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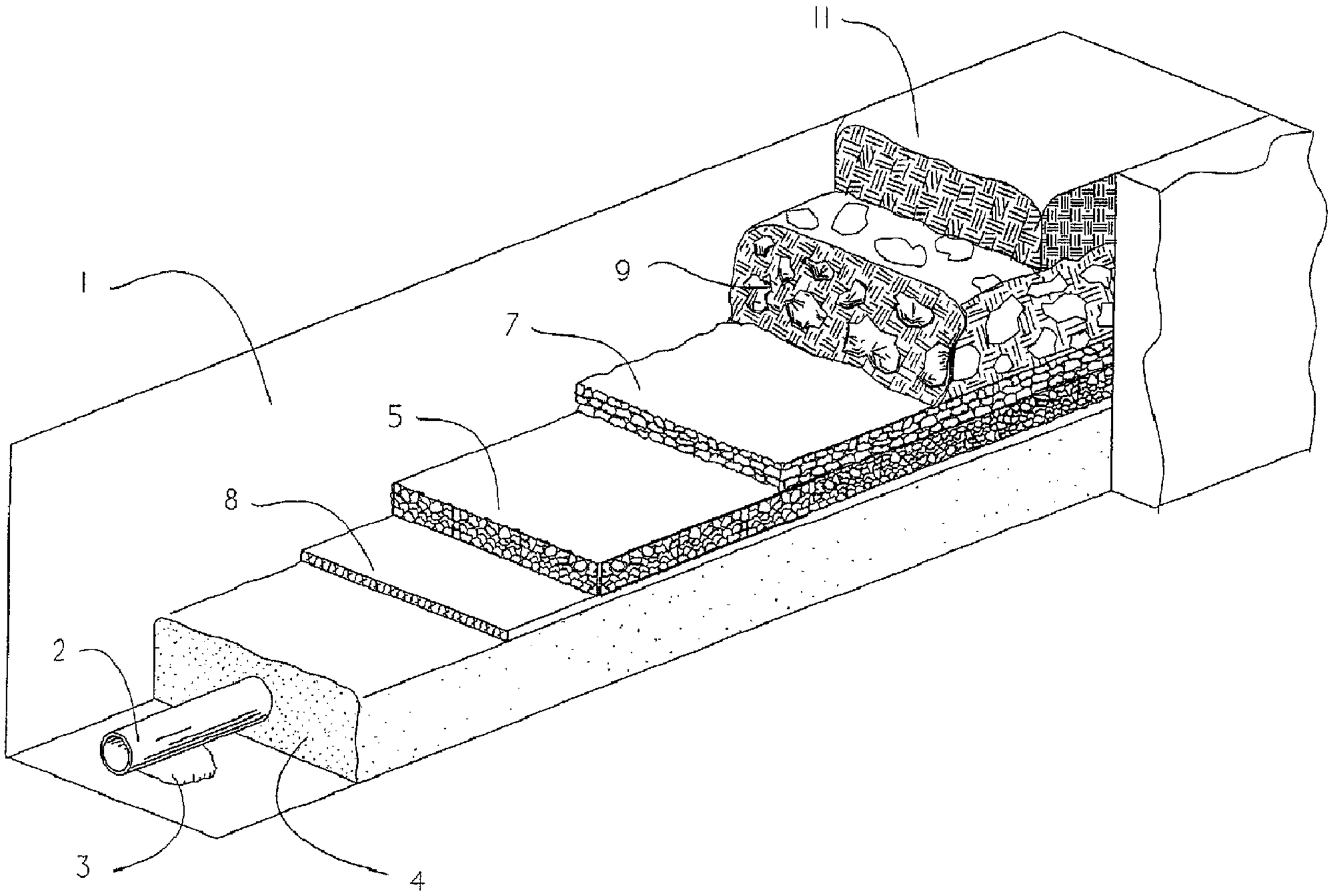
(54) Titre : PROCEDE ET SYSTEME POUR LE REMBLAYAGE DE STRUCTURES COMPRESSEES ENFOUIES
(54) Title: METHOD AND APPARATUS FOR BACKFILLING PADDED UNDERGROUND STRUCTURES



(57) Abrégé/Abstract:
In a method for backfilling pipe (2), cable or other structures placed in a ditch (1) and surrounded by a padding material (4), a geotextile material (8) is placed over the padding material (4) and then spoil (6) is backfilled into the ditch. The geotextile material (8) prevents rocks and other large particles from encroaching upon the padding material (4) which surrounds the buried structure (2)

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(57) Abrégé(suite)/Abstract(continued):
and then scratching, bending or breaking the buried object. Preferably, the spoil (6) is separated into layers of increasingly larger diameter particles. The geotextile material (8) can be carried as a roll on a padding machine or a frame attached to a tractor or other vehicle. A spreader and optionally a leveler are also provided to evenly place the geotextile material in the ditch. A tensioning device may also be provided to prevent inadvertent unwinding of the geotextile material as it is placed in the ditch (1).

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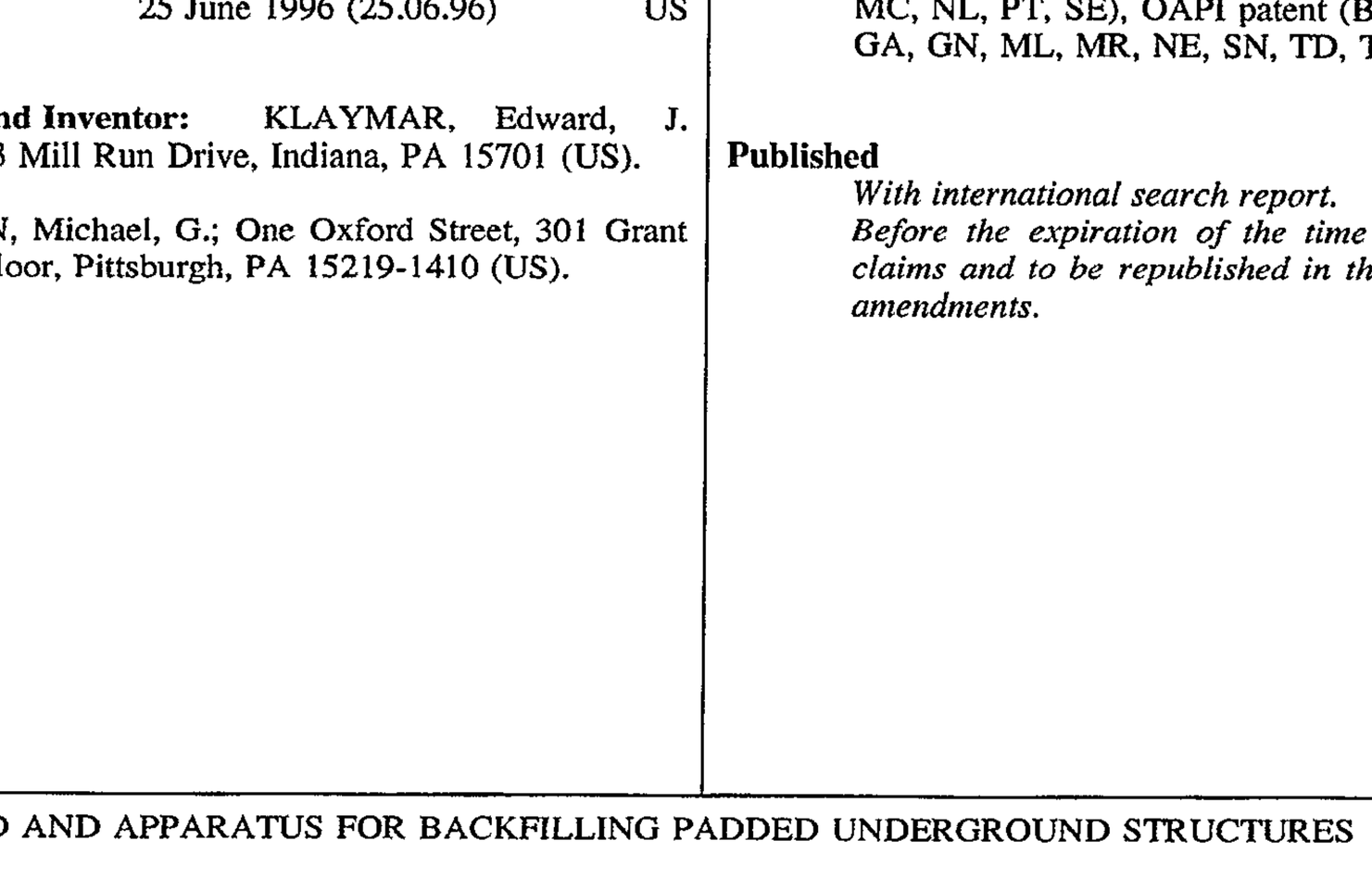


(57) Abstract

In a method for backfilling pipe (2), cable or other structures placed in a ditch (1) and surrounded by a padding material (4), a geotextile material (8) is placed over the padding material (4) and then spoil (6) is backfilled into the ditch. The geotextile material (8) prevents rocks and other large particles from encroaching upon the padding material (4) which surrounds the buried structure (2) and then scratching, bending or breaking the buried object. Preferably, the spoil (6) is separated into layers of increasingly larger diameter particles. The geotextile material (8) can be carried as a roll on a padding machine or a frame attached to a tractor or other vehicle. A spreader and optionally a leveler are also provided to evenly place the geotextile material in the ditch. A tensioning device may also be provided to prevent inadvertent unwinding of the geotextile material as it is placed in the ditch (1).

TITLE

METHOD AND APPARATUS FOR BACKFILLING PADDED UNDERGROUND STRUCTURES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method and apparatus to stabilize the backfill of ditches containing a pipeline, cable or other structure surrounded by sand or other padding material to prevent rocks or other larger particles from encroaching upon the padding material which surrounds the pipe.

2. Description of the Prior Art

Steel pipelines are used for transporting fluids, such as gas or oil, over a long distance, and it is common practice to bury the pipelines underground. Typically, top soil is stripped away and reserved for reapplication after the trench is backfilled. A trench is dug to a depth which allows 3 feet of cover over the pipe and 6 inches of space under the pipe. Subsoil removed from the trench is piled near the trench for later use as backfill material.

The pipe is laid on supports which hold the pipe generally six (6) inches above the trench floor. These supports can be sand bag piles or foam blocks spaced every 12 feet or so, or on a continuous bed of rock free soil. The pipe is then covered with rock free dirt called padding so that the padding material surrounds the pipe a minimum of 6

inches under, over and beside the pipe. Typically, the padding material is sand or subsoil with a particle size having a diameter not larger than 1 1/2 inches. Some specifications call for a maximum diameter of 1 inch or 1/2 inch. The industry term for this construction step is "Pipeline Padding."

In fairly low rock content areas pipeline padding can be accomplished with a backhoe operator virtually selecting dirt without rocks and gradually pulling it into the trench. In more rocky areas sand or screened dirt must be purchased and hauled to the right-of-way or produced on-site by pipeline padding machines. Padding machines are specifically designed portable screening machines which process the excavated spoil or right-of-way subsoil to produce and place padding material over the newly laid pipe. After the padding has been applied the remaining rock and subsoil spoil are then reintroduced into the trench.

Figure 1 shows a cross-section of a trench 1 backfilled according to one prior method. The pipeline 2 is surrounded by padding material 4. Typically this padding material will have been screened from soil dug from the trench. The remaining soil 6 is deposited over the padding material to completely backfill the trench.

A second prior art backfill method is illustrated by the trench cross-section of Figure 2. In this method the soil removed from the trench is run through multiple screens. The final screening creates the padding material 4 which typically contains subsoil having particles sized up to 5/8 inches nominal in diameter. Intermediate screenings provide intermediate layers 5, 7 and 9. Layer 5 contains 5/8" to 1 1/2" stone. Layer 7 contains 1 1/2" to 5" stone. Layer 9 contains 5" plus rocks produced by the multiple screened device and the remaining rock and subsoil spoil backfilled into the

trench. Layers 5 and 7 form a non-compactable barrier between the padding material 4 and the larger rock and subsoil mixture 9. In many areas a layer of topsoil 11 shown in Figures 5 and 6 is placed over the backfill to completely fill the trench.

The screening and backfilling of soil into the trench are often done by pipeline padding machines. This backfilling device usually includes a storage hopper or similar compartment for receiving the backfill material, a continuous conveyor and a system of vibrating screens for sorting the backfill material. The components within the backfilling device are supported by a mainframe which is carried above the ditch to be backfilled. A support arm rigidly locks the backfilling device with a tractor or other means of locomotion. The backfilling device is configured to backfill the ditch with various layers of different sized backfill material in a single pass. One such backfilling device is described in United States Patent No. 4,955,756.

The major problem facing owners and users of underground pipelines is corrosion. Corrosion is an electrochemical process, requiring an anode and a cathode electrically connected in an electrolyte. Corrosion is a self-poisoning process, and in order for it to continue over a long period of time, a mechanical or chemical means for depolarization or depassivation must exist. Interference with any one of these requirements will reduce the corrosion rate.

A widely used method of protecting pipes is the use of coating materials including tape, plastic, enamel, epoxy and urethane paint. The coatings separate the anode and cathode or isolate the electrolyte from the metal as long as the coating is free of defects.

In addition to the coatings it is known practice to use cathodic protection for the protection of metals buried underground. Present pipeline designs frequently include cathodic protection in accordance with the known technology which is effected by connecting the surface of the steel pipe either to a buried sacrificial anode or to an impressed current source. Cathodic protection is useful in preventing localized erosion of scratched and chipped pipe. However, cathodic protection is unable to protect from corrosion caused by water migration under the protective coating where the protective coating acts as an insulator. If the coating separates from the pipe, water may migrate under the coating and set up a corrosion cell using the coating as a shield against the cathodic protection. Furthermore, cathodic protection is expensive and typically is performed throughout the useful life of the pipeline.

Pipeline owners have developed techniques to observe underground pipelines in use. Some methods enable pipeline owners to see changes in pipeline wall thickness caused by localized corrosion. If the pipe is sufficiently corroded so that the wall thickness becomes too thin, the pipeline must be replaced. Because replacement of underground pipelines is expensive, pipeline owners have continued to search for better ways to prevent corrosion. Most of this effort has been directed to developing improved alloys, coatings and cathodic protection systems. Little attention has been paid to preventing damage to coatings during pipeline installations. Prior to the present invention the art has ignored the chipping and scratching of pipeline coatings which occurs after installation.

Obviously scratching and chipping of the pipeline can occur during pipeline handling on installation. A second less obvious method of scratching and chipping involves migration of rocks into the padding layer.

Rocks can and do break into the padding and damage the pipe coating during backfill using the method which results in the backfilled trench of Figure 1. After construction the padding layer provides only minimal support for point loads allowing rocks to move down into the padding layer and reach the pipe. This movement can occur during periods when standing water accumulates in the bottom of the trench. The water can mix with the padding material to an extent where the padding layer completely loses its ability to support the overhead rocks. In this condition the padding material and the overhead rocks change positions and the pipe becomes surrounded by rocks. Further movement of the rocks against the pipe chips or cracks the protective coatings resulting in corrosion. Thus, there is a need for a backfill method which creates a backfill trench in which rocks are prevented from entering the padding layer. Preferably this method can be practiced using existing pipeline padding machines as well as in less rocky areas where padding can be accomplished by selective backfill.

Rocks can not break into the padding layer 4 during backfill using the method which results in the backfilled trench of Figure 2. Layers 5 and 7, which form a non-compactable barrier of sized stone prohibit point loads from acting on the top surface of the padding layer 4. After construction, however, excess water in the backfilled trench will allow the padding material 4 and the non-compactable layers 5 and 7 to gradually mix until at some point rocks could enter the padding layer 4.

There are a class of materials known as geotextiles which are used primarily in roadway construction for erosion control. These materials allow subsurface water to pass while preventing adjacent soil from migrating past the geotextile layer. Light and medium weight nonwoven geotextiles placed over or around a drainage layer of large stone and rocks allow subsurface water to flow into the drainage core while preventing adjacent soil from clogging the drainage system. Geotextiles are placed over railroad beds to prevent fouling of ballast beneath railway track. Geotextile layers have also been placed around layers of soil to create retaining walls and to allow slopes to be safely steeped. Geotextiles as well as other types of sheet materials such as polyethylene sheets and bentonite clay liners are also used in landfills. The art, however, has failed to recognize that geotextiles could be used in pipeline trenches to prevent rock migration into the padding layer.

In United States Patent No. 5,176,025 Nicholas Butts discloses a pipeline system for preventing, detecting and containing leakage from subterranean pipeline transporting hydrocarbon liquids and gases. This system is designed to both prevent corrosion and contain any liquids or gases that leak from the pipeline. In Butts' system steel pipe is wrapped with a geotextile material impregnated with hydrated lime. That wrapper is completely covered by a protective, water impermeable layer of high density polyethylene (HDPE) sheet. Each sheet of HDPE is welded to the adjacent sheet forming a continuous impermeable sleeve around the pipe. Should the sleeve break and water permeate the sleeve the lime impregnated geotextile layer dissolves creating a highly alkaline solution providing the electric potential for cathodic protection. Since water

causes the geotextile used by Butts to dissolve that geotextile offers no protection against rock migration resulting from water in the trench.

Geotextiles have also been proposed for use in swamp weights as an alternative to concrete swamp weights for resisting buoyant forces acting on pipelines crossing water inundated terrain or organics. After the pipeline has been lowered into the ditch, a woven geotextile fabric is placed at designed intervals along the ditch. The fabric is draped down one ditch wall, placed across the ditch bottom, over the top of the pipe, and then draped up the other ditch wall. The backfill, consisting of either native ditch spoil material, a mixture of native and imported material, or entirely imported material, is then placed over the pipe in the normal manner. In this system the geotextile does not run the full length of the trench nor does it stabilize the backfill profile to prevent migration of rocks.

Underground pipes have also been wrapped with polyethylene webbing to protect the pipe from rocks and other debris. This material, called rock shield, usually consists of extruded plastic although geotextile fabric is sometimes used. Rock shield is utilized as a second coating layer wrapped around the pipe. In this system the geotextile does not stabilize the backfill to prevent rocks from entering or mixing with the padding material.

Buried fiber optic, telephone and electrical cables as well as underground storage tanks and other buried structures are often padded with sand and covered with subsoil in the same manner as underground pipelines. Buried electrical service lines are commonly enclosed in a polyethylene wrapping. Television and other communications cables are constructed with a polyethylene outer layer. Movement of rocks against the

outer surface of these cables can remove insulation, bend and even break these cables. Indeed, some electric utilities have reported rock damage to the outer layers of buried electrical cables. Buried storage tanks and other metal structures can be damaged by underground rock movement in the same manner as underground pipes. Therefore, any backfill method and device which protects underground pipelines, may also be suitable for protecting buried cable and other structures.

SUMMARY OF THE INVENTION

I provide a method and backfilling machine for backfilling a trench containing a pipe, cable or other structure in which a geotextile material is placed over or around the padding materials. The geotextile prevents rocks from mixing with the padding material.

In applications where backfill is screened to provide layers of increasingly larger size stones, the geotextiles can be placed on top of the padding layer.

I further provide an improved padding machine which carries a roll of geotextile material and automatically lays that material over the padding material. A spreading arm is preferably provided to keep the fabric flat in the trench while being covered with subsequent layers.

I also provide an apparatus for placing geotextile material over the padding layer which can be used with selective backfill practices or when padding material is imported.

I further provide a padding machine which automatically lays geotextile material over padding material, which includes a material spreader/installer to protect the geotextile from damage during the backfill process.

Other objects and advantages of my backfill method and improved padding machine will become apparent from a description of certain present preferred embodiments thereof shown in the drawings.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a cross-sectional view of a trench containing a pipeline backfilled according to one prior art method.

Figure 2 is a cross-sectional view of a trench containing a pipeline backfilled in accordance with a second prior art method.

Figure 3 is a cross-sectional view of a pipeline in a trench which has been backfilled according to a first present preferred embodiment of my backfill method.

Figure 4 is a cross-sectional view of a trench containing a pipeline backfilled according to a second preferred embodiment of my backfill method.

Figure 5 is perspective view of a trench containing a pipeline backfilled in accordance with the second preferred backfill method.

Figure 6 is a perspective view similar to Figure 5 illustrating a pipe backfilled in accordance with a third present preferred backfill method.

Figure 7 is a side view of a present preferred embodiment of my improved padding machine.

Figure 8 is a perspective view of a portion of a padding machine illustrating a second preferred embodiment of my improved padding machine.

Figure 9 is an end view of an apparatus for applying geotextile material over the padding material which can be carried by a tractor or other mobile carrier.

Figure 10 is a side view of the apparatus shown in Figure 9.

Figure 11 is a cross-sectional view similar to Figure 3 of a fiber optic cable which has been backfilled according to the first present preferred embodiment of my backfill method.

Figure 12 is a side view of an underground storage tank which has been backfilled according to the second present preferred embodiment of my backfill method.

Figure 13 is a perspective view of a portion of a second preferred embodiment of my apparatus for applying geotextile material over the padding material.

Figure 14 is a side view of the apparatus shown in Figure 13 as padding material is being applied.

Figure 15 is a side view similar to Figure 14 of a third preferred embodiment of a portion of my apparatus for applying geotextile material over the padding material.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The first present preferred embodiment of my method is based upon the prior art practice of Figure 1. Referring to Figure 3, a pipeline 2 is placed in a ditch or trench 1 and covered with padding material 4. A geotextile material 8 is placed over the

padding material and generally extends from one side of the ditch to the other. I prefer to use woven rather than nonwoven geotextile material. Backfill containing a random mixture of rock and subsoil 6, often called spoil, is then placed on top of the geotextile material. If desired, top soil (not shown) can be placed over the backfill material to complete the filling of the ditch.

Although geotextile material does not provide excellent load bearing capabilities as it can be torn or ruptured nor does geotextile material have excellent load distribution capabilities it can stabilize the padding material 4 if the backfill spoil 6 contains a low to moderate percentage of larger rocks and provided the backfill spoil 6 is carefully placed on top of the geotextile material 8.

The geotextile material 8 acts as a stabilizing sheet which permits water to pass while preventing the passing of solids, either from the padding material 4 or the backfill spoil 6, provided that the geotextile material 8 is not torn or ruptured. There may be other nondegradable fabrics not generally considered to be geotextiles which could be used as this stabilizing sheet. Consequently, the padding material 4 will maintain its integrity and not be encroached by rocks and there will be no scratching of the pipe after the backfill process has been completed.

A second preferred embodiment of my method is illustrated in Figures 4 and 5. As in the prior art process of Figure 2, a pipe 2 is placed in trench 1 and covered with padding material. The padding material has been created by running the spoil removed from the trench through a series of screens. The material passing through the finest screen is the padding material. Preferably, the padding material will contain particles having a diameter of up to 5/8 nominal inches. Next, I place a layer of geotextile

fabric 8 on top of the padding layer. Then, I place a layer of stone ranging between 5/8 and 1 1/2 inches in diameter on top of the geotextile material to form layer 5. On top of layer 5 is placed a layer 7 containing stone having diameters from 1 1/2 inches to 5 inches. Finally, layer 9 which contains rock having a diameter greater than 5 inches mixed with smaller stone and soil is placed. Preferably, an automated padding machine is used to separate the soil removed from the trench into the various layers 4, 5, 7 and 9. In most installations a layer of top soil 11 will be placed on top of the coarse backfill layer 9. When the pipe is initially placed in the trench it is supported by sandbags 3 or other supports. The sandbags maintain the pipe 2 at some distance above the trench floor to allow padding material to be placed under the pipe. In the installation shown in Figures 4 and 5, layers 5 and 7 form a non-compactable barrier between padding and the rock and soil backfill layer 9. This barrier distributes loads over the top surface of the padding material. The geotextile fabric 8 prevents mixing of the padding material 4 below and the sized stone 5 above. Consequently, the integrity of both the non-compactable barrier and the padding layer 4 is maintained and rock damage to the pipe is prevented.

A third present preferred embodiment of my backfill method is shown in Figure 6. In this embodiment geotextile material 8 is draped down one side of the trench across the bottom and up the opposite side of the trench. Then, the pipe 2 is placed on sandbags 3 in the trench. Padding material 4 is deposited around the pipe. Then that portion of the geotextile fabric 8 extending above the trench is folded over the top of the padding layer 4 as shown. Then, backfill layers 5, 7, 9 and top soil 11 are placed on top of the geotextile fabric. These layers are placed in the same manner as described before in the embodiments of Figures 4 and 5. This embodiment of my backfill method is intended to

be used where the trench has been excavated in very unstable subsoil where rocks can break away from the unexcavated trench walls 51 or work upward from the unexcavated trench bottom 52.

The methods illustrated in Figures 4 thru 6 can be practiced using the padding machine shown in Figures 7 and 8. Referring to Figure 7, the padding machine 18 has a frame 20. A hopper 22 having a grizzly 24 is placed on top of the frame. When backfill material is placed on top the grizzly large rocks will fall off forming layer 9. Other material will pass through hopper 22 onto conveyor 28. If the padding machine is of the type described in my United States Patent No. 4,955,756, the conveyor will deliver the material to a double screen within housing 32. Material having a diameter between 1 1/2 and 5 inches will fall through chute 34. Stones having a diameter between 5/8 inches and 1 1/2 inches will fall from the bottom edge 35 of housing 32. In an alternative machine having a single screen in housing 32 there is a large screen 26 at the bottom of hopper 32. Material having diameter between 1 1/2 and 5 inches will fall from the back of screen 26 onto chute 30. That material will drop to form layer 7. Material passing through screen 26 will fall onto conveyor 28. That conveyor moves the material onto screen 32. Stones having a diameter between 5/8 inches and 1 1/2 inches will not pass through screen 32. Rather, they will fall onto chute 34 and then down to form layer 5. In both types of machines, the fine material having a diameter of 5/8 inches or less drops through screen 32 onto chute 33 and into the trench to form the padding material 4.

In the improved padding machine I provide a support 36 on which I place a roll 38 of geotextile material 8. Geotextile material is routed around roller 40 held by bracket 39 and then laid on top of the padding layer 4. Roller 40 also levels the padding

layer during placement of the geotextile fabric. Although I prefer to place the geotextile fabric on the padding layer, I have shown an optional support 36a. Using this support the geotextile fabric is placed between layers 5 and 7 as shown in chainline.

In Figure 8 I show an alternative configuration of the padding machine wherein the roll 38 of geotextile fabric 8 is mounted directly on the padding machine frame. A pair of leveling arms 42 having a roller 44 between them extends from chute 33. This arrangement maintains the geotextile fabric on the padding layer as the remaining layers 5, 7 and 9 are deposited.

When selective backfilling is done or padding material is imported the geotextile material may be placed in the trench using the apparatus 60 shown in Figures 9 and 10. A rectangular support frame 61 has a mast 62. A cable 63 and clevis 64 are provided to attach the frame 61 to a tractor or other mobile carrier indicated by chainline 70. A roll of geotextile material 66 is carried on rack 65 attached to the top of the frame. I prefer to provide a motor 75 for unrolling the roll of geotextile material. I prefer to provide a padding leveler 69 which is connected to the bottom of the frame by telescoping steel tubing 68. A hydraulic cylinder 67 is provided to adjust the height of the leveler 69. I prefer to provide brackets 71 on the rear of the leveler 69 which holds roller 72. A spreader 73 preferably having a pair of arms with a roller connected between the arms such as is used in the embodiment of Figure 8 extends from the bottom of the frame 61. Geotextile material is fed from roll 66 under roller 72 and spreader 73 onto padding material 4. The leveler 69 assures that at least a portion of the padding material will be at the same level as the spreader to enable even placement of the geotextile material.

As shown in Figure 11 buried fiber optic cable 80 having a transmissive core 81, reflective layer 82 and protective coating 84 is padded with sand or other padding material 4. A geotextile material 8 is placed over or around the padding material. Then backfill containing soil 6 covers the geotextile materials. If desired, top soil (not shown) can be placed over the backfill material to complete filling of the ditch 1. The geotextile material prevents rock migration from the backfill soil into the padding layer. Consequently, migrating rocks cannot strike the cable 80 and damage the protective coating 82 and reflective layer 81.

An underground storage tank 90 with access pipe 92 shown in Figure 12 is surrounded by a padding material 4. Geotextile material 8 is placed on or around the padding layer. Then the spoil is selectively returned to the trench to create layers 5, 7 and 9 containing stone of progressively larger nominal diameters. Topsoil or concrete (not shown) may be placed over the top layer. As in the embodiment of Figures 4 and 5 the geotextile material prevents mixing of the padding material and the stone above the geotextile material. Furthermore, layers 5, 7 and 9 form a non-compactable barrier. Consequently, rock damage to the storage tank is prevented.

In Figures 13 and 14 I show an alternative configuration of a padding machine 94 wherein a roll of geotextile fabric 95 is mounted so as to hang below the padding machine frame 96. The roll of geotextile fabric is held by fabric roll supports 98 which are provided at each end of a shaft 100. Supports 98 can be adjustable to accept varying widths of geotextile fabric roll 95. Also, the shaft can be provided with bearings (not shown) for ease of unrolling. A tensioner 102 may be provided to control the unrolling of the roll of geotextile material so as to resist unwinding of the roll 95 as the

padding machine 94 is pulled by the tractor or other mobile carrier along the trench. This is an alternative to providing a motor for unrolling the roll of geotextile material (Figures 9 and 10). The tensioner could be a bar, roller or flat sheet resting on the roll or a brake acting against the sides or core of the roll. A geotextile spreader/installer 104 can be provided to keep the geotextile fabric 8 spread as it is laid on top of the padding material 4 and to prevent collapsing of the fabric as it is unrolled. This also helps to lay the fabric directly on the padding material as the layer 5 is spread on top of the geotextile fabric. The spreader/installer 104 is preferably made of a strong flexible material such as that used for conveyor belting and having attached on a bottom portion 105 neoprene rubber where the geotextile fabric meets and passes under the spreader. It eliminates the need for the roller 40 shown in Figure 7 which may be damaged or restricted by rocks. As the fabric is unrolled from the geotextile fabric roll 95, it slides underneath the bottom portion 105 of the spreader/installer 104, while the top surface 106 of the spreader/installer prevents all or a portion of the material which forms layer 5 from falling on unsupported geotextile fabric, preventing damage to the fabric. This spreader/installer preferably is wider at the top than at the bottom because trench walls are usually sloped. A top width of 40 inches (101.60 cm) and a bottom width of 30 inches (76.20 cm) can be used. In an alternative embodiment, one end of the spreader/installer 104 may be attached on the shaft 100 so as to provide resistance on the geotextile fabric roll 95 such that it acts as the tensioner 102.

Similar to the apparatus shown in Figure 10, a padding leveler 108 may be connected to the frame 96, such as by telescoping steel tubing 110. A hydraulic cylinder 112 may also be provided to adjust the height of the leveler 108. In the embodiment shown in Figure 15 I also provide a roller 114 for the geotextile fabric positioned well 16.

above the padding layer 4. The carrier may be an idler. The geotextile fabric is unrolled from the roll 95 and passes under the carrier 114 and then slides underneath the bottom surface 105 of the spreader/installer 104.

As shown in Figures 14 and 15, the padding machine may also include chutes 116, 118 from the padding machine or other padding material source extend through the frame 96. The chutes deliver the different layers of spoil on top of the geotextile fabric 8 after it is placed over the padding material 4. The padding material is placed over the pipe 2, or other buried structure such as the fiber optic cable 80 or tank 90, and the padding machine 94 is moved in the trench while the leveler 108 levels the padding material. As the geotextile fabric unrolls from the roll, it slides underneath the geotextile fabric spreader. Alternatively it may also pass underneath the idler 114 in Figure 15 prior to sliding underneath the spreader/installer. Material having a diameter between 5/8 inches and 1 1/2 inches will fall from the first chute 116 onto the geotextile fabric 8 to form layer 5. Material having a diameter between 1 1/2 and 5 inches will fall from the second chute 118 on top of the prior stone layer to form layer 7. Large rocks from the backfill can then be placed on top of the larger size stone layer 7 to form layer 9. Top soil may then be placed on the layer 9.

Although I have shown certain present preferred embodiments of my method and padding machine, it should be distinctly understood that the invention is not limited thereto, but may be variously embodied within the scope of the following claims.

I claim:

1. A method of filling a trench after a structure has been placed in the trench including:

a. depositing a padding material around the structure, the padding material comprised of subsoil containing stones having a diameter of not more than 1 1/2 inches and filling only a portion of the trench;

b. applying a geotextile material, which permits water to pass while preventing passage of solids, over the padding material; and

c. applying spoil over the geotextile material to backfill the trench.

2. The method of claim 1 wherein the step of applying spoil includes the steps of:

a. separating the spoil by particle size into two portions, the first portion containing soil having particle sizes smaller than the second portion;

b. applying the first portion of spoil over the geotextile material; and

c. applying the second portion of spoil over the first portion of spoil.

3. The method of claim 2 wherein the first portion of spoil contains particles having a diameter of from 1 1/2 inches to 5 inches.

4. The method of claim 1 wherein the padding material contains particles having a diameter of not more than 5/8 inches and the step of applying spoil is includes of the steps of:

a. separating the soil by particle size into a first portion containing spoil having particle sizes of from 5/8 inches to 1 1/2 inches, a second portion containing spoil having particle sizes of from 1 1/2 inches to 5 inches, and a third portion containing spoil having particle sizes greater than 5 inches;

b. applying the first portion of spoil over the geotextile material;

c. applying the second portion of spoil over the first portion of spoil;

d. applying the third portion of spoil over the second portion; and

d. applying any remaining rock and subsoil spoil over the third portion.

5. The method of claim 1 wherein the structure is selected from the group consisting of fiber optic cables, electrical cables, telephone cables, pipes and storage tanks.

6. A method of filling a trench having two sides and a bottom including:

a. draping a geotextile material, which permits water to pass while preventing passage of solids, over the sides and bottom of the trench;

b. placing a structure selected from the group consisting of fiber optic cables, electrical cables, telephone cables, pipes and storage tanks in the trench;

c. depositing a padding material around the structure, the padding material comprised of spoil containing stones having a diameter of not more than 1 1/2 inches and filling only a portion of the trench;

d. folding the geotextile material around the padding material; and

e. applying spoil over the geotextile material to backfill the trench.

7. The method of claim 6 wherein the step of applying spoil includes the steps of:

a. separating the spoil by particle size into two portions, the first portion containing spoil having particle sizes smaller than the second portion;

b. applying the first portion of spoil over the geotextile material;

c. applying the second portion of spoil over the first portion of spoil; and

d. applying any remaining rock and subsoil spoil over the second portion as spoil.

8. The method of claim 7 wherein the first portion of spoil contains particles having a diameter of from 1 1/2 inch to 5 inch.

9. The method of claim 6 wherein the padding material contains particles having a diameter of not more than 5/8 inches and the step of applying spoil is comprised of the steps of:

a. separating the spoil by particle size into a first portion containing spoil having particle sizes of from 5/8 inches to 1 1/2 inches, a second portion containing spoil having particle sizes of from 1 1/2 inches to 5 inches, and a third portion containing spoil having particle sizes greater than 5 inches;

b. applying the first portion of spoil over the geotextile material;

c. applying the second portion of spoil over the first portion of spoil;

d. applying the third portion of spoil over the second portion; and

e. applying any remaining rock and subsoil spoil over the third portion.

10. A method of filling a trench after a structure has been placed in the trench including:

a. depositing a padding material around the structure, the padding material comprised of subsoil containing stones having a diameter of not more than 1 1/2 inches and filling only a portion of the trench;

b. applying a stabilizing sheet over the padding material which stabilizing sheet permits water to pass through the stabilizing sheet and prevents passing of solids through the stabilizing sheet; and

c. applying spoil over the stabilizing sheet to backfill the trench.

11. The method of claim 10 wherein the structure is selected from the group consisting of fiber optic cables, electrical cables, telephone cables, pipes and storage tanks.

12. An improved backfilling device of the type which applies a padding material around a structure in a trench and then applies a backfill material over the padding material wherein the improvement includes a supply of geotextile material, which permits water to pass while preventing passage of solids, on the backfilling device and a roller extending from the backfilling device wherein geotextile material from the supply is routed around the roller and into the ditch at a selected level above the backfilling device.

13. The improved backfilling device of claim 12 including a chute extending from the backfilling device and over which the padding material flows from the backfilling device into the trench and wherein the supply of geotextile material is attached to the chute.

14. The improved backfilling device of claim 12 also including a chute extending from the backfilling device and over which the padding material flows from the backfilling device into the trench and at least one arm extending between the chute and the roller.

15. The improved backfilling device of claim 12 wherein the supply of geotextile material is a roll of geotextile material.

16. An apparatus for placing geotextile material over padding material surrounding a structure in a ditch including:

a. a frame sized and configured to be attached to a carrier which moves along one side of the ditch holding at least a portion of the frame over the ditch;

b. a supply of geotextile material on the frame, the geotextile material being a material which permits water to pass through the material while preventing passage of solids; and

c. a spreader extending from the frame and under which the geotextile material passes as the geotextile material is placed in the ditch.

17. The apparatus of claim 16 also including a leveler extending from a frame.

18. The apparatus of claim 17 also including at least one hydraulic cylinder connected between the frame and the leveler.

19. The apparatus of claim 16 wherein the supply of geotextile material is a roll of geotextile material.

20. The apparatus of claim 19 also including a motor attached to the frame and connected to the roll of geotextile for unrolling geotextile material from the roll.

21. The apparatus of claim 16 further including a first chute for applying a first portion of spoil over the geotextile material.

22. The apparatus of claim 21 further including a second chute for applying a second portion of spoil over the first portion of spoil.

23. The apparatus of claim 17 wherein the spreader has a top surface which prevents spoil from contacting the geotextile material before the geotextile material is placed in the ditch.

24. The apparatus of claim 16 wherein the spreader is a sheet of flexible material attached to and extending from the frame.

25. The apparatus of claim 24 wherein the supply of geotextile material is a roll of geotextile material and including a shaft attached to the frame and connected to the roll of geotextile material for unrolling the geotextile material from the roll.

26. The apparatus of claim 25 further including a tensioner connected to the roll for controlling the unrolling of the geotextile material from the roll.

27. A method of filling a trench after a structure has been placed in the trench including:

a. depositing a padding material around the structure, the padding material comprised of subsoil containing stones having a diameter of not more than 1 1/2 inches and filling only a portion of the trench;

b. applying a geotextile material over the padding material, the geotextile material being a material which permits water to pass through the material while preventing passage of solids;

c. applying spoil over the geotextile material to backfill the trench; and

d. protecting the geotextile material from damage as the spoil is applied over the geotextile material.

28. The method of claim 27 wherein the step of applying spoil includes the steps of:

a. separating the spoil by particle size into two portions, the first portion containing soil having particle sizes smaller than the second portion;

b. applying the first portion of spoil over the geotextile material; and

c. applying the second portion of spoil over the first portion of spoil.

29. The method of claim 27 wherein the padding material contains particles having a diameter of not more than 5/8 inches and the step of applying spoil includes the steps of:

a. separating the soil by particle size into a first portion containing spoil having particle sizes of from 5/8 inches to 1 1/2 inches, a second portion containing spoil having particle sizes of from 1 1/2 inches to 5 inches, and a third portion containing spoil having particle sizes greater than 5 inches;

b. applying the first portion of spoil over the geotextile material;

c. applying the second portion of spoil over the first portion of spoil;

d. applying the third portion of spoil over the second portion; and

d. applying any remaining rock and subsoil spoil over the third portion.

30. A method of filling a trench after a structure has been placed in the trench including:

a. depositing a padding material around the structure, the padding material comprised of subsoil containing stones having a diameter of not more than 1 1/2 inches and filling only a portion of the trench;

b. applying a stabilizing sheet over the padding material which stabilizing sheet prevents passage of solids and permits passage of water through the stabilizing sheet;

c. controlling the rate at which the stabilizing sheet is applied over the padding material; and

d. applying spoil over the stabilizing sheet to backfill the trench.

Fig.1.
Prior Art

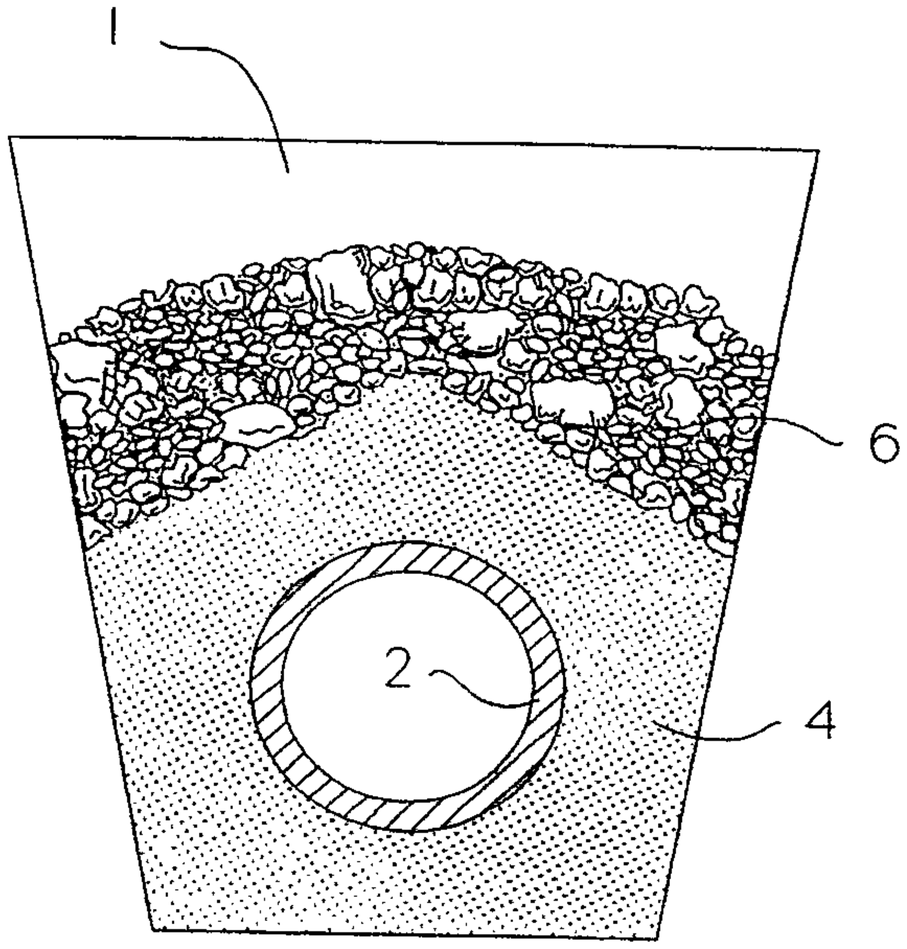


Fig.2.
Prior Art

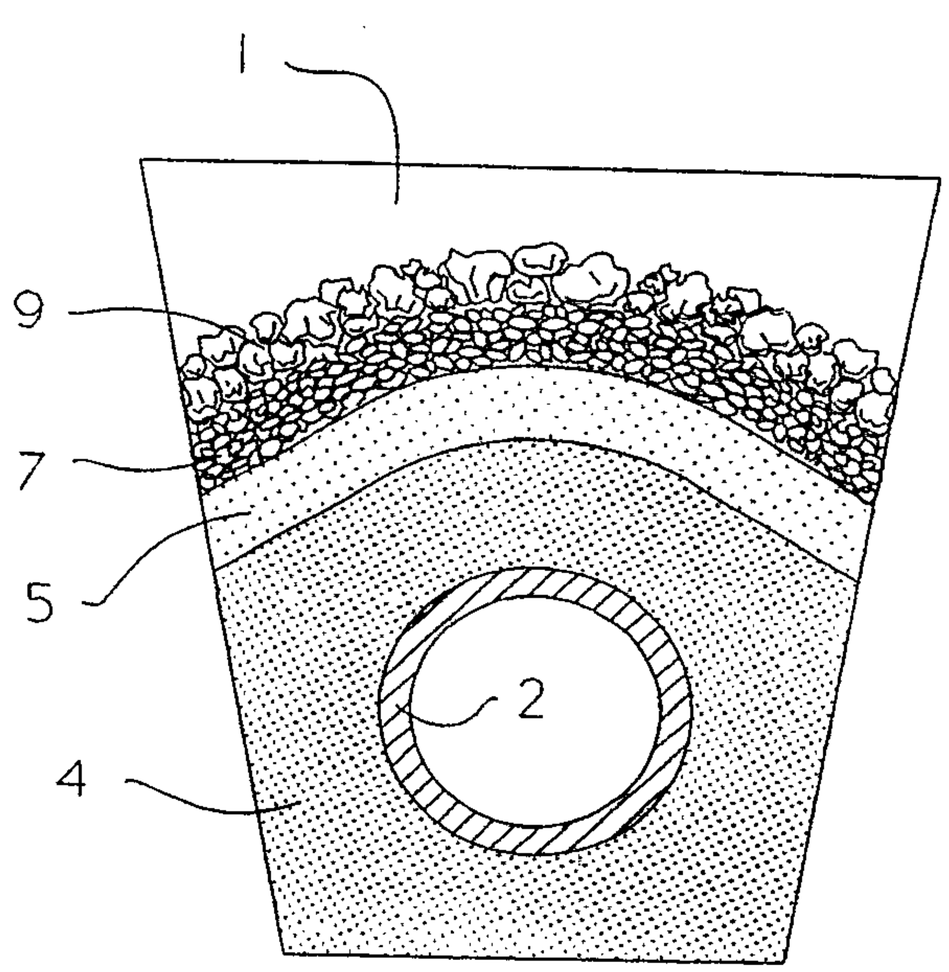


Fig.3.

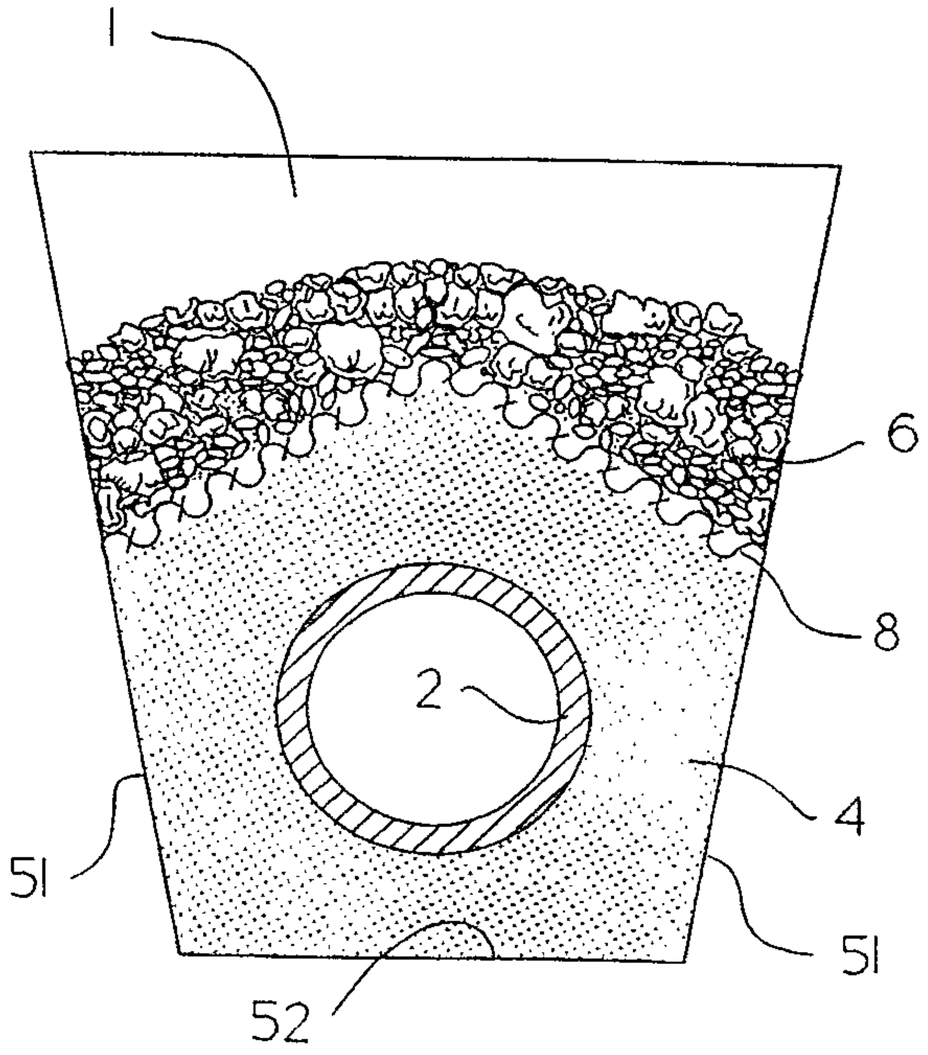
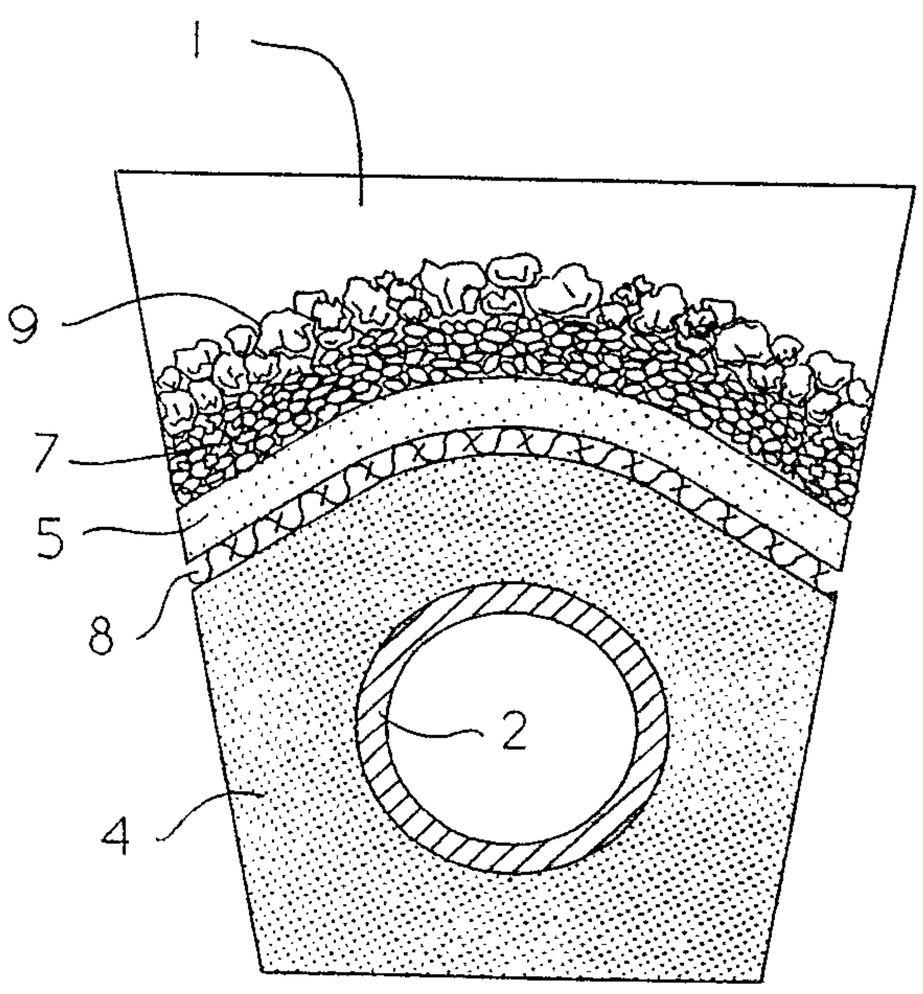


Fig.4.



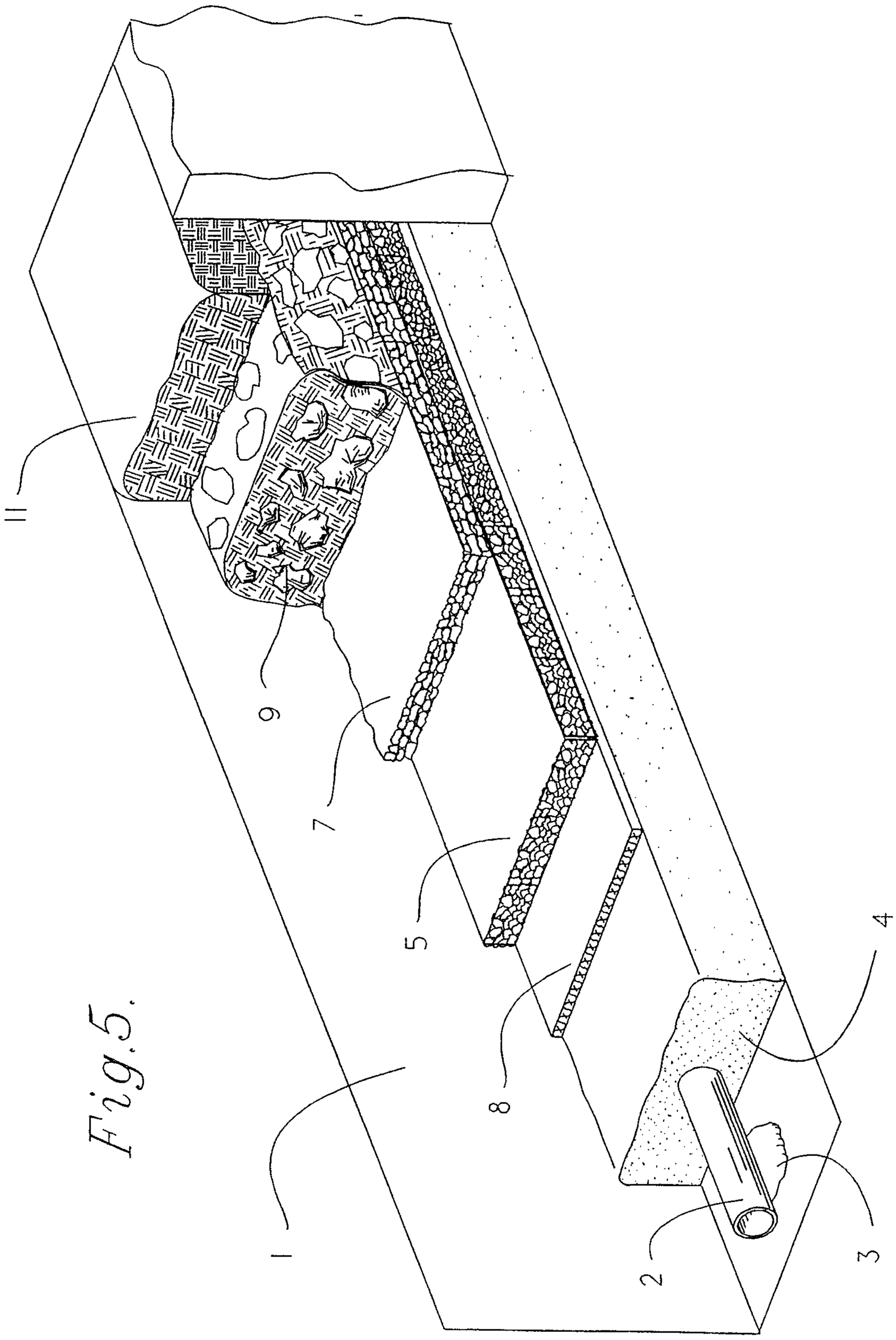


Fig.5.

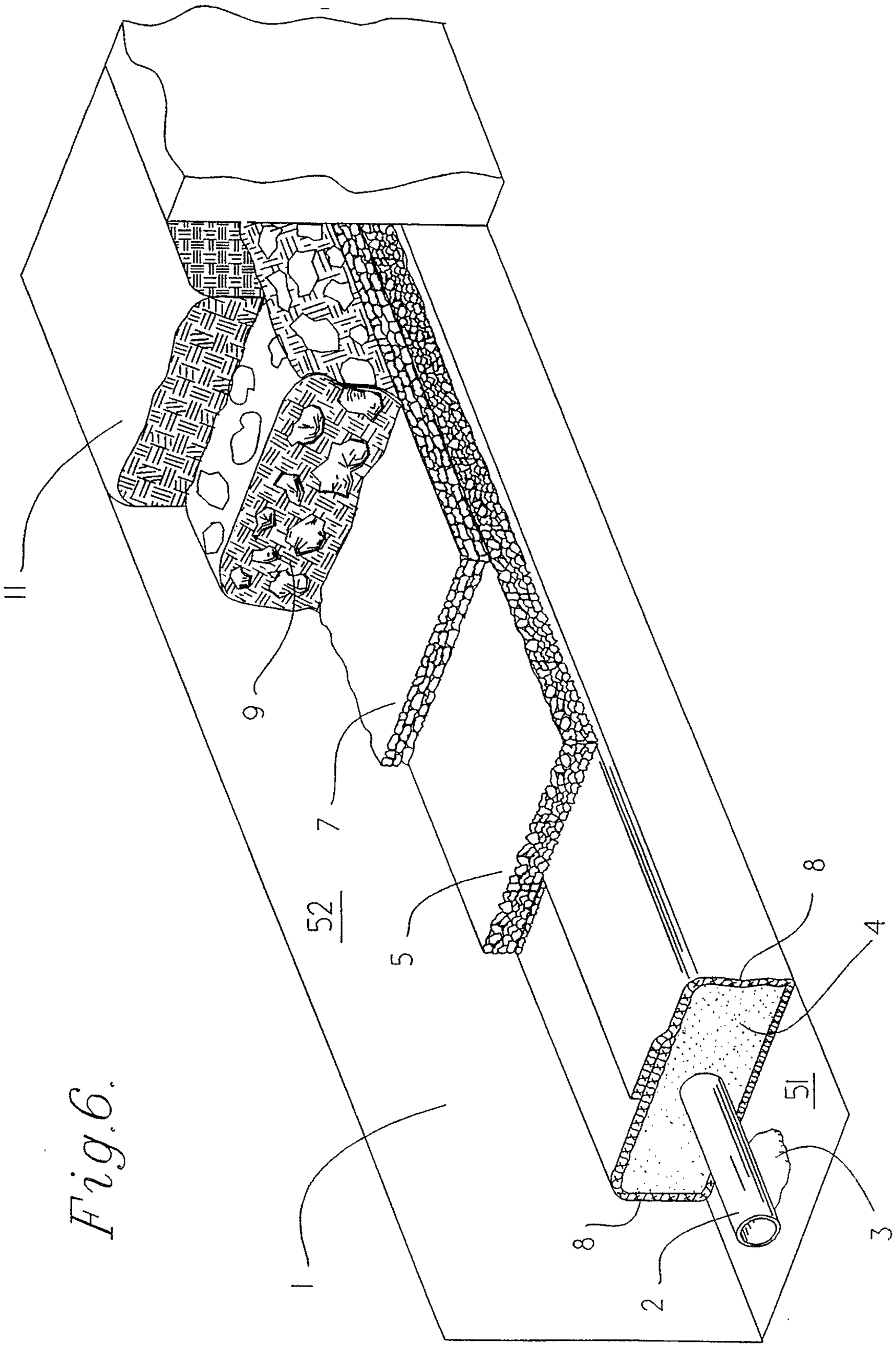


Fig.6.

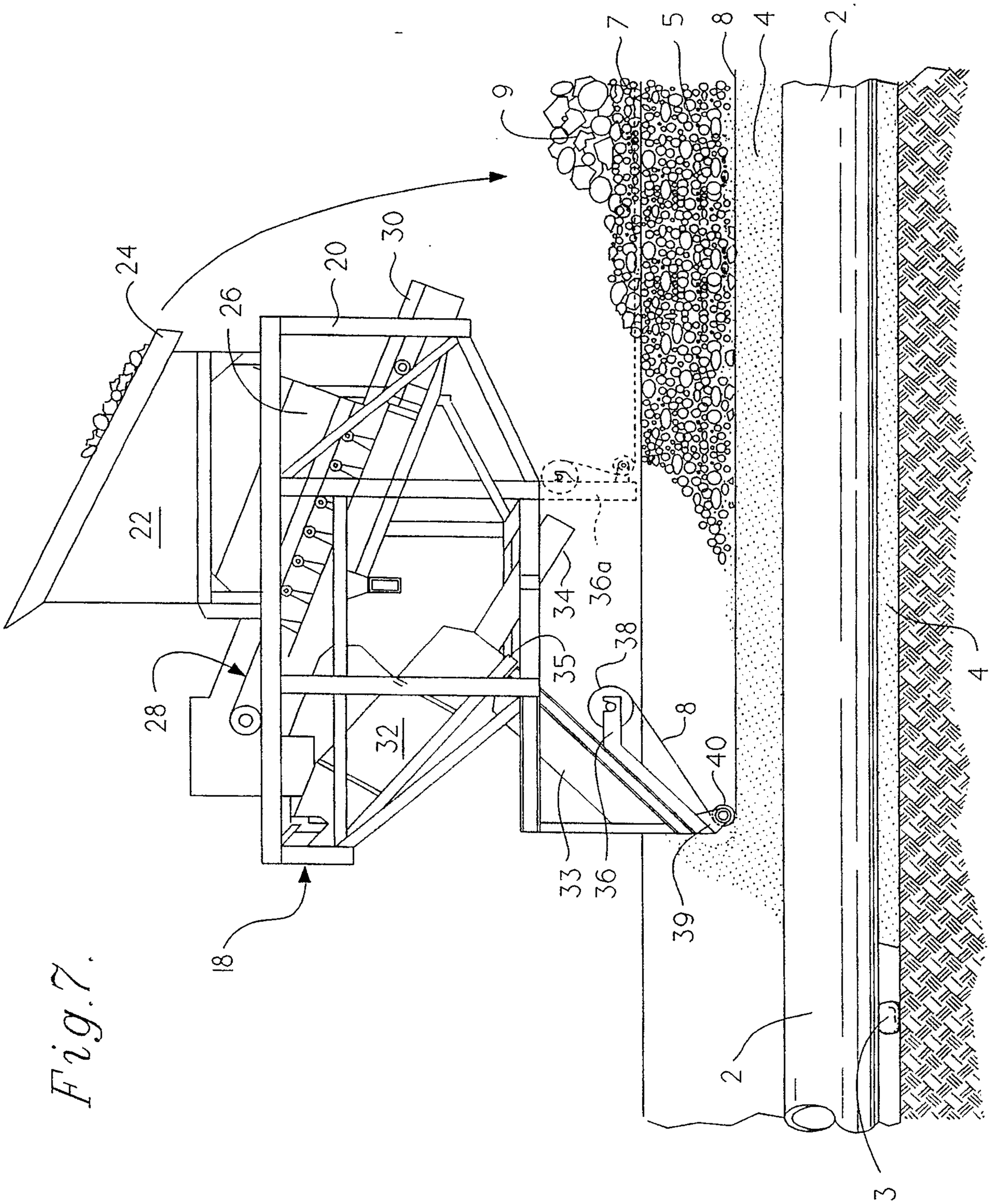
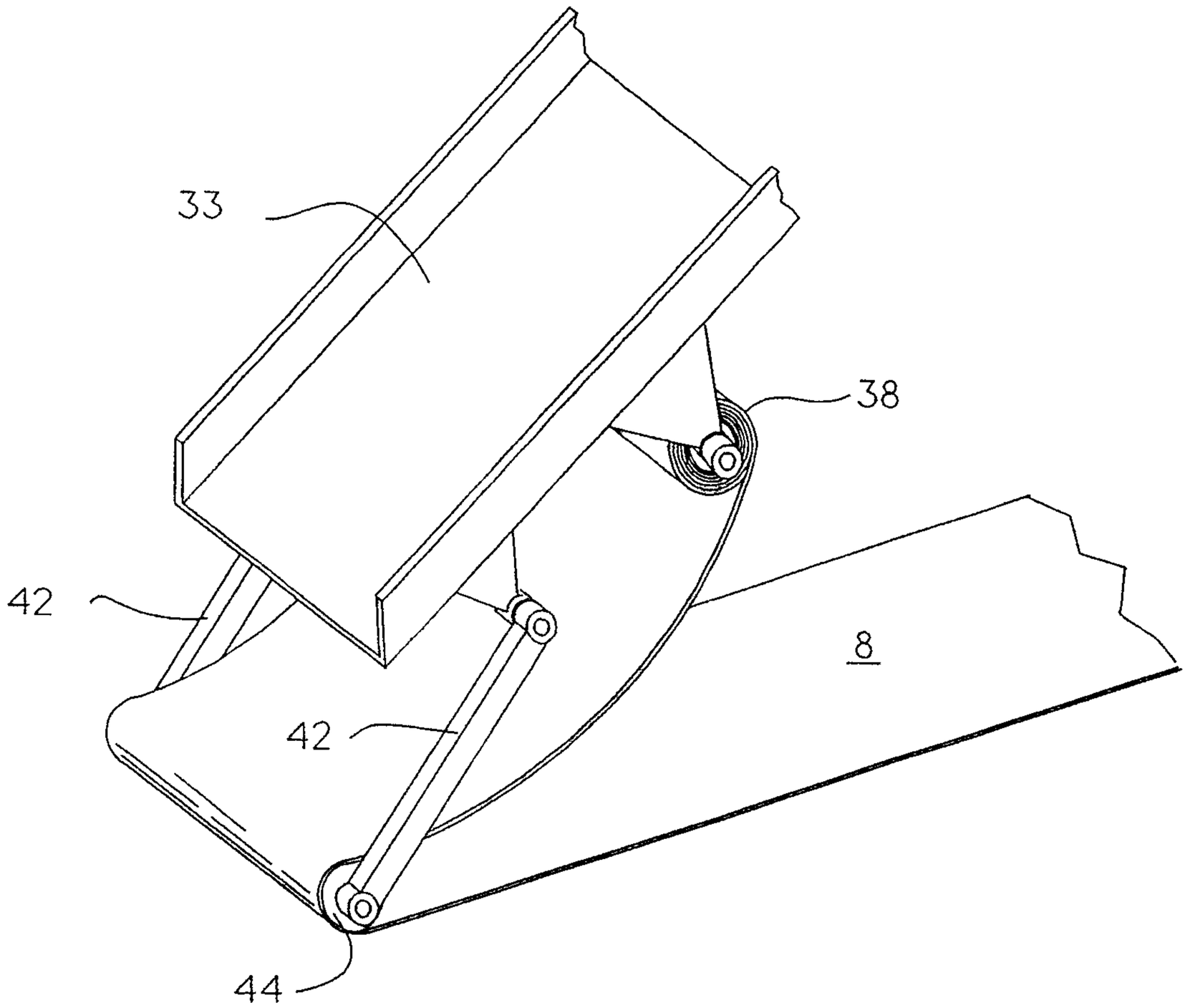


Fig. 7.

Fig.8.



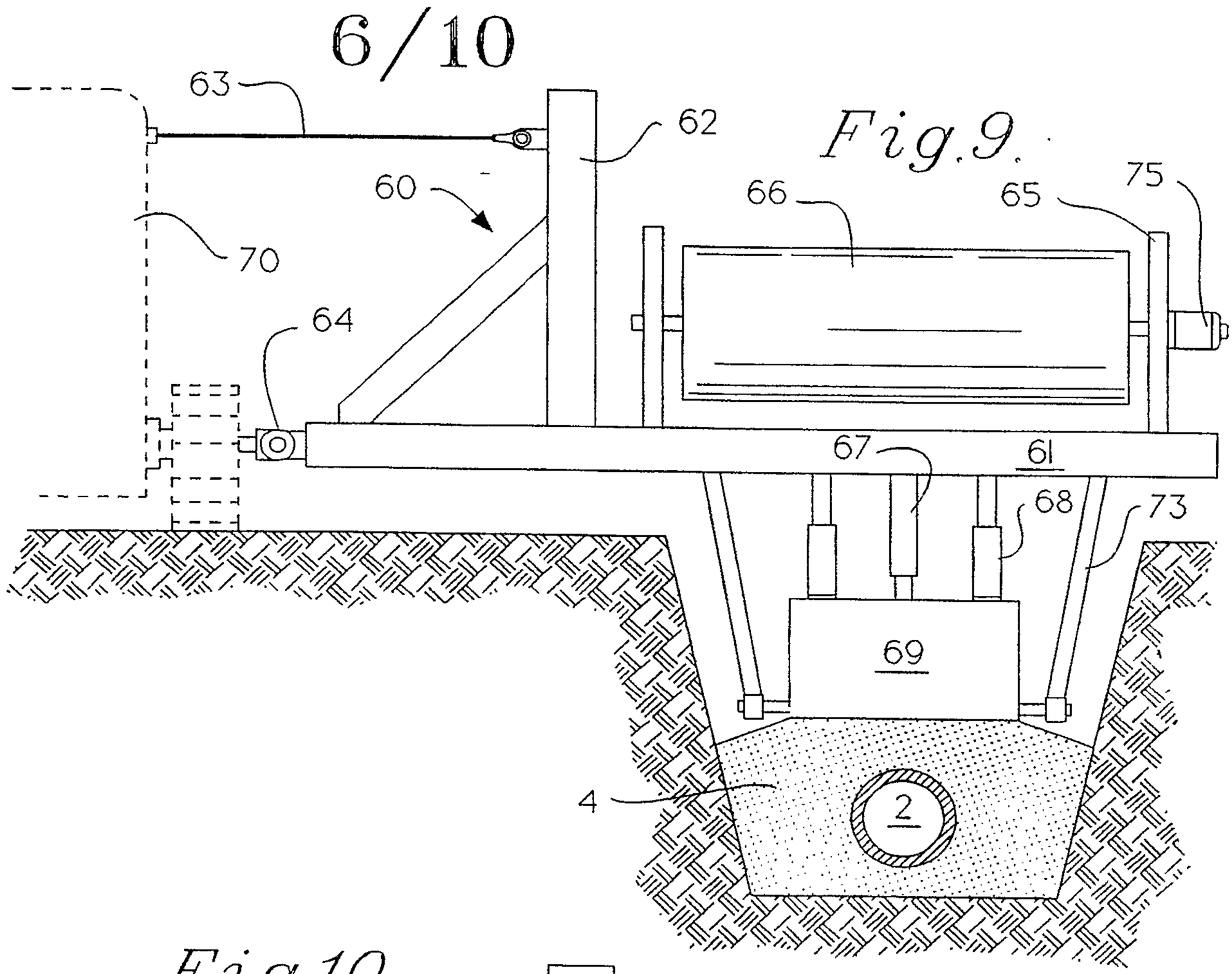

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Fig.9.

Fig.10.

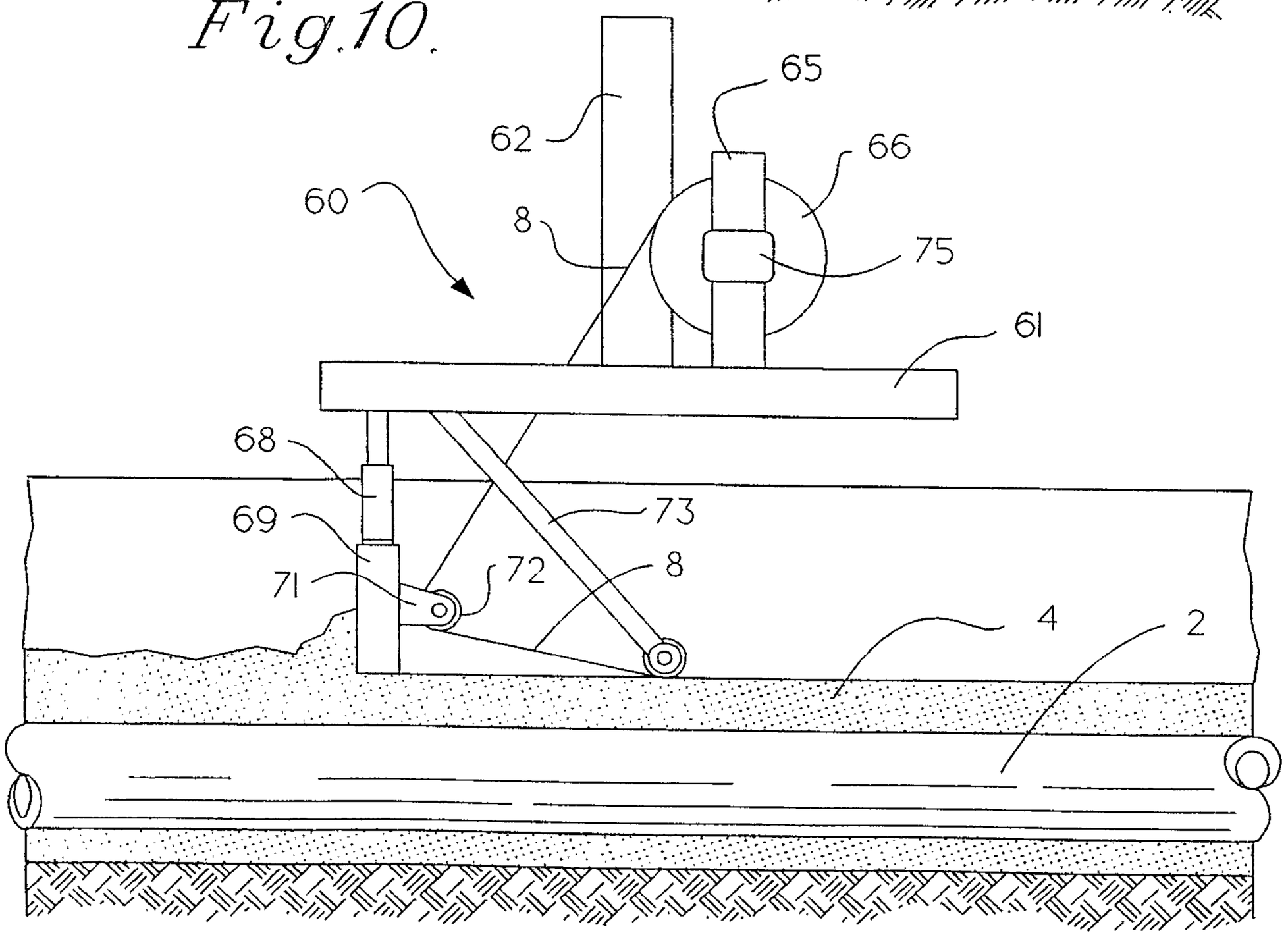
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Fig.11.

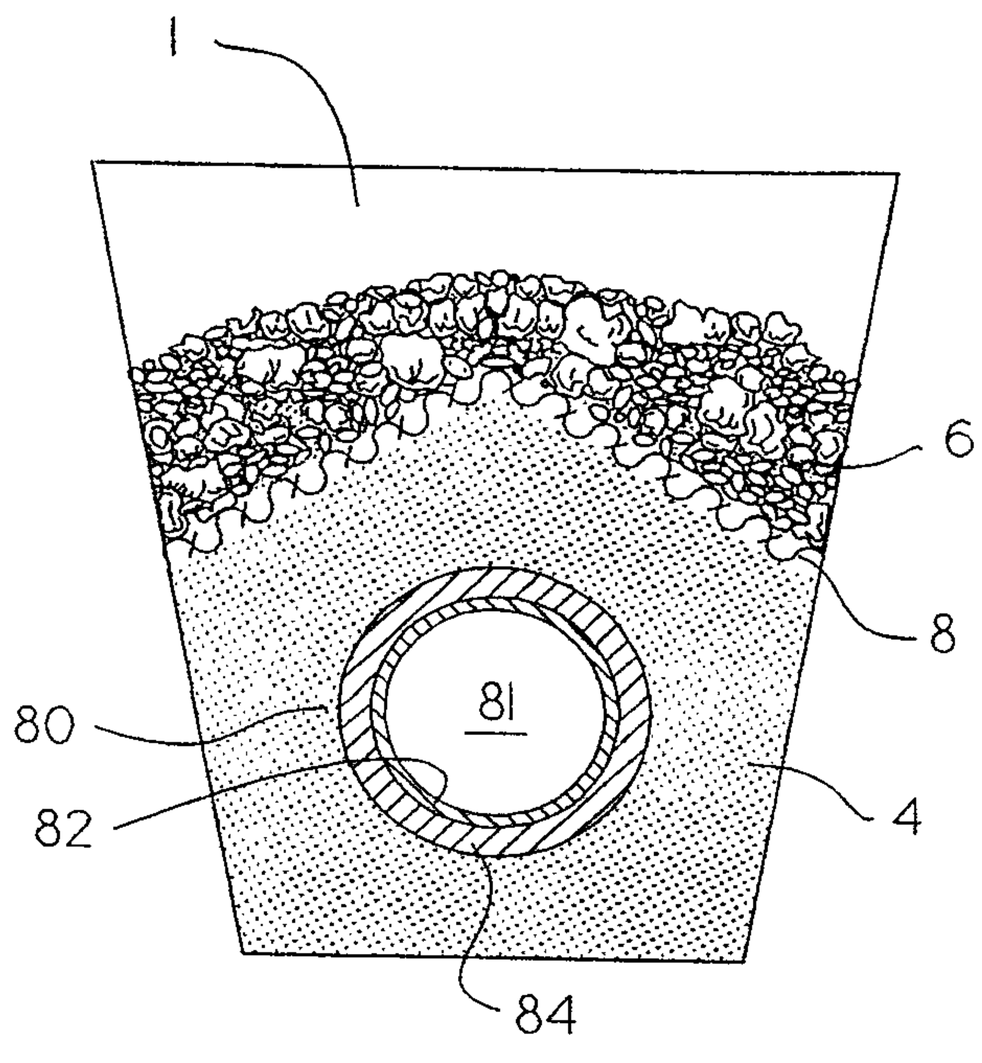
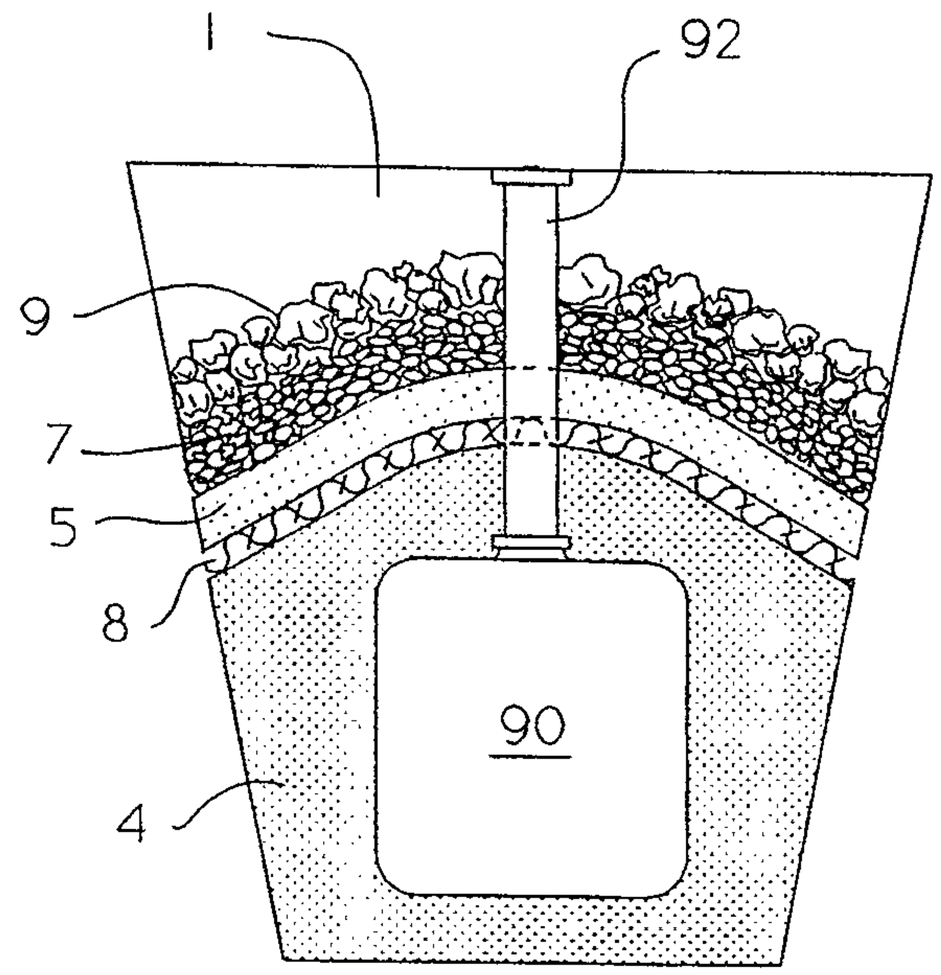


Fig.12.



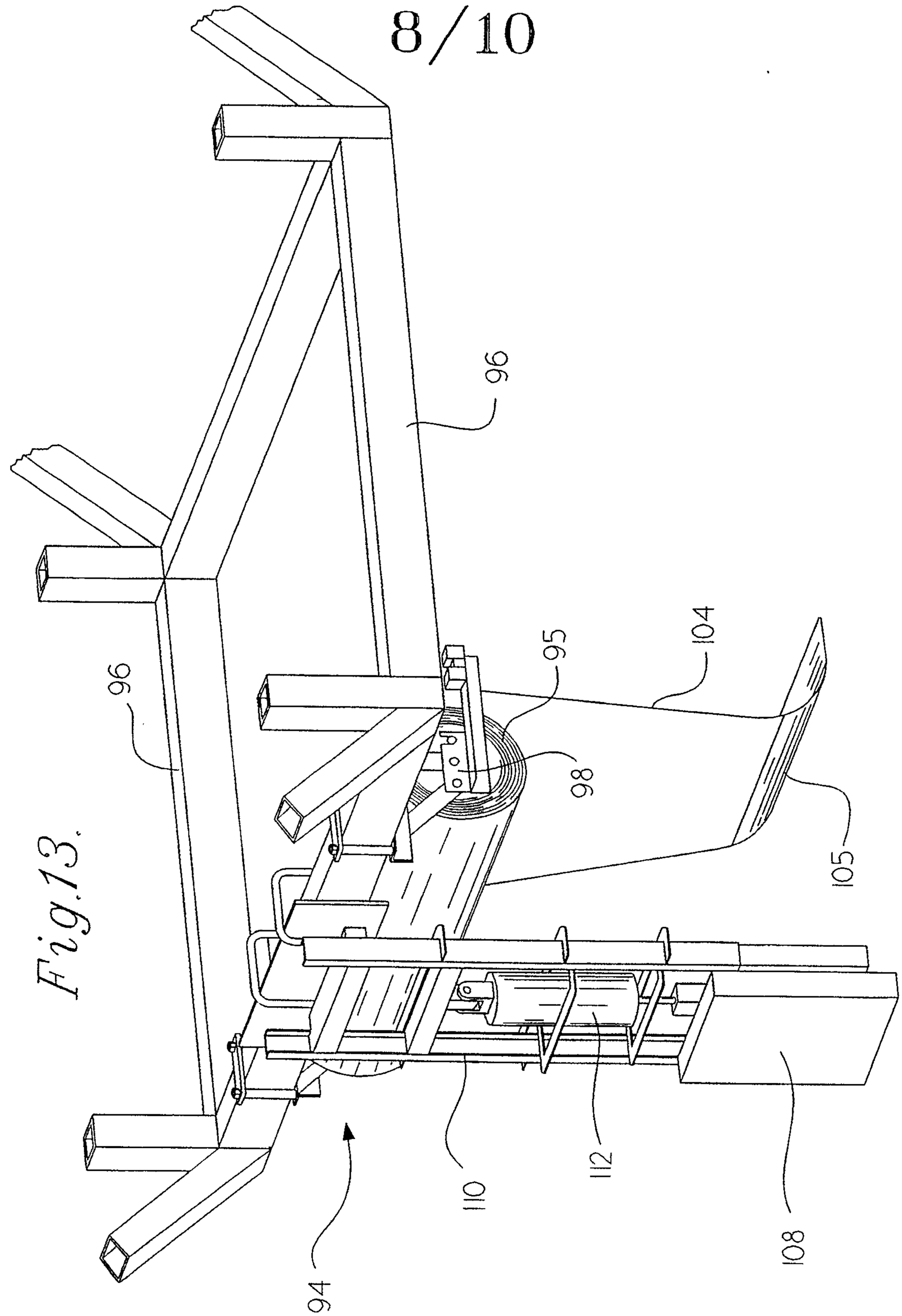


Fig.13.

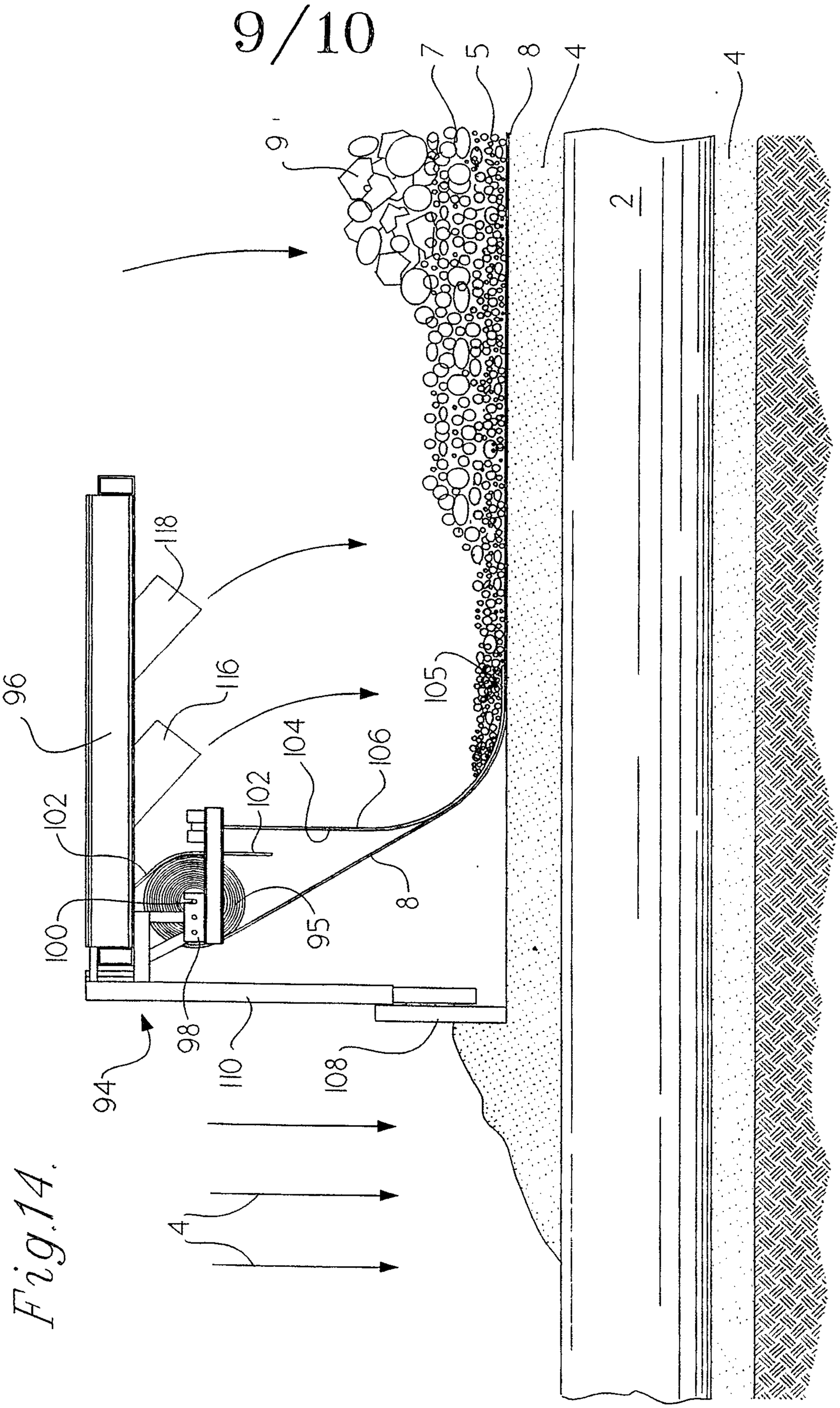


Fig.14.

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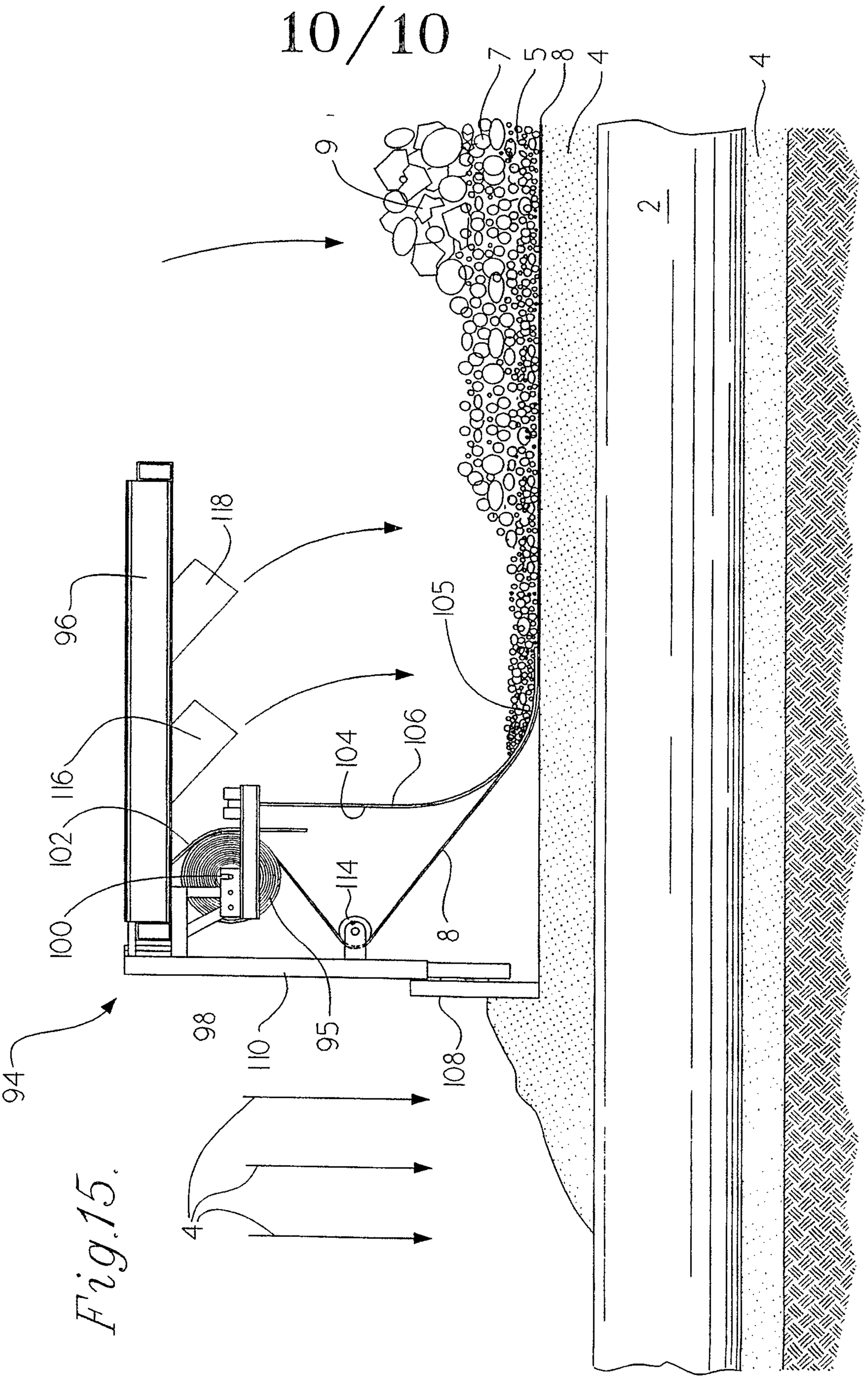
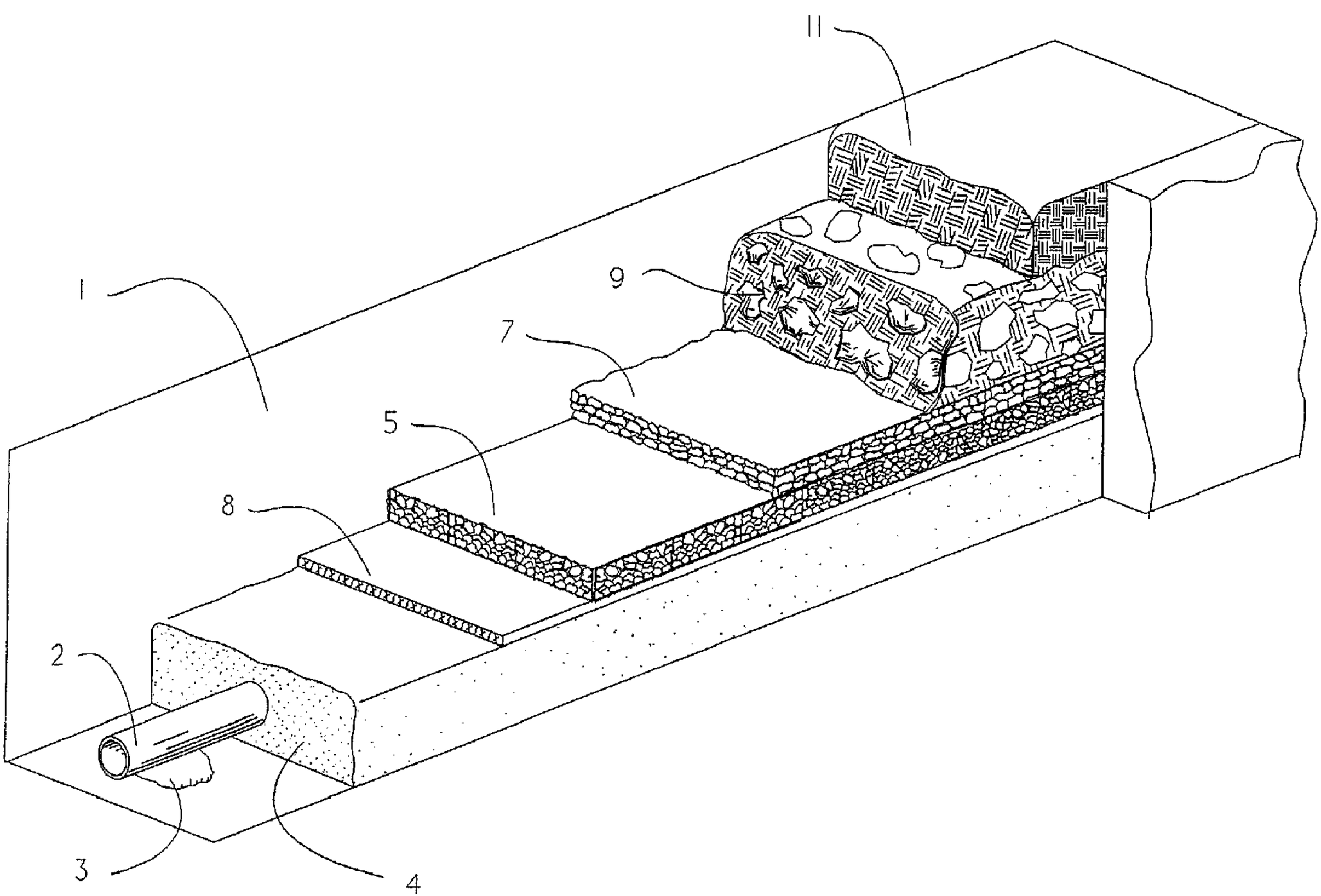


Fig.15.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