No. 781,025. PATENTED JAN. 31, 1905.

G. H. RUPLEY.

PROCESS OF INSULATING COILS.

APPLICATION FILED JUNE 13, 1903.

Fig. 3.

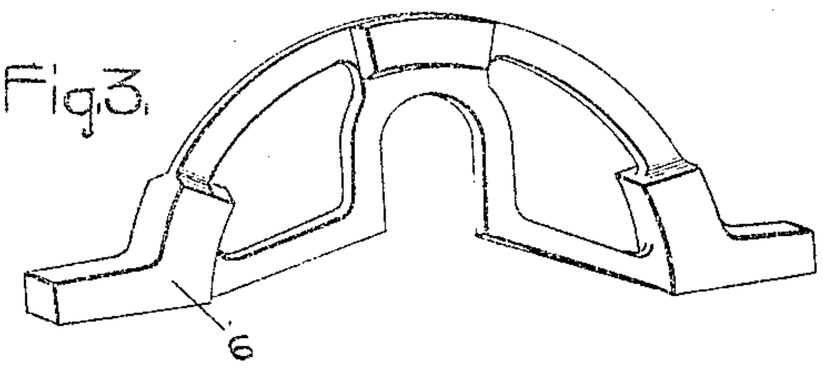


Fig. 1.

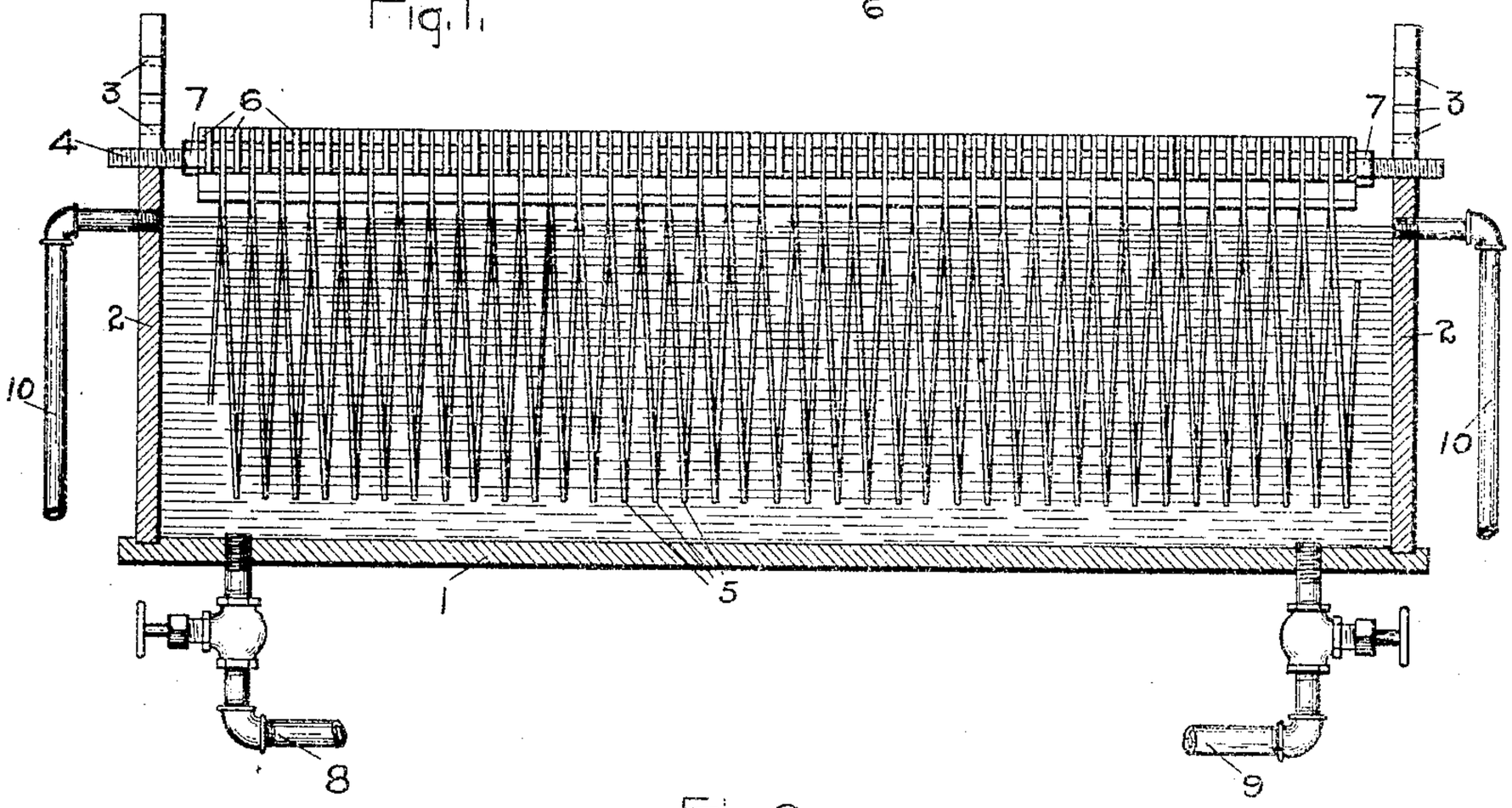
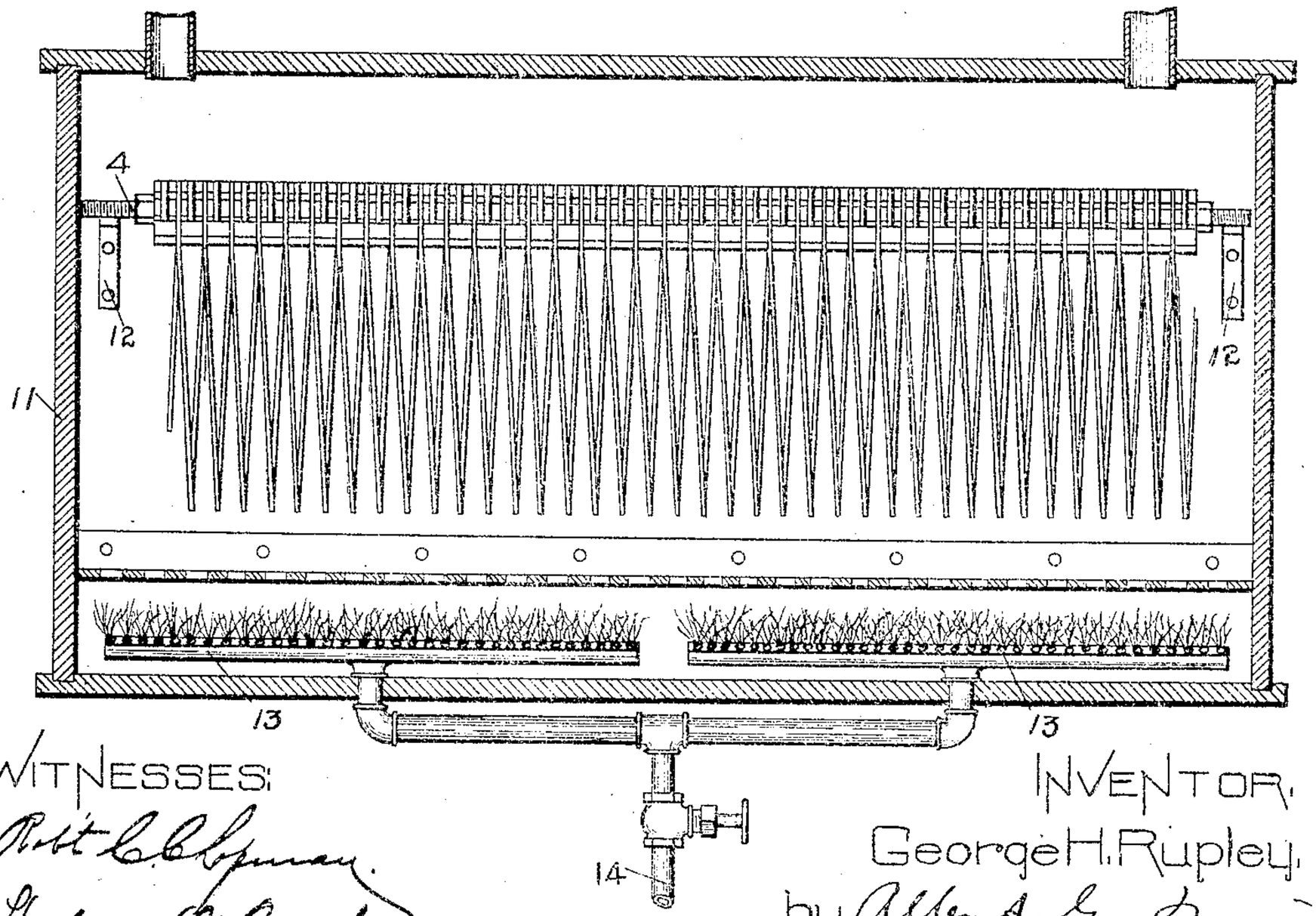


Fig. 2.



WITNESSES:

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No. 781,025. Patented January 31, 1905.

UNITED STATES PATENT OFFICE.

GEORGE H. RUPLEY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

PROCESS OF INSULATING COILS.

SPECIFICATION forming part of Letters Patent No. 781,025, dated January 31, 1905.

Application filed June 13, 1903. Serial No. 161,302.

To all whom it may concern:

Be it known that I, GEORGE H. RUPLEY, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Processes of Insulating Coils, of which the following is a specification.

This invention relates to a process of insulating electric conductor-coils, and particularly the coils of flat metal ribbon wound on edge now commonly used as the winding for the pole-pieces of dynamo-electric machines.

The object of the invention is to provide a method of insulating these coils which shall be cheaper and which shall require less of the operator's time than those heretofore followed.

In a broad sense my process consists of applying the insulating material to all the convolutions of the coil simultaneously, whereas heretofore the common practice has been to insulate each turn successively by hand by inserting strips of insulating fabric. This latter method is necessarily slow and expensive, and it is these objections which I seek to overcome with my invention.

By my improved process I stretch a coil out to a considerable length, support it on a rod, and space the convolutions apart, so that no two of them come in contact with each other at any point. By means of the supporting-rod I suspend the coil in a tank, so that the convolutions dip into insulating material a definite distance, or I admit insulating material to the tank after the coil is suspended therein until a predetermined portion of the convolutions of the coil is immersed in the insulation. I then withdraw the insulation from the tank or raise the coil out of the insulation; but this is done very slowly, so as to allow perfect drainage and insure freedom of the material adhering to the coil from beads. The coil thus partially coated is placed in an oven where the insulation is baked. When thoroughly dried and hardened, the coil is reversed on the rod, so that the uncoated portion is lowermost, and the coil is again suspended in the tank. The insulating material is admitted until it rises around the convolutions up to or above the margin of the first coating. The material is then withdrawn slowly and the coil baked as before. The thickness of the coating obtained by a single dipping and baking is not great, and its insulating strength may not be sufficient for the purpose for which the coil is to be used. To secure greater insulating strength, the coil may be dipped several times, and in doing this I prefer to make the separate coatings lap joints. For this purpose the coil may be dipped to a depth of two-thirds of its diameter the first time and after baking may be dipped again, this time to a depth of only one-third of the diameter. After this second coating is baked the coil may be reversed on the support and its other side dipped and baked in the same way. The coil thus gets two coatings of the insulation over its entire surface; but the joints between the two parts of each coat overlap. This may be continued to give any thickness and strength of insulation desired. This process is particularly advantageous in insulating edge-wound coils for the reason that in winding these coils from a straight ribbon-conductor the wire, unless held under great pressure, thickens at the inner side of the bend. This results in a coil which is thicker through the bent portions of the several convolutions than through the straight portions. This difference in thickness may be offset in insulating the coil by making the two parts of a coating overlap in the middle, thus building up the thickness of the middle portion of the coil equal to the outer portions.

By this process the coils may be thoroughly insulated, the insulation can be made as strong as is desired, and the amount of the operator's time required in insulating each coil is very small.

My invention, therefore, comprises the process of insulating a coil of wire consisting in holding the coil in an open position in which the several turns do not touch each other and applying insulating material to all the convolutions simultaneously.

It comprises also the process of insulating

a coil of wire consisting in opening the coil, so that adjacent convolutions are not in contact with each other, immersing the coil while in this open position in a bath of insulating material, and then baking the coated coil.

It further comprises other novel features which will be definitely indicated in the appended claims.

In the accompanying drawings, which illustrate apparatus by which a coil may be insulated according to my process, Figure 1 is a sectional elevation of the coating-tank. Fig. 2 is a sectional elevation of the baking-oven, and Fig. 3 is an enlarged perspective view of one of the spacers.

In Fig. 1, 1 represents the tank in which the coil is coated, having sides 2 2, which are extended upward and have notches 3 3 cut in them. The coil 5 is hung on the rod 4 and stretched to an open position, and the spacers 6 6 are inserted between adjoining convolutions, as shown. These spacers fit over the rod 4 and hold the turns of the coil far enough apart to prevent the lower portions of the turns coming in contact with each other. The nuts 7 7 on the threaded ends of the rod 4 are then tightened up against the outside spacers until the coil is held firmly. The tank is provided with a feed-pipe 8 and drain-pipe 9 and with overflow-pipes 10 10. Valves are provided in the feed and drain pipes to cut off the flow of the material through them. The rod 4 is placed in position with its ends in a pair of the notches 3 3, and the insulating material is admitted through the feed-pipe 8. The material rises in the tank to the level of the overflow-pipes 10 10, and the portion of the coil lying below these pipes receives its coating of the material. The notches 3 3 may be so arranged that when the rod 4 is in the lowest pair two-thirds of the coil is below the level of the pipes 10 10, and when in the next pair one-half of the coil is below this level, and when in the upper pair one-third is below this level, so that when the coil has been coated while the rod is in the lowest pair it may then be reversed with the rod in the upper pair and the coil will be evenly coated all over. When the material has risen to the height of the overflow-pipes, the feed is cut off by the valve and the valve in the drain-pipe is opened, allowing the insulating material to flow back into the reservoir. The material must be drained off very slowly, as otherwise the coating of the coil would not be even and beads would be formed therein. After the material has all been drained off the coil is placed in the baking-oven 11 (shown in Fig. 2) with the ends of the rod 4 on the brackets 12 12. This oven is heated by suitable burners 13 13, fed by the pipe 14, as shown. In the oven the coating of the material is baked until it is dry and hard, and the coil is then ready to receive another coating, which is put on in the same manner, the coil being baked after each coating of the material. After one side of the coil has been coated and baked in this manner the nuts 7 7 are loosened and the position of the coil on the rod 4 is changed, so that the portion of the coil which before was above the level of the overflow-pipes 10 10 is now lowermost. This portion of the coil is then coated as before, the rod 4 being placed in the notches, which will make the several coatings even. By supporting the coil with the ends of rod 4 in the different pairs of notches the several coatings may be made to lap joints as above described, or in case of edge-wound coils the outer portions of which are thicker than the middle portions the two parts of the same coating may be made to overlap.

In the drawings I have shown apparatus by which the coil is coated by suspending it in an empty tank, filling the tank to a certain level with the insulating compound, and then slowly withdrawing the compound from the tank. However, a coil could as well be insulated by my process by maintaining the material in the tank at a definite depth and arranging mechanism to lower the coil a certain distance into the insulating material and then slowly withdraw it therefrom.

My invention may be carried out with any form of insulation which may be applied in a fluid state either hot or in solution; but I prefer to use one which may be hardened quickly after coating by baking. For this purpose I prefer to employ specially-treated linseed-oil, as described in my companion application, Serial No. 135,372, filed December 16, 1902, and harden the film by partial distillation of the less refractory components of the compound.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The process of insulating coils of electric conductor, consisting of opening the coil until adjacent convolutions are out of contact with each other, and immersing the coil in an oxidizable oil compound.

2. The process of insulating conductor-coils, consisting of stretching the coil until the several turns do not touch each other, immersing the coil in an oxidizable oil compound, and baking the coated coil.

3. The process of insulating a conductor-coil, consisting of opening the coil so that adjacent turns do not touch, and applying an oxidizable oil compound to all the turns of the coil simultaneously while the coil is in said open position.

4. The process of insulating a coil of edge-wound ribbon conductor, consisting in opening the coil so that adjacent turns do not touch, immersing the coil in insulating material, slowly withdrawing the bath from the coil, and hardening the film or coat.

5. The process of insulating a coil of edge-

wound conductor-ribbon, consisting in opening the coil so that adjacent turns do not touch, immersing one side of the coil in insulating material to a predetermined depth, hardening the film, immersing the other side of the coil in the material, and then hardening the second film.

6. The process of insulating a coil of edge-wound conductor-ribbon, consisting in opening the coil so that adjacent turns do not touch, immersing one side of the coil in insulating material a plurality of times to different depths, hardening the film after each immersion, and immersing the other side of the coil and hardening the film in a similar manner.

7. The process of insulating a conductor-coil, consisting in opening the coil so that adjacent turns do not touch, immersing one side of the coil in insulating material a plurality of times to different depths, baking the coil after each immersion, immersing the other side of the coil and baking in a similar manner, and collapsing the coated coil.

8. The process of insulating coils of conductor, consisting of stretching the coil so that the several turns do not touch, immersing the coil in insulating material to a certain depth, baking the coated coil, immersing the coil again to a different depth and baking, and immersing the other side of the coil twice in the material, baking it after each immersion.

9. The process of insulating a coil of ribbon-conductor wound on edge, consisting in coating it a plurality of times in an insulating-bath, the several coats overlapping longitudinally of the coil, and hardening each coat before the next is applied.

In witness whereof I have hereunto set my hand this 11th day of June, 1903.

GEORGE H. RUPLEY.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.