

PATENT SPECIFICATION

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(54) CONNECTION APPARATUS FOR USE IN FLUID SUPPLY LINES

(71) We, FESTO-MASCHINENFABRIK GOTTLIEB STOLL, a Company of the Federal Republic of Germany, of Ulmer Strasse 48, Esslingen a.N., Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a connection apparatus for use in a fluid supply line with a hose formed of a resilient material and carrying gaseous or fluid media, particularly for compressed air hoses formed for example of a plastics material, or rubber.

According to the present invention there is provided connection apparatus for use in a fluid supply line with a hose which is formed of a resilient material and which carries gaseous or fluid media, said apparatus comprising a first unit into which an end of the hose can be inserted, and which comprises means for locking the hose end in its inserted position, said locking means comprising locking members arranged around the periphery of the first unit, and a locking ring which is displaceable in both directions along an outer circumference of the first unit between an ineffective position and an effective position wherein the locking ring moves the locking members to a position for clamping the hose end, and a second unit which comprises a screw threaded connection, the first and second units being manufactured individually as separate parts which are a push fit one within the other to form a detachable connection.

Preferably said first and second units each have a bore, the diameters of the bores being so designed as to define an effective bore of constant cross-section through the apparatus in the intended direction of flow of the medium, the effective bore being defined by individual, co-axial bore sections the consecutive internal diameters of which, in the intended flow direction, are constant or increasing.

Preferably also said second unit comprises a first section where the internal diameter is substantially equal to the diameter of the

effective bore, a second section where the internal diameter is substantially equal to the internal diameter of the bore of the first unit, and a third section accommodating a packing ring located between the assembled first and second units. Advantageously the internal diameter of the bore in the first unit is constant.

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

Fig. 1 shows apparatus according to the invention in elevation, in an axial section and in a schematic representation; and

Figs. 2 and 3 show two variants of details of the arrangement according to Fig. 1 on an enlarged scale.

Connection apparatus represented in Fig. 1 is designed on the lines of a plug and socket connection. It comprises at one end a first part 2, which includes a screw threaded socket section 1, and at the other end, a second part 4 which comprises a plug-in unit 5, divided by longitudinal slots 3 into several, for example four, chuck elements or jaws which are equidistantly spaced around the circumference, and a locking ring 7 which can be displaced along the outer circumference of the unit 5 in either direction as indicated by the arrow 6. The ring 7 is adjustable between an effective position and an ineffective position and causes, in its effective position, the chuck elements or jaws to assume their clamping position in which they lock an inserted hose end. The part 4 containing the plug-in unit 5 is located on that side of the part 2 remote from the threaded section, for accommodating the hose end which is slipped there into.

The part 2 including the screw threaded section 1, and the part 4 which contains the plug-in unit 5, are independent, individual parts which are separately manufactured and later joined together in a detachable manner, by pushing one into the other. The end of the plug-in unit 5 which is remote from the chuck elements or jaws is inserted into the end of the part 2 on the side thereof



which is remote from the screw threaded section 1, a packing ring 8 having the form of an O-ring being located between the end surface 9 of the inserted section of the unit 5, and a contact surface 10 provided by a step in the bore of the part 2. The arrangement not only presents a detachable connection which is easily and quickly established but is adaptable to all feasible conditions. Since the connecting unit consists of the two parts it may be used with any hose dimension or rather pipeline size, with the facility for using in the apparatus different parts 2 having sections 1 of different sizes but otherwise the same external and internal contours, and possibly different parts 4 each however having the same external contour, the same tools therefore being usable in each case for dismantling and assembling of the parts.

In order to ensure that the connecting operations do not interfere with the flow of the medium, the bore diameters of the plug-in unit 5 and the part 2 are adjusted to each other in such a manner that any reduction of passage cross section is avoided in the flow direction indicated by the arrow 10a. The bore in the part 2 has a first section in the screw-threaded section 1 with a reduced diameter d1, adjacent thereto a second middle section having a larger diameter d2 substantially equal to an internal diameter D1 of the plug-in unit 5, which is substantially constant throughout the total length of the unit 5, and a third section with a larger internal diameter d3 substantially equal to an external diameter D2 of the inserted section of the plug-in unit 5. The constant internal diameter D1 of the bore of the plug-in unit 5 thereby corresponds to the internal diameter d2 of the middle section of the part 2, and the internal diameter d1 of the screw-threaded section 1 corresponds to an internal diameter D3 of the inserted hose end; the difference between the internal diameter d1 and the internal diameter d2 corresponds approximately to the thickness D of the inserted hose end. Therefore the continuous bore consists of individual co-axial bore sections, whereby the internal diameters of the consecutive bore sections, viewed in the flow direction according to the arrow 10a are either constant or gradually increasing but never decreasing.

In order to ensure that the connection is as reliable as possible, even in the presence of "breathing" hoses, i.e. hoses which are subjected to a pulsating flow of fluid, the apparatus includes means which connect the part 2 with the part 4 in a detachable manner which make it at least difficult to separate the parts which were jointed together by pushing one into the other. The plug-in unit 5 which is depicted in Fig. 1, comprises, on its outer circumference, a projection 11

which is annular in the form of a torus with a trapezoidal cross section, and which is encircled by an inwardly angular portion 12 on an annular end section on the part 2 remote from the threaded section 1.

In the variant according to Fig. 3, an end section 15 of the part 2 remote from the screw-threaded section 1 is provided with a bearing surface 16 which is located on its internal circumference and is outwardly angular towards the plug-in unit 5, the inclination being, for example, within the range of self-retention. The inserted end 17 of the plug-in unit 5 comprises a bearing surface 18 on its external circumference, which is complementary to the internal bearing surface 16, and which, on the side which is remote from the screw-threaded section 1, is terminated by a stopping edge 19 extending at right angles to the longitudinal median plane of the part 2.

In the variant shown in Fig. 2, an inserted end 20 of the plug-in unit 5 comprises on its outer circumference at least one annular projection 21 which engages with a corresponding recess 22 in the internal circumferential surface of an end section 23 of the part 2 remote from the screw-threaded section 1. The projection 21 and the corresponding recess 22 are limited by surfaces 24, 25 which are inclined relative to each other, the forward facing surface 25 on the projection and the corresponding surface of the 22 being less inclined to the axis of the unit than the opposite surface areas. The purpose of this arrangement is to ensure that by interaction between these substantially saw-tooth shaped projections and recesses the parts are easily assembled but resist disconnection.

In an alternative design which is not shown in the drawings, the arrangement is such that the part 2 comprising the screw-threaded section 1 includes, at its inner circumference, at least one projection extending inwardly, which may, for example be annular, and which engages with a corresponding recess in the outer surface of the plug-in unit. The mating surfaces are inclined in a manner analogous to the arrangement shown in Fig. 2.

A further safeguard against accidental disconnection is a tooth 28 with a saw-tooth like cross-section, which projects from the inner circumference of the chuck elements or jaws and engages with the outer circumference of the inserted pipe, the two surfaces 29, 30 which define the tooth towards the inside being such that the surface 29 which is remote from the screw-threaded unit 1 is less inclined to the axis of the unit so that the teeth facilitate the insertion of the pipe end but resist its removal. The resilient chuck elements or jaws of the plug-in unit thereby surround from the outside the in-

serted end which has no internal support.

Fig. 1 indicates that the plug-in unit 5 comprises at least one frusto-conical section 35, where the external diameter increases in the axial direction as shown by the arrow 10a towards the free end, and outwards in the radial direction. This frusto-conical section 35 located between a first cylindrical section 36 constituting the inserted end, and a second cylindrical section 37 located in the direction of the free end, defines at least part of the chuck elements or jaws. The longitudinal slots 3 which divide the slip-in unit into individual chuck elements or jaws, extend from the free end 38 approximately over half the length of the unit 5, through the second cylindrical section 37, the frusto-conical section 35, and part of the first cylindrical section 36. This is a particularly useful arrangement which facilitates the manufacture and assembly of the components and makes it easy to connect, and disconnect the parts.

A further means for protecting the connection is a safety zone in the plug-in unit 5. The locking ring 7 when reaching the safety zone, is automatically protected against undesired displacement, but can be easily removed from the safety zone by hand. This safety zone may be created by providing projections on one part and recesses in the other; in the present case the frusto-conical section 35 comprises the safety zone and is inclined in such a manner that the locking ring is self-retained. The locking ring which clamps the inserted hose end is thereby adjustable on the outer circumference of the plug-in unit, between an ineffective position on the end adjacent to the part 2 and an effective position on the free end, an internal diameter D5 of the locking ring being substantially equal to an external diameter D4 of the second cylindrical zone 37 of the slip-in unit.

The plug-in unit 5 has, at its free end, an integral stopping member 40 in the shape of a stopping ring whose external diameter exceeds the internal diameter of the locking ring. In this manner the locking ring 7 is protected against being accidentally pushed off the slip-in unit, when assembling the components of the connection apparatus. In addition to this, the locking ring has an annular recess 41 around its external circumference.

The design of the plug-in connection apparatus is very simple and its manipulation is quick and easy. It follows moreover that the connection established thereby is reliable, provided however, that the hoses or rather the hose ends are sufficiently rigid in the radial direction. This is reasonably to be expected when using conventional plastics hoses. Their safe fixing is moreover guaranteed by the fact that the chuck elements or

jaws are pressed from all sides, uniformly and at constant pressure, against the hose.

In an apparatus as hereinbefore described, it is therefore possible to connect the parts swiftly and without effort as often as desired. The apparatus is suitable for connections which "hold" even in the presence of "breathing" hoses and in similar conditions, and does not lose its locking ring, neither damages nor bruises the hose during its insertion, does not cause the flow resistance to vary during the assembly of the parts, has no adverse effect on the flow of the medium, and calls for the least imaginable effort during assembly. The design simplifies production, reduces the manufacturing costs, increases the functional efficiency of the connection, and ensures that it remains perfect even with "breathing" hoses although being a connection which is made quickly and effort-less as often as desired.

WHAT WE CLAIM IS:—

1. Connection apparatus for use in a fluid supply line with a hose which is formed of a resilient material and which carries gaseous or fluid media, said apparatus comprising a first unit into which an end of the hose can be inserted, and which comprises means for locking the hose end in its inserted position, said locking means comprising locking members arranged around the periphery of the first unit, and a locking ring which is displaceable in both directions along an outer circumference of the first unit between an ineffective position and an effective position wherein the locking ring moves the locking members to a position for clamping the hose end, and a second unit which comprises a screw threaded connection, the first and second units being manufactured individually as separate parts which are a push fit one within the other to form a detachable connection.

2. Apparatus according to Claim 1, wherein said first and second units each have a bore, the diameters of the bores being so designed as to define in use an effective bore of constant cross-section through the apparatus in the intended direction of flow of the medium, the effective bore being defined by individual, co-axial bore sections the consecutive internal diameters of which, in the intended flow direction, are constant or increasing.

3. Apparatus according to Claim 2, wherein the bore in said second unit comprises a first section where the internal diameter is substantially equal to the diameter of the effective bore, a second section where the internal diameter is substantially equal to the internal diameter of the bore of the first unit, and a third section accommodating a packing ring located between the assembled first and second units.

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A further means for protecting the connection is a safety zone in the plug-in unit 5. The locking ring 7 when reaching the safety zone, is automatically protected against undesired displacement, but can be easily removed from the safety zone by hand. This safety zone may be created by providing projections on one part and recesses in the other; in the present case the frusto-conical section 35 comprises the safety zone and is inclined in such a manner that the locking ring is self-retained. The locking ring which clamps the inserted hose end is thereby adjustable on the outer circumference of the plug-in unit, between an ineffective position on the end adjacent to the part 2 and an effective position on the free end, an internal diameter D5 of the locking ring being substantially equal to an external diameter D4 of the second cylindrical zone 37 of the slip-in unit.

The plug-in unit 5 has, at its free end, an integral stopping member 40 in the shape of a stopping ring whose external diameter exceeds the internal diameter of the locking ring. In this manner the locking ring 7 is protected against being accidentally pushed off the slip-in unit, when assembling the components of the connection apparatus. In addition to this, the locking ring has an annular recess 41 around its external circumference.

The design of the plug-in connection apparatus is very simple and its manipulation is quick and easy. It follows moreover that the connection established thereby is reliable, provided however, that the hoses or rather the hose ends are sufficiently rigid in the radial direction. This is reasonably to be expected when using conventional plastics hoses. Their safe fixing is moreover guaranteed by the fact that the chuck elements or

jaws are pressed from all sides, uniformly and at constant pressure, against the hose.

In an apparatus as hereinbefore described, it is therefore possible to connect the parts swiftly and without effort as often as desired. The apparatus is suitable for connections which "hold" even in the presence of "breathing" hoses and in similar conditions, and does not lose its locking ring, neither damages nor bruises the hose during its insertion, does not cause the flow resistance to vary during the assembly of the parts, has no adverse effect on the flow of the medium, and calls for the least imaginable effort during assembly. The design simplifies production, reduces the manufacturing costs, increases the functional efficiency of the connection, and ensures that it remains perfect even with "breathing" hoses although being a connection which is made quickly and effort-less as often as desired.

WHAT WE CLAIM IS:—

1. Connection apparatus for use in a fluid supply line with a hose which is formed of a resilient material and which carries gaseous or fluid media, said apparatus comprising a first unit into which an end of the hose can be inserted, and which comprises means for locking the hose end in its inserted position, said locking means comprising locking members arranged around the periphery of the first unit, and a locking ring which is displaceable in both directions along an outer circumference of the first unit between an ineffective position and an effective position, wherein the locking ring moves the locking members to a position for clamping the hose end, and a second unit which comprises a screw threaded connection, the first and second units being manufactured individually as separate parts which are a push fit one within the other to form a detachable connection.

2. Apparatus according to Claim 1, wherein said first and second units each have a bore, the diameters of the bores being so designed as to define in use an effective bore of constant cross-section through the apparatus in the intended direction of flow of the medium, the effective bore being defined by individual, co-axial bore sections the consecutive internal diameters of which, in the intended flow direction, are constant or increasing.

3. Apparatus according to Claim 2, wherein the bore in said second unit comprises a first section where the internal diameter is substantially equal to the diameter of the effective bore, a second section where the internal diameter is substantially equal to the internal diameter of the bore of the first unit, and a third section accommodating a packing ring located between the assembled first and second units.



4. Apparatus according to Claim 3, wherein the internal diameter of the bore in the first unit is constant.

5. Apparatus according to Claim 3 or 4 wherein said first unit is a push fit in said second unit and the packing ring is located between an end face of the inserted end of the first unit and a bearing surface defined by a step in the bore of the second unit between the second and third sections thereof.

6. Apparatus according to any of the preceding claims, wherein means are provided normally to retain the parts assembled but enable ready separation of the parts.

7. Apparatus according to Claim 6, wherein said retaining means comprises at least one projection on the outer circumference of the first unit or on the inner circumference of the second unit, extending outwardly or inwardly respectively, said projection engaging with a corresponding recess in the inner or outer circumference respectively of the other unit.

8. Apparatus according to Claim 7, wherein the projection and the corresponding recess are each defined by a pair of surfaces which are inclined relative to each other, the forward facing surface of the projection relative to the direction of push fit, and the corresponding surface of the recess, being less inclined to the axis of the first unit than the rearward facing surface

of the projection and the corresponding surface of the recess, such that the parts can be assembled without effort but cannot easily be disconnected.

9. Apparatus according to Claim 8, wherein the first unit comprises on its outer circumference an annular member of trapezoidal cross-section, around which extends an inwardly angled portion of the second unit.

10. Apparatus according to Claim 9, wherein the end surface of the second unit which is adjacent to the first unit, comprises on its inner circumference an internal bearing surface which is tapered outwardly towards the first unit at an angle within the range of self-retention, and wherein the inserted end of the first unit comprises an external bearing surface on its outer circumference which is complementary to the internal bearing surface and terminates, at the side thereof remote from the second unit, in a stopping surface which extends at right angles to the longitudinal median axis of the first unit.

11. Connection apparatus substantially as hereinbefore described with reference to the accompanying drawings.

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