

March 19, 1940.

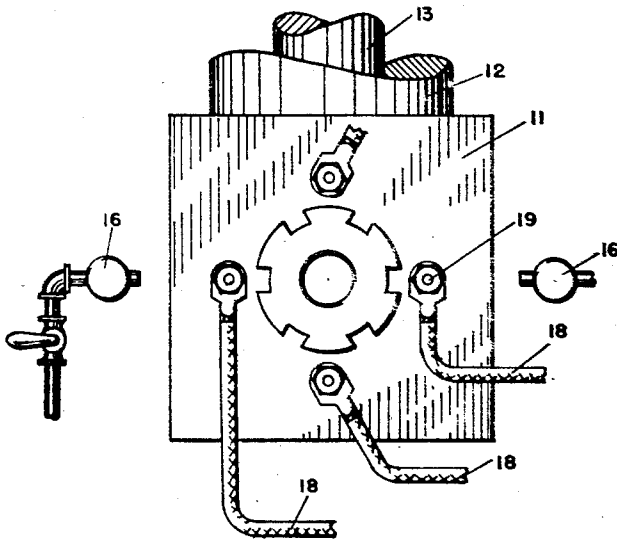
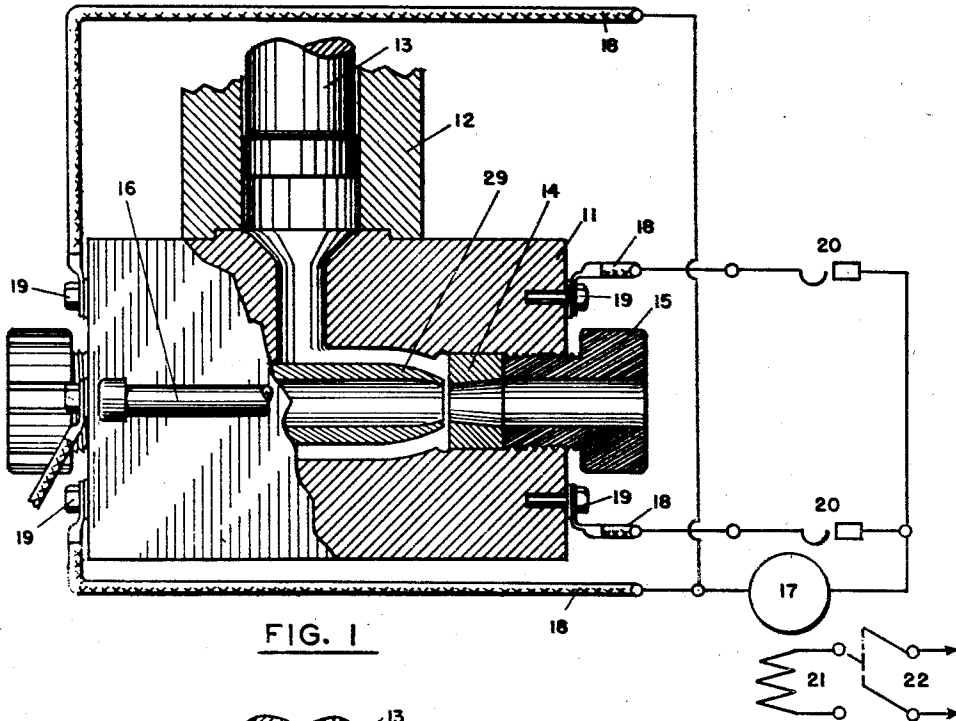
G. B. KIDD

2,194,283

HEATING DEVICE

Filed July 15, 1939

2 Sheets-Sheet 1



BY

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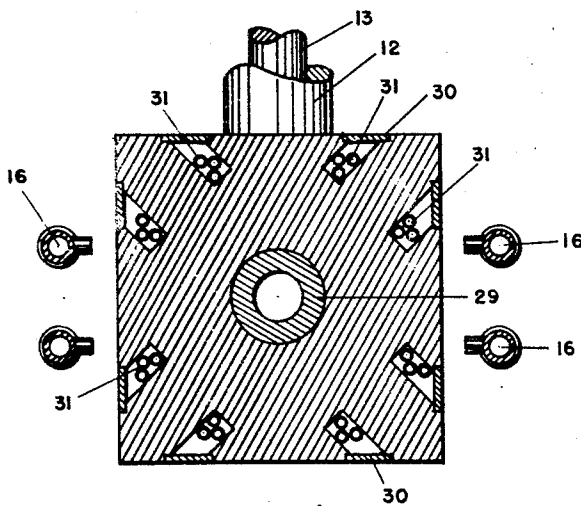
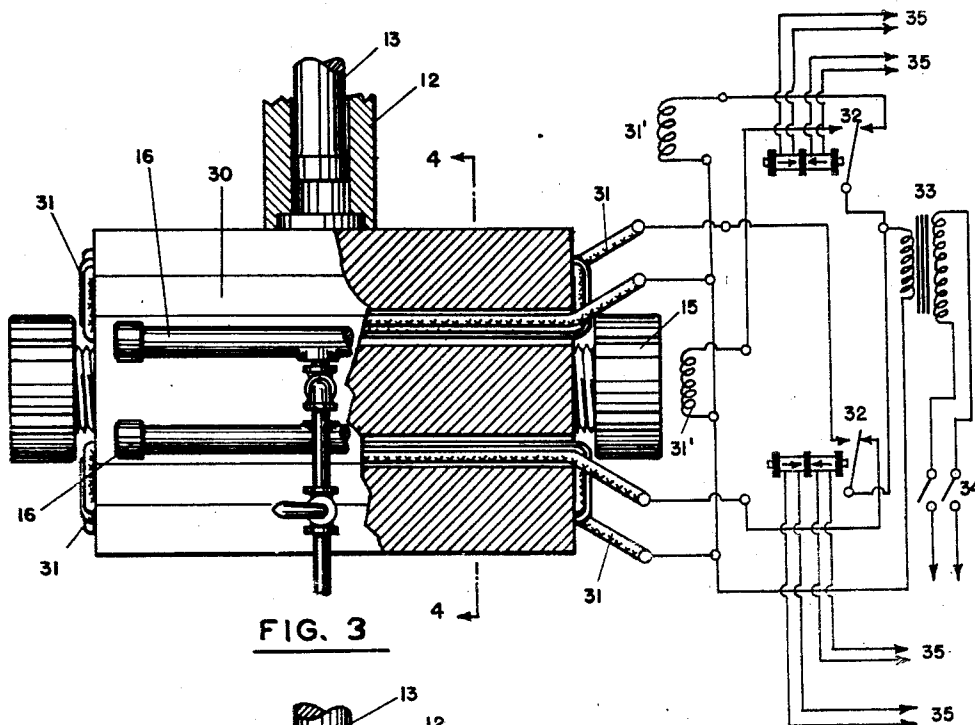
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HEATING DEVICE

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2 Sheets-Sheet 2



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2,194,283

HEATING DEVICE

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11 Claims. (Cl. 207—16)

The present invention relates to apparatus used for heating die blocks and, more particularly, to a heating unit for use with a die block designed for the application of lead sheaths to electric cable.

Lead sheaths are commonly applied to electric cables as protection against corrosion and abrasion and also as a means of retaining within the cable any impregnating compound which may be used. The lead sheaths are usually applied by extruding a pipe of lead about the insulated cable, the cable being passed through the center of the die block.

In recent years considerable attention has been given to the thickness and concentricity of the sheath as lead is a relatively expensive metal, and also because the sheath must withstand severe stresses which are occasioned by the expansion and contraction of the insulation and impregnating compound during the heating and cooling cycles, caused by the variations in current that a cable is called upon to carry. If the sheath is not sufficiently thick it will be unable to withstand these stresses and, of course, if the sheath is once broken the cable is worthless.

One of the results of the investigation of lead sheaths has been the development of several different devices for use in the detection of eccentricity of the metallic sheath. United States Patent 1,985,277 to Braddon and 2,111,210 to Ebel are typical of two forms of apparatus which may be used for this purpose and which produce a record showing the magnitude and position on the sheath circumference of the thick and thin portions.

It is the chief object of this invention to provide a method and apparatus for the production of concentric lead sheaths, said apparatus being adapted to be manually or automatically controlled by sheath eccentricity detectors, either of one of the designs previously mentioned or of other types.

A further object of the present invention is the provision of a method and apparatus for heating die blocks which may be varied with extreme speed to maintain a concentric sheath. It is to be understood that the thickness of the sheath at a particular point is commonly controlled by changing the temperature of the die block at various points about its circumference; a high temperature tending to produce a thicker sheath than a low temperature. The lead to be extruded is poured into the cylinder of the lead press in a molten state. Pressure is not applied however until the metal has chilled sufficiently

to reach a plastic zone, just below the melting point. At this temperature lead has the property of welding to itself under pressure so that the seams in the sheath which are formed during extrusion do not weaken it appreciably.

After the sheathing operation is started efforts are generally made to maintain the temperatures existing in the die block constant and if this were possible a concentric sheath would be maintained, other factors being equal. However, the temperatures vary in the die block at points where it is impractical, at the present time, to measure them. This is evidenced by major variations in sheath thickness around the sheath circumference during extrusion although temperatures are maintained as well as present day methods allow. At the present time the attempt is generally made to maintain equal temperatures at a number of control points located in the die block between its surfaces and the die although the temperatures at the die are not known.

I am aware that the practice of correcting eccentricity in lead sheaths by varying the temperature of the die block is not new, but the present invention contemplates the use of two independent heating mediums for the die block, the first source of heat maintaining the entire block at a temperature slightly below the minimum operating temperature of the block, and a second source of heat, which may conveniently be applied near the inner surfaces of the block which may be used to vary the temperature of various points in the block very quickly. Preferably, the first source of heat is an economical one, such as gas which is commonly used today, but it is not necessary that it be quickly variable in intensity. Many of the die blocks use at the present time are heated exclusively with gas by means of burners directed against their outer surfaces and the disadvantage of these installations is the length of time which must elapse before a change in the gas flame is apparent in the temperature on the inner surface of the block. This is not surprising when it is realized that the walls of the block may be four or five inches in thickness to withstand the terrific pressures which are developed.

The second source of heat is preferably electrical as the temperature of the block may be varied very rapidly by its use.

What I propose is a method and means, contrary to usual practice, of causing unequal temperatures in the die block to correct variations in sheath thickness. Two methods are suggested

for getting localized heating at various parts of the die block. These means may be used to entirely heat the block but preferably are used as incremental heaters in conjunction with other well known means intended for uniform heating.

Referring to the drawings in which similar reference numerals denote similar parts:

Figure 1 is a side elevation of a die block heated in accordance with the present invention, a portion of the block having been broken away to reveal the interior construction and the accompanying electrical equipment and wiring being shown diagrammatically.

Figure 2 is an end elevation of the die block shown in Figure 1.

Figure 3 is a view similar to Figure 1 of a second embodiment of the present invention.

Figure 4 is a section taken in the plane 4-4 of the embodiment shown in Figure 3.

Referring to the drawings, the die block 11 is placed beneath the cylinder 12 of the lead press which contains the ram 13 that is actuated by hydraulic pressure. In operation the cylinder of the lead press and the various spaces within the die block are filled with lead, but this has been omitted in the drawings for the sake of clarity. The die block 11 is bored out along its central axis and is fitted with a core 29 through which the cable to be sheathed passes. In operation it will be seen that the cable, which is supplied from a reel at the rear of the die block, is passed through the center of the core 29, in the direction indicated by the arrow, at which point it is surrounded by lead. The outside diameter of the lead is, of course, determined by the die 14 which is held in place in the block by the nut 15. In the conventional installation a die block of this character would generally be heated by a gas burner 16 which directs the flames against the outer surface. While I may use gas flames for heating as shown in the drawings it is to be understood that the amount of heat which is derived from this source is insufficient to keep the block at operating temperature.

The feature of the present invention lies in the use of an additional localized source of heat which may be almost instantaneously controlled. Such a source is indicated in Figures 1 and 2 by a direct current generator 17 which is connected to the die block through the cables 18 by studs 19 which are tightly fitted into the block to provide a joint of low electric resistance. By means of the contactors 20 the current from the generator 17 may be thrown into any one of the four circuits, only two of which are shown in Figure 1. In addition, the field 21 of the generator 19 may be reduced before opening the contactors 20 by means of a switch 22. Alternately, a continuously variable resistor may be used to control the generator output. In this way the second source of heat is variable both as to position and intensity. As will be apparent, when one of the contactors 20 is closed a current will flow through one corner of the block from one of the terminals 19 to the corresponding terminal at the other end. The current density will be greatest on that side of the center on which the terminal is located and because of the resistance of the metal that side of the block will be heated to a higher degree than the remainder. It will be apparent that any degree or location of heat may be secured by varying the terminals which are energized, or if desired, energizing more than one set at a time, and by varying the intensity of the current.

For simplicity, only four sets of terminals have been shown, but this number may of course be increased or decreased to fit particular circumstances.

In Figures 3 and 4 a similar die block is shown in which the gas burners 16 have been supplemented by apparatus for induction heating.

A second embodiment of the present invention is shown in Figures 3 and 4, gas heating being combined with electrical induction heating. In this design coils 31 consisting of a few turns of extremely heavy wire are embedded in the outer edges of the block in grooves and are protected by cover plates 30. Four such coils are shown in the present example so that each edge of the block may be heated independently of the others. In Figure 3 two of the coils are shown diagrammatically as 31', as they otherwise could not clearly be shown in the drawings. The electric current which is preferably of high frequency is supplied to each coil through the electrically operated switches 32, the current being drawn from the transformer 33 which is supplied from an appropriate source through the switch 34. Auxiliary circuits 35 which are connected to a sheath eccentricity detector may be used if it is desired to have the operation of the unit entirely automatic. Manual control may be had by inserting switches in the line at this point. When one or more of the coils 31 are energized an alternating current magnetic field is set up in the block which has a maximum density in the region of the coil. As is well known magnetic conductors placed in such a field are heated due to hysteresis in the material and also due to so-called "eddy currents" in the material.

What I claim is:

1. In apparatus of the class described a die block and means for heating said die block comprising a first source of heat applied externally to the surface of said die block and a second source applied intermediate the inner and outer surfaces of said die block, both of said heat sources being arranged symmetrically about said die block.

2. In apparatus of the class described a die block and means for heating said die block comprising a first source of heat characterized by its economy and constituting the major source of heat and a second source of heat adapted to maintain all portions of said die block at the correct temperature for extrusion of a concentric sheath, said second source being characterized by the rapidity with which it may be varied.

3. In apparatus of the class described a die block and two sources of heat for said die block, the first source of heat being flames directed against the surface of the die block and the second source being electrical in nature and applied intermediate the inner and outer surfaces of said die block.

4. In apparatus of the class described, a die block and means for heating said die block, said means comprising gas heaters directed against the outer surface of said die block and electrical heating means applied intermediate the inner and outer surfaces of said die block.

5. A die block and two sources of heat for said die block, the first source comprising means for heating said die block to a point less than its operating temperature and a second source of heat effective to increase the temperature at any position on the cross-section of the die block.

6. A die block and two sources of heat for said die block, the first source comprising means

for heating said die block to a point less than its operating temperature and a second source of heat effective to place the zone of maximum temperature at any position on the cross-section of said die block.

7. A die block equipped with two sources of heat, the first source comprising means for heating said die block uniformly to a temperature less than the operating temperature and a second source of heat effective to place a zone of maximum temperature at any position on the cross-section of said die block.

8. A die block fitted with two sources of heat, the first source comprising heating means applied to the exterior of said block and effective to maintain a temperature below the operating temperature of said block and a second source of heat comprising means symmetrically arranged within said block effective to change the position of the zone of maximum temperature.

9. A heating device comprising a plurality of groups of heating elements arranged symmetrically with respect to the object to be heated,

one of said groups being adapted to maintain a uniform temperature throughout the object to be heated and a second group of heating elements effective to position a zone of maximum temperature at any point on the cross-section of the object to be heated.

10. A heating device comprising two groups of heating elements, one of said groups being adapted to maintain a uniform temperature throughout the object to be heated and the second group being effective to position a zone of maximum temperature, at any point on the cross-section of the object to be heated.

11. A heating device comprising two groups of heating elements, one of said groups being adapted to maintain a uniform temperature throughout the object to be heated and the second group being effective to position a zone of maximum temperature, resulting from the simultaneous operation of both groups of heating units, at any point on the cross-section of the object to be heated.

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