

VALVE ASSEMBLY.

This invention relates to valve assemblies. Although the invention is particularly applicable to quick connect/disconnect couplings and will be explained with particular reference thereto, the invention may be used with other fittings or fluid containing devices, such as control valves, non-return valves, unions, pipe or tube connectors, or the like.

Conventional quick connect/disconnect couplings are subject to slight leakage when they are uncoupled or to entrainment of air when they are coupled. Likewise, the various seals and packings are subject to blowout and leakage. It would be desirable, therefore, to provide a coupling with a valve assembly having improved seals and packings, and which would be arranged for minimizing any leakage or air entrainment when the coupling is connected and disconnected.

According to the present invention, a valve assembly comprises valve and coupling parts relatively moveable between closed and open positions, and a seal assembly comprising an external circumferential seal of deformable material carried by said valve part, said coupling part having thereon a valve seat co-operatively engaged by said seal in said closed position, said seal having one axial end portion of

reduced diameter and an opposite axial end portion of larger diameter, said seal and said valve seat having co-operating sealing surfaces sloping from the larger diameter end portion to the reduced diameter end portion, and metal seal retainer means peripherally and axially surrounding said seal at said reduced diameter end portion thereof to combine said seal and prevent blowout thereof and sized to be closely and slidably received in said coupling part in said closed position, positively co-operable metal-to-metal stop surfaces being operatively provided between said valve part and said coupling part, said metal stop surfaces co-operating with one another when said valve assembly is in said closed position to limit pressures on said seal.

Thus, a fluid coupling subassembly according to one embodiment of the invention includes an internal body valve having a seal engageable by a valve seat on a slide for closing the slide and body against fluid flow through the coupling subassembly. The body valve seal has sloping or tapered surface areas, preferably on the internal as well as the external surfaces thereof for creating a mechanical advantage which increases the compressive stress on high points or irregularities. One end and a peripheral end portion of the body valve seal is surrounded by the metal

retainer for resisting blowout of the seal. On the opposite side of the seal from the metal retainer, a positive metal stop surface is provided for engagement with a co-operating surface on the slide. The
5 co-operating stop surfaces prevent extrusion of the seal.

A fluid coupling subassembly according to another embodiment of the invention includes a stem member having a poppet moveable therein between closed and
10 open positions. The poppet has an external circumferential seal with sloping or tapered surfaces preferably on the internal as well as on the external periphery thereof. The poppet seal is engageable with a seat on the stem member. One end of the poppet and
15 a peripheral end portion of the poppet seal are surrounded by a metal retainer for preventing blowout of the poppet seal. One side of the metal retainer serves as a positive metal stop for co-operation with a corresponding stop on the stem member to prevent
20 extrusion of the poppet seal.

The principal advantage of the present invention is the provision of an improved valve assembly.

An additional advantage of the present invention resides in providing an improved fluid coupling having
25 improved seals.

The invention is further described with reference to the accompanying drawings, wherein:

FIGURE 1 is a side cross-sectional elevational view showing a coupling having valve assemblies of the present invention, the coupling being about ...

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to be connected or just after it has been disconnected;

FIGURE 2 is a view similar to FIGURE 1 showing the coupling in its connected configuration;

FIGURE 3 is a cross-sectional side elevational view of the body assembly only of FIGURES 1 and 2;

FIGURE 4 is a cross-sectional side elevational view of the stem assembly only of FIGURES 1 and 2;

FIGURE 5 is a top plan view of an operating sleeve used in the latch mechanism;

FIGURE 6 is a top plan view of a stop button;

FIGURE 7 is a cross-sectional view taken generally along lines 7-7 of FIGURE 6;

FIGURE 8 is an end view of a spring used in association with the stop button of FIGURES 6 and 7;

FIGURE 9 is a cross-sectional view taken generally along lines 9-9 of FIGURE 8;

FIGURE 10 is a top plan view taken generally on-line 10-10 of FIGURE 8;

FIGURE 11 is an enlarged partial side elevational view in cross-section showing a packing receiving space;

FIGURE 12 shows the axial cross-sectional conformation of a packing ring;

FIGURE 13 shows the axial cross-sectional conformation of a backup ring;

FIGURE 14 is an enlarged, partial cross-sectional elevational view showing a slide bearing between the valve body part and the slide;

FIGURE 15 shows the axial cross-sectional conformation of a seal ring used between a body and stem;

FIGURE 16 is an end view showing fin members used to support a body valve bolt;

FIGURE 17 is a top plan view taken generally along lines 17-17 of FIGURE 16;

FIGURE 18 is a cross-sectional view taken

generally along lines 18-18 of FIGURE 17;

FIGURE 19 is an end view showing a guide member for a poppet;

5 FIGURE 20 is a cross-sectional view taken generally along lines 20-20 of FIGURE 19;

FIGURE 21 is a partial cross-sectional view similar to FIGURE 1 showing the various component diameters which are modified to provide keyed mating pairs of body and stem assemblies; and,

10 FIGURE 22 is a table showing examples of various diameters in FIGURE 21 which provide keyed mating pairs of body and stem assemblies.

Description of A Preferred Embodiment

15 Referring now to the drawings wherein the showings are for purposes of illustrating preferred embodiments of the invention only and not for purposes of limiting same, FIGURE 1 shows a mating pair of body and stem coupling members or assemblies A and B, respectively, in a position about to be connected upon
20 movement axially toward one another.

Body assembly A includes a body part or member C having a slide part D axially slidable thereon. Slide part D is normally biased to the right in FIGURE 1 into engagement with a body valve E by means of a coil spring
25 12. Body valve E is attached to an elongated member or bolt F and held centrally within the body part C by support fins G.

Stem assembly B includes a stem part or member H having a poppet I disposed therein. Poppet I is
30 normally biased to the left in FIGURE 1 into engagement with a seat adjacent an open end of the stem by means of a coil spring 14. Spring 14 surrounds a guide shaft or bolt J extending through an opening in a guide member K against which spring 14 also acts.

35 When a mated pair of body and stem assemblies

A,B are to be coupled, they are positioned as shown in FIGURE 1. It will be noted that the outer end portion of stem member H engages the outer end portion of slide part D and, upon movement of assemblies A,B toward one another, slide part D retracts to the left in FIGURE 1 out of engagement with body valve E. At the same time, body valve E enters the open end of stem member H and engages poppet I to move same away from its seat, i.e., to the right in FIGURE 1. Once the assemblies are connected, the parts are arranged as generally shown in FIGURE 2 and fluid flow can take place through the connected assemblies.

Body part C is internally threaded as generally indicated at 16 for connection to another fluid conduit. Other interconnecting means could also be advantageously employed, however. An external circumferential groove 18 in the body part C loosely receives inwardly extending first end portions 20 of a plurality of latch members L. These latch members preferably comprise metal stampings, and have an arcuate conformation in an end view. The opposite end portions of latch members L include inwardly extending latch hooks 22 and outwardly extending latch projections 24.

A generally cylindrical abutment sleeve M is positioned over body part C and has an outer end portion reversely curved inwardly as generally indicated at 28. Reversely curved end portion 28 has an axially extending portion overlying axially extending portions of first end portions 20 of latch members L to loosely hold same within groove 18 for allowing swinging movement of the latch members opposite end portions toward and away from coupling longitudinal axis 30. A snap ring 32 received in a suitable external circumferential groove in body part C retains abutment sleeve M in position. Abutment sleeve M includes an outwardly extending circumferential

bead 34 for stiffening same against a deformation, and also includes a terminal end 36.

Operating means in the form of a generally cylindrical sleeve N surrounds latch members L and has
5 an outer end portion reversely curved inwardly as generally indicated at 40. An outwardly extending circumferential bead 42 provides an inner circumferential recess 44 having a gradual slope to provide a cam surface for cooperation with latch
10 projections 24. In the outward released position of latch members L as shown in FIGURE 1, latch projections 24 are received in recess of 44. This relationship also acts to retain operating sleeve N against complete displacement to the right from body assembly A. A coil
15 spring 46 is positioned between the reversely curved outer end portion of abutment sleeve M and the inner terminal end of operating sleeve N for normally biasing operating sleeve N away from abutment sleeve M.

A generally rectangular opening 48 in operating
20 sleeve N receives stop means in the form of stop button O having a downwardly depending leg 50 freely received through a slot 52 spaced slightly from rectangular opening 48. A generally circular leaf spring P has an upper flat projection 54 received in the recessed
25 underside of button O and normally biases the stop button upwardly in the view of FIGURE 1. Stop button O has a leading edge 55 with a slow slope to prevent accidental cocking of the button when contacted by an external object having relative movement generally
30 toward abutment sleeve M. Stop button O also has an inner end 56 engageable with abutment sleeve inner end 36 to prevent further movement of operating sleeve N within abutment sleeve M to the left in FIGURE 1 until stop button O is depressed for allowing button inner end
35 56 to pass beneath end 36 of the abutment sleeve. The

inner end portion of operating sleeve N is closely received and guided within abutment sleeve M.

Stem assembly B includes cooperating coupling means on stem member H in the form of a circumferential groove 60 for receiving latch hooks 22. With the components positioned as shown in FIGURE 1, movement of body part C and stem member H toward one another causes slide D to retract to the left. At the same time, latch hooks 22 ride along the outer surface of slide D and an outer surface portion 62 of stem member H until latch hooks 22 reach groove 60. At this point, latch members L swing inwardly for reception of latch hooks 22 within groove 60. Spring 46 disposed between abutment sleeve M and operating sleeve N, biases operating sleeve N to the right in FIGURE 1. This causes the cam surface portion of recess 44 to cooperate with latch projections 24 for urging latch hooks 22 into groove 60. This also releases operating sleeve N for movement to the right from the latch releasing position of FIGURE 1 to the latch holding position of FIGURE 2. In the latch holding position, the outer ends of latch projections 24 engage the inner cylindrical surface of operating sleeve N at a location spaced from recess 44 on the opposite side thereof from reversely curved outer end portion 40. Also, the outer end of reversely curved end portion 40 engages an abutment 64 on stem member H for holding operating sleeve N against further movement to the right in FIGURE 2. When latch hooks 22 are received in a latching condition in groove 60, the latch members are positioned substantially 360° around the groove. This relationship enhances the connected relationship between body and stem coupling members A,B.

With the components connected as shown in FIGURE 2, such connection requires movement of operating sleeve N to the left until latch projections 24 are

generally aligned with recess 44. However, axial movement of operating sleeve N to the left in FIGURE 2 is prevented because terminal end 56 of stop button 0 engages terminal end 36 of the abutment means defined by abutment sleeve M. In order to free operating sleeve N for movement to its releasing position, it is necessary to depress stop button 0 and hold same depressed while operating sleeve N is urged axially to the left so that stop button terminal end 56 will pass beneath abutment terminal end 36 as shown in FIGURE 1. Thus, the latch means requires independent movements in two different directions for moving same to a releasing position. The movement of button 0 is generally toward and away from coupling longitudinal axis 30 with the motion being generally pivotal about button projection 50 in slot 52. Once recess 44 is generally aligned with latch projections 24, the biasing action of spring 12 urging slide D to the right is also urging stem member H to the right. The cooperating cam surfaces between latch hooks 22 and groove 60 cause the end portions of latch members L to be cammed generally radially outward for reception of latch projections 24 in recess 44.

It will be noted that stop button 0 is located between outwardly extending circumferential beads 34, 42. Preferably, the button does not project above a plane tangent to the outer surfaces of both beads 34 and 42. Thus, button 0 is protected by the beads against accidental movement to its unblocking position from its normal blocking position where movement of operating sleeve N to its latch releasing position is prevented. Outwardly extending circumferential bead 42 on operating sleeve N also performs the function of providing an abutment against which a person's thumb and fingers may act to move operating sleeve N to the left against the biasing force of spring 46.

FIGURE 5 simply shows the rectangular opening 48 and slot 52 in operating sleeve N with more particularity.

FIGURES 6 and 7 show the stop means defined by stop button 0. It will be recognized that stop button 0 is transversely curved to the general curvature of operating sleeve N. The underside of stop button 0 is recessed. An outwardly extending flange 70 extends outwardly from the button underside along abutment end 56 thereof and partly along the opposite sides thereof toward projection 50. The flanges along the sides of button 0 terminate sufficiently short of the end having downwardly extending projection 50 for allowing the button to be positioned within and without operating sleeve N. When in the uncocked blocking position as shown in FIGURE 2 to block movement of operating sleeve N into abutment sleeve M, flange 70 abuts and approximately conforms to the inner contour of operating sleeve N partially around the rectangular opening 48 while projection 50 extends downwardly through slot 52. To move to the cocked position shown in FIGURE 1 to allow terminal end 56 to partially enter abutment sleeve M, the button pivots on the portion of operating sleeve N between rectangular opening 48 and slot 52. Terminal end 56 is within a plane either perpendicular to axis 30 or sloping from the outer periphery of button 0 in a direction both radially inward and axially outward from terminal end 36 of abutment sleeve M. This is to prevent a camming force which would work to depress and cock the button when sleeve N is moved into sleeve M.

As shown in FIGURES 8-10, button spring P comprises a generally flat leaf spring curved into a generally circular conformation having freely overlapping terminal end portions 72, 74 for allowing spring contraction and expansion. The top portion of

the spring opposite from the overlapping ends has a generally rectangular cut-out 76 therein and an upwardly raised projection 54. The outer corners of projection 54 are relieved as generally indicated at 80 to
5 generally correspond with the curved corners of button 0 adjacent projection 50. Spring projection 54 is curved to the general transverse contour of stop button 0 and is sized for reception in the recessed underside of the button. Thus, spring P holds stop button 0 in a
10 position normally projecting upwardly through rectangular opening 48 with a button flange 70 engaging the inner surface of operating sleeve N. Depressing stop button 0 may cause spring P to contract by further overlapping movement of terminal end portions 72, 74 and
15 by deformation of spring projection 54.

Inner body part C and outer slide part D include closely facing cooperating outer and inner cylindrical surfaces 81, 82, respectively (FIGURE 2). Body part C has an inner terminal end 84 spaced radially
20 inward from outer surface 81 thereof. A taper surface extends from inner terminal end 84 to inner surface 81. As best shown in FIGURE 11, this taper surface includes a slow taper surface 86 inclined to coupling longitudinal axis 30 at a small angle and merging into a
25 fast taper surface 88 adjacent the intersection thereof with outer surface 81. In general, slow taper surface 86 is more parallel to axis 30 than perpendicular thereto, while fast taper surface 88 is more perpendicular to axis 30 than parallel thereto. The
30 taper surface cooperates with a portion of inner surface 82 on slide D to define a packing receiving space and fast taper surface 88 is located adjacent the apex of this space.

A backup ring 90 and a packing ring 92 are
35 positioned in the packing receiving space with backup ring 90 being located adjacent fast taper surface 88.

Figure 13 shows a backup ring 90 having a cylindrical outer surface 94 generally corresponding to inner cylindrical surface 82 of slide D and an inner surface 96 inclined at substantially the same taper as slow taper surface 86. Backup ring 90 includes opposite parallel ends 98, 100 extending perpendicular to outer surface 94, with outer surface 94 merging into end surfaces 98, 100 with smoothly curved convex corners. All of the seals and packings used in the preferred embodiment here under discussion are preferably constructed of virgin polytetrafluoroethylene ("TFE"). Backup ring 90 preferably comprises polyphenylene sulfide (PPS) filled TFE or some other fairly hard yet pliable material so as to render the backup ring expandable yet relatively non-deformable compared to packing ring 92. Both TFE and PPS provide excellent compatibility with an extremely wide range of chemicals. Seals and backup rings of these materials have been found to be longer lasting and more resistant to failure than conventional rubber or other elastomeric seals. However, it will be appreciated that other materials also could be employed satisfactorily to accommodate various environments or coupling applications.

As shown in FIGURE 12, packing ring 92 has a generally cylindrical outer surface 104 and an inner cylindrical inner surface portion 106. Parallel opposite ends 108, 110 extend perpendicular to outer and inner surfaces 104, 106. Approximately one-half of the axial width of inner surface 106 has a taper surface 112 thereon for cooperation with slow taper surface 86. The slow taper provides a mechanical advantage which allows packing ring 92 to deform and conform to irregularities on the surfaces of the various components. This mechanical advantage and resulting deformation enables

TFE, which is a relatively hard sealing material, to provide a gas tight seal while subjected to relatively low packing loads. The thickness and axial width of packing ring 92 are also such that packing ring end 110 is spaced axially a substantial distance outwardly beyond body part end 84.

With particular reference to FIGURE 3, a generally cylindrical cup-like packing gland R is closely slidably received within hollow body part C. Gland R has an axially inward extending reversely curved flange 116 inside of body part C and a radially outward extending flange 118 disposed axially outward from inner terminal end 84 thereof for engaging terminal end 110 (FIGURE 12) of packing ring 92.

Slide D has an inner inwardly extending portion 120 against which a spring eyelet 122 is positioned. The biasing means defined by coil spring 12 has one end received over eyelet 122 and the opposite end bearing against inwardly extending reversely curved flange 116. The reverse curve of flange 116 beneath the end coil of spring 12 combines with the alignment function of spring eyelet 122 to contain spring 12 against unseating forces from moving fluids. Spring 12 defines a slide biasing means for normally biasing slide D in one direction off or away from body part C, and also defines a packing biasing means for urging packing 92 and backup ring 90 to the left in FIGURES 1 and 2 tightly into the packing receiving space.

When the coupling is internally pressurized, the pressure force acts on packing ring 92 to force such packing and backup ring 90 further into the packing receiving space. The taper surface 86 imparts radially outward motion to the packing ring for causing such ring to be pressed firmly into the inner surface of the

slide. The slow taper surface 86 provides a mechanical advantage which amplifies the compressive stresses on high points and irregularities in the packing at points where they contact the slide or body. Backup ring 90 prevents extrusion of the packing ring into the interface between the outer surface 81 of the body and the inner surface 82 of the slide. Axial movement of the packing ring causes it to contact the backup ring and forces same to move axially. The slow taper surface 86 causes the axially moving backup ring to move radially outward to firmly engage the inner surface 82 of the slide for preventing the packing from extruding past the backup ring. The fast taper surface 88 reduces the tendency for axial movement of the backup ring. This combines with the less deformable or harder material composition of the backup ring to minimize the tendency of the backup ring to extrude between the body and slide.

As shown in FIGURE 14, the outer end portion of slide D has an internal circumferential recess with a sloping wall 126 in outwardly spaced opposing relationship to body part outer surface 81. Recess sloping wall 126 slopes outwardly away from axis 30 at a slow taper when proceeding from right-to-left in FIGURE 14, and this is also the one direction in which slide D moves when the two body and stem coupling assemblies A, B are being connected. A TPE bearing ring 127 has a generally L-shaped cross-sectional configuration including a larger axial leg 128 received in the internal slide recess and a radial leg 129 extending outwardly along slide terminal end 130. Axial leg 128 has a generally cylindrical inner surface with a diameter slightly less than the external diameter of external cylindrical surface 81 on body part C. Axial leg 128 has an external surface with a slow taper generally corresponding to the taper on recess sloping surface

126. A cam surface 131 connects the outer surface of radial leg 129 with the inner surface of axial leg 128, and aids initial assembly as well as wiping action during connection of the coupling assemblies. Slide D
5 has an external circumferential groove 132 spaced a short distance axially from terminal end 130 thereof and is of generally rectangular cross-sectional shape. Retaining means for preventing complete displacement of the bearing ring from the recess while allowing limited
10 axial movement thereof relative to the slide comprises a metal retainer ring including an inwardly extending flange 133 overlying bearing ring radial leg 129. The axial spacing between flange 133 and slide terminal end 130 is substantially greater than the axial thickness of
15 bearing ring radial leg 129. A retainer ring cylindrical portion 134 is closely received over that portion of slide D extending between terminal end 130 and groove 132, and which portion has an external diameter smaller than the remainder of slide D by
20 approximately two times the radial thickness of retainer ring cylindrical portion 134. A plurality of circumferentially-spaced inwardly extending barbs or detents 135 are punched and bent from cylindrical portion 134 and slope inwardly toward axis 30 at a slow
25 taper from right-to-left in FIGURE 14. The axial distance between the terminal end of cylindrical portion 134 and the terminal end of detents 135 is substantially less than the axial width of groove 132. In other words, there is a loose fit so that the retainer ring
30 can move back-and-forth axially. When the retainer ring is being assembled, detents 135 will bend outwardly until they snap back into groove 132. Engagement between the terminal end of cylindrical portion 134 and one side of groove 132, and between the terminal ends of
35 detents 135 and the opposite side of groove 132, define

the limits of axial movement for the retainer ring. During movement of slide D in the one direction to connect the coupling, which is movement of slide D from right-to-left in FIGURE 14, cooperation between the
5 tapering surfaces of the slide recess and the bearing ring axial leg causes axial leg 128 to contract generally radially into firm engagement with body part external surface 81. Thus, during connecting movement, slide D rides on bearing ring 127 having a very low
10 coefficient of friction instead of riding on another metal surface. This is significant in that substantially all of the major coupling components are preferably of stainless steel and galling is a particular problem associated with such material. The
15 firm engagement of bearing ring axial leg 128 with external surface 81 of body part C also performs a thorough wiping action. When slide D is thereafter moved in the opposite direction, i.e., to the right or uncoupling direction in FIGURE 14, bearing ring 127 is
20 free for limited movement to the left so it does not compressively engage body part C with great force and allows free separation of the parts when lateral forces are minimal.

Inwardly extending portion 120 of slide D
25 terminates in an axially extending projection 136 having an external circumferential groove 138 (FIGURE 3) receiving a TFE seal ring 140. Slide D is part of body assembly A and may be considered a body part. The terminal end portion of slide D having groove 138
30 therein may be considered a body terminal end portion having a terminal end 141. Groove 138 has a groove bottom and axially-spaced groove sidewalls, including one groove sidewall closest to terminal end 141 and an opposite groove sidewall further therefrom. The groove
35 bottom slopes outwardly away from axis 30 at a small

angle in a direction from the one groove sidewall toward the opposite groove sidewall. As best shown in FIGURE 15, seal 140 has an inner surface 142 sloping at a shallow angle from axis 30 and an outer cylindrical portion 144. Parallel opposite ends 146, 148 extend perpendicular to cylindrical surface 144. Approximately one-half of the width of seal 140 adjacent end 148 has an external sloping surface 150 sloping downwardly toward inner surface 142 at a shallow angle from axis 30. The bottom of cylindrical groove 138 is shaped to generally correspond with seal inner surface 142, while an inner surface portion 152 of stem member H is shaped to generally correspond with external surfaces 144, 150 by having stem member cylindrical and sloping surfaces 153, 155 (FIGURE 4). The diameter of inner cylindrical surface 82 on slide D is substantially greater than the largest external diameter of seal 140. As a result, a pressure force differential will exist when the coupling is pressurized to normally bias slide D to the right in FIGURE 2, and to more firmly engage and compress seal 140 between slide D and stem member H. A stem seal backup ring 156 is positioned between the left end of TFE seal 140 and the left end of groove 138 and, besides preventing extrusion of seal 140, it has the same or similar properties and material composition as packing backup ring 90.

Body valve E includes an external recess closely receiving a seal 160, with the surface of the recess corresponding in size and shape with the inner surface of the seal. Seal 160 has both external and internal surfaces which are sloped outwardly away from axis 30 in a direction proceeding away from slide D. This enhances the sealing action and allows the seal to conform with irregularities. An outer sloping surface 162 on seal 160 corresponds with a valve seat 164 on the interior of slide D adjacent the open end. Body valve E

also includes a sloping stop surface 166 spaced axially and radially from seal 160 for cooperation with a corresponding sloping stop surface 168 adjacent the open end of slide D. This cooperation between the stop surfaces 166, 168 prevents damage or extrusion to seal 160 under high pressures. One end and an outer peripheral portion of seal 160 are surrounded by a metal retainer ring 170 for preventing blowout of seal 160 under high fluid pressure conditions. Metal retainer ring 170 is retained in position by a suitable snap ring 172 positioned in a suitable circumferential groove in body valve E. Body valve stop surface 166 is located on the opposite side of seal 160 from metal retainer ring 170 and stop surface 166 is located axially further away from slide D than retainer ring 170.

Poppet I includes an external recess shaped for closely receiving a poppet seal 180 having internal and external surfaces which are tapered outwardly from axis 30 in a direction away from the open end of stem member H. These internal and external tapering surfaces enable the seal to conform with irregularities on the mating surfaces. Seal 180 also has an outer sloping surface 182 for cooperation with a corresponding valve seat 184 adjacent the open inner end of stem member H. A tapering stop surface 189 on a metal retainer ring 187 is cooperative with a corresponding tapered stop surface 188 adjacent the open inner end of stem member H. Under normal circumstances, stop surfaces 189, 188 will not engage one another, but will do so to prevent extreme deformation or extrusion of seal 180 under extremely high pressures. Retainer ring 187 surrounds an end and a peripheral portion of seal 180 to prevent seal blowout and is retained in position by a snap ring 190 received in a suitable groove in poppet I. Stop surface 189 and retainer ring 187 are located at the same end of

seal 180, and retainer ring 187 is located axially closer to the open inner end of stem member H than is the portion of poppet I on the opposite side of seal 180 from retainer ring 187.

Bolt or elongated member F is secured to body valve E in a known manner and includes a pair of axially-spaced projections 202, 204 between which a circumferential groove 206 is defined. Support fins G include a pair of fin members shown in detail in FIGURES 16-18. Each fin member is generally M-shaped in end view and includes a pair of main legs 208 connected by a generally U-shaped portion having a central curved portion 210 which is spaced from the terminal ends and is curved outwardly away therefrom. As best shown in FIGURES 17 and 18, curved central portion 210 is axially offset from main legs 208. When a pair of fin members are reversely positioned with the terminal ends of main legs 208 thereof engaging one another as shown in FIGURE 16, the inner facing surfaces of curved central portions 210 lie on the periphery of a common circle having a diameter approximately the same as the diameter of the bottom of bolt groove 206. In addition, the distance between the opposite axial ends of curved central portion 210 is approximately the same as the distance between the inner facing surfaces of projections 202, 204.

When a pair of fin members are reversely positioned in cooperative relationship around a bolt F as shown in FIGURE 3, one end of legs 208 engages a circumferential shoulder 212 in the bore of body part C. A snap ring 214 received in a suitable circumferential groove retains support fins G in the desired position. As shown in FIGURE 3, curved central portions 210 are axially offset from legs 208 in a direction away from body valve E. The shape and position of the fin members allows maximum flow through

the bore of body part C while providing maximum strength for holding body valve E in position and resisting both shear and compressive forces.

As shown in FIGURES 19 and 20, poppet guide member K includes a plurality of radially extending circumferentially spaced apart spokes 220 issuing from a central area 222. A central opening 224 extends through the central area and is surrounded by a circular raised boss 226. The outer terminal ends 228 of spokes 220 are curved to lie on the periphery of a common circle and the spokes are equidistantly spaced from one another. As shown in FIGURE 20, spokes 220 are inclined out of a flat plane in a direction opposite to the projecting direction of circular boss 226.

As shown in FIGURE 4, poppet guide bolt J is surrounded by coil spring 14 and has a terminal end in the general shape of a truncated cone which abuts a corresponding conical bottom surface of a bore in poppet I. A shoulder 230 within a stem adapter 232 engages the outer end portions of spokes 220 on poppet guide K. A small diameter portion 234 of guide bolt J is closely received and slidably guided through hole 224. An enlarged portion of the guide bolt provides an abutment 236 for engaging the end of circular boss 226. One end of coil spring 14 is closely received over circular boss 226 and the other end thereof engages the back of an enlarged head on the terminal end portion of guide bolt J within the bore in poppet I for normally biasing the poppet to its closed position. The interior outer end portion of stem member H is suitably threaded for cooperation with external threads on stem adapter 232, and the interior of stem adapter 232 is threaded as indicated at 240 for connection to another fitting on a conduit. Here, too, interconnecting means of types other than threads 240 could be advantageously employed.

With reference to FIGURES 21 and 22, the external diameter portion of stem member H which is received within operating sleeve N is varied by adding cylindrical shims 246 of various thicknesses thereto.

5 Thus, the external diameter S of stem member H may be selectively varied. The inner diameter of reversely curved portion 40 of operating sleeve N is varied by machining the portion to variable desired internal diameters T. The largest external diameter portion of
10 body valve E is varied by machining it to variable diameters V. The diameter of the smallest internal diameter portion 250 at the open inner end of stem member H is similarly varied by machining it to variable diameters U.

15 A plurality of pairs of mating body and stem assemblies are constructed and dimensioned such that the body assembly of one key will mate only with a stem assembly having the same key. Progressively larger keys have progressively larger external stem member diameters
20 S, larger internal operating sleeve diameters T, larger body valve external diameters V, and larger stem open end internal diameters U. Thus, there is provided a coded system of couplings including a plurality of pairs of keyed mating body and stem assemblies A,B. Each body
25 assembly includes an inner body valve E and an outer coupling sleeve defined by operating sleeve N. Each stem assembly has a stem member H with an external diameter S and an open stem end through which body valve E is received. Mating body and stem assemblies are
30 dimensioned for close reception of stem member H within sleeve N and for close reception of body valve E within inner stem member end 250. With this arrangement, body and stem assemblies having different keys will not mate or connect due to interference either between a stem
35 member H and a coupling sleeve N or between a body valve

E and a stem inner end 250.

Examples of various diameters for a plurality of different keys is shown in Figure 22. A stem assembly will not couple with the body of a higher key because
5 of interference between valve body E and internal opening 250. A body assembly having a higher key will always have a larger external diameter on body valve E than the corresponding internal diameter at open end 250 of a smaller key stem assembly. A body assembly
10 will not mate or connect with a stem assembly of a higher key because of interference between the external diameter of stem member H and the internal diameter of sleeve N. A stem assembly of a higher key will always have a larger external stem member
15 diameter than the corresponding internal diameter of the sleeve on a smaller key body assembly.

Attention is drawn to Patent applications numbered 2144193A (No. 84/02967), 2172365A, 2172366A and
2172368A whose claims are directed to matter described
20 above.

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CLAIMS

1. A valve assembly comprising valve and coupling parts relatively moveable between closed and open positions, and a seal assembly comprising an external
5 circumferential seal of deformable material carried by said valve part, said coupling part having thereon a valve seat co-operatively engaged by said seal in said closed position, said seal having one axial end portion of reduced diameter and an opposite axial end
10 portion of larger diameter, said seal and said valve seat having co-operating sealing surfaces sloping from the larger diameter end portion to the reduced diameter end portion, and metal seal retainer means peripherally and axially surrounding said seal at said
15 reduced diameter end portion thereof to combine said seal and prevent blowout thereof and sized to be closely and slidably received in said coupling part in said closed position, positively co-operable metal-to-metal stop surfaces being operatively
20 provided between said valve part and said coupling part, said metal stop surfaces co-operating with one another when said valve assembly is in said closed position to limit pressures on said seal.

2. A valve assembly as claimed in claim 1, in
25 which said reduced diameter end portion of the seal faces into the interior of the coupling part and said



larger diameter end portion faces away from said coupling part interior.

3. A valve assembly as claimed in claim 1 or 2, in which said metal stop surfaces are at the end of the seal facing axially away from the interior of the coupling part.

4. A valve assembly as claimed in claims 2 and 3, in which said metal stop surfaces are adjacent said seal, whereby the seal retainer means and the co-operating metal stop surfaces totally confine said seal when the valve assembly is in said closed position.

5. A valve assembly as claimed in claim 3 or 4, in which said metal stop surfaces slope outwardly at a steeper angle than said sealing surfaces.

6. A valve assembly as claimed in claim 1, in which said larger diameter end portion of the seal faces into the interior of the coupling part and said reduced diameter end portion faces away from said coupling part interior, and in which said metal stop surfaces are at the end of the seal facing axially away from said coupling part interior.

7. A valve assembly as claimed in claim 6, in which said metal stop surfaces slope outwardly at a steeper angle than said sealing surfaces.



8. A valve assembly as claimed in claim 1, 2, 3, 4 or 6, in which said metal stop surfaces are sloping or tapered.

5 9. A valve assembly as claimed in any preceding claim, in which the internal surface of said seal also slopes inwardly from the larger diameter end portion to the smaller diameter end portion and the seal is received in an external recess in the valve part, such recess having a surface which corresponds in size and
10 shape with the internal surface of the seal.

10. A valve assembly as claimed in any preceding claim, further comprising a spring operative between said valve and coupling parts to bias the valve assembly to said closed position.

15 11. A fluid coupling subassembly comprising: a valve body having a valve fixed therein, a slide axially slidable on said body between valve open and closed positions, slide biasing means for normally
20 biasing said slide away from said body into engagement with said valve, a valve seal carried by said valve for sealingly engaging a valve seat on said slide in said closed position thereof, said seal and seat having corresponding co-operating sealing surfaces sloping relative to the longitudinal axis of said
25 body, metal seal retainer means surrounding the smaller diameter axial and peripheral portion of said



seal at the valve body side thereof, said seal
retainer means being slidably received in said slide
in said valve closed position, and co-operating
positive metal-to-metal stops between said valve and
5 said slide on the opposite side of said seal from said
valve body side thereof.

12. The fluid coupling subassembly as claimed in
claim 11, wherein said stops comprise co-operating
stop surfaces sloping relative to said longitudinal
10 axis at a steeper angle than said sealing surfaces.

13. A fluid coupling subassembly comprising: a
hollow stem including an inner stem end and having a
poppet therein moveable between closed and open
positions for respectively closing and opening said
15 inner stem end, poppet biasing means for normally
biasing said poppet to said closed position, a seal
carried by said poppet, a valve seat on said hollow
stem adjacent said inner stem end and co-operatively
engaging said seal in said closed position of said
20 poppet, said seal and seat have corresponding
co-operating sealing surfaces sloping relative to the
longitudinal axis of said stem, metal seal retainer
means surrounding the smaller diameter axial and
peripheral portion of said seal at the inner stem end
25 side thereof, said seal retainer means being slidably
received in said inner stem end in said closed



position of said poppet, and co-operating positive metal-to-metal stops between said retainer means and said stem on the same side of said seal as said inner stem end side thereof.

- 5 14. The fluid coupling subassembly as claimed in claim 13, wherein said stem and poppet have co-operating stop surfaces sloping relative to said axis at a steeper angle than said sealing surfaces.

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