

May 14, 1940.

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2,200,521

METHOD OF MAKING RESISTANCE ELEMENTS

Filed Nov. 10, 1937

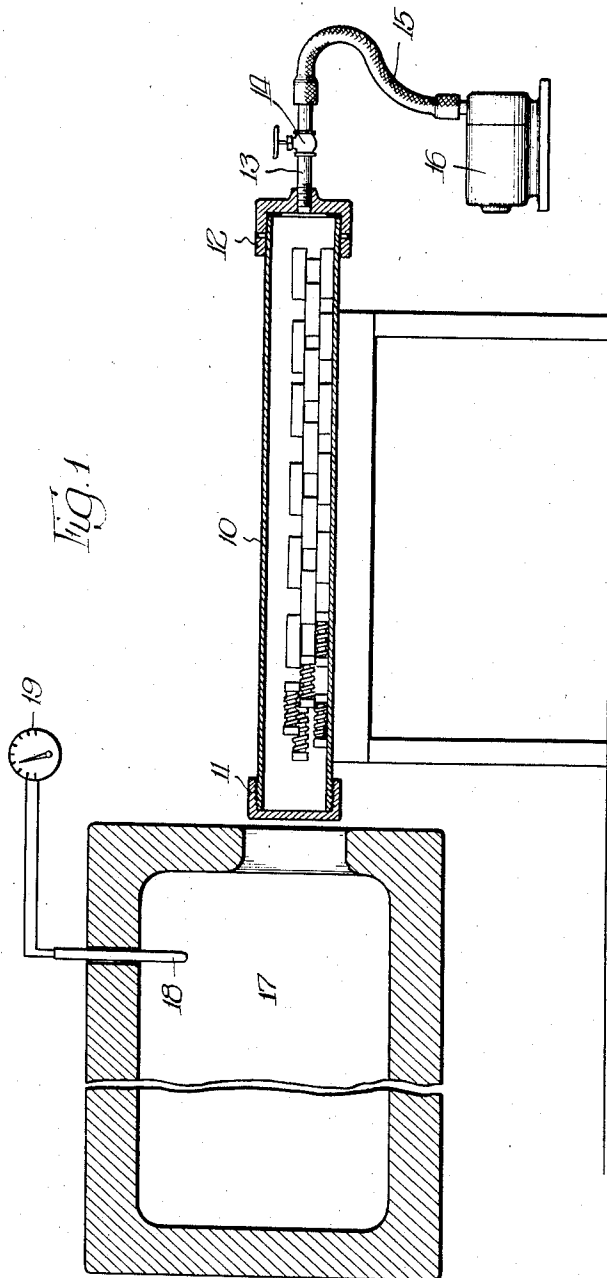


Fig. 2.



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UNITED STATES PATENT OFFICE

2,200,521

METHOD OF MAKING RESISTANCE
ELEMENTS

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Application November 10, 1937, Serial No. 173,865

1 Claim. (Cl. 201—75)

My invention relates to a method of making resistance elements by depositing carbon thereon.

I am aware of the development of the art to which this invention relates, as represented by patents heretofore granted, and in the pursuit of more extensive knowledge of the subject, in order to perfect a process in which there is relative certainty of results, I have conducted a long series of experiments.

In all the processes known to me there is no certainty of results; they depend for success on elements of time, temperature, pressure and stability of materials, a variation in any one of which will cause a variation in the final product.

For example, in cases where a hydrocarbon gas is caused to pass through or is confined in a heated chamber containing the articles to be coated, the success of the operation is dependent on, first, the temperature of the chamber; second, on the amount of gas fed therein, this in turn being dependent on the pressure of the gas from the source of supply; and, third, on the length of time during which the articles are subjected to treatment. This process is uncertain of results over an extended period of time.

It is well known that the activity of dissociated carbon molecules is a function of the temperature and pressure, and that for effective coating that will tightly adhere to, if not impregnate a dielectric base such as porcelain, the heat must be relatively high and the pressure above atmospheric as high as reasonably possible. Under such circumstances, with a known temperature and a known quantity of hydrocarbon, a known area of resistance material can be coated to exactly the same extent in repeated operations, the coating being of uniform penetration or adherence.

Thus in the method here disclosed, I have eliminated hit-and-miss operation and completed the development of the prior art.

The method will be more readily understood by reference to the accompanying drawing, in which:

Fig. 1 is a diagrammatic illustration of apparatus adapted for use in carrying out the idea; and,

Fig. 2 is a side view of one form of resistance element such as intended to be coated.

In carrying out the method I provide a relatively long tube 10 preferably composed of stainless steel of the character known as Ascoloy, one end being tightly closed by a cap 11 and the other end having an easily removable cap 12 adapted to be tightly engaged with the tube by

means of threads or a bayonet joint. Connected to the cap 12 is a pipe 13 having a valve 14 therein, the pipe being connected, preferably by a flexible tube 15, to an exhaust pump indicated generally at 16. A heating chamber, is indicated at 17, having therein a thermally responsive device 18 connected to a gauge or indicator 19.

In carrying out the process a quantity of porcelain resistance bases or cores 20, such as shown in Fig. 2, are placed within the tube 10. The preferred form of such elements is that of a cylindrical body having its exterior surface in the form of a spiral. In an operation subsequent to that of coating the element, the peripheries of the spirals are ground off, thus compelling the current to flow in a spiral path, the extent to which the peripheries are removed determining roughly the resistance of the finished element.

After the porcelain cores are placed in the tube, a quantity of a hydrocarbon in liquid form is also placed in the tube. A preferred hydrocarbon may be one of the following, the respective quantities, relative to the number and size of the porcelain bases, being suggested hereinafter:

Toluene	25
Xylene	
Acetone	
Furfural	
Isopropyl ether	
Isopropyl alcohol	30

After the porcelain tube and the hydrocarbon are placed in the tube, the cap 12 is closed over the open end and the vacuum pump is operated for a short time to exhaust a substantial portion of the air from the tube. Thereafter the tube is placed in the heating chamber and allowed to remain therein for a predetermined time at a predetermined temperature. The hydrocarbon will vaporize and expand to create a substantial pressure above atmospheric, the quantity used being gauged to avoid a pressure that would be likely to result in an explosion. If desired, of course, a safety valve may be connected to the tube in order to avoid any danger. Thereafter the tube is removed and may be set aside to cool until such time as the exposure of the coated elements to the air will not result in extensive oxidation. If continuous production is desired, a number of the tubes and caps are provided in order that the tubes may become amply cooled between operations.

In the use of a hydrocarbon such as acetone, for example, I prefer to charge the tube with approximately 100 porcelain cores of approxi-

mately $1\frac{1}{4}$ x $\frac{1}{4}$ inches in size and place in the tube with the porcelain blanks approximately 15 cc. of acetone. With the tube and blanks at substantially room temperature, the container, is allowed to remain in the heating chamber for approximately 30 minutes at a temperature of the heating chamber of 1500 F. This practice has been found to result in a thoroughly uniform coating of carbon that tightly adheres to and, in fact, somewhat impregnates the body of porcelain. The degree of penetration is dependent on the density of the porcelain. Thus I am able to produce a resistance element in which the coating is uniform and will not vary in successive operations.

The quantities of the other hydrocarbons mentioned and the approximate temperatures for most successful operation are as follows, it being assumed that the time within the heating chamber and the quantity of core material will remain substantially the same as that already indicated.

	Cubic centimeters	Minutes
Toluene.....	1	15
Xylene.....	1	15
Acetone.....	15	30
Furfural.....	1	30
Isopropyl ether.....	15	30
Isopropyl alcohol.....	15	30

While, undoubtedly, many other hydrocarbons

may be used for the described purpose, I consider it essential to utilize a hydrocarbon of the general character of those herein indicated, that remains in liquid form at normal temperatures, for the stated reason that the quantity charged into the operating chamber may be more definitely ascertained than where a hydrocarbon in gaseous form is used. It will be understood also that the size and shape of the porcelain elements is unimportant and that the apparatus disclosed is merely typical. As to these and other matters, it will be understood that the scope of my invention is to be determined from the appended claim.

I claim:

The method of making resistance elements which consists in providing a chamber adapted to be sealed, placing therein the elements to be coated, together with a measured quantity of liquid acetone, sufficient to release a required quantity of nascent carbon for coating said elements, then closing and sealing said chamber, then withdrawing a substantial portion of the air therefrom, and then subjecting said chamber to a predetermined heat sufficient to decompose the acetone to form carbon and for a predetermined period, thereby causing expansion and consequent increase of pressure to a predetermined substantial degree above atmospheric, and then removing the elements from said chamber.

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