No. 714,934. Patented Dec. 2, 1902.

W. S. MOODY.

MEANS FOR PREVENTING BREAKDOWN OF HIGH POTENTIAL WINDINGS.

(Application filed Apr. 26, 1902.)

(No Model.)

Fig. 1.

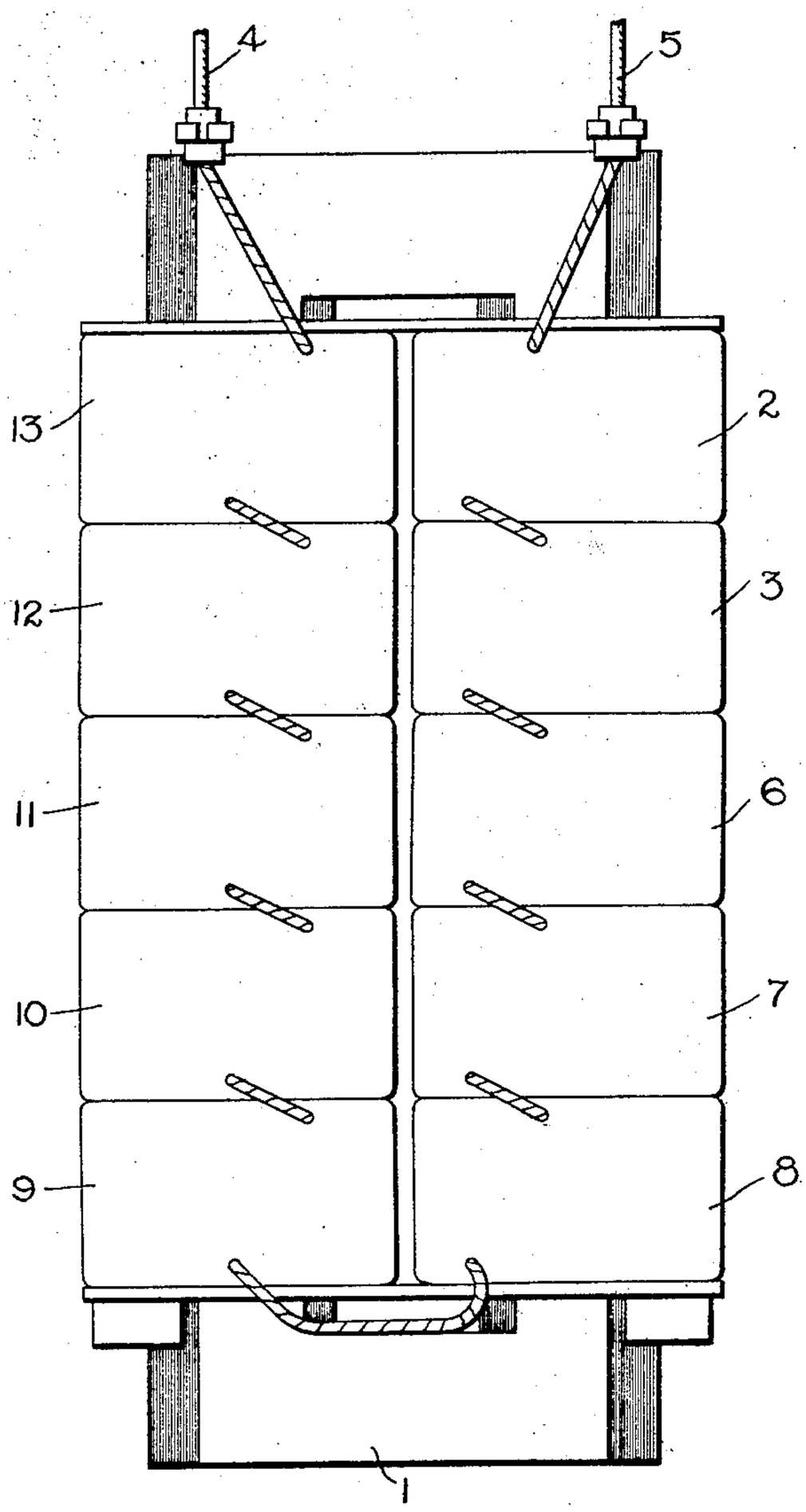
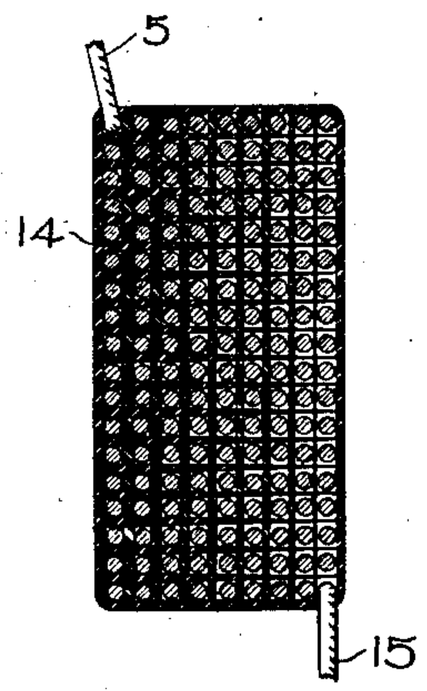


Fig. 2.



Witnesses.

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UNITED STATES PATENT OFFICE.

WALTER S. MOODY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MEANS FOR PREVENTING BREAKDOWN OF HIGH-POTENTIAL WINDINGS.

SPECIFICATION forming part of Letters Patent No. 714,934, dated December 2, 1902.

Application filed April 26, 1902. Serial No. 104,893. (No model.)

To all whom it may concern:

Be it known that I, WALTER S. MOODY, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Means for Preventing Breakdown of High-Potential Windings, (Case No. 2,868,) of which the following is a specification.

My invention relates to a means for protecting high-potential windings, such as the windings of transformers or dynamo-electric machines, from the injurious effects of suddenly-applied high potentials, such as may be due to lightning, resonance, or similar causes. When a winding possessing inductance is submitted to the influence of high electric potentials—such, for example, as by connecting the winding to a high-potential circuit or in case the winding be connected to a circuit by the occurrence in the circuit of high electromotive forces due to resonance effects or to lightning—the immediate effect is to raise the potentials of the terminals of the winding to that of the line. Owing to the inductance of the winding, however, there is an appreciable interval before the interior portions of the winding, or those portions removed from the outer turns adjacent to the terminals, are correspondingly raised in potential. The result is that for a certain time interval an excessively high potential difference may exist between the portion of the winding adjacent to a terminal and the portions farther removed from the terminal. This difference of potential may cause a breakdown of the insulation to take place in that portion of the winding which is near one of the terminals, and the high-potential discharge which produced the breakdown may be followed by the dynamo-current, thereby short-circuiting a portion of the winding and possibly destroying the same. To overcome this difficulty, I provide those portions of the winding which are submitted to these excessive differences of potential with an insulation of sufficient dielectric strength to resist the electric stress, the remaining portions of the winding being insulated only to a degree demanded by normal conditions of operation.

The scope of my invention I will particularly point out in claims appended hereto, while the invention itself will be described in detail in the following specification, which is to be taken in connection with the accompanying drawings, in which—

Figure 1 represents a transformer constructed in accordance with my invention, and Fig. 2 a detail view of a portion of the winding of the transformer shown in Fig. 1.

In Fig. 1 the transformer-core is represented at 1 and is provided with primary and secondary coils arranged in any usual manner. In the present instance the coils indicated, for example, at 2 3 are high-potential coils, the low-potential coils being wound underneath, and therefore not visible. The various high-potential coils are represented as being connected in series, and the terminals of the series of coils thus connected are indicated at 4 and 5. The coils or turns of the transformer-winding lying nearest to the terminals 4 5 are those which are subjected to the greatest electric stress when the transformer is connected to line or is subjected to the influence of high resonance potentials or lightning discharges. The intermediate windings 3 and 6 to 12, inclusive, are insulated in the usual manner, so as to withstand the stress of normal working conditions, while the extreme windings 2 and 13, the terminals of which are connected to the terminals 4 5 of the transformer, are provided with much thicker and stronger insulation in order to withstand the excessive electric stress which may occasionally be imposed upon the turns of the winding nearest to the transformer-terminals by causes briefly mentioned above.

Fig. 2 represents in cross-section one of the windings of the transformer connected to the transformer-terminals. Supposing the winding to be formed in layers extending lengthwise of the cross-section, it will be noted that the turns which lie nearest that terminal which is connected to the transformer-terminal are provided with excessively heavy insulation, (indicated by the dark shading at 14.) The terminal 5 of this winding, which may be considered as identical with the terminal 5 of the winding 2 in Fig. 1, is connected to turns of conductor which are surrounded by heavy insulation, decreasing in

thickness as the turns progress until at the opposite terminal 15 the insulation may be of normal amount, as in the intermediate coils of the transformer. Instead of tapering the insulation as indicated the terminal-coils 2 and 13 may be provided with insulation uniformly heavy throughout, the intermediate coils being provided with insulation of the usual character and amount.

Owing to the fact that insulating material will withstand higher potential differences for a short time if applied temporarily than it would be capable of withstanding if permanently applied, it will be seen that the application of heavy insulation to those turns of a winding nearest the terminals provides a simple and effective means for preventing injury due to excessive temporarily-applied electric stress, for while this heavy insulation might not be able to stand the continuous application of the excessive electric stress, still for a limited time it will successfully prevent breakdown, and this is all that is ordinarily necessary.

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

1. The combination with a winding for electrical apparatus, of terminals for said winding, insulation of comparatively great dielectric strength for portions of the winding near a terminal or terminals, and insulation of less dielectric strength for other portions of said winding.

2. The combination with a winding for electrical apparatus, of heavy insulation for portions of the winding near a terminal or terminals of said winding, and lighter insulation for other portions of said winding.

3. A winding for electrical apparatus, consisting of turns of electrical conductor, and insulation between the turns of greater strength near the terminals of the winding than at intermediate portions.

4. A winding for electrical apparatus, consisting of turns of electrical conductor, heavy insulation between turns near a terminal of the winding, and lighter insulation between other portions of the winding.

5. A winding for electrical apparatus, consisting of turns of electrical conductor, and insulation between the turns thickest near a terminal of the winding and decreasing in thickness toward intermediate turns of the winding.

6. An electrical transformer provided with high-potential windings, terminals for said windings, and insulation between the turns of said winding heaviest near said terminals and of less resisting power between said terminals.

In witness whereof I have hereunto set my hand this 25th day of April, 1902.

WALTER S. MOODY.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.