

Method for completing a borehole

The invention relates to a method for completing a borehole before the start of production, wherein after the introduction of the borehole the borehole wall is anchored
5 sealingly by means of a conveying tube and/or casing tube, and the borehole wall is perforated at desired locations by means of perforation units.

The object on which the invention is based is to provide a method for completing a borehole prior to the start of
10 production (through tubing rotary drill bores), without the use of cemented conveying tubes and/or casing tubes.

The method should fulfill the following conditions:

- reliable/robust connection of the formation to the borehole
- 15 • remote control for activating the perforation guns
- the boreholes must be finished and ready for production in the shortest possible time
- preferably, only one descent into the bore
- the system must be capable of being used above the
20 conductor tubing by means of which the bore is completed
- after installation, the possibility of access to the borehole so that maintenance work can be carried out
- it must be possible to use the system via a side
25 orifice in the casing tube
- allows the completion of several horizons
- allows the selective production of different horizons
- capable of being used for short and long sections up to a few hundred meters
- 30 • use must be possible in petroleum and natural gas bores (under dry and wet conditions)

- guarantee of compatibility with surface controlled subsurface safety valves or other sensitive borehole equipment

The aim is to have a simultaneous installation of the
5 conveying tube and/or casing tube and of the perforation unit. The system or method must allow the sealing off of various zones and the selective activation of each zone at any desired position and at any desired time point.

On account of the temperature restrictions in explosive
10 perforation systems, long underground times are not possible before the explosion. The flow channels in the reservoir therefore have to be set up immediately after the installation of the system, even when multiple-horizon completions with different production times are required.

15 This object is achieved, according to the invention, in that the conveying tube and/or casing tube are/is provided on their/its outer face with a swellable sealing jacket, the sealing jacket after activation swelling and anchoring the annular gap sealingly between the conveying tube and/or
20 casing tube and the borehole wall and at the same time centering the conveying tube and/or casing tube in the borehole. This affords a method for completing a borehole before the start of production, without cemented conveying tubes and/or casing tubes having to be used.

25 In a development, the activation and swelling of the sealing jacket are carried out after perforation. As a result, the conveying tube and/or the casing tube are/is anchored sealingly and at the same time centered in the borehole.

In an inventive refinement, the perforation pressure and/or
30 the borehole temperature and/or the liquid which is generated in the production zone are/is used for activating the sealing jacket for swelling purposes. These are characteristic variables which change during and/or after perforation.

In one embodiment, the material used for the sealing jacket is a viscous material and/or a rubber or thermoplastic.

In a development of the invention, the sealing jacket is designed to be deactivatable and, after deactivation, is
5 permeable to liquids or gases. As a result of deactivation, previously sealed-off regions can be opened again.

Preferably, chemical and/or thermal activation stimulators are used for deactivation.

In one embodiment, the chemical activation stimulators used
10 are aggressive media, for example acids, which dissolve the sealing jacket or parts of the sealing jacket.

In an inventive refinement, for thermal deactivation, the activation stimulator used is a heating module which, for activation, is brought to the desired location in the
15 conveying tube and/or casing tube.

In one refinement, different sealing jackets are used for different horizons, so that, if different activation stimulators are used, a selective opening of the sealing jackets is achieved, and these orifices can be connected to
20 the conveying tube for production.

In a preferred refinement, at least one perforation unit is inserted inside the conveying tube and/or casing tube.

In a preferred refinement, the conveying tube and/or casing tube are/is designed in a module-like manner together with
25 the perforation unit, each module consisting of a section of the conveying tube and/or casing tube and of a perforation unit. These modules can be connected to one another, for example via a screw connection, outside the borehole.

Preferably, all the necessary components, such as charges,
30 ignition cable sections and wire pieces, are preinstalled in the module, the terminals for electrical and ballistic contact being installed fixedly at one end of each module,

and, at the other end, the terminals being prestressed by means of a spring, so that, after the connection of two modules, reliable electrical and ballistic contact between the individual modules is ensured.

- 5 In an inventive development, the terminals of the first module which are to be coupled are coupled to the terminals of the contiguous second module so that the terminals lie opposite one another in their axial direction and thus, during use, transfer electrical and ballistic contact, the
10 terminals of at least one module being acted upon with force in the direction of the terminals of the contiguous other module, so that the end faces of the adjacent terminals always touch one another during use.

- In one embodiment, to trigger the perforation unit or
15 perforation units, a gas-pressure-activated ignition mechanism is used, which is installed at the lower end of the perforation system.

- In one design variant, preferably in single-horizon completions, the gas-pressure-activated ignition mechanism
20 activates an impact fuse.

In another embodiment, particularly in multiple-horizon completions, a separate electrical detonator is used for each perforation zone.

- In this case, in a development of the invention, the
25 detonators are connected via wires, the ignition mechanism containing an induction appliance, which is operated by the gas pressure, and the induced current then igniting the detonators.

- In another embodiment, the ignition mechanism used is a
30 wire-operated firing head (wireline firing head) which is installed on the top side of the conveying tubing before installation takes place in the lower region of the borehole. For ignition, a module on the cable is moved into

the borehole, latches on the ignition mechanism on top and, by the electrical connection of the borehole head to the perforation unit, locks on the electrical signals which are required for igniting the detonators. After detonation, the
5 ignition mechanism is separated from the conveying tubing and is moved out of the borehole with the aid of the cable.

In one embodiment, the elements of the perforation unit dissolve automatically after detonation. As a result, production is not impeded by residues of the perforation
10 unit.

Since the elements of the perforation unit can be dissolved automatically after detonation, preferably reactive materials, such as zinc, aluminum or magnesium, are used for the charge housings of the hollow charges.

15 Non-reactive sleeve materials of the charges, which generate a fine sand-like dust, such as glass or porcelain, may also be used for the charge housings.

A conveying tube and/or casing tube according to the invention for carrying out the method is characterized in
20 that the conveying tube and/or casing tube has on its outer face a swellable sealing jacket.

In one embodiment, the material of the sealing jacket is a viscous material and/or a rubber or thermoplastic.

Preferably, the sealing jacket is deactivatable and, after
25 deactivation, is permeable to liquids.

In one embodiment, the conveying tube and/or casing tube is designed in a module-like manner, and at least one perforation unit is inserted in each module.

In one refinement, the terminals for electrical and
30 ballistic contact are installed fixedly at one end of each module and, at the other end, the contacts are prestressed by means of a spring, so that, after the connection of two

modules, reliable electric and ballistic contact between the individual modules is ensured.

In a preferred development, the terminals of the first module which are to be coupled are coupled to the terminals
5 of the contiguous second module so that the terminals lie opposite one another in their axial direction and thus, during use, transfer electrical and ballistic contact, the terminals of at least one module being acted upon with force in the direction of the terminals of the contiguous other
10 module, so that the end faces of the adjacent terminals always touch one another during use.

In an inventive refinement, the perforation units contain charge housings of the hollow charges which dissolve automatically after detonation.

15 Preferably, the charge housings of the hollow charges consist of reactive materials, such as zinc, aluminum or magnesium, or consist of non-reactive materials which, after the detonation of the hollow charges, generate a fine sand-like dust, such as glass or porcelain.

20 The invention is described in detail below.

A simultaneous perforation of all the production horizons can easily be achieved if conventional perforation systems are used together with the conveying tube technique. In order to separate different horizons from one another and
25 seal off individual perforation ducts, a sealing-off device on the outside of the conveying tube is proposed. The sealing-off device used may be a slide. Preferably, according to the invention, a sealing jacket is employed which is installed on the conductor tube on the outside and
30 which is activated under specific conditions. The sealing material of the sealing jacket preferably extends over the entire length of the sidetrack completion, that is to say of a side train. It is possible that the perforation horizons which are intended for immediate production are not equipped

with the sealing material, if this is required by the geology or production conditions.

The perforation pressure, the borehole temperature or the liquid which is generated by the conveying zone may be used
5 for activating the sealing jacket, with the result that the material of the sealing jacket swells and closes the annular gap between the conductor tube and the open hole. The sealing jacket may be manufactured from a viscous material, for example from a type of rubber or thermoplastic, which is
10 exposed immediately after perforation. The activation and swelling of the sealing jacket must take place after perforation.

After the activation of the sealing jacket, the various zones are isolated, and all the desired perforation ducts in
15 the reservoir are closed and therefore separated from the conveying tube. The ducts are tied up directly to the conveying tube at the location where no sealing jacket has been applied and are therefore ready for production. As soon as the sealing material of the sealing jacket has been
20 swollen, it not only closes the annular gap, but also centers the conveying tube in the open borehole.

In order to connect specific desired horizons, various types of deactivation of the sealing material may be employed. In particular, chemical and thermal activation stimulators may
25 be used. By using aggressive media, for example acids, part of the sealing material can be dissolved. For different horizons, different sealing materials must be employed, that is to say, if different acids are used, a selective opening of the perforation ducts can be achieved. To dissolve the
30 sealing material by the supply of heat, a heating module may be employed which, using a wireline tractor, is brought to the corresponding location. Depending on the position of the heating module, horizons can be selectively opened and connected to the conveying tube for production.

Hydrocarbon production itself takes place directly via the conveying tube. The conveying tube also functions as a transport mechanism for the perforation system. A conveying tube made from steel with a sealing jacket made from sealing material transports the perforation unit downward in the borehole and serves for completing the side track, that is to say the side train. In order to obtain a free flow path and allow access to the borehole for the purpose of maintenance work, a self-dissolving perforation unit is employed inside the conveying tube.

One possibility for achieving this aim is to use reactive materials for the charge housings for the purpose of generating a self-destructing charge (for example zinc or magnesium). The charges are attached to locations which are provided for production in the conveying tube. In each individual horizon, the charges are connected via detonating cords. A booster-booster ballistic transfer is used for ballistic and electrical connection between various sections of the conveying tube. Various perforation zones are connected via wires. Each perforation zone has its own detonator for igniting the detonation.

In order to ensure a rapid assembly of this installation at the borehole location, all the charges, ignition cable sections and wire pieces are preinstalled in the conveying tube before they are transported to the borehole location. The conveying tube has flat threaded connections (for example, extreme line joints) at the ends. The wire and booster connectors are fastened centrally inside the conveying tube. One side of the terminal is always fixedly installed, while the other side is prestressed by means of a spring. Reliable electrical and ballistic contact between the individual tube pieces is thereby ensured.

For triggering the perforation unit, various devices may be employed. For use in the case of once-only descent, a gas-pressure-activated ignition mechanism is proposed which can be installed at the lower end of the perforation unit. This

ignition mechanism may activate an impact fuse for single-horizon completions or for several horizons in which the individual perforation regions are connected via a detonating cord. In this application, only a single
5 detonator is employed.

Alternatively, a gas-initiated inductive-electrical ignition mechanism may be used. Such an appliance would, as a result of the movement of a piston, induce in a coil an electrical current which is used in order to initiate the various
10 electrical detonators inside the conveying tube. A further possibility for ignition would be to use a wireline firing head at the upper end of the installation, this wireline firing head being connected to all the detonators. In this case, a cable has to be laid downwardly in the borehole and
15 connected to the ignition mechanism. The explosive impulse is then sent downward in the borehole via the cable.

Such an ignition device would make it possible to use electrical and electronic detonators or EFI/EBW which have the additional advantage that they are HF-safe. As a
20 result, a reliable operation of the system can be achieved. Even radio traffic does not have to be interrupted during use. The latched cable is used in order to move out the explosive head after the explosion. As a result, as already mentioned, a free flow path and direct access for later
25 maintenance work are made possible.

The system contains in detail the following components:

Hollow charges

For the method or system according to the invention, a standard hollow charge has to be modified so that it self-
30 destructs. It is proposed to use reactive materials for the charge housings. The reactive materials used could be, on the one hand, metals, such as zinc, aluminum or magnesium. In the case of zinc charges, problems with specific borehole scavengings may arise. An exact analysis of the borehole

conditions is therefore necessary before this material can be employed. The advantage of zinc is its easy solubility in acid, with the result that the residues of the charges can easily be dissolved. Furthermore, the residues of the
5 zinc charges normally take the form of fine dust which has a very large surface, thus further promoting a dissolution of the residues.

Aluminum and magnesium are highly reactive materials which react even during the operation of detonating the hollow
10 charges. Moreover, magnesium reacts with water, this, in turn, having an effect conducive to the dissolution of the residues.

An alternative to solving the problem of a self-destructing hollow charge would be to use reactive materials, such as
15 propellants or explosives, in combination with reactive binders, in order to produce the housing of the hollow charge. A similar solution is known from military applications with regard to caseless ammunition.

A further solution would be to use non-reactive sleeve
20 materials which generate a fine sand-like dust. Glass or porcelain are materials which may be used for hollow charge housings and which leave behind only fine particles. These could then be washed out of the borehole together with the first quantities produced and be separated from the
25 hydrocarbons in a sand separator. As a result, as already mentioned, a free flow path and direct access for subsequent maintenance are made possible.

Conveying tube and connectors

A standard conveying tube with flat threaded connections
30 (for example, extreme line joints) at the ends is employed. As a result, the conveying tubes can be screwed together without sockets, with the result that a flat surface is obtained after the tube is finished. Standard materials and sizes of conveying tubes are employed. The desired diameter

range amounts to 2-7/8", 3-3/8", 4", 4½", 5" with a standard length of 3-9 m. However, smaller and larger diameters may also be used (min. 1-9/16"/max. 7").

Initiating device, ballistic transfer and electrical contact

- 5 Various initiating devices may be used for the system.
Three different systems are proposed.

Preferably, a gas-activated ignition mechanism is employed which is installed at the end of the perforation system. Installation in one operation with remote-controlled
10 ignition of the perforation units is thereby possible.

In the case of single-horizon completions, this gas-activated ignition mechanism activates an impact fuse (mechanical gas-activated ignition mechanism).

In the case of multiple-horizon completions, a separate
15 electrical detonator is proposed for each perforation zone. The detonators are connected via wires. The ignition mechanism contains an induction appliance which is operated by the gas pressure. The induced current then ignites the electrical detonators (electrical inductive gas-activated
20 ignition mechanism).

The third initiation possibility is to use a wireline firing head. This firing head is installed on the top side of the conveying tubing before installation in the lower region of the borehole takes place. A snap mechanism is located on
25 the top side. For ignition, a module is moved into the borehole on the cable and latches on the ignition mechanism on top. By the borehole head being connected electrically to the perforation unit, the electrical signals required for igniting the detonators can be locked on. After detonation,
30 the ignition mechanism is separated from the conveying tubing and moved out of the borehole with the aid of the cable.

The disadvantage of this solution is that an additional descent into the borehole is required. On the other hand, one advantage is that it is possible to use electronic detonators or EBW/EFI initiators. These detonators are HF-safe, and there is therefore no need to suspend radio traffic during use. The system therefore acquires additional safety, in particular under offshore conditions.

Each conveying tube is equipped with the charges, the ignition cable, the detonators, wires and ballistic and electrical transfer devices before transport to the borehole location takes place. A connector unit, such as is described in EP 1 828 709 A1, is installed at the end of each conveying tube. One side is fastened and the other tensioned by a spring. This ensures a reliable transfer of the detonation and/or of the electrical signals between the various sections. During the installation of the system on site in a borehole, the threaded parts of the conveying tube sections are screwed together. In this case, there is no fear of any damage to the electrical and ballistic terminals. This method allows a simple, safe, reliable and rapid assembly of the conveying tube sections.

Sealing jacket

The sealing jacket is a central integral part of the system. In this case, a material may be used which expands either in conjunction with specific liquids when the perforation pressure prevails or when there is the action of heat. The sealing jacket is installed on the outside of the conveying tube made from steel. The application of the material to the outer face of the steel tube may take place by adhesive bonding, vulcanization, thermal shrinkage, extrusion or other robust fastening methods. The coefficient of expansion must be carefully selected as a function of the minimum and maximum diameter of the open hole.

In order to allow a selective opening of the perforation ducts for production, it must be possible to deactivate and

open the sealing material at specific locations and specific time points by means of special methods.

The sealing material could be melted away by the action of heat. For this purpose, a heating module may be employed
5 which is moved into the borehole on a cable. In this case, a borehole tractor for horizontal boreholes may be used. By means of this module, the required heat energy for dissolving the sealing jacket is generated.

Another possibility for the selective opening of the sealing
10 jacket is to use aggressive chemicals, for example acids, which dissolve the sealing jacket. To remove specific regions by etching, either the use of different types of sealing materials which react only with specific chemicals is required or it is necessary to separate the individual
15 regions by means of packers.

Opening module

Depending on the type of sealing material, a heating module must be used so that it is possible to generate in the borehole sufficient heat with the aid of which the sealed-
20 off ducts can be opened again. This device is required only when a chemical method for opening the regions is not employed.

Shut-off of various horizons within the conveying tube

Standard shut-off devices, such as plugs or packers, can be
25 installed in the conveying tubing by means of standard methods, for example by means of cables, in combination with a tractor for horizontal boreholes. In addition, shut-off devices may be installed on the surface during the installation of the conveying tube. In this type of use, it
30 is necessary to ensure that the shut-off devices are capable of withstanding the detonation pressure arising during perforation. Furthermore, access to the lower-lying

sections of the installation is restricted inside the conductor tube on account of shut-off devices.

The proposed solution for the problem of the completion of the through tubing rotary drill bores for boreholes, without
5 the use of cemented conductor tubes, constitutes a completion which is exceedingly variable and modern.

In particular, the solution affords a reliable robust method for connecting the production horizons to the borehole, using standard perforation systems which are well known in
10 the industry. By the use of a gas-activated ignition mechanism functioning mechanically or inductive-electrically, remote activation of the perforation system is possible. Since the perforation system is installed inside the conductor tube and standard threads are used which are
15 screwed together at the borehole location, without in this case the fear of damage to the electrical or ballistic contacts, the assembly time required can be minimized, and the borehole can be finished and put into operation in the shortest possible time.

20 The system can be installed in the borehole in one operation. The perforation system is installed inside the conveying tubing with which the borehole is completed. By a self-destructing perforation system being used, a free flow path and easy access for the maintenance of the borehole are
25 achieved. The diameter of the system is designed so that the system can be introduced via a side aperture in the casing tube. In this case, the stipulated minimum dimensions for opening regions are adhered to.

By the use of an opening device, a selective opening of the
30 perforation ducts in the case of multiple-horizon completions, with selective production in different horizons, is possible. The corresponding intervals are limited only by the standard conveying tube technique. The system may be used in oil and gas boreholes under wet or dry
35 conditions.

On account of the super-flat outer face of the completion section, which is coated with a sealing jacket, the conductor tube is compatible with underground-installed safety valves [subsurface safety valves (SCSSV)] or with
5 other sensitive borehole equipment located in the set-up.

The invention is further explained below with reference to figures.

Figure 1 shows a borehole 1 as a main borehole and a branching-off secondary track as borehole 2. In the
10 following figures, a completion of the borehole 2 prior to the start of production is described. The borehole 2 is subdivided into various zones 13a, 13b, 13c, and each zone requires a different completion or completion at a different time point.

Figure 2 shows a finished completion for the zones 13a and 13b which consist of modules 11a, 11b and 11c connected to one another. Each of the said modules 11a, 11b and 11c consists of a conveying tube 4a, 4b, 4c which is provided on its outside in each case with a sealing jacket 6. The
15 conveying tubes 4a, 4c with their sealing jackets 6 are perforated, so that production can take place via the perforation ducts 14.
20

Figure 3 shows a conveying tube 4 which is provided on its outer face with a sealing jacket 6. To deactivate the sealing jacket 6, that is to say to dissolve the sealing
25 jacket 6 at specific locations, various methods may be adopted. To dissolve the sealing jacket 6 by the supply of heat, a heating module 7 may be employed which, using a well tractor with a wireline unit, is brought to the
30 corresponding location. The heating module 7 heats the sealing jacket 6 at the desired locations, with the result that the material of the sealing jacket melts at these locations and thereby provides opening ducts. Perforation ducts 14 are thereby connected for production purposes.

Figure 4 shows a conveying tube 4 which is provided on its outer face with a sealing jacket 6. To deactivate the sealing jacket 6, that is to say to dissolve the sealing jacket 6 at specific locations, chemical activation
5 stimulators are employed here. Here, these are aggressive acids 17 which dissolve parts of the sealing jacket 6.

Figure 5 shows a module 11a consisting *inter alia* of a conveying tube 4 with a sealing jacket 6 which is activated, that is to say closed, and acts as a seal. The perforation
10 ducts 14 are therefore partitioned off from production. The hollow charges have dissolved after detonation, and no residues are present.

Figure 6 shows two modules 11a, 11b connected to one another via a screw connection 18 and in each case having a
15 perforation unit 5. Each perforation unit 5 consists of a tubular housing into which hollow charges 10 are inserted. These hollow charges 10 consist in each case of a charge housing 9 with an inserted charge. Moreover, each
20 perforation unit 5 has an ignition cord for initiating the hollow charges 10 and an electrically conductive wire 19. For coupling between these, these terminals 12 are connected to one another between the modules 11a, 11b.

Each module 11a, 11b contains all the necessary components, such as charges, ignition cable sections and wires 19, which
25 are preinstalled in the module 11, the terminals 12a for electric and ballistic contacts being installed fixedly at one end of each module 11, and, at the other end, the terminals 12b being prestressed by means of a spring 8, so that, after the connection of two modules 11, reliable
30 electrical and ballistic contact between the individual modules 11 is ensured.

The terminals of the first module 11 which are to be coupled are coupled to the terminals of the contiguous second module so that the terminals 12a, 12b lie opposite one another in
35 their axial direction and thus, during use, transfer

electrical and ballistic contact, the terminals 12b of at least one module being acted upon with force in the direction of the terminals of the contiguous other module, so that the end faces of the adjacent terminals 12a, 12b
5 always touch one another during use.

Figure 7 shows an extract from the completion of a borehole. The individual modules 11a, 11b can be seen in the two zones 13b and 13a. Each module consists of a conveying tube 4 with a sealing jacket 6 (see the previous figures).
10 Arranged at the lower end is a gas-pressure-activated ignition head 15 which initiates the ignition of the hollow charges 10. The ignition signal is conducted to the individual perforation units in the modules and ignites the hollow charges there. Reference symbol 16 denotes a
15 detonator for initiating the contiguous ignition cord in the zone 13b, which, in turn, initiates, that is to say explodes, the hollow charges in the perforation units of the modules in this zone. The zones in which production is to be started by the provision of the perforation ducts can
20 therefore be controlled, as desired.

Patent Claims

1. A method for completing a borehole (1, 2) before the start of production, wherein after the introduction of the borehole (1, 2) the borehole wall (3) is anchored sealingly by means of a conveying tube (4) and/or casing tube, and the borehole wall (3) is perforated at desired locations by means of perforation units (5), characterized in that the conveying tube (3) and/or casing tube are/is provided on their/its outer face with a swellable sealing jacket (6), wherein after activation the sealing jacket (6) swells and anchors the annular gap sealingly between the conveying tube (4) and/or casing tube and the borehole wall (3) and at the same time centers the conveying tube (4) and/or casing tube in the borehole (1, 2).
2. A method as claimed in claim 1, characterized in that the activation and swelling of the sealing jacket (6) are carried out after perforation.
3. A method as claimed in claim 1 or 2, characterized in that the perforation pressure and/or the borehole temperature and/or the liquid which is generated in the production zone are/is used for activating the sealing jacket (6) for swelling purposes.
4. A method as claimed in one of claims 1 to 3, characterized in that the material used for the sealing jacket (6) is a viscous material and/or a rubber or thermoplastic.
5. A method as claimed in one of claims 1 to 4, characterized in that the sealing jacket (6) is designed to be deactivatable and, after deactivation, is permeable to liquids or gases.

6. A method as claimed in claim 5, characterized in that chemical and/or thermal activation stimulators are used for deactivation.
7. A method as claimed in claim 6, characterized in that the chemical activation stimulators used are aggressive media, for example acids, which dissolve the sealing jacket (6) or parts of the sealing jacket (6).
8. A method as claimed in claim 6 or 7, characterized in that, for thermal deactivation, the activation stimulator used is a heating module (7) which, for activation, is brought to the desired location in the conveying tube (4) and/or casing tube.
9. A method as claimed in one of claims 1 to 8, characterized in that different sealing jackets (6) are used for different horizons, so that, if different activation stimulators are used, a selective opening of the sealing jackets (6) is achieved, and these orifices can be connected to the conveying tube (4) for production.
10. A method as claimed in one of claims 1 to 9, characterized in that at least one perforation unit (5) is inserted inside the conveying tube (4) and/or casing tube.
11. A method as claimed in claim 10, characterized in that the conveying tube (4) and/or casing tube are/is designed in a module-like manner together with the perforation unit (5), each module (11) consisting of a section (4a) of the conveying tube (4) and/or casing tube and of a perforation unit (5).
12. A method as claimed in claim 11, characterized in that all the necessary components, such as charges, ignition cable sections and wire pieces, are preinstalled in the module (11), the terminals (12a) for electrical and

ballistic contact being installed fixedly at one end of each module (11), and, at the other end, the terminals (12b) being prestressed by means of a spring (8), so that, after the connection of two modules (11), reliable electrical and ballistic contact between the individual modules (11) is ensured.

13. A method as claimed in claim 12, characterized in that the terminals (12a, 12b) of the first module (11) which are to be coupled are coupled to the terminals of the contiguous second module so that the terminals (12a, 12b) lie opposite one another in their axial direction and thus, during use, transfer electrical and ballistic contact, the terminals (12b) of at least one module being acted upon with force in the direction of the terminals of the contiguous other module, so that the end faces of the adjacent terminals (12a, 12b) always touch one another during use.
14. A method as claimed in one of claims 1 to 13, characterized in that, to trigger the perforation unit or perforation units (5), a gas-pressure-activated ignition mechanism is used which is installed at the lower end of the perforation unit (5).
15. A method as claimed in claim 14, characterized in that preferably, in single-horizon completions, the gas-pressure-activated ignition mechanism activates an impact fuse.
16. A method as claimed in one of the preceding claims, characterized in that, particularly in multiple-horizon completions, a separate electrical detonator is used for each perforation zone.
17. A method as claimed in claim 16, characterized in that the detonators are connected via wires, the ignition mechanism containing an induction appliance, which is

operated by the gas pressure, and the induced current then igniting the detonators.

18. A method as claimed in one of the preceding claims, characterized in that the ignition mechanism used is a wire-operated firing head (wireline firing head) which is installed on the top side of the conveying tubing before installation takes place in the lower region of the borehole, and, for ignition, a module on the cable is moved into the borehole and latches on the ignition mechanism on top, and, by electrical connection of the borehole head to the perforation unit, the electrical signals required for igniting the detonators are locked on, and, after detonation, the ignition mechanism is separated from the conveying tubing and is moved out of the borehole with the aid of the cable.
19. A method as claimed in one of claims 1 to 18, characterized in that the elements of the perforation unit (5) dissolve automatically after detonation.
20. A method as claimed in claim 19, characterized in that reactive materials, such as zinc, aluminum or magnesium, are used for the charge housings (9) of the hollow charges (10).
21. A method as claimed in claim 20, characterized in that non-reactive sleeve materials which generate a fine sand-like dust, such as glass or porcelain, are used for the charge housings (9).
22. A conveying tube and/or casing tube for carrying out the method as claimed in one of claims 1 to 21, characterized in that the conveying tube (4) and/or casing tube has on its outer face a swellable sealing jacket (6).
23. A conveying tube and/or casing tube as claimed in claim 22, characterized in that the material of the

sealing jacket (6) is a viscous material and/or a rubber or thermoplastic.

24. A conveying tube and/or casing tube as claimed in claim 22 or 23, characterized in that the sealing jacket (6) is deactivatable and, after deactivation, is permeable to liquids.
25. A conveying tube and/or casing tube as claimed in one of claims 22 to 24, characterized in that the conveying tube (4) and/or casing tube is designed in a module-like manner, and at least one perforation unit (5) is inserted in each module.
26. A conveying tube and/or casing tube as claimed in claim 25, characterized in that the terminals for electrical and ballistic contact are installed fixedly at one end of each module and, at the other end, the terminals are prestressed by means of a spring (8), so that, after the connection of two modules, reliable electrical and ballistic contact between the individual modules is ensured.
27. A conveying tube and/or casing tube as claimed in claim 26, characterized in that the terminals of the first module which are to be coupled are coupled to the terminals of the contiguous second module so that the terminals (12a, 12b) lie opposite one another in their axial direction and thus, during use, transfer electrical and ballistic contact, the terminals (12b) of at least one module being acted upon with force in the direction of the terminals (12a) of the contiguous other module, so that the end faces of the adjacent terminals (12a, 12b) always touch one another during use.
28. A conveying tube and/or casing tube as claimed in one of claims 22 to 27, characterized in that the perforation units (5) contain charge housings (9) of the hollow

charges (10) which dissolve automatically after detonation.

29. A conveying tube and/or casing tube as claimed in claim 28, characterized in that the charge housings (9) of the hollow charges (10) consist of reactive materials, such as zinc, aluminum or magnesium, or consist of non-reactive materials which, after the detonation of the hollow charges, generate a fine sand-like dust, such as glass or porcelain.