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PATENT APPLICATION

5 "Method for installing at least one cable and/or empty pipe in laid
pipe ducts used for supply or disposal, more particularly sewage pipe
 systems or pipe mains and the like"

10 The present invention relates to a method for installing at least one
cable and/or empty pipe in laid pipes used for supply or disposal,
more particularly in sewage pipe systems or pipe mains and the like,
 wherein the cables and/or empty pipes which are to be laid are
 introduced into the pipe duct and fixed on the wall of same.

15 The field of communications shows a constantly increasing growth rate
and an end to this growth can still not be foreseen at the present
 time. Whereas in particular telecommunications have developed to a
 large extent through satellites the transmission of data and
 information through earth-laid cables still ranks of equal importance
 to transmissions by satellite. Furthermore pipelines and cables laid
20 in the ground are becoming increasingly important with the
 introduction of glass fibre cables which make it possible to transmit
 large amounts of data at high speeds.

25 Particularly in relation to glass fibre cables a rapid cost-effective
cross-linking is desirable for establishing communication networks
 covering a wide surface area. Laying cables or pipelines in this way
 naturally requires expensive earth work, unless it is possible to use
 already existing installed empty pipes or other usable pipe ducts.

One way of installing cables and/or empty pipes, where cables such as data transmission lines can be drawn into these empty pipes, and which is already in practice at the moment, is to fix in the existing pipe ducts, such as for example sewage pipes which can have very large cross-sections, the new cables or empty pipes which are to be fixed on the walls for example by pipe or cable clips which are fastened by dowels at regular intervals along the sewage pipe walls. This type of installation is obviously very labour and cost intensive and can only be carried out in sewage pipes having a large enough cross-section to be accessible to a person, unless camera guided and monitored robots are used for this type of pipe laying so that then cables or empty pipes can be fitted even in sewage pipes which are not large enough to walk through.

Also several empty pipes or cables can be fixed by tension clips which are tensioned against the circumference of the overall channel cross-section. Such tension clips can also be laid by means of robots, even in existing pipe ducts, such as sewage pipes, which have a smaller cross-section but which is still large enough for such robots, i.e. the pipe diameters must be 200 mm and more. It is evident that the empty pipes and cables which are subsequently laid, whether fixed by pipe or cable clips or with the said tension clips, are fully exposed to the raw sewage operation. These pipe routes have to withstand both the sewage flow with high water surges and also high pressure pipe cleaning. In particular experience has shown that sewage particles settle on the filigree clips and tension rings and sooner or later clog up the channel so that it can be expected that these fastening elements used to fix the subsequently laid cables and empty pipes will not stand up to the pressure build up which will arise. For this reason it is not anticipated that this method of operation will be used in future in view of the breakdown factors which can be expected.

In addition the normal channel operation becomes difficult. The corresponding pipe ducts can no longer be pressure tested or shut off by shut-off bubbles.

According to DE U1 298 01 424 flat hollow profiled sections are used for laying cables in a non walk-in sewage pipe, in the manner of a

cable duct made from metal or plastics and either stuck or fixed by dowels on the inside wall of a sewage pipe. For this pipe-laying process, robots are used to enter into non walk-in gas, water or sewage pipes.

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The drawback with these robot systems is that the pipe duct has to have been previously renovated. If the cables or pipelines are hung up by the robots without the pipe duct having previously been renovated, then it can be expected in the future that these cables
10 will have to be covered with an inliner (lining), which is then mostly no longer correctly possible. This would involve not inconsiderable additional processing steps, incurring extra costs.

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Renovating processes for pipe ducts are obviously also known where shape-stable pipe sections are pushed into old or damaged pipe ducts and then connected together. The interspace between the pipe which is to be newly added and the old pipe can be caulked with these measures, using a suitable casting substance, a so-called "dammer". Within the scope of introducing such shape-stable relining pipes, distributed for
20 example by Messrs. Hobas Rohre AG, Switzerland, it was also proposed to insert cables or empty pipes in the interspace between the new pipe and the old pipe duct. It is obvious that this method of procedure is fundamentally expensive and if cables or empty pipes, such as for example for telecommunications, are to be laid then this is always
25 linked with introducing such shape-stable pipe linings of plastics or steel.

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Where an inliner is already laid, i.e. an internal lining is provided, laying additional cables or empty pipes is always coupled with further inliner renovation work. Where the pipe ducts require renovation but have not yet been renovated, this is of hardly any importance and indeed has economic advantages.

In any case this means, where in intact or even newly laid pipe ducts these additional pipelines are to be laid in pipe ducts which do not require renovation, the linked renovation involves additional work and costs.

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The object of the invention is now to overcome the aforesaid drawbacks of the prior art and to provide a method which enables the additional and subsequent laying of cables and/or empty pipes in existing pipelines or pipe ducts which is competitive when compared directly
10 with the traditional trench method and in which the subsequently laid cables and pipes have solid protection, and renovation can be correctly carried out either before or after where necessary, although is not absolutely essential and the pipe duct operation is not restricted. Furthermore the possibility is also to be offered of
15 removing again any subsequent inliner renovation whereby the cables and/or empty pipes can remain in the pipe duct.

This is achieved through a method of the type mentioned at the beginning which is characterised in that a tubular or hose-like
20 internal lining is pushed and/or drawn into the laid pipe duct, wherein at least one flexible empty pipe and/or cable is or are arranged on the outside surface area of the lining.

Preferred embodiments of the invention will be apparent from the sub-
25 claims.

The basic idea of the invention lies in drawing or pushing a tubular internal lining into already existing laid pipeline ducts, in sewage pipe systems or pipe mains and the like, for example also in
30 ventilation pipes, and in mounting between the outside wall of this internal lining and the inside wall of the existing pipe duct the new cables or empty pipes in order to draw in further pipelines or cables later on. With this method of procedure no additional mounting elements or fixing parts are required in order to fix and hold the
35 newly laid individual cables and/or empty pipes in the pipe duct. Furthermore through the tubular internal lining a new smooth pipe wall is provided through which the sewage is guided so that no blockage points are formed which could restrict the flow through the pipe duct

or could form blockages as a result of a build-up thereon of solid parts carried along in the sewage. Indeed the smooth inside surface of a new tubular internal lining of this kind will improve the hydraulics. All newly laid empty pipes and cables are separated from
5 the medium flowing through the pipe duct and the risk of corrosion and abrasion does not materialise. At the same time with this method of procedure existing pipe ducts or sewage pipes can be additionally sealed or renovated. It is evident that with this method there are practically unlimited possibilities for installing and dismantling
10 data communication networks with relatively small expense since practically all households or other industrial and communal installations are already connected to sewage pipe systems which can be used even if such sewage pipes have a relatively small diameter, for example even in the case of pipe ducts whose diameter is between
15 80 and 150 mm since the method according to the invention can even be used in these pipe ducts.

It may be that the conditions in existing laid sewage pipes, pipe duct systems or mains networks are such that the tubular internal lining
20 can only then be drawn in when its outer diameter is substantially less than the internal diameter of the pipe duct into which the tubular internal lining is to be pushed or drawn. Particularly in these cases an irreversibly deformable hose is drawn in as the tubular internal lining, with the outer diameter of the hose being such that
25 it can easily be drawn into the pipe duct. This hose is then deformed through suitable measures, such as through high internal pressure, to become pressed against the inside wall of the pipe duct so that the cables and/or empty pipes are also pressed irretrievably between the deformed hose and the pipe duct wall.

30 A flexible hose is preferably used for such a deformable hose which can be folded up with regard to its cross-sectional dimensions so that a flat panel is produced which can be easily drawn into the existing sewage pipe or pipe duct system or mains network. When this type of
35 hose is drawn in, the required empty pipes and cables can be fitted onto the outer surface at the same time. After the hose is drawn into the sewage pipe the hose can be closed at its ends and then when filled with a fluid medium or with a gaseous medium such as for

example compressed air can be pressed against the inside wall of the pipe duct and then irreversibly solidified and secured against the inside wall, for example by heat or UV radiation, where the material of the hose can be hardened by heat or UV radiation. Once the hose is
5 solidified and secured the pressure can be withdrawn from the inside of the hose. The hose then lies tightly against the inside wall of the pipe duct, holding the cables and empty pipes.

Basically it is possible to attach the cables and/or empty pipes (for
10 drawing in cables) which are to be installed on all sides of the tubular internal lining and thus on all sides of the existing pipe duct. Preferably such empty pipes and/or cables are attached to the upper region of the outside surface of the tubular internal lining so that once the tubular internal lining is installed they become
15 positioned on the upper side of the pipe duct.

In order to facilitate the installation work on site, i.e. at the building site, it can be advantageous to use a tubular internal lining which already contains the or each empty pipe and/or cable integrated
20 in the wall. With regard to a deformable hose as internal lining such cables and empty pipes can be integrated in the wall.

It can be sufficient to fix the empty pipes and/or cables which are to be installed, on the outside of the tubular internal lining which is
25 to be pushed or drawn in, at certain spots along the length of the outer surface so that when installing the tubular internal lining these remain in fixed association with each other. This type of spot fastening is also possible immediately on site during installation of the tubular internal lining with simple means so that the individual
30 pipes or cables which are to be installed are fixed on the tubular internal lining depending on requirements immediately during drawing in the internal lining.

If a hose is drawn into the pipe duct then for reasons of stability it should be a woven hose, with a glass fibre hose being preferred. Furthermore it is possible to use, as the hose, a textile woven and/or plaited hose impregnated with a hardening resin. The resin used here
5 should be one which sets under UV radiation or heat in order to then solidify the hose pressed under pressure against the pipe duct wall. Since the resin has an adhesive property, before it hardens a foil of tubular shape should be applied to the outer and/or inner surface of this hose so that the hose walls do not stick against each other,
10 particularly if the hose is drawn into the pipe duct in the folded state.

When as the tubular internal lining a tube is used which is dimensionally stable per se, i.e. it is not brought to its final shape
15 under pressure after insertion and then solidified, it can be particularly advantageous to wind the tubular shaped internal lining spirally into a stable shape from a material web as it is inserted into the pipe duct. To this end a corresponding machine assembly is set up in an access shaft and the material web is supplied as an
20 endless web to this machine. In the machine this web is then wound spirally and the individual longitudinal edges of this spiral shape which adjoin one another lengthways are connected together by suitable means, for example by flanging over or welding the edges. The spiral
tube is then pushed forwards continuously into the pipe duct whilst at
25 the same time the cable and/or empty pipe which is to be installed is introduced onto the outer wall. The web material which is used in order to form the spiral structure tube can be a metal or plastics web.

30 A further possibility which is to be preferred under certain circumstances is that where a plastics tube is used as the tubular inner lining, wherein the cross-section of the tubular wall is drawn as a folded profiled section into the existing pipe duct and then is deformed back to the original tubular cross-section under internal
35 pressure through a heated medium.

In order to produce a close contact between the shape-stable tube which forms the tubular inner lining and the inside wall of the pipe duct, it is preferable if as the tubular internal lining is used a
5 plastics pipe whose tubular cross-section prior to entry into the existing pipe duct is reduced mechanically through tensile extrusion and relaxed again back to the original tubular cross-section after entry by lifting the tensile strain. With this measure the tubular internal lining closely adjoins the wall of the pipe duct and thus the
10 empty pipes and/or cables drawn in between the outside wall of this plastics pipe and the inside wall of the existing pipe duct are held in close contact against same.

The subsequent installation of cables and/or pipelines into existing
15 pipe ducts, in sewage pipe systems or mains networks or the like is preferably undertaken through so-called manholes or other readily accessible places. In the region of these installation accesses the cables and/or empty pipes inserted between the tubular internal lining and the existing pipe duct are guided by their ends into a distributor
20 and/or connector box in order that they can then be cross-linked with each other at a later date in the area of these connector boxes or can be connected to an existing communications network or an electrical network; the same applies for empty pipes into which then cables, for
25 example data communication cables, can be inserted to be accessible through the connector boxes.

The assembly mass which is used to cover the cables and/or empty pipes and which sticks the cables and/or empty pipes together and to the pipe wall, provides at the same an all round protection. This
30 particularly applies when the cables and/or empty pipes are fully embedded into the assembly mass, so that they thus become quasi cast. In a further preferred embodiment the or each cable and/or empty pipe which is to be laid is covered with an assembly mass which has adhesive properties and is then inserted with an assembly hose acting
35 as the tubular internal lining, into the pipe, the assembly hose is then enlarged and the or each cable and/or empty pipe is then pressed against the pipe wall, and after a sufficient holding time during which the cables and/or empty pipes become stuck against the wall, the

pressure acting on the assembly hose is withdrawn. The particular advantage with this procedure is that only one assembly hose is used which once the cables or empty pipes are installed in the already laid pipe duct can be removed and then used again so that only the laid
5 empty pipes or cables remain in the existing pipe duct, for example a sewage pipe. With this method there is also the possibility of installing cables and/or empty pipes side by side, at certain intervals and in very different configurations, all at the same time.

- 10 The assembly hose which is used is preferably as already mentioned above removed again from the pipe duct after assembly; by using an assembly hose of this kind made from a suitable material it is possible to use the assembly hose several times for installing such
15 cables or empty pipes in existing supply or disposal pipelines and systems.

The assembly position of these cables or empty pipes which are fitted in subsequently against the inside wall of a pipe duct can be determined in advance for which then these cables are positioned
20 correspondingly on the assembly hose. The assembly position will however lie mostly in the upper circular half or upper arc of the cross-section of the pipe duct into which the cables and empty pipes are inserted.

- 25 Preferably the cables or empty pipes which are to be installed are embedded over their entire length into an assembly mass having adhesive properties, i.e. a correspondingly suitable adhesive mass, with which they can then also be pressed and stuck against damp inside
30 walls of pipe ducts. An epoxy resin of this kind can be a dual-component epoxy resin which can be hardened for example over a certain period of time or with additional supply of heat or through radiation with a suitable wave length.

In addition as carrier material for the assembly mass or adhesive material can be used mineral and /or synthetic inserts, for example in the form of woven, knitted or felt materials. The most suitable material is used corresponding to requirements.

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It is evident that after sticking and hardening, the additional cables are fixedly connected to the inside wall of the pipe duct and are preferably bonded into the assembly mass and where applicable an additional carrier material so that the cables and/or empty pipes

10 become one component with the assembly mass. The cables are covered and protected by a defined layer of mass from the inside of the pipe duct and from the sewage where these pipes are sewage pipes. The mass lines the cables with smooth transitions to the pipe duct and connects them in keyed and force locking engagement to the inside wall of the
15 pipe duct. Where necessary an outer cover layer can also be provided which is introduced in the form of a web material, i.e. a web material which is first applied to the assembly hose, after which the empty pipes and cables which are to be laid are arranged on the web material and embedded in the mass. This cover layer can however also be
20 fixedly connected on one side on the outside to the carrier materials and remains in the pipe duct after sticking on the empty pipes.

If the adhesive or carrier mass which is used has static material characteristics then it is even possible with the aforementioned
25 process afterwards to increase the static load-bearing capacity of the pipe duct in which the empty pipes or cables were introduced.

As assembly hose should preferably be used a flat hose which is drawn into the pipe duct. By flat hose here is meant one which first before
30 introduction into the pipe duct can be collapsed into a flat web so that the empty pipes or cables can be fitted onto the top side thereof.

A hose of this type is then, once it has been drawn into the pipe duct, expanded by a suitable liquid or gaseous fluid so that the cables and empty pipes which are preferably laid out on the top side, embedded in a mass having the adhesive properties, are then pressed
5 against the inside wall of the pipe duct. In order to expand the hose it is possible to use a gaseous or even fluid medium wherein in most cases a gaseous medium is preferred, for example air. To inflate the hose, one end can be closed, unless the hose is inflated from both ends.

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In order to ensure optimum pressing of the assembly mass with the cables or empty pipes, the flat hose should be made with regard to its circumference, slightly undersized relative to the pipe duct and should have expanding properties so that it can be adapted to the
15 conditions in the pipe duct. Preferably hoses can be considered which are made from rubber or silicon and have inherently good separating properties with regard to the assembly mass.

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In order to ensure optimum release of the assembly hose from the mass once the mass has hardened in the pipe duct, separating layers can be arranged between the assembly hose and the assembly mass having the adhesive properties, or an adhesive and/or carrier mass, with the separating layers being in the form of for example paste-like
separating means, or however also in the form of suitable web
25 material, such as for example a plastics foil.

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It can be useful, particularly when the cables and/or empty pipes which are to be laid in the pipe duct are to be attached at the sides of the duct cross-section ("transoms"), to fix the separating layer on
30 the assembly hose, a preferred option here being the use of a touch and close fastening band. The mass is then placed with the empty pipes and/or cables on the separating layer so that the pipes and cables can be positioned exactly with regard to the cross-section of the pipe duct.

A further possibility is to connect the separating layer, e.g. in the form of a foil, to one of the outer carrier materials or inserts by a bonding or lining which then remains fixedly stuck in the pipe duct after the cables and/or empty pipes have been stuck and the assembly
5 hose has been removed.

There is also the possibility of fixing the separating layer in the form of the web material on the assembly hose by means of double-sided adhesive tape. An adhesive tape of this kind can then be removed with
10 or after removal of the assembly hose from the pipe duct.

Further details and features of the invention will be apparent from the following description of embodiments with reference to the drawings in which:

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Figure 1A shows a cross-section through a laid pipe duct with a tubular internal lining inserted therein in the folded state and having cables and/or empty pipes already mounted on the top side;
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Figure 1B shows the pipe duct of Figure 1A with tubular internal lining pressed against the inside wall;
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Figure 2 shows a diagrammatic view for explaining the method of laying the tubular internal lining, as shown in Figures 1A and 1B;
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Figures 3A, 3B show cross-sections through a laid pipe duct with two different method steps of arranging an internal lining which is introduced initially in the deformed state (Figure 3A);
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Figure 4 shows a diagrammatic view of introducing the pipe sections as internal lining by arranging thereon the empty pipes or cables which are to be installed;

Figure 4B shows a cross-section through the pipe duct of Figure 4A with laid pipe sections;

5 Figure 5 shows a diagrammatic view which shows the construction of a communications network by using the method according to the invention;

10 Figure 6 shows a diagrammatic view of an assembly process according to a second embodiment in the region of a supply shaft where the cables and/or empty pipes which are to be laid are introduced together with an assembly hose; and

15 Figures 7A, 7B and 7C each show a cross-sectional view of a pipe duct at different stages of laying the assembly hose and the empty pipes and/or cables which are to be laid.

20 In order to install cables and/or empty pipes 2 in an existing laid pipe duct 1, such as for example a sewage pipe, as shown in Figure 2, a hose 3 which has been folded across its cross-section to form a flat web is drawn off from a supply reel 4 and let down over an inlet pulley 5 into a supply shaft 6 which runs perpendicular between the street surface 7 and the pipe duct 1 or channel 8. This hose 3 can be a woven and/or plaited hose which is impregnated with resin so that this hose 3 or the web folded therefrom is easy to handle, i.e. is flexible. As the hose 3 runs in, the cables or flexible empty pipes are unwound from supply reels 11, supplied for example in a supply lorry 9, and are guided over a guide pulley 10 and brought together with the folded hose. In the region of the inlet pulley 5 the cables and/or empty pipes 2 can be fixed spot-wise on the top side of the folded hose 3 so that the cables/empty pipes 2 cannot slip around. The hose 3 together with the cables/empty pipes 2 is drawn into the pipe duct 1 through the shaft 6, from where the duct 1 is readily accessible, for example by means of a draw cable which pulls in the direction of the arrow 12. The hose 3 is then drawn into the duct along to another entrance or access area (not shown in Figure 2), for example a further shaft so that the end is accessible there. The hose 3 with the cables/empty pipes 2 on the top side thereof then lies on

the bottom of the pipe duct 1 as shown by dotted lines 13 in Figure 2, or by the cross-sectional view of the pipe duct 1 in Figure 1A. The hose 3 is then separated from the supply reel 4 and closed airtight at its two open ends. Compressed air is then supplied through at least

5 one of these closed ends, through a compressor installed on the lorry 9 for example, so that the hose 3 becomes inflated and is pressed against the inside wall of the pipe duct 1. The cables/empty pipes 2 hereby become pressed against the top side of the pipe duct 1. The cable/empty pipes 2 hereby come to adjoin the top side of the pipe

10 duct 1, as shown in Figure 1B. When the hose 3 is in this position adjoining the inside wall of the pipe duct 1, depending on the type of hose 3 used, it becomes fixed or solid; for example if the hose 3 is of a type impregnated with resin which sets under heat, then the inside of the hose 3 is heated up in order to set the resin, but if it

15 involves a resin which sets under UV radiation then the inside of the hose 3 is subjected to infra red radiation using a suitable radiation device. After the hose 3 has set and hardened, the internal pressure can be removed. The cables and/or empty pipes 2 are then inserted and fixed in a transfer station 14 which is fixed readily accessible on

20 the wall of the shaft 6. The ends of the hose 3 can then be fixed appropriately in the region of the transition between the pipe duct 1 and shaft 6 so that the interspace between the wall of the pipe duct 1 and the outside of the hose 3 is sealed off. The pipe duct 1 is thus

25 as shown in Figure 1B provided with a smooth internal lining, with simultaneous protection and simultaneous sealing of the cables or empty pipes 2 which adjoin the inside wall of the pipe duct 1. Cables, such as data communication lines in the form of light conductor fibre cables which will be required later on can then be

30 installed between the pipe duct 1 and the hose 3.

As can be seen from Figures 1 and 2 this method here relates to the post-installation of cables and/or empty pipes into existing pipe ducts, sewage pipe systems or mains networks and is a very flexible universal method of utilising existing sewage pipe systems to build up
5 communications networks.

Whereas previously the method for installing cables and/or empty pipes 2 in existing sewage pipe systems was described using a flexible folded hose 3, Figure 3A shows a cross-section of a sewage pipe 1 in
10 which a longitudinally folded pipeline section of a deformed plastics pipe is shown which is folded inwards by its edges, seen in cross-section, i.e. the two edges are folded down and turned to face each other. A pipe deformed in this way, and made for example from a plastics material, has a certain stability of shape in the folded
15 state, as shown in Figure 3A. Cables/empty pipes 2 are in turn arranged and fixed on the top side of this folded hose 3 so that they face towards the upper wall of the pipe duct. Once this hose 3 is suitably positioned in the pipe duct 1 the hose is deformed back to the original pipe cross-section through a heated medium and internal
20 pressure, so that it lines the inside of the pipe duct 1 and at the same time presses the cable/empty pipes 2 against the inner wall of the pipe duct 1, as shown in Figure 3B.

Whereas previously the method has been described using a hose as a
25 tubular internal lining, Figure 4A shows a diagrammatic view of a pipe duct 1 which extends between two shafts. As opposed to the method of procedure described above, in the illustration of Figure 4A individual pipe sections 16 are let down into the one shaft 3 and are pushed
section by section by a feed mechanism 17 into the pipe duct 1. The
30 individual pipe sections 16 are hereby pushed into each other, welded together or screwed together so that they become connected together. At the same time cables/empty pipes 2 are attached to the top side of these pipe sections 16 and are pushed forwards together with the pipe sections 16. These cables/empty pipes 2 can be supplied directly from
35 a supply vehicle according to the illustration of Figure 2. After the pipe sections 16 have been forced forwards along to the second shaft 3 the cables/empty pipes 2 are then again inserted and fixed into a transfer station 14. The required length for the cables/empty pipes

can already be left on inserting the first pipe section 16 into the pipe duct 1, or these cables or empty pipes can be extended up to the transfer station 14. If it is desired then a plugging material 15 can be pressed into any interspaces which may remain or produce a ring
5 chamber, as shown in Figure 4B.

Figure 5 shows the diagrammatic build-up of a network using the method indicated above. In order for example to build up a new data transfer network, it is preferable to use the already laid main pipe ducts 1 of
10 a pipeline network, preferably those provided for sewage disposal, in order to install therein a number of individual cables/empty pipes 2 between the various transfer stations 14 by using a tubular internal lining, for example a hose 3 or pipe sections 16, as described above. Through existing house connections, i.e. the mains connection pipes
15 which take the sewage and waste water from a house 18 to the pipe duct 1, likewise marked with reference numeral 1, hoses 3 are introduced forming a tubular internal lining, clamped between a hose and the pipe duct 1. A transfer station 14 is then provided in the house 18 in order to connect up this household to the newly laid network. A
20 separate connection point 19 can be provided in the region of the transition from the house connecting pipe duct 1 to the main pipe duct 1 in order to provide the required branches of the cables/empty pipes 2 to the house 18.

25. According to a second embodiment, as shown in Figure 6, for post-laying cables and/or empty pipes 102 in an existing pipe duct 101, for example a sewage pipe, which is already laid in the ground, a supply 104 of flat-folded assembly hose 105 is set up in the region of a supply shaft 103 which runs perpendicular between the street surface
30 107 and the pipe duct 101. Furthermore supply reels 106 are provided at the supply shaft 103 on which the cables/empty pipes 102 are wound which are to be subsequently laid.

These supply reels 106 can be supplied for example on a lorry 108. From the lorry 108 the cables or empty pipes 102 run out over a guide pulley 109 at the back of the lorry 108 and perpendicular down into the supply shaft 103. Underneath the guide pulley 109 a container
5 111 containing an assembly mass 112 having adhesive properties is positioned on a platform 100. Roughly in the middle of the container 111 is an applicator device 113 which has two guiding and applicator rollers 114 between which the cables/empty pipes 102 are passed as they run over the guide pulley 9. As the cables/empty pipes 102
10 unwind so they are covered all round, i.e. on both sides with the assembly mass 112 at the applicator device 13 and the guide and applicator rollers 114.

The assembly mass 112 is preferably a dual-component epoxy resin.
15

The cables/empty pipes 102 which have thus become covered run out under the platform 100 and are brought together with the assembly hose 105 and laid down on the top side of the latter. The assembly hose
20 105 is for this purpose guided from the supply reel 104 over a first guide pulley 115 and a second guide pulley 116 set at the edge of the supply shaft 103, with the second guide pulley 116 in particular ensuring that the assembly hose 105 is produced as a flat web in the region where it comes together with the cables/empty pipes 2.

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The assembly hose 105 can be a silicon or rubber hose.

The assembly hose 105 on which now rest the cables and/or empty pipes
30 102 which have been covered with assembly mass 112 is then inserted at the end of the supply shaft 103 into the pipe duct 101 whereby the assembly hose 105 is drawn in the direction of the arrow 117 as it is laid. For this purpose a draw cable of a draw device (not shown in further detail) can be fixed at the end, not shown, of the assembly
35 hose 105 in order to draw the assembly hose 105 to a further supply shaft 103 which is connected to the pipe duct 101.

As can be seen in Figure 6 two batches 118 of a carrier strip 119, for example in the form of a woven band, can be additionally placed in the container 111 for the assembly mass 112, and are impregnated with the
5 assembly mass 112 and are then guided over the applicator and guide rollers 114 and are applied either side onto the cables/empty pipes 102 which are to be laid.

After the assembly hose 5 with the cables/empty pipes 102 placed on
10 the top side thereof, and where necessary with the additional carrier strip 119, has been introduced into the pipe duct 101, it is closed at the end (which is not shown) in the region of the other supply shaft 103, which is likewise not shown, and is separated from the supply reel 104 in the region of the supply shaft 103 which is shown in
15 Figure 6. A pump device which is positioned on the lorry 108 is then connected to the interior of the assembly hose 105 and pumps through a fluid, preferably air.

Figure 7A shows the position of the assembly hose 5 drawn into the
20 pipe duct 101 and having the cables/empty pipes 102 located thereon, as well as the two carrier strips 119, on the one hand between the assembly hose 105 and the cables/empty pipes 102 and on the other on the top side of the cables/empty pipes 102. Starting from this position according to Figure 7A air is supplied through the pump
25 device to the interior of the assembly hose 105 so that the latter is inflated, as shown in Figure 7B. As the assembly hose 105 inflates so the cables/empty pipes 102, embedded in the assembly mass 112 under pressure and lying between the carrier strips 119, are pressed against the top side of the pipe duct 101.

30 The assembly hose 105 is then held in the inflated state, as shown in Figure 7B, until the assembly mass 112 is set and the cables/empty pipes 102 are stuck together and to the wall of the pipe duct 101 in the upper circular arc region thereof. In order to set the assembly
35 mass 12 heat is applied or another radiation, depending upon the type of assembly mass which is used.

- After a holding time which is sufficient for the assembly mass 112 to become hardened, the pressure is withdrawn from the interior of the assembly hose 105. Through elastic shrinkage the assembly hose 105 is released from the assembly mass 112 so that it can be removed again from the pipe duct 101 and through the supply shaft 103. The cables/empty pipes 102 then remain, as shown diagrammatically in Figure 7C. It can be seen that the cables/empty pipes 102 are embedded on the one hand in the carrier mass 102 and on the other are covered by the outer carrier strips 119 which face towards the interior of the duct 101.
- The assembly position of the cables/empty pipes 102 against the inside wall of the pipe duct can be determined in advance but will mostly lie in the upper circle half of the duct cross-section.
- The assembly mass, preferably a dual-component epoxy resin can also be cold-setting.
- The hardening process can however be accelerated with extra assistance by using heat, i.e. the hardening time can be reduced. This can take place by heating water, air or by means of steam through which the assembly hose 105 is expanded.
- In addition mineral and/or synthetic textile layers and braided and/or woven fabric can be used as carrier material for the adhesive.
- The assembly hose serves not for the simultaneous renovation and lining of the pipe duct but only as a reusable assembly aid and will be removed again from the pipe duct once the adhesive has set.

PATENT CLAIMS

1. Method for the installation of at least one cable and/or empty
5 pipe in existing laid pipe ducts serving for supply or disposal, more particularly in sewage pipe systems or mains networks and the like, wherein the cables and/or empty pipes to be laid are introduced into the pipe duct and fixed against the wall thereof, characterised in that a tubular or hose-type internal lining is pushed and/or drawn
10 into the existing laid pipe duct whereby at least one flexible empty pipe and/or cable is arranged in the outside surface area of the lining.
- 15 2. Method according to claim 1 characterised in that the cables and/or empty pipes which are to be laid are covered with an assembly mass having adhesive properties, that they are then embedded with an assembly hose serving as the hose-type internal lining into the pipe duct, that the assembly hose is then expanded and the cables and/or
20 empty pipes are pressed against the pipe duct wall and that after sufficient holding time so that the cables and/or empty pipes stick against the wall, the pressure acting on the assembly hose is withdrawn.
- 25 3. Method according to claim 1 characterised in that a deformable hose is drawn in as the internal lining.
- 30 4. Method according to claim 3 characterised in that a second hose for the internal lining is inserted into the hose by means of a pressurised medium and is pressed against the inside wall of the pipe duct where it becomes irreversibly fixed.

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5. Method according to claim 3 characterised in that the hose is impermeable to fluid media.
6. Method according to claim 3 characterised in that the hose is perforated.
7. Method according to claim 3 characterised in that the hose consists of a material having a textile structure.
8. Method according to claim 1 characterised in that an irreversibly deformable hose is drawn in as the internal lining.
9. Method according to claim 8 characterised in that the hose is drawn into the pipe duct, the hose for lining the pipe duct is pressed by filling with gaseous or fluid medium against the inside wall of the pipe duct and is irreversibly fixed onto the inside wall.
10. Method according to claim 1 characterised in that the empty pipe and/or cable is applied to the outside surface of the tubular internal lining.
11. Method according to claim 10 characterised in that the empty pipe and/or the cable is or are applied onto the upper area of the outside surface.
12. Method according to claim 1 characterised in that a tubular or hose-type internal lining is used which contains the empty pipe and/or cable integrated in the wall.
13. Method according to claim 1 characterised in that the empty pipe and/or cable is fixed by at least some points on the outside surface of the tubular or hose-type internal lining along the length thereof.
14. Method according to claim 1 characterised in that for installing the tubular or hose type internal lining, the empty pipe and/or cable are held ready and then on drawing in the tubular or hose type internal lining into the pipe duct the empty pipe and/or cable is or are placed onto the hose.



15. Method according to claim 1 characterised in that as tubular or hose-type internal lining, one such lining is used whose cross-sectional circumference corresponds roughly to the cross-sectional
5 circumference of the pipe duct.

16. Method according to claim 1 characterised in that a woven hose is used as the hose.

10 17. Method according to claim 16 characterised in that a glass fibre hose is used as the woven hose.

18. Method according to claim 16 characterised in that a textile woven and/or braided hose impregnated with a settable resin is used as
15 the hose.

19. Method according to claim 18 characterised in that the outer and/or the inner surface of the hose is covered with a foil in tubular form.

20 20. Method according to claim 17 characterised in that as resin is used a resin which can be hardened through ultraviolet radiation.

21. Method according to claim 1 characterised in that the hose is
25 drawn into each relevant pipe duct as a substantially flat web.

22. Method according to claim 1 characterised in that a data communication cable is drawn in as the cable.

30 23. Method according to claim 1 characterised in that the tubular or hose-type internal lining is formed by individual tubular sections which are connected together as they are brought into the pipe duct.



24. Method according to claim 1 characterised in that the tubular internal lining is wound spirally from a material web as it is introduced into the pipe duct.

5 25. Method according to claim 1 characterised in that as the tubular or hose-type internal lining a plastics tube is used whose tubular wall cross-section is introduced into the existing pipe duct as a folded profiled section which is then re-shaped back to its original tubular cross-section through internal pressure by means of a heated
10 medium.

26. Method according to claim 1 characterised in that as tubular or hose-type internal lining, a plastics tube is used whose tubular cross-section prior to entry into the existing pipe duct is reduced
15 mechanically by tensile extrusion and after entry is relaxed again back to the original tubular cross-section by lifting the tensile strain.

27. Method according to claim 1 characterised in that after laying
20 the empty pipe and/or cable the respective ends thereof are guided into a distributor or connector box which is mounted in the access area into the relevant pipe duct.

28. Method according to claim 2 characterised in that the assembly
25 hose is removed again from the pipe duct after the pressure has been withdrawn.

29. Method according to claim 2 characterised in that the cable and/or empty pipe is or are covered with an assembly mass on the basis
30 of a dual component epoxy resin capable of cold-setting through chemical reaction.

30. Method according to claim 2 characterised in that the assembly
mass is hardened through heat.

35 31. Method according to claim 2 characterised in that the assembly mass is reinforced by insert layers.



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32. Method according to claim 31 characterised in that insert layers of mineral and/or synthetic materials are introduced for reinforcement.

5 33. Method according to claim 31 characterised in that the insert layers are introduced in textile form.

34. Method according to claim 31 characterised in that the insert layers are introduced in the form of woven and/or knitted and/or
10 braided material.

35. Method according to claim 31 characterised in that the insert layers are introduced in the form of felt.

15 36. Method according to claim 2 characterised in that the cable and/or empty pipe are embedded on all sides in the assembly mass.

37. Method according to claim 2 characterised in that a flat hose is introduced in the pipe duct as an assembly hose.
20

38. Method according to claim 37 characterised in that the flat hose can be made of plastics or rubber.

39. Method according to claim 37 characterised in that the flat hose
25 has expanding properties in respect of its circumference.

40. Method according to claim 2 characterised in that a separating layer is mounted between the assembly hose and the adhesive and/or carrier mass or the carrier mass having adhesive properties.
30

41. Method according to claim 40 characterised in that the separating layer is arranged on the assembly hose in the form of a material web.

42. Method according to claim 41 characterised in that the web
35 material is left in the pipe duct as a cover for the cables and/or empty pipes.



43. Method according to claim 41 characterised in that the separating layer is mechanically fixed on the assembly hose.

5 44. Method according to claim 43 characterised in that the separating layer can be released again from the assembly hose.

45. Method according to claim 41 characterised in that the mechanical fixing is undertaken by means of a touch and close band.

10 46. Method according to claim 42 characterised in that the separating layer is fixed on the assembly hose in the form of a material web by means of a double-sided adhesive tape.

15 47. Method according to claim 28 and claim 46 characterised in that the adhesive tape is removed from the pipe duct after the assembly hose has been removed.

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