(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 009 272**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **79200480.6**

(22) Date of filing: **31.08.79**

(51) Int. Cl.³: **E 02 B 3/12**

(30) Priority: **14.09.78 NL 7809351**

(43) Date of publication of application: **02.04.80 Bulletin 80/7**

(84) Designated Contracting States: **BE DE FR GB IT NL**

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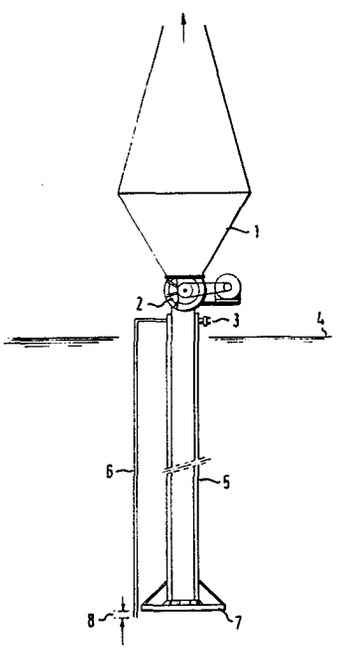
(54) A method for the stabilization of hydraulics works using an open bituminous mixture, a lining produced with this method and a chute for use in this method.

(57) A method for the stabilization of hydraulic works, such as linings on slopes, dikes, dams, beds formed by dropping aggregate, which contain a covering course of stone, said course being penetrated with a bituminous mixture, characterized in that the bituminous mixture is an open mixture of a mineral aggregate containing round gravel and mastic asphalt, which mixture penetrates the covering course completely or substantially completely.

A lining produced with this method.

A chute or pipe for use in this method.



EP 0 009 272 A1

A METHOD FOR THE STABILIZATION OF HYDRAULICS WORKS USING AN OPEN BITUMINOUS MIXTURE, A LINING PRODUCED WITH THIS METHOD AND A CHUTE FOR USE IN THIS METHOD

Hydraulic works, such as dikes, dams, jetties and breakwaters, are usually subject to severe attack by waves and currents. Fluctuating water levels may also cause loads on the lining of the dam or dike body. In order to protect such works as far as possible against wave action and currents, the slopes are lined with basalt or concrete blocks or with heavy stones. However, it has been observed that such a lining ultimately deteriorates by wave and current action unless artificial elements of very large dimensions are chosen. In particular at high tide and in stormy weather, linings of normally available stones are not always stable enough to withstand the heavy attack by waves and currents. Stabilization against such attack can be obtained by grouting with bitumen or bituminous mixtures so that a water-impermeable structure is obtained.

It has been observed that such a structure has certain drawbacks in that, due to its impermeability to water, a water pressure builds up which may impair the stability of the revetment.

The build-up of a water pressure under the revetment may be caused by the tide, wave suction and as a result of ground water flow.

The invention relates to the use of bituminous mixtures for the stabilization against wave and current action of bottom and bank linings of dikes, canals, dams, harbours, beds formed by dropping aggregate, etc. and to the method for applying said mixtures, in such a way that the build-up of a water pressure under the revetment (designated below as lining or covering course) is prevented.

From the Netherlands patent application No. 6918752 a method is already known for the stabilization against wave attack of hydraulic works, such as banks, dikes and dams, the linings of which are made of stones, which method comprises the laying of a bituminous mixture in patches which penetrate into the lining and thereafter form a discontinuous layer underneath the surface of the lining. This bituminous mixture is an impermeable mixture of bitumen, mineral aggregate and filler.

According to the invention the envisaged object may be achieved in a more effective way by using an open mixture of mastic and mineral aggregate. By mastic is meant here a mixture of bitumen and filler. Open bituminous mixtures, such as for example sand asphalt, generally have insufficient flow properties for good penetration between the stones. However, it has surprisingly been found that certain mixtures of round mineral aggregate and mastic indeed exhibit sufficient flow properties. As a result, the use of patches may be dispensed with and complete penetration achieved, while appropriate choice of the mineral moreover gives filter properties to the protecting layer.

The invention therefore relates to a method for the stabilization of hydraulic works, such as linings on slopes, dikes, dams, beds formed by dropping aggregate, which contain a covering course of stone, said course being penetrated with a bituminous mixture, characterized in that the bituminous mixture is an open mixture of a mineral aggregate containing round gravel and a mastic asphalt, which mixture penetrates the covering course completely or substantially completely.

The invention also relates to a lining thus produced and to a lining which exclusively comprises this bituminous mixture.

The lining is preferably at least 30 cm thick and preferably comprises stones having dimensions of at least 20 cm. It is also possible to apply to the bottom a continuous coating of the bituminous mixture, thereby consolidating the subsurface

without allowing groundwater pressures to arise. The round gravel, which is preferably a round and natural gravel or gravel sand, preferably has dimensions of 0.4-15 mm, in particular 1-8 mm, and is preferably mixed with 4-18% by weight, in particular 6-12% by weight, of mastic asphalt which preferably comprises filler, for example approximately 40-60% by weight, in particular approximately 50% by weight, and approximately 60-40% by weight of bitumen, in particular approximately 50% by weight. A particularly suitable bitumen is road-building bitumen having a penetration of 300-1000, in particular of 500-800 (1/10 mm, 25°C, 5 sec., 100 g); plasticizers, such as a mineral oil, and other additives may also be added, such as, for example, natural rubber or synthetic rubber, for example thermoplastic rubber of the polystyrene/polyisoprene or polybutadiene/polystyrene type.

The mastic asphalt is prepared separately, and the round, heated an dried gravel is subsequently mixed with the mastic asphalt. After mixing at, for example, 90-140°C the mixture is ready and then preferably contains at least approximately 20% of void volume.

The stone course is preferably completely penetrated with this hot mixture.

By using the present bituminous mixture containing round gravel it is possible for the stone course to be penetrated to be arranged practically directly on any existing sub-layer, it having been found that in addition to a sufficient penetrating capacity and a sufficient filter effect - also in the case of a silt-containing subsurface - sufficient stability is obtained. For these properties it has been found that the use of round gravel is essential.

The wide limits which are given should therefore be viewed in the light of the requirements which the subsurface sets in respect of the filter stability, for coarse, permeable gravel-containing subsurface requires a high degree of permeability; a subsurface of fine sand requires a lower permeability in order to be able to form a sufficiently stable filter.

It has further been found that the present bituminous mixture is capable of filling the voids between the stones within a reasonable period of time, if necessary under water by cold flow.

The method of applying the bituminous mixture may be carried out with a crane, also under water, although preference is given to a method for applying the bituminous mixture under water, in which use is made of a chute or pipe in which the liquid column present is displaced with the aid of air pressure, the upper part of the chute being provided with an airlock and the lower part preferably with a distributing device.

The airlock is preferably a continuously metering airlock, optionally provided with a fixed shaft.

The invention also relates to this method as well as to the chute itself.

An example of such a chute is shown in the Figure, in which:

1. represents a hopper;
2. a finned casing;
3. pressurized air;
4. the water level;
5. an insulated pipe;
6. a pressure relief device;
7. a distributing device;
8. a distance of approximately 5 cm.

With the aid of a chute of this type the bituminous mixture is passed in an optionally hot condition to just above the point of application as a result of the fact that the liquid column present in the chute is displaced by air. Metering of the bituminous mixture remains possible by using an airlock which preferably operates continuously and which is optionally provided with a fixed shaft.

The outlet of the chute is preferably insulated.

The chute is preferably provided with a pressure relief device of sufficient capacity, preferably comprising a small-

diameter pipe running parallel with the chute, the outlet being approximately 5 cm below the lower extremity of the chute.

CLAIMS

1. A method for the stabilization of hydraulic works, such as linings on slopes, dikes, dams, beds formed by dropping aggregate, which contain a covering course of stone, said course being penetrated with a bituminous mixture, characterized in that the bituminous mixture is an open mixture of a mineral aggregate containing round gravel and a mastic asphalt, which mixture penetrates the covering course completely or substantially completely.

2. A method as claimed in claim 1, characterized in that the covering course which is penetrated is at least 30 cm thick and contains stones having dimensions of at least 20 cm.

3. A method as claimed in claim 1 or 2, characterized in that the round gravel is a round and natural gravel or gravel sand having dimensions of 0.4-15 mm.

4. A method as claimed in any one of the preceding claims, characterized in that 4-18% by weight of mastic asphalt is present in the bituminous mixture and that the mastic asphalt contains approximately 40-60% by weight of filler and approximately 60-40% by weight of bitumen.

5. A method as claimed in any one of the preceding claims, characterized in that the bitumen has a penetration of 300-1000.

6. A method as claimed in any one of the preceding claims, characterized in that the bituminous mixture has a void volume of at least 20%.

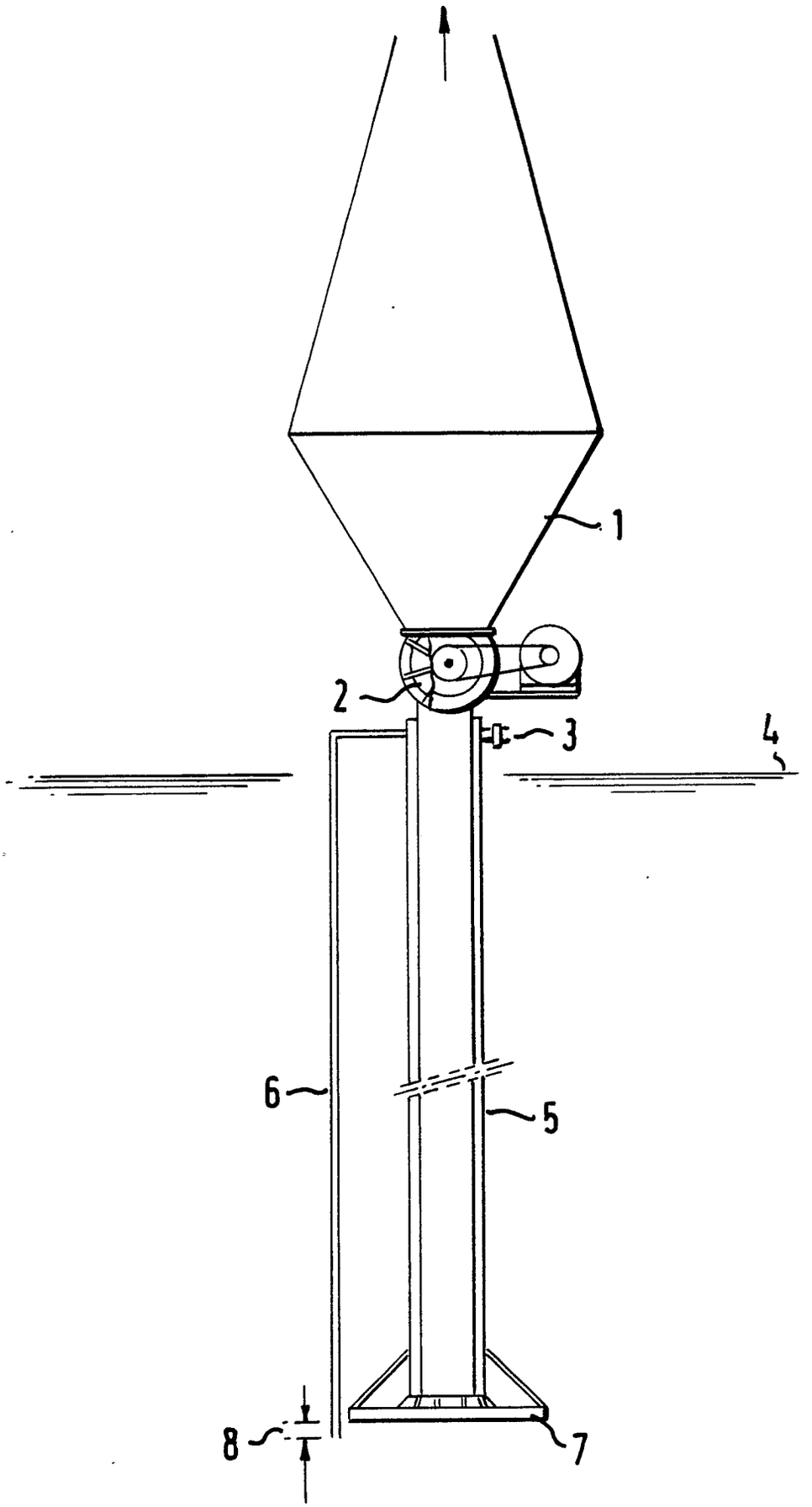
7. A lining produced with the method as claimed in any one of the preceding claims.

8. A lining which exclusively comprises a bituminous mixture as defined in any one of the preceding claims.

9. A method for the application under water of a bituminous mixture as claimed in any one of the preceding claims, characterized in that use is made of a chute in which the liquid column present is displaced with the aid of air pressure, the upper part of the chute being provided with an airlock and the lower part preferably with a distributing device.

10. A method for the application under water of a bituminous mixture as claimed in claim 9, in which the airlock is a continuously metering airlock, optionally provided with a fixed shaft.

11. A chute as defined in claim 9 or 10.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European Patent Office

PARTIAL EUROPEAN SEARCH REPORT

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application number 0009272
EP 79 20 0480

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	CH - A - 496 857 (DEUTSCHE ASPHALT UND TIEFBAU) * Column 1, lines 1-40; column 2, lines 1-40; column 3, lines 1-20; column 3, lines 51-55; column 4, lines 4-23 *	1,3,7, 8
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	OTAR, vol. 49, September 1964, 's-Gravenhage, J.A. KANT "Nieuwe type oever-bescherming ten behoeve van scheepvaartkanalen en andere water-wegen", pages 47-53. * Page 48, figure 3 *	1,2
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D	FR - A - 2 032 295 (BITUMARIN) * Claims 3 and 5 * &. NL - A - 69 18752	4
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	DE - B - 1 128 353 (BATAAFSE PETROLEUM MAATSCHAPPIJ)	5

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CLASSIFICATION OF THE APPLICATION (Int Cl.)

E 02 B 3/12

TECHNICAL FIELDS SEARCHED (Int. Cl.)

E 02 B
E 02 D

INCOMPLETE SEARCH

The Search Division considers that the present European patent application does not comply with the provisions of the European Patent Convention to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of some of the claims.

Claims searched completely: 1-9, 11
Claims searched incompletely: 10
Claims not searched:
Reason for the limitation of the search:

Neither from the description nor from the figures is to be taken what is meant by a "metering airlock" and "the fixed shaft".

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

Place of search	Date of completion of the search	Examiner
The Hague	05-12-1979	HANNAART

EPO Form 1505.1 06.78

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	* Column 1, lines 43-46; column 4, lines 62-68; column 5, lines 1,2 *		
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	DE - B - 1 091 044 (KRUK)	9,11	
	* Column 3, lines 60-70; column 4, lines 1-21; figures *		
	--		
	FR - A - 501 636 (HOCQUART)	9,11	TECHNICAL FIELDS SEARCHED (Int. Cl.³)
	* Page 1, lines 39-62; page 2, lines 1-21; figures 1,2 *		
