

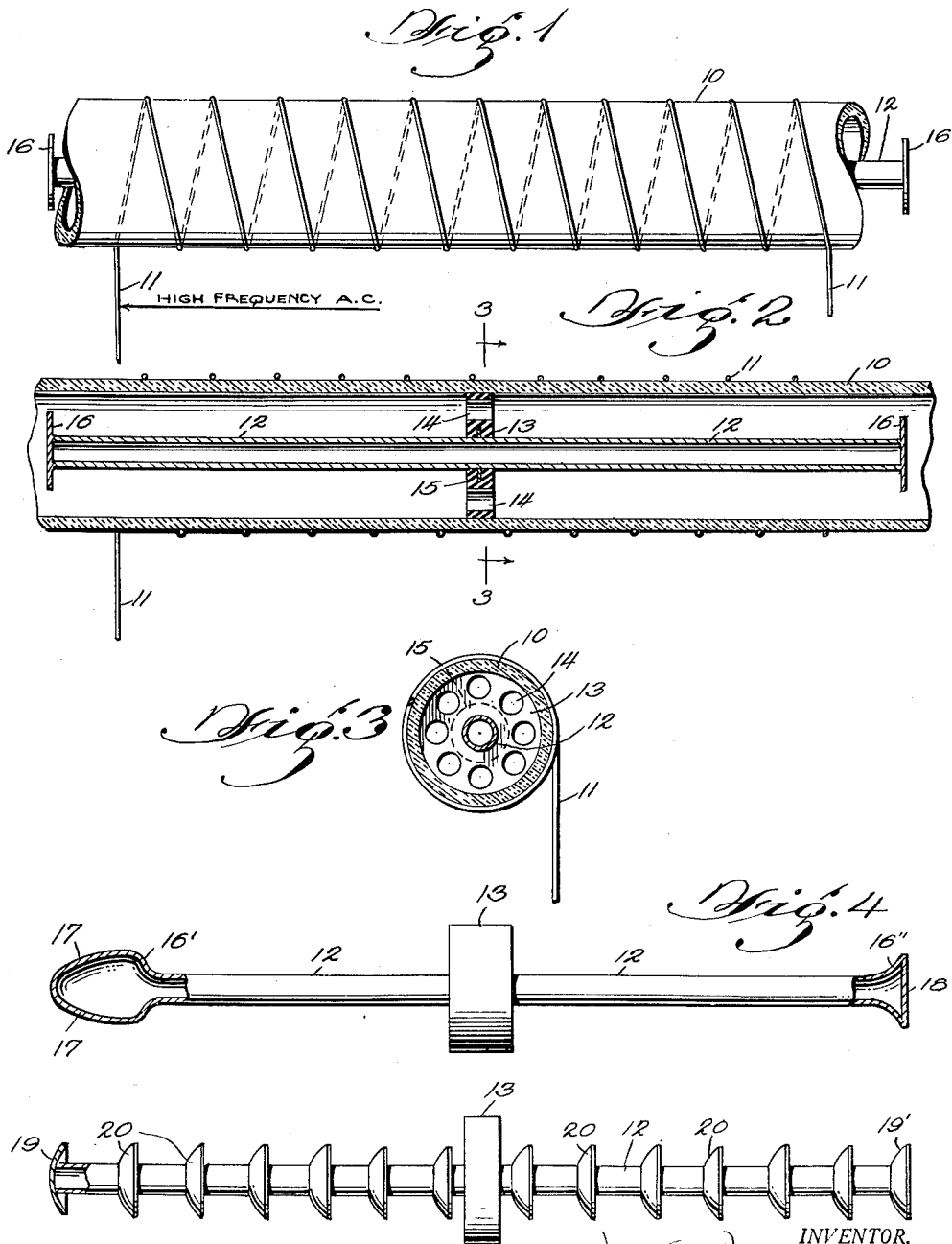
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APPARATUS FOR PUMPING AND STERILIZING LIQUIDS

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APPARATUS FOR PUMPING AND
STERILIZING LIQUIDS

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to a method and apparatus for pumping and treating fluids, and particularly to an improved magnetostriction apparatus useful in a mobile unit either by itself or as an adjunct to a pumping system for the purpose of pumping, sterilization and/or heating, or other treatment of water by high frequency vibration.

The problem of utilizing a mobile unit for safeguarding health by instantaneous and continuous purification of water which normally appears to be fresh and clear where no permanent equipment is available is of major value. Particularly has it been discovered that in warm climates, bodies of apparently pure and clear water suitable for bathing and other purposes contain organisms, for example, such as schistosomiasis, which may cause impairment to health or death to an infected person.

The principles of the application of high frequency alternating currents to produce a vibratory motion and the beneficial results obtained therefrom are well known theoretically, and many types of constructions have been created for making such applications useful. Among these applications there has been developed generally the use of crystalline structures as illustrated by W. Claypoole in Pat. No. 1,738,565, and tubular or bar members centrally disposed in or subject to an electrical field, as illustrated by E. E. Turner, Jr. in Patent No. 2,219,348, to emulsify, deflocculate, sterilize, or otherwise produce particular results which appear to be beneficial and desirable for specific conditions required. Heretofore, however, it has not been discovered that improved results may be obtained by utilizing the vibrational effects of a vibrator so as to produce a pumping effect for moving a fluid body or cause fluid flow in addition to sterilization of large quantities of fluid by agitation with or without the creation of high heat effects. Particularly there is no known mechanical apparatus or mechanical unit which is readily transportable and conveniently available to easy application for pumping and sterilizing large quantities of impure water to render it sterile for human use and consumption.

It is, therefore, an object of this invention to provide an improved magnetostriction apparatus for the pumping and treatment of fluid materials.

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It is an additional object of this invention to provide an improved vibratory element for use in magnetostriction apparatus.

Another object of this invention is to correlate vibrational frequency with fluid pressure to obtain a desired organic and bacteriological kill.

Another object of this invention is to provide an apparatus which affords instantaneous and continuous purification of water as it flows there-through at a rapid rate and in relatively large volumes to supply an enormous demand.

It is a further object of this invention to provide a simple compact pumping and sterilizing unit for mobile equipment.

Further objects and advantages will be apparent from the following description of the accompanying drawings, wherein;

Figure 1 is a front plan view of magnetostriction apparatus with the casing showing broken end sections;

Figure 2, a cross sectional view of apparatus as disclosed in Figure 1;

Figure 3, an end view in cross section on line 3—3 of Figure 2;

Figure 4, a modified vibratory element and,

Figure 5, is a further modified vibratory element.

Referring to the drawings, an electrically non-conducting transparent glass conduit, or tube 10, having threaded ends or the like attachment means (not shown) has wrapped about its outer surface conductor wiring 11 to which is fed an alternating current from a high frequency source (not shown). As indicated, the conduit 10 is formed of transparent glass, for purposes of illustration and observation of vibrational effects. However, other non-conductive materials may be used as ceramics, rubber and resins, or the like, and the glass or other material need not be of a transparent character. Within the tubular conduit 10 centrally and longitudinally disposed therein, particularly with respect to the electrical wiring, is a vibratory member 12. This vibratory member 12 is mounted through resilient supporting ring 13, formed of rubber or rubbery material, or the like, and provided with openings 14 for passage of fluid therethrough and a centering supporting ring 15 located at the nodal point of the vibratory member 12.

The vibratory member 12, as illustrated, is an elongated hollow body formed of a suitable magnetizable metallic material in the nature of iron, and the like, or a composition of aluminum, nickel and cobalt or the like as known to the trade.

Further, this vibratory element 12 may be formed

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of a single sheet material, or of laminated thin sheet material formed in the usual manner known to the trade. A pair of end section members 16 formed of the same material as element 12, are welded to, or otherwise closed, the ends of the vibratory member 12 to form a tubular-like body having inclosed therein a fluid-tight air space which permits the bar seemingly or in effect to be floated by supporting ring 13 in the body of a liquid material which it pumps or aids in pumping through the casing 10. As illustrated, these end members 16 are in the nature of extended plunger means substantially across the internal diameter of tubing 10 to present vibratory surfaces projecting crosswise to fluid flow within casing 10 and produce by their pulsating effect a pumping action. Fluid flow through casing 10 is preferably under pressure, it being understood that the natural harmonic vibratory frequency of a particular fluid is a function, in part, of the pressure in that fluid. The end members 16 act as vibratory pump elements without materially obstructing fluid flow.

In Figures 4 and 5 are shown modified constructions of the vibratory bar 12 which are streamlined in order to present a maximum mechanical vibratory motion with the least resistance and a greater pumping effect to flowing fluids or liquids. In Figure 4 the elongated ends of vibratory member 12 are flared outwardly at ends 16' and 16'' with the forward edges 17 drawn together to form a point. The outwardly flared portion 16'' is closed by a flat end plate 18. The ends 17 and 18 form with the vibratory member 12 a hollow closed body of arrow-like contour with its end portions extended substantially across the internal diameter of casing 10 without materially obstructing fluid flow when current flows through conductor 11.

As illustrated, in Figure 5, the tubular element 12 is provided with curved or disc plate-like leading and trailing end members 19 and 19' respectively which close the ends of the tube 12 by being welded, bolted or threaded thereto or formed integral therewith in any suitable conventional manner to form a vibratory element. Intermediate the end members 19 and 19' and the central resilient supporting member 13 on tubular member 12, there is provided an additional number of curved disc or saucer-like elements 20 constructed of the same material as element 12 and secured by spot welding or the like. These disc-like members 20 are preferably equal in number, evenly distributed and of equal size and weight to provide a vibratory member 12 which is balanced with respect to the resilient mounting 13. By the addition of the curved elements 20 a more pronounced pumping effect is produced in addition to the provision of a plurality of vibratory bodies with increased over-all vibratory surface area in contact with fluid flow.

The apparatus, as illustrated, is adapted to be coupled into a piping or hose by suitable screw threads or clamps (not shown) positioned on the ends of the conduit 10. With this arrangement and by the use of an additional pump of a conventional character, coupled to the piping or hose, it has been found that water can be instantaneously and continuously purified at the rate of approximately 60 gallons per minute.

The choice of a fixed frequency to give desired bacteria kill may, of course, be optional dependent upon the structural materials of the unit and the particular area and the germs or bacteria contained in the water undergoing

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treatment. In the selection of such frequency, care must be taken to avoid frequencies in the natural harmonic range, for example, of conduit 10. As is well known each particular material, such as rubber, glass, etc., has its own frequency and to prevent its being shattered by vibratory motion a different frequency range is set up internally of the conduit 10. Such frequencies as desired, however, may be supplied by a high speed generator as the simplest application or it may be desirable to utilize a piezoelectric crystal type oscillator and a suitable amplification system to obtain the desired power.

In the operation of this device it was discovered that the frictional heat created by the unit is extremely high, and while that heat may be utilized with the vibration frequency to sterilize water or other fluid, as by partially blocking fluid flow with a valve (not shown) or the like, it is preferable to allow a rapid passage of water which cools and absorbs this excess heat. Accordingly, the rate of water flow will determine its relative heat absorption and where, for example, the device is utilized as an adjunct to a pumping system and/or for pumping and sterilizing cold water, the water may be used directly for bathing purposes without the necessity of additional heating.

Having thus described my invention it will be apparent that the unit is adaptable to advantageous uses and applications not illustrated but for which it is readily applicable by minor changes in its construction and installation which may come within the scope of the appended claims.

I claim:

1. A tubular casing constituting a portion of a conduit for conveying liquid, a conductor coil about said casing and connected to a source of high frequency current, an elongated vibrator resiliently mounted at a nodal point and concentric with said tubular casing so as to be freely vibratable through its unsupported length, said vibrator having curved enlargements thereof so constructed as to exert a pumping action on liquid flowing in said casing.

2. A tubular casing constituting a portion of a conduit for conveying liquid, a conductor coil about said casing and connected to a source of high frequency current, an elongated vibrator resiliently mounted at a nodal point and concentric with said tubular casing so as to be freely vibratable through its unsupported length, a resilient mounting for said vibrator, liquid passageways about said mounting, said vibrator having curved enlargements thereon so constructed as to exert a pumping action on liquid flowing through said casing.

3. A tubular casing constituting a portion of a conduit for conveying liquid, a conductor coil about said casing and connected to a source of high frequency current, an elongated vibrator resiliently mounted at a nodal point and concentric with said tubular casing so as to be freely vibratable through its unsupported length, said vibrator having a plurality of liquid-flow-impedance elements provided over its unsupported length so constructed as to exert a directional pumping action on liquid contained in said casing.

4. An electrically non-conducting tubular casing constituting a portion of a conduit for conveying liquid, a conductor coil supported by said casing and connected to a source of high frequency current, an elongated vibrator resiliently

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mounted at a nodal point and having extended end sections concentric with said tubular casing so as to be freely vibratable through its extended length, mounting means for said vibrator having liquid passageways therethrough and said end sections having a plurality of enlargements thereon, said enlargements presenting less resistance to liquid flow in one direction than in the opposite direction, so as to exert a pumping action on said liquid flowing in said casing in said first direction.

5. A tubular casing constituting a portion of a conduit for conveying liquid, a conductor coil about said casing and connected to a source of high frequency current, an elongated vibrator resiliently mounted at a nodal point and concentric with said tubular casing so as to be freely vibratable through its unsupported length, said vibrator having an enlargement presenting less resistance to liquid flow in one direction than in the opposite direction, so as to exert a pumping action on said liquid flowing in said casing in said first direction.

6. A tubular casing constituting a portion of a

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conduit for conveying liquid, a conductor coil about said casing and connected to a source of high frequency current, an elongated vibrator resiliently mounted at a nodal point and concentric with said tubular casing so as to be freely vibratable through its unsupported length, said vibrator having a plurality of enlargements, at least one of said enlargements presenting less resistance to liquid flow in one direction than in the opposite direction, so as to exert a pump action on said liquid flowing in said casing in said first direction.

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