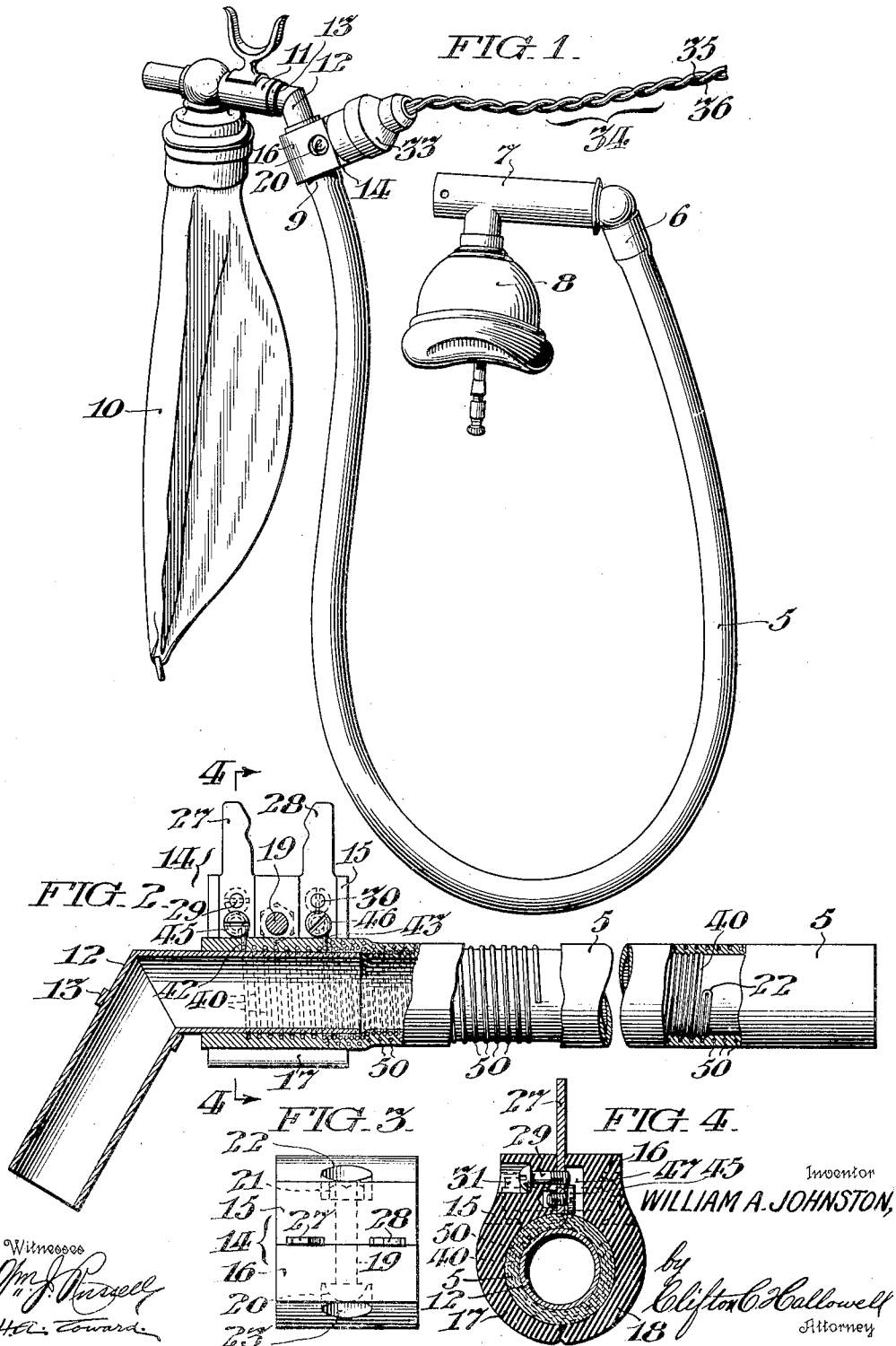


W. A. JOHNSTON.
FLEXIBLE TUBING.
APPLICATION FILED MAY 23, 1913.

1,105,795.

Patented Aug. 4, 1914.



UNITED STATES PATENT OFFICE.

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FLEXIBLE TUBING.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM A. JOHNSTON, a citizen of the United States, and a resident of Prince Bay, county of Richmond, State of New York, have invented certain new and useful Improvements in Flexible Tubing, of which the following is a specification, reference being had to the accompanying drawings.

10 This invention relates particularly to tubing formed of flexible material for conveying fluids, and is especially applicable to tubing used by anesthetists for conveying gases from gas cylinders or containers to an
15 inhaler, for the purpose of effecting anesthesia.

It is well known to those familiar with the practice of administering anesthetics, that gas, such as nitrous oxid or oxygen, when suddenly released under pressure from a
20 container, is reduced in temperature to such an extent as to be injurious to the patient to whom it may be administered, and, therefore, various more or less efficient means
25 have been devised for warming such gases as they are discharged from said containers.

The principal object of this invention is, to provide a flexible connecting tube with an electrical conductor of such electrical resistance as to be sufficiently heated when connected with a source of electric current, to
30 raise the temperature of any fluid which may be caused to flow through the bore of said tube.

35 Other objects of this invention are, to provide a flexible tube having electric heating means, with an attachment plug having terminal contacts for connection with the terminals of said electrical heating means,
40 and having means adjustable to clamp said tube, in telescopic relation, to a nipple or other suitable connection or fitting; and to provide said tube with an electrical conductor formed of resistance material, which not
45 only serves as a heat producing medium, but also affords reinforcement for the wall of said tube.

This invention comprehends a flexible tube having heating means comprising doubled
50 electric resistance wire helically coiled about said tube, and having its terminals disposed in closely adjacent relation, approximating one end of said tube.

This invention also includes all of the various novel features of construction and

arrangement hereinafter more definitely specified.

In the accompanying drawings, Figure 1 is a perspective view showing a flexible tube conveniently applied for anesthetic purposes, and connecting the gas-bag of a gas administering apparatus, with an inhaler. Fig. 2 is a fragmentary sectional elevational view of said tube, showing the wiring embedded in its wall, portions of the wall of
60 said tube being broken away for convenience of illustration; Fig. 3 is a plan view of the attaching plug, *per se*; and Fig. 4 is a transverse vertical sectional view taken through said plug and tube, on the line 4—4 in Fig. 2.
65

In said figures, the flexible tube 5, which is designed especially for use in connection with the parts of an anesthetic administering apparatus, is shown in the drawing with its outlet end 6 connected with an inhaler 7,
70 having the face mask 8 of known construction, the inlet end 9 of said tube 5 being connected with the gas-bag 10 through the pipe 11 and elbow or angle fitting 12, which latter is arranged to be frictionally engaged in
80 telescopic relation with said pipe 11. As best shown in Fig. 2, the fitting 12 is provided with a band or collar 13, integral therewith and forming an abutment for limiting the extent to which said fitting may be
85 telescoped within said pipe 11, said abutment being arranged to engage the end of the pipe 11, as shown in Fig. 1.

The fitting 12 is removably telescoped within the inlet end of the tube 5, which
90 latter is arranged to be clamped in fixed relation to said tube by the electrical attachment plug 14, which forms a collar and which is preferably divided axially, and comprises the relatively adjustable complementary
95 sections 15 and 16, providing opposed jaws 17 and 18 respectively embracing the inlet end of the tube 5 and the fitting telescoped therein, said sections being relatively adjusted and held in clamped relation
100 upon the tube 5 by the adjusting screw 19, having the slotted head 20 and the nut 21, the sections 15 and 16 respectively having countersunk recesses 22 and 23 for the nut 21 and head 20, respectively. The attachment
105 plug 14 conveniently provides suitable electrical contact terminals 27 and 28, which are secured to the section 15 by the screws 29 and 30, having their slotted heads disposed
110 in the recesses 31 in the section 15, to which

said terminals 27 and 28 are secured. The terminals 27 and 28 may be connected with the source of electric current by the cord socket plug 33 on the end of the flexible electric cord 34, comprising the electrical conducting wires 35 and 36 leading to any suitable source of electric current supply.

Referring now to the construction of the tube 5, as best shown in Fig. 2, said tube is provided with an electrically conductive wire 40, which is preferably embedded in the wall of the tube 5, near the surface of the bore thereof, and which is helically coiled therein around said bore, and may extend from any desired or selected point in the tube to the end thereof. Said electrically conductive wire is preferably composed of relatively high electrical resistance material, and is preferably doubled at its center to form the return bend or bight 22, and coiled in doubled pitch convolutions so that its respectively opposite ends 42 and 43 may terminate adjacent to the inlet end of the tube, convenient for connection with the cord 34 leading from the source of electric current, by the cord socket plug 33. The ends 42 and 43 of the resistance wire 40 may be respectively connected with the terminal contacts 27 and 28 by the binding screws 45 and 46, as best shown in Fig. 2, the section 16 being provided with suitable recesses 47 for the heads of the binding screws 45 and 46.

It will be obvious from the above description, that when the cord socket plug 33 is connected with the attachment plug 14, to connect the wires 35 and 36 of the cord 34 with the respective terminal contacts 27 and 28, an electric current may be caused to pass through the resistance wire 20 in the tube 5, whereby heat will be generated therein, which will be transmitted to the gas or other fluid forced through the bore of the tube 5.

It may be here noted, that while the resistance wire 20 affords reinforcement for the wall of the tube 5, said tube may be further reinforced, to prevent collapsing, by the spring wire 50, which may be also helically coiled around the tube 5, and may be either embedded therein, as shown in Fig. 2, or may obviously extend exteriorly thereto.

While I have shown and described the tube 5 as connecting an inhaler with the parts of an anesthetic administering apparatus, it is obvious that a tube constructed in accordance with my invention may be as readily employed for heating fluids other than gaseous fluid, such as fluids in a liquid state, and may be adapted to an entirely different kind of apparatus and employed for entirely different purposes. Furthermore, the application of the heating means herein described may be rendered equally effective in tubing of differing formation, such as tubing formed of layers of flexible

material, tubing formed by molding, or a combination of both, or tubing formed wholly or partly of metal.

It is not desired to limit this invention to the precise details of construction and arrangement herein set forth, as it is obvious that various modifications may be made therein without departing from the essential features of the invention as defined in the appended claims.

Having thus described my invention, I claim:

1. A fluid-conveying tube, having electrical resistance means for heating the fluid passing therethrough, and a coiled spring wire affording reinforcement for the wall of said tube and maintaining it cylindrical.

2. A fluid-conveying tube, formed of flexible material, having electrical resistance embedded in its wall for heating the fluid passing therethrough, and a reinforcing wire coil in the wall of said tube.

3. A fluid-conveying tube, having an electrical resistance disposed therein, a plug connection forming an adjustable collar embracing the end of said tube, having terminal contacts for said resistance, said collar comprising sections having opposed jaws embracing said tube, and a bolt at one side of said tube for adjusting the sections to clamp said tube.

4. A fluid-conveying tube, formed of flexible material, having an electrical resistance wire in the wall thereof with its terminals disposed near one end of said tube, a plug connection forming an adjustable collar embracing the end of said tube and having terminal contacts for engagement with the terminals of said resistance wire, and means for adjusting said collar to clamp the tube on a pipe or suitable fitting.

5. A fluid-conveying tube, having an electrical resistance wire coiled in the wall thereof with its terminals disposed near one end of said tube, a plug connection forming an adjustable collar embracing the end of said tube and having terminal contacts for engagement with the terminals of said resistance wire, said plug connection comprising separable sections having opposed jaws embracing said tube, and means for relatively adjusting said sections to clamp the tube on a pipe or suitable fitting.

6. A fluid-conveying tube, formed of flexible material, having flexible electrical resistance in the wall thereof for heating the fluid passing therethrough.

7. A fluid-conveying tube, formed of flexible material, having an electrical resistance wire embedded in the wall thereof for heating the fluid passing therethrough.

8. A fluid-conveying tube, formed of layers of flexible material, having electrical resistance wire included between said layers for heating the fluid passing therethrough.

9. A fluid-conveying tube, formed of flexible material, having electrical resistance wire spirally wound in said tube for heating the fluid passing therethrough.

5 10. A fluid-conveying tube, formed of flexible material, having an electrical resistance wire wrapped around said tube for heating the fluid passing therethrough, and providing suitable terminals for connection
10 with an electric circuit.

11. A fluid-conveying tube, formed of flexible material, having an electrical resistance wire doubled at its center, and helically wound from a selected point in said tube,
15 with its free ends terminating adjacent to the end of said tube.

12. A fluid-conveying tube, having electrical resistance wire included in its wall, with its terminals extending adjacent to one
20 end of said tube, and a plug connection having terminal contacts connected with said terminals and comprising means for clamping said tube to a separable pipe or suitable fitting.

25 13. A fluid-conveying tube, having electrical resistance wire spirally coiled in the wall thereof, with its terminals disposed near one end of said tube, and a plug connection having terminal contacts engaged
30 with the terminals of said resistance wire, and having means embracing said tube, for removably clamping the tube to a pipe or suitable fitting.

35 14. A fluid-conveying tube, formed of flexible material, having a doubled electrical resistance wire helically coiled in the wall thereof, with its terminals disposed near one end of said tube, a plug connection forming an adjustable collar embracing the end of said tube, and having terminal contacts for engagement with the terminals of said resist-

ance wire, and means for adjusting said collar to clamp the tube on a pipe or suitable fitting.

15. A fluid-conveying tube, having an electrical resistance wire embedded in the wall thereof, and provided with terminals, a plug connection forming an adjustable collar embracing the end of said tube, and having terminal contacts for engagement with
50 the terminals of said resistance wire, means for adjusting said collar to clamp said tube on a pipe or suitable fitting, and a separate reinforcing wire helically coiled around said tube.
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16. A fluid-conveying tube, having an electrical resistance wire helically coiled in the wall thereof, and provided with terminals for connection with a suitable source of electric current, and a reinforcing wire
60 helically coiled around said tube, in the opposite direction.

17. A fluid-conveying tube, having a doubled electrical resistance wire helically coiled in the wall thereof, with its terminals
65 disposed near one end of said tube, a plug connection forming an adjustable collar embracing the end of said tube, and having terminal contacts for engagement with the terminals of said resistance wire, said plug
70 connection being divided axially and comprising relatively movable sections having opposed jaws embracing said tube, and means for relatively adjusting said sections to clamp the tube on a pipe or suitable fitting.
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In testimony whereof, I have hereunto set my hand this 14th day of May, A. D., 1913.

WILLIAM A. JOHNSTON.

Witnesses:

SEYMOUR CASE,
PETER C. MILLER.