

March 2, 1971

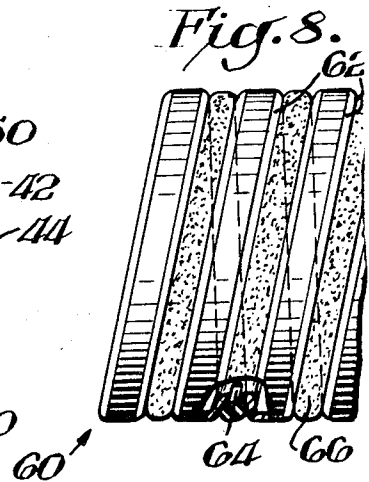
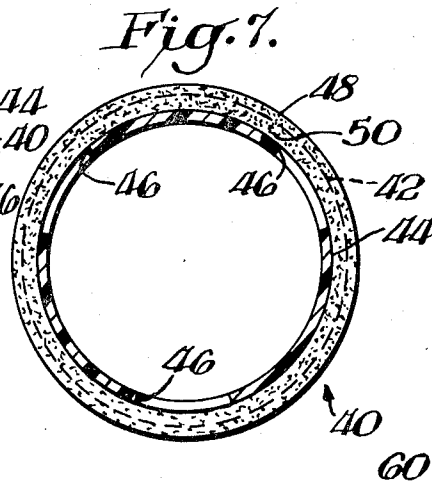
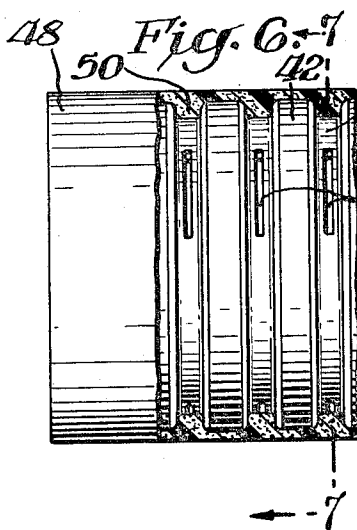
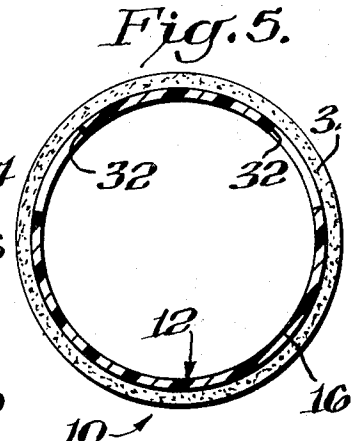
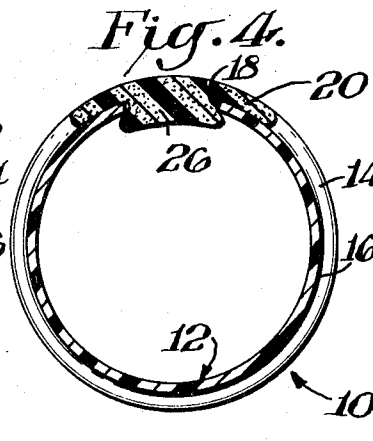
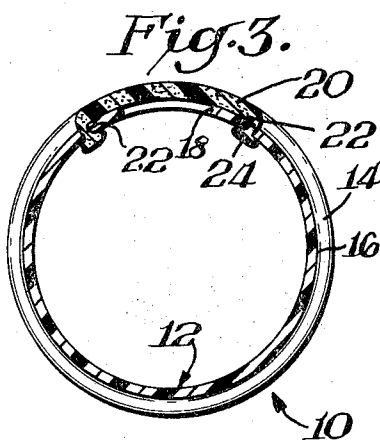
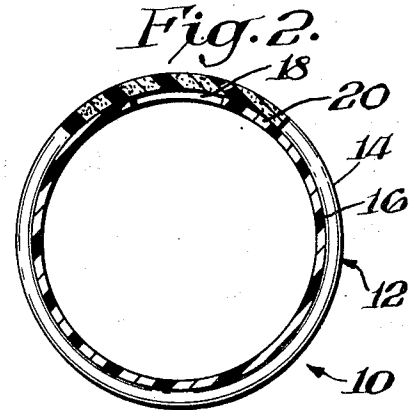
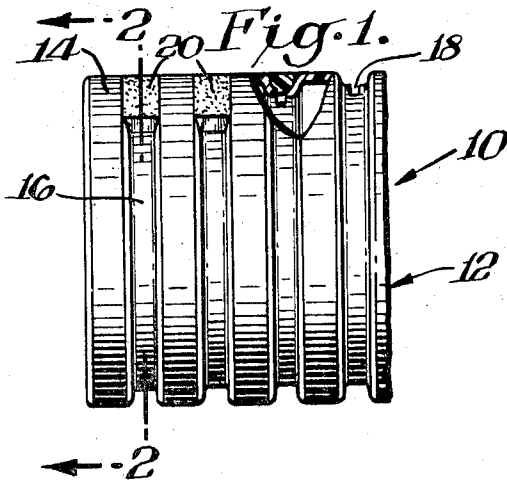
M. E. SIXT

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CORRUGATED DRAINAGE TUBES

Filed Feb. 14, 1968

2 Sheets-Sheet 1



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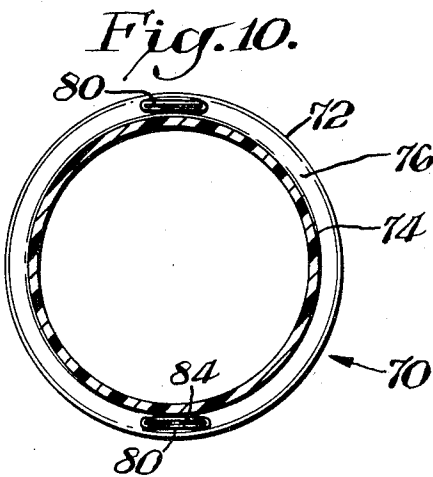
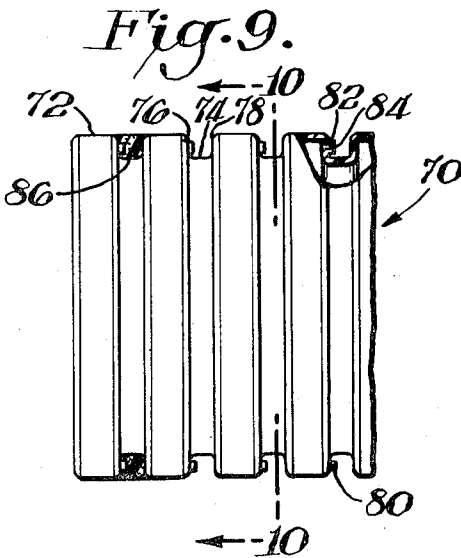
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CORRUGATED DRAINAGE TUBES

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## CORRUGATED DRAINAGE TUBES

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Continuation-in-part of application Ser. No. 663,051, Aug. 24, 1967. This application Feb. 14, 1968, Ser. No. 705,482

Int. Cl. E02b 11/00; F16l 11/12

U.S. Cl. 61—11

2 Claims

### ABSTRACT OF THE DISCLOSURE

A flexible corrugated drainage tube having alternating annular peaks and valleys and a plurality of openings arranged transversely to the longitudinal axis of the tube. Filter media covers the slotted openings so that liquid draining through the openings into the interior of the tube initially passes through the filter media.

### CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 663,051, filed Aug. 24, 1967 and now abandoned.

### BACKGROUND OF THE INVENTION

The present invention relates to drainage tubes, and more particularly to flexible corrugated drainage tubes that filter incoming liquids.

In the past, land improvement through subsurface drainage systems was an expensive and time-consuming operation. The red clay tile commonly used for this purpose required the manual piecing together of relatively short lengths to construct the desired system. Misalignment of the tile pieces was and still is, a constant problem and extreme care is required when the drainage systems of tiles is covered with earth in order to avoid breakage of the tile material. Often, in soils having a high silt or colloidal count the subsurface drainage networks become clogged thereby rendering them unsuitable for their intended purpose. Hence, the industry has long sought a drainage system which avoids the above noted disadvantages.

Accordingly, it is an object of the present invention to provide simple, inexpensive and easy-to-install drainage tubes for use in constructing subsurface drainage networks that function in a highly beneficial and trouble-free manner.

### SUMMARY OF THE INVENTION

In accordance with the present invention, a flexible corrugated drainage tube having alternating annular peaks and valleys is provided with a plurality of slotted openings arranged transversely to the longitudinal axis of the tube. Filter material covers the slotted openings so that liquid draining through the openings into the interior of the tube initially passes through the filter material.

The slotted openings may be arranged in selected annular valleys of the tube with the filter material disposed in the selected annular valleys. Moreover, the filter material can be secured to the drainage tube by adhesive or by positioning a portion of the filter material through the slotted opening it covers into the interior of the tube. Alternatively, apertures may be provided adjacent the ends of each slotted opening and portions of the filter material covering that opening forced through the apertures into the interior of the tube to anchor the filter material.

The filter material may comprise a plurality of narrow strips, one strip for each selected annular valley. Each strip fills the annular valley in which it is located and completely surrounds the drainage tube. Moreover, the filter material can take the form of a unitary sheath that

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completely envelopes the drainage tube with portions of the sheath extending into the annular valleys of the tube in which the slotted openings are located.

Another type of drainage tube has a spiral corrugation with slotted openings in the corrugation. An endless elongate strip of filter material is disposed in the spiral corrugation so that liquid draining into the tube through the slotted openings initially passes through the filter material.

### BRIEF DESCRIPTION OF THE DRAWING

Novel features and advantages of the present invention in addition to those mentioned above will become apparent to one skilled in the art from a reading of the following detailed description in conjunction with the accompanying drawing wherein similar reference characters refer to similar parts and in which:

FIG. 1 is a side elevational view of a corrugated drainage tube according to the present invention with portions broken away to show detail;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a sectional view similar to FIG. 2 illustrating another embodiment of the present invention;

FIG. 4 is a sectional view similar to FIG. 2 illustrating another embodiment of the invention;

FIG. 5 is a sectional view similar to FIG. 2 illustrating still another embodiment of the present invention with the filter material shown in elevation;

FIG. 6 is a side elevational view of another corrugated drainage tube according to the present invention with portions broken away to show detail;

FIG. 7 is a sectional view taken along line 7—7 of FIG. 6 with the filter material shown in elevation;

FIG. 8 is a side elevational view of still another corrugated drainage tube according to the present invention with portions broken away to show detail;

FIG. 9 is a side elevational view of another corrugated drainage tube according to the present invention with portions broken away to show detail; and

FIG. 10 is a sectional view taken along line 10—10 of FIG. 9.

### DETAILED DESCRIPTION OF THE INVENTION

Referring in more particularity to the drawing, FIG. 1 illustrates a portion of a flexible corrugated drainage tube 10. In use, a plurality of drainage tubes, such as 10, are interconnected with proper fittings and connectors to construct a subsurface drainage network or system. For the most part, the drainage system usually comprises a series of main lines as well as a plurality of lateral lines or branches that empty into the mains. The length of the drainage tubes is only limited by the convenience in handling and shipping them. The drainage system is arranged below the surface of a field for example by digging slit trenches and then positioning the drainage tubes in the trenches. Finally, earth is filled in around the tubes to complete the installation of the subsurface drainage system.

Corrugated drainage tubes, such as 10, are preferably fabricated of durable, high-strength polyethylene although other materials are suitable. Extruding techniques may be employed to initially shape the tubing by forcing molten plastic material through an annular orifice, as is well known. The corrugations are formed by a reshaping operation.

The corrugated drainage tube 10 comprises a body portion 12 having a series of alternating annular peaks 14 and valleys 16. Selected annular valleys are provided with drainage slots or openings 18 arranged transversely to the longitudinal axis of the tube so that liquid can pass into the tube and drain away into a main, irrigation ditch,

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or waterway, for example. As shown in FIGS. 1 and 2, a drainage slot 18 is provided in every annular valley 16 of the corrugated drainage tube 10. The width of the slots is about  $\frac{1}{16}$  of an inch and the length is such that the combined open area provided by all of the slots in the tube is preferably between about one-half and one percent of the longitudinal surface area of the tube. This percentage of slotted open area to the longitudinal surface area of the tube functions exceptionally well to provide proper drainage when installed. The slotted openings 18 provide the necessary fluid inlet area without sacrificing tube strength. Compared to perforations the slots are few in number, however, the width is such that heavy soils do not enter into the tube during the draining operation.

Other slotted opening arrangements can also be utilized to provide the necessary fluid inlet area. Although a longitudinal path of slotted openings is shown in FIG. 1 with one slotted opening in each annular valley, the slotted openings can be arranged three in every fourth annular valley or two in every other annular valley. Numerous combinations are available within the scope of the present invention.

As shown in FIGS. 1 and 2, filter material 20 covers the slotted openings 18. For purposes of illustration, one of the annular valleys of the tube illustrated in FIG. 1 is not covered by filter material, it being understood that in the finished product filter material is disposed over the slotted opening in that valley. Each element of filter material 20 is preferably preformed and has a length somewhat longer than the length of the slotted opening it covers. The width of each filter element is approximately the same as the distance between adjacent peak portions 14 of the drainage tube 10.

Ester type polyurethane foam is a highly satisfactory filter material for use in fabricating tubing according to the present invention. Unlike ordinary urethane foams which are composed of strands connected by thin membrane-like windows, the ester type polyurethane foam, of the type produced by Scott Paper Company, for example, has a three dimensional structure of skeletal strands alone which gives this foam unique filtering characteristics. Other filter materials are also suitable in conjunction with the corrugated drainage tubing of the present invention. Fiber glass and other synthetic fibers can be secured to the drainage tube 10 over the slotted openings 18 to provide the filter construction.

In FIG. 1, the individual strips of filter material are fabricated from open-celled polyurethane foam. Each strip of filter material is preformed to a desired shape and is anchored by adhesive in one of the annular valleys over the slotted opening. The adhesive is preferably applied to opposite sides of the filter strip so that the securing takes place between the side walls defining the annular valleys rather than at the bottom of the valleys where the slotted openings are located. By utilizing this expedient, the adhesive material does not contact the tube in the vicinity of the slotted openings thereby preventing inadvertent clogging of the openings through a buildup of adhesive at the openings. Alternatively, the filter material can be manufactured or foamed in place on the tubing after the slots are made.

FIG. 3 illustrates another embodiment of the present invention wherein the slotted openings in a corrugated drainage tube are covered with filter material by mechanically anchoring the material directly over the slotted openings. In this regard, the corrugated drainage tube includes apertures 22, one located at each end of each slotted opening. The end portions of each filter strip are compressed slightly and stuffed through the apertures 22 so that a portion 24 at each end of the filter strip is located inside the drainage tube. Once this portion clears the aperture it springs back to its original shape whereby the filter strip is positively secured to the tube in covering relationship over the slotted opening. Alternatively, the

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apertures 22 may be produced at the same time the filter material is forced therethrough.

FIG. 4 is a cross-sectional view similar to FIGS. 2 and 3, illustrating another method for securing the filter material 20 to the corrugated drainage tube 10. In this instance, the central portion 26 of each filter strip is stuffed through the slotted opening over which it is disposed. As in the case of the embodiment of the invention shown in FIG. 3, once the central portion 26 of the filter material 20 clears the slotted opening 18 it springs back to its original shape which is considerably larger than the width of slotted opening it covers. This particular orientation of filter material and tubing provides a satisfactory arrangement for securing the filter to the tubing over each slotted opening.

Another form of the present invention is shown in FIG. 5 wherein selected annular valleys of a corrugated drainage tube 30 are provided with a pair of slotted openings 32. Filter material 34 in the form of a narrow elongate strip completely surrounds each annular valley in which the slotted openings are located to thereby cover the slotted openings. Hence, liquid draining into the interior of the tube initially passes through the filter material 34. Each strip of filter material may be annular in configuration and simply snapped in place around the tube, or it can be a double ended piece in which case the ends are simply secured together by adhesive after it is positioned in one of the selected annular valleys.

FIGS. 6 and 7 illustrate another embodiment of the present invention wherein a flexible corrugated drainage tube 40 has alternating annular peaks 42 and valleys 44. Each of the valleys include three equally spaced apart slotted openings 46. Filter material 48 in the form of a unitary sheath completely envelopes the corrugated drainage tube 40 thereby covering the slotted openings 46 so that liquid draining through the openings into the interior of the tube initially passes through the filter material. Portions 50 of the filter material 48 extend into the annular valleys 44 so that for a given exterior dimension of the filter sheath a maximum amount of filter material is disposed in the path of the incoming liquid.

FIG. 8 illustrates a drainage tube 60 having a spiral corrugation 62 with spaced apart slotted openings 64 in the corrugation. An endless elongate strip of filter material 66 is disposed in the spiral corrugation in covering relationship over the slotted openings. A machine similar to a toroidal core winder or tire wrapping machine can be utilized to wind or wrap the filter material around the tube. In operation, liquid draining through the slotted openings into the interior of the tube initially passes through the filter material 66.

FIGS. 9 and 10 illustrate another embodiment of the present invention comprising a flexible corrugated drainage tube 70 having alternating annular peaks 72 and valleys 74. The valleys are defined in part by annular side walls 76, 78 which serve to interconnect adjacent peaks and valleys of the tube. As shown in FIG. 9, one of the side walls of each valley includes a pair of bulging portions 80 which extend into the valley. The tip or end 82 of each bulge 80 is open to provide a slotted opening 84. The bulging portions 80 are integral with the tube, and the tube with its bulging portions can be produced by extrusion and suction molding techniques, for example. A downstream cutting operation may be used to sever the closed tip of each bulging portion to thereby provide the slotted openings 84. Alternatively, the molding equipment utilized to manufacture the tube can be provided with suitable retractable cores so the ends of the bulging portions are open thereby eliminating the downstream severing operation.

The bulging portions 84 can be located, one or two on each side wall 76, 78 or any other desired combination. Moreover, the slotted openings 84 can be dimensioned to provide the desired inlet open area.

Filter material 86 of the types described above covers the slotted openings 84 to filter incoming liquids. Al-

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though the filter material can be anchored in place by utilizing the above described expedients, it is preferably secured in place by simply stuffing it into the annular valleys in the vicinity of the slotted openings 84. The bulging portions 80 function to hold the filter material in place by compressing the central portion of the filter opposite the bulges.

Once the tubing of the present invention is installed below the surface of a field, for example, the filter material functions as an ordinary filter, and additionally, as a surge mitigator. Thus, the filter material reduced the velocity of the incoming water so that a significant portion of the colloidal particles in the water precipitate out naturally. A layer of natural filter then begins to buildup around the tubing to thereby progressively produce a more effective filter or surge mitigator.

What is claimed is:

1. A flexible corrugated drainage tube having alternating flat annular peaks and flat annular valleys with walls interconnecting the flat peaks and valleys, a plurality of slotted openings in the tube for providing communication between the interior and exterior of the tube so that liquid can drain through the slotted openings into the interior of the tube, and filter material completely occupying the open space defined by the flat peaks and valleys and the interconnecting walls in the area of the slotted openings whereby liquid draining through the slotted openings into the interior of the tube initially passes through the filter material, and apertures in the tube adjacent the ends of each slotted opening, portions of the filter material extending through the apertures into the interior of the tube to secure the filter material to the tube.

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2. A flexible corrugated drainage tube having alternating flat annular peaks and flat annular valleys with walls interconnecting the flat peaks and valleys, a plurality of slotted openings in the tube for providing communication between the interior and exterior of the tube so that liquid can drain through the slotted openings into the interior of the tube, and filter material completely occupying the open space defined by the flat peaks and valleys and the interconnecting walls in the area of the slotted openings whereby liquid draining through the slotted openings into the interior of the tube initially passes through the filter material, and wherein outwardly bulging portions are provided in the interconnecting walls and the slotted openings are located in the outwardly bulging portions.

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