

Nov. 23, 1965

H. L. CRUMPLER

3,219,368

DRAINAGE LINE IMPROVEMENTS

Filed May 29, 1962

3 Sheets-Sheet 1

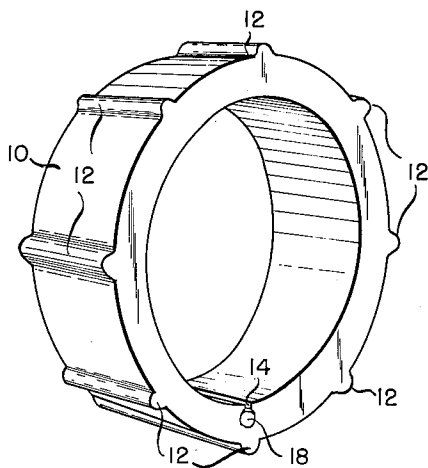


Fig. 1

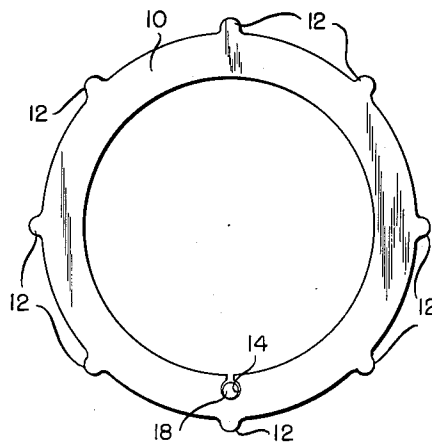


Fig. 2

Fig. 3

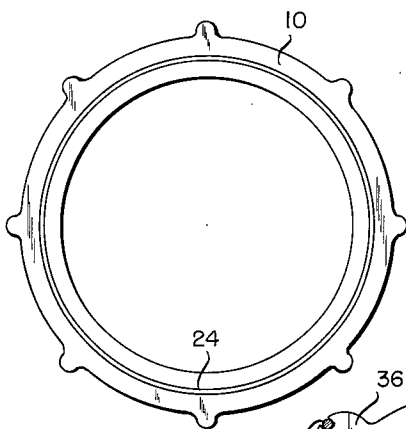


Fig. 4

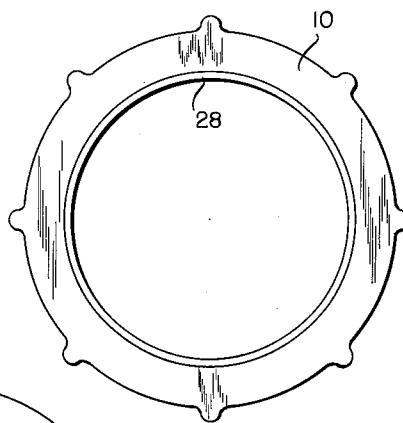
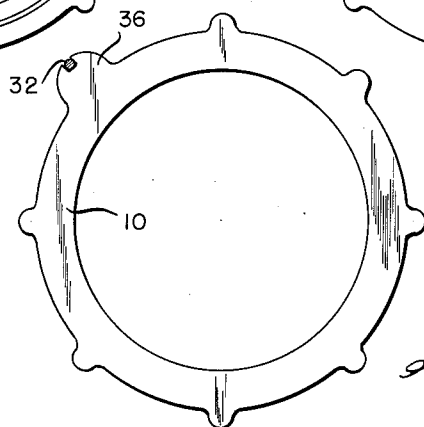


Fig. 5



INVENTOR
Houston L. Crumpler

Strauch, Nolan & Moore
ATTORNEYS

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H. L. CRUMPLER

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3 Sheets-Sheet 2

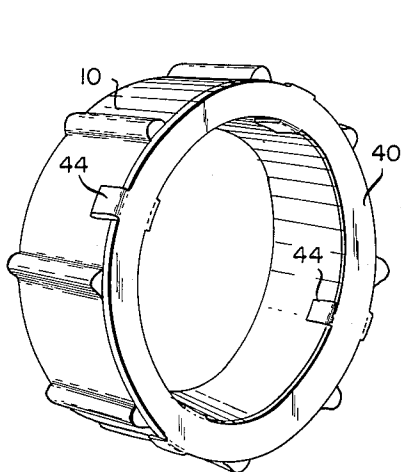


Fig. 6

Fig. 6

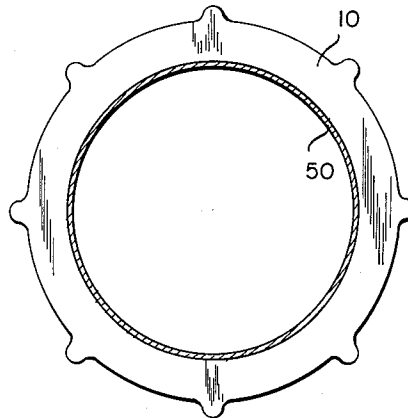


Fig. 7

Fig. 7

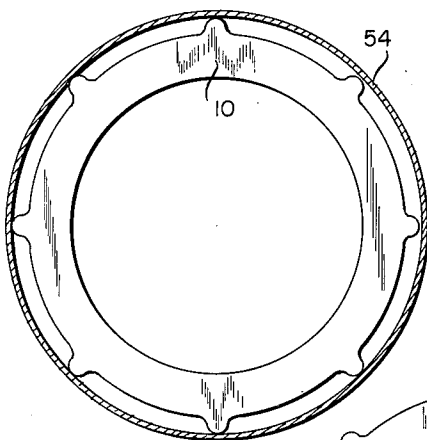


Fig. 8

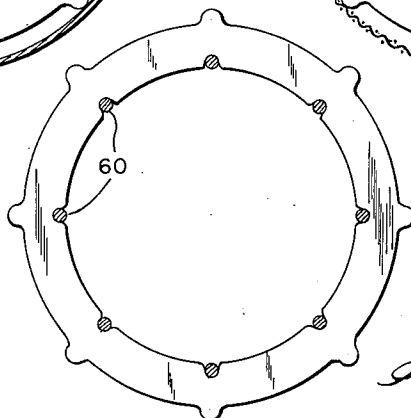
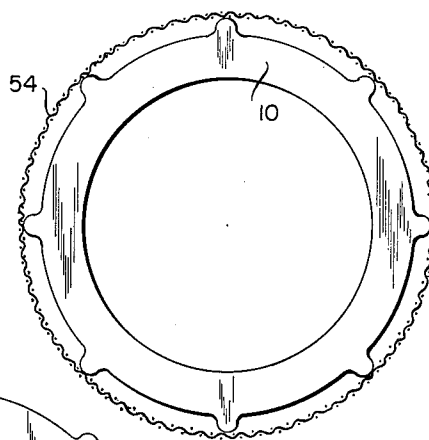


Fig. 10

INVENTOR
Houston L. Crumpler

Stauch, Nelson & Moore
ATTORNEYS

Nov. 23, 1965

H. L. CRUMPLER

3,219,368

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3 Sheets-Sheet 3

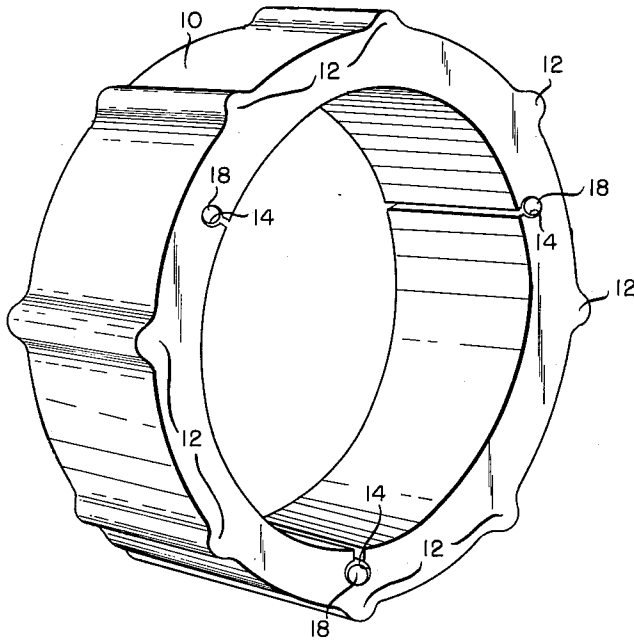


Fig. 11

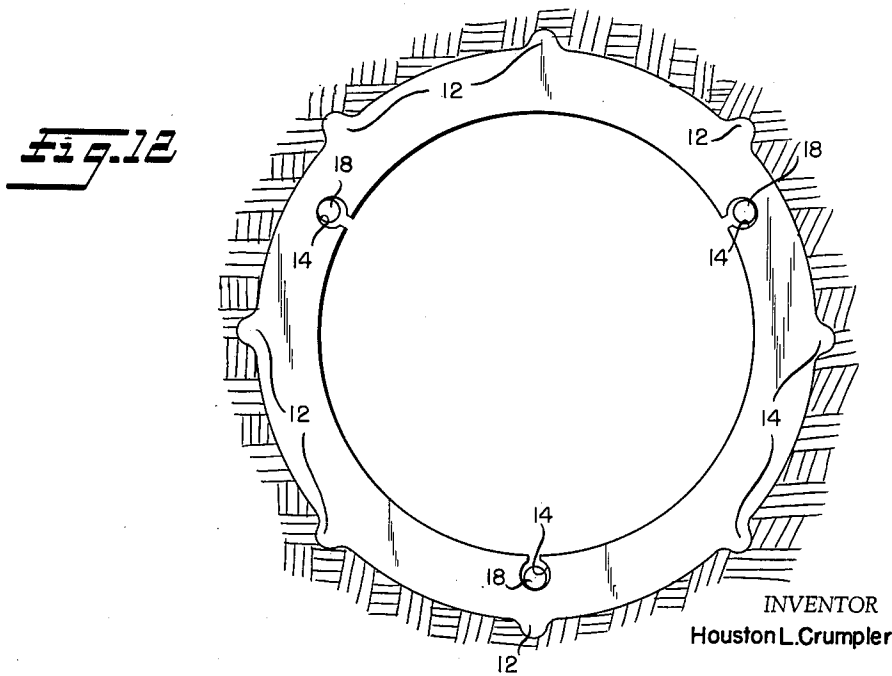


Fig. 12

INVENTOR
Houston L. Crumpler

Harold Nolan & Hale
ATTORNEYS

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DRAINAGE LINE IMPROVEMENTS

Houston L. Crumpler, P.O. Box 68, Roseboro, N.C.

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2 Claims. (Cl. 285—285)

This application is a continuation-in-part of my now abandoned application Serial No. 170,943, filed February 5, 1962, and entitled "Root Growth Inhibiting Drain Tile."

This invention relates to improvements in underground lines adapted to convey liquid materials and more particularly to improvements in drain lines and drain tile from which such lines are constructed, and to a related method of maintaining or improving the condition of soil adjacent such lines and for maintaining the line free from obstructions tending to block or clog the line and prevent free flow therethrough.

I have discovered that the improved drain tile disclosed in my above-identified copending application is capable of preventing foreign materials from clogging or otherwise tending to prevent relatively free flow of fluids therein and that such improved tile is particularly suited for construction of drainage or sewage lines, as for example, those extending from septic-tanks and the like. It was originally thought that the improvement in maintain lines free from clogging was primarily due to the ability of my improved tile to prevent the growth of roots therein; however it has been recently discovered that the greatest beneficial results achieved by my improved tile actually reside in maintaining or improving the percolation and/or infiltration capabilities of the surrounding soil and maintaining the line free from undesirable iron compounds produced by the action of aerobic and anaerobic bacteria on iron. The problem of ingrowing roots is substantially completely averted by my invention, but such problem has been found to be localized in certain areas of the country, whereas soil clogging is of such major widespread difficulty that septic-tank line designs and maintenance are, in many cases, directed to coping with this problem in the first instance and to efficient disposal of effluent secondly.

It is now known that the most common failure of septic-tank lines carrying sewage effluent is due primarily to clogging of the surrounding soil which eventually should receive and percolate or infiltrate the effluent. Such failure is frequently evidenced in septic-tank percolation systems by the rise of effluent to the surface of the earth. It is believed that failure of the soil to handle the effluent is due to a clogging of the soil pores by filtration of solids suspended in the effluent, aerobic bacteria in the effluent, and iron sulfide produced by the action of anaerobic bacteria on the waste from the septic-tank. Also, in certain areas arerobic bacteria will form a gellatinous precipitate with iron which will collect and clog the line. Soil clogging generally takes place, at least initially, at the bottom of the trench directly below the tile. A detailed study of the problems involved in sewage lines has been made under the auspices of the Federal Housing Administration by the Sanitary Engineering Research Laboratory of the University of California and is reported in "Biological Aspects of Failure of Septic-Tank Percolation Systems Final Report," written by John H. Winneberger et al. and dated August 31, 1960. Reference is hereby made to this report for a detailed analysis of the problem here involved.

According to the above-referred to septic-tank article, ferrous sulfide is the product of anaerobic environment in which there is a considerable need for elements or compounds capable of accepting electrons. Micro-organisms present in the effluent use iron and sulphur as electron acceptors and the waste ferrous iron and sulfide sulphur react spontaneously to form ferrous sulfide. The source of

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iron and sulphur in sewage is primarily vegetable waste from garbage grinders and human excreta. When sewage is applied to a soil, initial clogging is a result of filtration of suspended solids. Soon, however, micro-biological activity becomes a major factor and under anaerobic conditions, a soil clogged with organic solids and biological growth soon becomes further clogged with the relatively insoluble ferrous sulfide. The latter is precipitated from solution to depths well beyond the organically clogged zone and is most probably the principal cause of the ultimate clogging of a soil receiving sewage effluents. The ferrous sulfide has a widespread occurrence throughout this country in septic-tank systems where anaerobic environment exists such as in digester sludge and supernatant, and has a distinct tendency to form in cracks, crevices and other points of irregularity of stone particles. It is believed that the aerobic bacteria also causes considerable difficulty in that it forms a flocculent, gellatinous precipitate with iron present in sewage effluent and tends to clog the line itself by an accumulation of this precipitate. The problem with aerobic bacteria has been encountered in Florida for example, and is compounded by the sandy soil seeping into the line supplying additional iron and joining with the gellatinous precipitate to obstruct flow.

Another problem frequently arising in drainage lines is the retardation of liquid flow therethrough due to the line becoming infested with root growth. After a drainage line, sewer line or the like has been in service only a few years, it frequently must be cleaned out or dug up and replaced due to clogging by ingrowing roots which are naturally attracted to liquids flowing in the line. This is costly and sometimes extremely inconvenient when lawns must be damaged and trees or shrubs removed or tilled during line repair or replacement.

Briefly the present invention has the advantage of substantially eliminating the problems mentioned in the foregoing paragraphs by providing an underground fluid conduit section or unit such as a drain tile or sewer pipe unit which reduces or may entirely prevent formation of ferrous sulfide and also prevent the growth of plant roots into the line constructed from such units. This is achieved, in accordance with the preferred embodiment of this invention, by securing a suitable material capable of reacting with the liquid carried by the line to form a substance which will act to prevent root growth and the accumulation of bacteria precipitated iron compounds. Such material is preferably located in a longitudinal groove along the bottom of the drain line unit where it will be contacted by liquid traveling in the line in an area where root incursion is most likely to occur, and in an area which, from its seepage from a non-watertight line into the surrounding soil, is facilitated.

Another important advantage is that the crushed stone bed needed for septic-tank lines prior to this invention, may be eliminated without any substantial loss in efficiency or service time. This constitutes a considerable economic saving.

Accordingly, it is a primary object of this invention to provide a tubular unit for constructing a fluid conduit which will retard formation of undesirable iron compounds tending to clog the conduit or surrounding soil. It is also a primary object to provide such a tubular unit which will also prevent growth of roots in a drainage line whereby a drainage line, particularly a non-watertight line constructed from such units, will have a prolonged service life. More specifically, it is an object of this invention to incorporate a material such as copper in a tubular unit for constructing a fluid conduit, which material will prevent or retard clogging of the system by reducing the effects of iron compounds and roots tending to develop in the conduit.

Another object of this invention is to incorporate a root inhibitor material into a drainage unit in a novel manner to act as, or form, a root inhibiting substance.

A further object of this invention is to provide a drainage line unit containing a specific material adapted to react with the liquid being conducted by the drainage line to form a substance which will seep into and condition, the surrounding soil to improve its percolation and/or infiltration properties.

Still another object of this invention is to provide a novel method of conditioning the soil surrounding a drainage line and to prevent or reduce clogging of said line.

Other objects and advantages of the present invention will become apparent to those skilled in the art from the appended claims and following description taken in connection with the accompanying drawings wherein:

FIGURE 1 is a perspective view of a fluid conduit unit embodying the preferred embodiment of the present invention;

FIGURE 2 is an end view of the fluid conduit illustrated in FIGURE 1;

FIGURES 3, 4, 5, 7, 8, 9 and 10 are end views similar to FIGURE 2 of fluid conduit unit similar to that shown in FIGURE 1, but each illustrating a different embodiment of the present invention as will be described hereafter; and

FIGURE 6 is a perspective view of a drainage unit similar to the view shown in FIGURE 1, but illustrating another embodiment of the present invention.

FIGURES 11 and 12 illustrate still another embodiment particularly suited for use in fine grain soil areas, but also having general applicability.

A preferred embodiment of this invention is illustrated in FIGURES 1 and 2 in a fluid conduit unit 10 of any desirable length, and which, when connected end-to-end in an abutting relation with a plurality of other similarly shaped members, constitutes a fluid flow conduit normally used in conducting drainage, sewage, and the like in the well-known manner, especially in septic-tank percolation systems.

Longitudinal ribs 12 are conventional elements which prevent rolling and may add additional strength. A longitudinal recess 14 is provided along the interior wall of unit 10 to receive an element 18 which in its preferred form, is a relatively pure copper wire (purity of over 90 percent being preferred). Recess 14 is formed such that element 18 may be quickly and easily introduced into one end thereof and shoved into place. The longitudinal opening into the interior of the annular wall of unit 10, at the top thereof, is of a lesser width than said wire to thereby insure its retention in place during service and transportation prior to service.

In the field, it would be very difficult and expensive to thread one or more copper wires to a new line being laid due to the necessary modifications to large drainage line laying machinery for example, and the handling of copper coil or other metallic wire. On the other hand, by inserting the element or wire directly into the unit at the place of manufacture, no modification in existing line laying techniques is required.

Optimum results are achieved by placing element 18 in the bottom of the conduit where liquids tend to collect and are therefore present during most of the service time of the conduit, and where roots will normally attempt to enter the line in preference to other locations. As shown in FIGURES 1 and 2, the copper will react with the liquid in the line and produce a bacteria toxic and root inhibiting reaction product which will initially collect in recess 14 and be channeled to a break in the conduit, as in a joint or crack which roots tend to infiltrate, and through which the substance may seep into contact with the surrounding soil along with the effluent.

Where fine grain soil is encountered which may seep through the joints of the line between adjacent units 10 and could possibly bury a single element 18 on the bot-

tom, three elements 18 are preferred as shown in FIGURES 11 and 12 so that at least one will always be contacted by liquid flowing in the line.

Instead of elemental copper, other materials may be used. Such materials are for example, copper oxide, sulfide, sulfate, and/or carbonate. It is believed that a bacteria toxic and root inhibiting reaction product is also formed when such other materials contact dilute acidic or basic aqueous solutions, especially those commonly found in septic-tank lines. Other materials which react with such solutions to form root inhibiting substances, and may also reduce the undesirable effects of bacteria action on iron in the line, but which are less desirable than copper from an economic standpoint, or have shorter or less satisfactory service life, are materials such as molybdenum, vanadium, magnesium, manganese, uranium, mercury, silver, tin, zinc, or lead, used either alone or in combination with each other or with copper.

It is not certain how the formation of ferrous sulfide is prevented or retarded. However, it is believed that the copper reacts with the effluent, particularly the acids contained therein the copper sufficiently to produce a substance which may be for example, an oxide, sulfide, sulfate, or carbonate, which has a sufficiently deleterious effect on the bacteria to prevent reduction of iron and sulfur in the formation of ferrous sulfide.

To those skilled in this art, the manufacturer of ceramic drain tile or sewer pipe is commonplace. Basically it involves the extrusion of a plastic clay or plastic clay and non-plastic grog mixture into the desired cylindrical configuration as that of the drain tile, unit 10 shown in FIGURE 1. The term grog is generally used to mean essentially any clay like material that has been fired to a temperature where its characteristic plasticity is destroyed. Used in structural clay production, it, grog, serves to eliminate lamination, makes drying and firing faster and with less shrinkage.

The geometric configuration shown in FIGURE 1 is typical of ceramic drain tile. Various modifications of this basic geometric configuration currently used in commercial operations depend on the properties of available raw materials, machinery available, customer requirements, intended service requirements, and personal preferences of the manufacturer or customer involved. The green ware (drain pipe or sewer pipe) is dried and subsequently fired on a predetermined firing schedule (heat-work relationship) in order that the fired ware may possess the desired physical properties.

In accordance with this invention, various other modes of applying a soil conditioning and root prohibiting material to drain tile units, are illustrated in the drawings. Since copper is preferred, this material will be used throughout in discussing the exemplary modifications of this invention.

In FIGURE 3, a copper hoop 24 is shown inserted in an annular groove in the end of unit 10.

A copper coil 28 is frictionally held in place in the interior of unit 10 in FIGURE 4.

In FIGURE 5, a copper rod or wire 32 is frictionally (or otherwise) engaged in a longitudinal slot formed in an enlarged re-enforced rib 36.

In FIGURE 6, an annular copper plate 40 having substantially the same configuration as the end of unit 10 is shown attached to the end surface of the drain tile by frictional engagement of tabs 44 on the inner and outer walls thereof. The tabs hold copper plate 40 in place during shipment and drainage line construction. Once the unit 10 is positioned in the drainage line, the plate will be substantially permanently positioned in a joint between the ends of adjacent drainage units, but will be accessible to liquids flowing in the line and any soil liquids present therein. The plate 40 does not seal the joint between the tile units since flow of effluent through such joints is intended for septic-tank lines.

A relatively thin copper tubing is shown and disposed

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about a drainage unit 10 in FIGURES 7, 8 and 9. In FIGURE 7, a thin copper tube 50 of any suitable length is located about the interior wall of unit 10. In FIGURES 8 and 9, tubes 54 are on the exterior of unit 10 and of a solid sheet and mesh respectively.

In FIGURE 10, a plurality of copper rods or wire 60 are shown embedded in the inner wall of unit 10. Here again the copper may be of any suitable length and secured by frictional engagement in slots formed in the ware or otherwise bonded thereto. If desired, the slots may be of the same cross-sectional configuration as recesses 14 in FIGURE 2, or they may be holes formed in the end of the unit thereby rendering the ends of the rods 60 liquid accessible through a joint or crack subsequently formed in the ware.

In a further embodiment of this invention, the non-plastic grog material, used for example in the manufacture of ceramic sewer pipe and/or drain tile, may be replaced with a non-plastic inorganic soil conditioning substance such as copper, copper oxide, copper carbonate, copper sulfides and sulfates, ores, or minerals containing copper as a significant ingredient.

Incorporation of these materials in the ware in this manner permits production of ready use root resistant, soil conditioning ceramic drain tile or sewer pipe. Although the latter are normally fired in an oxidizing atmosphere, an inorganic root repelling and clog preventing material such as copper or a derivative retains its ability to function as desired in accordance with this invention when contacted with a non-neutral solution in the flow line. This is true even though on firing, oxidation of the clog preventer will convert it to an inorganic oxide such as cupric oxide, cuprous oxide, or stannic oxide, for example.

Whether the clog preventer is an integral part of the ceramic ware formulation, in the form of a copper-containing a grog or applied in a aint solution, and whether fired along with the clay ware to form the finished product or attached to the drainage unit after firing is largely a matter of economics and a particular manufacturing procedure involved. However, if such material is organic, examples of suitable ones being dinitrophenol and 2,4-dinitrocresol, firing the same will destroy their desired root growth prohibiting ability. Therefore, application of such organic material to the ware is best carried out by making a solution thereof and painting the fired ware surfaces.

A copper glaze may also be applied to ware to produce the soil conditioning results. In normal practice in firing, glazing is carried out by shovelling salt into the kiln and closing it off near or at the end of the firing phase. Intense heat of short duration is produced in a thin surface layer of ware melts sufficiently to form a glaze coating. Copper mixed with the salt shovelled into the kiln will produce a copper laden glaze finish. Copper thus held is not quickly removed from finished product but it is sufficiently available to react with the soil acids and solutions carried by a drainage line to effect soil conditioning.

A suitable inorganic paint is a mixture containing finely divided particles of copper or copper compounds such as oxide, sulfides and sulfates with a suitable carrier material. The term "paint" is used herein to mean a mixture with or without pigment, with some suitable liquid to form an adherent covering when spread on a surface in a thin coat for protection purposes. The drain tile or sewer pipe unit is sprayed, brushed or dipped with

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the copper paint to coat either the inside, outside or both surfaces of the units in question, and the paint is subsequently allowed to dry before placing the drainage unit in service. By the employment of the paint concept both organic and inorganic materials can be successfully attached or applied to a draining unit. Normally a paint may be applied to the fired ware at any time before installing such a unit as a part of a drainage system. However, in the case of concrete and ceramic drainage units (drain tile and sewer pipe) the paint may be used in lieu of partially replacing the water content of the formulation mixture.

From the foregoing it is apparent that the attachment of the clog preventing material to the ware is not necessary. Copper wire, sheet or foil tubing or wire mesh can be simply wrapped, placed or inserted into or around the drainage line, as it is being constructed, in any suitable place where it will be contacted with the soil or soil fluids or fluid being conducted in the line.

I claim:

1. In a drainage system for sewage effluent comprising a drain line buried in percolating soil, said drain line comprising a plurality of seriatly disposed ceramic conduits, each having a longitudinal groove opening radially inwardly into the interior of said line along the bottom thereof, liquid permeable joints connecting said conduits together and providing openings in said line for deliberately permitting seepage of said effluent into the surrounding soil and means comprising a material disposed in the longitudinal groove of said conduits for reaction with said sewage effluent to produce a solution which is toxic to bacteria in the effluent, said solution being flowable with said effluent for infiltration into the surrounding soil to inhibit formation of bacteria precipitated iron compounds and thereby prevent clogging of said line and the soil surrounding said line by said bacteria and said compounds.

2. In a drainage system for sewage effluent comprising a drain line buried in percolating soil, said drain line comprising a plurality of seriatly disposed ceramic conduits, each having a longitudinal groove opening radially inwardly into the interior of said line along the bottom thereof, means providing openings in said lines for deliberately enabling seepage of said effluent into the surrounding soil and rod-like copper means disposed in the longitudinal groove of said conduits for reaction with said sewage effluent to produce a solution which is toxic to bacteria in the effluent, said solution being flowable with said effluent for infiltration into the surrounding soil to inhibit formation of bacteria precipitated iron compounds and thereby prevent clogging of said line and the soil surrounding said line by said bacteria and said compounds.

References Cited by the Examiner

UNITED STATES PATENTS

542,978	7/1895	Saunders	285—114
666,241	1/1901	Barraclough	285—55
1,968,734	7/1934	Best	285—285
2,194,266	3/1940	Allen	285—336
2,269,629	1/1942	Kreidel	285—55 X
2,449,731	9/1948	Therrien	285—285
2,550,021	4/1951	Rappl	138—103 X
2,613,958	10/1952	Richardson	285—55 X
3,123,879	3/1964	Boduroff et al.	339—103 X

CARL W. TOMLIN, *Primary Examiner.*