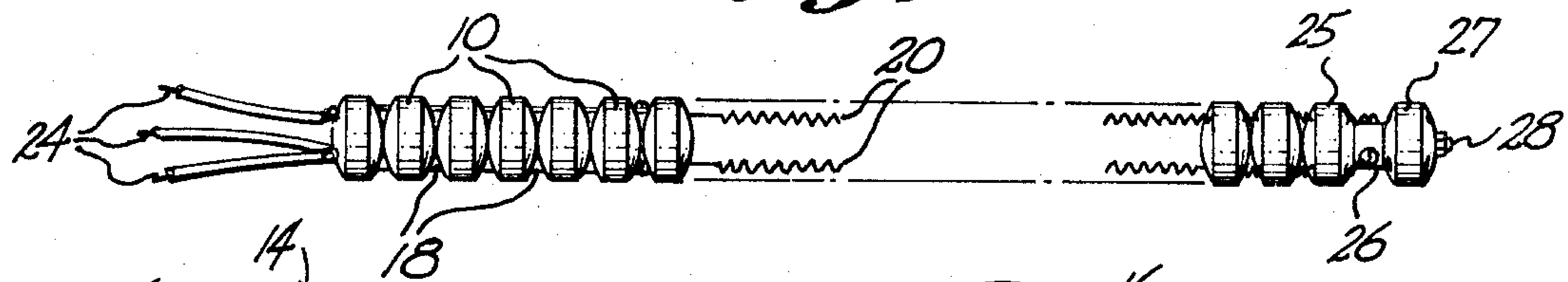
ARTICULATED IMMERSION HEATER

Filed April 1, 1968

Fig. 1.



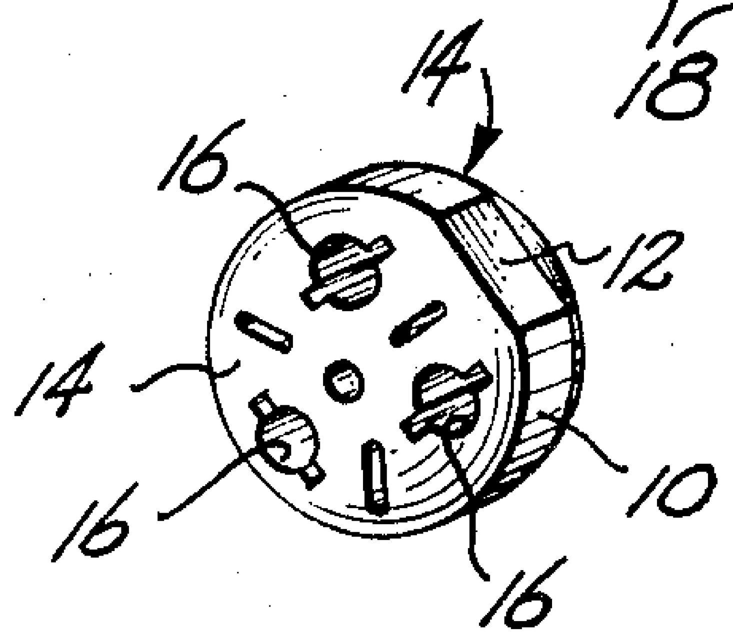


Fig. 2.

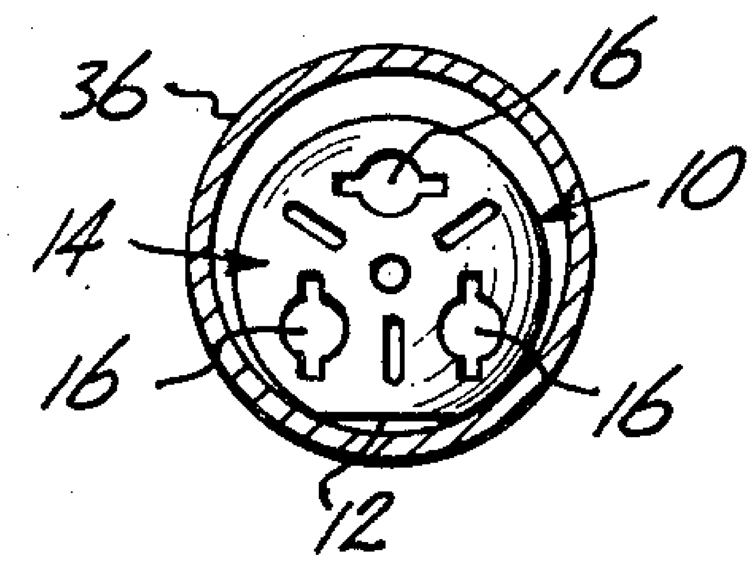
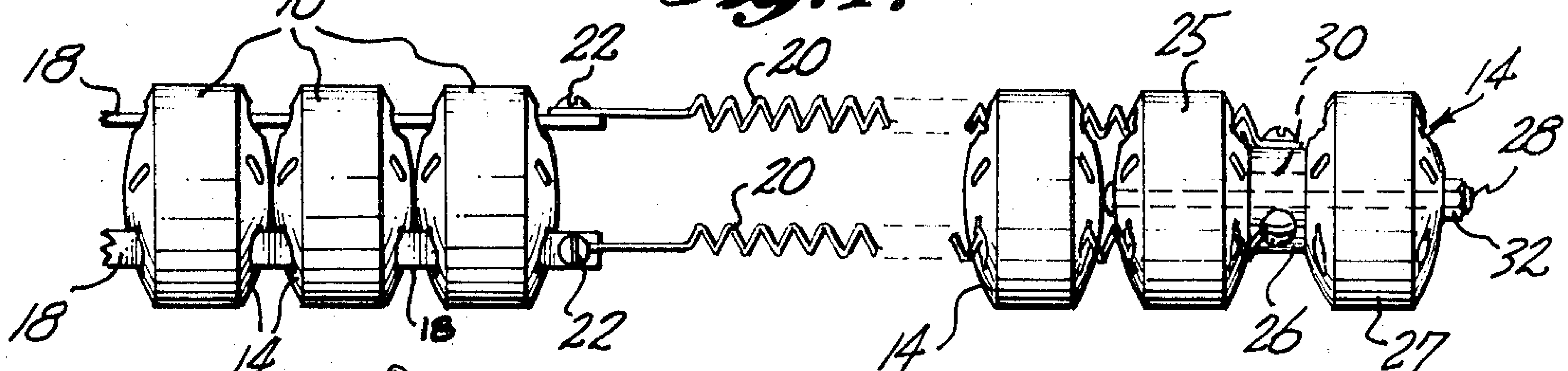


Fig. 3.

Fig. 4.



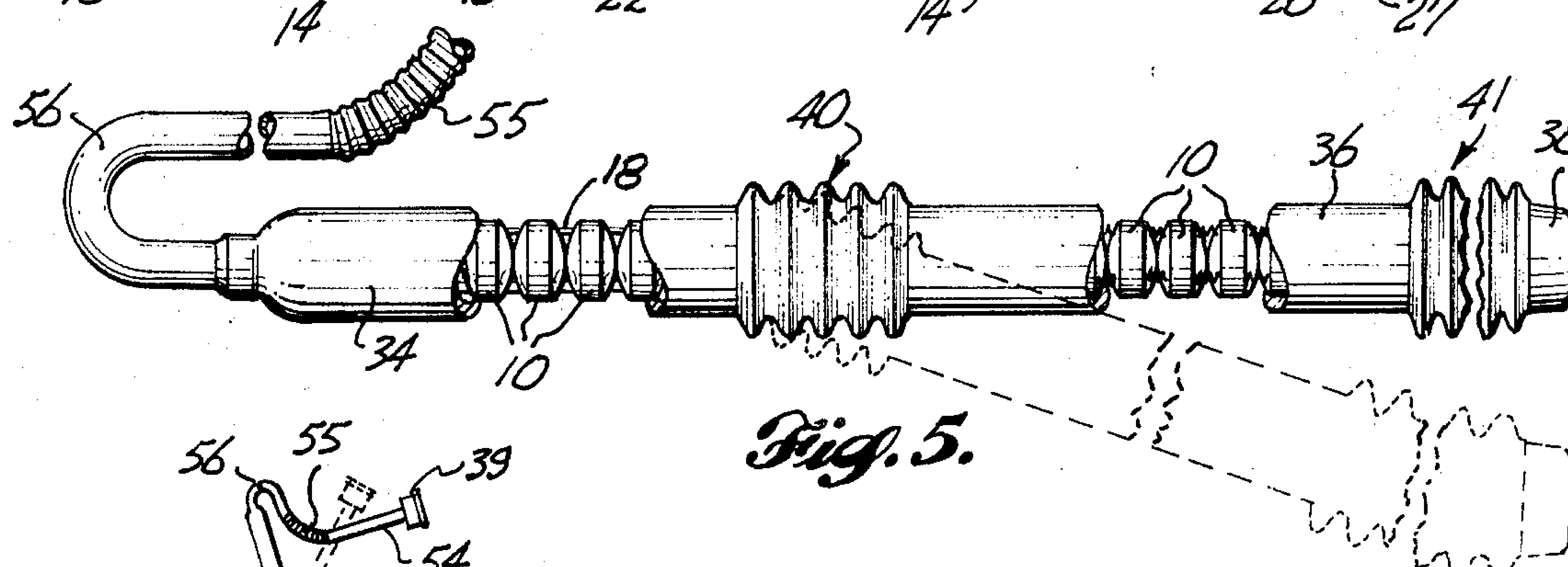


Fig. 5.

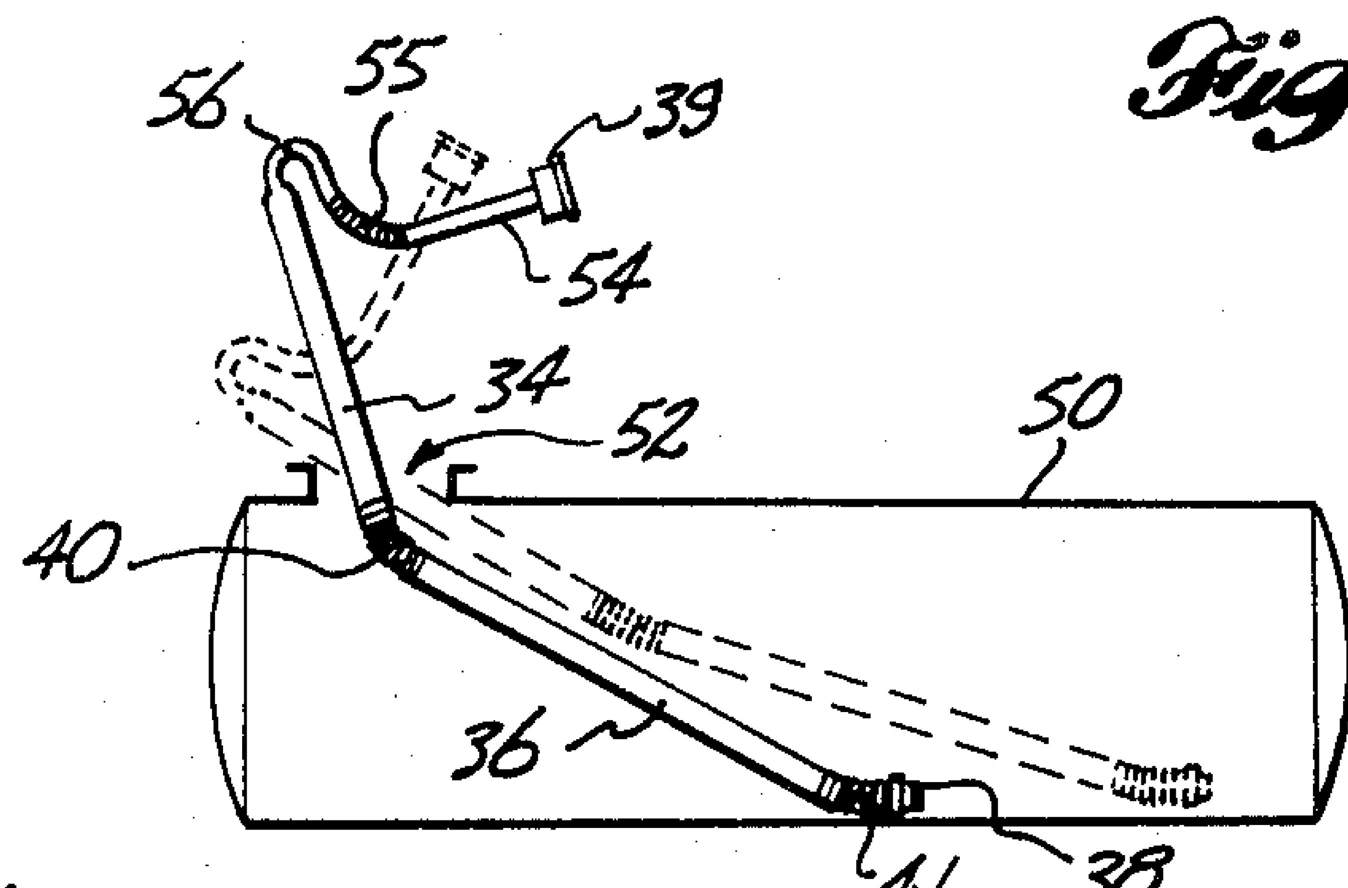


Fig. 6.

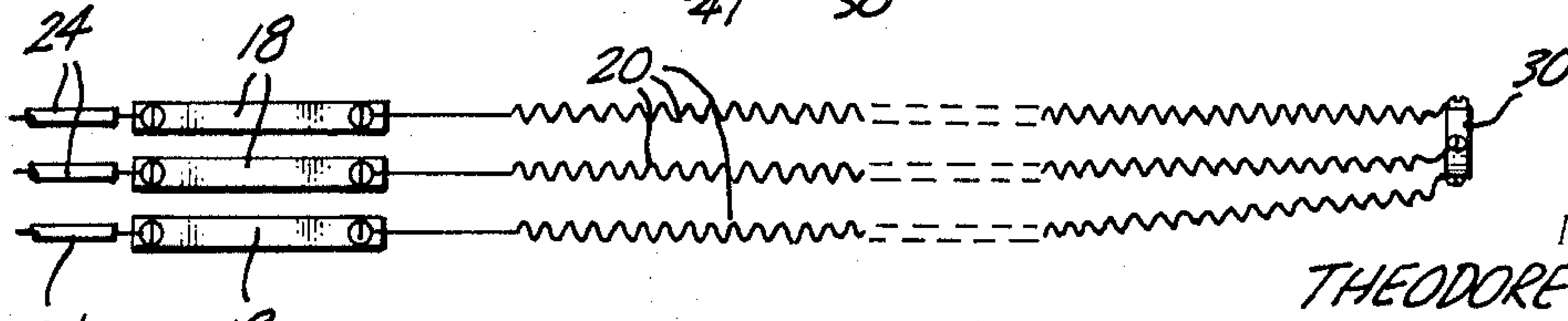


Fig. 7.

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ARTICULATED IMMERSION HEATER

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U.S. Cl. 219—310 1 Claim

ABSTRACT OF THE DISCLOSURE

A flexible heater element has a heater assembly, formed of an electric-resistance element threaded throughout and connecting together an elongated series of insulative blocks, fully encased in a sheath formed of at least two flexible tubular members intermediately connected in an articulated manner by a relatively short manually flexible joint member.

BACKGROUND

Long, high capacity electric immersion heaters are variously used to raise the temperatures of fluids contained in tanks and vessels. A typical installation occurs in the road building business in connection with heating road oils and the like. The installation of such heaters during manufacture of the tanks and vessels is desirable. However, their replacement or supplementation in the field, especially where the tank or vessel is underground or torch cutting and welding is impractical or unduly costly, presents substantial problems. One solution to the problem is to provide a lengthy, flexible heater unit that may be inserted through an access opening usual in such tanks and vessels in the upper areas. Such a heater is shown in my U.S. Pat. No. 2,888,546 where a fully flexible corrugated sheath was employed to encase a unidirectionally flexible electric resistance assembly. It has been found that due to the length of such shields, there is a practical problem of adequately degreasing the interior of the sheath. Also, inspection of the sheath, which is ordinarily manufactured from shaped metallic ribbons welded together, to determine that it is fluid-tight throughout its length is time-consuming and costly. And where the resistance is unidirectionally flexible but concealed within the flexible sheath the installers risk internal and hidden damage unless great care is taken to determine orientation of the heater unit at the point where flexure is desired.

PURPOSES

It has, therefore, been among the main objectives of this invention to provide a fluid-tight sheathed electric resistance heater unit which is universally flexible; which has flexibility provided at only those points where needed to effect installation through a side wall of an elongated tank or vessel; which is simple and economical to construct and install; and which may be installed by relatively unskilled workers in the field without resort to heating or special manipulation. These and other objects will become apparent during the course of the following description of a preferred embodiment of the invention.

IN THE DRAWINGS

FIG. 1 shows an elongated universally flexible assembly of insulated resistance elements, a portion being omitted for convenience of illustration;

FIG. 2 is a perspective view of an insulator;

FIG. 3 is a face view of an insulator as installed in a tubular sheath;

FIG. 4 is an enlarged portion of the assembly of FIG. 1;

FIG. 5 shows an articulated electric immersion heater unit according to this invention, portions being omitted for illustrative convenience;

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FIG. 6 shows a mode of installation of such an articulated heater unit in a vessel; and

FIG. 7 schematically shows a typical electric resistance element assembly.

DESCRIPTION

Insulator **10**, formed of ceramic or similar material, is generally circular in profile having a flat **12** which aids in assembly and has functions during use. The opposite faces **14** are convex and apertures **16** extend therebetween. Essentially the apertures **16** are round holes having diametrically opposed grooves, as shown in FIG. 2.

In an assembly of insulators **10**, as shown in FIG. 4, an initial few receive bars **18** to which the inner ends of spiral resistance elements **20** are attached as by screws **22**. Elements **20** are resilient lengthwise and may be expanded and contracted as the assembly is flexed. Elements **20** extend longitudinally of a long assembly of insulators and link them together in a flexible manner so that the convex faces **14** of adjacent insulators are in contact but may be misaligned as when the assembly is bent out of a straight line.

Supply wires **24** are conductively attached to the inner ends of bars **18**. The outer ends of elements **20** attach to a conductive collar **26** disposed between the last two insulators **25** and **27** of the assembly. Bolt **28** which axially passes through insulators **25** and **27** and intervening collar **26** as well as a small insulative collar **30**. Nut **32** on bolt **28** bears on the terminal insulator **27** and tightens together the components of the terminal assembly.

A fluid-tight articulated sheath encases an assembly, as described in the manner best shown in FIG. 5. Such a sheath comprises at least a pair of elongated inflexible tubes **34** and **36**, the latter being referred to as the outer tube and having a closed end **38**. Inner tube **34** may be threaded to receive a junction box or other fitting **39**. Tubes **34**, **36** are sequentially arranged and are coupled together in an articulated manner by a manually flexible joint section **40**. The flexible joint section may be formed integral with tubes **34** and **36**, or it may be separately formed and then integrated into the sheath assembly.

Joint section **40** has a length substantially less than the length of either of the tubes. The function of section **40** is to permit manual flexing of the sheath assembly with misalignment of the tubes **34**, **36** being restricted to joint section **40**. Thus, the length of the section need be only sufficient to permit tubes **34** and **36** to be misaligned up to about 45° with respect to each other.

Articulating joint section **40** may be either annularly or spirally corrugated metal of a thickness (about 0.020 to 0.040 inch) and structure and length permitting manual flexing, preferably without heating. Section **40** may be formed in situ in a mid-portion of a long tube or it may be separately formed and then welded in place between a pair of tubes **34**, **36**.

Flexure of joint section **40**, as well as flexure of the insulated resistance elements **20**, is universal. This means that the angular disposition of a component on one side of a bend occurring within joint section **40** may be in any radial direction with respect to the axis of the other component on the opposite side of the bend. When the sheath encases the resistance unit, bending of the latter and misalignment of blocks **10**, is localized in the area within section **40**. However, extensive and compressive forces within the coiled resistance elements is not so localized but is distributed in both directions from the point of bend. Thus, undue strain on the resistance elements through the area of a manually flexible joint **40** is avoided.

In FIG. 6 tank or vessel **50** is shown provided with an upper manhole or other access port usually located some distance from an end of the vessel. It is a practical impossibility to insert a rigid heater unit of length substantially the same as the interior length of vessel **50** through opening **52**. By providing an articulated heater unit, as described, an outer tube portion **36** may first be inserted and angularly disposed somewhat as shown. By bending the unit at joint **40**, the inner tube **34** then may be introduced while at the same time tube **36** is further advanced within the vessel **50**. Finally, a standpipe **54**, which may also include a flexible section **55** and a return bend portiton **56**, and is connected to junction box **39**, is disposed in the opening where it may be secured to receive power supplied to conductors **24** therein.

The invention has been described with reference to a unit comprising two elongated rigid tubes and one intermediate articulating coupler section **40**. Also on occasion to facilitate introducing the heater unit, the forward end may have a flexible section **41** adjacent the end closure **38**. It will be apparent to those skilled in the art that to accommodate certain circumstances the unit may have more than two rigid sections in which case an additional one or more manually flexible sections **40** will be employed. Other changes as in material, size and proportion and the like are contemplated.

What is claimed is:

1. The combination, comprising:

an elongated horizontal vessel to contain fluid to be heated and having an access port in the top side thereof;

an elongated immersion heater in said vessel, including:

a fluid tight sheath comprising at least two sequentially arranged inflexible tubes, coupled end-to-end by a universally and manually flexible joint section;

means sealing the remote end of said sheath;

an inflexible return bend coupled to the nonremote end of said sheath and associated with a standpipe disposed in said access port; and

flexible electric resistance heater means extending longitudinally of said sheath and having current supply conductors introduced through said standpipe and said return bend;

said heater sheath and return bend extending substantially the full length of the interior of said vessel and being longer than the radial distance from the most remote interior part of said vessel to the mouth of said access port.

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U.S. Cl. X.R.

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