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BE DE DK FR GB NL(71) Applicant: **WELLING HOLDING B.V.**
Pittelderstraat 14
NL-6942 GJ Didam (NL)(72) Inventor: **Hop, Gerardus Johannes**
c/o Pittelderstraat 14
NL-6942 GJ Didam (NL)(74) Representative: **Smulders, Theodorus A.H.J.,**
Ir. et al
Vereenigde Octrooibureaux
Nieuwe Parklaan 97
NL-2587 BN 's-Gravenhage (NL)(54) **An apparatus for pouring a fluid hardening mass in layers under water.**

(57) An apparatus for pouring a fluid hardening mass, such as concrete, in layers under water is disclosed. The apparatus comprises a hopper with a downwardly directed pouring tube (1) and a widened pouring tube foot (4). The widened pouring tube foot (4) comprises, from the edge of the flowout opening (2) of the pouring tube (1), a substantially radially outwardly extending bottom plate (3). The bottom plate comprises an upright collar (10) on its outer circumference.

The bottom plate (3) of the pouring tube foot (4) has a stepped configuration, the lowermost part of which forms a supporting portion (9) adapted to rest on the bottom (12) and the higher part of which constitutes the lift portion (5, 6, 7) of the pouring tube foot (4).

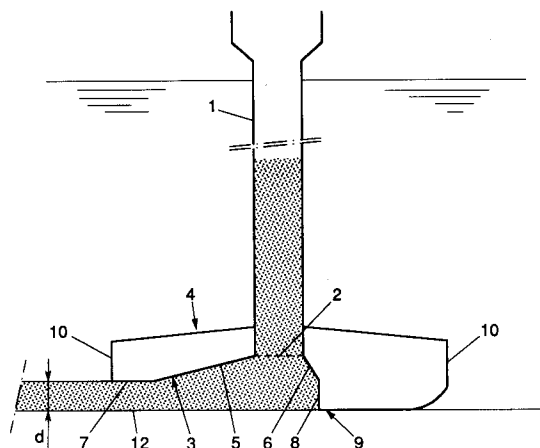


FIG. 1

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This invention relates to an apparatus for pouring a fluid hardening mass, such as concrete, in layers underwater, this apparatus comprising a hopper with a downwardly directed pouring tube and a widened pouring tube foot which comprises, from the edge of the mouth of the pouring tube, a substantially radially outwardly extending bottom plate which comprises an upright collar on the outer circumference thereof.

Such an apparatus is disclosed in Dutch patent 181,939. The pouring tube foot is of rotation-symmetrical design and is pressed in upward direction by the concrete already poured when the height of the concrete column in the pouring tube exceeds the height corresponding with the hydrostatic equilibrium of the concrete column in the pouring tube and the water column between the top of the floor which has been poured underwater and the water level on the side of the pouring tube. The lower portion of the telescopic pouring tube and the pouring tube foot "float" on the concrete. By measuring the vertical displacement of the pouring tube foot, the position of the top surface of the poured concrete layer and/or the thickness thereof can be determined.

This known apparatus enables underwater pouring of a floor whose top surface is located at a particular distance under the water level, regardless of the configuration of the bottom. When the top surface of the poured concrete layer has attained the desired level, the pouring tube is displaced laterally over a short distance by means of a displacement device, whereby the pouring tube foot will initially move in downward direction to be subsequently brought to the desired level again through the pouring of concrete.

The object of the present invention is to provide an apparatus with which a relatively thin concrete floor of a constant thickness can be poured while following the configuration of the bottom underwater. This object is achieved according to the invention by providing an apparatus of the above-described type, wherein the bottom plate of the pouring tube foot has a stepped configuration, the lowermost part of which forms a supporting portion adapted to rest on the bottom and the higher part of which constitutes the lift portion of the pouring tube foot.

The stepped design of the bottom plate of the pouring tube foot makes it possible for the apparatus to move itself over the underwater bottom and to provide thereon a floor whose thickness corresponds with the difference in height between the supporting portion and the lift portion. In fact, as soon the pouring tube is pushed upwards and the supporting portion comes clear of the bottom, a force acting in horizontal direction is exerted on this supporting portion by concrete pouring out on

the opposite side of the pouring tube foot, this horizontal force being able to displace the apparatus laterally until the supporting portion sinks onto the bottom again. In this way a continuous strip of concrete can be provided on the bottom.

In order to give the top surface of the thus poured concrete strip a level configuration, the lift portion on the side remote from the supporting portion is provided with a horizontally extending skim portion.

Preferably, the edge of the supporting portion proximal to the mouth of the pouring tube is connected to the edge of the lift portion by means of a vertical wall, this vertical wall surrounding the mouth of the pouring tube at a distance therefrom through at least 180°. This vertical wall constitutes the propulsion portion of the pouring tube foot.

In order to clearly define the direction of displacement of the apparatus, the supporting portion, in top plan view, is in the form of a dihedral angle.

It is noted that the article "Van onderwater-beton naar beton onder water" ["From underwater concrete to concrete under water"], by Hillen, in CEMENT, vol 22, no 7, July 1970, discloses a method of placing concrete under water, wherein concrete is directed to the bottom by means of a flexible pouring pipe, referred to as hydrovalve. Provided around the lower end of the hydrovalve is a shield in the form of a ring 1 m high, which forms a keel for the hydrovalve, so that it depends perpendicularly. By displacing the hydrovalve laterally, it is possible to pour a level strip of concrete. The ring is suspended at a particular height above the bottom and levels the concrete during displacement. This principle of pouring level strips of concrete is also described in the Dutch patent no. 181,939, referred to hereinabove.

One embodiment of the apparatus according to the invention will now be further explained, by way of example only, with reference to the accompanying drawings. In the drawings:

Fig. 1 is a cross-sectional view of the pouring tube with the pouring tube foot arranged at the lower end thereof;

Fig. 2 is a top plan view of the pouring tube foot; and

Figs. 3 and 4 respectively show a lateral view and a rear view of the guiding device for the pouring tube.

The pouring tube 1 is provided, adjacent the mouth 2 thereof, with a pouring tube foot 4 whose bottom plate 3 has a stepped configuration. The lowermost part of the stepped bottom plate 3 consists of a horizontally extending supporting portion which can rest on the underwater bottom 12 on which the concrete floor is to be provided. The higher-level lift portion 5, 6, 7 comprises a conical portion 5, 6, adjoining the mouth 2. The portion 6

on the side of the supporting portion 9 may have a smaller apical angle than portion 5 located opposite the supporting portion 9. The side of the lift portion 5, 6, 7 remote from the supporting portion 9 merges with a horizontally extending skim portion 7, which, in top plan view, has the shape of an arc of a circle. The vertical distance d between the skim portion 7 and the horizontal plane going through the supporting portion 9 defines the thickness of the concrete floor to be placed.

The edge of the supporting portion 9 proximal to the pouring tube 1 is connected with the edge of the lift portion 5, 6 through a vertical wall 8. As appears from Fig. 2, the vertical wall 8 surrounds the mouth 2 of the pouring tube 1 at a distance therefrom through at least 180° and preferably through about 270°. The two legs of the vertical wall 8 diverge in the direction of the skim portion 7.

In top plan view, the supporting portion 9 has a pointed shape, i.e. the form of a dihedral angle. Provided on the outermost edges of the supporting portion 9 as well as the skim portion 7 is an upwardly directed collar 10. To stiffen the pouring tube foot 4, a plurality of radially extending stiffening ribs 11 may be provided on top of the bottom plate 3.

Figs. 3 and 4 schematically show the auxiliary means arranged for guiding the pouring tube 1 during the displacement thereof. The pouring tube 1 is suspended from a yoke 14 which is displaceable in the X-direction over a frame 12 which is supported by a pontoon 13. The frame 12 is displaceable in the Y-direction, i.e. perpendicular to the direction of displacement of the yoke 14 relative to the frame 12. Such a supporting construction is known per se, so that a further explanation thereof can be omitted.

The operation of the apparatus according to the invention is as follows:

Starting from the position as depicted in Fig. 1, the supporting portion 9 of the pouring tube foot 4 rests on the bottom 12, the level of the concrete in the pouring tube 1 being in hydrostatic equilibrium with the height of the water column between the top of the floor poured under water and the water level laterally of the pouring tube 1. When in this situation a supplementary amount of concrete is poured into the pouring tube, the pouring tube foot is lifted and the supporting portion 9 comes clear of the bottom 12.

The concrete flowing from the pouring tube foot 4 on the rear side thereof exerts a horizontally directed force on the vertical wall 8 of the pouring tube foot, so that it moves laterally, together with the pouring tube, until the hydrostatic equilibrium has been achieved again and the supporting portion 9 rests on the bottom 12 again. By then, on the rear side of the pouring tube foot 4, a smooth

concrete floor of a thickness 'd' has formed, levelled by the skim portion 7.

In the manner described, a smooth concrete strip can be provided on the bottom 12, whereafter, at the end of the strip, the direction of travel can be reversed by 180° in order to pour a next strip adjacent the newly provided strip of concrete.

Claims

1. An apparatus for pouring a fluid hardening mass, such as concrete, in layers under water, said apparatus comprising a hopper with a downwardly directed pouring tube and a widened pouring tube foot which comprises, from the edge of the mouth of the pouring tube, a substantially radially outwardly extending bottom plate which comprises an upright collar on the outer circumference thereof, characterized in that the bottom plate (3) of the pouring tube foot (4) has a stepped configuration, the lowermost part of which forms a supporting portion (9) adapted to rest on the bottom (12) and the higher part of which constitutes the lift portion (5, 6, 7) of the pouring tube foot (4).
2. An apparatus according to claim 1, wherein the lift portion has a conical configuration adjacent the mouth of the pouring tube, characterized in that the lift portion (5, 6, 7) on the side remote from the supporting portion (9) merges into a horizontally extending skim portion (7).
3. An apparatus according to claims 1-2, characterized in that the edge of the supporting portion (9) proximal to the mouth (2) of the pouring tube (1) connects to the edge of the lift portion (5, 6, 7) through a vertical wall (8) which surrounds the mouth (2) of the pouring tube (1) at a distance therefrom through at least 180°.
4. An apparatus according to claims 1-3, characterized in that the supporting portion (9), in top plan view, has the form of a dihedral angle.

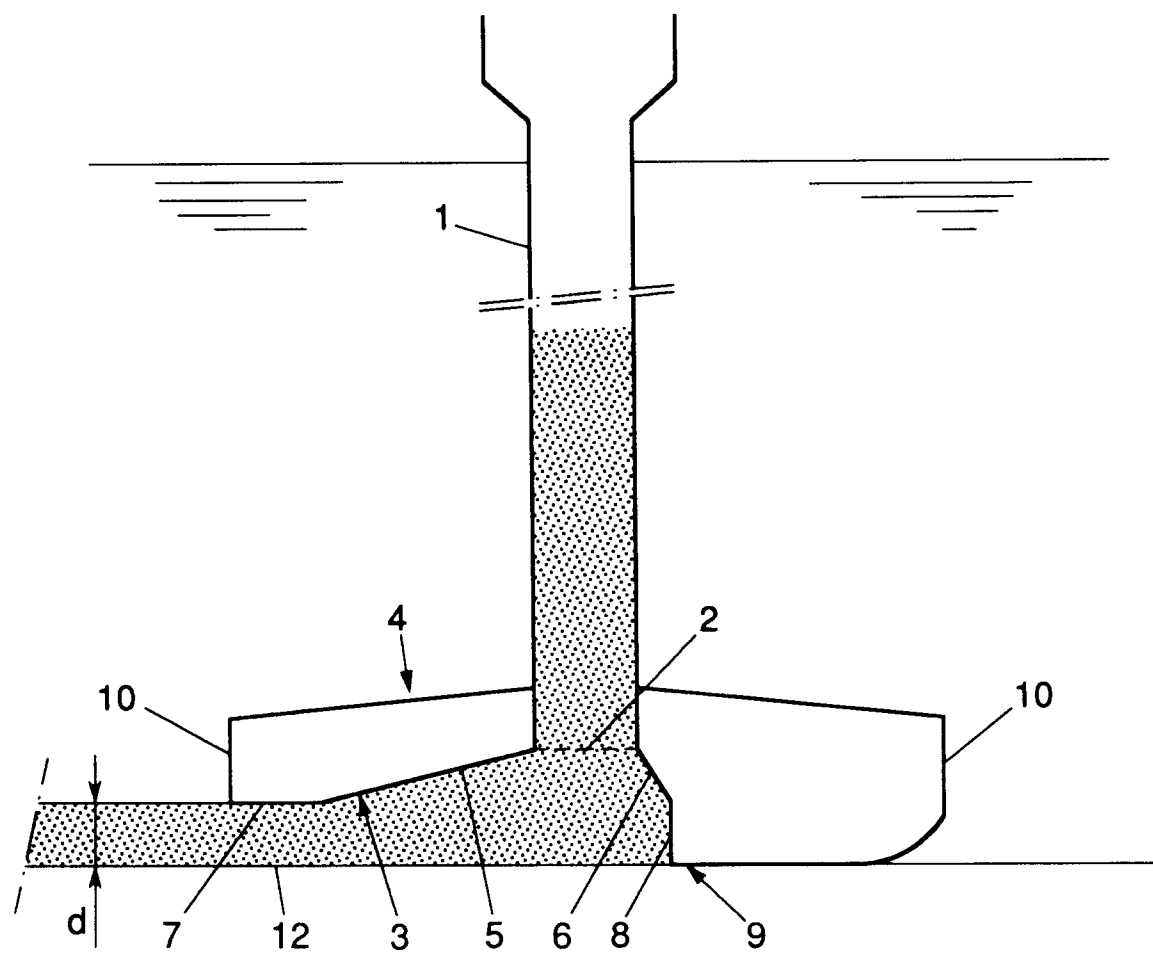


FIG. 1

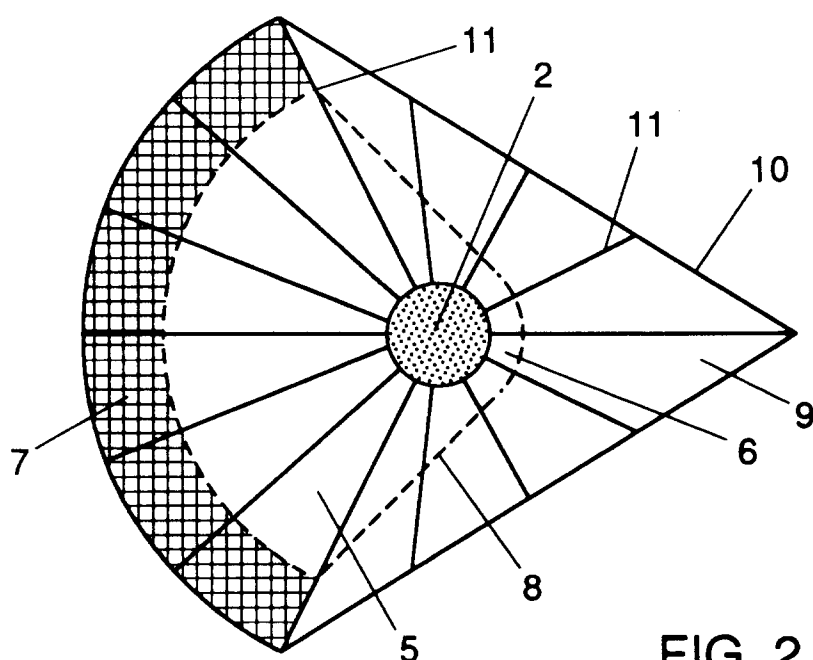


FIG. 2

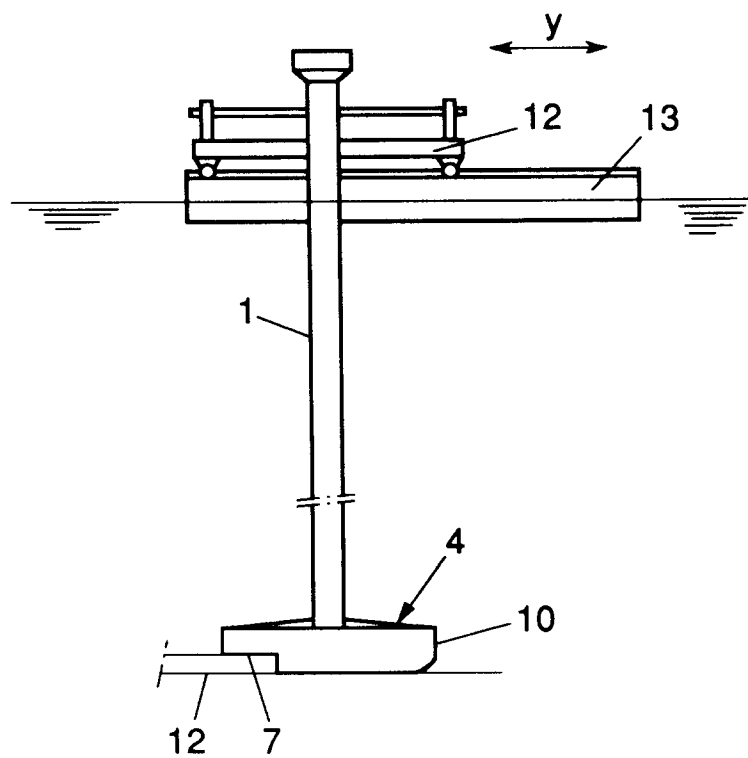


FIG. 3

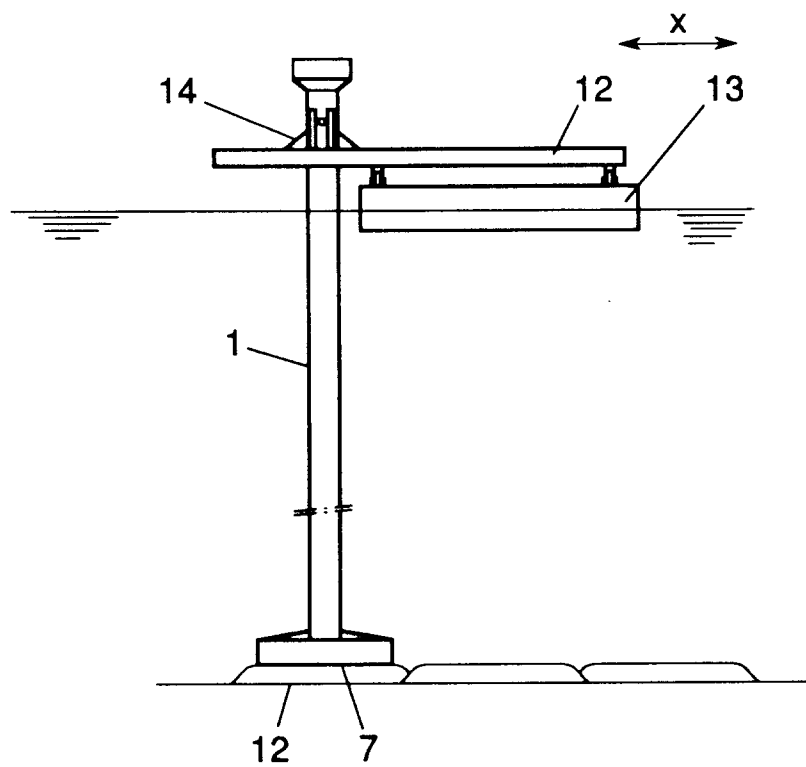


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 94 20 1774

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)
X	CEMENT, vol.22, no.7, July 1970, AMSTERDAM NL pages 298 - 304 HILLEN 'Van onderwaterbeton naar beton onder water'	1,2	E02D15/06
Y	Page 303: figure at the bottom, right	3	
A	---	4	
D,Y	NL-B-181 939 (AANNEMINGSMAATSCHAPPIJ WELLING)	3	
A	* the whole document *	1,2,4	
A	---		
	PATENT ABSTRACTS OF JAPAN vol. 9, no. 209 (M-407) (1932) 27 August 1985 & JP-A-60 070 222 (KUMAGAIGUMI K.K.) 22 April 1985 * abstract *	1	

			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			E02D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		22 September 1994	Blommaert, S
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	