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54 Steps.

57 There is described the combination of a step for use with a tubular man-hole liner having at least one pair of horizontally located cylindrical holes therein. The step is substantially U-shaped in plan. It has a tread part and a pair of arms extending from the tread part to walls located respectively at the ends of the arms. A pair of cylindrical projections respectively project from the walls to engage in the holes. The outer ends of the projections are hollow and frusto-conical plugs are received within the hollow ends and distort them into engagement with the walls.

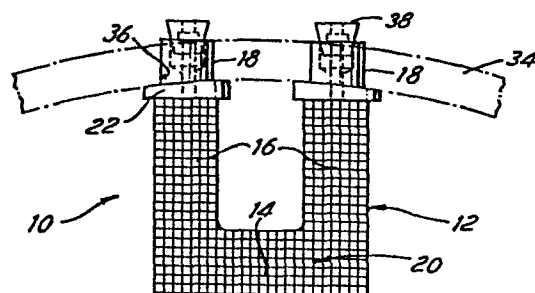


FIG.1

STEPS

- 1 -

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This invention is concerned with steps of the kind which are used inter alia in man holes to permit a person to climb either down into the man hole or up out of the man hole. Such steps are presently normally comprise a steel tube or rod that has been bent into a "U"-shape and the ends of the arms are fixed into holes in the wall of the man hole. These holes are normally of greater cross-sectional area than the ends and cement is forced into the gaps about the ends. This process is often crude and adequate sealing is not effected so that leakage often takes place. Furthermore the steps tend to work loose and often cannot be properly replaced.

According to the present invention there is provided a step comprising a flat tread, a wall at one end of the tread, and projection means on the side of the wall remote from the tread, the projection means having a hollow outer part and being adapted to be fixed into a man-hole liner and to receive plug means which will cause the part to expand and to seal against the holes in the man-hole wall. A sealant is preferably placed between each the projection means and the wall of the hole. The projection means are preferably comprised by a pair of projections preferably by a pair of tubes the ends of which are open.

The tread is preferably generally "U"-shaped in plan. It is preferably supported by gusset means preferably extending therefrom preferably to the abovementioned wall where that wall is provided.

The step preferably comprises a plastics material and is preferably nylon, preferably a high impact nylon.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings.

In the drawings:-

Figure 1 is a plan of a step of the invention in position in a tube forming part of a man hole lining,

10 Figure 2 is a side view of the step,

Figure 3 is an underplan of the step,

Figure 4 is a sectional side view of a modified step of the invention, and

Figure 5 is a enlarged side view of a plug.

15 Referring now to the drawings, there is shown a step 10 of the invention. The step 10 is a high impact nylon moulding and comprises a horizontal "U"-shaped tread 12 having a tread part 14 and a pair of arms 16 at the end of which are a pair of tubular projections 18 respectively. The  
20 step is about 150 mm wide and 55mm deep. The arms 16 are about 42mm wide and 75 mm long. The upper surface 20 of the tread part 14 is roughened by having grooves formed therein to provide a good gripping surface.

At the ends of the arms 16 there is provided respectively a pair of transverse vertical walls 22 which extend from slightly above and to substantially below the upper surface 20.

5 The width of the walls 22 is slightly greater than that of the arms 16. The outer surfaces 22a of these walls 22 lie on an arc as will be described below and they carry the projections 18.

The step 10 is generally frusto-triangular in side elevation leading from about 15mm at its outer narrow end 23 to about 70mm at the junction with the walls 22. The sides 24 of the step form, as it were, reinforcing gussets which extend downwardly and terminate near the lower edges of the walls 22. A groove 26, that is "U"-shape in plan, 15 is formed in the undersurface 28 of the step 10 to reduce the material content thereof, the side walls on either side of the groove providing the necessary strength to the step.

The projections 18 are about 40mm in outside diameter and about 57mm in mean axial length i.e. about the same dimension as the thickness of the wall of the liner. They are 20 parallel with one another and are substantially solid at their junction with the walls 22 with a central bore 30

terminating at the end face 32 of the groove 26. From about midway along their length, these projections 18 are hollow.

Used with the step as will be described is a pair of  
5 plugs 38 made of high impact nylon. Each plug 38 has a cylindrical inner part 38a having a diameter to be an interference fit in the bores 36 and a frusto-conical outer part 38b having a small core angle (see Figure 5).

The step 10 is used as one of a vertical series of steps  
10 inserted into a circular section pipe-like man-hole liner 34. When casting this liner 34, inserts or core pieces are located at appropriate locations so that holes 36 are left which are adapted to receive the projections 18. These projections 18 are inserted into the holes 36, preferably  
15 erably with a layer of water sealant being placed between the projections and the walls of the holes. The plugs 38 are then hammered into each of the tubular ends or bores 30 of the projections causing them to expand slightly and consequently to be jammed into the holes 36 and  
20 forming a semi-permanent connection therein. Thereafter the liner 34 will be inserted into the manhole.

The arc of lie the outer surfaces 22a of the walls 22 has a radius that is the same as that of the liner 34 so that these surfaces 22a lie substantially flush therewith.

25 In a modification shown in Figure 4, the plug 38a which is otherwise substantially identical with the plug 38, has a

end face 32 through the intermediary of a washer (not shown). For the rest, the step is identical to that described above.

After the projections are inserted in the holes 36 in the  
5 liner 34, the plugs 38a are placed in the open ends of the  
projections 18. The bolt 42 engages the nut 40. On rotation of the bolt 42, the plug 38a is drawn into the projection to expand it thereby jamming the walls of the projection against the sides of the holes 36.

10 I have found that the steps abovementioned are extremely robust and are capable of carrying very heavy loadings. Further the connection between the projections 18 with the plugs therein and the liner is firm and secure. The steps  
15 also provide a solid purchase for the foot of a person climbing on to them. Because the steps comprise nylon they are substantially impervious to acid attack.

The invention is not limited to the precise constructional details hereinbefore described and illustrated in the drawings. For example the groove may extend below the arms only or it may be omitted if desired. The various  
20 dimensions of the steps may be varied. The shape of the upper parts of the walls 22 can be changed. The step need

not be "U"-shaped. The end faces of the projections may be arcuate to lie flush with the outer surface of the liner. A suitably shaped (non-circular section) single projection may be provided.

CLAIMS:

1. A step comprising a flat tread, a wall at one end of the tread, and a projection means on the side of the wall remote from the tread, characterised in that the projection means (18) has a hollow outer part and being adapted to be fixed into a man-hole liner and to receive plug means (38) which will cause the part to expand and to seal against the holes in the man-hole wall..

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2. A step as claimed in Claim 1 wherein the said wall of the step extends downwardly below the projection means.

3. A step as claimed in Claim 1 further comprising plug means inserted in the said hollow part of the projection means causing the latter to expand.

4. A step as claimed in Claim 3 wherein the plug means has a nut cast therein and wherein a bolt passes through the tread and engages the nut to draw it into the said hollow part.

5. A step as claimed in Claim 1 wherein the tread **0174197** generally "U"-shaped in plan having a pair of arms joined by a tread part, a pair of separate walls respectively at the ends of the arms remote from the tread part, a pair of said projections respectively on said walls, and a gusset means at the edges of the said arms to reinforce said arms.

6. A step as claimed in Claim 2 wherein the tread is generally U-shaped in plan and is supported by gusset means extending on the underside to the said wall.

7. A step as claimed in Claim 1 wherein the step comprises nylon.

8. The combination of

- (i) a tubular man-hole liner having at least one pair of cylindrical holes therein, with
- (ii) at least one step that is substantially U-shaped in plan and having
  - (a) a tread part;
  - (b) a pair of arms extending therefrom;
  - (c) walls located respectively at the ends of the arms extending downwardly below the tread;
  - (d) gusset-like extensions below the arms connecting with the walls;

- (e) a pair of cylindrical projections respectively on the walls, the diameter of which is substantially the same as the diameter of the holes, the projections being received in the holes, the outer ends of the projections being hollow; and
- (f) frusto-conical plug means respectively received within the hollow ends of the projections and distorting them into engagement with the walls.

9. The combination of Claim 8 wherein the surfaces of the walls remote from the arms are arcuate and of substantially the same radius as the pipe liner.

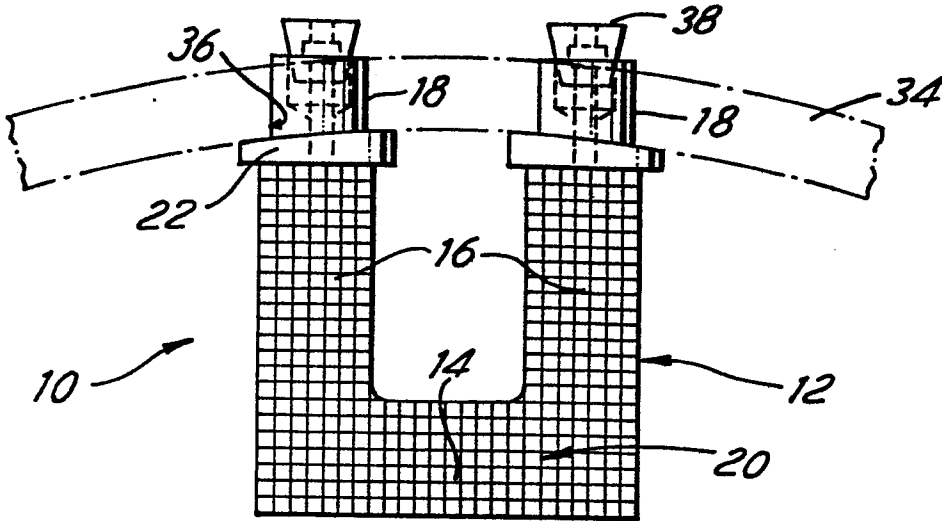


FIG. 1

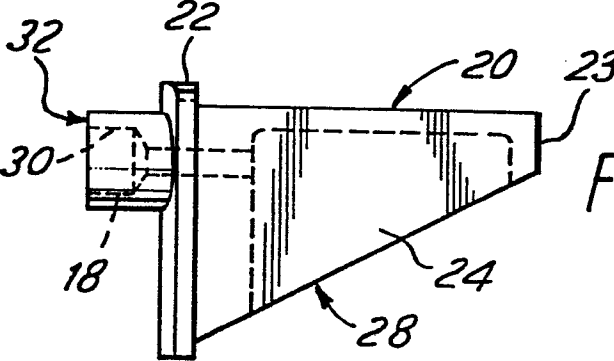


FIG. 2

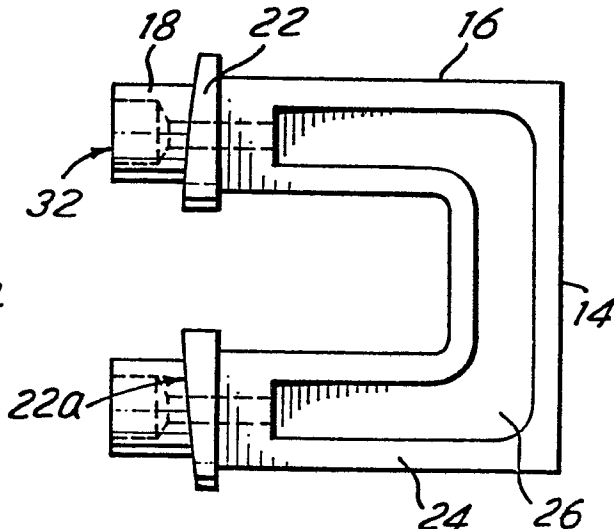


FIG. 3

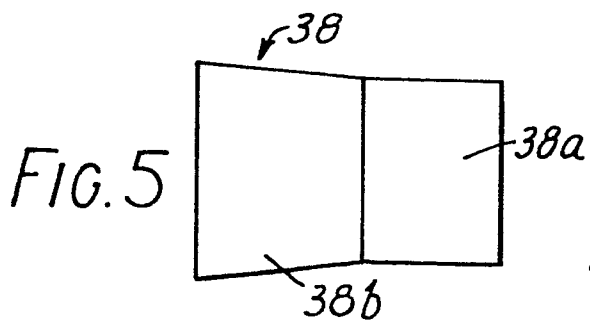


FIG. 5

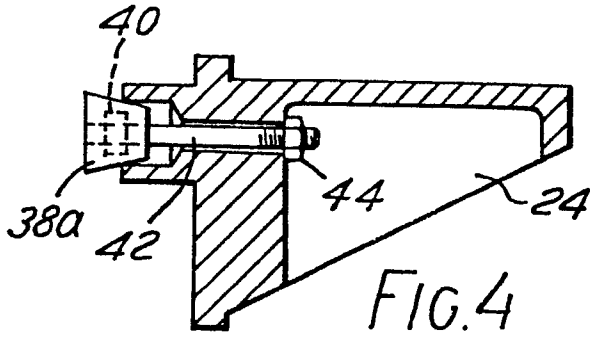


FIG. 4