

Process and Apparatus for the Rehabilitation of Old Piping Laid out in the Ground

The invention relates to a process for the rehabilitation of old piping laid out in the ground, preferably of a sewage conduit, making use of a resin-impregnated hose composite of fibres, felt or a fabric, which is introduced into the old piping through a shaft extending from the surface to the old piping and which, by means of a pressurising medium, is pressed against the inner wall of the old piping, whereupon the pressurising medium is heated and the pressure load and the thermal load on the hose composite are maintained until the resin has been cured.

The invention also relates to an apparatus for practising the rehabilitation process.

There has been known a process of the above-specified type in which the lining hose made from clipped felt, fibres or a fabric and provided with a fluid-impermeable layer on the outside and/or inside is impregnated with resin in the factory and transported in a refrigeration vehicle to the place of use. After cleaning the old piping to be rehabilitated, the lining hose is inserted into the old piping via a shaft. Into the shaft there is placed a reversing tube which protrudes from the upper shaft opening. The end of a standard hose is affixed to the upper edge of the reversing tube, whereas an end end of a lining hose is attached to the lower end of the reversing tube. The standard hose folds itself into the lining hose under the influence of a pressurising medium, preferably water. The standard hose, which by the water pressure is moved through the lining hose, expands the lining hose and presses the same against the inner wall of the old piping. To the free front end, namely to the inside of the standard hose, there is attached a perforated heating hose which, when the standard hose is inverted, is introduced together with the standard hose into the lining hose. After that, hot water or steam is introduced from the outside through the heating hose, whereas water is drained from the lower part of the reversing hose so that the degree of filling of the above-described open system, which accommodates the pressurising medium, is kept constant.

In the known process, only the impregnation of the lining hose is carried out above ground, and the lining hose is then transported as a cooled hose to the point of use.

The problem underlying the invention is to arrange a process of the above-specified type so that by increasing the degree of above-ground preparation, effected preferably at the point of impregnation, the expenditures and the possible sources of errors during the installation at the building site are reduced and, hence, the quality of the finished lining is improved and made uniform.

According to the invention, this problem is solved in that, above ground, compressed air is applied to invert one hose into an other, that this hose composite has on the outside and on the

inside an impermeable layer and, at the centre, at least one layer impregnated with resin, that the hose composite is closed at both ends by means of connection heads having a passage and is inserted through a shaft into the old piping and that a heated pressurising medium introduced through the connection heads and run in a closed circuit presses the hose composite against the inner wall of the conduit to be rehabilitated, keeps it in this position until the resin has been cured, and flows through the hose composite over the entire cross section in one direction during the curing operation.

In the process according to the invention, the circulating heated pressurising medium can be run through a plurality of hose composites which are interconnected by hoses or conduits and were introduced into the old piping.

By contrast to this described known process, the heating medium flows continuously through a prearranged hose system. Thus, the hose system is part of the heating circuit. Compared with the previous process, in which the heating medium circulated in the hose system, this results in an improved heat distribution over the pipe cross section and in a more readily controllable (regulated) heating and cooling characteristic and, possibly, also in a marked reduction of the heating and cooling times. Improved quality control is obtained by producing the hose composite in the manufacturing plant.

Since the pressurising medium is run through a closed system, there are no pressure variations. Furthermore, improved compaction is obtained. A plurality of old pipings can be rehabilitated simultaneously. The old pipings may be offset horizontally or laterally.

In one embodiment of the process, the heated pressurising medium is run through a closed system only during the time of resin curing. The pump and the heat exchanger which are provided in the closed system can be detached and the ends of the pipe conduits or hoses containing the pressurising medium can be shut off with blocking members. The blocking is removed at the end of the subsequently beginning cooling period and then the pressurising medium is drained off. Further, the connection heads at the end of the lining hose are removed. Ventilating means can be provided to avoid a negative pressure.

The apparatus for carrying out the process has an above-ground pressurising chamber which is operated with compressed air and has a socket for attaching an end of the lining hose and of the standard hose adapted to fold into the lining hose or of the hose foil and of the lining hose adapted to fold into the hose foil. One or more lining hoses inserted into old pipings form part or parts of a closed hose or pipe system in which at least one pump and at least one heating unit for the pressurising medium passed through the system are arranged.

Other features of the invention are obvious from the dependent claims.

Embodiments of the inventive process and of the apparatus for carrying out the process are shown in the drawings and will be described below.

There show:

Figure 1, a schematic representation of an above-ground pressurising chamber operating with compressed air;

Figure 2, lining hoses inserted in two old piping conduits offset in height and the associated pipe or hose system for running the pressurising medium through a closed circuit;

Figure 3, a section of a connection head for the end of a lining hose;

Figure 4, the above-ground folding of a lining hose into a hose foil with the aid of compressed air;

Figure 5, the above-ground folding of a standard hose into a lining hose with application of compressed air, wherein the standard hose is provided with resin carrier means; and

Figure 6, the above-ground folding of a plastic standard hose into a lining hose, likewise under application of compressed air.

Figure 1 shows a pressurising chamber 1 operating with compressed air and having a socket 2 at the edge of which there is affixed an end 3 of a standard hose 4 and an end 5 of a lining hose 6. The standard hose 4 is folded in the form of a stack 7 outside the pressurising chamber 1 and introduced into the pressurising chamber 1 through a port 8 provided with a seal 9 and is attached to the socket 2 with the loose end 3. The lining hose 6 is expanded by the compressed air, which acts in the direction of arrows 10, and accommodates the standard hose 4 in its interior.

As shown in Figure 6, the standard hose 4 can be a plastic hose 11.

As shown in Figure 5, it is also possible to coat the plastic hose 11 of the standard hose with a resin carrier 12. When the standard hose is folded into the lining hose 6, the resin carrier binds to the resin-impregnated layer 13 of the lining hose 6 which is provided with a fluid-impermeable layer 14 on the outside.

It follows from Figure 4 that it is also possible to fold a lining hose 6 into a hose foil 15 with the aid of the pressurising chamber 1.

The hose composite formed by the standard hose 4 and a lining hose 6 or by a hose foil 15 and a lining hose 6 is provided at its ends with a connection head 16 the diameter of which is smaller than that of the old piping to be rehabilitated.

The connection head, the section of which is shown in Figure 3 and which is made of, for example, aluminium or some other lightweight metal, is configured as a hollow body. The interior 17 is open at the front ends and consists of a cylindrical part 18 and a conical part 19. A

connection socket 20 provided with an outer thread is arranged before the conical part. A tensioning nut for a cable for pulling in the lining hose into old piping or a hose connector can be fixed at this connection socket.

In order to connect the ends of the lining hose with a connection head 16, the ends of the hose are drawn over the connection head which has circumferential grooves 21, 22. Attachment clamps 23, 24, which press parts of the ends of the lining hose into circular grooves 21, 22, are placed around the ends of the lining hose.

In the case of the embodiment illustrated in Figure 2, lining hoses are drawn into two old pipings 25, 26 which are accessible from the ground surface via shafts 27, 28, 29; the lining hoses can be made in accordance with the embodiments shown in Figures 4, 5 or 6. These hose-like linings are parts of a closed system for a pressurising medium, e.g., water, which via a pipe conduit or hose 30 is admitted to the connection head 16 of the hose-like lining A, runs via a connecting hose 31 through the hose-like lining B, leaves the shaft 27 via a hose or pipe conduit 32, and flows through a heating unit 33.

If only the hose-like lining B is pulled into the old piping 25, the pressurising medium is admitted via the hose or pipe conduit of the hose or pipe conduit 34 which is indicated by dash-and-dot lines and connected with the connection head of the hose-like lining B.

In order to form a module, the heating unit or the heat exchanger 33 can be combined with a pump conveying the pressurising medium in the closed system. This module can be detached for a cooling period after closing the loose ends of the pipe conduit or hoses 30 and 33 by blocking members.

The pressurising chamber 1, which operates with compressed air and is used above ground in the manufacturing plant or at the place of use, can be easily transported because its dimensions are small.

List of reference numbers

- 1 pressurising chamber
- 2 socket
- 3 end
- 4 standard hose
- 5 end
- 6 lining hose
- 7 stack
- 8 port
- 9 seal
- 10 arrow
- 11 plastic hose
- 12 resin carrier
- 13 layer
- 14 layer
- 15 hose foil
- 16 connection head
- 17 interior
- 18 cylindrical part
- 19 conical part
- 20 connection socket
- 21 groove
- 22 groove
- 23 attachment clamp
- 24 attachment clamp
- 25 old piping
- 26 old piping
- 27 shaft
- 28 shaft
- 29 shaft
- 30 hose line
- 31 connecting hose
- 32 hose or pipe conduit
- 33 heating unit
- 34 hose or pipe conduit



Claims

1. A process for the rehabilitation of an old piping laid out in the ground, preferably of a sewage conduit, making use of a resin-impregnated hose composite of fibres, felt or a fabric, which is introduced into the old piping through a shaft extending from the surface to the old piping and which, by means of a pressurising medium, is pressed against the inner wall of the old piping, whereupon the pressurising medium is heated and the pressure load and the thermal load on the hose composite are maintained until the resin has been cured, characterised in that, above ground, compressed air is applied to invert one hose into an other, that this hose composite has on the outside and on the inside an impermeable layer and, at the centre, at least one layer impregnated with resin, that the hose composite is closed at both ends by means of connection heads having a passage and is inserted through a shaft into the old piping and that a heated pressurising medium introduced through the connection heads and run in a closed circuit presses the hose composite against the inner wall of the conduit to be rehabilitated, keeps it in this position until the resin has been cured, and flows through the hose composite over the entire cross section in one direction during the curing operation.
2. The process according to Claim 1, characterised in that for setting up the hose composite above ground, a standard hose (4) is folded into the flat lining hose (6) or a lining hose (6) is folded into a hose foil (15) with application of compressed air and that the ends of the lining hose (6) provided with a folded-in standard hose (4) or with the enclosing hose foil are fitted with the connection head (16) to which tensioning means or hoses or conduits (30, 31, 32, 34) can be connected.
3. The process according to Claim 1, characterised in that the circulating heated pressurising medium is run through a plurality of hose-shaped linings A, B which were drawn into possibly horizontally or laterally offset old pipings (25, 26) and are interconnected by hoses or conduits (31).
4. The process according to any one of Claims 1 to 3, characterised in that, only during the time of curing, the heated pressurising medium is circulated in a closed system and, subsequently, the pump and the heating unit are detached and the ends of the pipe conduits or hoses (30, 32) are shut off with a blocking member until cooling of the pressurising medium has taken place.
5. Apparatus for carrying out the process according to Claim 1, characterised in that above ground there is provided a pressurising chamber (1) operated with compressed air, which chamber has a socket (2) for fixing an end of the lining hose (6) and of the standard hose (4) or of the hose foil (15) adapted to be folded into the lining hose (6) and of the lining hose (6) adapted to be



folded into the hose foil (15) and that one or more hose-shaped linings A, B inserted into old pipings (26, 26) are part or parts of a closed hose system or pipe system, wherein at least one pump and at least one heating unit for the pressurising medium run through the system are arranged.

6. The apparatus according to Claim 5, characterised in that the pump and the heating unit form a module (33) and that blocking members and ventilating means are provided in the pipe conduits or hose lines (30, 32).

7. The apparatus according to Claim 5, characterised in that the connection head (16) is configured as a hollow body the interior of which is open at the front ends and is formed by a cylindrical part (18) and a conical part (19) changing to a cylindrical connection socket (20) provided with an external thread to which a tensioning nut or a hose connector can be applied.

8. The apparatus according to Claim 7, characterised in that the cylindrical part (18) has annular grooves (21, 22) to accommodate part of an end of the lining hose slid onto the connection head, as well attachment clamps placed around the hose end.

9. The apparatus according to Claim 5, characterised in that the standard hose (4) which is adapted to be folded in or the lining hose (6) which is adapted to be folded in is stored in folded form outside the pressurising chamber (1), passed through the pressurising chamber (1) via a port (8) provided with a seal (9) and through the socket (2), and attached at the edge of the socket.