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**(71) Applicant: C.V. BUCHAN (CONCRETE)
LIMITED
Sandiway House Hartford
Northwich Cheshire CW8 2YA(GB)**

72 Inventor: **Smith, Christopher Richard**
"The Old Schoolhouse"
Edingale, Tamworth, Staffordshire(GB)
 Inventor: **Forrester, Charles W.**
"Brackenwood", Off Hilderstone Road
Meir Heath, Staffordshire(GB)

74 Representative: **Adams, William Gordon et al**
RAWORTH, MOSS & COOK 36 Sydenham
Road
Croydon Surrey CR0 2EF(GB)

⑤4 Reinforced concrete lining segment incorporating nonreturn valve.

⑤7 A reinforced concrete lining segment includes a non-return valve (5) for the injection of grout, with particular application in tunnels and shafts. The non-

return valve is cast-in the segment during manufacture thereof.

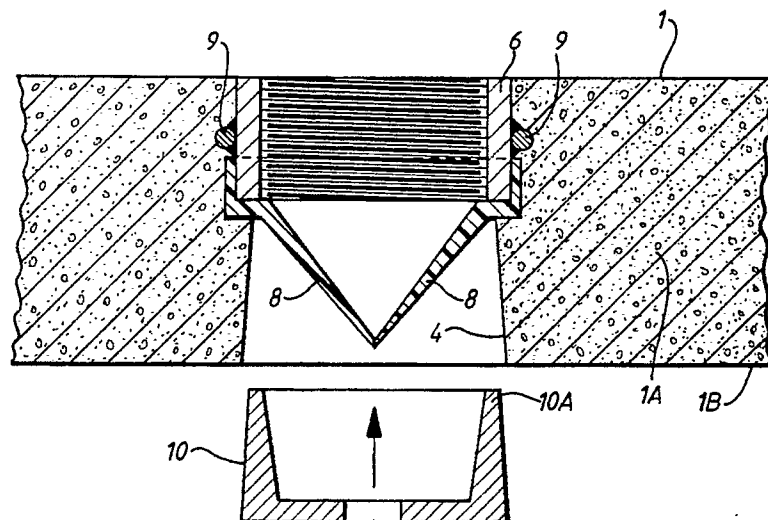


Fig.5.

REINFORCED CONCRETE LINING SEGMENT INCORPORATING NON-RETURN VALVE

This invention relates to a reinforced concrete lining segment incorporating a non-return valve for injection of grout.

Hitherto, reinforced concrete lining segments have been provided with either a plain round hole for the injection of grout via a push-fit grout nozzle or have been provided with a threaded steel socket in the hole for use with a screw-in type nozzle. The threaded socket is cast-in at the time of manufacture of the segments. After the grout holes/sockets have been used, they are sealed using either a plain concrete or timber plug hammered home or a threaded cast iron plug.

Sometimes, a non-return valve has been threaded on site into a standard grout socket, the purpose of the non-return valve being to prevent grout spillage during construction, thereby saving cleaning and other costs. They also allow the injection of grout against external pressures from either ground water or bentonite.

According to the present invention, there is provided a reinforced concrete lining segment having a non-return valve for the injection of grout, the valve being located in a bore through the thickness of the segment, characterised in that the non-return valve is cast-in during manufacture of the reinforced concrete lining segment.

The lining segment may be a tunnel or shaft lining segment.

The valve can include a moulded plastics part made of polyurethane for example. The valve can be of a composite construction with the moulded plastics part formed to fit over the outside diameter of a threaded socket, preferably of steel. The steel threaded part is for receiving the nozzle of a grout gun, whilst the polyurethane part provides the valve action. The non-return action of the valve can be provided by resilient petals depending from a skirt portion of the valve surrounding the socket, adjacent edges of the petals being resiliently biased to press against one another thereby normally to close the valve. A moulded part can also be used to assist in holding the valve in place.

Holding reinforcement for the socket can be provided by anchor wires welded to the outside of the socket.

Although reference is made herein to a lining segment, it will be appreciated that the invention extends to the case where the segment forms a complete ring.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a diagrammatic cross-sectional

view of a number of reinforced concrete lining segments bolted together,

Figure 2 is an enlarged view of one of the segments shown in Figure 1.

Figure 3 is an even more enlarged view of part of the segment shown in Figure 2 and showing it joined at an adjacent circumferential joint to another segment,

Figure 4 is a cross-sectional end view of a non-return valve and socket shown in Figures 2 and 3, and

Figure 5 is a cross-sectional side view of the valve and socket of Figure 4 incorporated in the lining segment.

Referring to the drawings, Figure 1 shows a typical bolted reinforced concrete lining made up of individual segments bolted to one another. Shown in Figure 1 are "ordinary" segments 1, two top segments 2 and a key segment 3.

One of the segments 1 is shown in more detail in Figures 2 and 3 and it will be seen that that segment is provided on casting with a through bore 4 which houses a non-return valve 5 including a cylindrical threaded socket 6.

As shown in more detail in Figures 4 and 5, the non-return valve 5 has a cylindrical skirt 7 surrounding and adjoining the circumference of the threaded steel socket 6. The valve 5 is made of polyurethane and, in the example shown, has four resilient petals 8 depending from the skirt 7 with adjacent edges that press against one another so as normally to close the valve. Anchor wires 9 welded to the socket 6 serve to hold the steel socket in place in the segment.

A moulded part 10, shown separately in Figure 5, has a central aperture in it and is fitted so that its periphery 10A fits against the non-return valve 5 at the juncture between the skirt 7 and petals 8.

The steel socket itself is known as a grout socket and is a shortened version, as compared with known types, relatively to the length of the bore through the segment. Figure 5 shows the back skin 1A of the segment 1 and the external circumference 1B, i.e. that part of the segment which is intended to lie outside of the tunnel or shaft.

The valve 5 with its socket 6, anchor wires 9 and moulded part 10 are all cast-in the segment during manufacture and are retained there after stripping, by the concrete.

The combination of the socket and valve allows grout to be injected using a steel nozzle attached to the threaded steel socket, both of which are resistant to damage.

It will be appreciated that the present non-

return valve can be incorporated in any thickness of segment from the thinnest segment to the thickest and by casting in situ, there is a cost saving advantage as compared with the fitting cost on site. In addition, the particular design type allows a greater throat area than the equivalent screw-in type.

Claims

1. A reinforced concrete lining segment (1) having a non-return valve (5) for the injection of grout, the valve being located in a bore (4) through the thickness of the segment, characterised in that the non-return valve (5) is cast-in during manufacture of the reinforced concrete lining segment.
2. A lining segment according to claim 1, wherein said valve is of a composite construction with a moulded plastics part formed to fit over the outside diameter of a threaded socket (6) for receiving the nozzle of a grout gun.
3. A lining segment according to claim 2, wherein said moulded plastics part provides the valve action and is formed by resilient petals (8) depending from a skirt portion (7) of the moulded plastics part, adjacent edges of the petals being resiliently biased to press against one another thereby normally to close the valve (5).
4. A lining segment according to claim 2 or 3 and comprising holding reinforcement for the socket (6) provided by anchor wires (9) welded to the outside of the socket.
5. A lining segment according to claim 2, 3 or 4 and comprising a further moulded part located to protect the non-return components of the valve.
6. A lining segment according to any one of the preceding claims and being a tunnel or shaft lining segment.
7. A lining segment according to any one of the preceding claims and being in the form of a complete ring.

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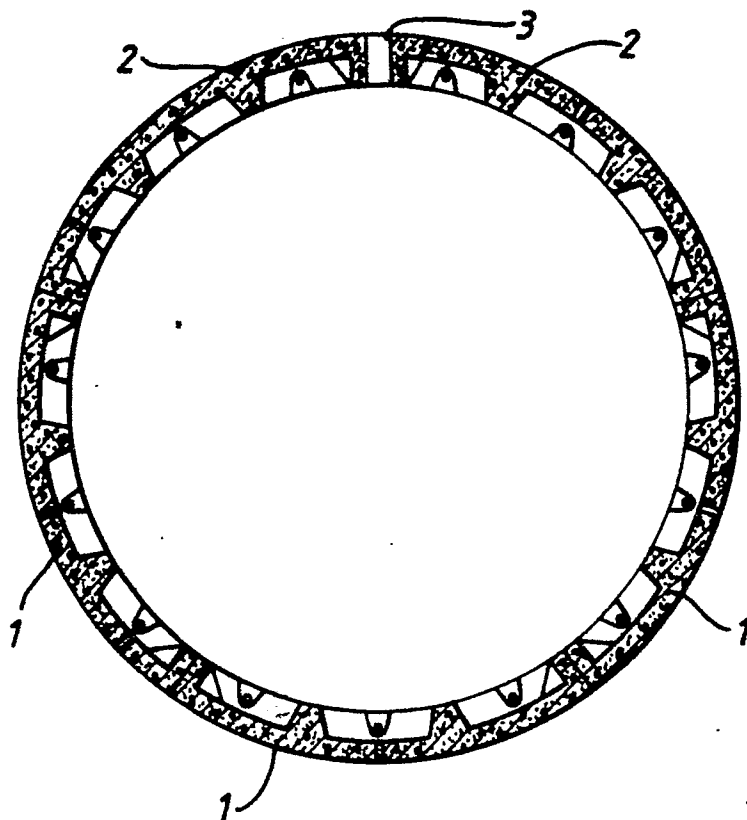


Fig.1.

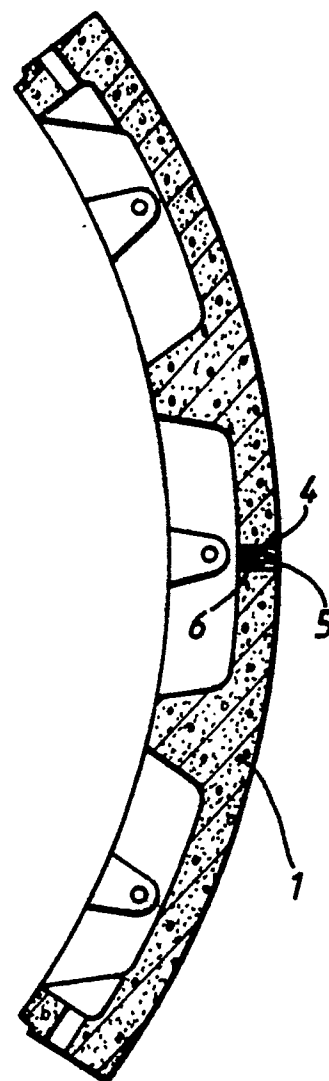


Fig.2.

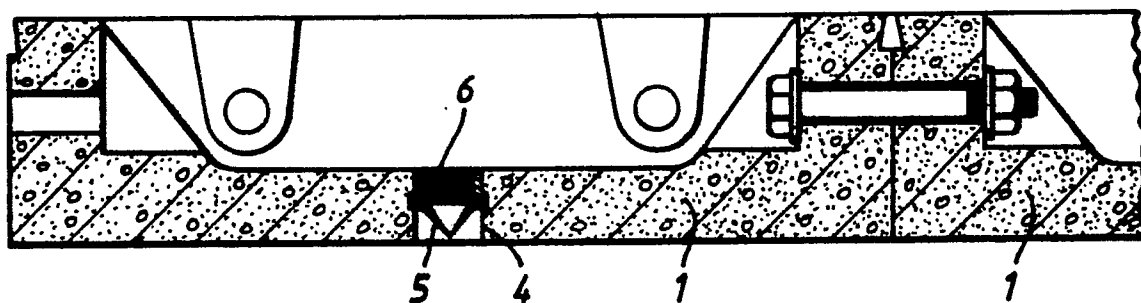


Fig.3.

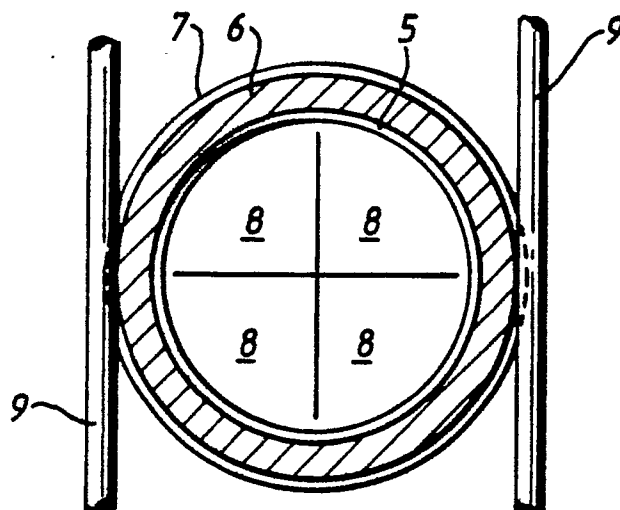


Fig.4.

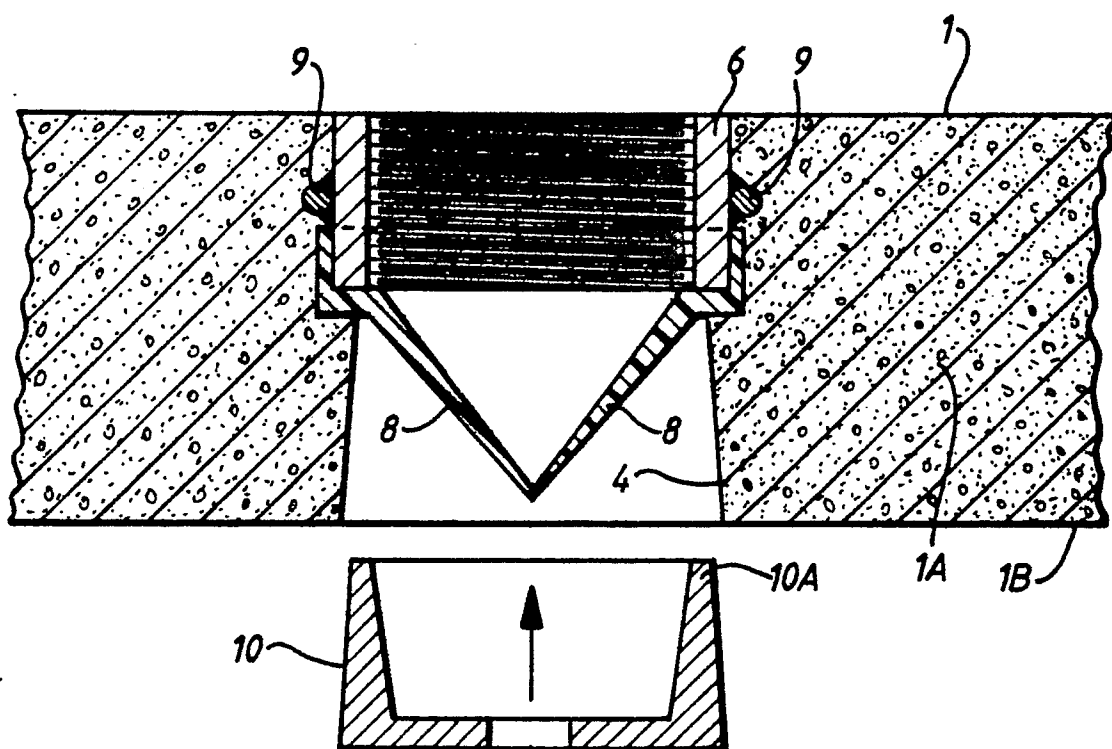


Fig.5.



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	DE-A-2 631 312 (WAYSS & FREYTAG) * Page 6; figures * -----	1,6	E 21 D 11/08
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E 21 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10-09-1990	Examiner RAMPELMANN J.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			