United States Patent

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[54] **APPARATUS FOR GROUTING**
6 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **401/188,** 401/265, 285/158, 52/744

[51] **Int. Cl.** **B43k 5/02,** F16l 41/06

[50] **Field of Search** 285/158, 196, 338, 345, 346, 334, 334.3, 382.4, 259, 231, 232, 233, 256; 52/744, 749; 401/188, 265; 61/36; 118/410; 141/383; 222/385; 264/36

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ABSTRACT: Apparatus for injecting grouting materials under pressure into a wall structure through a hole. A grouting nozzle is attached by a hose to a pump. A tube of elastic material is inserted in the cylindrical drilled hole in the wall. The nozzle has a tapered shank portion with screw threads that have a long axial face and a short radial face. After the tube is placed in the hole, the nozzle is inserted in the tube and rotated until the nozzle is secured in the hole. The pump can then be operated to inject fluid under pressure through the nozzle to the interior of the wall structure. The nozzle can be easily removed from the hole unscrewing the nozzle relative to the tube.

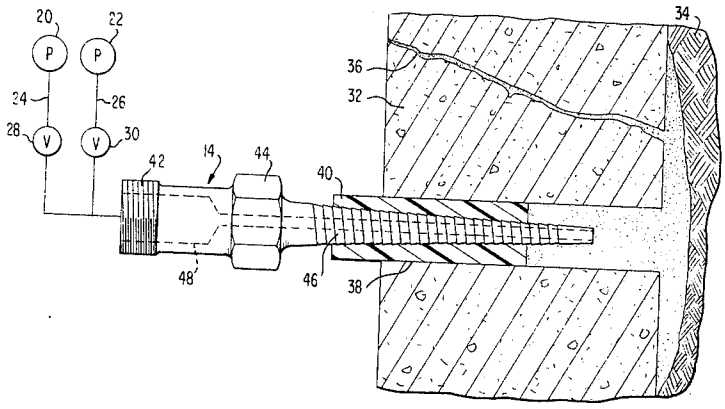


FIG.1

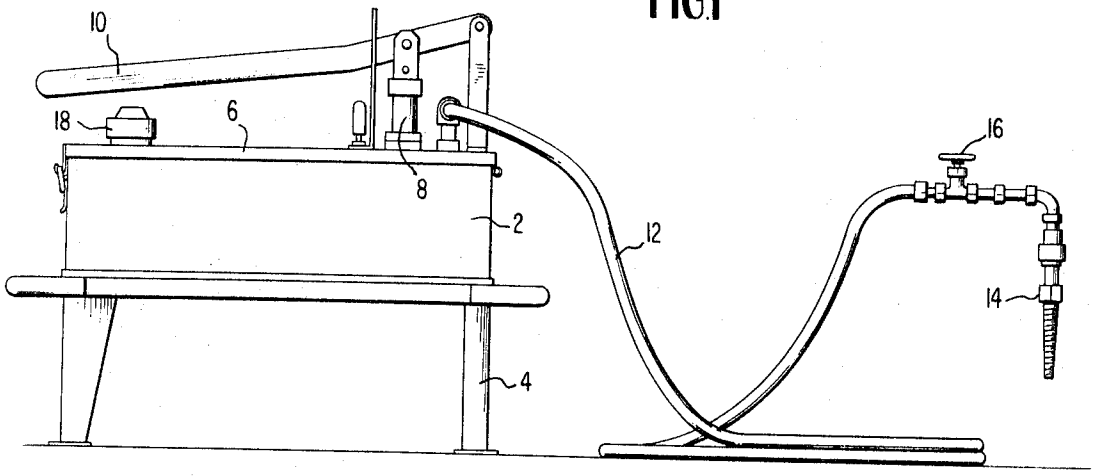
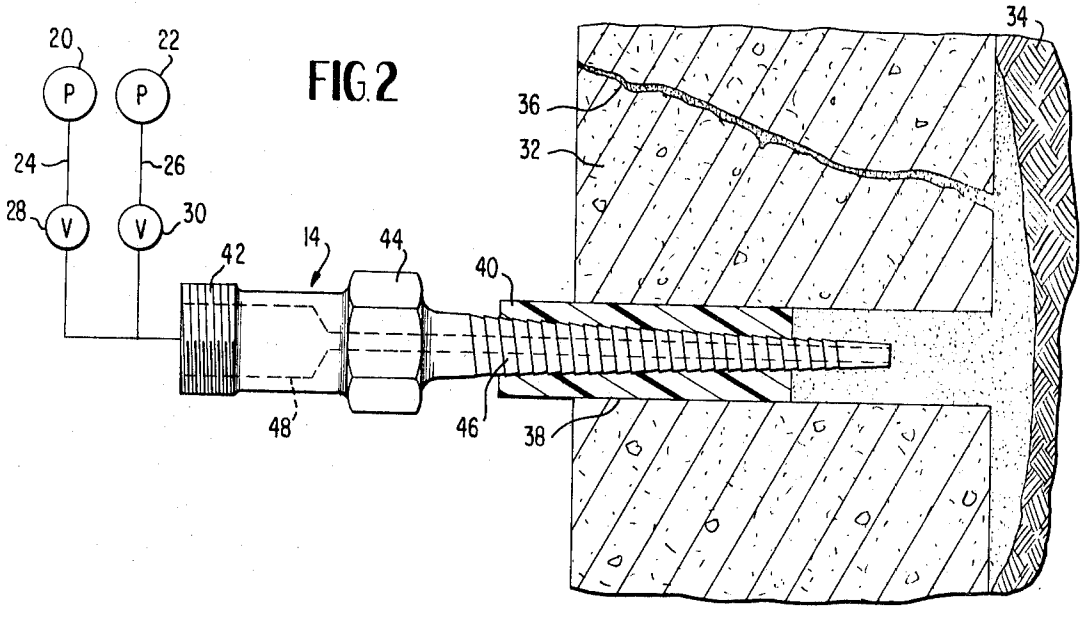


FIG.2



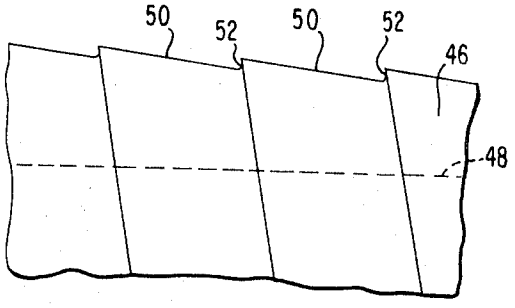


FIG.3

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APPARATUS FOR GROUTING

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of our copending application Ser. No. 529,857, filed Feb. 24, 1966, and now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to grouting operations and more particularly to methods and apparatus for injecting grouting materials through walls and similar structure.

Over a period of time masonry walls may develop cracks that allow water or other fluids to leak through the wall. This condition may occur in basement walls of buildings where the walls extend below ground level.

One method of overcoming this leakage condition without digging up the ground on the outside of the wall is to drill a hole through the wall. Grouting material is then injected through the hole to the outer surface of the wall where it flows along the outer surface of the wall and into the cracks or openings in the wall. When it hardens, the grouting material seals the cracks and prevents the leakage of fluid through the wall.

It is conventional practice to insert in the hole a pipe nipple that has been wrapped with rubber or fabric tape by pounding the pipe nipple into the hole with a hammer. This procedure is not always successful because the nipple occasionally becomes bent as it is driven into the hole and causes the concrete around the drill hole to break off. If the nipple is not tightly secured in the hole, it may be dislodged while the grouting material is being injected. The grouting material is injected under pressure and the fluid pressure in the hole acting on the end of the nipple may be sufficient to cause the nipple to be blown back out of the hole.

It may be necessary to apply grouting material at numerous locations over the surface of a large wall. Under these circumstances, a great deal of time may be spent in attempting to fasten the grouting nozzle tightly in each of the holes and then removing them from the holes after the grouting operation is completed. Of course, when a nipple is tightly fastened in a hole by conventional techniques, it resists removal of the nipple by pulling it back out of the hole.

In view of the difficulties encountered in attempting to carry out grouting operations by conventional techniques, it is an object of this invention to provide an improved method and apparatus for injecting grouting materials.

It is a further object of this invention to provide a method and apparatus for readily mounting a grouting nozzle in a wall opening.

It is a still further object of this invention to provide a grouting nozzle mounting arrangement which resists being forced out of a wall opening by fluid pressure.

It is another object of this invention to provide a grouting nozzle assembly that may be easily removed from a wall opening.

SUMMARY OF THE INVENTION

These objects are accomplished in accordance with a preferred embodiment of the invention by a grouting nozzle having a tapered and threaded shank portion used in cooperation with an elastomeric tube. The tube is inserted in a drilled hole in a wall. The nozzle is then inserted and threaded into the tube. As the nozzle is threaded into the tube, the tube is expanded by the shank portion of the nozzle outwardly against the interior surface of the drilled hole. The particular configuration of the threads on the nozzle resists cutting into the internal surface of the tube as the nozzle turns relative to the tube. Expansion of the tube against the wall of the hole tightly wedges the nozzle in the hole. This nozzle mounting arrangement resists being blown out of the hole by fluid pressure when grouting fluid is injected through the nozzle. However, the nozzle may be easily removed by unscrewing the nozzle from the tube.

DESCRIPTION OF THE DRAWINGS

This invention is illustrated in the accompanying drawings in which:

FIG. 1 is a side elevational view of the grouting apparatus of this invention;

FIG. 2 is an enlarged cross-sectional view of a wall or similar structure, with the nozzle of this invention inserted therein; and

FIG. 3 is an enlarged cross-sectional view of the threads on the nozzle.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a portable pump unit may be used for injecting grouting fluid under pressure. The pump unit includes a tank 2 which is supported on a stand 4. The tank 2 has a pressure-tight cover 6 which may be hinged at one end and locked the opposite end. A fluid pump in the tank 2 has a plunger 8 that is operated by a hand lever 10. A hose 12 conducts fluid from the tank 2 under pressure to a nozzle 14. A valve 16 is provided between the nozzle and the hose to control the flow of fluid through the nozzle 14. The tank 2 may be filled with grouting fluid by removing a screw cap 18 which covers a filling opening in the top 6.

Various types of grouting materials may be utilized, depending upon the particular conditions encountered. One type of grouting fluid that may be employed is a chemical grout comprising a catalyzed, aqueous mixture of acrylamide and N,N'—methylenebisacrylamide which gels rapidly at ordinary concentrations and temperatures. The two separate components of this grout, one of which is a catalyst, may be individually transmitted from supply sources to the nozzle 14. Such an installation is shown schematically in FIG. 2. Separate pumps and reservoirs 20 and 22, each of which may be of the type shown in FIG. 1, contain the components of this chemical grout. Separate hoses 24 and 26 conduct the components through valves 28 and 30 to the nozzle 14 where the components are mixed together to form a gel. When only one grouting fluid is used, the pump and hose arrangement of FIG. 1 may be employed.

A portion of a wall 32 is shown schematically in FIG. 2 with earth fill 34 behind the wall, so that only the front of the wall is exposed. The wall has a crack 36 that is to be filled with grouting material. A cylindrical hole 38 is drilled in the wall 32 and a short tube 40 is inserted in the hole. The tube is formed of rubber, deformable plastic, or similar elastomeric material. Preferably, the tube 40 is of a conventional size and has a relatively thin wall. The tube wall may be as thin as one-sixteenth of an inch or one-eighth of an inch.

The nozzle 14 has a threaded portion 42 for receiving a conventional threaded coupling connecting the nozzle with the valve assemblies 28 and 30. The nozzle 14 is also provided with a hexagonal body portion 44 to facilitate rotation of the nozzle. A shank portion 46 extends outwardly from the hexagonal portion 44. The nozzle 14 has a central passage 48 for conducting grouting fluid through the nozzle. As an alternative, the passage 48 may have internal threads corresponding to the threads 42 for receiving a coupling member.

The threaded shank portion 46 of the nozzle is shown in detail in FIG. 3. The thread profile is not symmetrical. The thread has a relatively long axial face 50 and a relatively short radial face 52. The threaded portion of the shank 46 is tapered and the slope of the axial portion 50 of the thread is preferably twice the angle of taper of the shank portion 46. The radial portion 52 is relatively short and the distance from the root to the crest of the thread is preferably less than one-fourth of the pitch of the thread. The radial portion 52 of the thread faces away from the distal end of the shank portion 46. The slope of the axial portion 50 of the thread is less than 30° in order to provide a large axial bearing surface for expanding the elastomeric tube 40 without cutting into the tube. The short radial portion 52 provides sufficient deformation of the material of the tube 40 to form a bearing surface that cooperates with the radial portion 52 to advance the shank

portion 46 into the tube as the nozzle 14 is turned about its central axis. Because of the larger bearing surface of the axial portions 50 on opposite sides of each radial portion 52, the threads do not cut into the surface of the tube 40.

In operation, the tank 2 of the pump unit shown in FIG. 1 is filled with grouting fluid and the lever 10 is operated to pump fluid into the hose 12. The valve 16 is initially closed to shut off the flow of fluid to the nozzle 14. When the system shown in FIG. 2 is utilized, the two pumps 20 and 22 supply a grout solution and a catalyst separately to the nozzle 14. Initially, the valves 28 and 30 are closed. The hole 38 is drilled in the wall 32 adjacent the crack 36 that is to be filled and the tube 40 which may be slightly smaller than the diameter of the hole 38 is inserted in the hole. The shank portion 46 of the nozzle 14 is then inserted in the end of the tube 40 and pushed into the tube by hand until the frictional resistance of the tube prevents further insertion of the shank. The nozzle is then given a right hand rotation to advance the shank portion into the hole 38 and at the same time to expand the tube 40 outwardly against the wall of the hole. The hexagonal portion 44 of the nozzle facilitates turning the nozzle.

When the nozzle shank 46 has been threaded into the tube a sufficient depth to cause the tube 40 to be tightly wedged in the hole 38, the valve 16, or the valve 28 and 30, are opened to allow the grouting fluid to flow under pressure through the nozzle 14. The grouting fluid flows through the central passage 48 and into the drill hole 38 where it is diverted by the earth filling 34 behind the wall and is directed under pressure into the crack 36. When the grouting fluid has filled the crack, the valves are closed. The nozzle 14 may be removed from the hole 38 by a left-hand rotation of the nozzle. The wedging action between the tube 40 and the hole 38 is sufficiently strong to resist the fluid pressure in the hole 38.

As a specific example of the threaded portion of the nozzle which produces satisfactory results, the shank portion 46 has a taper angle of approximately 2½ and the slope of the axial portion 50 is approximately 5° greater than the taper angle. The pitch of the threads is about one-eighth of an inch and the depth of each thread, that is the distance from the crest to the root of each thread, is about 0.010 inch.

The threaded shank portion of the nozzle of this invention provides a convenient and quick method of inserting a nozzle in a drill hole when used in cooperation with an elastomeric tube which is wedged between the shank portion and the wall of the drill hole. The nozzle may be easily inserted and removed from the drill hole without damage to the nozzle or piping. Furthermore, there is no danger of chipping the wall 32 around the hole when the nozzle is inserted.

While this invention has been illustrated and described in several embodiments, it is recognized that variations and changes may be made therein without departing from the invention as set forth in the claims.

We claim:

1. Apparatus for injecting grouting fluid under pressure comprising:

means for pumping grouting fluid from an inlet at low pressure to an outlet at high pressure, nozzle means, conduit means for conducting grouting fluid from said outlet to said nozzle means;

said nozzle means including a tapered shank portion having a passage extending from the base end to the distal end, said conduit means communicating with said passage, said shank portion having an external screw thread thereon, said screw having a thread profile defined by the thread crest and an outer thread face and an inner thread face on opposite sides of said crest, said outer thread face being on the distal end side of said crest and having a greater proportion of surface area of said thread profile than said inner face, said outer thread face having a substantially constant taper in the direction of said distal end and having a greater slope than the taper of said shank portion; and

a resiliently compressible tube having a central bore smaller than said shank portion at said base end and larger than said shank portion at said distal end, whereby said outer thread face expands said tube to engage the surface of a bore hole in a wall without cutting said tube and thereby resists blowing out due to the pressure of said grouting fluid in said bore hole.

2. The apparatus according to claim 1 wherein said pumping means is included in a portable hand operated pump unit.

3. The apparatus according to claim 2 wherein said pump unit includes a tank for receiving grouting fluid.

4. The apparatus according to claim 1 including a second means for pumping grouting fluid from an inlet at low pressure to an outlet at high pressure, second conduit means for conducting grouting fluid from said outlet of said second pump means to said nozzle means independently of said first mentioned conduit means, whereby two components of a grouting material are conducted separately to said nozzle means where mixing occurs.

5. The apparatus according to claim 1 wherein said inner thread face extends substantially radially of the central axis of said shank portion.

6. The apparatus according to claim 5 wherein said outer thread face has a slope of less than 30° relative to the central axis of said shank portion.