

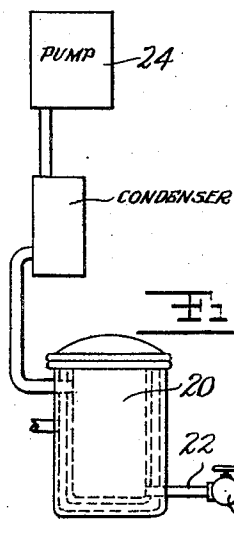
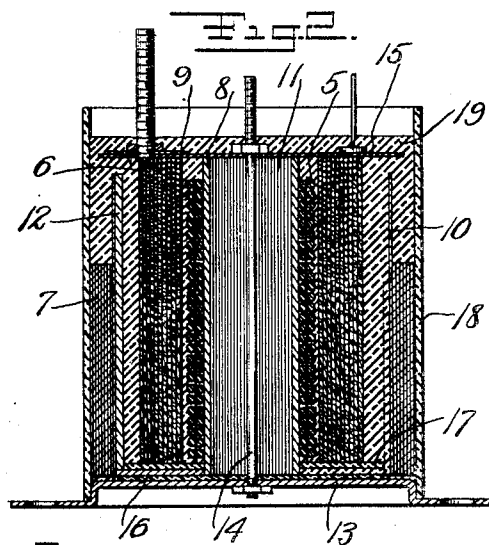
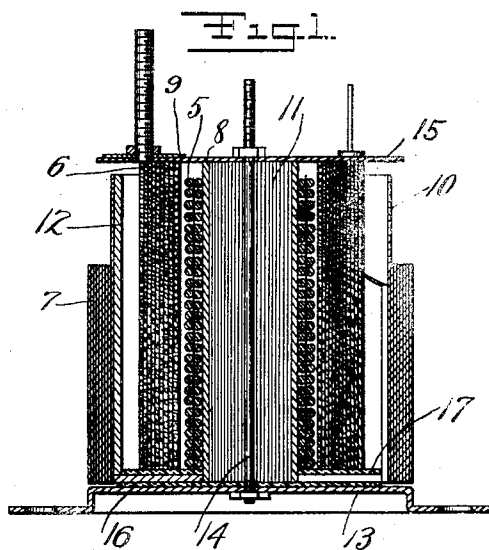
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F. J. GROTEN, JR

COIL AND CONDENSER TREATMENT

Filed Feb. 26, 1920



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By his Attorneys  
*[Signature]*

## UNITED STATES PATENT OFFICE.

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## COIL AND CONDENSER TREATMENT.

Application filed February 26, 1920. Serial No. 361,392.

*To all whom it may concern:*

Be it known that I, FRANK J. GROTEN, Jr., a citizen of the United States of America, residing at Meriden, New Haven County, Connecticut, have invented a new and useful Coil and Condenser Treatment, of which the following is a specification.

The main object of my invention is the economical production of compact, durable and efficient coils and condensers for motor ignition work. The adjustments of the ignition system are of course dependent upon the characteristics of the coil and condenser. It is therefore important that all the devices of a given style shall be uniform in every particular so that they will be interchangeable. They must also be capable of quantity production in order to be available for general use. These devices are subjected to varying electrical conditions and to rough usage. As it is practically impossible for the ordinary user or mechanic to inspect or repair such a device, it should not be subject to deterioration.

To accomplish the best results at a minimum expense, the coils and condensers are first made up according to suitable specifications. The primary coil may consist of one or more layers of suitably insulated wire such as enameled copper. One layer may be wound on a paper tube or on a core and if there is more than one layer, a sheet of insulation such as paper may be interposed between the layers. The secondary may be made up in the same way usually having a large number of layers of smaller wire. The condenser will usually consist of alternate layers of metal foil and fabric, for instance, two strips of foil wound with paper between.

The primary, secondary and condenser elements are then heated for say 40 minutes at about 60° C. They are then preferably dried in a vacuum so that the moisture is sure to be removed without excessive heating. I have found a temperature of 60° C. and a vacuum of about 29 inches of mercury for 90 minutes satisfactory.

The elements are then suddenly immersed in or flooded with a special hot thin liquid compound and subjected to pressure until thoroughly impregnated. This may take say 30 minutes at a pressure of say 25 to 50 lbs. per square inch, and a temperature of say 130° to 135° C. The compound which

I have found gives the best results consists of approximately 85% by weight of a synthetic resin and 15% of oil. The resin I prefer to use is known as "cumar" and consists, I believe, of polymers of para-coumarone, para indene and the polymers of certain other hydrocarbons obtained from certain coal tar distillates such as crude naphthalene. The polymerization I understand is carried out by the use of sulfuric acid which after the reaction is completed is neutralized with an alkali and the product washed with water and distilled. The melting point depends upon the treatment. This substance has the peculiarity that unlike most gums it can be heated considerably above its melting point without frothing and decomposition. Also it is uniform in quality, free from foreign matter and neither acid or alkali. I prefer to use a product having a melting point of about 80° to 100° C. The oil is preferably pure boiled linseed oil. The mixture must be very liquid well below the charring temperature of the paper or other spacing material employed so as to completely and uniformly impregnate the element without damage to the insulation. The melting point of the mixture is about 60° C. The resin and oil are heated to a temperature of about 130° C. and mixed so as to be very thin and flow readily when hot. I have found that this compound when handled as above indicated ensures a device with exceedingly high and uniform dielectric properties which is permanent and reliable in character. The coils and condenser for a single device are preferably assembled before impregnation. This facilitates handling and ensures uniform treatment.

After treatment as above described, the three elements are allowed to drain off excess liquid and then with the usual magnetic core and with a magnetic shield if desired, are surrounded by a casing and a filler compound is poured into the casing and between the elements to more perfectly insulate the parts and keep out all moisture. This filler is preferably composed of the same ingredients as the impregnating compound only I use a resin having a higher melting point for instance about 130° to 150° C. 84% of this mixed with 16% linseed oil and poured at about 180° C. permanently fixes the parts in their proper relation and in no manner

affects the impregnating compound and at the same time has the property of regelation at the normal working temperature of the coil so that no damage is done if it is cracked. It will so to speak be "self-healing." The softening point of the filler is about 82° C.

Fig. 1 shows one form of device ready to be impregnated according to my invention (full size).

Fig. 2 shows the same elements as Fig. 1, but located in a casing and filled.

Fig. 3 is a diagrammatic view of apparatus for impregnating according to my invention.

It will be understood that I have shown but one form of device, and do not consider my invention as limited to any particular form of coil or condenser, or to any particular combination of coils and condenser.

In the particular form shown, 5, 6 and 7 respectively are the primary coil, secondary coil and condenser. The primary coil is shown as wound on a tube 8, a secondary coil on a tube 9 and the condenser has an insulating inner layer 10. The core 11 may be of any suitable type and a magnetic shield 12 may be interposed between the secondary coil and the condenser. The three elements are mounted on a base plate 13 and held together by a rod 14 and cross piece 15. The layer of insulating material 16 is shown interposed between the bottom of the shield, the core and the base plate. Another layer of insulation 17 is shown interposed between the primary and secondary coils and the bottom of the shield 12. As above indicated, the coils and condenser are preferably assembled and impregnated as a unit. After the elements have been impregnated with the compound as above mentioned, a casing such as 18 is placed around the condenser and the filler compound 19 poured in as before referred to.

The impregnating process may be conveniently carried out in apparatus indicated diagrammatically in Fig. 3, where 20 indicates a vat or tank adapted to hold a number of the units to be impregnated, and 21 indicates a tank for containing the impregnating compound or mixture of resin and oil. These two tanks may be heated in any suitable way as for instance by steam jackets. The inner chambers of the tanks are connected by a pipe 22 having a valve 23. A pump 24 is connected to the inner chamber of tank 20. A condenser may be used between the pump and the tank. In carrying out the process the elements to be treated are placed in the tank 20 and heated for say 40 minutes at a temperature of say 60° C. The pump is then started and operated so as to produce a vacuum in the tank 20 of say 29 inches, which is maintained say for an hour and a half. Meanwhile the im-

pregnating compound in the tank 21 is heated to say 130° to 135° C. There is practically no volatilization of the compound under these conditions. At the end of the vacuum drying period the valve 23 is opened and the impregnating liquid sucked over into the tank 20. The valve 23 is then closed and the pump operated until a pressure of say 50 lbs. per square inch is obtained. The coils are left in the impregnating liquid under this pressure for about a half hour and the temperature of the liquid maintained at approximately 130° to 135° C. The valve 23 is then opened and the impregnating liquid which has not been absorbed is forced back into the melting tank 21. The impregnating tank 20 is then opened and the coils allowed to drain for a few minutes. After this, reheating to a temperature above boiling water, say 120° C., will not cause the compound to run out. The coils are then taken out and placed in the casings and filled with the filler compound. As the impregnating compound has a small co-efficient of expansion the element can be taken immediately from the impregnating liquid without danger of cracking, and without causing the layers to separate as the article cools.

It should be understood that I have given the details of only one particular product and the particular steps of the preferred process merely as examples and without intending to limit my claims to the exact proportions, times, temperatures, and pressures given. My invention in the broader aspect covers the treatment of coils or condensers alone or combined.

This process of impregnation not only supplements the insulation on the wire and between the layers of the condenser, but seals it uniformly throughout in case the insulation happens to be defective. The filler compound further protects the coils and condenser, and prevents the absorption of moisture from the air and keeps out surface water, either of which would seriously interfere with the operation of the device if it did not actually ruin it.

I claim:

1. The improvement in the art of preparing electrical elements such as coils and condensers which comprises heating the element to approximately 60° C. and then impregnating it with a compound of synthetic resin and oil at a temperature of between 125 and 140° C., draining the element and then cooling it.

2. The improvement in the art of preparing electrical elements such as coils and condensers which comprises heating the element to approximately 60° C. and then impregnating it with a compound of synthetic resin and oil at a temperature of approximately 130° C., and at a pressure of above

25 lbs. per square inch, draining the element and then cooling it.

3. The improvement in the art of preparing ignition coils which comprises simultaneously heating a plurality of independent completed coils in a receptacle and removing the moisture, flooding the plurality of coils with a hot liquid impregnating compound of synthetic resin and oil, applying pressure to the liquid and coils within the receptacle, draining the receptacle and allowing the coils to dry in the receptacle.

4. The improvement in the art of preparing ignition devices which comprises heating a plurality of devices each consisting of coils assembled on a core, submerging the devices in a heated composition containing synthetic resin, applying pressure to force the composition into the interstices of the separate devices, and draining and drying the devices.

5. Improvement in the art of preparing combined ignition coil and condenser devices which comprises heating the coils and condensers after they are assembled, flooding them with a hot liquid composition containing synthetic resin, applying pressure to the composition and the articles submerged therein, draining off the excess liquid and drying the articles.

6. The improvement in the art of preparing coils, condensers and the like having

supports which comprises heating a plurality of the elements while assembled on their supports, submerging the elements and their supports in a hot liquid composition having a melting point of over 50° C. and containing synthetic resin, applying pressure to the liquid composition, and then draining and drying the elements and their supports.

7. Improvement in the art of preparing ignition devices which comprises heating them, impregnating the devices with a hot composition containing synthetic resin, placing each device in a suitable casing and filling the casing with a liquid composition containing synthetic resin and having a higher melting point than the impregnating composition and having a softening point at approximately the normal working temperature of the device.

8. The process of preparing an ignition element which comprises heating a plurality of the elements in a closed receptacle to drive out moisture contained in the elements, drawing off the moisture from the receptacle, flooding the elements with a hot liquid composition containing synthetic resin, applying pressure to the composition and the elements contained therein and maintaining the temperature thereof, draining off the excess liquid and drying the elements.

FRANK J. GROTEN, JR.