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(54) **A device and a method for smoothing out irregularities**

(57) A device for smoothing out irregularities of internal walls of pipes by applying a paste adhering to a said wall at a location of a said irregularity comprises at least one blade-like member (3) configured to be introduced into a said pipe. The device also comprises means configured to rotate said member about an axis substantially in parallel with a centre axis of a said pipe for distributing paste discharged at said location to form a layer on a said internal wall.

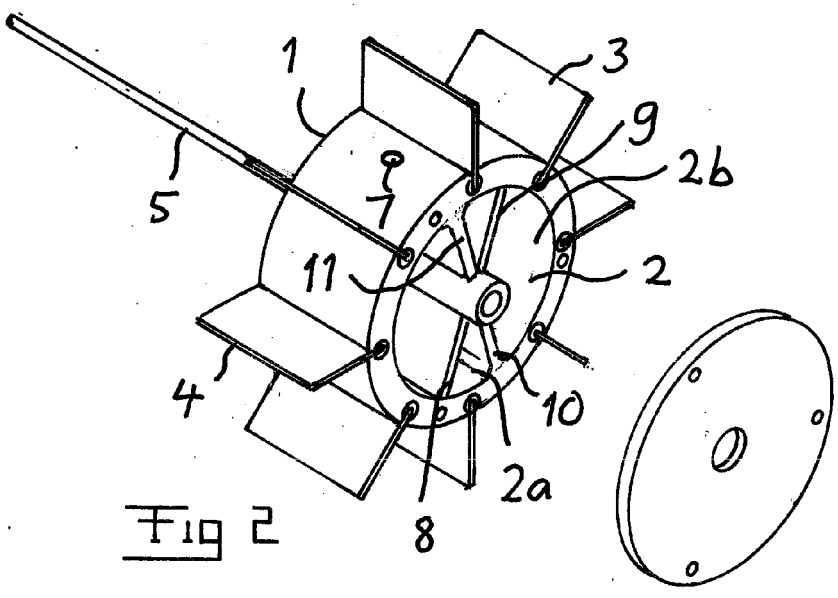

Fig 2

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Description

TECHNICAL FIELD OF THE INVENTION AND BACKGROUND ART

[0001] The present invention relates to a device for smoothing out irregularities, such as holes or grooves emanating from joints between interconnected pipe parts, of internal walls of pipes by applying a paste adhering to a said wall at a location of a said irregularity, as well as a method for smoothing out such irregularities.

[0002] The irregularities at stake may be of any conceivable type, although joints between interconnected pipe parts and holes in a pipe wall may be mentioned as examples. Neither is the invention restricted to any particular pipes, but the invention is particularly, but not exclusively, applicable to pipes which are to be sealed and/or reconditioned by internally coating these pipes, such as for example "water pipes" inaccessible from the outside due to the location thereof inside building elements, in the ground or the like. Such "water pipes" comprise all types of pipes conducting water, also waste water and discharge pipes, larger main pipes in the soil or ground as well as pipes in the heating, water and sanitation system of accommodations, and ventilating pipes for ventilating buildings. The condition of pipes of this type is impaired with age, and for example rust in pipes of cast iron tends to create irregularities in the form of holes in the walls thereof at certain exposed locations, which may lead to leakage having sometimes severe consequences, such as costly moisture damages in buildings, leakage of substances being harmful to the environment into the ground and so on. Also pipes of plastic change with time and fissures therein may arise as a consequence of aging. There is therefore a need to recondition such pipes after a certain period of time through an internal coating thereof with a protecting layer, so that holes or fissures in the pipes resulting in damages of the environment will never appear. Such reconditioning may for example be carried out by pulling any type of slide or carriage through a pipe while spraying coating material onto the inner wall of the pipe through a nozzle arranged at the slide or the carriage.

[0003] However, some irregularities in the form of cavities, especially joints between interconnected pipe parts, are difficult to cover by such reconditioning methods known. It is therefore a desire to cover such irregularities with a paste for smoothing out such irregularities before said coating material is sprayed onto the internal wall of the pipe for reconditioning thereof. "Paste" may be any type of high viscous material able to efficiently cover and smoothing out such irregularities, such as sand putty.

[0004] It is known through EP 0 768 924 B1 to feed such a paste into a pipe and then distribute the paste on the internal walls of the pipe by brushes rotated in the pipe. However, this device and method are not efficient in covering irregularities in the form of cavities, such as holes or grooves emanating from joints interconnecting pipe parts of a pipe, since the straws of the brushes will move into such cavities and remove the paste therefrom resulting in a poor covering of the paste especially where the cavities are located and where this covering is of particular importance.

SUMMARY OF THE INVENTION

[0005] The object of the present invention is to provide a device and a method of the type defined in the introduction addressing the problem just mentioned of such devices and methods already known.

[0006] This object is according to the invention with respect to the device obtained by providing such a device, which comprises

- at least one blade-like member configured to be introduced into a said pipe,
- means enabling moving of said blade-like member in a said pipe to a said location, and
- means configured to rotate said at least one blade-like member about an axis substantially in parallel with a centre axis of a said pipe into which said blade-like member is configured to be introduced for distributing said paste to form a layer on a said internal wall of a pipe smoothing out a said irregularity.

[0007] By rotating said at lease one blade-like member about an axis substantially in parallel with a centre axis of a pipe into which said blade-like member is configured to be introduced paste discharged at said location may be well distributed while covering and smoothing out irregularities of the type mentioned above. Such blade-like members will not enter into typical cavities in such pipes but have such a width that they will move over such cavities while rather ensuring filling thereof with said paste. "Blade-like" is here to be interpreted broadly and shall cover every member configured to behave like a continuous blade and may even cover brushes having straws arranged with an extremely high density and of such a material that individual straws may not enter into cavities in an internal wall of a pipe and remove paste therefrom.

[0008] According to an embodiment of the invention said at least one blade-like member is elastically bendable and has such an extension to an end thereof remote from a member carrying the blade-like member that this is forced to be bent by the internal walls of a pipe for which the device is designed which results in an efficient smoothing out of irregularities in the form of cavities of internal walls of a pipe at said location and by that a smooth internal wall along the circumferential extension thereof making the internal wall at said location well prepared for being coated by material sprayed thereon as mentioned above should that be desired.

[0009] According to another embodiment of the invention said at least one blade-like member defines in a rest position a radius from said axis of rotation thereof by an end of said blade-like member remote from said axis of

rotation thereof exceeding a radius of a pipe for which the device is designed by at least 5%, 5%-45%, 5%-40% or 15%-35%. This means that said at least one blade-like member will by the end thereof efficiently bear against the internal walls of a said pipe and move a said paste therealong when said body rotates and by that efficiently filling said irregularities for smoothing them out.

[0010] According to another embodiment of the invention said at least one blade-like member is made of rubber or a rubber-like material making it well suited for moving a said paste over the internal wall of a pipe while filling cavities thereof.

[0011] According to another embodiment of the invention said blade-like member has an end configured to bear upon a said internal pipe wall and extend in parallel with or substantially in parallel with the axis of rotation of said blade-like member, which thanks to the blade-like character makes the member able to move over said irregularities when it rotates. According to a further development of this embodiment said blade-like member has a rectangular or a substantially rectangular shape with a side of said rectangle defining the end of the blade-like member configured to bear upon a said internal pipe wall. "Rectangular" also covers "spuare".

[0012] According to another embodiment of the invention the device comprises a plurality of said blade-like members substantially uniformly distributed around a said axis of rotation which are at least 2, at least 3, at least 5 or at least 7 to the number.

[0013] According to another embodiment of the invention said means for rotation of said at least one blade-like member comprises an elongated member connected to a member carrying said at least one blade-like member and driving means remotely arranged with respect to said carrying member and configured to rotate said elongated member around a centre axis thereof for rotating said carrying member. It may by this be ensured that the paste is not reaching the driving means, and the driving means may then also be arranged outside the pipe.

[0014] According to another embodiment of the invention said elongated member of the embodiment last mentioned is flexible, such as a metal wire. This means that the driving means may be located at a substantial distance to said carrying member with said at least one blade-like member, such as outside the pipe, even if a pipe having bends is to be covered by said paste at a location "behind" such a bend.

[0015] According to another embodiment of the invention the device comprises means configured to discharged said paste at said location towards a said internal pipe wall. The presence of such paste discharging means in said device enables obtaining of an efficient smoothing out of said irregularities by operation of the device.

[0016] According to another embodiment of the invention constituting a further development of the embodiment last mentioned said discharging means is configured to cooperate with said rotation means so as to discharge said paste by said rotation of said at least one blade-like member, which results in an advantageous double function of said rotation means also used to obtain discharging of said paste at said location.

[0017] According to an embodiment of the invention the device also comprises a hollow body configured to be introduced into a said pipe and having an inner room configured to contain a said paste. This constitutes a preferred way of bringing the paste to the location in question.

[0018] According to another embodiment of the invention said rotation means is configured to rotate said body and by that said at least one blade-like member, in which this is advantageously accomplished by making said at least one blade-like member projecting from said body.

[0019] According to another embodiment of the invention said means for discharging said paste comprises at least one part arranged inside said room and a member connecting said part to said means for rotation of said at least one blade-like member so as to transfer a rotation of a member belonging to said rotation means to said part so as to force said paste out through at least one opening in said body. It is advantageous to utilize the means for rotation of said at least one blade-like member to also discharge the paste from said body facilitating the construction of the device and making the operation thereof reliable.

[0020] According to another embodiment of the invention constituting a further development of the embodiment last mentioned said connecting member is configured to allow said part of said discharging means to rotate with respect to said body so as to make said part move with respect to walls delimiting said room for forcing said paste out through said at least one opening.

[0021] Preferred features and advantages of the method according to the present invention defined in the appended independent method claim appear clearly from the above discussion of devices according to embodiments of the invention.

[0022] Further advantages as well as advantageous features of the invention will appear from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] With reference to the appended drawings, below follows a specific description of embodiments of the invention cited as examples. In the drawings:

Fig 1 is a very schematic, partially sectioned view illustrating a device according to the invention in operation,

Fig 2 is an exploded perspective view illustrating a part of a device according to a first embodiment of the invention,

Fig 3 is a schematic view illustrating a part of the device shown in Fig 2 in operation,

Fig 4 is a schematic, partially sectioned view illustrating how a device according to the present invention may be used for smoothing out irregularities in a pipe,

Fig 5 is a partially sectioned view illustrating a part of a device according to a second embodiment of the invention,

Fig 6 is a very schematic, partially sectioned view illustrating a device according to a third embodiment of the invention in operation,

Fig 7 is a very schematic, partially sectioned view illustrating a device according to a fourth embodiment of the invention in operation, and

Fig 8 is a very schematic, partially sectioned view illustrating a device according to a fifth embodiment of the invention in operation.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0024] A device according to the type to which the present invention relates is schematically illustrated in Fig 1 and a first embodiment thereof will now be described while simultaneously also referring to Figs 2-4. The device has a hollow body 1 configured to be introduced into a pipe P, such as a "water pipe", for smoothing out irregularities, such as holes or grooves emanating from joints between interconnected pipe parts, of internal walls of such a pipe by applying a paste adhering to a said wall at a location of a said irregularity. The hollow body 1 has an inner room 2, in this embodiment divided into two parts 2a, 2b, configured to contain a said paste.

[0025] Blade-like members 3 of an elastically bendable material, such as rubber, projects from the body 1 and have such an extension from the body to the ends 4 thereof remote from the body that they are forced to be bent by the internal walls 19 of a pipe for which the device is designed as shown in Fig 3.

[0026] The device has also means enabling moving of the body in a said pipe to a said location, which is here obtained by pushing or pulling said body 1 by an elongated member 5 attached centrally to the body 1 and preferably being flexible, such as a metal wire. The device comprises means 6 in the form of any type of motor configured to rotate the body 1 about an axis substantially in parallel with the centre axis of said pipe by rotating the elongated member 5. A supply S for the elongated member provides an elongated member 5 with a length sufficient to reach a said location. Each part 2a and 2b of the room 2 of the hollow body is provided with an opening 7 located at the periphery of the body. Paste may be filled into the room 2 of the hollow body through this opening when the hollow body is outside a said pipe and then be discharged from said room through these openings when the body is at said location by rotation of the elongated member 5 causing rotation of a member 8, 9 inside each room part 2a, 2b for forcing the paste out through the respective opening 7. The elongated member is connected to the hollow body while being allowed to rotate with respect thereto so as to make the members 8, 9 move with respect to walls delimiting the room parts 2a, 2b for forcing the paste out through the openings 7. Stop members 10, 11 are arranged to allow such a mutual rotation until these members are hit by the members 8, 9 and the room of the hollow body is substantially empty of paste, whereupon continued rotation of the elongated member 5 will by the action of the members 8, 9 upon the stop members 10, 11 result in a rotation of the entire hollow body with said blade-like members 3, as shown through the arrow A in Fig 3. The blade-like members will then distribute the paste discharged to form a layer on a said internal wall of a pipe smoothing out any possibly irregularities thereof.

[0027] Fig 4 illustrates the way of operation of a device according to the present invention, in which it is illustrated how the hollow body 1 of the device has already been brought to a location L_1 of an irregularity in the form of a joint 12 between interconnected pipe parts 13, 14 for smoothing out this irregularity by applying paste 15, such as sand putty, filling the circumferential groove formed by said joint 12. The paste has been forced out through the openings 7 of the hollow body and moved through the blade-like members 3 for distribution thereof. It is shown how the hollow body 1 is later on moved towards another location L_2 for smoothing out a similar irregularity in the form of a pipe joint 12' after having been filled with paste again.

[0028] Fig 5 illustrates a device according to a second embodiment of the invention differing from the device described above by the way of discharging paste 15 from the hollow body 1'. The elongated member 5' is here connected to a stiff member 16' with an external thread received in an internal thread of a wall part 17' of the hollow body 1'. A plate 18' is secured to the end of the member 16' and will through rotation of the member 16' by rotation of the elongated member 5' move to the right in Fig 5 inside a room 2' of the hollow body while forcing said paste out through openings 7' at the periphery of the body. A stop member 19' of the member 16' is arranged to hit parts of the body 1' preventing further rotation of the member 16' with respect to the body 1', so that continued rotation of the elongated member 5' will then result in a rotation of the hollow body and by that a movement of said blade-like members 3' for distributing the paste discharged to form a layer on the internal wall 20' of the pipe P for smoothing out a said irregularity thereof.

[0029] A device according to a third embodiment of the invention is shown in Fig 6, and this differs from the device according to the other two embodiments shown by the fact that the blade-like members 3" are arranged on a carrying member in the form of a frame 23 separated from the hollow body 1" containing said paste. Rotation

of the elongated member 5" caused by the driving means 6" will result in feeding of said paste out through a substantially axial opening thereof so as to flow through a substantially rigid hose 21 attached to said frame 23. This hose will extend inside said frame 23 for discharging said paste as indicated by the dashed lines 22. The frame 23 and by that the blade-like members 3" will be brought to rotate by rotating the hose 21 connected to the frame 23. This may for example be achieved in the same way as illustrated in Fig 5. In such a case the rotation of the elongated member 5" will first force said paste out of the hollow body 1" into the hose 21 and when the hollow body is empty also rotation of the frame 23 for moving said paste by the blade-like members 3".

[0030] A device according to a fourth embodiment of the invention is schematically illustrated in Fig 7. The blade-like members 3"' are here, as in the embodiment shown in Fig 6, arranged on a carrying member 24 connected to an elongated member 5"' driven to rotate by a driving means 6'" configured to be arranged outside a said pipe P. Means 25 in the form of a pump configured to feed paste to be discharged at a said location inside said pipe P is configured to be arranged outside said pipe during operation of the device. The pump 25 is connected to the carrying member 24 through a hose 26 for obtaining discharging of said paste at said location.

[0031] Fig 8 illustrates very schematically a device according to a fifth embodiment of the invention differing from the one shown in Fig 7 by the way of feeding said paste to said location for discharging thereof on an internal wall of the pipe. This device comprises a container 27 in a form of a cylinder configured to contain said paste. The container 27 is connected to a member 28 configured to be controlled to provide compressed air to a piston inside the container 27 for forcing paste out thereof to the carrying member 24 and onto the internal wall of said pipe P. Thus, in the embodiments shown in Fig 7 and 8 it will be possible to control a discharging of paste at said location independently of any rotation of the blade-like members 3'" caused by the rotation of the respective carrying member 24.

[0032] The invention is of course not in any way restricted to the embodiments described above, but many possibilities to modifications thereof will be apparent to a person with ordinary skill in the art without departing from the scope of the invention as defined in the appended claims.

[0033] "Means enabling moving of said blade-like member in a said pipe to a said location" as used here is to be interpreted to also cover pushing or pulling said blade-like member or a member carrying this partly or entirely manually to said location. The supply shown in Fig 1 may also include power means for such pushing and pulling.

[0034] "Means for discharging said paste" does also include a pure use of centrifugal forces created by rotation of a body containing said paste for discharging said paste.

Claims

1. A device for smoothing out irregularities, such as holes or grooves emanating from joints between interconnected pipe parts, of internal walls of pipes by applying a paste adhering to a said wall at a location of a said irregularity, **characterized in that** said device comprises

   • at least one blade-like member (3, 3') configured to be introduced into a said pipe,
   • means enabling moving of said blade-like member in a said pipe to a said location, and
   • means (5, 5', 6) configured to rotate said at least one blade-like member (3, 3') about an axis substantially in parallel with a centre axis of a said pipe (P) into which said blade-like member is configured to be introduced for distributing said paste to form a layer on a said internal wall (20, 20') of a pipe smoothing out a said irregularity.

2. A device according to any of the preceding claims, **characterized in that** said at least one blade-like member (3, 3') is elastically bendable and has such an extension to an end thereof remote from a member carrying the blade-like member that this is forced to be bent by the internal walls (20, 20') of a pipe for which the device is designed.

3. A device according to claim 2, **characterized in that** said at least one blade-like member (3, 3') defines in a rest position a radius from said axis of rotation thereof by an end of said blade-like member remote from said axis exceeding a radius of a pipe for which the device is designed by at least 5%, 5%-45%, 10%-40% or 15%-35%.

4. A device according to claim 2 or 3, **characterized in that** said at least one blade-like member (3, 3') is made of rubber or a rubber-like material.

5. A device according to at least one of the preceding claims, **characterized in that** said at least one blade-like member (3, 3') has an end configured to bear upon a said internal pipe wall and extend in parallel with or substantially in parallel with the axis of rotation of said blade-like member.

6. A device according to claim 5, **characterized in that** said at least one blade-like member (3, 3') has a rectangular or a substantially rectangular shape with a side of said rectangle defining the end of the blade-like member configured to bear upon a said internal pipe wall.

7. A device according to any of the preceding claims, **characterized in that** it comprises a plurality of said

blade-like members (3, 3') substantially uniformly distributed around a said axis of rotation and which are at least 2, at least 3, at least 5 or at least 7 to the number.

8. A device according to any of the preceding claims, **characterized in that** said means for rotation of said at least one blade-like member (3, 3') comprises an elongated member (5, 5') connected to a member (1, 1', 23, 24) carrying said at least one blade-like member and driving means (6) remotely arranged with respect to said carrying member and configured to rotate said elongated member around a centre axis thereof for rotating said carrying member.

9. A device according to claim 8, **characterized in that** said elongated member (5, 5') is flexible, such as a metal wire.

10. A device according to any of the preceding claims, **characterized in that** it comprises means (8, 19, 18') configured to discharge said paste at said location towards a said internal pipe wall.

11. A device according to claim 10, **characterized in that** said discharging means is configured to cooperate with said rotation means so as to discharge said paste by said rotation of said at least one blade-like member.

12. A device according to any of the preceding claims, **characterized in that** it also comprises a hollow body (1, 1') configured to be introduced into a said pipe (P) and having an inner room (2, 2') configured to contain a said paste.

13. A device according to claim 12, **characterized in that** said rotation means is configured to rotate said body (1, 1') and by that said at least one blade-like member (3, 3').

14. A device according to claim 13, **characterized in that** said at least one blade-like member (3, 3') projects from said body (1, 1').

15. A device according to claim 12, **characterized in that** said means for discharging said paste comprises at least one part (8, 9, 18') arranged inside said room (2, 2') and a member connecting said part to said means for rotation of said at least one blade-like member so as to transfer a rotation of a member (5, 5') belonging to said rotation means to said part so as to force said paste out through at least one opening (7) in said body.

16. A device according to claim 15, **characterized in that** said connecting member is configured to allow said part (8, 9, 18') of said discharging means to rotate with respect to said body (1, 1') so as to make said part move with respect to walls delimiting said room for forcing said paste out through said at least one opening.

17. A method for smoothing out irregularities, such as holes or grooves emanating from joints between interconnected pipe parts, of internal walls of pipes by application of a paste adhering to said wall at a location of a said irregularity comprising the steps:

a) discharging said paste towards the internal wall of a said pipe at said location,
b) introducing at least one blade-like member (3, 3') into said pipe (P) and moving it to said location, and
c) rotating said at least one blade-like member so as to distribute said paste over said internal wall of the pipe at said location.

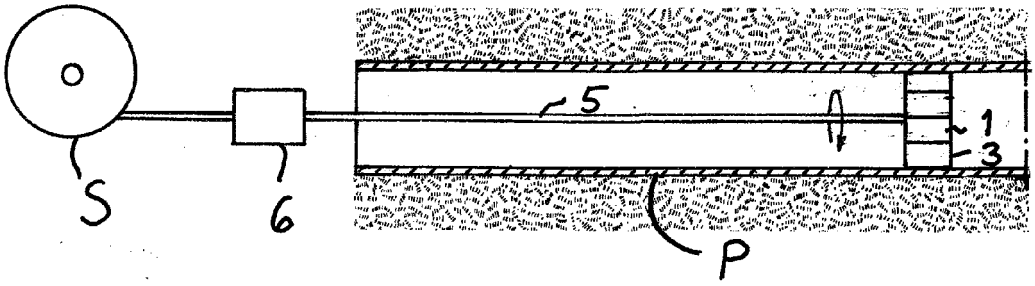

Fig 1

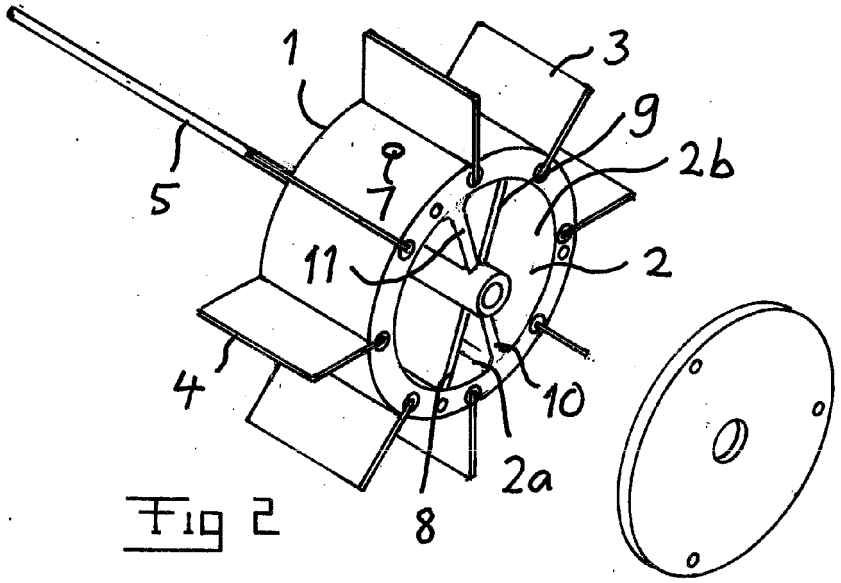

Fig 2

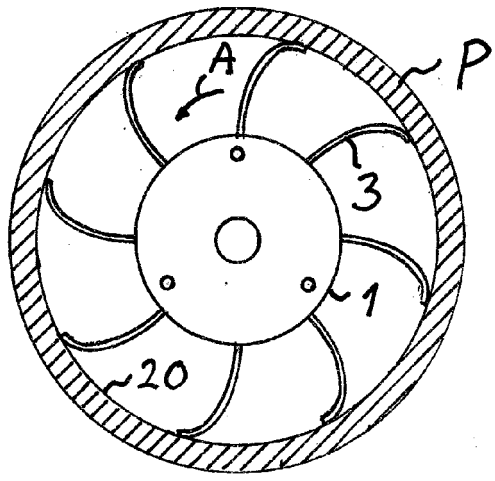

Fig 3

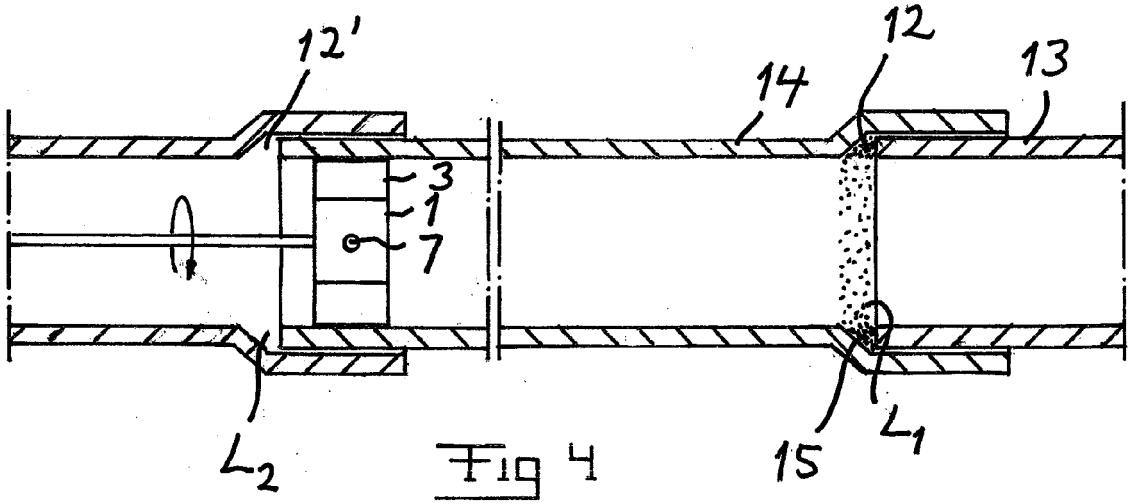

Fig 4

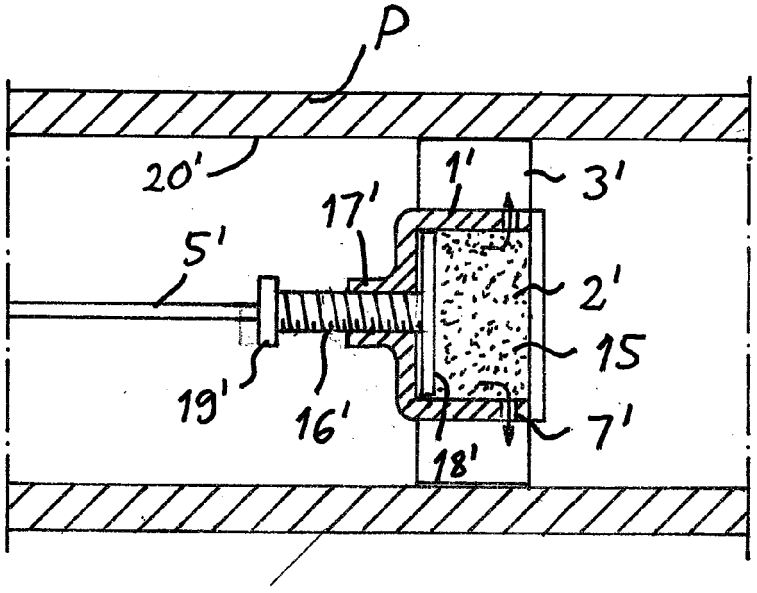

Fig 5

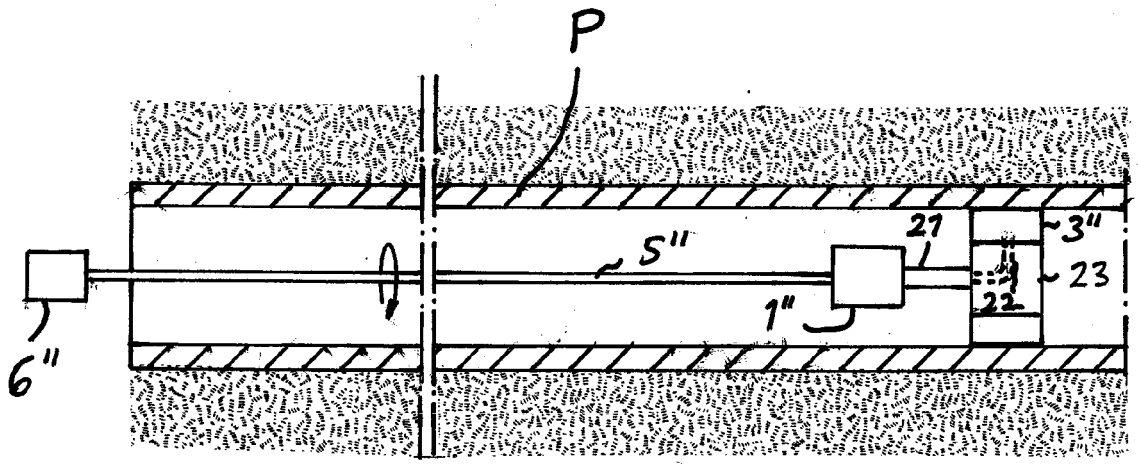

Fig 6

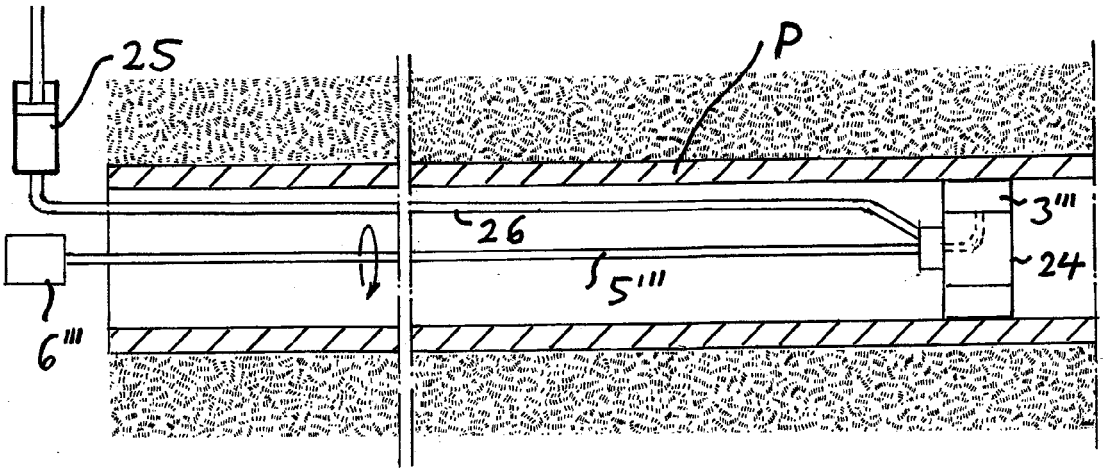

Fig 7

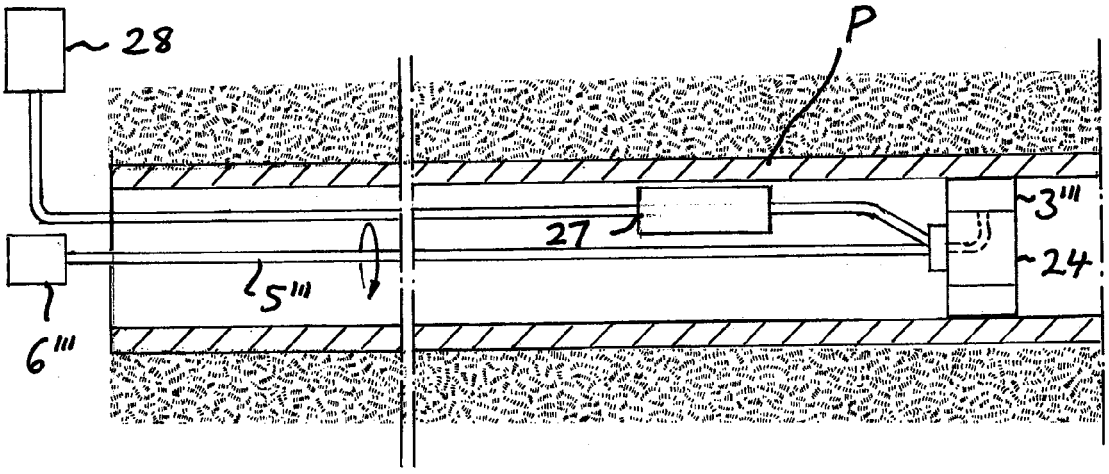

Fig 8

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EUROPEAN SEARCH REPORT

Application Number
EP 12 15 2114

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 590 445 A (BRAUN WALTER HEINRICH) 6 July 1971 (1971-07-06) * abstract; figures * -----	1-17	INV. B28B19/00
X	US 3 167 837 A (MATHENY FRANCIS M) 2 February 1965 (1965-02-02) * figures * -----	1-3,5-8, 10-12,17	
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TECHNICAL FIELDS SEARCHED (IPC)

B28B
F16L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 June 2012	Balzer, Ralf

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 15 2114

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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27-06-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 3167837 A	02-02-1965	NONE	
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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