Nov. 6, 1928. 1,690,994

D. U. POWELL

ELECTRIC HEATER

Filed Oct. 10, 1927 2 Sheets-Sheet 1

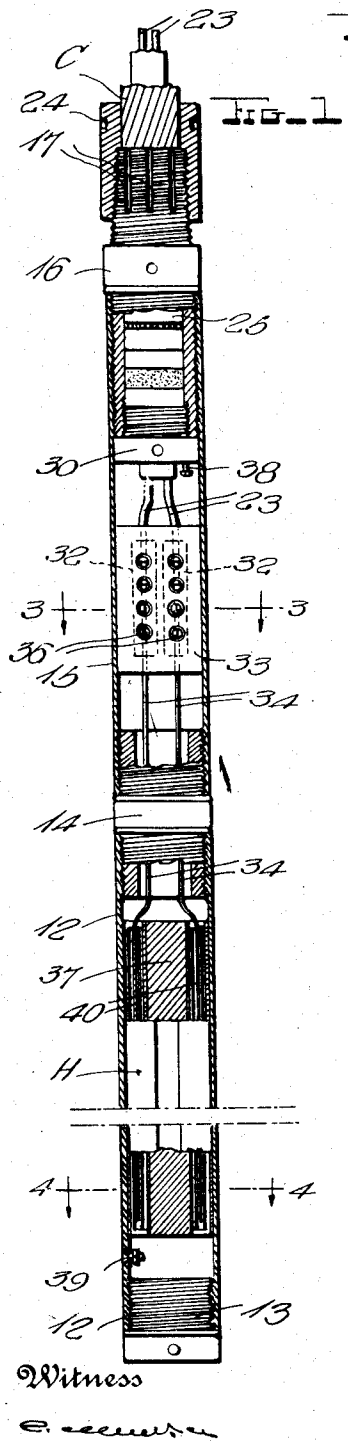


FIG. 1

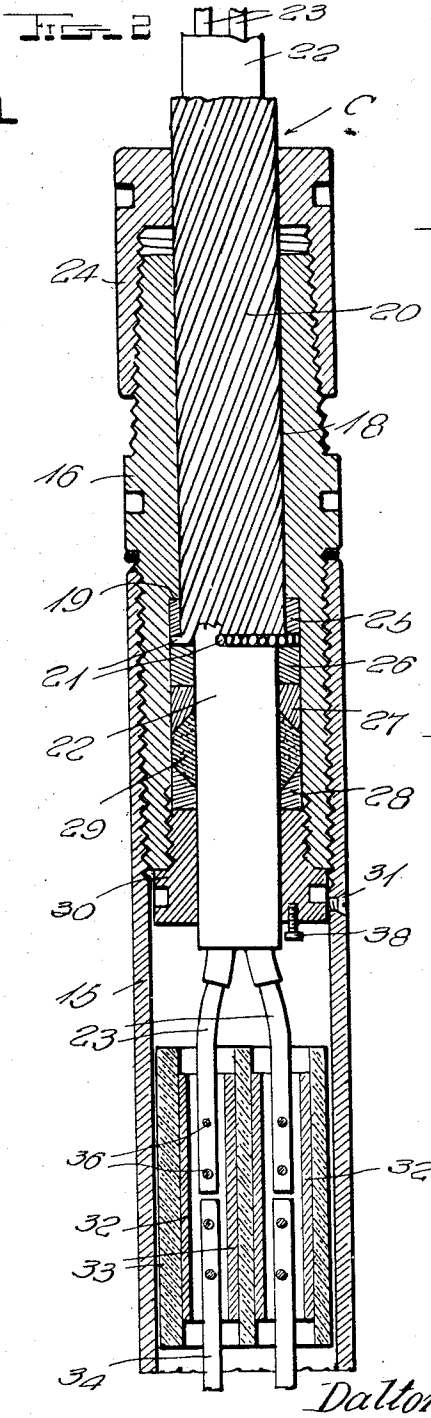


FIG. 2

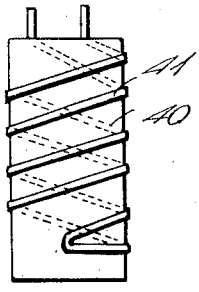


FIG. 10

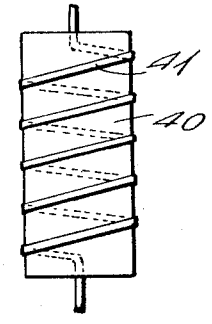


FIG. 11

Witness

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ELECTRIC HEATER

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Fig. 3

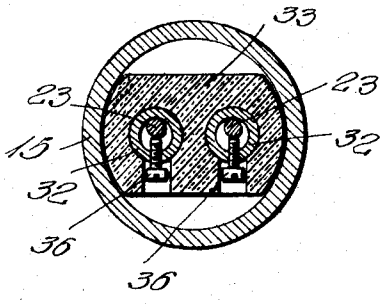


Fig. 9

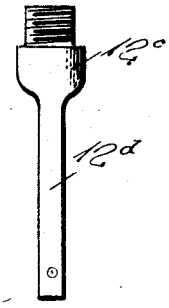
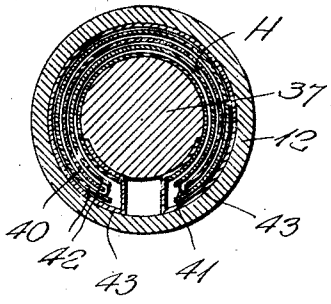
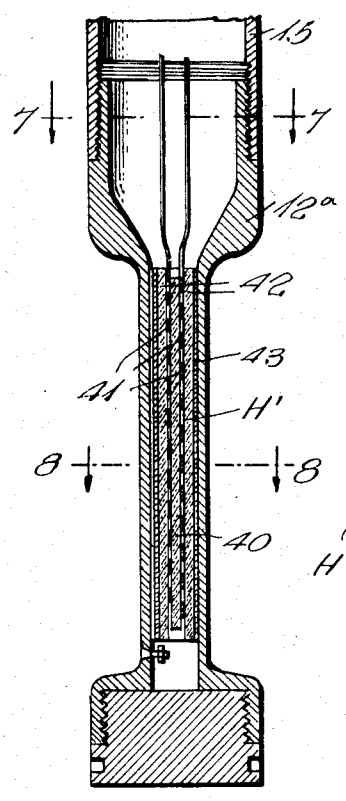


Fig. 4





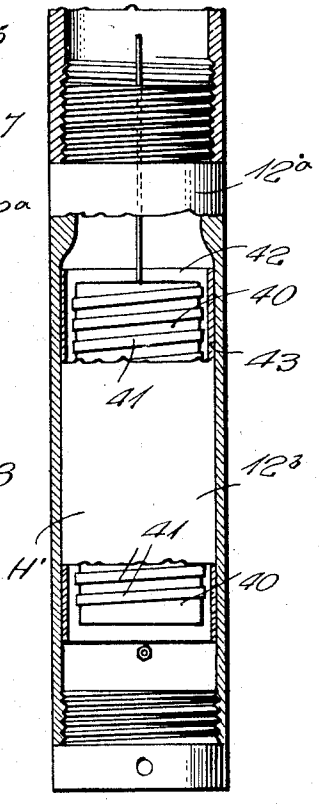


Fig. 5

Fig. 6

Fig. 7

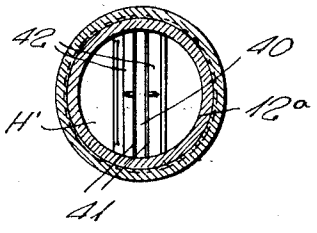
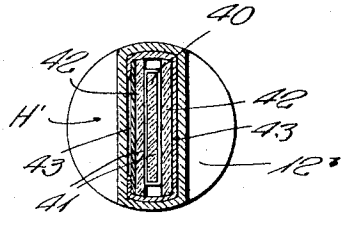


Fig. 8



Witness

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Patented Nov. 6, 1928. 1,690,994

UNITED STATES PATENT OFFICE.

DALTON U. POWELL, OF WOODSFIELD, OHIO, ASSIGNOR OF ONE-THIRD TO SAMUEL K. FRANK AND ONE-THIRD TO RAY L. DAVIS, OF WHEELING, WEST VIRGINIA.

ELECTRIC HEATER.

Application filed October 10, 1927. Serial No. 225,354.

The invention aims to provide a new and generally improved electric heater which may be advantageously used for a wide variety of uses, novel provision being made whereby no liquid or even moisture may enter the heater casing to produce any undesirable results.

The heater casing is equipped with a current-conducting cable, and further objects of the invention are to provide unique means for tightly securing this cable and the casing together; and to provide an effective packing around a portion of the cable to prevent possible entry of moisture or liquid.

Another object of the invention is to provide a sectional construction which may be easily and inexpensively manufactured and may readily be produced in different sizes without alterations as to details of construction.

Yet another aim is to produce a new and improved heating element for use in the casing, a novel process being employed to form a curved heating element, with an unusual length of resistance wire, should such an element be desirable.

With the foregoing and minor objects in view, the invention resides in the novel subject hereinafter described and claimed, the description being supplemented by the accompanying drawings.

Fig. 1 is a longitudinal sectional view partly in elevation showing one form of construction.

Fig. 2 is an enlarged longitudinal sectional view partly in elevation.

Figs. 3 and 4 are transverse sectional views on the correspondingly numbered lines of Fig. 1.

Figs. 5 and 6 are sectional views at right angles to each other showing a modified form of construction, portions of Fig. 6 being in elevation.

Figs. 7 and 8 are transverse sectional views on lines 7—7 and 8—8 of Fig. 5.

Fig. 9 is a side elevation showing a still further modified form of construction.

Figs. 10 and 11 are side elevations showing different ways in which the heating element may be constructed.

In the form of construction shown in Figs. 1 to 4, 12 denotes a lower tube closed at its lower end by a plug 13 and fluid-tightly connected at its upper end by an appropriate coupling 14, with an upper tube 15. Threaded into this upper tube, is a substantially cylindrical body 16 whose upper end constitutes a neck which is longitudinally tapered and is rendered contractible and expansible by providing it with longitudinal slits 17. A passage 18 extends longitudinally through the body 16 and has its inner end portion of greater diameter than its outer end portion, providing a shoulder 19 which faces inwardly. A current conducting cable C passes into the passage 18 and in the present showing, embodies a metallic armor 20 having its inner end bent laterally outward as at 21 between the shoulder 19 and the inner end of the body 16. This cable also embodies a sheath 22 of lead or other desired material disposed within the armor 20 and projecting inwardly beyond the same, the current conducting wires 23 being housed within said sheath and appropriately insulated from each other.

A nut or cap 24 is threaded upon the neck-forming upper end of the body 16 and is internally tapered for the purpose of tightly contracting the neck around the cable C to assist in establishing a tenacious connection between the heater casing and the cable. The outwardly bent end 21 of the cable armor is also tightly clamped to complete this tenacious connection, and provision is made for tightly packing the space between the sheath 22 and the wall of the passage 18, preventing entrance of moisture or liquid.

In the present showing, a clamping collar 25 is disposed in the inner portion of the passage 18, between the shoulder 19 and the laterally bent armor end 21, and a second clamping collar 26 is co-operable with said collar 25 in clamping said armor end 21. A packing-contracting collar 27 surrounds the projecting sheath end 22 and contacts with the collar 26, a second packing-contracting collar 28 surrounds said sheath end 22 in spaced relation with the collar 27, an appropriate packing 29 surrounds said sheath end 22 between the two collars 27—28, and a packing-compressing device 30 is threaded into the inner end of the passage 18. When this device 30 is tightened, it forces all of the annular means 28—29—27—26—25 toward the shoulder 19. Hence, the collars 25—26 are made to tightly hold the outwardly bent armor end 21, and the collars 27—28 are caused to compress the packing 29 causing it to tightly engage the sheath end 22 and the wall of the passage 18.

Appropriate locking means such as a screw

31 may be provided for holding the device 30 in adjusted position.

The wires 23 enter metallic coupling tubes 32 which are mounted in an insulating and heat-resisting block 33 in the tube 15. Other conducting wires 34 extend into these tubes and lead to an electric heating element H in the tube 12, the wires 23—34 being secured in the tubes 32, by binding screws 36. The heater H is of substantially cylindrical form and to add to the efficiency of this heater, a metallic core 37 is preferably provided in the same. This heater is preferably constructed in a manner hereinafter described.

The heater shown has both terminals at its upper end and is used in a two-wire circuit. If such a heater is to be used and the current returned through a metallic portion of the cable C instead of through one of the wires 34, one terminal of the heater may be connected to the device 30 by a binding screw 38, or a ground connection could be provided with some other metallic part of the heater casing.

If the cable C be provided only with one wire and the terminals of the heater H be disposed one at the upper end of said heater and one at the lower end thereof, said wire may be connected with the upper terminal and the lower terminal may be connected with the tube 12 by an appropriate binding post or the like such as that indicated at 39 in Fig. 1. Figs. 5, 6, 7, 8 and 9 show the provision which may be made for using a flat heater H′ instead of a cylindrical heater. In Figs. 5, 6, 7 and 8, a tube 12^a having a flat portion 12^b, is provided for the heater H′, the upper end of this tube being threaded directly into the tube 15 if desired, instead of using a coupling such as 14. With the exception of the flattened portion 12^b and the provision for connecting the tube 12^a with the tube 15, this tube may be considered as substantially identical with the tube 12.

The tube 12^c shown in Fig. 9 is very similar to the tube 12^a but its flattened portion 12^d may be closed by a plate or the like welded in place, instead of enlarging said end and closing it with a plug as in Figs. 5 and 6.

In forming either the heater H or the heater H′, I make use of a central strip of mica or other appropriate insulating material 40. Around this strip, I wrap ribbon wire 41 so as to provide reaches of this resistance wire at opposite sides of said strip, and the terminals of the wire may be both disposed upwardly as in Fig. 10, or one upwardly and one downwardly as in Fig. 11. Against the outer sides of the above-named reaches of the wire 41, I place additional strips 42 of mica or other appropriate insulating material. Then, the three strips 40—42 and the resistance wire 41 are encased in a thin metal casing 43 to retain them tightly assembled. All of these assembly steps are performed while the strips 40—42 are in flat form, and they are permitted to remain in this form if a flat heater is to be produced, such as that illustrated in Figs. 5 to 8. However, if a curved or cylindrical heater such as H is to be produced, the entire assembly formed by the parts 40—41—42—43, is rolled or otherwise curved after such assembly is complete. Thus, the desired curved or cylindrical formation is imparted to the heater and it will be observed that such heater possesses resistance reaches near both its inner and outer peripheries, so that its efficiency is much greater than can be obtained from cylindrical heaters in which an insulating core is provided, around which the resistance wire is merely wrapped, providing no resistance wire at the inner periphery of such core.

The invention is of great advantage for heating oil wells to increase production by dissolving at any depth, the paraffine and other gummy substances existing in wells. This heater may be used both for complete immersion and as a space heater. It will be observed that the cable C will advantageously carry the entire weight of the parts connected with its lower end, serving also to conduct current to the heater. Any entrance of oil or the like into the heater casing is prevented by the novel packing means and it will be observed that such means also acts to some extent to provide an effective weight supporting connection between cable and casing. A cable such as that shown is preferably employed, but in some uses of the invention, cables provided with coverings of non-metallic materials may be used and when this is done, the armor clamping means such as 25—26, may possibly be replaced with additional packing means.

The invention is rather simple and inexpensive, yet is practical and advantageous, not only from the standpoint of use, but from a manufacturing and commercial standpoint.

On account of the excellent results obtainable from the details disclosed, they are preferably followed. However, within the scope of the invention as claimed, numerous variations may be made.

I claim:—

1. In an electric heater, a casing for a heating element, said casing being provided with a longitudinally split contractable and expansible neck to receive a cable for conducting current to the heating element, said neck being tapered at its outer end and externally threaded, and an internally tapered nut threaded on said tapered neck portion for tightly contracting it around the cable.

2. In an electric heater, a casing for a heating element, said casing being provided with an outwardly projecting contractable neck, with a cable-receiving passage extending longitudinally through said neck, and with an inwardly facing shoulder between the ends of

said passage, means for contracting said neck tightly around the cable, cable-surrounding packing means in the inner portion of said passage, and a packing compresser in the inner end of said passage for forcing the packing toward said shoulder.

3. In an electric heater, a casing for a heating element, said casing being provided with a cable-receiving passage, a cable extending into said passage for conducting current to the heating element, said cable having an armor whose inner end is bent outwardly in the passage and being provided also with a sheath within the armor projecting beyond said outwardly bent end of said armor, annular means in said passage for clamping said outwardly bent armor end, additional annular means in said passage surrounding said projecting portion of said sheath and embodying packing means, a stationary shoulder in the passage for limiting movement of said annular means in one direction, and a thrust device mounted in said passage for forcing said annular means toward said shoulder.

4. In an electric heater, a casing for a heating element, said casing being provided with an outwardly projecting contractable neck, with a cable-receiving passage extending longitudinally through said neck, and with an inwardly facing shoulder between the ends of said passage, a cable passing into said passage and having an armor whose inner end is bent outwardly and disposed between said shoulder and the inner end of the passage, said cable being provided also with a sheath which projects inwardly beyond said bent armor end, annular means in the passage for clamping said outwardly bent armor end, additional annular means in said passage surrounding said projecting portion of said sheath and embodying packing means, means in the inner end of said passage for forcing said annular means toward said shoulder to operative position, and means for contracting said neck around the cable armor.

5. An electric heater comprising a tube closed at its lower end and internally threaded at its upper end, a tubular cylindrical body having its lower end threaded into the upper end of said tube, the upper end of said body being split and tapered for contraction tightly around a current conducting cable, a nut threaded on said split tapered end for contracting said end, cable-engaging packing means in said body, and means for compressing said packing means to cause tight contact thereof with the body and cable.

In testimony whereof I have hereunto affixed my signature.

DALTON U. POWELL.