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JP 2006007060 A **US 20050161405 A1**

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(54) Abstract Title: **A fluid conveying conduit**

(57) A fluid conveying conduit comprises a tube 3 and a coil 15 for producing a magnetic field the coil having a plurality of electrical connections. The tube 3 has an inner surface 5 and an outer surface 7, the inner surface 3 defining a fluid channel. At least a section of the coil 15 extends around the fluid channel, and is located intermediate the inner surface 5 and outer surface 7, along at least a section of the length of the tube 3. The arrangement prevents build up on the inner surface 5 of the pipe 3 and is particularly useful in beer lines, gas pipes and water pipes.

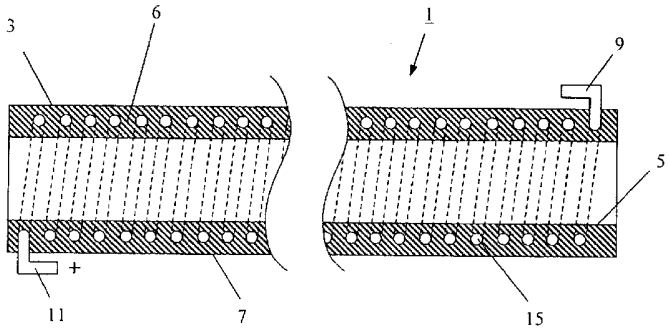

Fig 1

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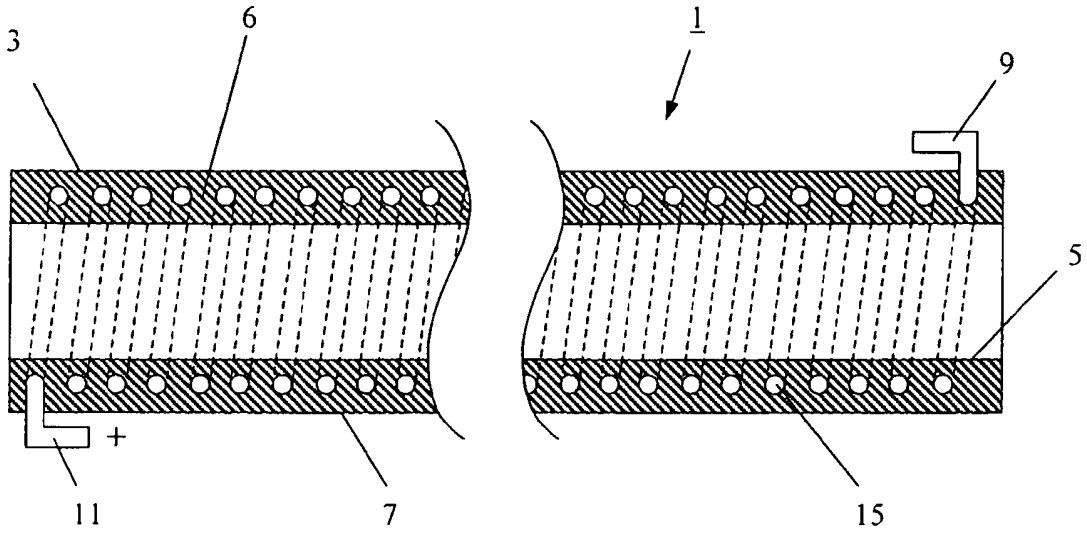

Fig 1

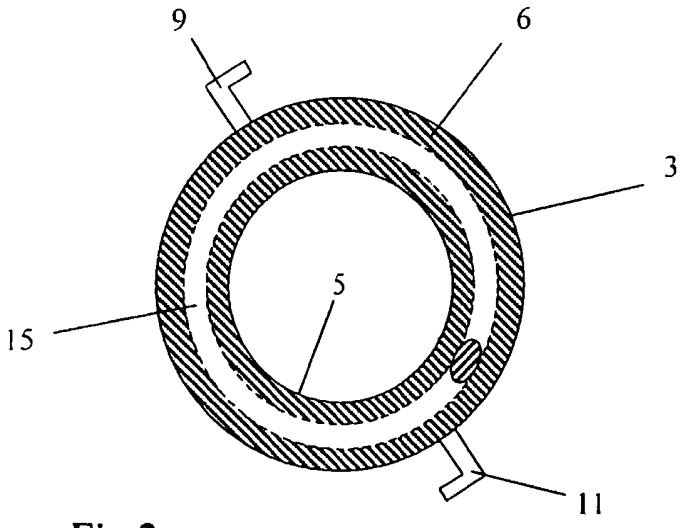

Fig 2

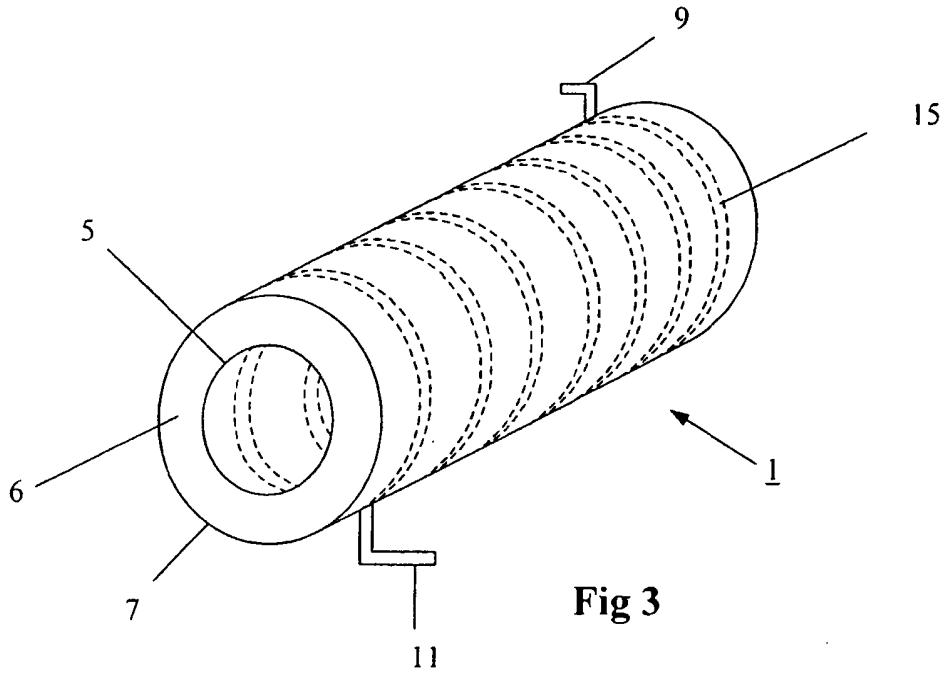

Fig 3

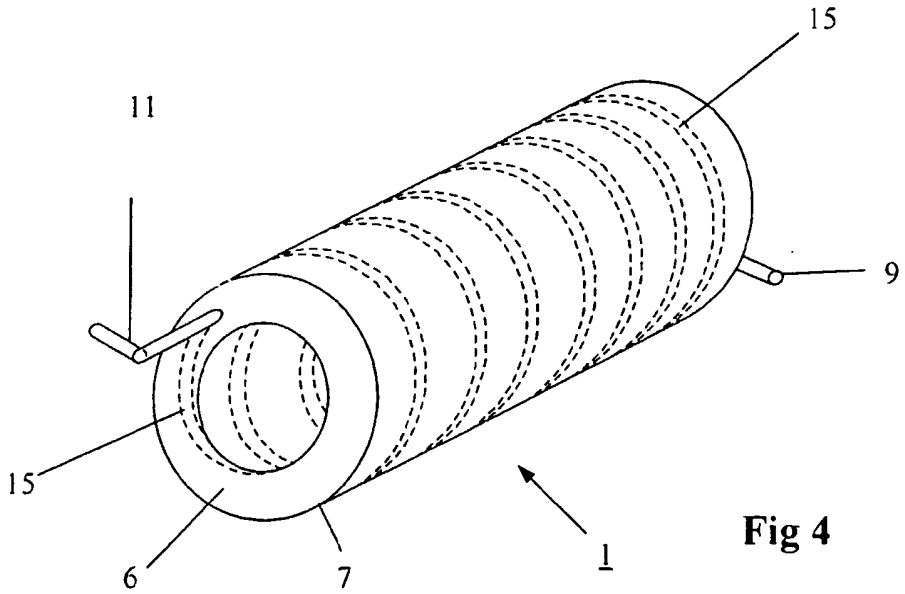

Fig 4

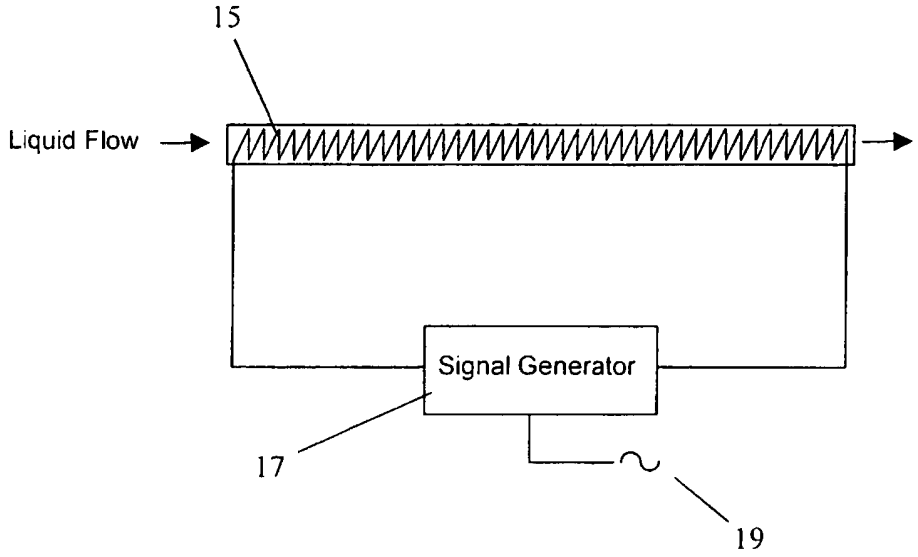

Fig 5

FLUID CONVEYING CONDUIT

The present invention relates to a fluid conveying conduit, such as a water pipe, or beer line, and in particular to a fluid conveying conduit having an integral coil for producing a magnetic field.

Fluid conveying conduits, such as water pipes, beer lines, gas pipes or the like are commonly used to transport liquids from a supply point to a distribution point. For conduits which convey consumable liquids, regulatory requirements dictate that the liquid is transported by the conduit with a minimum of contamination to the liquid.

Water pipes frequently experience build up of limescale, and deposition of particulates present in the water. In the case of beer lines, yeast and other contaminates build up within the pipes, resulting in contamination of the beer. Similarly, oil pipes experience sludge and bacteria build up resulting in corrosion of the pipe.

Once contaminants have deposited within a pipe, the pipe must then either be cleaned, or possibly replaced. Beer lines are frequently cleaned to remove contaminants. However, the cleaning of beer lines incurs significant costs, in terms of the equipment and chemicals required to clean the lines, down time, and the loss of beer within the lines, which must be discarded when the lines are cleaned.

UK Patent Number GB2,367,106 describes a system for cleaning beer lines, comprising an electro-magnetic coil wrapped round the beer line, and a signal generator for causing the coil to produce a magnetic field. This system

prevents contaminants from depositing on the inner surface of the beer lines, and therefore significantly reduces the frequency with which the lines needed to be cleaned. However, it has been found that in day to day operation, coils wrapped around the beer lines are prone to damage, as well as movement relative to the beer lines, which can effect the performance of the coil. The application of such a system to water pipes may also lead to coil damage. In addition, providing a coil wrapped around the external surface of a water pipe is not always suitable for the environment in which such pipes are utilised.

It is therefore desirable to provide an improved fluid conveying conduit, which addresses the above described problems, and/or which offers improvements generally.

According to the present invention, there is provided a fluid conveying conduit, as claimed in the accompanying claims. According to the present invention, there is also provided a system for cleaning fluid conveying conduits as described in the accompanying claims.

In an embodiment of the present invention, there is provided a fluid conveying conduit comprising a tube having an inner surface and an outer surface, the inner surface defining a fluid channel; and a coil for producing a magnetic field, the coil having a plurality of electrical connections. At least a section of the coil extends around the fluid channel, and is located intermediate the inner surface and outer surface, along at least a section of the length of the tube.

By locating the coil within the tube, between the inner and outer surfaces, the cleaning effect of the coil is increased because the coil is located closer to the inner

surface and hence to the fluid conveyed within the tube. In addition, locating the coil within between the inner and outer surfaces of the tube protects the coil from damage.

In another aspect of the invention, the tube comprises a tube wall, and at least a section of the coil is encased within the tube wall along at least a section of the length of the tube.

In a further aspect, the at least a section of the length of the tube, and the at least a section of the coil are integral. This section of the tube may be formed about the at least a section of the coil. The coil may be a helical coil.

In an alternative embodiment of the present invention, there is provided a fluid conveying apparatus, comprising a fluid conveying conduit as described above, and a signal generator, connected to the coil, for providing an electric signal to the coil, to cause the coil to produce a magnetic field.

The signal generator may provide a pulsed or varying energy signal to the coil, the signal having varying frequencies.

The pulsed or varying energy input signal may comprise a square waveform having varying frequencies.

The present invention will now be described by way of example only, with reference to the following illustrative figures in which:

Figure 1 shows a longitudinal cross sectional view of a conduit according to an embodiment of the present

invention;

Figure 2 is a transverse section view of the conduit of Figure 1;

Figure 3 is a perspective view of the conduit of Figure 1;

Figure 4 is a perspective view of a conduit according to an alterative embodiment of the invention; and

Figure 5 shows a fluid conveying apparatus, according to yet another embodiment of the invention.

Referring to Figure 1, the fluid conveying conduit 1 comprises a tube 3 having a tube wall 6. The tube 3 is an elongate, cylindrical tube, although the tube 3 may be any fluid conveying conduit, of any suitable shape, for example a tube of square cross section, and may convey liquids, gases, powders, or any fluid medium exhibiting the characteristics of a fluid. The present invention is also applicable to fluid conveying conduits of varying size. For example, the conduit may be a beer line or water pipe, of relatively small diameter, or a gas pipe, or oil pipeline having a much larger diameter.

The tube 3 comprises an outer surface 7 and an inner surface 5. The inner surface 5 of the tube 3 defines a fluid channel 12 for carrying a fluid. The tube wall 6 may be formed of a rigid, or flexible material, depending on its application, for example a rigid tube may be more suitable for a water pipe, whereas a flexible pipe may be required for use as in conveying beverages such as beer.

For application as a beer line, the tube is formed from flexible PVC, although it is understood that the tube 3 may be formed of any material suitable for the fluid to be conveyed and the environment in which the conduit is to be utilised. The diameter of the inner surface 5, and the thickness of the wall 6, may be varied, and preselected accord to the environment and application for which the conduit is to be used.

To prevent deposition of calcium, limescale, bacteria, yeast, or other contaminants, on the inner surface 5, an electro-magnetic coil 15 is provided. The coil 15 extends around the fluid channel 12 and along the length of the tube 3. The coil 15 may extend along the entire length of the tube 3, or only along a preselected section, or sections, of the tube 3. The coil 15 shown in the illustrations is a helical coil, and extends around the channel 12 in a helical configuration, although other suitable electro-magnetic coil configurations may also be utilised.

The coil 15 is located between the outer surface 7, and inner surface 5 of the tube 3, encapsulated within the wall 6. The coil 15 is integrated within the tube 3 and integral with the wall 6. The coil 15 is encased within the wall 6 as the tube 3 is formed, for example by extrusion, or during a moulding process. The coil 15 may be formed from any suitable electrically conductive material, for example, a copper or steel wire.

Electrical connections 9 and 11 are provided at either end of the coil 15, for connecting the coil to a signal generator 17. The electrical connections 9 and 11 may comprise extensions of the coil, extending outwardly through the wall 6, form connection points. Alternatively,

the electrical connections 9 and 11 may be separate connections members, which extend through the wall 6 to connect with the coil 15, or any other suitable means of connecting the coil 15 to an electrical source.

An electrical signal is provided to the coil 15 by the signal generator 17, to cause the coil 15 to produce a magnetic field. The signal generator 17 converts the electrical supply 19 to an input signal for the coil 15. The input signal may be a pulsed or varying energy input signal, and may have varying frequencies. Specifically, the pulsed or varying energy input signal may comprise a square wave waveform, having varying frequencies. The input signal provided by the signal generator 17 is adapted to effect the cleaning of the tube 3. In particular, the input signal causes the coil 15 to produce a magnetic field which prevents, or minimises deposition of particulates suspended in the fluid within the tube 3 on the inner surface 5.

Encasing the coil 15 within the wall 6 of the tube 3, allows the coil 15 to be located closer to the inner surface 5 of the tube 3. It has been found that by locating the coil 15 closer to the inner surface 5, and consequently closer to the fluid within the tube 3, the cleaning effect of the coil 15 is significantly increased. The cleaning effect of the coil 15 may be maximised by encasing the coil 15 within the wall 6 such that the coil 15 is closer to the inner surface 5 than the outer surface 7, and as close to the inner surface 5 as possible within the constraints of the material from which the tube 3 is formed.

Encasing the coil 15 within the tube 3, also protects the coil 15 from damage. The windings of the coil 15 are able to maintain their configuration, even when the tube 3 is flexed, and movement of the coil 15 relative to the tube 3

is prevented. In addition, it has been found that the coil 15 provides structural reinforcement for the tube 3, which prevents crimping or flattening of the tube 3.

In the illustrated embodiment, the coil 15 is completely encased within the wall 6 of the tube 3. Alternatively, the tube 3 may comprise an inner tube section and an outer tube section, with the coil being provided in the space defined between the inner and outer tube sections. This arrangement may comprise a tube having a channel formed between the inner and outer surface, or the tube may comprise a first tube section, and an second outer sleeve section which is provided over the coil 15.

Any suitable signal may be provided to the coil 15 to effect cleaning of the tube 3. However, it has been found that it is particularly effective to provide an AC signal to the coil 15, which varies between positive and negative on a continual and constantly repetitive scale. The frequency of the signal provided by the signal generator is in a range above audio frequency and below radio frequency.

The signal generator 17 may comprise a free running oscillator emitting a near sawtooth (RAMP) signal. The RAMP signal is fed into a voltage controlled oscillator, which provides a changing square wave configuration, dependant on the input signal from the RAMP generator. This signal, which is varying in frequency, is provided to an output transistor via a resistor, and is then provided to the coil 15 via a capacitor at either end of the coil 15. This configuration ensures a uniform signal configuration.

Therefore, there is provided a fluid conveying conduit, having an integral coil, which improves the efficacy of the cleaning action of the coil, and protects the coil from

damage.

It will be appreciated that in further embodiments various modifications to the specific arrangements described above and shown in the drawings may be made. For example, whilst the conduit is described in terms of a beer line, or water pipe, it will be appreciated it may be a conduit for conveying any fluid.

CLAIMS

1. A fluid conveying conduit, comprising:

a tube, having an inner surface and an outer surface, the inner surface defining a fluid channel; and

a coil for producing a magnetic field, the coil having at plurality of electrical connections;

wherein at least a section of the coil extends around the fluid channel, and is located intermediate the inner surface and outer surface, along at least a section of the length of the tube.

2. The conduit of claim 1, wherein the tube comprises a tube wall, at least a section of the coil being encased within the tube wall along at least a section of the length of the tube.

3. The conduit of claim 1 or 2, wherein the at least a section of the length of the tube, and the at least a section of the coil are integral.

4. The conduit of any preceding claim, wherein the at least a section of the tube is formed about the at least a section of the coil.

5. The conduit of any preceding claim, wherein the coil is a helical coil.

6. A fluid conveying apparatus, comprising:

the fluid conveying conduit of any one of claims 1 to 5; and

a signal generator, connected to the coil, for providing an electric signal to the coil, to cause the coil to produce a magnetic field.

7. The apparatus of claim 6, wherein the signal generator provides a pulsed or varying energy signal to the coil, the signal having varying frequencies.

8. The apparatus of claim 6 or 7, wherein the pulsed or varying energy input signal comprises a square waveform having varying frequencies.

9. A fluid conveying conduit, substantially as hereinbefore described with reference to, and/or as shown in figures 1 to 5.

10. A fluid conveying apparatus, substantially as hereinbefore described with reference to, and/or as shown in figures 1 to 5.

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Application No:	GB0618453.5	**Examiner:**	Rhodri Evans
Claims searched:	1-10	**Date of search:**	5 December 2006

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-8	US 2005/0161405 A1 (Holland) figures 8-10 and paragraphs 0119-0127.
X	1-8	JP 2006007060 A (Motoi) figure 1 and WPI abstract accession number 2006-082654[09].

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

F2N; F2P

Worldwide search of patent documents classified in the following areas of the IPC

B08B; C02F; F16L

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC