the present invention is to provide a press-block coupling which enables leakage of fluid to be avoided during connection and disconnection manoeuvres.

[0005] According to the present invention, the above purposes are achieved by a press-block coupling having the characteristics forming the subject of the claims.

[0006] The present invention will now be described in detail with reference to the attached drawings, which are given purely to furnish a non-limiting example, and in which:

- Figure 1 is a schematic cross section of a press-block coupling according to the present invention, and
- Figure 2 is a schematic cross section illustrating a joint made up of two complementary couplings joined together.

[0007] With reference to Figure 1, the number 10 designates a press-block coupling according to the present invention. The coupling 10 comprises a base body 12 having a plane face 14 designed to rest against a corresponding face of a complementary coupling. The base body 12 has a first opening 16 which is designed to be connected to a branch of a fluid circuit, for example, by means of a hose (not illustrated). The first opening 16 communicates with a cylindrical chamber 18

which ends with a second opening 20. The second opening 20 is designed to establish a fluid connection with a corresponding opening of a complementary coupling. The second opening 20 is surrounded by a first annular seal 22 housed in a groove formed in the plane face 14. A valve seat 24 is formed in the vicinity of the second opening 20. In the example illustrated in the figure, the valve seat 24 is made up of an annular edge adjacent to a cylindrical hole defining the second opening 20.

[0008] A valve element 26 is mounted in a sliding way inside the chamber 18. The valve element 26 has a plunger portion 28 which engages, with little play, the cylindrical wall of the chamber 18 and divides the chamber into a first section 18a and a second section 18b. The valve element 26 moreover has a closing portion 30 having a surface 32 shaped like the frustum of a cone, which is designed to close the valve seat 24.

[0009] The base body 12 has a hole 34 for insertion of the valve element 26 into the chamber 18. The hole 34 is sealed by a plug 36. A helical spring 38 in compression is set between the plug 36 and the valve element 26, and produces an elastic force which pushes the surface 32 having the shape of a frustum of a cone against the valve seat 24. The helical spring 38 is partially housed within a blind hole 40 formed in the plunger portion 28 of the valve element 26. In the closed position of the valve element 26 (i.e., in the condition where the valve seat 24 is closed by the surface 32 having the shape of a truncated cone) there is a distance h between the valve element 26 and the plug 36. This distance h represents the opening stroke of the valve element 26.

[0010] A calibrated throat 42 is formed in the closing portion 30 of the valve element 26. The calibrated throat 42 sets the first section 18a of the chamber 18 in fluid connection with a blind duct 44 communicating with the second section 18b. The closing section 30 in the valve element 26 further comprises a non-return valve 46 set in a hole which sets the duct 44 in communication with the first section 18a. The non-return valve 46 enables direct passage of fluid from the second section 18b towards the first section 18a and prevents fluid flow in the opposite direction. From the constructional point of view, the non-return valve 46 consists of a ball, and an elastic ring 50 prevents the ball 46 from coming out of the hole 48.

[0011] The coupling 10 according to the present invention further comprises an auxiliary chamber 52 communicating with an auxiliary opening 54 formed in the plane face 14. The auxiliary chamber 52 communicates with the section 18b of the main chamber 18 by means of a duct 56. An auxiliary valve element 58 consisting, for example, of a ball is designed to close the auxiliary opening 54. In the closed configuration, the auxiliary valve element 58 protrudes from the plane face 14. A second annular seal 60 surrounds the auxiliary opening 54. A rod 62 is set in a freely sliding way inside

the auxiliary chamber 52. The rod 62 and the auxiliary valve element 58 are inserted in the auxiliary chamber 52 through a hole 64 sealed by plug 66. A helical spring 68 in compression is set between the rod 62 and the plug 66, and produces an elastic force which pushes the auxiliary valve element 58 into the closing position of the auxiliary opening 54. When the auxiliary valve element 58 closes the auxiliary opening 54, the rod 62 is at a distance from the plug 66 by an amount h_1 which defines the opening stroke of the auxiliary valve element 58.

[0012] Figure 2 illustrates a press-block coupling made up of two couplings 18 which are complementary to one another and are coupled together. The second coupling 10 does not have the seals 22, 60 on the plane face 14, but, apart from this difference, is substantially identical to the first coupling, and the elements corresponding to the ones described previously are designated by the same reference numbers. The two complementary couplings are provided with means of reciprocal connection designed to withhold the two plane faces 14 in a mutually facing position. In the embodiment illustrated in Figure 2, these connection means comprise a screw 70 which extends with play through a through hole 72 formed in the base body 12 of the first coupling and engages a threaded hole 74 formed in the base body 12 of the second coupling. To facilitate alignment of the holes 72, 74 during the manoeuvre of connecting the two couplings, the base body 12 of one or of both the couplings may be provided with a step 76 (Figure 1) projecting from the plane face 14. The said step constitutes a reference surface set in such a way that the holes 72, 74 of the two complementary couplings are aligned with respect to one another when a corresponding reference surface of the complementary coupling is set up against the step 76.

[0013] Figure 2 illustrates the condition in which the two couplings 10 are mechanically coupled together by means of the screw 70 and a fluid under pressure is fed to the first opening 16 of one of the two couplings.

[0014] With reference to Figure 2, in the condition in which the two complementary couplings 10 are coupled together, the openings 20 and 54 of one coupling are aligned with the corresponding openings of the complementary coupling. The mechanical force that keeps the plane faces 14 of the two couplings in contact with one another produces a mechanical force on the auxiliary valve elements 58, which are pressed one against the other. These elements move away from the respective openings 54 and activate the fluid connection between the auxiliary chambers 52 of the two complementary couplings.

[0015] Before the connection with a complementary coupling is made, one of the two couplings is in the condition of Figure 1, with a fluid pressure P_1 in the first opening 16. The first opening 16 communicates directly with the first section 18a of the main chamber 18. The non-return valve 46 is closed, and in the second section

18b there is the same pressure P_1 , given that the section 18b communicates with the section 18a by means of the calibrated throat 42. In the auxiliary chamber 52 there is therefore the same pressure P_1 . In this condition, the auxiliary valve element 58 is pressed against the auxiliary opening 54 by the pressure of the fluid and by the elastic force of the spring 68. The auxiliary valve element 58 is pressed against the valve seat 24 by the pressure P_1 and by the elastic force of the spring 38.

[0016] Now, suppose that a coupling 10 having the pressure P_1 in its first opening 16 is connected with a complementary coupling 10 having a pressure P_2 smaller than P_1 , in the opening 16. Also the complementary coupling, prior to connection of the joint, is in the condition in which both the auxiliary valve element 58 and the main valve element 26 are closed.

[0017] When the two complementary couplings are coupled together, the auxiliary valve elements 58 are opened by the mechanical force that pushes the one against the other. The pressure of the fluid in the auxiliary chamber 52 of the first coupling, which initially was equal to the value P_1 , decreases, and the pressure in the section 18b of the main chamber 18 decreases accordingly. Assuming that the pressure in the opening 16 of the first coupling is kept constantly at P_1 , the pressure in the section 18a also remains at the value P_1 . The pressure in the section 18b of the first coupling does not instantaneously go to the value P_1 because the calibrated throat 42 causes a delay. At the instant in which the pressure in the section 18a of the first coupling is greater than the pressure in the chamber section 18b, the main valve element 26 is subjected to a pressure force opposed to the elastic force of the spring 38. When the pressure force exceeds the elastic force, the main valve element 26 assumes the open configuration.

[0018] In the auxiliary chamber 52 of the complementary coupling, the pressure, which initially was P_2 , increases. Consequently, the pressure in the section 18b of the second coupling increases. Hence, the non-return valve 46 opens and sets the section 18a in fluid connection with the section 18b. Consequently, the pressure in the section 18a increases rapidly, and this pressure increase, combined with the pressure P_1 acting on the opening 20, brings about opening of the main valve element 26 of the second coupling. In conditions of equilibrium, the joint is thus in the configuration illustrated in Figure 2, where the auxiliary valve elements 58 are kept open by the mechanical force that pushes them against each other, and the main valve elements 26 are kept open by the pressure of the fluid.

[0019] When the circulation of fluid ceases, the fluid pressures in the two couplings 10 of the joint become equal, and the two main valve elements 26 close under the action of the elastic forces produced by the springs 38. More precisely, when the two couplings 10 are separated from one another, the mechanical force that keeps the auxiliary valve elements 58 pressed against

each other ceases, and these valve elements assume their closed position under the action of the pressure of the fluid and of the elastic force produced by the respective springs 68. The closing of the auxiliary valve elements 58 produces an increase in pressure in the sections 18b of the main chambers 18, and, following upon this increase in pressure, the main valve elements 26 are forced into their closed position under the action of the pressure of the fluid and of the elastic force exerted by the respective springs 38.

[0020] The press-block coupling according to the present invention eliminates almost completely the leakages of fluid during the manoeuvres of connection and disconnection. During operation, the coupling has smaller head losses than do corresponding couplings of a known type, because the openings 20 are not obstructed by the presence of the main valve element 26. Another major advantage of the press-block coupling according to the present invention is that the faces of mutual coupling 14 are almost completely smooth and can be cleaned with extreme ease. Furthermore, the present invention enables a multiple number of couplings independent from one another to be made inside one and the same base body 12.

Claims

1. A press-block coupling for fluid circuits, comprising:
 - a base body (12) provided with a first opening (16), designed to be connected to a branch of a fluid circuit, and with a second opening (20), designed to establish a fluid connection with a corresponding opening of a complementary coupling; and
 - at least one main valve element (26) which can move in a main chamber (18) formed in the base body (12) and co-operates with a valve seat (24) designed to activate or interrupt fluid connection between the first opening (16) and the second opening (20), characterized in that it comprises an auxiliary valve element (58) with mechanical opening, set in such a way that, in use, following upon mechanical opening of the auxiliary valve element (58), a variation in pressure is produced in said main chamber (18) such as to bring about opening of the main valve element (26) under the action of the pressure of the fluid.
2. A press-block coupling according to Claim 1, characterized in that the main valve element (26) comprises a plunger portion (28) which divides the main chamber (18) into two sections (18a, 18b), the first one of which (18a) contains the aforesaid valve seat (24), and the second one of which (18b) is in fluid connection with the aforesaid auxiliary opening (54) by means of the auxiliary valve element (58).
3. A press-block coupling according to Claim 2, characterized in that the main valve element (26) presents a calibrated throat (42) which sets said sections (18a, 18b) of the main chamber (18) in communication with one another.
4. A press-block coupling according to Claim 1, characterized in that the base body (12) comprises a plane face (14) in which said second opening (20) and said auxiliary opening (54) are formed.
5. A press-block coupling according to Claim 3, characterized in that the aforesaid auxiliary valve element comprises a closing element (58) which, in the closed position, projects partially from said plane face (14).
6. A press-block coupling according to Claim 2, characterized in that the main valve element (26) comprises a non-return valve (46) inserted in a duct (44, 48) that connects said sections (18a, 18b) of the main chamber (18) together.

Fig. 1

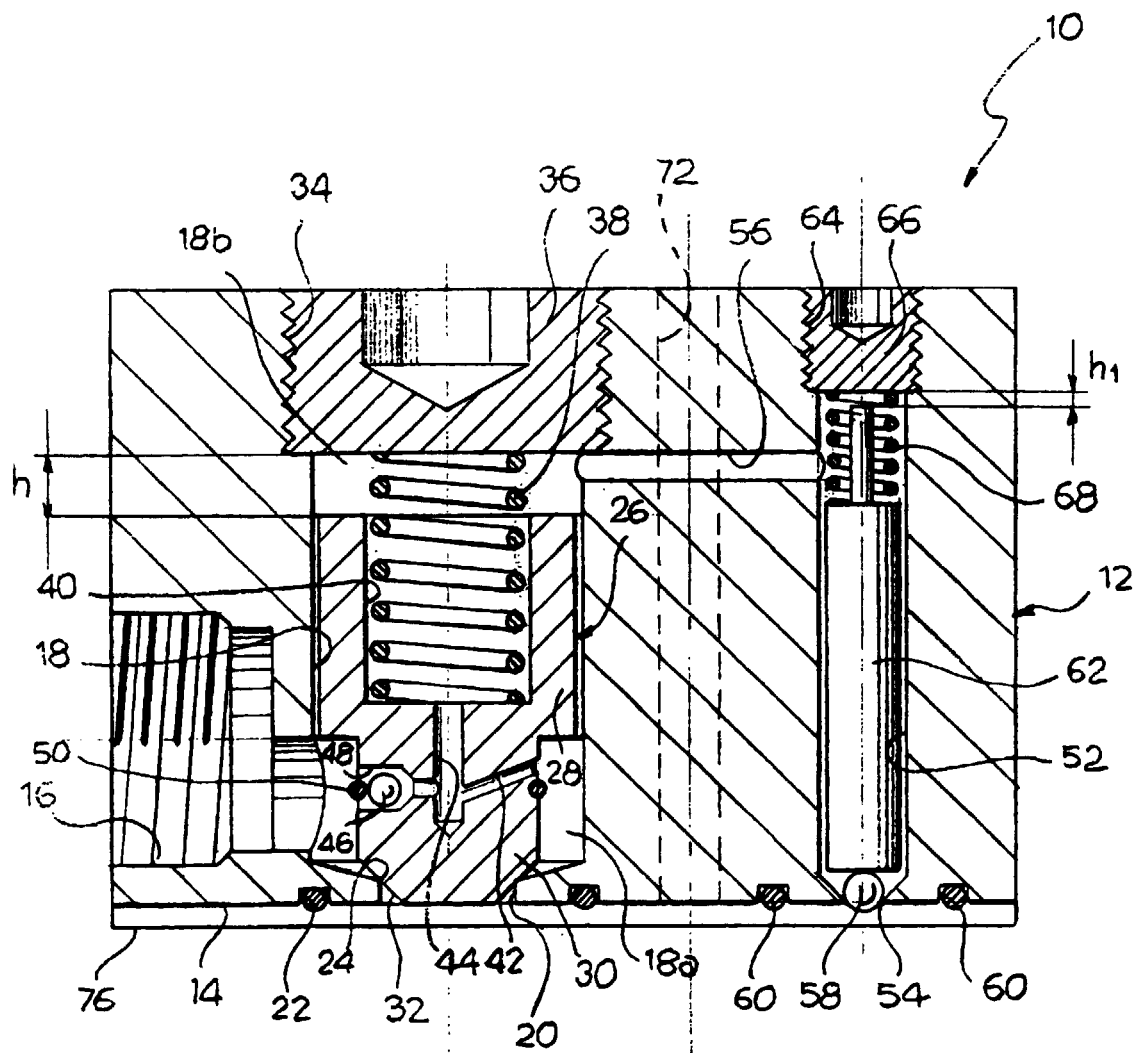


Fig. 2

