

(19) **DANMARK**

(10) **DK/EP 3351843 T3**



Patent- og
Varemærkestyrelsen

(12) **Oversættelse af
europæisk patentskrift**

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- (51) Int.Cl.: **F 16 L 55/18 (2006.01)** **F 16 L 55/163 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2021-06-07**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-03-10**
- (86) Europæisk ansøgning nr.: **18152301.0**
- (86) Europæisk indleveringsdag: **2018-01-18**
- (87) Den europæiske ansøgnings publiceringsdag: **2018-07-25**
- (30) Prioritet: **2017-01-18 DE 102017100917**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **Fremgangsmåde og apparat til reovering af rør**
- (56) Fremdragne publikationer:
WO-A1-88/01707
WO-A2-2012/016244
DE-A1- 4 421 290
US-A1- 2015 013 815

Method and device for renovating pipes

Description

5 **[0001]** The present invention relates to an apparatus and a method for renovating pipes. Such apparatus are known from the prior art and are also referred to as so-called renovation packers. Usually, such renovation packers have a cylindrical and also expandable tubular body, which is in particular closed or closable on both sides and has a compressed air connection. These
10 renovation packers are inserted into a damaged pipe and expanded inside this pipe. For this purpose, a renovation material is attached to the outer surface of the renovation packer and this is usually filled with a suitable resin or hardening mixture. The renovation packer is transported to the damaged area of the pipe and expanded to deposit the renovation material on the inner surface of the
15 pipe. In this way, the damaged area can be repaired.

[0002] The renovation material pressed onto the inner wall of the pipe in this way then usually requires a certain setting and curing time to ensure a stable and functional repair of the pipe or sewer. Usually, this renovation material then
20 hardens under construction site temperatures.

[0003] It is known that many of the renovation materials mentioned would cure considerably faster under higher temperatures.

25 **[0004]** The present invention is therefore based on the object of creating a renovation packer by means of which the curing time of a renovation material can be significantly reduced. According to the invention, this object is achieved by the subject matters of the independent claims. Advantageous embodiments and further developments are the subject matter of the subclaims.

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[0005] A renovation packer according to the invention for at least partial renovation of elements and in particular of pipes has a resilient main body which is expandable at least in sections by the application of a flowable medium. Furthermore, a heating device is provided in order to heat at least one

section of the renovation packer, wherein the heating device has a feed connection in order to feed a flowable medium to the renovation packer for heating thereof. Renovation is understood to mean in particular the repair of damaged areas such as holes, cracks and the like in the pipe.

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[0006] The pipes can be straight pipes as well as pipes that are curved at least in sections. The renovation packer described here can also be used to renovate other elements, such as channels, shafts, sumps, pipes or pipe components. Preferably, however, the elements to be renovated are elements into which the renovation packer can be inserted and, in particular, elements which completely surround the renovation packer in at least one circumferential direction during renovation.

[0007] Document DE 44 21 290 A1 shows a method and a conveying device for the sealing of in particular sewage pipes in public sewing systems which have overtime leakages because of wear. In the method a kind of a plastic hose is transported through the sewage pipe up to the leaking connection area by means of a specific conveying device, wherein the plastic hose is elastically deformable and a bubble is used which is within the plastic hose and which is blown up through vapour, pressurized air or the like, so that the deformable plastic hose applies in the leaking area to the inner wall of the sewage pipe to be sealed and thus seals the sewage pipe.

[0008] According to the invention, the renovation packer has an outlet opening for discharging the flowable medium from the renovation packer.

[0009] It is therefore proposed that a flowable and, in particular, a heated flowable medium is supplied to the renovation packer for heating thereof.

[0010] Advantageously, at least one space section of the renovation packer or the main body is arranged between the feed connection and the outlet opening. Starting from the feed connection, the flowable medium passes into the interior of the renovation packer, which is in particular designed as a cavity, and from there ultimately to the outlet opening.

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[0011] In a preferred embodiment, the resilient main body is tubular. This means that there is preferably a cavity in the interior of the main body which can be applied with the flowable medium. According to the invention, this resilient
5 main body has at least one and preferably two end faces. In this case, these end faces preferably close the resilient main body, so that the only openings are the feed connection and the outlet opening. This cavity can preferably extend from the feed connection to the outlet opening. It is possible that this cavity is only limited by the circumferential wall of the main body. In particular, no pipes
10 for conveying the flowable medium preferably run inside the cavity.

[0012] In a further preferred embodiment, the renovation packer and in particular its main body is designed in such a way that it can also be guided through curved pipes. In particular, due to the design of the main body as a
15 tubular body described here, it can also be designed very flexibly and can also be guided through pipes with strong curvature. The respective pipes can, as mentioned, run in a straight line as well as curved. The pipes can have angles of curvature that lie between 1° and 180°, preferably between 1° and 120° and particularly preferably between 1° and 90°. The pipes can also have different
20 cross-sections or changing cross-sections. Thus, the pipes to be renovated can also be pipe bends.

[0013] Thus, preferably, this resilient main body is essentially closed (except for the said openings). Advantageously, the outlet opening is arranged in a different
25 area of the main body than the feed connection. Advantageously, the outlet opening is arranged in a different surface area than the feed connection. This separate arrangement allows the flowable medium to cover a certain flow path in order to reach the outlet opening from the feed connection. In particular, as mentioned above, the flowable medium can pass unhindered from the supply
30 connection to the outlet opening and is in particular guided only through the wall of the main body.

[0014] A feed connection is understood to be an element to which a feed device, such as a feed line or a feed hose, can be connected. For this purpose,

the feed connection can have coupling devices to connect a corresponding hose.

5 **[0015]** In a further advantageous embodiment, a flow direction of the flowable medium in a region of the feed connection and a flow direction out of the outlet opening are the same or these flow directions do not differ.

10 **[0016]** In a further advantageous embodiment, an outer surface of the renovation packer and in particular an outer surface of the main body can be pressed against an inner surface of a pipe to be renovated. In a further advantageous embodiment, an outer surface of the renovation packer and in particular of the main body can be coated with a material which is used for renovating the respective pipe.

15 **[0017]** Advantageously, a material can be arranged on the outer surface of the renovation packer, which is applied to the inner surface of the pipe to be renovated. This material is preferably selected from a group of materials that includes GRP fabric, needle felt, aramid, Kevlar, carbon, knitted fabric, knitted polyamide, knitted textiles or combinations of these materials. These materials
20 are pressed onto the damaged area and in this way its functionality (or that of the pipe) is restored. Preferably, the surface of the main body or the renovation packer is also equipped with a hardening material, in particular a resin mixture, and this is then also brought to the corresponding damaged area inside the pipe and pressed against this inner wall.

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[0018] In a further advantageous embodiment, the main body is thus a resin-impregnated lining tube. As mentioned above, the heating enables faster curing.

30 **[0019]** In a further advantageous embodiment, the outlet opening is designed in such a way that the flowable medium can exit from this outlet opening essentially freely. It is thus proposed that, in particular at this point, no connection is provided to which a pipe is connected, but that the flowable material exits directly again from the main body or the renovation packer. In

particular, the flowable medium exits through the outlet opening directly into the environment and particularly preferably directly into the pipe to be renovated.

5 **[0020]** In a further advantageous embodiment, the feed connection and/or the outlet opening are arranged on an end face of the main body. In this way, the accessibility of these openings is facilitated.

10 **[0021]** In a further advantageous embodiment, the feed connection is suitable and intended for feeding a gaseous medium to the main body. Advantageously, this gaseous medium is hot air, water vapour or the like. However, it would also be possible for a liquid medium to be supplied via the supply connection.

15 **[0022]** In a further advantageous embodiment, the supply connection and the outlet opening are arranged on different end faces of the main body. This means that the flowable medium is fed to the main body from one side and is removed from the other side or exits from the latter.

20 **[0023]** In a further advantageous embodiment, the gaseous medium serves both for expanding and also for heating the main body. In this case, it is preferably provided that this flowable medium can flow freely within the main body at least in sections and, in particular, can flow freely up to the outlet, i.e. to the outlet opening.

25 **[0024]** According to the invention, the renovation packer has at least one valve device. This valve device is arranged by or near the outlet opening. In this way, it can be achieved that the renovation packer is applied with a specific pressure and that the valve device only opens when a specific limiting pressure is exceeded, in order to discharge the flowable medium from the renovation packer again. In particular, the valve device is thus arranged in the area of the
30 outlet opening. Advantageously, the valve device is an adjustable valve in order to be able to set the pressure at which expansion takes place.

[0025] In addition, the feed connection can also have a further valve device, in particular at the feed connection of the renovation packer. This further valve

device can be a non-return valve, for example, which allows the flowable medium to enter the renovation packer, but not to leave it.

5 **[0026]** In a further advantageous embodiment, it would also be possible for the main body of the renovation packer to be made of a material that has a certain permeability for gases. In this way, a more efficient heating of the main body can be achieved. Advantageously, the main body is made of a resilient material that has a certain thermal conductivity, so that this main body is quickly heated by the flowable medium.

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[0027] In a preferred embodiment, the material of the main body is selected from a group of materials including rubber types, silicones, silicone mixtures and plastic materials. Thus, the main body can also be formed as a plastic tube which is sewn, welded, glued or cast. Combinations of these types of
15 connections can also be used.

[0028] Advantageously, the main body has a circumferential wall. This circumferential wall preferably has a thickness which is greater than 2 mm, preferably greater than 3 mm, preferably greater than 4 mm, preferably greater
20 than 5 mm and particularly preferably greater than 6 mm. Furthermore, the circumferential wall preferably has a thickness or strength which is less than 60 mm, preferably less than 50 mm, preferably less than 40 mm. These dimensions of the wall thickness have proven to be well suited in order to achieve sufficient flexibility even for curved tubes on the one hand and to
25 enable targeted heating on the other hand.

[0029] Preferably, the cavity inside the main body has a cross-section that is larger than 4 mm, preferably larger than 6 mm, preferably larger than 8 mm. In a further advantageous embodiment, the cavity inside the main body has a
30 cross-section that is smaller than 40 mm, preferably smaller than 35 mm, preferably smaller than 30 mm. The choice of this cross-section also serves for the purpose of achieving fast and satisfactory heating of this main body.

[0030] The present invention is further directed to a renovation packer assembly comprising a renovation packer of the type described above and a compression device which produces a pressurised flowable medium to be fed to the renovation packer. In particular, this is a compressor which generates
5 compressed air. This compressed air is preferably fed to the renovation packer in order to expand it.

[0031] In a further advantageous embodiment, the renovation packer arrangement comprises a heating device which is suitable and intended for
10 heating the gaseous medium generated by the compression device. This heating device can be, for example, an electrical heating device, but heat exchangers known per se from the prior art would also be possible in order to heat the compressed air coming from the compressor device.

[0032] In a further advantageous embodiment, this heating device is connected
15 to the renovation packer via a tubular body. By means of this tubular body, the heated gaseous medium is conducted from the heating device to the renovation packer. Preferably, this tubular body is an insulated hose and/or a heatable heating hose and in particular an electrically heatable heating hose. For this
20 purpose, this conduit connection may for example comprise a material such as EPDM. In addition, this connecting line may also have metal braiding or the like, in particular in order to achieve electrical heating thereof.

[0033] In a further advantageous embodiment, the hose connection between
25 the heating device and the renovation packer is resilient.

[0034] The present invention is further directed to a method for renovating elements and in particular pipes, wherein a renovation packer is introduced into an element to be renovated and is expanded within said element to be
30 renovated by application of a gaseous medium. Furthermore, at least one section of the renovation packer is heated.

[0035] According to the invention, the heating takes place by means of a flowable medium which is introduced into at least one section of the renovation

packer, wherein the flowable medium is at least partially discharged again from the renovation packer. Preferably, the flowable medium is discharged from the renovation packer directly into the environment and/or into the pipe to be renovated, in particular if an end face of the renovation packer is still located in this pipe.

[0036] It is therefore also proposed on the process side that the renovation packer is heated by a flowable and in particular gaseous or liquid medium. Advantageously, the flowable medium is transported between the feed connection and an outlet opening without pipes, i.e. in particular without additional pipes inside the renovation packer. In this way, a very simple design of the apparatus can be achieved.

[0037] In a further advantageous embodiment, the same gaseous medium is used to expand and heat the section of the renovation packer. This means, for example, that a pressurised flowable medium is fed to the renovation packer in order to expand it. At a certain overpressure, this medium exits from the renovation packer again through an outlet. In this way, on the one hand, a certain flow of the flowable medium can be achieved within the renovation packer and, on the other hand, a desired expansion can also be achieved. In this way, the flowable medium is first fed to a cavity within the renovation packer and causes the expansion of the renovation packer there. The flowable medium is then discharged from the renovation packer via the outlet opening.

[0038] In a further advantageous method, the flowable medium, when it enters the renovation packer, has a temperature which is greater than 40 degrees, preferably greater than 50 degrees and particularly preferably greater than 60 degrees. Further advantages and embodiments can be seen in the accompanying figure. Thereby shows:

In a further preferred embodiment, the renovation packer is designed in such a way that at least one element of the renovation packer is movable relative to the element to be renovated and, in particular, can be discharged and/or removed from this element once the renovation of the element has been completed. In particular, the main body of the renovation packer is designed to be removed

from the element to be renovated, such as a pipe, after renovation has been completed.

5 Fig. 1 a schematic representation of an arrangement according to the invention for renovating pipes.

10 **[0039]** Figure 1 shows a rough schematic representation of an arrangement for renovating pipes 10 according to the invention. In this arrangement, a renovation packer 1 is inserted into the pipe 10 to be renovated. The renovation packer is then expanded by application with compressed air. In the process, an outer wall of the renovation packer, which is provided with a renovation material, lies against the inner wall and in particular against the damaged area of the pipe 10.

15 **[0040]** The reference sign 8 indicates a connection by means of which the flowable medium can be fed to the renovation packer 1. The reference sign 4 indicates the heating device in total, which is used to heat the renovation packer. This has several components, such as in particular the connection 8 for feeding the flowable medium as well as an outlet opening 6, through which the
20 flowable medium can exit from the renovation packer again.

[0041] The reference sign 12 indicates a valve device which is adjustable so that a total pressure within the renovation packer is adjustable. The reference sign 2 indicates a resilient main body of the renovation packer.

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[0042] The reference sign 50 refers in its entirety to a renovation packer arrangement comprising the above-mentioned components. This renovation packer arrangement has a compressor device 52 by means of which a pressurised flowable medium and in particular a gaseous medium is produced.
30 Starting from this compressor device, the compressed gaseous medium is fed to a heating device 54 via a connection line 56.

[0043] The flowable medium is heated by means of this heating device. The flowable medium then reaches the connection 8 and thus the renovation packer

via a connecting line, such as in particular a connecting hose 58. The main body of the renovation packer is preferably designed as an internally hollow tube, so that the flowable medium can distribute evenly within the cavity formed by the tube. Finally, the flowable medium exits again via the outlet opening 6.

5 The reference sign 22 indicates a cavity inside the main body. This cavity extends from the connection 8 to the outlet opening 6. This cavity is only formed by the circumferential wall of the main body 2.

[0044] The applicant reserves the right to claim all features disclosed in the application documents as essential to the invention, provided they are
 10 individually or in combination new compared to the prior art. It is further pointed out that the individual figures also describe features which may be advantageous in themselves. The skilled person immediately recognises that a certain feature described in a figure can also be advantageous without adopting
 15 further features from this figure. Furthermore, the skilled person recognises that advantages can also result from a combination of several features shown in individual figures or in different figures.

List of reference signs

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[0045]

	1	renovation packer
	2	resilient main body
25	4	heating device
	6	outlet opening
	8	connection
	10	pipe
	12	valve device
30	22	cavity
	50	renovation packer arrangement
	52	compressor device
	54	heating device
	56	connecting line

58 connection hose

PATENTKRAV

1. Renoverings-packer (1) til mindst delvis renovering af elementer og navnlig rør, med et elastisk basislegeme (2) som kan ekspanderes, i det mindste i visse
5 afsnit, ved tilførsel af et flydbart medium, og med en opvarmningsindretning (4) til opvarmning af mindst et afsnit af renoverings-packeren (1), hvorved opvarmningsindretningen (4) omfatter en tilløbsforbindelse (8) for tilførsel af et flydbart medium til renoverings-packeren (1) med henblik på opvarmning af denne, hvorved renoverings-packeren (1) omfatter en udløbsåbning (6) for afgivelse af
10 det flydbare medium fra renoverings-packeren (1), hvorved endeflader lukker det elastiske basislegeme, således at de eneste åbninger er tilløbsforbindelsen (8) og udløbsåbningen (6), og hvorved renoverings-packeren (1) omfatter mindst én ventilindretning (12), som er arrangeret ved eller på udløbsåbningen (6), således at renoverings-packeren (1) påvirkes af et specifikt tryk, og ventilindretningen (12) kun åbner, når et specifikt grænsetryk overskrides, med henblik på at afgive det flydbare medium igen fra renoverings-packeren (1).

2. Renoverings-packer (1) ifølge krav 1,
kendetegnet ved, at udløbsåbningen (6) er udformet således, at det flydbare
20 medium kan afgå stort set frit fra denne udløbsåbning (6).

3. Renoverings-packer (1) ifølge mindst et af de foregående krav,
kendetegnet ved, at
tilløbsforbindelsen (8) og/eller udløbsåbningen (6) er arrangeret på en endefla-
25 de af basislegemet (2).

4. Renoverings-packer (1) ifølge mindst et af de foregående krav,
kendetegnet ved, at
tilløbsforbindelsen (8) er egnet til og bestemt til at tilføre et gasformigt medium
30 til basislegemet (2).

5. Renoverings-packer (1) ifølge mindst et af de foregående krav,
kendetegnet ved, at

det gasformige medium tjener både til ekspansion og til opvarmning af basislegemet (2).

6. Renoverings-packer arrangement (50) med en renoverings-packer (1) ifølge
5 mindst et af de foregående krav samt en kompressionsindretning (52), der frembringer tryksætning af et gasformigt medium, som skal tilføres til renoverings-packeren (1) hvorved endefladerne lukker det elastiske basislegeme (2), således at de eneste åbninger er tilløbsforbindelsen (8) og udløbsåbningen (6), og hvorved renoverings-packeren (1) omfatter mindst en ventilindretning (12),
10 der er arrangeret ved eller på afgangsåbningen (6), således at renoverings-packeren (1) påvirkes af et specifikt tryk, og ventilindretningen (12) kun åbner, når et specifikt grænseværditryk overskrides, med henblik på at afgive det flydbare medium igen fra renoverings-packeren (1).

15 7. Renoverings-packer arrangement (50) ifølge krav 6 med en opvarmningsindretning (54), som er egnet til og bestemt til at opvarme det gasformige medium, der er frembragt af komprimeringsindretningen (52).

8. Fremgangsmåde til renovering af elementer og navnlig rør, hvorved en renoverings-packer (1) indføres i et element (10), der skal renoveres, og, inden i dette element (10), som skal renoveres, ekspanderes ved tilførsel af et gasformigt medium, og hvorved mindst et afsnit af renoverings-packeren (1) opvarmes, hvorved opvarmningen sker ved hjælp af et flydbart medium, som tilføres til mindst eet afsnit af renoverings-packeren (1), hvorved det flydbare medium i
25 det mindste delvist afgives igen fra renoverings-packeren (1), hvorved endeflader lukker det elastiske basislegeme (2), således at de eneste åbninger er tilløbsforbindelsen (8) og udløbsåbningen (6), og hvorved renoverings-packeren (1) omfatter mindst en ventilindretning (12), der er arrangeret ved eller på udløbsåbningen (6), således at renoverings-packeren (1) påvirkes af et specifikt tryk, og ventilindretningen (12) kun åbner, når et specifikt grænseværditryk
30 overskrides, med henblik på at afgive det flydbare medium igen fra renoverings-packeren (1).

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9. Fremgangsmåde ifølge krav 8,

kendetegnet ved, at

det samme gasformige medium anvendes til at ekspandere og til at opvarme afsnittet af renoverings-packeren (1).

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