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METHOD AND APPARATUS FOR INSERTING A COMMUNICATION WIRE THROUGH A PIPELINE BY AIR FLOW
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A method and an apparatus are provided for inserting and removing a communication wire [1] in and out of a pipeline [3] by air flow, in which static electricity can be prevented from being generated, and a long communication wire [1] can be inserted and removed. The communication wire [1] is fed from a reel [2], and inserted into a pipeline [3] through a blowing head [4]. Compressed air is also sent from a compressor [5] to the pipeline [3] through the blowing head [4]. A drop cylinder [7] is attached to a T-branch [6] on the way of the pipeline [3], conductive material [9] stored therein is supplied into the pipeline [3] at a controlled rate. A recovery bottle [10] is attached to the outlet side of the pipeline [3] so that the air flow blowing out of the outlet side is passed through a filter [11], and at the same time the conductive material [9] is recovered. By making the conductive material [9] pass through the pipeline [3] together with the air flow, generated static electricity can be eliminated, and the communication wire [1] can be prevented from contacting tightly with the pipeline [3] because of the static electricity.

Claim

1. A method for inserting a communication wire through a pipeline, comprising the steps of inserting the communication wire into said pipeline, propelling the wire through said pipeline by air flow, and introducing conductive minute solids into said air flow.

7. A method for inserting a communication wire through a pipeline comprising the steps of:

- inserting the communication wire into said pipeline;
- propelling the communication wire through said pipeline by air flow; and
- introducing substantially spherical small size conductive particles, having particle size of between about 50 to 300 μm , with the communication wire into said air flow.

METHOD AND APPARATUS FOR INSERTING A COMMUNICATION WIRE
THROUGH A PIPELINE BY AIR FLOW

BACKGROUND OF THE INVENTION

1. Field of the invention

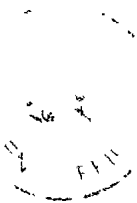
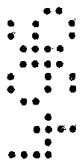
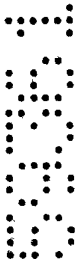
5 The present invention relates to a method and apparatus for inserting a communication wire through a pipeline, in which the communication wire, such as an optical fiber cable or the like, coated with an insulating material is inserted through the pipeline by air flow, and particularly relates to the method in which the resistance of propelling the communication wire is reduced.

10 2. Description of the Related Art

15 In a method of inserting a communication wire material through a laid pipeline by air flow while blowing compressed ~~air there~~^{there through}, it is important to reduce the friction coefficient between the communication wire and the inner wall of a pipeline. For example, in an optical fiber cable disclosed in Japanese Patent Unexamined Publication No. Hei-2-50111, the friction coefficient is reduced by adding a solid lubricant to an outermost layer of a coating layer which is a contacting surface with the inner wall of a pipeline. In addition, a method of laying an optical fiber cable in which blowing powder talc as lubricant is disclosed in Japanese Patent Examined Publication No. Hei-2-22921.

In general, a pipeline through which a communication wire is inserted is made of insulating resin. The coating layer of the communication wire also is made of an insulating resin. With respect to an optical fiber cable, for example, the cable is usually coated with foamed polyethylene and it is compressed and inserted into a polyethylene pipeline. As for the gas for propelling the cable, dried air or nitrogen is usually used in order to avoid increasing the frictional resistance due to moisture.

There is therefore a tendency to cause static electricity by friction when a communication wire is compressed and inserted into a pipeline by air flow. If static electricity is generated, resistance is produced by the electrostatic force so that frictional resistance increases. In the above-mentioned methods, there has been an effort to reduce the friction coefficient, but there is no effort to reduce static electricity. Although a method of coating the surface of a coating layer of a communication wire with an antistatic material, such as diethanolamine or the like, has been reported, experiments made by the present inventor and others have proven that the antistatic material is shaved from the communication wire by friction against the pipeline. The antistatic effect is reduced if the insertion distance is increased, that is, the greater the insertion distance, the lesser the antistatic effect of the antistatic material.



The following reasons are thought to account for the above-given results.

1. Since such an antistatic material has the function of discharging charged static electricity by absorbing moisture to form a semiconductor film on the material surface, the conductivity thereof becomes lost if the insertion distance is increased so that the time of exposure to the propelling dried air is prolonged.
2. The antistatic material layer is shaved from the communication wire so that the beneficial effect of preventing charge accumulating is reduced.
3. If the insertion distance of the wire is increased, the frequency of frictional interaction between the pipeline and the communication wire is increased, and so the possibility of generating static electricity is increased.

Thus, in a known method of inserting a communication wire through the pipeline by air flow, the attraction between a pipeline and the communication wire is increased by the charging of static electricity during propelling by the velocity of the air flow. The frictional resistance too is increased with increase in the insertion length of the communication wire.

SUMMARY OF THE INVENTION

The present invention, taking the foregoing problems into consideration, has a preferred object to provide a method of inserting a communication wire into or through a pipeline by air flow, in which the friction coefficient between the communication wire and the pipeline can be reduced so that a long communication wire can be inserted.

Further, the present invention has a preferred object to provide an apparatus for inserting a communication wire through a pipeline by air flow, in which the friction coefficient between the communication wire and the pipeline can be reduced so that a long communication wire can be inserted.

5 The invention discloses a method for inserting a communication wire through a pipeline, comprising the steps of inserting the communication wire into said pipeline, propelling the wire through said pipeline by air flow, and introducing conductive minute solids into said air flow.

10 The invention further discloses a method for inserting a communication wire through a pipeline comprising the steps of:

inserting the communication wire into said pipeline;

propelling the communication wire through said pipeline by air flow; and

introducing substantially spherical small size conductive particles, having particle size of between about 50 to 300 μm , with the communication wire into said air

15 flow.

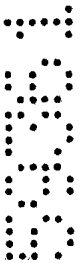
In a preferred embodiment, conductive minute solids, such as scale-like thin films each made of conductive material and having a smooth surface, small size particles each made of conductive material, or the like, are inserted into a pipeline together with a communication wire and compressed air, and passed through the

20 pipeline by the air flow. The communication wire contacts the pipeline and generates

contact resistance so that the rate of movement is decreased. On the other hand, the conductive minute solids are located away from the wall of the pipeline or the communication wire so that they move at a rate almost equal to the rate of the air flow.

Thus, the conductive minute solids such as thin films, particles, or the like,
5 pass through between the wall of the pipeline and the communication wire at a rate greater than the communication wire to be discharged from the outlet of the pipeline. On the way, the conductive minute solids also contact charged portions of the pipeline and the communication wire. When the conductive minute solids contact portions that are charged positively and negatively, they short-circuit and thereby tend to the positive
10 and negative charges. When contact is made with either portion, the conductive minute solids rob that portion of its charge. Unlike insulating substances, the conductive minute solids are not charged locally, rather the charge is distributed over all the solids by their conductivity to be charged in a state of low voltage. The charged conductive minute solids are moved by air flow and discharge the charges they carry when they
15 arrive at a position having an opposite potential.

Even if the charged conductive minute solids cannot discharge until they arrive at the outlet of the pipeline, they nevertheless collect a number of charges along their

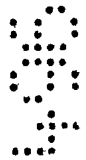
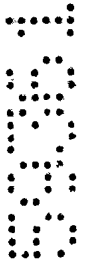


path of travel and are distributed over the solids (such as thin films, small size particles, or the like) by their conductivity, so that the solids are charged at a very low voltage to thereby make it possible to eliminate the charges in the insertion system.

If scale-like thin films such as graphite films of, for example, 0.5 mm square
5 and 0.05 mm thick, are used as the conductive minute solids, the potential gradient of their edge portions is arranged to be large enough that the effect of discharging and eliminating static electricity acts effectively like a lightning rod. In addition, the superficial content per weight is large enough that there is an effect whereby many charges can be eliminated by a material of lesser weight.

10 If small size particles, each made of conductive material, are used as the conductive minute solids, even when the small size particles are held between the communication wire material and the pipeline, it is possible to eliminate static electricity and at the same time reduce the frictional resistance between the communication wire and the pipeline by rolling of the small size particles, much in the
15 principle of bearings, and thereby produce an increased surface smoothness.

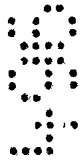
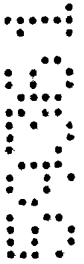
As for the material to produce the above-mentioned effect, it is open to select graphite, metal such as copper or aluminum, or the like, but desirably as long as the material is able to conduct and distribute high potential static electricity.



Further preferably, small size particles are inserted into a pipeline together with a communication wire and compressed air, and passed therethrough with the air flow through the pipeline. If the small size particles are held between the communication wire and the pipeline along the way, the communication wire is

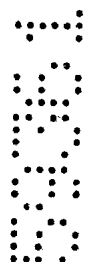
5 elevated by a value equal to the particle size. As noted, the small size particles reduce the frictional resistance between the communication wire and the pipeline by rolling, much like the principle of bearings.

Small size particles that are light weight and easy to roll, should be hard in quality. Hard plastics, light in specific gravity, such as acrylic, styrene, polycarbonate, or the like, are useful materials for the small size particles. Materials which are light to
10 be easy to roll include a spherical plastics particle, a hollow plastic particle such as an acrylic particle or the like, having no edges and has the specific gravity of about 1 or less are preferred. Further, for a material that is hard in quality, a spherical particle having a minute surface and no edges, such as polyacrylate, polymethacrylate,



polystyrene, polycarbonate, polyoxymethylene or the like, and is glass-shaped at room temperature is preferred. The spherical particle preferably should be harder than the pipeline and the communication wire. Most preferably, the spherical particle should have a hardness of at least 80 Shore hardness, and the pipeline and the communication
5 wire should have a hardness of no more than 70 Shore hardness.

A particle size of 50 to 300 μm is preferable. If the particle size is less than 50 μm , the influence of static electricity generated in the particles can be so large that the particles are difficult to move in the air flow. Such small particles may decrease the internal diameter of the pipeline by adhering to the inner wall of the pipeline so that the
10 frictional resistance appears to have increased. On the other hand, if the particle size is too large, the particles clog the space between the pipeline and the communication wire so that the communication wire is squeezed, the frictional resistance is increased and thus the performance of insertion is reduced. For these reasons, particles having the size of between about 50 to 300 μm are preferred in order to move in the pipeline at a
15 sufficient rate with the air flow, and to reduce the resistance to the insertion by causing a bearing effect in the space between the communication wire and the pipeline.



BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Fig. 1 is an explanatory diagram of an embodiment of both an apparatus and a method of the present invention for inserting or removing a communication wire
5 through a pipeline by air flow.

Fig. 2 is an explanatory diagram of the results of experiments with a first embodiment.

Fig. 3 is an explanatory diagram of the results of experiments with a second embodiment.

10 Fig. 4 is a sectional view of a communication wire used in examples of the present invention.

PREFERRED EMBODIMENTS OF THE INVENTION

The preferred embodiments of the present invention will be described with reference to the accompanying drawings.

15 Fig. 1 is an explanatory diagram of an embodiment of both an apparatus and a method for inserting a communication wire material through a pipeline by air flow.
The reference numeral 1 represents a communication wire; 2, a reel; 3, a pipeline; 4, a blowing head; 5, a compressor; 6, a T-branch; 7, a drop cylinder; 8, an air-tight stopper; 9, conductive material; 10, a recovery

bottle; and 11, a filter. The communication wire 1 is fed from the reel 2, and inserted into the pipeline 3 through the blowing head 4. Compressed air is inserted from the compressor 5 to the pipeline 3 through the blowing head 4. The communication wire material 1 is introduced into the blowing head 4 through an air-tight seal, and inserted into the pipeline 3 by a driving reel. The T-branch 6 is provided on the way of the pipeline 3, and the drop cylinder 7 is attached thereto. A small hole is opened on the side of the T-branch 6 in the drop cylinder 7, and the conductive material 9 stored therein is supplied from the T-branch 6 into the pipeline 3 at a controlled rate, for example, in the range of 0.5 g/min to 20 g/min. The air-tight stopper 8 is provided on the top of the drop cylinder 7 so that the compressed air introduced into the pipeline 3 does not flow backward in the drop cylinder 7. The recovery bottle 10 is attached to the outlet side of the pipeline 3 so as to discharge the air flow blowing out of the outlet side of the pipeline 3 through the filter 11. Accordingly, the conductive material ^{emitting from} ~~getting out of~~ the end portion of the pipeline 3 ^{entrained} ~~together~~ with the air flow is recovered into the recovery bottle 10. Generally, in the apparatus and method, the velocity of the air flow in the pipeline is from 1 to 10 m/min.

As the communication wire 1, as shown in Fig. 4, a wire material coated with a foamed polyethylene coating 13 and having an outer diameter of 2 mm was used. The communication

wire 1 ~~was~~ comprised of seven optical communication wires 12 each having an outer diameter of 250 μ m and arranged so that one of them was put at the center and the rest six were disposed around the center. A polyethylene pipe having an inner diameter of 6 mm and an outer diameter of 8 mm was used as the pipeline 3, and inserting was performed through the pipeline which was 1,500 m long.

The blowing head 4 has the same shape as that disclosed in Japanese Patent Examined No. Hei-2-22921, and has a driving roller for drawing the communication wire 1 into the pipeline 2 filled with compressed air, and a nozzle for introducing the compressed air supplied from the compressor into the pipeline. The drop cylinder 7 is provided for dropping the conductive material 9 into the pipeline 3. The T-branch 6 is disposed on the pipeline 3 side of the drop cylinder 7, and the air-tight stopper 8 is provided on the upper portion thereof. The pressure in the drop cylinder 7 is ~~made~~ ^{arranged to be} almost the same as that in the pipeline 2 through the gap of the conductive material 9, so that the conductive material 9 can be dropped into the pipeline 3 by gravity. The quantity of dropping can be changed by the attachment angle of the drop cylinder 7.

The experimental results with a first embodiment will be described as follows.

-- Comparative Example 1-1 --



Inserting a communication wire without dropping a conductive material was performed by use of compressed air of pressure 6 kg/cm², and the insertion of the wire was easily performed at the rate of 10 m/min or more until the length of inserting was 700 m. However, the rate of insertion of the communication wire decreased at or after 700 m, until the rate was about 1 m/min at 850 m. In this state, the communication wire contacted with the pipeline tightly, and if a large quantity of communication wire was inserted from the inlet of the pipeline, it wound in the pipeline to lose the transfer characteristic of the communication wire. The wire in such a condition cannot be used in practice.

-- Example 1-1 --

Graphite scale-like pieces each being 0.5 mm square and 0.05 mm thick were inserted from the T-branch into the pipeline at a rate of about 2 g/min from the time when the insertion rate was decreased in Comparative Example 1-1 (at approximately 90 min), so that the insertion rate of the wire increased gradually, and recovered to the insertion rate of 10 m/min in 20 minutes. The conductive material was inserted continuously as it was, and insertion through the entire pipeline 1,500 m in length could be performed. Fig. 2 shows the change of the rate of insertion for Comparative Example 1-1 and Example 1-1.

-- Example 1-2 --

The conductive material in Example 1 was inserted from the time of starting insertion in the same manner, so that an insertion rate of not less than 10 m/min could be maintained throughout the pipeline, and insertion through the entire 1,500 m of pipeline could be completed in 97 minutes.

-- Example 1-3 --

Small balls, each made of aluminum and having an outer diameter of 0.3 mm, were dropped as conductive material, and insertion was performed in the same manner as in Example 1 or 2, so that the wire insertion rate was always 10 m/min or greater, and insertion through the entire 1,500 m of pipeline could be performed in 102 minutes.

-- Comparative 1-2 --

After insertion of a communication wire was performed for 20 minutes while graphite scale-like pieces used in Example 1 were being dropped at a rate of 2 g/min into a pipeline for the first 5 minutes, insertion of the communication wire was continued with the dropping stopped. As a result, the insertion rate decreased to less than 10 m/min after the insertion distance of 750 m was reached. The reason for the decrease in the insertion rate was thought to be caused by the increase in static electricity generated between the communication wire and the inner wall of the pipeline after the dropping of the graphite scale-like pieces was stopped. The

results from this Comparative Example is evidence that static electricity is eliminated, or greatly reduced, in the insertion process.

-- Comparative 1-3 --

Insertion of a communication wire was performed while talc particles (the size
5 of each of which was about several μm to 30 μm) made from an insulating material
were dropped into a pipeline. As a result, the rate decreased to less than 10 m/min at
600 m. At that time, electrostatic charging was detected on the outer surface of the
pipeline.

The necessity of eliminating or greatly reducing static electricity was
10 confirmed from the results of Comparative Examples 1-2 and 1-3. The benefits of
eliminating static electricity are also seen for a short pipeline. The presence of
charging can be tested in a pipeline after inserting a communication wire in the cases in
which the method described was used and was not used by cutting the pipeline and/or
wire and sprinkling insulating powder such as talc over the pipeline or the
15 communication wire. The quantity of the conductive material adhering to the inner
surface of the pipeline and the outer surface of the communication wire was small in the
case of using the method of embodiments of the present invention, giving no influence
to the operation of the communication wire having been laid. By using this conductive
material, it is possible to eliminate the phenomenon of tight contact between a
20 communication wire and a pipeline caused by static electricity, so that it is possible to
perform good insertion in the case of an insertion over a long distance.

If high bulk density particles such as metal particles are used as the conductive material to be introduced into a pipeline, preferably, they are spherical shaped, spheroidal, or the like and do not injure or interfere with the communication wire or the pipeline. They also have a large enough specific gravity, for example, the
5 preferable specific gravity is 2 g/cm^3 or over, so that they are effective in a pipeline having many descents.

On the other hand, scale-like material having a low bulk density and a high movability by air flow may act effectively in a pipeline having many ascents. As the material having a low bulk density, it is preferably plate-like or porous material which
10 is lighter in weight comparing with the surface area thereof. For example, it is preferable that the ratio of the weight to volume ratio of the material is 1.5 g/cm^3 or less. Further, as a material having a high movability, a material, on the surface of which graphite, molybdenum disulfide or the like exists so that the friction coefficient thereof is 0.5 or less, is preferable. Of such scale-like material, graphite is light in
15 weight and exhibits a high slidability at the same time, to thus be effective for use in an embodiment.



The experimental results with a second embodiment will be described as follows. Insertion was performed in the same manner as that in the first embodiment.

5 -- Comparative Example 2-1 --

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Inserting a communication wire without dropping small size particles was performed by use of compressed air of pressure 6 kg/cm², and the insertion was easily performed at the rate of 10 m/min or more until the inserted length of the wire was 700 m. However, the rate of insertion of the communication wire decreased after 700 m to a rate of about 1 m/min at 850 m. In this state, the communication wire contacted with the pipeline tightly, and if a large quantity of communication wire was inserted from the inlet of the pipeline, *resulting in the loss of* it wound in the pipeline ~~to lose~~ the transfer characteristic of the communication wire. *A* ~~The~~ wire in such a condition cannot be used in practice and the insertion rate is not practical.

-- Example 2-1 --

Substantially spherical small size acryl particles each having a diameter of about 100 μm were inserted from the T-branch into the pipeline at a rate of about 2 g/min from the time when the propelling rate of the communication wire was increased in Comparative Example 2-1 (at approximately 90 min), so that the insertion rate of the wire increased gradually, and recovered to the insertion rate of 10 m/min in 18 minutes. The



rate was further increased and reached 14 m/min in 35 minutes. The small size acryl particles were sent continuously, and the wire was inserted throughout the entire 1,500 m of the pipeline. Fig. 3 shows the change of the rate of insertion for the communication wire for both Example 21- and Comparative Example 2-1.

-- Example 2-2 --

The small size acryl particles in Example 1 were sent from the time of ~~starting the~~ ^{start of} propelling of the communication wire in the same manner, so that the insertion rate of the wire of 10 m/min could be maintained all over the pipeline, and insertion throughout the entire 1,500 m of pipeline could be completed in 87 minutes.

-- Example 2-3 --

Hollow acryl particles of 100 μ m, as the small size particles, were dropped, and insertion of the coated wire was performed in the same manner as that in Example 2-1 or 2-2, so that a wire insertion rate of not less than 10 m/min could be maintained over the entire length of the pipeline, and insertion of the wire throughout the 1,500 m could be performed in 90 minutes.

-- Example 2-4 --



Substantially spherical iron particles having particle size of about 100 μm , as small size particles, were dropped, and insertion of the wire was performed in the same manner as in Examples 2-1 and 2-2, so that insertion throughout the entire 1,500 m of pipeline could be performed in 125 minutes without lowering the wire propelling rate to less than 10 m/min. However, the reason why the insertion rate was lower than that for the acrylic particles in Example 2-2 is thought to be due to the lesser roller bearing effect of the iron since the iron particles are too heavy to roll effectively ~~as~~ compared to the acrylic particles.

-- Comparative 2-2 --

Insertion was performed while substantially spherical acrylic particles having a diameter of about several μm to 30 μm were dropped into a pipeline, so that the wire propelling rate decreased to less than 10 m/min at 150 m. In this case, the reason why the insertion rate decreased is thought to be due to the adhesion of the acrylic particles to the inner surface of the pipeline to thereby increase friction.

-- Comparative 2-3 --

Insertion was performed while substantially spherical acrylic particles having a diameter of about 350 μm to 500 μm were dropped into a pipeline, so that the rate decreased to less than 10 m/min at 50 m, and insertion was stopped at 60 m.

In this case, the acrylic particles were seen to clog the space between the inner wall of the pipeline and the communication wire. Thus, the acrylic particles were too large to obtain good performance for the insertion or propelling of the communication wire.

-- Example 2-5 --

Fluororesin particles having a particle size of about 100 μm , as small size particles, were dropped, and insertion was performed in the same manner as in Examples 2-1 and 2-2, so that insertion over 1,500 m of pipeline could be performed in 130 minutes without lowering the wire propelling rate to less than 13 m/min. In the case of this example, the reason why the rate of propelling was lower than that in the case of using acrylic particles in Example 2-2 is because the fluororesin particles were soft enough to be deformed ^{when} between the communication wire and the pipeline so that the communication wire was difficult to lift and the particles ^{had difficulty in} ~~were difficult to~~ rolling, ~~roll~~ thereby lowering the bearing effect.

-- Example 2-6 --

Acrylic particles shaped as a cube of approximately 100 μm , as small size particles, were dropped, and insertion was performed in the same manner as in Examples 2-1 and 2-2. Inserting could be performed throughout the entire 1,500 m of pipeline in 120 minutes without lowering the wire propelling



rate to less than 10 m/min. The reason why the insertion rate was lower was because the particles were cuboidal in shape and ^{had difficulty rolling} ~~were thus difficult to roll~~ effectively.

5 -- Example 2-7 --

The communication wire inserted throughout the entire 1,500 m of pipeline in Example 2-2 was tested for recovery by use of compressed air having a pressure of 6 kg/cm², but the communication wire could not move or be removed from the pipeline. When the acrylic particles in Example 2-2 were inserted from the opposite end of the pipeline (near the recovery bottle and filter of Fig. 1), the whole length of the communication wire could be pulled out of or removed from the pipeline in 100 minutes.

As is apparent from the above description, according to the present invention, it is possible to perform insertion of a communication wire through a long pipeline stably, and the present invention can also be used to remove or recover a communication wire from a pipeline.

The claims defining the invention are as follows:

1. A method for inserting a communication wire through a pipeline, comprising the steps of inserting the communication wire into said pipeline, propelling the wire through said pipeline by air flow, and introducing conductive minute solids
5 into said air flow.
2. A method as claimed in claim 1 wherein each of said conductive minute solids comprises conductive material which is a scale-like thin film having a smooth surface.
3. A method as claimed in claim 2 wherein said scale-like thin film is
10 selected from the group consisting of graphite and metal.
4. A method as claimed in claim 1 wherein said conductive minute solids are small size particles of between about 50 to 300 μm , each particle comprising conductive material.
5. A method as claimed in claim 4 wherein each of said small size
15 particles are selected from the group consisting of graphite and metal.
6. A method as claimed in claim 1 wherein said conductive minute solids are introduced into said pipeline at a place beyond the position where said communication wire is inserted into said pipeline and in the direction of insertion of said wire.
7. A method for inserting a communication wire through a pipeline
20 comprising the steps of:
inserting the communication wire into said pipeline;
propelling the communication wire through said pipeline by air flow; and
introducing substantially spherical small size conductive particles, having
25 particle size of between about 50 to 300 μm , with the communication wire into said air flow.
8. A method as claimed in claim 7 wherein said substantially small size particles are harder than said pipeline and said communication wire.

9. A method as claimed in claim 8 wherein said substantially small size particles have a hardness of at least 80 Shore hardness, and said pipeline and communication wire have a hardness of not more than 70 Shore hardness.

10. A method as claimed in claim 8 wherein said substantially spherical
5 small size particles are light enough to pass through said pipeline by air flow having a velocity of 1 to 10 m/min.

11. A method as claimed in claim 10 wherein a ratio of weight to volume measured in a vessel of said substantially small size particles is not more than 1.5 g/cm³.

10 12. A method as claimed in claim 7 wherein said substantially spherical small size particles comprise hard plastics having a hardness of at least 80 Shore hardness, and the ratio of the weight to volume in a vessel of said substantially small size particles is not more than 1.5 g/cm³.

13. A method as claimed in claim 7 wherein said substantially small size
15 particles comprise plastics particles.

14. A method as claimed in claim 7 wherein said small size particles comprise hollow particles made of plastics.

15. A method for inserting a communication wire through a pipeline substantially as hereinbefore described with reference to the accompanying drawings.

20 DATED this Twenty-third Day of April 1996

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Patent Attorneys for the Applicant

SPRUSON & FERGUSON

Method and Apparatus for Inserting a Communication Wire Through a Pipeline by Air Flow

Abstract

A method and an apparatus are provided for inserting and removing a communication wire [1] in and out of a pipeline [3] by air flow, in which static electricity can be prevented from being generated, and a long communication wire [1] can be inserted and removed. The communication wire [1] is fed from a reel [2], and inserted into a pipeline [3] through a blowing head [4]. Compressed air is also sent from a compressor [5] to the pipeline [3] through the blowing head [4]. A drop cylinder [7] is attached to a T-branch [6] on the way of the pipeline [3], conductive material [9] stored therein is supplied into the pipeline [3] at a controlled rate. A recovery bottle [10] is attached to the outlet side of the pipeline [3] so that the air flow blowing out of the outlet side is passed through a filter [11], and at the same time the conductive material [9] is recovered. By making the conductive material [9] pass through the pipeline [3] together with the air flow, generated static electricity can be eliminated, and the communication wire [1] can be prevented from contacting tightly with the pipeline [3] because of the static electricity.

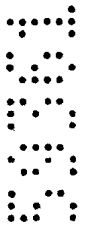


Figure 1.

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FIG. 1

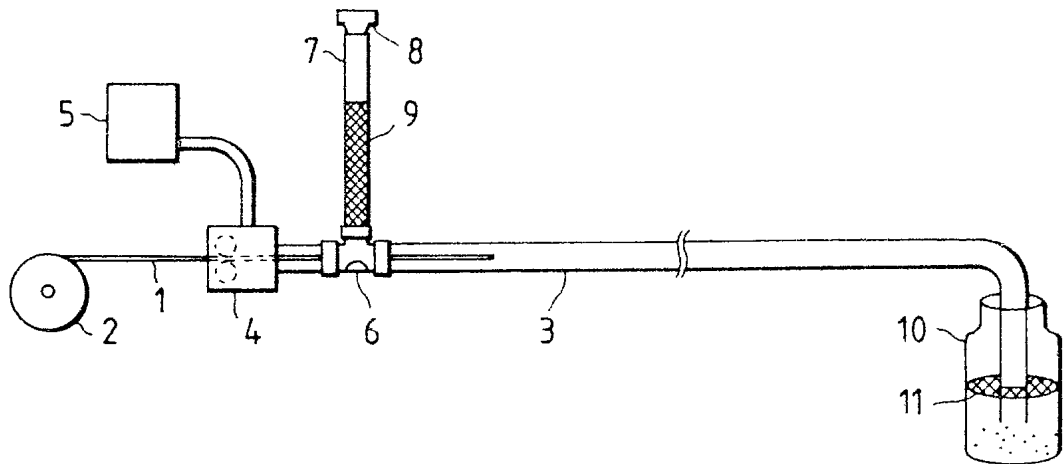


FIG. 2

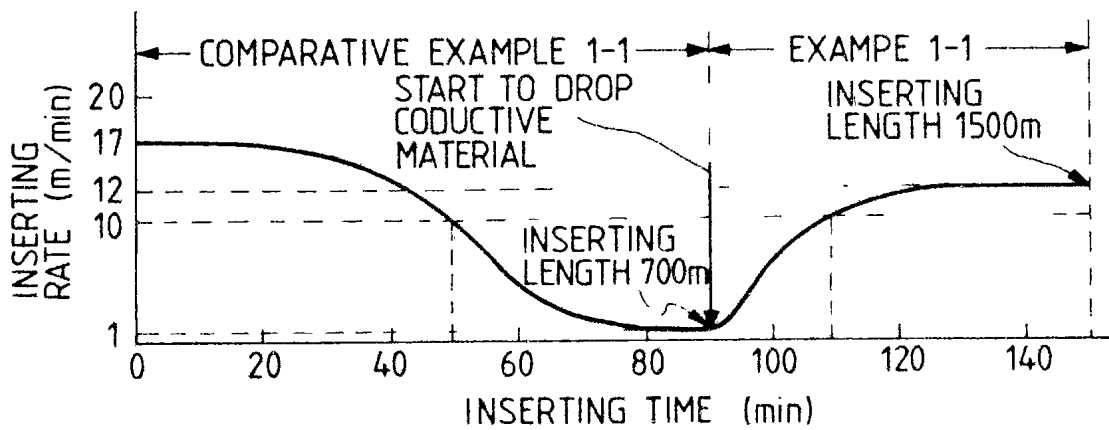


FIG. 3

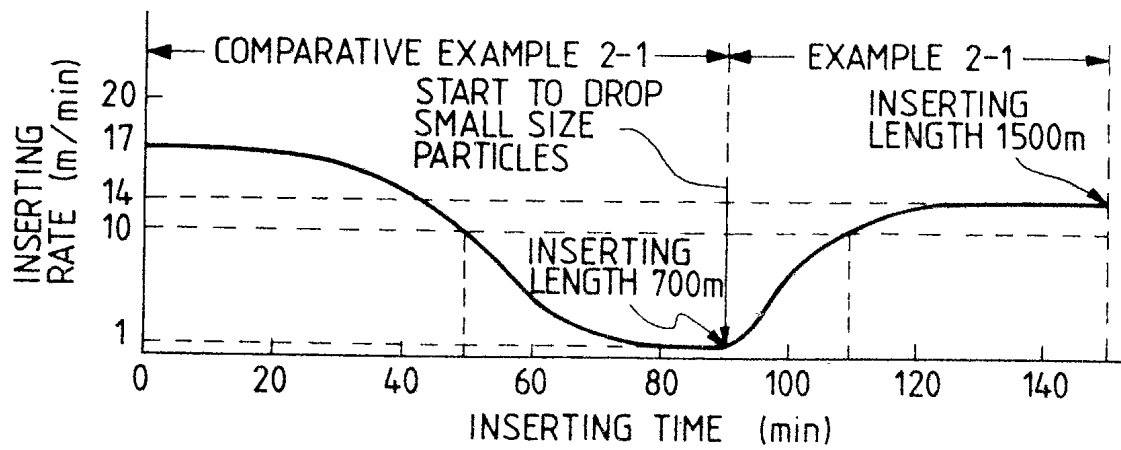


FIG. 4

