

Improvements in or relating to sealing assemblies

The present invention relates to improvements in or relating to sealing assemblies, particularly those which are used for providing a watertight seal between an earthing rod and a waterproof membrane in a building structure.

As described in co-pending UK patent application no. GB 0911354.9, owned by the present applicant, it is commonplace to provide buildings with earthing rods, which act as conductors for lightning. These rods typically travel from beyond the highest point of the building to the subsoil to provide a conductive pathway for lightning to pass to the ground. It is often necessary for the rod to pass through building structures, such as concrete slabs and the like, to reach the subsoil underneath.

In such situations, it is desirable to provide a seal between the rod and the building structure to prevent ingress of water from the subsoil into the building. Often, the rod will penetrate a waterproof membrane running through the building structure, such as a damp course, which is adapted to prevent moisture rising into the building. It is preferable that the membrane is sealed around the rod in a watertight manner to maintain the waterproof barrier.

Apparatuses suitable for providing a seal between an earthing rod and a building structure are disclosed in UK patent no. GB 2 226 343 B and UK patent application no. GB 0911354.9. An example of such an apparatus is illustrated in Figure 1. The apparatus comprises a housing 10 in which sealing means 12a, 12b, 13a, 13b and an earthing rod 14 may be disposed. The housing 10 is fixed to an inspection chamber 20 which, along with the housing is cast into the concrete structure. The housing is sealed to a waterproof membrane 16 within the building structure. Typically, the housing 10 is attached to one end of a tube 22, through which the earthing rod 14 passes. Sealing means 24 are provided between the housing 10 and the tube 22 to prevent ingress of moisture therebetween, and the housing has a cap 18 to provide compression to top O-ring 13a of the seal pack. In any case, since sealing means 12a, 12b, 13a, 13b are provided between the earthing rod 14 and the housing 10, and since the housing 10 is

sealed to the waterproof membrane 16, the continuity of the waterproof barrier may be maintained throughout the building structure despite the penetration of an earthing rod.

The effectiveness and longevity of the apparatus illustrated in Figure 1 depends
5 principally upon the sealing means 12a, 12b, 13a, 13b within the housing 10 and the seal between the housing 10 and the waterproof membrane 16.

The sealing means 12a, 12b, 13a, 13b within the housing 10 tends to provide a good seal as a result of a compression fit between the metal surface of the earthing rod
10 14 and the surface of the housing 10, which may be made from metal or hard plastic. Degradation of the seal provided by the sealing means 12a, 12b, 13a, 13b within the housing 10 is typically very slow; the principal cause of failure being as a result of damage caused by inspection or removal of the sealing means 12a, 12b, 13a, 13b. The seal arrangement disclosed in UK patent application no. GB 0911354.9 and illustrated in
15 Figure 1 addresses this problem.

The seal between the housing 10 and the waterproof membrane 16 in the building structure is often not as good as that provided by the sealing means 12a, 12b, 13a, 13b in the housing 10, and may be more prone to failure. In particular, it is not possible to
20 replicate the compression fit which maintains the quality of the seal between the earthing rod 14 and the housing 10 in the case of the housing 10 and the membrane 16.

Presently, solutions to the problem of sealing between the housing 10 and the membrane 16 have been to apply an adhesive 30 or resin such as silicon sealant or
25 mastic between the membrane 16 and the housing 10. However, it is difficult to apply adhesives uniformly; some areas may be applied with too much, which could have an affect on building tolerances, and some areas may be applied with too little, thereby preventing the formation of a good seal. Moreover, it can be difficult for an engineer to identify where adhesives have been applied and where they have not, leaving open the
30 potential for the housing 10 and the membrane 16 to be left with no adhesive. Finally, adhesives and resins suffer from a limited operational life and will perish over time, usually sooner than the components on which they are applied. In the case of membranes through building structures, it is often very difficult (if not impossible) for

adhesives and resins to be replaced. In summary, present solutions provide an imperfect seal which is difficult to apply and even more difficult to maintain.

Accordingly, it would be desirable to improve the quality and longevity of the
5 seal between a housing for an earthing rod and a waterproof membrane in a building structure.

The present invention provides just such an improvement and thereby solves the above-mentioned problems. In a first aspect, the present invention provides an apparatus
10 for providing a watertight seal between an earthing rod and a building structure having a waterproof membrane. The apparatus comprises a tube adapted such that an earthing rod may pass therethrough. The principal purpose of the tube is to allow unhindered passage of the rod through the building slab, for example for rod driving subsequent to seal installation.

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First sealing means are provided for preventing the passage of moisture between the earthing rod and the tube and second sealing means are provided for preventing the passage of moisture between the tube and the waterproof membrane. Such sealing means may take any form.

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Finally, the apparatus comprises clamping means having upper and lower clamp members adapted such that the waterproof membrane running through the building structure may be clamped between the clamp members. Such clamping means are particularly advantageous since they apply a permanent mechanical force to the
25 membrane which maintains the watertight seal. A mechanical interface is advantageous over adhesives, and the like, since it will not degrade over time, or at least will degrade over a similar time frame to the materials which make up the apparatus. It will be appreciated that mastic or adhesive may be used; the clamp members will compress the mastic adhesive, thus ensuring an even and consistent seal.

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The apparatus may further comprise a housing adapted to contain the first sealing means. In accordance with particular embodiments of the invention described in more

detail below, the housing may form part of the clamping means, or the clamping means may be entirely separate from the housing.

The housing has a bore which is adapted in two respects: firstly to receive the
5 tube and secondly such that the earthing rod may pass therethrough. For example, in cases where the housing is provided at a surface of a building structure, the portion of the bore at which the tube is received may comprise a seat adapted to receive an end of the tube. The diameter of this portion of the bore may be greater than that of the portion of the bore through which the earthing rod may pass. The first sealing means is disposed
10 between an inner surface of the housing bore and the earthing rod.

In accordance with a first preferred embodiment of the invention, the upper clamp member may form part of the housing. In this case, the second sealing means is disposed between the housing and the tube.

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In the case of the first preferred embodiment, the lower clamp member may, for example, be an adjustable collar movably attachable to a portion of the housing. This arrangement is particularly preferred since it may accommodate different thicknesses of waterproof membrane. In a particularly preferred arrangement, the lower clamp member
20 and the portion of the housing to which it is movably attachable comprise inter-engagable screw threads. Accordingly, in use, the waterproof membrane may be clamped between said upper and lower clamp members upon tightening of the screw threads.

25 In accordance with a second preferred embodiment of the invention, the clamping means may be entirely separate from the housing. The clamping means is thus movable with respect to the housing so as to be positionable along the length of the tube. In this case, the second sealing means is disposed between the clamping means and the tube. This embodiment is particularly preferred, since the clamping means may be
30 adjusted to suit the location of the membrane in the building structure. This embodiment is therefore particularly useful in cases where the membrane is a long way from the surface of the building structure, where the housing may be located.

The upper and lower clamp members which comprise the clamping means may be engaged with inter-engagable screw threads. In this case, the waterproof membrane may be clamped between said upper and lower clamp members upon tightening of the screw threads.

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Alternatively, the upper and lower clamp members which comprise the clamping means may be engaged with fixing means, such as one or more screws or bolts, passing from one of the upper and lower clamp members and being secured at the other, such as by a corresponding number of screw threads or bolts, for example. In this case, the
10 waterproof membrane may be clamped between said upper and lower clamp members upon fixing of the fixing means, such as by tightening the one or more screws or nuts and bolts.

Regardless of which embodiment of the invention is adopted, one or both of said
15 upper and lower clamp members may comprises a substantially planar section and at least one protrusion extending from said substantially planar section for gripping the waterproof membrane, in use. The substantially planar section of the clamp member, or members, ensures that the membrane lies flat against the clamping means and thus ensures a good seal. Moreover, the at least one protrusion helps to ensure that the seal
20 remains watertight, and helps to prevent the membrane from slipping.

A second aspect of the invention provides clamping means for use in the apparatus of any preceding claim. The clamping means is in accordance with the clamping means described in connection with some of the apparatuses above, and
25 comprises upper and lower clamp members adapted such that a waterproof membrane may be clamped therebetween. Each clamp member of the clamping means has a bore adapted to enable a tube to pass therethrough and the clamping means comprises sealing means for preventing the passage of moisture between the clamping means and the tube.

30 A third aspect of the invention provides a housing for use in the apparatus of any preceding claim. The housing is in accordance with the housing described in connection with some of the apparatuses above, and comprises a bore adapted firstly to receive a tube and secondly such that an earthing rod may pass therethrough. First sealing means

are provided for preventing the passage of moisture between the earthing rod and the tube and second sealing means are provided for preventing the passage of moisture between the tube and the waterproof membrane. The housing includes clamping means having upper and lower clamp members adapted such that the waterproof membrane
5 may be clamped therebetween.

A detailed description of three preferred embodiments of the invention shall now be described with reference to the accompanying drawings, in which:

10 Figure 1 is a cross section illustrating a seal apparatus known from the prior art;

Figure 2 is a cross section of a first embodiment of the present invention;

Figure 3 is a side view of a second embodiment of the present invention;

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Figure 4 is an exploded view of the clamping means of Figure 3;

Figure 5 is a cross section of the clamping means of Figure 3;

20 Figure 6 is a close up view of a portion of the cross section of Figure 5; and

Figure 7 is an exploded view of a clamping means of a third embodiment of the present invention.

25 A first embodiment of an apparatus 100 according to the invention is shown in Figure 2. The apparatus 100 comprises a housing 102 having a bore 104 extending therethrough. The bore is adapted to receive an earthing rod 106 which, in use, extends through the bore 104. Furthermore, the bore 104 includes a seat 108 which is adapted to receive one end of a tube 110, through which the earthing rod 106 passes. The earthing
30 rod 106 is electrically isolated from the tube 110 by an air gap, but other isolation means may be used instead or as well as an air gap.

Sealing means in the form of two o-rings 112 are provided between the outer surface of tube 110 and the inner surface of the housing bore 104. The two o-rings 112 surround the tube 110 and are located within two annular channels in the inner surface of the housing bore 104. Of course, more or fewer o-rings and channels may be used, if
5 desired.

As with apparatuses of the prior art, apparatus 100 is provided with sealing means adapted to prevent ingress of moisture between the earthing rod 106 and the inner surface of the housing 102. The sealing means comprises two compression rings 114a,
10 114b which force two o-rings 116a and 116b against the earthing rod 106 and the inner surface of the housing 102, respectively. The arrangement of the sealing means is not part of the present invention, and any suitable arrangement may be adopted, depending on the circumstances.

15 A cap 118 is attached to the housing 102 by screw threads to provide compression to the top o-ring 116a of the sealing means.

The housing comprises a circumferential flange 120 extending radially outwardly from the housing 102. The flange 120 comprises a plurality of upstanding ridges 122
20 which act as a water bar and restrict the passage of water by capillary action. The ridges 122 are merely an optional feature and do not form part of the invention; indeed the flange 120 is an optimal feature.

The housing is affixed to a portion of a building structure 124 by a nut 126 which
25 may be tightened against the building structure by virtue of inter-engagable screw threads on the nut 126 and the housing 102. Of course, the housing may be affixed to a building structure by any means, or it may be embedded in the building structure. The illustrated arrangement is merely optional.

30 A waterproof membrane 128 is illustrated extending through the building structure. As shown clearly in Figure 2, the flange 120 extending radially outwardly from the housing 102 overlies the membrane 128. The flange 120 provides a substantially planar surface with which to contact the membrane 128.

The apparatus comprises clamping means having upper and lower clamping members between which the membrane is clamped. In the present embodiment, the upper clamping member is formed by the flange 120 of the housing 102, but other
5 embodiments might instead provide a separate portion on or about the housing to act as the upper clamping member. The lower clamping member is formed by a collar 130 which is movably attachable to the housing by virtue of inter-engagable screw threads 132 on the inner surface of the collar 130 and the outer surface of the housing 102.

10 A protrusion is provided on the lower clamp member by a serrated retaining ring 134 disposed on an upper surface of the collar 130. Once the collar 130 is tightened using the inter-engagable screw threads 132, in order to clamp the membrane 128 between the collar 130 and the flange 120, the serrated retaining ring 134 grips the membrane 128 to prevent it from becoming released from the clamping means. Mastic
15 or adhesive may be included in the joint; the clamping members ensure compression of the mastic or adhesive to provide an even consistent seal.

A second embodiment of an apparatus 200 according to the present invention is illustrated in Figures 3 to 6.

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As shown in Figure 3, the apparatus 200 comprises a housing 202 which is substantially in accordance with the housing of Figure 1. In particular, the housing receives a tube 210 and comprises a bore through which an earthing rod may pass. Sealing means are provided between the earthing rod and the housing. The housing also
25 comprises a cap 218 and a flange 220, substantially in accordance with the corresponding features of the embodiments of Figures 1 and 2. As with the figure 2 embodiment, the flange 220 is an optimal feature.

In contrast to the embodiment of Figure 2, the embodiment of Figure 3 comprises
30 clamping means 230 which are separate from the housing 202. This separation allows the clamping means 230 to be adjustable along the whole length of the tube 210 such that they may be positioned wherever the membrane 228 is situated in the building structure.

As shown in more detail in Figures 4 and 5, the clamping means 230 comprises an upper clamp member 232 and a lower clamp member 234, each of which has a bore 244, 246 in the centre thereof, the bore sized to allow the tube 210 to pass therethrough.

- 5 The bore 244 of the upper clamp member 232 is larger than the bore 246 of the lower clamp member, and is sized to fit over a sleeve 248 on the lower clamp member. To maintain a good seal, however, the fit of the bore 244 of the upper clamp member 232 and the sleeve 248 on the lower clamp member 234 is a friction fit.

- 10 Sealing means adapted to prevent ingress of moisture between the clamping means 230 and the tube 210 are provided in the form of two o-rings 236 between the inner surface of the sleeve 248 and the outer surface of the tube 210. The two o-rings 236 surround the tube 210 and are located within two annular channels in the inner surface of the sleeve 246. Of course, more or fewer o-rings and channels may be used, if
15 desired.

- The upper and lower clamp members 232, 234 are clamped together by fixing means in the form of bolts 238 which pass from the upper clamp member 232, through apertures in each of the upper and lower clamp members 232, 234 and engage screw
20 threads in the lower clamp member 234. Other fixing means may be used in place of bolts 238, and the particular arrangement of fixing means and clamp members may be adjusted depending on circumstances.

- Figure 6 shows a close up view of the interface between the upper and lower
25 clamp members 232, 234 and the membrane 228. Each of the upper and lower clamp members 232, 234 comprises a substantially planar surface and an annular projection 240, 242 extending from the planar surface towards the membrane 228. Of course, other embodiments may provide a projection on only one of the upper and lower clamp members. Alternatively, the upper and lower clamp members may comprise more than
30 one annular projection each. In the embodiment of Figures 3 to 6, the annular projections 240, 242 are radially offset from each other. However, they may be provided at the same radial distance such that they extend towards the membrane at the same

locations. As with the embodiment of figure 2 mastic or adhesive may additionally be used.

Finally, a third embodiment of a clamping means 330 for use in an apparatus
5 according to the present invention is illustrated in Figure 7.

Clamping means 330 differs from that illustrated in Figures 3 to 6 only in the means by which the upper clamp member 332 and lower clamp member 334 are fixed together. In this embodiment, the inner surface of bore 344 and the outer surface of
10 sleeve 348 are provided with inter-engagable threads 338a, 338b. By means of the threads 338a, 338b, the upper and lower clamp members 332, 334 may be screwed together in order to clamp the membrane 338 therebetween.

In all other respects, the embodiment of Figure 7 is identical to the embodiment
15 of Figure 3 to 6.

It will be appreciated that modifications may be made to the embodiments described above without departing from the scope of the invention which is defined by the appended claims.

Claims

1. An apparatus for providing a watertight seal between an earthing rod and a building structure having a waterproof membrane; the apparatus comprising:
 - 5 a tube configured to allow the earthing rod to pass therethrough, in use;
 - a housing containing first sealing means for preventing the passage of moisture between the earthing rod and the tube, wherein the housing further comprises a bore configured to receive the tube and to allow the earthing rod to pass therethrough, in use, and wherein the first sealing means is disposed between an inner surface of the housing
 - 10 bore and the earthing rod;
 - second sealing means for preventing the passage of moisture between the tube and the waterproof membrane; and
 - clamping means having upper and lower clamp members configured to allow the waterproof membrane to be clamped therebetween, in use;
 - 15 wherein the clamping means is separate from, and movable with respect to, the housing so as to be positionable along the length of the tube, and wherein said second sealing means is disposed between the clamping means and the tube.
2. The apparatus of claim 1, wherein the housing further comprises a seat adapted to
- 20 receive a first end of the tube.
3. The apparatus of claim 1 or claim 2, wherein the upper and lower clamp members comprise inter-engagable screw threads, such that, in use, said waterproof membrane may be clamped between said upper and lower clamp members upon
- 25 tightening of the screw threads.
4. The apparatus of claim 1 or claim 2, further comprising fixing means passing between the upper and lower clamp members, such that, in use, said waterproof membrane is clamped between said upper and lower clamp members upon fixing of the
- 30 fixing means.

5. The apparatus of claim 4, wherein the fixing means are one or more screws which pass through apertures in one of the upper and lower clamp members and which are secured by screw threads at the other of the upper and lower clamp members.
- 5 6. The apparatus of any preceding claim, wherein one or both of said upper and lower clamp members comprises a substantially planar section and at least one protrusion extending from said substantially planar section for gripping the waterproof membrane, in use.