Aug. 7, 1956 A. G. HERON 2,758,194

FLEXIBLE HOSES

Filed April 27, 1954 2 Sheets-Sheet 1

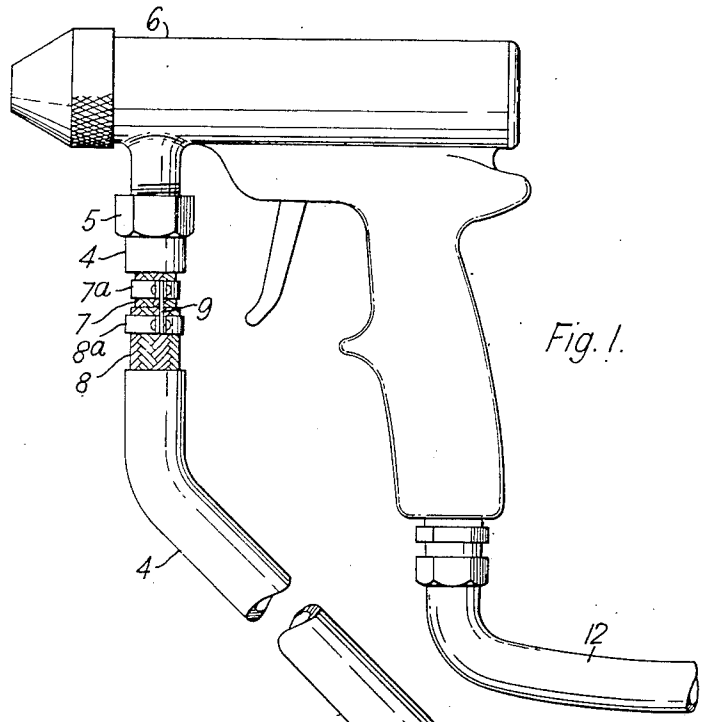


Fig. 1.

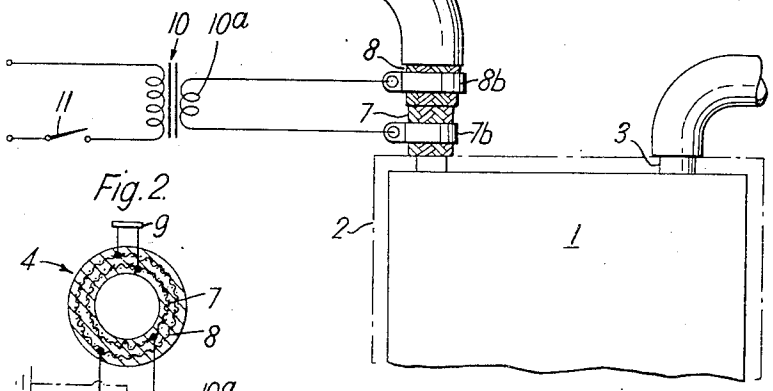


Fig. 2.

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Aug. 7, 1956 A. G. HERON 2,758,194

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Filed April 27, 1954 2 Sheets-Sheet 2

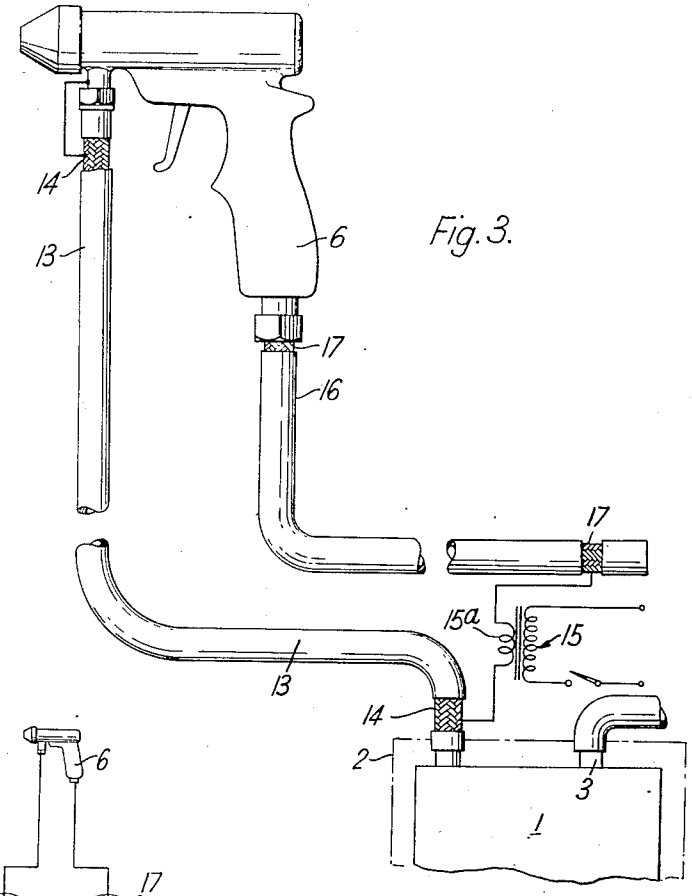


Fig. 3.

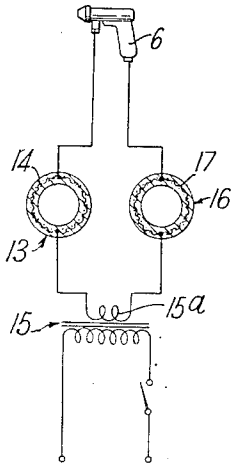


Fig. 4.

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FLEXIBLE HOSES

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Application April 27, 1954, Serial No. 425,998

Claims priority, application Great Britain May 5, 1953

2 Claims. (Cl. 219—46)

This invention relates to electrically heated flexible hoses of the kind comprising conductor means associated with the hose, and adapted to be connected to a low voltage supply source.

If such a heating hose could be made which would be reliable under all conditions of use, it would fulfill a great need on account of the many uses it would have, one of which, for example, is the conveying of viscous paint for coating a ship's hull. Hence a number of proposals have been made, but none, apparently, with much success.

In some proposals, the hose comprised heating resistance wires in the form of helically wound heating elements, or an electric heating resistance cable wound round the hose, arranged in passages formed in the wall of the hose, or incorporated in the hose. In other proposals, the hose was a flexible metal tube of helical form or of articulated sections. The conductors were variously connected to the usual supply source or to the low voltage winding of a step-down transformer.

In the hoses using the usual high operating temperature resistance wire, owing to the small cross section of the wire, the conductor was weakened, and soon fractured; and even in the thicker low voltage heating conductors, as there was only one conductor, these were also unreliable owing to their liability to fracture under mechanical stress during use. In the flexible metal tubing, in addition to the necessity of using return conductors, with their disadvantage of unavoidably fouling adjacent objects, these had the further disadvantage that, owing to the varying contact areas between the adjacent turns or articulations resulting from moving the hose from time to time and so changing its curvature, the resistance of the hose was always changing, so that effective control of the heat generated was not possible.

The object of the present invention is to provide a form of flexible electrically heated hose of the kind referred to which will have a constant resistance and thus ensure a uniform heat input, without risk of shock to the operator, and at the same time possess a mechanical robustness which will stand up to all the normal hard wear and tear to which such a hose is necessarily subjected, without risk of fracture.

According to the invention, the conductor means consist in metallic braiding which forms part of the structure of the hose.

Owing to the large cross-sectional area resulting from the multiplicity of wires or strips of which the braiding is made, the amount of heat required is distributed over this large area, so that uniform heating of the braiding is effected at a temperature only a little above that required for the hose. Hence conductor means are provided which are able to withstand the passage of high currents without risk of overheating and burning out; and, in view of the low voltage of the current, without risk of shock to the operator. Again, the flexing of the hose does not vary the resistance of the braided conductor means for the reason that its wires or strips are connected in parallel. Further, the braiding imparts the requisite mechanical

strength to the hose, and so renders it capable of very hard usage without risk of fracture.

Where a single hose only is to be used, two braidings insulated from each other are applied, the ends of the braiding at one end of the hose are connected, for example by sweating, to a ferrule while the other ends of the braiding are respectively connected to the ends of the secondary winding of the transformer. The single form of hose lends itself for spraying with hot water, for example where the spray has to be applied at a distance from the water supply.

Where two hoses are to be used, as in the spraying of a substance, one braiding only need be used, the braidings on the two hoses being connected at one end, for example by the metal portion of the spraying gun, while at their other ends the braidings are connected to the ends of the secondary winding of the transformer. In this double hose form, the air in the one hose is also heated and so helps to maintain the liquid condition of the coating substance as it is sprayed.

The invention will now be described by way of example with reference to the accompanying semi-diagrammatic drawings which show devices for spraying a normally solid coating substance at ambient temperature.

In the drawings:

Fig. 1 shows an arrangement in which the coating material hose incorporates two conductors in the form of two coaxial braided sleeves.

Fig. 2 is a cross section on an enlarged scale of the hose showing its electrical connections.

Fig. 3 shows an arrangement in which the coating material hose and the air hose each incorporates a single conductor in the form of a single braided sleeve.

Fig. 4 is a cross section on an enlarged scale of the two hoses of Fig. 3 with the electrical connections.

Referring to Figs. 1 and 2, the coating substance is placed in a container **1** which is surrounded by a drum heater **2** according to that described in British Patent No. 713,653 and shown diagrammatically in chain lines. The drum heater is thermostatically adjusted so that the coating substance is raised to the required temperature. The compressed air is introduced through an inlet **3** at the top of the container **1** according to normal practice so as to force the now liquid substance through a hose **4** having its outer end connected by means of a union nut **5** to a spraying gun **6**, the hose **4** incorporating two coaxial sleeves of braided electrical resistance metal, **7**, **8** insulated from each other. The ends of the braidings adjacent the gun **6** are electrically united by clips *7a*, *7b* on each braiding connected by a strip **9** riveted to the strips, while the inner ends of the braidings are respectively connected through clips *7b*, *8b* to the ends of the low voltage secondary winding **10***a* of a step-down transformer **10** whose primary circuit is controlled by a switch **11**. The spraying gun **6** has its air inlet connected by the usual hose **12** to an air supply (not shown). The coating substance is thus maintained at the desired temperature and therefore liquid condition right up to the gun, so that spraying thereof may be carried out in the normal way. An additional advantage deriving from the use of two coaxial sleeves is that the heat gradient from the outer to the inner portion of the hose wall is not so steep as with a single sleeve, so that the thermal stresses on the hose wall are reduced.

By connecting the mid-point of the secondary winding to earth as shown in chain line at **10***b*, in Fig. 2, the gun which is connected to the mid-point of the secondary output, will have no potential to earth, so that it may be laid with safety on earthed surfaces such as a ship's hull.

In the form shown in Fig. 3 the coating substance flows through a single braided hose **13** whose braid **14** has its one end connected to one terminal of the secondary

winding 15*a* of a step-down transformer 15. The spraying gun 6 has its air inlet connected to a second hose 16 with which is incorporated a single braided heating conductor 17, the outer end of which is connected to the gun 6 and its inner end to the other terminal of the transformer secondary winding 15*a*. The braidings 14 and 17 are thus connected through the gun 6. The coating substance and the air are thus maintained at the desired temperature until the former is actually sprayed.

If desired the compressed air may be pre-heated prior to passing through the hose 16, so that the air in the compressed air hose—which is already heated by its conductor—is maintained at the desired temperature as it emerges from the spray gun.

The material of the hose may be rubber or polyvinyl chloride or any known flexible plastic capable of withstanding the necessary temperatures.

Other uses may be to conduct high temperature fluids without the use of lagging; the use in refrigerators for conveying defrost or other water from the refrigerator without freezing.

I claim:

1. Flexible hose comprising a hollow tubular structure, wherein the hose structurally includes metallic braiding in the wall thereof forming an electrical conductor adapted to be connected to a source of low-voltage electrical supply, such as the secondary winding of a step-down transformer, whereby any desired wattage may be introduced into the said conductor; said conductor comprising a pair of electrically insulated braidings in the wall of the hose, means at one end of the pair of braidings electrically connecting the pair, and means at the other end of the pair of braidings for respectively connecting same to the said ends of the secondary winding of said transformer.

2. In a flexible hose as set forth in claim 1, said hose being formed of separate sections each carrying one said braiding, the braidings on the two sections being electrically connected at one end, while the other ends of the braidings are respectively connected to the ends of the secondary winding of the transformer.

References Cited in the file of this patent

UNITED STATES PATENTS

926,695	Frost	June 29, 1909
964,722	West	July 19, 1910
1,105,795	Johnston	Aug. 4, 1914
1,386,912	Trimm	Aug. 9, 1921
1,575,152	Di Battista	Mar. 2, 1926
1,733,250	Davis	Oct. 29, 1929
1,809,714	Mathews	June 9, 1931
2,529,914	Challener	Nov. 14, 1950