

SPECIFICATION Hose End Fitting

This invention relates to a hose end fitting for attachment to a wire-braid reinforced flexible hose.

Wire-braid reinforced flexible hoses are formed from a (synthetic) rubber with the braided metal reinforcing being located within the wall thickness of the hose. End fittings are attached to such hoses in one or the other of two general ways. The first approach involves paring the outer rubber layer from the hose to expose the reinforcing braid for a portion of the length of the end of the hose, and by clamping the pared end of the hose between a hollow stem and a surrounding ferrule, with a portion of the length of the ferrule being swaged or otherwise brought into direct contact with the reinforcing braid. The second approach involves clamping an unpared end of the hose between a stem and ferrule and it is to this type of fitting arrangement that the present invention is directed.

To achieve positive connection between an end fitting and an unpared hose end, and to accommodate tensile loadings, the hollow stem portion is usually formed with external buttresses for engaging with the bore wall of the hose and the ferrule is usually furnished with internal buttresses for engaging with and biting into the outer rubber layer of the hose end. Ideally, the ferrule buttresses should bite right through contacted portions of the outer rubber layer of the hose end to contact the reinforcing and cause the braid to distort in an outward curve between adjacent buttresses. However, this latter requirement can and does lead to in-service problems with braid-reinforced hoses. Thus, in biting into the outer covering of the hose, a moisture path to the metal braid is created and, with creeping of the outer rubber covering, such moisture path can be exposed to atmosphere. This can and does result in serious corrosion of the hose reinforcement and consequential reduction of the tensile or burst strength of the hose. Creeping of the hose rubber occurs during attachment of the end fitting to the hose and/or as a result of in-service flexing of the hose.

The present invention seeks to avoid the above stated problem by providing a hose end fitting which is suitable for attachment to a wire-braided reinforced hose without the outer covering of the hose being pared to reveal the wire-braid reinforcement; the end fitting comprising a hollow stem portion for engagement with the hose bore and a ferrule which is arranged to connect with and locate about the stem portion, the ferrule having at least one internal buttress which is shaped and sized to bite into the outer covering of the hose and to extend to the hose reinforcement when the stem portion and ferrule are fitted to the hose end, said buttress having flanks which taper inwardly toward the stem portion, with the included angle between the flanks being within the range 20° to 45°, and the crest of said

buttress being convex, and the ferrule having an annular nib at or near one end thereof and spaced from the (adjacent) buttress, the nib defining an opening to the ferrule which has a diameter greater than the crest diameter of the buttress but less than the root diameter of the buttress, whereby the nib is caused to bite into the outer covering of the hose but not extend to the reinforcement when the fitting is attached to the hose end.

The nib, in biting into the outer covering of the hose, functions to prevent moisture migrating into the ferrule and entering any paths which may extend through the outer covering of the hose to the braid reinforcement within the fitting when it is attached to the hose end. As abovementioned, a moisture tracking path may exist within the outer covering of the hose end as a result of creeping of the hose rubber after it has been penetrated by the ferrule buttress.

The invention as above defined is applicable both to screw-type hose end fittings, in which clamping of the hose end is effected by screwing the ferrule onto the stem portion, and to swaged-type end fittings in which clamping of the hose end is effected by swaging the ferrule onto the stem-supported hose end.

To provide adequate anchorage between the fitting and the hose end a plurality of buttresses would normally be provided within the ferrule. Such plurality of buttresses may be constituted by two or more, preferably at least three, discrete annuli, but such number of buttresses might equally be provided, in effect, by a spiral form (thread-like) buttress within the ferrule. The spiral form buttress would normally be incorporated in the ferrule of screw-type end fittings, and separate annular buttresses would normally be incorporated in swaged-type end fittings. In the case of a helical form buttress, at least a portion of at least one convolution of the buttress preferably has a depth less than that of the remainder of the buttress length and such portion is preferably formed with a cutting edge.

As above stated the buttress or buttresses have flanks which taper inwardly toward the axis of the ferrule, with the included angle between the flanks of each buttress being in the range 20° to 45°. The choice of the most suitable angle would normally depend upon the nature and composition of the hose material for which the end fitting is intended, but an included angle which has been found to be most suitable for a range of hose materials is 35°. In order to avoid the crest of the (full depth) buttresses severing the wire reinforcement when the buttress(es) penetrate the outer rubber covering and contact the reinforcement, the crest of the or each full depth buttress is made convex by forming same with a small radius.

The invention will be more fully understood from the following description of two embodiments thereof which are described with reference to the accompanying drawings. In the drawings:

Figure 1 shows a half-sectional elevation view of a screw-type end fitting attached to a hose end.

Figure 2 shows, on an enlarged scale, a sectional scrap elevation view of a portion of the wall of the ferrule of the hose fitting as shown in Figure 1, and

Figure 3 shows a half-sectional view of a swaged-type end fitting attached to a hose end.

As shown in Figure 1 of the drawings, the end fitting comprises a hollow stem portion 10 which, at its left-hand end (as illustrated), would normally include a male or female connector portion. Such portion is omitted from the drawings because it in no way relates to the invention. The stem portion is tapered over a portion 11 of its length to facilitate its insertion into the bore of the hose 12, and the remaining portion of the stem has an external thread 13 which runs into the tapered portion 11. The tapered portion of the stem may be formed with a series of shallow buttresses or barbs (not shown) for gripping the bore of the hose 12.

The end fitting further comprises a ferrule 14 which surrounds the stem 10 and the hose end 12, the ferrule including a nose portion 15 which has a bore 16 threaded for engagement with threaded portion 13 of the stem. The remainder of the ferrule comprises a generally cylindrical body 17 which includes two integral hexagonal surrounds 18.

As shown in Figure 1, the bore 19 of the ferrule body 17 is formed with a series of internal buttresses 20. These buttresses may be individually formed, as a series of annuli, but they preferably exist as successive convolutions of a helical thread-like formation. The helix has roots and crests indicated by numerals 21 and 22 respectively. The root diameter of the helix is approximately equal to the outside diameter of the hose 12. Also, the helix has a pitch p and a buttress depth d , as shown in Figure 2 of the drawings. The buttress depth d is approximately equal to the thickness of the outer covering 23 of the hose, that is to say the depth d corresponds approximately with the radial depth of the hose reinforcement 24 below the periphery of the hose.

A nib 25 is formed at the end of the ferrule and defines a circular opening to the bore of the ferrule. The opening defined by the nib 25 has a diameter greater than that of the buttress crest 22 but less than that of the buttress root 21. Also, the position of the nib 25 corresponds approximately with the end of the stem 10.

Reference is now made in greater detail to the configuration of the helical-form buttress 20. As is shown in Figure 2 of the drawings, the flank surfaces 26 and 27 of each buttress converge toward the crest 22 and define an included angle β . Also the flank 26 is canted so as to make an angle α to a plane which is perpendicular to the axis of the end fittings. Values found particularly suitable for the angles α and β are 7° and 35° respectively, but these angles might be varied, either positively or negatively, to suit various types of hose material. The crest of each buttress

is slightly rounded, so as to avoid a sharp edge which might otherwise exist from severing the reinforcement 24 in the hose when contacted by the buttresses.

The cross-sectional profile of the helix is modified over the last one or one-and-a-half convolutions remote from the nose 15. Thus, as shown in Figures 1 and 2, the diameter of the crest is progressively increased, and the crest is given a sharp cutting profile as indicated by numeral 28. This profile is achieved by cutting-back the flank surface 26 of the helix to such an extent that the crest of the portion 28 does not extend into the outer covering 23 of the hose to such an extent as to contact the wire-reinforcement 24.

To attach the fitting of Figure 1 to the hose, the hose end-portion 12 is gripped firmly and pushed into the bore of the ferrule 14 whilst slowly rotating the ferrule. The shape of the nib 25 is such that it allows the outside surface of the hose to be pushed past and into the bore of the ferrule. As the hose end is advanced into the ferrule, with relative rotation occurring, the sharp end portion 28 of the buttress-forming helix slices into the outer covering of the hose and a spiral cut is thereby formed. The depth of the spiral cut is increased as the hose end is advanced into the ferrule, and the cut is eventually filled by the full depth d of the buttress 20. When this occurs the crests 22 of the buttresses contact the braid reinforcement 24, and the hose end is forced into the ferrule until such time as it abuts the nose portion 15.

The ferrule 14 is then held in a vice and the stem portion 10 is screwed into the bore of the hose, tapered end first and through the nose portion 15. As the stem is progressively advanced its threaded portion 13 progressively engages with the mating thread of the nose portion 15, and the tapered stem forces the hose end outwardly against the buttress crests 22. This causes the wall of the hose to be displaced outwardly and compression of the hose wall.

The buttresses 20 resist outward displacement of the hose wall, whereas the valleys between the buttresses do not. As a result the wire-braid reinforcement 24 of the hose tends to assume a serpentine path around the successive buttresses. Thus, a form of interlocking is achieved between the hose end and the fitting following their assembly.

As a further result of compression of the hose wall between the tapered stem 10 and the ferrule 14, the portion of the length of the hose between the cutting edge 28 and the nib 25 of the ferrule tends to be compressed in an axial direction. This axial compression tends to inhibit significant axial flow of the outer sheath of the hose during any flexing action of the hose assembly in service, this in turn preventing any extension of the spiral cut to the outside end of the ferrule. Furthermore, the nib 25, in biting into the outer wall of the hose to a depth less than that of the wire reinforcement braid 24, seals the interior of the ferrule against

ingress of atmospheric moisture which could otherwise erode the wire reinforcement.

Reference is now made to Figure 3 of the drawings, which shows a swaged-type hose end fitting. This comprises a hollow stem portion 30 and a ferrule 31 which is swaged onto the stem during assembly of the fitting to hose end 32.

The forward (lefthand) end of the stem includes a male or female coupling arrangement (not shown) and, behind such arrangement, an annular recess 33 and shoulder 34. The stem portion beyond the shoulder 34 includes a generally cylindrical wall 35 which merges into a tapered wall portion 36. The tapered wall portion is formed with a series of shallow buttresses or barbs 37 which serve to grip the bore of the hose against tensile loads.

The ferrule 31 has a generally cylindrical periphery and includes a nose portion 38 which is formed with an annular projection 39. The projection as formed has a diameter greater than that of the shoulder 34 but, when swaged onto the stem, is crimped into the recess 33. At the same time, a land 40 behind the projection is crimped onto the shoulder 34. In this way a positive interconnection is made between the ferrule and the stem.

The bore of the ferrule is formed with a series of separate annular, inwardly projecting, buttresses 41. The buttresses each have the same cross-sectional profile as those indicated by the numeral 20 in Figure 2 but, instead of each buttress being formed as part of a helical thread, as in the case of the arrangement above described with reference to Figures 1 and 2, each of the buttresses 41 is quite separated from the others.

The buttresses 41 have an approximately constant cross-section and, unlike the arrangement shown in Figures 1 and 2, none of the buttresses is formed with a sharp cutting edge. Each buttress has a depth corresponding approximately to the thickness 42 of the the outer covering of the hose 32, although the crest of the buttresses may be formed to lie on an imaginary line which tapers outwardly at a shallow angle (say 3°) from the hose entry end to the nose end of the ferrule.

As in the case of the previously described embodiment of the invention, the ferrule 31 of the present embodiment includes a nib 43 which defines an opening having a diameter greater than the crest diameter of the buttresses 41 but less than the root diameter of such buttresses. The function of this nib, is, again, to bite into the outer covering of the hose 32, without penetrating to the reinforcement mesh 44, and thereby to provide a seal against ingress of water or other moisture to the interior of the ferrule when it is swaged onto the hose end 32.

In assembly of the hose end fitting as shown in Figure 3 to a hose 32, the hose end is first forced into the interior of the ferrule 31 until it abuts the ferrule wall 45. Thereafter, the stem 30 is forced into the bore of the hose until the recess 33 aligns

with the projection 39 and the ferrule is then swaged inwardly onto the stem, using a cylindrical swaging press which acts along the full length of the ferrule body. This swaging operation results in the buttresses 41 of the ferrule biting into the outer covering 42 of the hose end 32 and deformation of the hose reinforcement 44 in much the same manner as that described above with reference to Figures 1 and 2.

In an alternative assembly process, a two stage swaging operation may be performed, the first stage involving swaging the nose end only of the ferrule onto the stem prior to insertion of the hose end 32. Then, the hose end 32 would be forced into the cavity between the stem and the unswaged portion of the ferrule, with such portion of the ferrule being thereafter swaged onto the hose end in the same stage.

Claims

1. A hose end fitting which is suitable for attachment to a wire-braided reinforced hose without the outer covering of the hose being pared to reveal the wire-braid reinforcement; the end fitting comprising a hollow stem portion for engagement with the hose bore and a ferrule which is arranged to connect with and locate about the stem portion, the ferrule having at least one internal buttress which is shaped and sized to bite into the outer covering of the hose and to extend to the hose reinforcement when the stem portion and ferrule are fitted to the hose end, said buttress having flanks which taper inwardly toward the stem portion, with the included angle between the flanks being within the range 20° to 45°, and the crest of said buttress being convex, and the ferrule having an annular nib at or near one end thereof and spaced from the (adjacent) buttress, the nib defining an opening to the ferrule which has a diameter greater than the crest diameter of the buttress but less than the root diameter of the buttress, whereby the nib is caused to bite into the outer covering of the hose but not extend to the reinforcement when the fitting is attached to the hose end.

2. A hose end fitting as claimed in Claim 1, wherein the included angle between the flanks is 35°.

3. A hose end fitting as claimed in Claim 1 or Claim 2 when fitted to a wire-braid reinforced hose which does not have its outer covering pared to reveal the wire-braid reinforcement.

4. A hose end fitting as claimed in Claim 3, wherein the root diameter of the or each buttress corresponds approximately with the outside diameter of the hose and wherein the depth of the or each buttress corresponds approximately with the depth of the wire reinforcement below the periphery of the hose.

5. A hose end fitting as claimed in any one of claims 1 to 4, wherein the ferrule has an internally threaded nose portion which is engageable with a screw thread on the stem portion, the internally threaded nose portion opening into a body portion



ingress of atmospheric moisture which could otherwise erode the wire reinforcement.

Reference is now made to Figure 3 of the drawings, which shows a swaged-type hose end fitting. This comprises a hollow stem portion 30 and a ferrule 31 which is swaged onto the stem during assembly of the fitting to hose end 32.

The forward (lefthand) end of the stem includes a male or female coupling arrangement (not shown) and, behind such arrangement, an annular recess 33 and shoulder 34. The stem portion beyond the shoulder 34 includes a generally cylindrical wall 35 which merges into a tapered wall portion 36. The tapered wall portion is formed with a series of shallow buttresses or barbs 37 which serve to grip the bore of the hose against tensile loads.

The ferrule 31 has a generally cylindrical periphery and includes a nose portion 38 which is formed with an annular projection 39. The projection as formed has a diameter greater than that of the shoulder 34 but, when swaged onto the stem, is crimped into the recess 33. At the same time, a land 40 behind the projection is crimped onto the shoulder 34. In this way a positive interconnection is made between the ferrule and the stem.

The bore of the ferrule is formed with a series of separate annular, inwardly projecting, buttresses 41. The buttresses each have the same cross-sectional profile as those indicated by the numeral 20 in Figure 2 but, instead of each buttress being formed as part of a helical thread, as in the case of the arrangement above described with reference to Figures 1 and 2, each of the buttresses 41 is quite separated from the others.

The buttresses 41 have an approximately constant cross-section and, unlike the arrangement shown in Figures 1 and 2, none of the buttresses is formed with a sharp cutting edge. Each buttress has a depth corresponding approximately to the thickness 42 of the outer covering of the hose 32, although the crest of the buttresses may be formed to lie on an imaginary line which tapers outwardly at a shallow angle (say 3°) from the hose entry end to the nose end of the ferrule.

As in the case of the previously described embodiment of the invention, the ferrule 31 of the present embodiment includes a nib 43 which defines an opening having a diameter greater than the crest diameter of the buttresses 41 but less than the root diameter of such buttresses. The function of this nib, is, again, to bite into the outer covering of the hose 32, without penetrating to the reinforcement mesh 44, and thereby to provide a seal against ingress of water or other moisture to the interior of the ferrule when it is swaged onto the hose end 32.

In assembly of the hose end fitting as shown in Figure 3 to a hose 32, the hose end is first forced into the interior of the ferrule 31 until it abuts the ferrule wall 45. Thereafter, the stem 30 is forced into the bore of the hose until the recess 33 aligns

with the projection 39 and the ferrule is then swaged inwardly onto the stem, using a cylindrical swaging press which acts along the full length of the ferrule body. This swaging operation results in the buttresses 41 of the ferrule biting into the outer covering 42 of the hose end 32 and deformation of the hose reinforcement 44 in much the same manner as that described above with reference to Figures 1 and 2.

In an alternative assembly process, a two stage swaging operation may be performed, the first stage involving swaging the nose end only of the ferrule onto the stem prior to insertion of the hose end 32. Then, the hose end 32 would be forced into the cavity between the stem and the unswaged portion of the ferrule, with such portion of the ferrule being thereafter swaged onto the hose end in the same stage.

Claims

1. A hose end fitting which is suitable for attachment to a wire-braided reinforced hose without the outer covering of the hose being pared to reveal the wire-braid reinforcement; the end fitting comprising a hollow stem portion for engagement with the hose bore and a ferrule which is arranged to connect with and locate about the stem portion, the ferrule having at least one internal buttress which is shaped and sized to bite into the outer covering of the hose and to extend to the hose reinforcement when the stem portion and ferrule are fitted to the hose end, said buttress having flanks which taper inwardly toward the stem portion, with the included angle between the flanks being within the range 20° to 45°, and the crest of said buttress being convex, and the ferrule having an annular nib at or near one end thereof and spaced from the (adjacent) buttress, the nib defining an opening to the ferrule which has a diameter greater than the crest diameter of the buttress but less than the root diameter of the buttress, whereby the nib is caused to bite into the outer covering of the hose but not extend to the reinforcement when the fitting is attached to the hose end.

2. A hose end fitting as claimed in Claim 1, wherein the included angle between the flanks is 35°.

3. A hose end fitting as claimed in Claim 1 or Claim 2 when fitted to a wire-braid reinforced hose which does not have its outer covering pared to reveal the wire-braid reinforcement.

4. A hose end fitting as claimed in Claim 3, wherein the root diameter of the or each buttress corresponds approximately with the outside diameter of the hose and wherein the depth of the or each buttress corresponds approximately with the depth of the wire reinforcement below the periphery of the hose.

5. A hose end fitting as claimed in any one of claims 1 to 4, wherein the ferrule has an internally threaded nose portion which is engageable with a screw thread on the stem portion, the internally threaded nose portion opening into a body portion



of the ferrule which includes the buttress(es) and which is arranged to receive the hose end.

5 6. A hose end fitting as claimed in claim 5, wherein the buttress is in the form of a thread-like helix.

10 7. A hose end fitting as claimed in claim 6, wherein the helical-form buttress has at least two convolutions and wherein the cross-sectional dimension, including the depth, of the buttress reduces to a sharp cutting edge over at least one convolution, the cutting edge being located adjacent but being spaced in an axial direction from the ferrule nib.

15 8. A hose end fitting as claimed in any one of claims 1 to 4, wherein the stem portion includes an annular peripheral recess and the ferrule includes a nose portion having an inwardly

20 directed annular projection, the ferrule being adapted to be swaged onto the stem portion so that the projection locates within the recess and, either at the same time or during a secondary swaging operation, the hose end is clamped between the stem portion and a body portion of the ferrule.

25 9. A hose end fitting as claimed in claim 8, wherein the body portion of the ferrule includes at least two said buttresses the buttresses being spaced-apart from one another and being of generally annular form.

30 10. A hose end fitting substantially as shown in Figures 1 and 2 or Figure 3 of the accompanying drawings and substantially as hereinbefore described with reference thereto.