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ELECTRIC HEATING DEVICE

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Fig. 1.

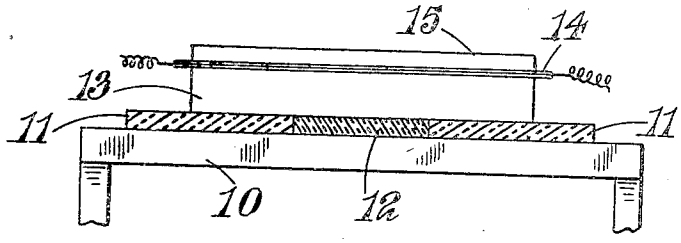
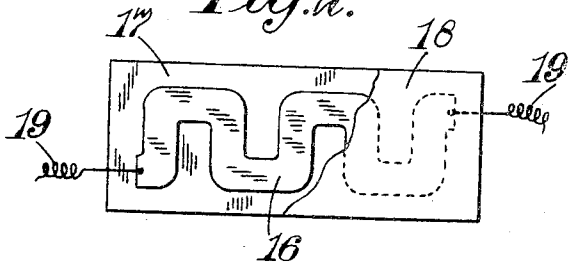


Fig. 2.



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ELECTRIC HEATING DEVICE

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2 Claims. (Cl. 219—19)

1

This invention relates to control devices for electric circuits, such as heating devices and has for its object to provide a device which will automatically open the circuit after a predetermined interval of time. When used with a heating device it will provide a predetermined amount of heat, and if desired at a predetermined temperature, and then interrupt the heating circuit so that no more heat is produced. Such a device is particularly suitable for use in the heat treatment of materials to relieve the operator of responsibility and of the necessity for continuous attention to the process. The vulcanising of rubber is an example of such a process, but the invention may be used for other processes such as the heat treatment of plastics.

In the accompanying drawings—

Figure 1 is a purely diagrammatic representation of the improved heating device, and the mode of its use and

Figure 2 is a front view partly broken away of the resistance element used in the heating device.

Referring first to Figure 1, this illustrates in diagrammatic form the application of this invention to a vulcaniser. Any convenient table or platen 10 is used to support the work which is indicated as a sheet of rubber 11 wherein a patch 12 is to be vulcanised. The heating device by which the required heat is imparted to the work is constituted by a block 13 of metal or other suitable material which is engaged with the work 11, 12 on the platen. Pressure may be applied to this block when used for vulcanising as is customary, although other kinds of heat treatment may not necessitate the application of pressure.

On the side of the thermal storage member 13 remote from the platen there is mounted a heating element 14 which comprises a suitable casing or cover with an electric resistance unit. On the other side of the heating element 14 remote from the storage member 13 a heat insulating block or cover 15 may be provided to prevent loss of heat from that side of the heating element.

The heating element itself is illustrated in Figure 2 and comprises an electrical resistance constituted by a thin strip of lead foil or other suitable material which is sandwiched between two sheets of paper 17, 18 so as to provide adequate support for it and to enable it to be readily handled. This is necessary since normally the resistance element 16 will be of such limited cross-section that it is mechanically weak. Suitable contacts or terminals 19 are provided for making electrical connection to the resistance 16.

2

The material of which the resistance element 16 is made is fusible in order that when it has attained a sufficiently high temperature it shall melt and break the electric circuit so that there is no further output of heat from it.

In the operation of the device when the current is switched on, the rate of evolution of heat is determined by the value of the resistance which determines the current, and whilst the heat is being evolved it is simultaneously being absorbed by the thermal storage member 13. The thermal conductivity of this member is selected so that it absorbs heat at a rate which is somewhat less than, but is comparable with, the rate of evolution of heat so that the temperature-rise of the resistance element 16 is retarded. It will be appreciated that the thermal storage element 13 has to attain a temperature comparable with the melting point of the resistance material before the latter will melt, and the time which it takes to reach this temperature is determined mainly by its heat-capacity, and also by its conductivity; the conductivity is a controlling factor from two points of view in so far as it determines the rate at which the storage member will absorb heat, and also the rate at which it will transmit heat to the work which is on the other side of the storage member from the heating element. These two factors therefore determine the time which must elapse before the resistance element 16 reaches its melting point and thereby interrupts the supply of heat.

After the supply of heat has been cut off, the heat stored in the thermal storage member 13 is gradually transmitted to the work to effect the desired heat treatment thereof.

It will be seen that this invention provides a heating device in which the quantity of heat imparted to the work is automatically controlled in a very simple manner, and the maximum temperature to which the work can be subjected is also under control, since it cannot exceed the melting point of the electric resistance element, and will usually be somewhat lower.

A further control is available in respect of the time which elapses before the circuit is broken, which can be obtained by taking into consideration the temperature-coefficient of resistance of the material of the heating element; if a material is selected which has a very high temperature-coefficient of resistance, its resistance will increase substantially with rise of temperature so that the rate of evolution of heat falls off as the temperature rises and the time

which elapses before it reaches its melting point will thereby be increased.

In the heating element illustrated in Figure 2, the whole of the electric resistance material is made of the fusible metal, but it will be appreciated that this is not essential since all the functions of this element as above described can be obtained if only a part of the resistance element is fusible provided this part is subjected to and its melting determined by the temperature of the thermal storage element. It is preferred, however, to construct the element as shown in Figure 2 for the reasons of simplicity and minimum cost of manufacture.

Apparatus in accordance with this invention is particularly suitable for use in vulcanising rubber, and may be made in the form of a portable outfit for repairing tyres or tubes of motor vehicles; the apparatus is then designed to be operated from the electric supply ordinarily available on a car, and all that is necessary is to insert the heating element in the device and switch it on. The control of the temperature and duration of heating is automatically effected, and the resistance element is so inexpensive that a new one can be used for each operation. The invention, however, is not limited to this particular purpose and it may be applied as above mentioned to various other heat treatments.

I claim:

1. In apparatus for the automatic heat-treatment of material at a preselected temperature, the combination of an electric heating element constituted by a thin foil of metal fusible at the preselected temperature and two sheets of insulating material enclosing said element, and a work-receiving platen of substantial heat-capacity in contact with said insulating material to absorb heat from the said fusible metal and reduce the rate of its rise in temperature.

2. In an electrically heated vulcaniser, the combination of an electric heating element in the form of a thin foil of metal fusible at the temperature of vulcanisation, a pair of sheets of thin insulating paper enclosing said heating element, a work-receiving platen of substantial heat-capacity in contact with said insulating paper, and a second platen adjacent said first platen to receive the work between them.

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