

This invention relates to a sealed shelter made of modules placed end to end, and communicating with one another in accordance with the preamble of claim 1. Such shelters are known, (e.g. BE-A-898,867), the modules of which appear in the form of pipes connected end to end; the term pipe has here and in the claims a broad sense which encompasses rectilinear or curved conduits, whatever their cross section. Each module generally comprises an outer envelope in reinforced concrete, and an envelope in solid sheet metal which covers the internal wall of the envelope in concrete up to the vicinity of the extremities of this envelope in concrete; the envelope in sheet metal may be covered internally with an envelope of concrete or of cement, generally not reinforced and thinner than the outer envelope.. To ensure sealing of the shelter, the modules comprise, at their extremities, metal rings which extend the sheet metal envelopes; the term ring has here, and in the claims, a broad sense which applies even when their section is not circular. These rings are rings welded, on one side, to the extremity of the sheet metal envelope which they extend, and are slightly tapered on the opposite side; this tapered shape appears either as a flare, or as a narrowing of the ring, which, by associating two rings of these two types, allows them to be made to enter one another and to ensure tightness either by means of a gasket, or by welding. In other embodiments the parts of the rings intended to be fitted into one another have sections which are substantially constant, but of different diameters, and the connection is sealed either by a gasket or by welding.

When the rings are welded, the sealing of these connections between modules is tight, not only with respect to gases, liquids and dust, but also with respect to electromagnetic waves. However, these connections are poorly resistant to mechanical stresses, due, for example, to earth movements; they then tend to break, which leads to loss of the seal.

This invention aims to avoid, or at least, to reduce this disadvantage.

This is achieved, in particular, by the use of rings, annulated and flexible, over an intermediate part of their length.

According to the invention, a sealed shelter made of pipe-shaped modules, each comprising at least one strong, thick outer envelope and one envelope in solid sheet metal, covering the inner wall of the outer envelope up to the vicinity of the extremities of this outer envelope, the modules of the shelter being connected end to end, the two facing extremities of the modules each comprising, to this end, a metal ring which extends their sheet metal envelope and is securely attached to it, the rings of the facing extremities being securely attached to one another, is characterised in that, whatever the two facing module extremities, one at least of the two rings corresponding to the facing extremities in question has an annulated and flexible part over an intermediate portion of its length.

This invention will be better understood and other characteristics will become apparent with the help of the following description, and of the figures which relate to it, representing:

- figure 1, a partial view of a shelter according to the invention,
- figure 2, a more detailed view of a part of the shelter according to figure 1.

In the figures, the corresponding elements are designated by the same identifications.

Figure 1 shows a longitudinal sectional view of a shelter section 1. This section is constructed by means of two modules 2, 3 constructed from pipes having an outer diameter of about four metres, joined end to end by a ring-shaped connecting device, J. A rectangular frame in rectangular lines surrounds a part of the shelter situated at the join between the modules 2 and 3; this part, which is shown in greater detail in figure 2, shows how the walls of the modules are constructed, and how the connecting device J ensures sealing inside the shelter.

Figure 1 also shows the floor, P, of the shelter 1 and a person standing, H, acting as a reference for assessment of the size of the shelter.

Figure 2 is a view, magnified by about six times, of the part

of the diagram of figure 1, surrounded by the rectangle F2.

Figure 2 shows that, outside the zone of their joint, the walls of the modules 2 and 3 are constituted by three superimposed envelopes 21, 22, 23 and 31, 32, 33; the outer envelope, 21, 31, is a thick layer of concrete associated with a strong reinforcement A1, A2; the intermediate envelope 22, 32, is constituted by a solid metal sheet and the inner envelope, 23, 33, is made of concrete.

In the joint zone between the modules the sheet metal is replaced by a metal ring, distinctly thicker than the sheet metal; this ring is welded on to the sheet metal which it extends: ring 20 connected to the sheet metal of the envelope 22 by the weld S1 and ring 30 connected to the sheet metal of the envelope 32 by the weld S2. The ring 30, which is a ring of conventional type, comes to fit, at its extremity opposite to the envelope 32, into the extremity of the ring 20 opposite to the envelope 22; a weld S connects the two rings at the level of the extremity of the ring 30 opposite to the envelope 32.

The ring 20, unlike the ring 30, is not a ring of conventional type; in fact, between its part welded to the sheet metal 22 and its part joined by fitting on to the ring 30, the ring 20 comprises an annulated and flexible intermediate part, formed of three sinusoidal arches. In order to make space for these sinusoidal arches the thickness of the envelope 21 is reduced by about one third, over its internal part, from a little in front of the sinusoidal arches as far as its extremity facing the module 3, and the envelope 23 is eliminated a little in front of the sinusoidal arches. The space between the ring 20 and the part of the envelope 22 of reduced thickness is filled with a bitumen-based flexible material, 24, which also covers the inner face of the ring 20, from the envelope 23 up to and including the three sinusoidal arches; this material has two functions: to contribute to the sealing of the joint against gases, fluids and dust, and to provide the annulated part of the ring 20 with the capability of being deformed under the effect of external stresses, so as to prevent it from breaking as would have been the case if it had been embedded in concrete. The spaces 4 and 5,

remaining free after fitting together of the two modules, and after the weld S has been made, are filled with concrete.

This invention is not limited to the example described. Thus, in particular, the two rings relating to the two facing extremities of two modules placed end to end, may each comprise an annulated intermediate part. Thus, the outer envelope 21 (figure 2) may be stopped at substantially the same level as the envelope 23, but a greater mass of extra concrete will have to be used in order to ensure protection of the ring. Thus, the rings may be assembled by any adequate assembly techniques and, in particular, by crimping. Thus, the annulated and flexible part may not be surrounded by flexible material, or may be covered on only one side, preferably the outer side, with a flexible material; in this case a free space must be left around this annulated part, since the concrete must not come into contact or come too close, so as to provide it with the capability of being deformed without breaking under the action of external stresses. Thus also, the annulated part may comprise a number of arches different from three, and these arches may be other than sinusoidal arches.

This invention relates in particular to anti-nuclear, anti-chemical and anti-bacteriological shelters for personnel and equipment.



CLAIMS

1. Sealed shelter made of pipe-shaped modules (2, 3), each comprising at least one thick, strong outer envelope (21, 31) and an envelope in solid sheet metal (22, 32) covering the inner wall of the outer envelope up to the vicinity of the extremities of this outer envelope, the shelter modules being connected end to end, the two facing extremities of the modules each comprising, to this end, a metal ring (20, 30) which extends their sheet metal envelope and is securely attached to it, the rings of the facing extremities being securely attached to one another, characterised in that, whatever the two facing module extremities, one (20) at least of the two rings corresponding to the facing extremities in question has an annulated and flexible part over an intermediate portion of its length.

2. Shelter as claimed in claim 1 characterised in that the annulated and flexible parts are surrounded by the outer envelope.

3. Shelter as claimed in claim 2 characterised in that, at each of the module extremities comprising a ring (20) having an annulated and flexible part, the outer envelope (21) relating to the module in question comprises a cavity arranged in its inner wall to make space for the annulated and flexible part of the ring.

4. Shelter as claimed in any of the above claims, characterised in that the annulated and flexible part is covered, at least externally, by a thick layer of a flexible material (24).