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DESCRIPTION

The invention relates to a system and method for installation of a pipe in a wall opening.

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Installation feed-throughs through walls are required for example in house lead-ins for new buildings, old buildings and renovation. In this case, pipes are usually guided through openings in a building wall in order to implement house connections for power, gas, water and district heating or communication lines etc. which are usually laid under the ground.

10 The pipes are used to protect the lines introduced into the house (US-A-4 607 469).

In addition, openings in building walls or all other types of openings, feed-throughs or beadings in the aircraft industry, vehicle industry, mechanical engineering, shipbuilding, swimming pool construction and the electric/electronics areas frequently need to be filled
15 and potted. In this case, a gas-tight and water-tight sealing of the openings or of pipes in the openings is usually required for this. Requirements for this are frequently specified in standards which can apply for example for a respective country or internationally.

In the following description, for the sake of simplicity reference is made in particular to
20 openings in building walls even if the descriptions also apply similarly for openings in walls in the other said areas of application.

Numerous standards apply in the building area, as to what is understood as a utilizable and defect-free execution of house connection elements as a single component or as part
25 of the structural shell such as for example a building or a ship. At the present time, such standards are DIN 1986, DIN 1988, DIN 18012, DIN 18195, DIN 18336, G-459-1, G-459-2, G-459-1-B, VP-601, EW-400-1, EW-400-2, EW-400-3, W-404, GW-322-2.

This means for example that house connections including mouldings, fittings and
30 connections must be both tightly sealed and conditioned and installed so that they withstand the stresses which occur when operated as prescribed. For this purpose, the annular space between house connection line and jacket pipe as well as the mounting

opening between jacket pipe and wall or base plate or housing connection line and wall or base plate must be capable of absorbing to a limited extent shrinkage and swelling movements as well as component deformations and must be tightly sealed to the connection space. In addition, house connections should be dimensioned at least for the maximum permissible operating pressure for which the pipe network to which the house connections are connected is designed or built. Critical points here are always the annular space seals towards the housing wall or jacket pipe for the house lead-in or the house lead-in combination system.

At the present time, hydraulic expansive mortars are used for said areas which require a waiting time of several days for their load-bearing capacity inter alia (final full hardening after 28 days). Even then hydraulic expansive mortars can only absorb small forces because of a lack of controlled filling of the annular space. As a result of lack of adhesion to the wall feed-throughs or core drill openings and especially PVC or PE plastics (e.g. house guidance combination systems), they also lose their original sealing function under loading. As a consequence, ground or seepage water as well as gas can penetrate the house lead-in and cause considerable damage. In addition, the loss of the water used together with the hydraulic expansive mortar introduced is very difficult to adjust or cannot be adjusted at all. The maximum guaranteed expansion of the expansive mortar is 0.3 % volume (e.g. 1000 ml fill volume corresponds to 2.5-3.0 kg of dry mass + water gives 0.5 volume = 1009 ml fill volume).

In addition, joint filling materials made of expanding resins based on polyurethane resins such as PU foams, PUR assembly foams etc. having a higher weight per unit volume are known. Due to their specification, these are always open-cell. As a result, expanding resins based on polyurethane resin are neither gas-tight nor water-tight. In addition, as a result of hydrolysis (splitting of a chemical compound with addition of a water molecule), they have a low durability and do not meet the requirements of the DVGW work sheets of G459 / VP601 / W400 / W404 / G322-2 / DIN 18195 / 1988 for annular space sealing for operating pressures up to 4 bar (1 bar = 10^5 Pa). In addition, they do not comply with the energy saving regulation for building construction in relation to a required airtightness (DIN 4108 Part 7 Edition 2002).

The installation technology for the sealing of gas and water house lead-ins in the civil engineering area requires a far higher degree of permanent reliability of the gas-tight and water-tight filling products compared with hydraulic expansive mortars and/or polyurethane resins on the basis of DVGW Standard G459-1 with an operating pressure of up to 4 bar (1 bar = 10^5 Pa) or DVGW Standard VP601 with an operating pressure of 1 bar (1 bar = 10^5 Pa).

It is therefore the object of the invention to provide a system and a method for installation of a pipe in a wall opening for a gas-tight and water-tight sealing of pipes in wall openings.

The object is solved by a system for installation of a pipe in a wall opening according to Patent Claim 1. Advantageous embodiments of the system are specified in the dependent patent claims.

The system comprises a space generating device for generating a chambered space between the pipe and the wall opening, expanding injection resin with an expansion volume of 3.0 to 5.0 : 1 in the chambered space for introducing into the chambered space generated by the space generating device, and a filling pipe for filling the chambered space generated by the space generating device with the expanding injection resin and for inserting into the space generating device.

The filling pipe preferably has a sleeve extension and a viewing and inspection cap for viewing and inspecting a fill level of the expanding injection resin in the chambered space, wherein the filling pipe is provided for inserting into the space generating device in such a way that the viewing and inspection cap is arranged outside the chambered space generated.

It is inter alia advantageous for trenchless (without a head hole) exchange of gas and water pipelines if the space generating device comprises a pipe collar for attaching to the pipe and for introducing between the wall opening and the pipe.

The space generating device can have a centring ring having a flange for placing against the wall surrounding the wall opening, wherein the centring ring has a filling opening for inserting the filling pipe.

- 5 The expanding injection resin has an expansion volume of 3.0 to 5.0 : 1 in the chambered space, preferably an expansion volume of 3.5 to 4.0 : 1 in the chambered space. Here the expanding injection resin does not shrink when it is cured. In addition, the expanding injection resin can have a solid volume of 100 % when it is cured. It is possible that the expanding injection resin is gas-tight under an operating pressure of at least up to 4 bar
- 10 (1 bar = 10^5 Pa) and is water-tight under an operating pressure of at least up to 10 bar (1 bar = 10^5 Pa), when it is cured. This gas- and/or water-sealing property of the expanding injection resin in the cured state is based in particular on the surface condition. The surface here is to be understood as the contact surface of the expanding injection resin with respect to the surroundings, for example the masonry or the pipeline. Preferably the
- 15 surface of the expanding injection resin in the cured state does not have an open-cell porous structure as is known for example from the afore-mentioned PU foams or PUR assembly foam but preferably has a closed-pore surface which additionally acts as a diffusion barrier for gaseous or liquid substances. It is further feasible that the surface of the cured injection resin has recesses which are caused by the propellant released during
- 20 expansion. Preferably however these recesses are configured to be closed towards the volume of the cured injection resin so that no continuous channel formation through the volume is brought about. This is advantageous since the gas- and/or water-sealing property of the cured injection resin is thus determined.
- 25 Furthermore the expanding injection resin in the chambered space has a density of greater than equal to 400 kg/m^3 . This is advantageous since such a high density of the expanding injection resin in the chambered space forms a stronger sealing of the area to be sealed, for example, in relation to water or gas than comparable expanding injection resins which have a lower density in the chambered space.

The pipe collar has a flexible tubular body which has a plurality of annular bulges. In this case, one end of the flexible tubular body has a smaller circular cross-section than another end of the flexible tubular body.

- 5 The annular bulges have a different width. It is advantageous if they have a different outer annular diameter.

In addition, the largest annular bulge of the plurality of annular bulges can be a half ring, which forms the other end of the annular body with the larger circular cross-section and
10 which is formed by intersecting a ring in the plane of its diameter.

The end of the tubular body with the smaller circular cross-section can adjoin the narrowest annular bulge of the plurality of annular bulges.

- 15 It is also possible that the plurality of annular bulges are arranged in such a way that the outer diameter of the plurality of annular bulges increases from the end of the tubular body with the smaller circular cross-section to the end of the tubular body with the larger circular cross-section.

- 20 The aforesaid object is also solved by a method for installing a pipe in a wall opening according to Patent Claim 13.

The method comprises the steps: inserting the pipe in the wall opening; inserting a filling pipe into the space between pipe and wall opening which is used to fill expanding
25 injection resin into the space; inserting the filling pipe into a space generating device; producing a chambered space between the pipe and the wall opening with the space generating device; and introducing expanding injection resin having an expansion volume of 3.0 to 5.0 : 1, preferably of 3.5 to 4.0 : 1 in the chambered space into the chambered space generated with the space generating device.

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The step for generating a chambered space between the pipe and the wall opening is executed with a space generating device which comprises a pipe collar constructed as

described previously and centring ring having a flange for placing against the wall surrounding the wall opening, wherein the centring ring has a filling opening for inserting the filling pipe. Here the method comprises the steps: pre-mounting the pipe collar on the pipe before the pipe is inserted into the wall opening, wherein the pipe collar is pre-mounted on the pipe in such a way that the end of the tubular body with the smaller circular cross-section is fastened to the pipe by cable ties; pushing the pipe with the pre-mounted pipe collar into the wall opening in such a way that the end of the tubular body with the smaller circular cross-section is firstly pushed into the wall opening, wherein the pipe with the pre-mounted pipe collar is pushed further through the wall opening than the pipe collar is long; moving the pipe and thereby the pre-mounted pipe collar in such a way that the pipe collar opens out again on the pipe; withdrawing the pipe from the wall opening until the pipe collar abuts externally against a side of the wall surrounding the wall opening; clamping the centring ring between the pipe and wall opening by pushing the filling pipe into the filling opening of the centring ring.

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With the previously described system and method, a permanent non-positive gas- and pressurized water-tight connection is achieved for sealing and fastening up to 4 bar (1 bar = 10^5 Pa) in front of the building wall and all types of pipe feedthrough combined with a high retention >30 kN.

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In relation to an ambient temperature such as, for example 15 °C, the system can seal the space between a core bore and its installation parts or the parts installed therein over the entire cross-section of the building wall in a controlled, permanent, gas- and water-tight, non-positive and positive manner. This property is guaranteed in particular by the favourable expansion ratio of 3.0 to 5.0 : 1 of the expanding injection resin in the chambered space. The finished installation is gas- and water-tight in accordance with DIN 1986, DIN 1988, DIN 18012, DIN 18195, DIN 18336, DVGW EW-400-1, EW-400-2, EW-400-3, W 404, DVGW G-459-1, G-459-2, G-459-1 B, DVGW VP-601, GW-322-2 and meets the highest requirements for retention as specified previously.

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By using core drilling systems to produce controlled drill openings, centring sets adapted for the house lead-ins can be used. The advantage of this rapid installation method lies in

the horizontal centring of the house lead-in with respect to the core drill opening. This ensures that the space to the core drill opening and the installation systems over the entire cross-section of the building wall can be made as small as possible, thereby avoiding axial forces on the housing lead-in. Components, such as for example, house lead-ins which
5 can transmit a torsional moment after installation are preferably installed in such a manner that they withstand torsional moments DN 25 (1") 240 N/m, DN 32 (1 1/4") 300 N/m, DN 40 (1 1/2") 360 N/m, DN 50 (2") 480 N/m with an action time of 10 seconds.

In addition, the expanding injection resin, the pipe collar and all the necessary parts are
10 inexpensive and their installation is very simple and therefore also time-saving and cost-effective.

The invention is described in detail hereinafter with reference to the appended drawing.
In the figures:

15 Fig. 1 shows a cross-sectional view of a pipe installed in a wall opening;

Fig. 2 shows a manual pressure gun for filling expanding injection resin into a filling pipe;

20 Fig. 3 shows another cross-sectional view of a pipe installed in a wall opening;

Fig. 4a shows a cross-sectional view of a pipe installed in a wall opening executed as a core bore;

25 Fig. 4b shows a plan view of a centring with flange and filling opening in installation position;

Fig. 4c shows a plan view of a centring without flange but with filling opening in
30 installation position;

- Fig. 5 shows another cross-sectional view of a pipe installed in a wall opening executed as a core bore;
- 5 Fig. 6a shows another cross-sectional view of a pipe installed in a wall opening executed as a core bore;
- Fig. 6b shows a plan view of a centring with flange and filling opening in installation position;
- 10 Fig. 6c shows a plan view of a centring comprising two centring ring half-shells without flange in installation position;
- Fig. 7 shows a cross-sectional view of a pipe installed in a wall opening executed as a core bore when making a trenchless pipe renovation;
- 15 Fig. 8 shows a cross-sectional view of a pipe collar; and
- Fig. 9 shows another cross-sectional view of a pipe installed in a wall opening executed as a core bore when making a trenchless pipe renovation.

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In the following description, the same and equivalent parts are provided with the same reference numbers.

(First exemplary embodiment)

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In Fig. 1 a pipe 10 through which a medium-guiding line 11 is guided is installed in an opening 12 in a building wall 13 or a wall opening 12. The pipe 10 is centred on the outer side 14 and inner side 15 of the building wall 13 in the wall opening 12 with a foam sealing and centring strip 16 in the wall opening 12, wherein the outer side 14 of the building wall 13 or the wall opening 12 adjoins the soil 17. Openings 18 to the soil 17 are provided in the foam sealing and centring strip 16 on the outer side 14 of the wall opening 12. The centring of the pipe 10 in the wall opening 12 on the inner side 14 of the wall

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opening 12 can be accomplished using quick fixing mortar instead of the foam sealing and centring strip 16.

5 A filling pipe 19 is inserted in the foam sealing and centring strip 16 on the inner side 15 of the wall opening 12 in order to fill expanding injection resin 20 into a space 21 formed between pipe 10, wall opening 12, foam sealing and centring strip 16 on the outer side 14 and foam sealing and centring strip 16 on the inner side 15. This space 21 is more accurately a chambered space 21 or chambered annular space.

10 With the expanding injection resin 20, it is possible to achieve a non-positive sealing and fastening of the pipe 10 in the wall opening 12, wherein component movements (torsion) are allowed and an axial torsional resistance exists. The expanding injection resin 20 is described in greater detail hereinafter.

15 The foam sealing and centring strip 16 on the outer side 14 and the foam sealing and centring strip 16 on the inner side 15 of the wall opening 12 are parts of a space generating device. The foam sealing and centring strip 16 is preferably self-adhesive on one side. It consists of a rot-proof, impregnated foam, which is installed in a pressed-back state and thus centres the installation components, i.e. the pipe 10 etc.

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As a result of the openings 18 to the soil 17 in the foam sealing and centring strip 16 on the outer side 14 of the wall opening 12, the expanding injection resin 20 partially emerges towards the earth 17, as can be seen from Fig. 1.

25 The filling pipe 19 is shown with a sleeve extension 19a in Fig. 1. A viewing and inspection cap 22, shown in Fig. 2, for viewing and inspecting a fill level of the expanding injection resin 20 in the chambered space 21 can be placed on the filling pipe 19. When the viewing and inspection cap 22 is removed from the filling pipe 19, the expanding injection resin 20 can be filled into the filling pipe 19 and therefore the chambered space
30 21 with the aid of a manual pressure gun 30 with nozzle tip 31 shown in Fig. 2. The mixing rod 32 shown in Fig. 2 is used for mixing the two-component expanding injection resin 20, which will be described in further detail subsequently.

Any openings present in the building wall 13 under the wall opening 12 which can be present for example in a wall built of brick masonry or hollow chamber blocks should be filled with filler granules before installation of the pipe 10 in the wall opening 12. It is furthermore also feasible to fill corresponding openings with the expanding injection resin whilst at least partially dispensing with filler granules. This is advantageous since as a result of the gas- and/or water-sealing effect of the cured expanding injection resin, cavities which are particularly liable to the build-up of damp are filled in order to thus avoid the formation of mould in the masonry.

The described sealing of the pipe 10 in the building wall 13 is permanently water-tight. The remaining cavity is only as gas-tight as the building material of the building wall 13.

The expanding injection resin 20 is a gas- and water-tight two-component epoxy resin (injection resin foam) having a very high density, hardness and compressive strength with built-in propellant for independent, controlled increase in volume.

The built-in propellant causes the expansion of the injection resin preferably due to chemical reactions. When components A and B are mixed together, energy in the form of heat is produced in an exothermic reaction process. This heat is sufficient to separate volatile constituents from the components, causing an increase in the volume of the injection resin. Furthermore, by means of a supply of a gas, for example CO₂ or (partially fluorinated) hydrocarbons, the injection resin can undergo a volume expansion. Depending on the choice of the predefined propellant, the chambers in which the components A and B are arranged or in the chamber sections or injection nozzle sections in which a mixture of components A and B is made, should accordingly be formed of heat-stable material and/or pressure-resistant material.

The expanding injection resin 20 is suitable for non-positive sealing and fastening of pipe feedthroughs in new buildings, old buildings and renovation as well as filling or potting of:

- House connections for power, gas, water, district heat
- House connections for communication lines
- 5 - Wall openings in building walls
- All types of openings, feedthroughs or beading in the aircraft industry, mechanical engineering, shipbuilding, swimming pool construction and the electrical/electronic areas.

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The material basis of the expanding injection resin 20 is a chemically curing two-component epoxy resin. More precisely, the expanding injection resin 20 consists of an A component (expanding injection resin) and a B component (expanding injection curing agent) which are to be mixed together before use. For this purpose, the expanding injection resin is preferably supplied in a double-chamber cartridge in which the A and B components are accommodated in separate chambers in the delivered state. Before filling the expanding injection resin 20 for example into an opening, the separation between the two chambers should be removed and the A and B components of the expanding injection resin 20 should be mixed together. This can be accomplished by inserting the double-chamber cartridge filled with the A and B components into the manual pressure gun 30 shown in Fig. 2 and depressing a plate provided between the individual chambers of the double-chamber cartridge, which is not shown in Fig. 2. About 40 to 50 mixing strokes are to be executed with the mixing rod 32 in order to mix the A and B components of the expanding injection resin 20.

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The configuration of the double-chamber cartridge described is not restricted to the listed example. Furthermore, it is thus feasible that the two chambers in which component A and component B are each spatially separate from one another are arranged directly adjacent to one another and have a common contact surface in their longitudinal direction. Preferably no additional housing which encloses the two chambers is provided. This side-by-side arrangement of the chambers is particularly advantageous since the aforementioned manual mixing of components A and B is omitted. After inserting the

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chambers into a manual pressure gun suitable for this purpose (not shown), each chamber is subjected to pressure which causes both components A and B to exit into the injection nozzle 31 and sufficient mixing thereof inside the injection nozzle. Preferably the chambers are exposed to the same pressure, preferably manually. Furthermore each of the
5 chambers can be exposed to a different pressure by means of the manual pressure gun which occurs particularly when component A and component B are required in different mass fractions to produce the 2K mixture. It is therefore feasible that the two chambers A and B preferably have different volumes for receiving components A and B. Furthermore, it is feasible that the common contact surface between the chambers is
10 detachable and can be at least partially removed by application of tension.

It is furthermore feasible that the chambers are arranged coaxially to one another and are preferably enclosed by a housing at least in their longitudinal direction. In this case, one chamber is enclosed by the second chamber in a jacket-like manner wherein the
15 components arranged in the chambers are spatially separated from one another. When pressure is applied to such a cartridge in a suitable manual pressure gun, in the simplest case both chambers are exposed to the same pressure which causes the exit of both components from the respective chamber into the injection nozzle 31. Advantageously the components are mixed inside the injection nozzle 31 which has turbulence elements
20 such as for example elements wound helically or arranged in a plate-like manner, for better mixing. It is further feasible that an additional cavity located upstream of the injection nozzle 31 is provided in which both components exit from the chambers when pressure is applied and mix together before the mixture exits from the injection nozzle. Furthermore it is also feasible to arrange the common chamber surface detachably in order
25 to facilitate the mixing of both components.

Naturally the design of the cartridge is not restricted to the examples mentioned here. Thus, for example it is feasible that further chambers are provided which for example provide additives for modifying the rheological properties or expansion properties.
30 Advantageously all the components arranged in the chambers are spatially separated wherein the separating surfaces can be arranged arbitrarily detachably. Furthermore, it is

feasible that additives such as, for example, fillers are added directly to components A and/or B.

Component A of the expanding injection resin 20 preferably consists of bisphenol-A-epichlorohydrin resin (CAS: 25068-38-6), bisphenol-F-epichlorohydrin resin (CAS: 9003-36-5) and tosyl isocyanate (CAS: 4083-64-1). Component B of the expanding injection resin 20 preferably consists of isophorone diamine (CAS: 2855-13-2), trimethylhexamethylene diamene (CAS: 25620-58-0) and diethylene triamine (CAS: 111-40-0) and p-tert butyl phenol (CAS: 98-54-4).

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The exemplary expanding injection resin 20 additionally has the following properties:

Processing temperature:	from +10 °C to +40 °C
Object temperature:	from +5 °C
Object temperature in winter building:	from +5 °C when observing certain installation rules
Pot time after mixing process:	3 to 4 minutes
Curing time:	at 20 °C about 45 to 60 minutes
Able to withstand stress (gas- and water-tight):	at 20 °C after about 100 minutes
Specific weight:	about 1.06
Density:	about $\geq 400 \text{ kg/m}^3$
Solid volume:	100 % absolutely free from shrinkage
Temperature-resistant:	-40 °C to +120 °C (in the chambered space)
Chemical resistance:	Gases G 260/I, G 260/II including liquid gas, water, media according to DIN 18195 T.5
Colour:	White (approx. RAL 9001)
Fire behaviour (building material class):	B1DIN 4102 (in the chambered space); the sealing level cannot burn further

	because of lack of oxygen supply and self-extinguishing setting
Specific resistance:	10^6 Ohm/cm^2
Dielectric strength:	6500 Volts/protection against electrical corrosion
Electrical insulation material class:	H/corrosion-resistant against mechanical and chemical attacks
MAK value of the cross-linking agent cleavage product (mg/m^3):	approx. 60 (at $+20^\circ\text{C}$ - 1010 mbar)
Odour	Inherent odour in the curing phase - odourless in the cured state, not hazardous to health
Standards and guidelines:	as mentioned previously
Storage time:	12 months (unopened in carton)
Storage:	Cool, dry, upright in carton
Storage temperature:	$>+10^\circ\text{C}$ to $+40^\circ\text{C}$

During the curing time the expanding injection resin 20 produces an exothermic thermal reaction. This thermal process ensures that any residual moisture that may be present, e.g. inside the wall opening or a core drill hole vaporizes and at the same time an adhesive dry substrate is formed which then ensures a positive and non-positive connection. The

5 tensile forces are transferred by the expansion of the injection resin which has been introduced into a masonry opening for example as liquid plastic formulation. As a result of the independent increase in volume of the expanding injection resin during the curing process, even the smallest cavities are non-positively and positively filled, thus creating a permanent mechanical fixed spatial connection, for example, from the jacket pipe 10 to the building wall 13. The increase in volume after the mixing process of the A and B components of the injection resin 20 is 3.0 to 5.0 : 1, preferably 3.5 to 4.0 : 1 in the chambered space.

More accurately, for example in the case of a two-component double-chamber cartridge

15 package - working package having a content of 300 ml, a filling volume of 1200 ml at

20 °C in the chambered space is obtained as a result of the expansive adjustment of the epoxy resin material. In addition, for example a two-component double-chamber cartridge package - working package with a content of 600 ml or a mixed quantity of 600 ml gives a filling volume of 2400 to 2600 ml. Furthermore a mixed quantity of 500 ml gives a filling volume of 2200 ml or 2400 ml. Other mixed quantities of the expanding injection resin 20 give a filling volume corresponding to the said examples. That is, the expansion volume of the expanding injection resin 20 thus corresponds to 3.0 - 5.0 : 1 in the chambered space. The maximum clearance dimension of the chambered space here preferably has a diameter of <300 mm and a depth of <600 mm.

The cured expanding injection resin 20 can be coated with all the usual coating systems in construction. According to the test standard DVGW work sheet G-459-1-G-450-2 and VP-601, tensile forces of at least 30 kN over the entire cross-section can be led off onto the building wall. In addition, the gas tightness of 4 bar (1 bar = 10^5 Pa) required in G459 1-2, the gas tightness of 1 bar (1 bar = 10^5 Pa) required in VP601 and the water tightness of 10 bar (1 bar = 10^5 Pa) are satisfied in conjunction with the torsional reliability and retention required therein.

A controlled gas- and water-tight sealing as well as a non-positive and positive join between building wall 13 and installation parts such as for example the pipe 10, which can be a plastic jacket pipe, a pipe capsule, a housing lead-in combination, a house lead-in in fixed-point installation, a stoneware/cement pipe, a ductile casting and steel pipe, comply with the generally recognized rules of engineering as well as the DVGW standard, work sheet G-459-1-G-459-2, G459-1 B, VP 601 (for the gas area), DVGW standard EW-400-1, EW-400-2, EW-400-3, fact sheet W-404 (for the water area), GW-322-2 (for the trenchless replacement of gas and water pipelines) in conjunction with a core drilling system as well as the DIN standards 18012/18195/18336/1986/1988.

In order to implement the installation of the pipe 10 in the wall opening shown in Fig. 1, the pipe 10 should firstly be inserted in the wall opening 12. The filling pipe 19 is then pushed into the space between pipe 10 and wall opening 12. The filling pipe 19 is then inserted into the space generating device and produces a chambered space 21 between the

pipe 10 and the wall opening 12 with the space generating device. The expanding injection resin 10 having an expansion volume of 3.0 to 5.0 : 1, preferably 3.5 to 4.0 : 1 in the chambered space 21 is then introduced into the chambered space 21 produced by the space generating device.

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(Second exemplary embodiment)

Figure 3 shows another exemplary embodiment for an installation of a pipe 10 in a wall opening 12. In this exemplary embodiment the installation of the pipe 10 is identical to the first exemplary embodiment apart from the differences described hereinafter. The same parts are therefore not described again.

In this exemplary embodiment, no openings 18 are provided on the outer side 14 of the wall opening 13 so that no expanding injection resin 20 can exit towards the soil 17. In Fig. 2 the chambered space 21 is therefore completely closed.

In addition, the foam sealing and centring strip 16 on the outer side 14 of the wall opening 12 and the region of the outer wall 14 arranged therearound is provided with a bituminous coating 40.

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(Third exemplary embodiment)

Figure 4a shows another exemplary embodiment for an installation of a pipe 10 in a wall opening 12. In this exemplary embodiment the installation of the pipe 10 is identical to the first exemplary embodiment apart from the differences described hereinafter. The same parts are therefore not described again.

In this case, the wall opening 12 is a core drill hole so that the wall opening 12 has a comparatively smooth inner wall as shown in Fig. 4a. On the inner side 15 of the building wall 13, a centring ring 50 with flange 551 and filling opening 52 is installed instead of a foam sealing and centring strip 16. The filling opening 52 is used for insertion of the filling pipe 19 with sleeve extension 19a. The centring ring 50 has a plurality of

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semicircular bulges 53 on the outer ring shell which are shown more clearly in the plan view in Fig. 4b. For better sealing of the centring ring 50 with respect to the inner side 15 of the building wall 13, a foam sealing ring 54 is inserted between the centring ring 50 and the inner side 15 of the building wall 13.

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On the outer side 14 of the building wall 13 in Fig. 4a, a centring ring 55 without flange 51 but with filling opening 56 is installed instead of a foam sealing and centring strip 16. This centring ring 55 also has a plurality of semicircular bulges 57 on the outer ring shell which is shown more clearly in the plan view in Fig. 4c.

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As can be additionally seen from Fig. 4a, in addition to the centring ring 55, in the direction of the outer side 14 of the building wall 13, a roll ring 60 is inserted in the core drill hole before which, again in the direction of the outer side 14 of the building wall 13, a bituminous seal 70 is inserted in the core drill hole or wall opening 12. The bituminous seal 70 closes the wall opening 12 towards the outer side 14 of the building wall 13 and can also cover the area of the outer side 14 of the building wall 13 around the wall opening 12, as shown in Fig. 4a.

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In this exemplary embodiment, the centring rings 50, 55 are parts of the space generating device.

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(Fourth exemplary embodiment)

Figure 5 shows another exemplary embodiment for an installation of a pipe 10 in a wall opening 12. In this exemplary embodiment the installation of the pipe 10 is identical to the third exemplary embodiment apart from the differences described hereinafter. The same parts are therefore not described again.

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In the core drill hole or wall opening 12 shown in Fig. 5, the centring ring 50 with flange 51 and filling opening 52 is installed on the outer side 14 of the building wall 13 whereas the centring ring 55 without flange 51 but with filling opening 56 and roll ring 60 are installed on the inner side 15 of the building wall 13.

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Thus, the sealing of the pipe 10 in the wall opening 12 can be accomplished from the outer side 14 of the building wall 13 so that a subsequent bituminous seal 70 or a bituminous coating next to the roll ring 60 is not required.

5

(Fifth exemplary embodiment)

Figure 6a shows another exemplary embodiment for an installation of a pipe 10 in a wall opening 12. In this exemplary embodiment the installation of the pipe 10 is identical to the third exemplary embodiment apart from the differences described hereinafter. The same parts are therefore not described again.

In Fig. 6a a polyester grid 80 is installed between pipe 10 and core drill hole or wall opening 12. The polyester grid 80 is more accurately installed over the entire sealing section and in the upper part of the core drill hole or wall opening 12 (cf. Fig. 6b). The polyester grid 80 ensures that the expanding injection resin 20 cannot run off through the polyester grid 80 during its liquid phase, i.e. shortly before filling. Thus, a positive and non-positive seal is only produced in the expansion phase of the expanding injection resin 20 by the controlled increase in volume of the expanding injection resin 20. It is furthermore feasible to use other flexible plastic networks or grids instead of the polyester grid.

In this exemplary embodiment, the centring ring 55 without flange 51 and without filling opening 56 of the third exemplary embodiment is formed from two centring ring half-shells 90 which are shown in Fig. 6a and 6c. The centring ring half-shells 90 also have a plurality of semi-circular bulges 91 on the outer ring shell which are shown more clearly in Fig. 6c in the plan view. In addition, the centring ring half-shells 90 have a plurality of self-adhesive strips 92 in order to be able to fix the centring ring half-shells 90 on the pipe 10. As can be seen from Fig. 6c, the centring ring half-shells 90 are installed in offset position. The centring ring half-shell 90a is hereinafter also designated as lower centring ring half-shell.

According to Fig. 6a, the bituminous seal 70 of the third exemplary embodiment according to this exemplary embodiment is implemented as a bituminous coating since the roll ring 60 and the centring ring half-shells 90 are arranged closer to the outer side 14 of the building wall 13. In particular, the roll ring 60 is inserted in the wall opening 12 in such a manner that the roll ring 60 ends flush with the outer side 14 of the building wall 13.

In this exemplary embodiment, the centring ring 60 and the centring ring half-shells 90 are parts of the space generating device.

(Sixth exemplary embodiment)

Figure 7 shows another exemplary embodiment for an installation of a pipe 10 in a wall opening 12. In this exemplary embodiment the installation of the pipe 10 is identical to the third exemplary embodiment apart from the differences described hereinafter. The same parts are therefore not described again.

The centring ring 55 without flange 51 but with filling opening 56 of the third exemplary embodiment is also formed from two centring ring half-shells 90 in this exemplary embodiment as in the fifth exemplary embodiment and as shown in Fig. 7 and Fig. 6c. That is, unlike the fifth exemplary embodiment, in this exemplary embodiment the centring ring half-shells 90 are arranged at various points along the thickness of the building wall 13.

In addition, a pipe collar 100 is mounted on the pipe 10 with cable ties 105 on the outer side 14 of the building wall 13 or wall opening 12. The pipe collar 100 in Fig. 7 is pushed into itself in front of the outer side 14 of the building wall 13. This is possible due to the design of the pipe collar as in Fig. 8 and is described hereinafter.

As shown in Fig. 8, the pipe collar 100 has a flexible tubular body which has a smooth tubular section 107 and a plurality of annular bulges 110, 120, 130. One end 140 of the flexible tubular body of the pipe collar 100 has a smaller circular cross-section than

another end 141 of the flexible tubular body of the pipe collar 100. The smooth tubular section 107 and the annular bulge 110 are in this case arranged nearest to the end 140 having the smaller circular cross-section. The annular bulge 120 is arranged between the annular bulge 110 and the annular bulge 130. And the annular bulge 130 is arranged
5 closest to the end 141 having the larger circular cross-section.

The annular bulge 110 is the narrowest annular bulge. The annular bulge 130 is the widest annular bulge. The annular bulge 110 is a half-ring which forms the other end of the annular body having the larger circular cross-section and which is formed by intersecting
10 a ring in the plane of its diameter. Furthermore, the outer ring diameter of the annular bulge 110 is the smallest and the outer ring diameter of the annular bulge 130 is the largest outer ring diameter.

That is the width and/or the outer ring diameter of the annular bulges 110, 120, 130 is
15 different and the outer diameter of the plurality of annular bulges increases from the end of the annular body having the smaller circular cross-section to the end of the tubular body having the larger circular cross-section.

The pipe collar 100 is preferably made of plastic. With a largest outer diameter of about
20 135 mm, the pipe collar is suitable for a diameter of the pipe 10 of 73 to 765 mm and a core drill hole having a diameter of 91 to 101 mm. The pipe collar 100 is preferably about 130 mm long in the non-pushed-together state.

In this exemplary embodiment the centring 50 and the pipe collar 100 are parts of the
25 space generating device.

The sealing of the pipe 10 according to Fig. 8 is particularly advantageous for trenchless pipe renovation. In this case, the pipe 10 is installed and sealed as follows.

30 Firstly the pipe collar 100 is pre-mounted to the pipe 10 and specifically before the pipe 10 is inserted in the wall opening 12. Here pre-mounting means that the pipe collar 100 is pre-mounted on the pipe 10 in such a manner that the end 140 of the tubular body

having the smaller circular cross-section is fastened to the pipe 10 by means of cable ties 105, preferably two cable ties 105. More accurately, the pipe collar 100 is fastened to the pipe 10 by means of cable ties 105, preferably two cable ties 105, on the smooth tubular section 107.

5

The pipe 10 with the pre-mounted pipe collar 100 is then pushed from the inner side 15 of the building wall 13 into the wall opening 12 in such a manner that the end 140 of the tubular body having the smaller circular cross-section is firstly pushed into the wall opening 12. In this case, the pipe with the pre-mounted pipe collar is pushed further
10 through the wall opening 12 onto the outer side 14 of the building wall 13 than the pipe collar 100 is long. The pipe 10 with the pre-mounted pipe collar 100 is then moved thereon in such a manner that the pipe collar 100 opens out again on the pipe 10. The pipe 10 with the pre-mounted pipe collar 100 thereon is then withdrawn from the inner side 15 of the building wall 12 from the wall opening 12 until the pipe collar 100 abuts externally
15 against the wall 13 surrounding the wall opening 12. The centring ring 50 is then clamped between pipe 10 and wall opening 12 by pushing the filling pipe 19 into the filling opening 56 of the centring ring 50. The remaining steps to produce the finished seal of the pipe 10 in the wall opening 12 are described in the first exemplary embodiment.

20 (Seventh exemplary embodiment)

Figure 9 shows another exemplary embodiment for an installation of a pipe 10 in a wall opening 12. In this exemplary embodiment the installation of the pipe 10 is identical to the sixth exemplary embodiment apart from the differences described hereinafter. The
25 same parts are therefore not described again.

In Fig. 9 the building wall 13 is shown with three hollow chambers 13a under the core drill hole or wall opening 12. Consequently the centring ring half-shell 90a mounted at the bottom on the pipe 10 is mounted on the pipe 10 and in the wall opening 12 in such a
30 manner that it is arranged between pipe 10 and building wall web 13a.

(General observations)

The pipe 10 is for example a jacket pipe, feed pipe, medium pipe, a pipe capsule or house lead-in combination or a corrugated jacket for a fixed-point mounting. That is, as mentioned previously the pipe 10 can be a plastic jacket pipe, a pipe capsule, a house
5 lead-in combination, a house lead-in in fixed-point installation, a stoneware/cement pipe, a ductile casting and steel pipe.

The system described can be installed in wall openings up to about 800 mm. In this case, all wall bases are largely dry, load-bearing, dust and grease-free, and to be freed of any
10 loose components.

REFERENCE LIST

	10	Pipe
	11	Medium-guiding line
5	12	Wall opening
	13	Building wall
	13a	Hollow chamber
	14	Outer side of building wall 13
	15	Inner side of building wall 13
10	16	Foam sealing and centring strip or quick fix mortar
	17	Soil
	18	Openings to soil 17
	19	Filling pipe
	19a	Sleeve extension
15	20	Expanding injection resin
	21	Chambered space
	22	Viewing and monitoring cap
	30	Manual pressure gun
	31	Nozzle tip
20	32	Mixing rod
	40	Bituminous coating
	50	Centring ring with flange
	51	Flange
	52	Filling opening
25	53	Semicircular bulge
	54	Foam sealing ring
	55	Centring ring without flange
	56	Filling opening
	57	Semicircular bulge
30	60	Roll ring
	70	Bituminous seal or coating
	80	Polyester grid

- 90 Centring ring half-shell
- 90a Lower centring ring half-shell
- 91 Circular bulges
- 92 Self-adhesive strip
- 5 100 Pipe collar
- 105 Cable tie
- 107 Smooth tubular section
- 130 Annular bulge
- 140 End of pipe collar 100 with the smaller circular cross-section
- 10 141 End of pipe collar 100 with the larger circular cross-section.

Patentkrav

- 1.** System til montering af et rør uden adgangshul (10) i en vægåbning (12), med et rør (10) til indsættelse i vægåbningen (12),
- 5 en rumdannelsesanordning (16; 50, 55; 50, 90; 50, 100) til frembringelse af et rum med kamre (21) mellem røret (10) og vægåbningen (12),
- ekspanderende sammenpresset harpiks (20) med en ekspansionsvolumen på mellem 3,0 og 5,0 : 1 i rummet med kamre (21) til indbringelse i det af rumdannelsesanordningen (16; 50, 55; 50, 90; 50, 100) frembragte rum med kamre (21), og et
- 10 fylderør (19) til ifyldning af den ekspanderende sammenpressede harpiks (20) i det af rumdannelsesanordningen (16; 50, 55; 50, 90; 50, 100) frembragte rum med kamre (21) og til indsættelse i rumdannelsesanordningen (16; 50, 55; 50, 90; 50, 100), **kendetegnet ved, at** rumdannelsesanordningen omfatter en rørmanchet (100) til påsætning på røret (10), før røret (10) sættes ind i vægåbningen (12), og til anbringelse mellem
- 15 vægåbningen (12) og røret (10), idet rørmanchetten (100) har et fleksibelt rørformet legeme, der har en flerhed af ringformede fordybninger (110, 120, 130) med forskellig bredde.
- 2.** System ifølge krav 1, hvor den ekspanderende sammenpressede harpiks (20)
- 20 foretrukket har en ekspansionsvolumen på mellem 3,5 og 4,0 : 1 i rummet med kamre (21).
- 3.** System ifølge krav 1 eller 2, hvor fylderøret (19) har en slangeforlængelse (19a) og en syns- og kontrolkappe (22) til visuel kontrol af påfyldningsniveauet for den
- 25 ekspanderende sammenpressede harpiks (20) i rummet med kamre (21), hvor fylderøret (19) er beregnet til indsættelse i rumdannelsesanordningen (16; 50) på en sådan måde, at syns- og kontrolkappen (22) er placeret uden for det frembragte rum med kamre (21).
- 4.** System ifølge et af de foregående krav, hvor rumdannelsesanordningen omfatter en
- 30 centreringsring (50) med en flange (51) til at sætte på væggen (13), der omgiver vægåbningen (12), hvor centreringsringen (50) har en fyldeåbning (52) til indsættelse i

fylderøret (19).

5. System ifølge et af de foregående krav, hvor den ekspanderende sammenpressede harpiks (20) er uden svind, når den er færdighærdet.

5

6. System ifølge et af de foregående krav, hvor den ekspanderende sammenpressede harpiks (20) er gastæt ved et driftstryk på mindst op til 4 bar ($1 \text{ bar} = 10^5 \text{ Pa}$) og vandtæt ved et driftstryk på mindst op til 10 bar ($1 \text{ bar} = 10^5 \text{ Pa}$), når den er færdighærdet.

10 **7.** System ifølge et af de foregående krav, hvor den ekspanderende sammenpressede harpiks (20) har en faststofvolumen på 100 %, når den er færdighærdet.

8. System ifølge krav 1, hvor en ende (140) af det fleksible rørformede legeme har et mindre cirkelformet tværsnit end en anden ende (141) af det fleksible rørformede legeme.

15

9. System ifølge et af de foregående krav, hvor de ringformede fordybninger (110, 120, 130) i rørmanchetten (100) har forskellig bredde og/eller forskellig udvendig ringdiameter.

20

10. System ifølge et af de foregående krav, hvor den største ringformede (130) fordybning af flerheden af ringformede fordybninger (110, 120, 130) er en halvring, der danner den anden ende (141) af det rørformede legeme med det største cirkelformede tværsnit, og som er dannet ved gennemskæring af en ring på dennes diameterniveau.

25

11. System ifølge et af de foregående krav, hvor enden (140) af det rørformede legeme med det mindste cirkelformede tværsnit grænser op til den smalleste ringformede fordybning (110) af flerheden af de ringformede fordybninger.

30 **12.** System ifølge et af de foregående krav, hvor flerheden af de ringformede fordybninger (110, 120, 130) er anbragt sådan, at den udvendige diameter af flerheden

af de ringformede fordybninger (110, 120, 130) øges fra enden (140) af det rørformede legeme med det mindste cirkelformede tværsnit hen mod enden (141) af det rørformede legeme med det største cirkelformede tværsnit.

- 5 **13.** Fremgangsmåde til montering af et rør (10) i en vægåbning (12) med et system ifølge et af de foregående krav med følgende trin:

- Formontering af rørmanchetten (100) på røret (10), før røret (10) indsættes i vægåbningen (12), hvor rørmanchetten (100) formonteres på røret (10) på en sådan måde, at enden (140) af det rørformede legeme med det mindste cirkelformede tværsnit fastgøres til røret (10) ved hjælp af kabelbindere (105)
- Indsættelse af røret (10) med den formonterede rørmanchet i vægåbningen (12) på en sådan måde, at enden (140) af det rørformede legeme med det mindste cirkelformede tværsnit skubbes først ind i vægåbningen (12), hvor røret (10) med den formonterede rørmanchet (100) skubbes videre gennem vægåbningen (12) som rørmanchetten (100) er lang. Bevægelse af røret (10) og derved den formonterede rørmanchet (100) på en sådan måde, at rørmanchetten (100) folder sig ud igen ved røret (10)
- Udtrækning af røret (10) fra vægåbningen (12), indtil rørmanchetten (100) ligger udvendigt på en side af den væg (13), som omgiver vægåbningen (12)
- Frembringelse af et rum med kamre (21) mellem røret (10) og vægåbningen (12) med rumdannelsesanordningen (16; 50, 55; 50, 90; 50, 100), som omfatter rørmanchetten (100) og en centreringsring (50) med en flange til at sætte på den anden side af væggen (13), der omgiver vægåbningen (12), hvor centreringsringen (50) har en fyldeåbning (52) til indsættelse af fylderøret (19)
- Klemning af centreringsringen (50) mellem røret (10) og vægåbningen (12) ved at skubbe fylderøret (19) ind i fyldeåbningen (52) på centreringsringen (50), som anvendes til at fylde den ekspanderende sammenpressede harpiks (29) i rummet
- Indbringelse af den ekspanderende sammenpressede harpiks (20) med en ekspansionsvolumen på mellem 3,0 og 5,0 : 1 i rummet med kamre i det med rumdannelsesanordningen (16; 50, 55; 50, 90; 50, 100) frembragte rum med kamre (21).

14. Anvendelse af et system ifølge et af kravene 1 til 12 til montering af et rør uden adgangshul (10) i en vægåbning (12).

Fig. 1

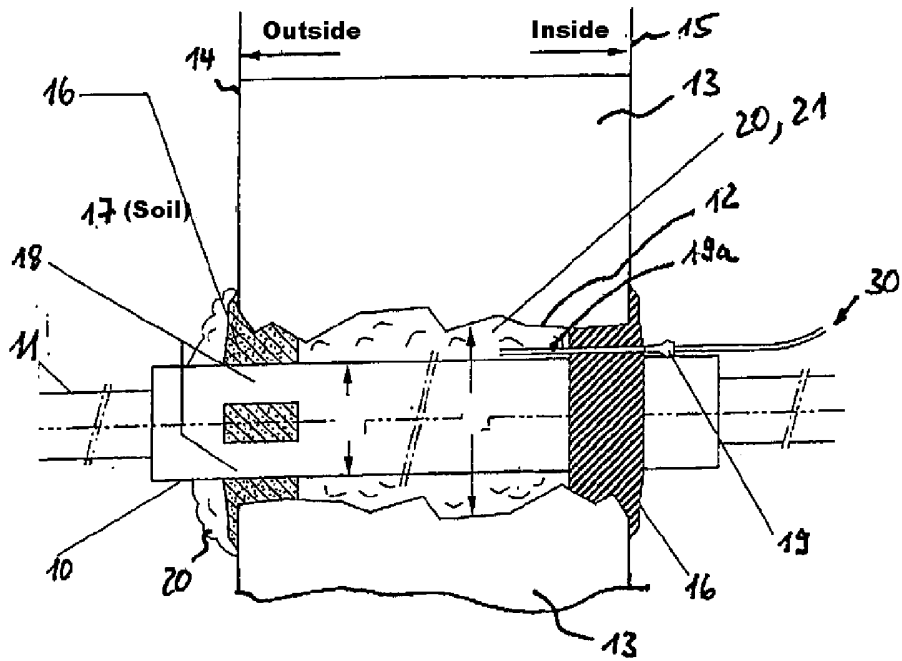


Fig-3

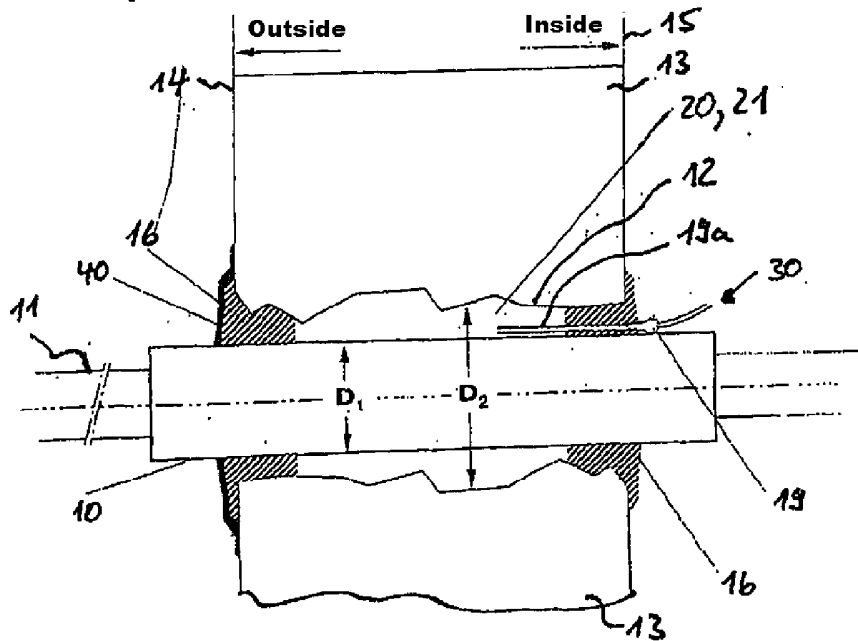


Fig. 4a

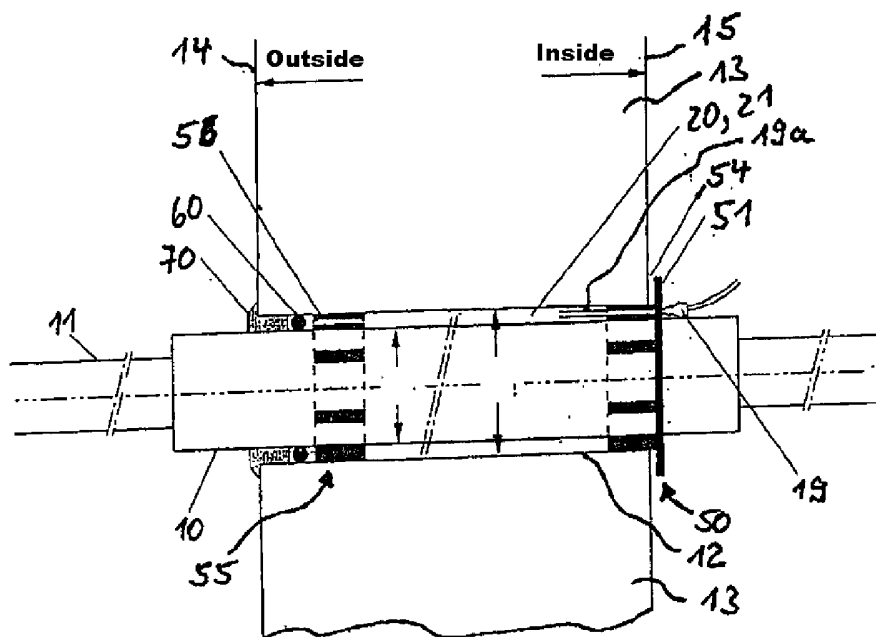


Fig. 4b

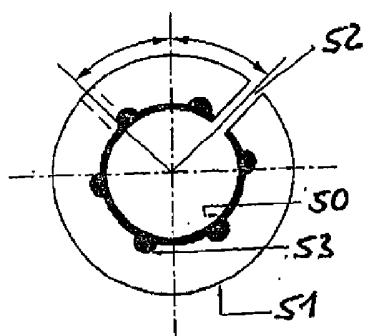


Fig. 4c

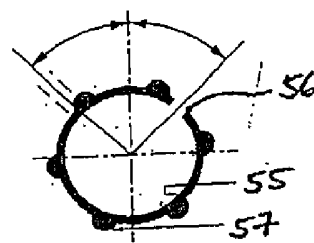


Fig. 5

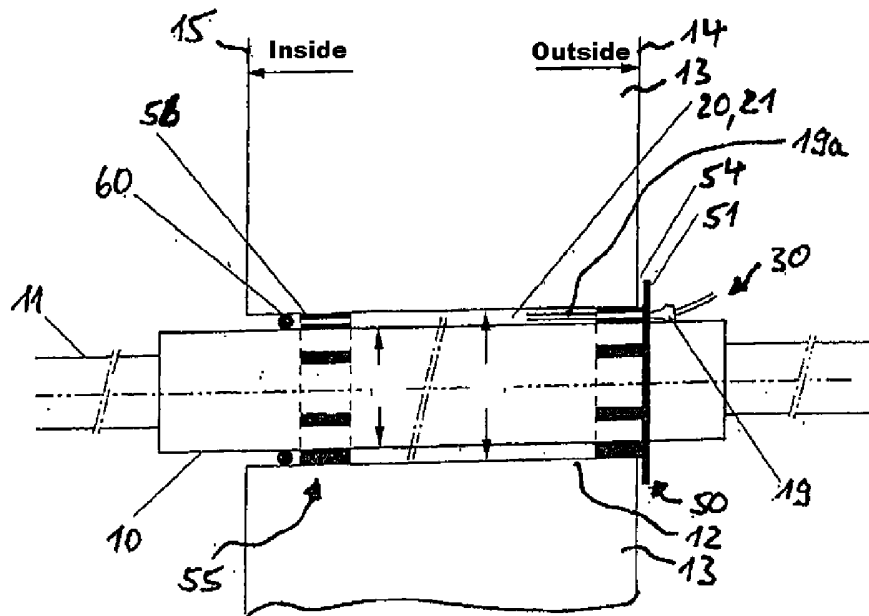
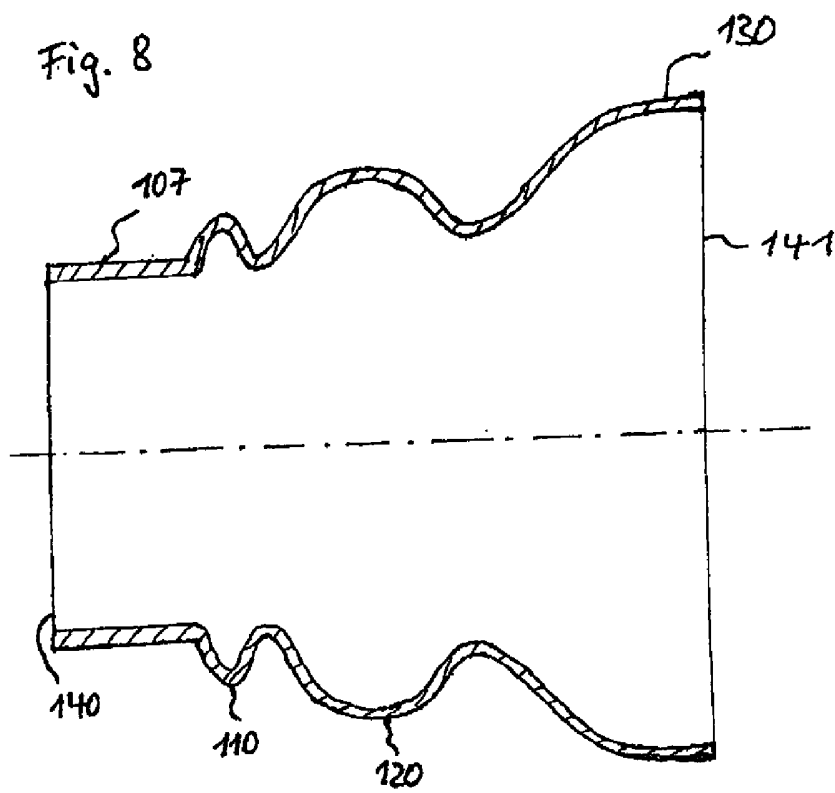


Fig. 8



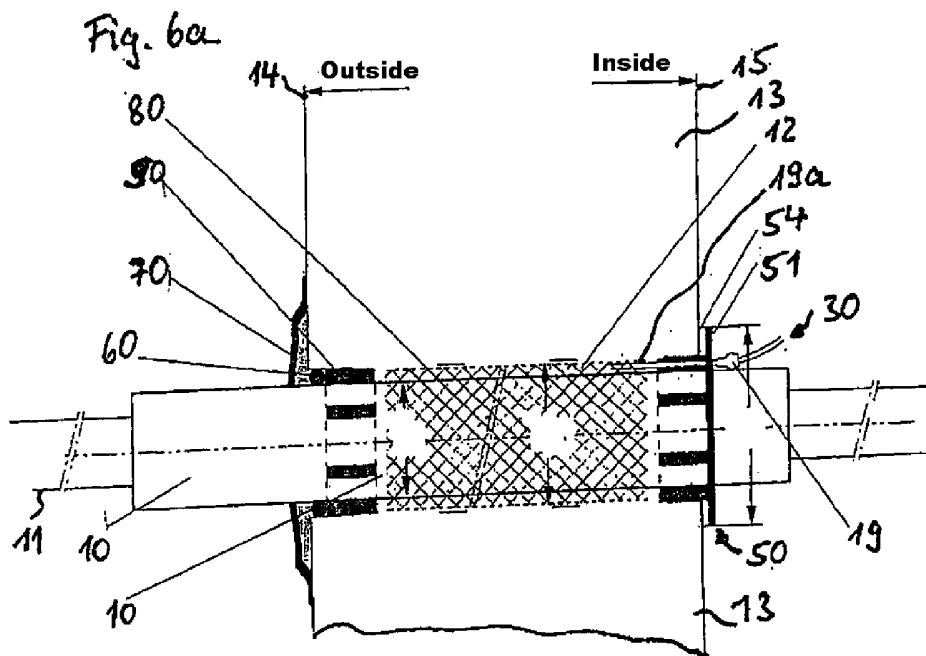


Fig. 6b

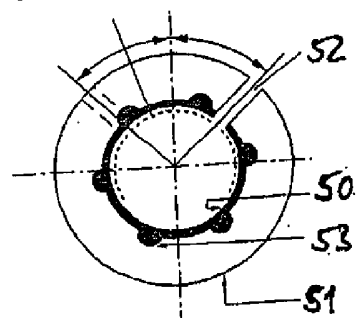


Fig. 6c

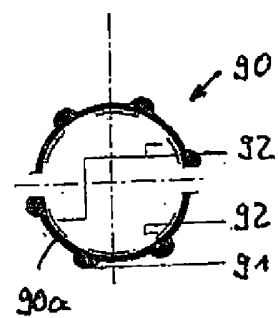


Fig. 7

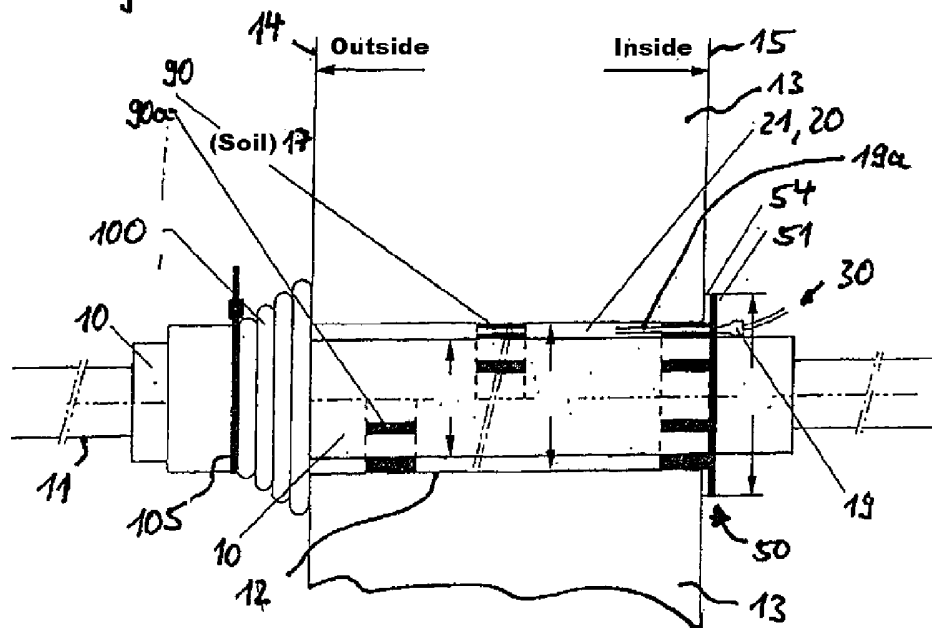


Fig. 9

