

June 17, 1941.

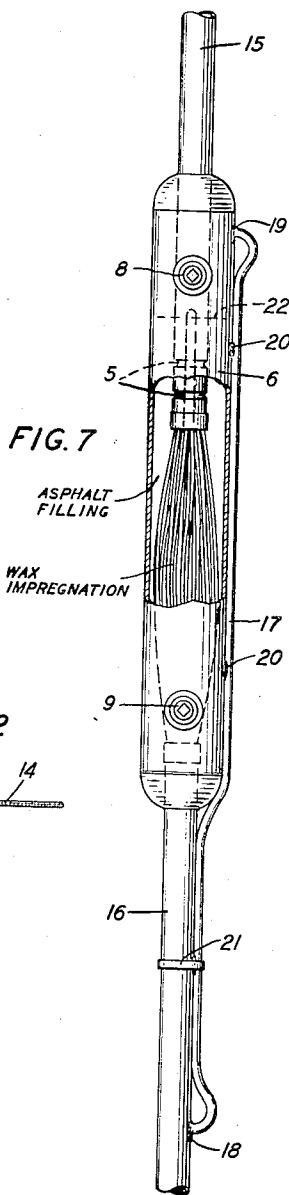
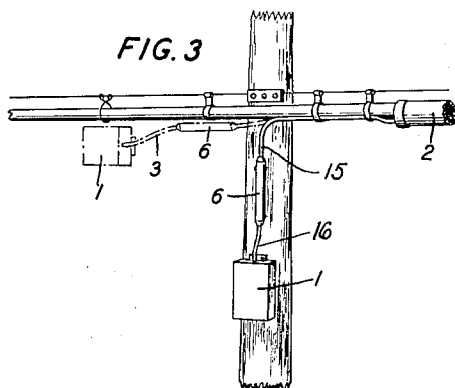
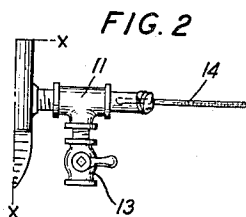
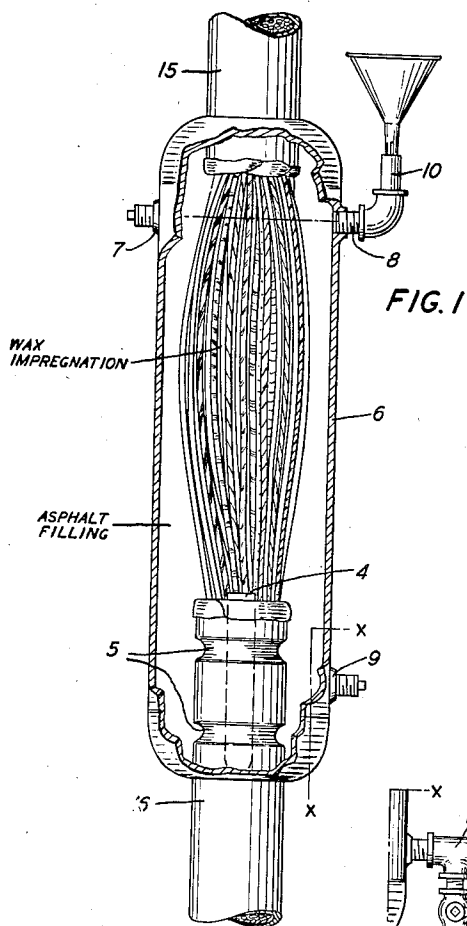
H. BAILLARD

2,246,286

CABLE PLUG

Filed July 8, 1939

2 Sheets-Sheet 1



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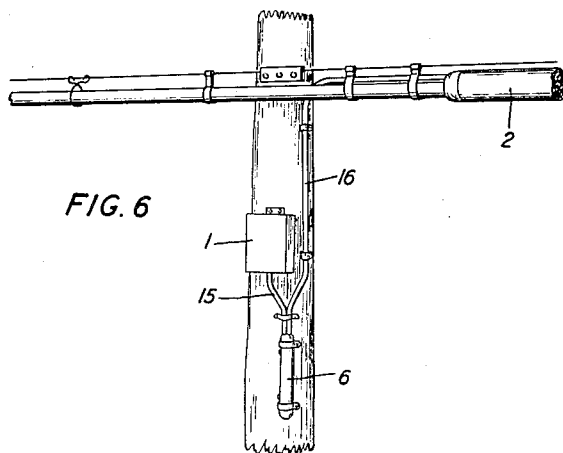
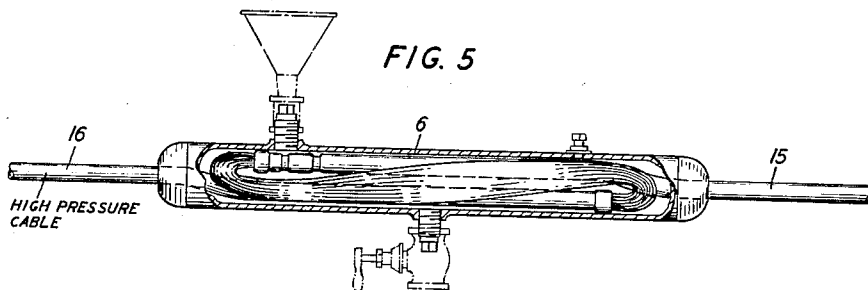
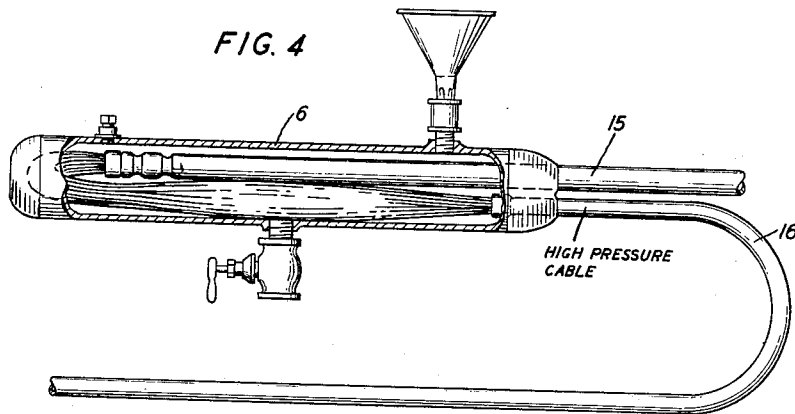
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,246,286

CABLE PLUG

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Application July 8, 1939, Serial No. 283,339

3 Claims. (Cl. 174—23)

This invention relates to methods of and means for sectionalizing multiple conductor communication cables or similar cables which comprise a plurality of insulated conductors covered with a gas-tight sheath; more particularly, it relates to cables having a multiplicity of conductors insulated with paper pulp or tape or similar fibrous material.

In the patent of Baillard and Pike No. 2,168,757 granted August 8, 1939, there are described certain cable plugs and methods of manufacture thereof which have been found desirable for use. The present invention has for an object to provide forms of plugs and methods of production thereof to fulfill requirements of use for conditions of use or conditions of manufacture under which it has been difficult to follow the procedure described in said patent.

A general object of the invention is to provide forms of plugs convenient to produce and will function satisfactorily when made or used or both made and used in a vertical position, that is, a position in which the long axis of the plug is vertical.

A further object is to provide plugs and methods of construction suitable for branch cables.

As described in said patent, the plugs are manufactured as well as used in a general horizontal position. It has been found that departures from previous methods of manufacture and variations of plug design are necessitated where the plugs are to be used in a vertical position. The general principles and details of plug manufacture, as described in said patent are applicable to production of plugs described herein. In accordance with said principles each plug when completed contains in the upper portion thereof a small space which becomes filled with air or gas which, in general, assumes the pressure of the gas in the cable section of highest gas pressure immediately adjacent to the plug. It is believed that the gas pressure in the plug arrives at the value which it finally assumes as a result of bubbles of gas passing into it. The present invention is based in part on the general discovery that it is not desirable for these bubbles of gas to traverse a long path through the asphalt filling of the plug in proceeding from the open end of the "high pressure" cable which terminates in the plug to the space or chamber in the top of the plug. The designs of plug herein described and the methods of manufacture are so chosen as to reduce such path or paths to a minimum distance.

In said prior patent there are described certain materials used in plug manufacture and con-

struction and certain procedures which in the main are applicable for producing plugs according to the present specification.

Thus, there is described a type of paraffin wax of high melting point used to thoroughly impregnate the insulation of conductors within the plug and a procedure for using said wax. When referred to herein reference is made to the same type of wax and except for the modifications noted the procedure is the same.

There is described in the prior patent a type of asphalt filling material and reference herein to asphalt signifies the same type of material.

Cable sleeves, core pins, cotton cord for loosely binding the ballooned conductors, and a ring tool for beating rings into the cable sheath may be employed for constructing the plugs described herein in the manner described in the prior patent. The dimensions, construction, and use of these elements may necessarily be modified in accordance with the dimensions of the particular cable for which a plug is to be made and in some cases, particularly in the case of cables with relatively few conductors, the core pin may be omitted.

A feature of the present invention comprises plug constructions adapted for toll entrance cables, and other plug constructions adapted for sealing off cables at distribution terminals, and other constructions for special applications where both cable sections must emerge from the same end of the plug, as well as plug constructions designed for manufacture, or use, or both under limitations of space or position, or both, and adapted to connect a cable section under pressure with another cable section either not under pressure at all or under a lower pressure.

In the appended drawings:

Fig. 1 is a diagrammatic cross-sectional view of one form of plug in an incomplete stage;

Fig. 2 illustrates a modified attachment to be located at the right of the line X—X of Fig. 1;

Fig. 3 illustrates diagrammatically in dotted lines the position in which such a plug may be constructed horizontally when space permits and in full lines the final position of the plug in use;

Fig. 4 illustrates diagrammatically an incomplete plug and a method of manufacturing another type of plug in which both cable sections emerge from the same end of the plug;

Fig. 5 illustrates an incomplete plug and a method of manufacturing another type of plug in which pressure is applied to the cable at only one end of the plug;

Fig. 6 illustrates the application in position of a plug according to Fig. 4; and,

Fig. 7 illustrates a type of plug in which a hermetically sealed by-pass pipe proceeds from the cable at the lower end of the plug externally of the plug into the upper part of the plug at or adjacent to the gas-filled space which forms therein at the top.

Fig. 3 may also be taken to illustrate the position of use of a plug constructed in a horizontal position.

In manufacturing any plug according to Fig. 4 or Fig. 5, it must be assumed that adequate extra length of cable is available to constitute the portion within the plug sleeve whereas the plugs in accordance with Fig. 1 or 7 may be utilized where no extra length of cable is available.

The reasons necessitating manufacture or use of a plug in vertical position may relate to considerations of space or considerations of the location of the plug which render it inconvenient to produce or use it in horizontal position. Except to note that such considerations exist under various circumstances, it is unnecessary to further dwell upon the matter. Plugs of this type may be utilized for mounting in the open air on pole lines or in underground locations as the necessity of the case may demand.

It will be noted from what follows that all of these plugs have the common feature that the path from the high pressure end of the cable to the gas-filled space which forms in the top of the plug is relatively short or, in any case, the portion of it extending through the asphalt filling is short or non-existent.

With reference now to Figs. 1 and 3, let it be assumed that the plug is to be installed between a terminal box 1 and a main cable 2 in a small section 15-16 of cable which proceeds from the main cable to the terminal box. Gas pressure is to be maintained in the main cable 2 and the portion 15 of small cable but the end 16 of the small cable next to the terminal box may be at the lower pressure or atmospheric pressure. Let it also be assumed that there is room and a convenient location and that other considerations permit the plug to be manufactured in the horizontal dotted line position in Fig. 3. Under such circumstances the low pressure end of the cable is provided with a core pin 4 and rings 5 beaten into the sheath. The high pressure end of the cable terminates within the plug sleeve 6 without either the core pin or rings. Although these could be provided, they are generally unnecessary. The high pressure end of the cable enters the plug from the top and terminates only a short distance from the top of the inner portion of the plug.

Openings 7, 8 and 9 are provided in the plug in the positions illustrated or other suitable positions and the manner of impregnating such a plug with wax and draining it and filling it with asphalt in a horizontal position is generally similar to the method described in the prior patent above referred to. Furthermore, the cable conductors are ballooned and preferably wrapped with light rope or cord in the manner described in the prior patent, although such cord has been omitted from the drawings to simplify the drawings. The cable sheath at the high pressure end as stated above projects into the sleeve 6 no more than two or three inches. Immediately after the plug is complete and after filling with asphalt, the plug is moved to the vertical position shown in full lines in Fig. 3. It is desirable that this be

done while the asphalt is still highly fluid so that it may adjust itself to the new position before it has been chilled to the solidification point.

Referring to the same Figs. 1 and 3, let it be assumed that it is necessary for reasons of space or convenience, or because the cable terminal cannot be dismantled, to construct the plug in a vertical position. In such case an angular attachment 10 is used for pouring wax through the plug in order to impregnate it and the wax is allowed to drain off through an angular attachment shown in Fig. 2 which replaces the portion of the right of the line X-X in Fig. 1. The angular fitting 11 of Fig. 2 is specifically made with the usual valve 13 constructed to allow the insertion of a thermometer 14, with the stem taped into the fitting. The use of the thermometer is essential in order to determine the temperature of the wax passing through the sleeve in order to insure that the wax does not solidify within the sleeve, as well as to insure that it is kept at a proper impregnating temperature during the impregnating operation. In such case, after the impregnating operation has been finished, the plug is properly drained through the opening 9. After pouring some asphalt through the plug to clear out most of the residual wax in the bottom of the plug, the opening 9 is sealed with a screw-threaded plug thoroughly treated with white lead to form an air-tight seal. The upper openings 7 and 8 are left open and the asphalt is poured in by means of a funnel fitting into the angular attachment 10 until the plug is filled as indicated by an overflow at the opening 7. The openings 7 and 8 are then hermetically sealed with screw-threaded plugs and the cable plug is completed.

Fig. 4 illustrates a plug which may be constructed in horizontal position for use vertically under circumstances where both cable sections must enter the same end of the plug, specifically into the top thereof. The cable sleeve 6 in this case is of sufficient diameter so that both the low pressure end 15 and the high pressure end 16 of the cable are sealed into the same end thereof by wiping an air-tight joint between the sleeve and the cable sections. The sheath of the high pressure cable section terminates just within the sleeve near the end which is to be the top thereof and the low pressure end 15 extends to a point near the bottom of the plug. The sheath is stripped off the cable for a sufficient length to allow the ballooned conductors to be bent back upon themselves in the end of the plug which is to constitute the bottom. The manner of impregnating, filling, and sealing such a plug as illustrated in Fig. 4 will be understood from a perusal of the prior patent above referred to. Immediately after being finished and before the asphalt has lost its liquidity the plug should be swung into the vertical position which it will occupy during use.

Occasionally it may happen that the high pressure cable section must enter the plug at the bottom and the plug is to be made for use in a vertical position. The plug is then made in accordance with Fig. 5 in which the left-hand cable section 16 is the high pressure section and the right-hand section 15 is the low pressure section. The high pressure section of the cable is extended into the plug practically the full length thereof with the sheath intact and the ballooned conductors are bent back upon themselves twice so that the low pressure cable section 15 which contains the rings beaten into the sheath and the

core pin (if used) extends with its sheath intact almost to the end of the plug which will constitute the bottom thereof in use. If space and circumstance permit, the plug according to Fig. 5 will be constructed in the horizontal position, in which case the procedure, technique and attachments described in connection with the construction of a plug according to Fig. 1 in the horizontal position will be employed. In every case where the plug is made in a horizontal position and used in a vertical position, it is desirable that it be placed in the final vertical position of use as soon as possible after completion and before the contents have cooled.

Fig. 6 illustrates a plug according to Fig. 4 under one condition of use. Both the high pressure cable section 16 and the low pressure cable section 15 enter the plug at the top. It will be understood that the diagrams illustrating positions of use and construction of the plugs given herein are illustrative and may be modified somewhat as circumstances necessitate.

It is sometimes desirable to construct a cable plug for vertical use with the high pressure cable section entering at the bottom and under the further condition that there is no slack cable available or insufficient slack cable to permit a plug to be constructed according to Fig. 5. In such case the plug may be constructed in accordance with Fig. 7 in which the high pressure cable section 16 enters at the bottom and the low pressure cable section enters at the top. In this case the low pressure cable section 15 extends a considerable distance within the cable sleeve, which is made of sufficient length to allow this to be done, and terminates some distance from the top, perhaps around the middle portion of the plug. In accordance with the invention, it is necessary to permit a free flow of gas from the high pressure cable section 16 into the top of the plug. In order to accomplish this a by-pass tube 17 is provided. This tube may consist of a small gauge copper tubing and is soldered at its lower end 18 into an opening in the cable sheath at a considerable distance from the lower end of the sleeve 6 and terminates at another point 19 as nearly as possible at the top of the plug where it is again soldered into an opening in the sleeve 6. The purpose of having the opening 18 removed from the sleeve 6 by a considerable distance, for example, ten inches, more or less, is to eliminate any possibility of impregnating wax flowing down into the cable sheath 16 and blocking the mouth of the tube 18. The purpose of having the opening 19 at the very top of the sleeve is to bring it to the point above the upper surface of the asphalt filling and for this purpose the point 19 is above the upper opening 8 which is used for impregnating the sleeve with wax and filling it with asphalt. The procedure of impregnating and filling a plug in accordance with Fig. 7 will generally be in accordance with that described in connection with Figs. 1 and 2 for constructing a plug in a vertical position. The copper tube is

applied before the filling and impregnating operations are performed. If desired, the copper tube may be soldered to the cable sheath and the plug sleeve at several points 20 as illustrated, or it may be attached by means of a ring of lead or other metal as shown in 21, or both, or it may be attached firmly in position by other equivalent means and procedures. When the plug is finished the top level of the asphalt will be approximately at the level indicated by the dotted line 22 in relation to the other elements of the plug.

What is claimed is:

1. A cable plug arranged for use with its long axis vertical, for sealing a cable section of high gas pressure from one of lower gas pressure, comprising a closed sleeve containing the insulated conductors of the cable, said sleeve making gas-tight contact with the adjacent termini of the sheaths of the two cable sections, a thermoplastic material having the cold flow properties of a light grade of asphalt substantially but not entirely filling said sleeve, and means whereby the interior of the high pressure cable section is directly connected, in a manner permitting the free flow of gas without passage through the filling material, between the interior of the high pressure cable section and the unfilled space above the thermoplastic material.

2. A cable plug for sealing two gas-tight cable sections each containing fibrously insulated conductors, said plug comprising a sleeve hermetically sealed to the sheath of each section, a portion of the sheath of one section being within the sleeve, at least one constricted annulus being provided in the sheath of one section within the sleeve, impregnating wax lying within the pores of and under the fibrous insulation of the conductors within the sleeve, a filling material having the thermoplastic properties of a light grade of asphalt filling most of the sleeve, the constricted annulus and terminus of its sheath being submerged under the surface of the filling, the other cable section which is the one of normal high gas pressure entering said sleeve and terminating above the normal upper surface of the filling material.

3. A cable plug for use for sealing a cable section of high gas pressure from one of lower gas pressure comprising a closed container through which the insulated conductors of the cable pass, said container making a metallically continuous gas-tight connection with the sheaths of the two cable sections, a thermoplastic material having the cold flow properties of a light grade of asphalt substantially but not entirely filling said container, said high pressure cable section entering said container below the normal upper surface level of the said material, and a gas-tight by-pass pipe connecting the space above said material with the space within the sheath of said high pressure cable section.

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