No. 885,771.

PATENTED APR. 28, 1908.

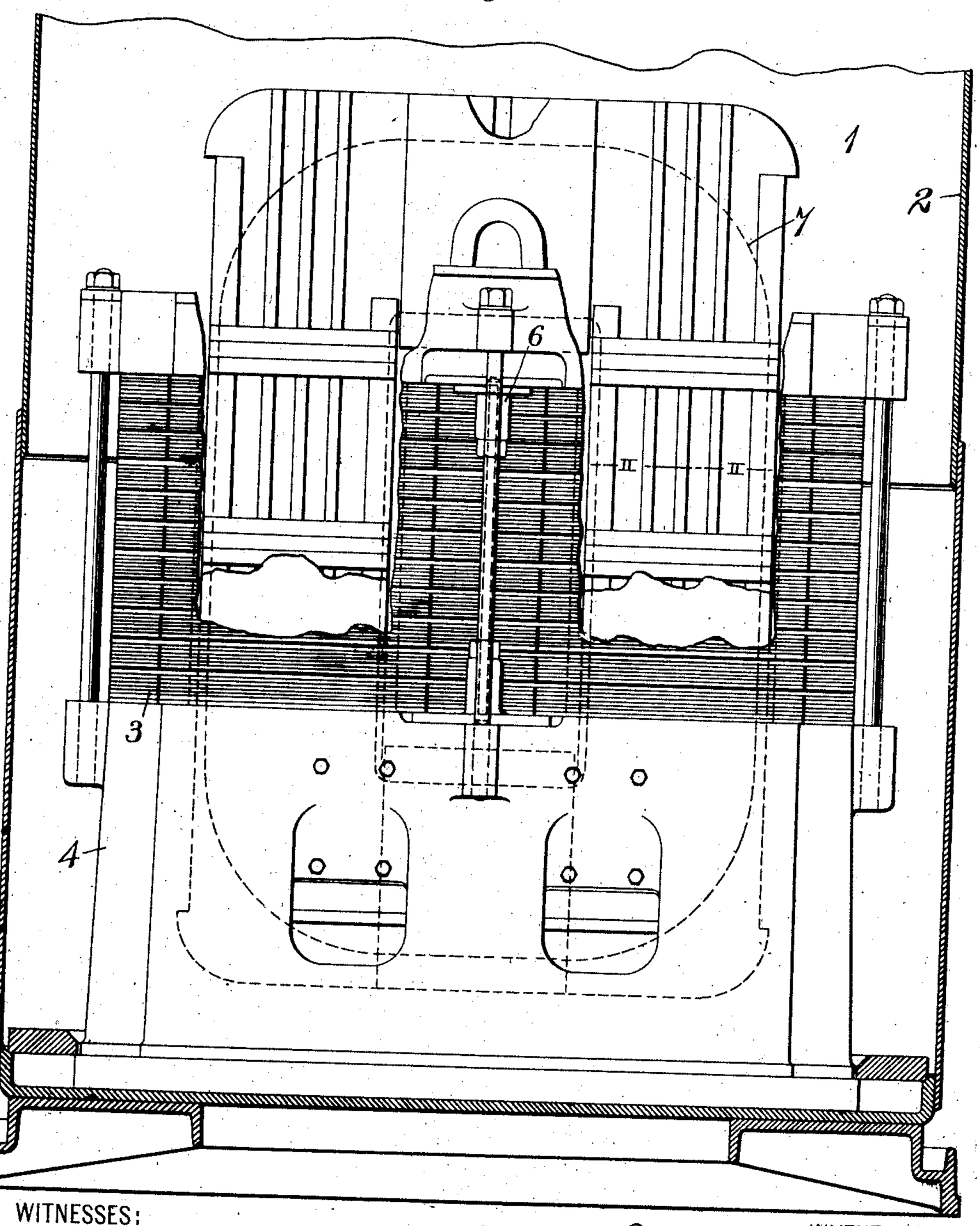
J. E. MATEER.

TRANSFORMER COIL INSULATION.

APPLICATION FILED DEC. 16, 1905.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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2 SHEETS—SHEET 2.

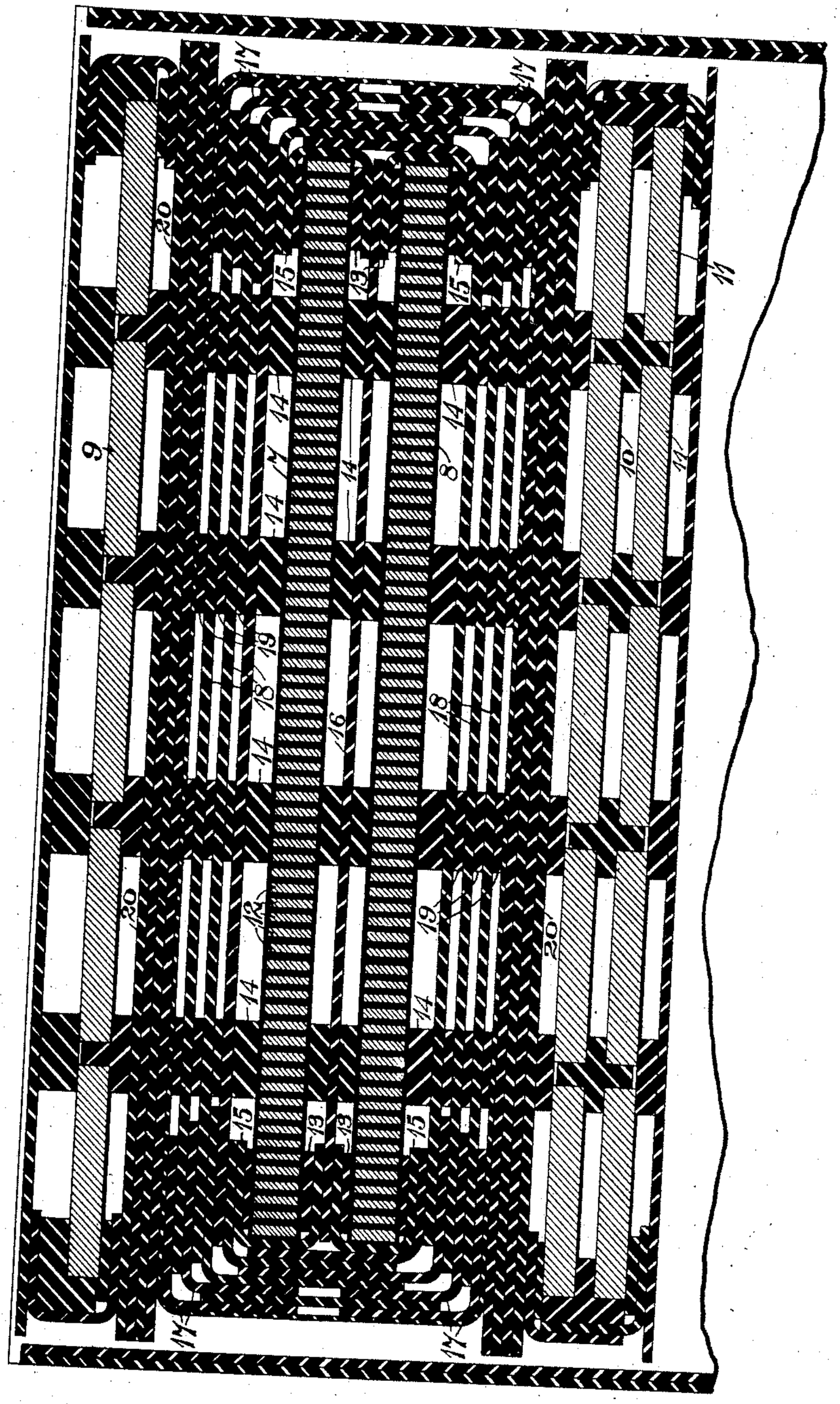

Fig. 2.

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JESSE E. MATEER, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

TRANSFORMER-COIL INSULATION.

No. 885,771. Specification of Letters Patent. Patented April 28, 1908.

Application filed December 16, 1905. Serial No. 292,104.

To all whom it may concern:

Be it known that I, JESSE E. MATEER, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Transformer-Coil Insulation, of which the following is a specification.

My invention relates to the insulation of coils for electrical apparatus and particularly to means for insulating and stiffening the coils of alternating electric current transformers which are adapted for relatively high voltage service.

The object of my invention is to provide means for insulating and stiffening transformer coils that shall be simple and durable in construction and effective in maintaining suitable ventilation, and the parts of which may be separated from the coils and from each other without mutilation or injury.

It is specially desirable, in transformers of large size and high voltage, to provide a coil insulation which may be easily applied and may stiffen as well as suitably insulate the coil. In order to accomplish this result and provide adequate insulation as well as obviate the tendency for the insulation to separate itself from the coil at one part when it is held in close engagement at another, I employ a plurality of channels, angle strips and spacing strips, together with flat barrier-plates, all of which are preferably constructed of hard insulating material, such as fullerboard. These members are so assembled, one part overlapping another, that an inclosing casing is formed which is forced together telescopically when pressure is applied to the completely insulated coil or groups of coils.

In the prior art, when coils of electrical apparatus were damaged or when it was necessary to remove the insulating wrapping, for any reason, the removed material was injured to such an extent that it could not be again used for the same purpose. On the other hand, a telescoping casing constructed in the aforesaid manner may readily be taken apart and re-assembled for insulating the same or another group of coils.

As the result of large numbers of tests and experiments in regard to the insulating properties of fluids, such as air and oil, it has been proved conclusively that the resistance to voltage strains does not increase directly as the distance of separation between current-carrying parts of unlike potential increases. In plotting the distance of separation in a fluid such as oil, as a function of the voltage at which a break-down occurs, a curve is obtained which shows that the value of voltage is proportional to the distance of separation for relatively low voltages, but a knee in the curve indicates the maximum distance in the fluid for which the ratio is maintained approximately constant, and after this point is reached, the distance increases very rapidly and out of all proportion to the voltage increase. It has been discovered, however, that the ratio may be substantially maintained for high voltages if barrier-plates of hard insulating material having a specific inductive capacity approximately the same as that of the fluid are interposed at frequent intervals in the fluid between points of different potential. The barrier-plates may be separated by strips of similar material and the construction in addition to withstanding specially high voltage strains for a given distance, permits of ventilation of the current-carrying parts and the circulation of the fluid.

My invention is well adapted for the insulation of the high tension coils of relatively large transformers, the construction and insulation of which have involved, in the prior art, a relatively large amount of labor and the use of large quantities of flexible material which materially interfered with the coil ventilation.

Figure 1 of the accompanying drawings is a front elevation of a transformer, a portion of the core being removed to disclose the coils, and Fig. 2 is an enlarged cross-section, on line II—II of Fig. 1, of a group of transformer coils which are provided with the insulation of my invention.

Referring to the drawings, a shell type transformer 1 is provided with an inclosing tank or casing 2 and comprises a magnetizable core or shell 3 and a group of coils both of which are supported from a hollow base 4. The relative position of the coils is maintained independently of the core by a coil support 6. The group of magnetizing coils comprises high voltage coils 7 and 8 and a plurality of groups of low voltage coils 9, 10 and 11. The high voltage coils 7 and 8 are

formed of insulated conductors 12 and the complete coils are insulated by a plurality of spacing strips 13, which are located near the edges of the assembled coils, and intermediate strips 14 which are bound against the side of the coil and parallel to the strips 13. Channel pieces 15 are next fitted over the edges of the coils and over the spacing strips 13 and serve to protect the coils from mechanical injury as well as to give additional insulation.

An insulating plate or barrier 16 is located between the coils 7 and 8, and the channel pieces 15 and the spacing strips 14 keep the insulating plate out of engagement with the sides of the coils, so that open spaces are left through which an insulating fluid, such as oil or air, may circulate. Angle strips 17 are placed outside of the assembled group over the corners of the channel pieces 15 and the plane surfaces of one angle strip overlap those of the next preceding strip on the adjacent corner of the assembled coil in such a way as to form a telescopic inclosing casing, the sides of the casing being completed by alternate barrier-plates 18, which are similar to the plate 16, and spacing strips 19 which are placed alongside the strips 14. The rigidity of the insulating material of which the angle strips and the barriers are constructed materially stiffens the coils, and the telescopic corner arrangement causes the insulating box to slide together and form a solid mass of minimum volume, when pressure is applied to the insulated coil, without interfering with the ventilation of the coil which is maintained by the spacing strips.

Groups of low voltage coils which are preferably insulated in a similar manner to a less degree are assembled on each side of the high voltage group and are separated therefrom by a plurality of barrier-plates 20. After the insulation for the high tension coils has been forced into as small a space as possible, the assembled coils are bound together by strips of any suitable material and are then in condition to be finally assembled with their magnetizable core, being well protected from mechanical injury and distortion by reason of the hardness of the insulating material.

Although I have shown a group comprising two high voltage coils with low voltage coils assembled on each side, the specific arrangement is not essential to my invention and I desire that variations in size, form and arrangement of parts which do not depart from the spirit of my invention shall be included within its scope.

I claim as my invention:

1. A transformer coil having spaced insulating strips at its sides, insulating channel pieces fitted over its edges, angle pieces fitted over the channel pieces, and barrier plates extending along the sides of the coil in contact with said strips and angle pieces to form an inclosing casing.

2. In an alternating electric current transformer, the combination with a plurality of coils, of means for insulating said coils comprising spaced strips along their sides, channel pieces fitting over the edges of the several coils, angle pieces fitting over the coil edges and the channel pieces, and barrier plates between the sides of the coils.

3. In an alternating electric current transformer, the combination with a plurality of coils, of insulating means for said coils comprising a plurality of channel pieces which fit over the edges of the coils, a series of barrier plates between adjacent sides of the coils, angle pieces fitting over the channel pieces, and spacing strips between the sides of the coils and the barrier plates.

4. In an alternating electric current transformer, the combination with a plurality of coils, of insulating means for said coils comprising a plurality of channel pieces fitted over the coil edges, barrier plates between adjacent sides of the coils, angle pieces fitted over the channel pieces and spacing strips, all constructed of relatively hard insulating material and constituting a ventilated inclosing casing for said coils.

5. In an alternating electric current transformer, the combination with a plurality of coils, of insulating means for said coils comprising channel pieces around the coil edges, barrier plates between the sides of the adjacent coils, angle pieces fitted over the channel pieces, and spacing strips between the coils and the barrier plates.

6. In an alternating electric current transformer, the combination with a plurality of coils, of transformer coil insulation comprising a plurality of channel pieces fitting over the coil edges, angle pieces that overlap each other around the channel pieces, and barrier plates of hard insulating material which combine with said channel and angle pieces to constitute an inclosing casing for the coil and add rigidity thereto.

7. In an alternating electric current transformer, the combination with a plurality of coils, of means for insulating and supporting said coils comprising a plurality of channel pieces fitting over the coil edges, angle pieces overlapping each other and the channel pieces, and barrier plates which are constructed of hard insulating material and the edges of which overlap those of the angle pieces.

8. In an alternating electric current transformer, the combination with a plurality of coils, of insulating and supporting means for said coils comprising a plurality of channel pieces which fit over the edges of the coils, a series of barrier plates between adjacent sides of the coils, angle pieces overlapping each other, and spacing strips between the coils

and the barrier plates, all of said parts being constructed of hard insulating material to constitute a ventilated inclosing casing.

9. In an alternating electric current transformer, the combination with a plurality of coils, of insulating and supporting means for said coils comprising channel pieces fitted over the coil edges, angle pieces fitted over the channel pieces and having overlapping adjacent edges, barrier plates extending along the sides of the coils and over the edges of the angle pieces, and spacing strips between the barrier plates and the coils, all combining to constitute a ventilated, telescopic inclosing casing.

10. A ventilated inclosing and insulating casing for a plurality of coils comprising channel pieces fitted over the edges of each coil, angle pieces fitted over a plurality of channel pieces and overlapping each other, barrier plates between the coils the edges of which overlap the angle pieces, and spacing strips between the barrier plates and the coil sides.

11. An insulation comprising a plurality of barrier-plates of hard insulating material, separating strips located at intervals between the plates and insulating fluid around and between the plates.

12. In electric apparatus, the combination with current-carrying parts of unlike potential, of means for insulating said parts from each other comprising a wall of insulating fluid maintained between the parts in which barrier-plates of hard insulating material are interposed at regular intervals.

13. In electric apparatus, the combination with current-carrying parts of unlike potential, of means for insulating said parts from each other comprising a wall of insulating fluid maintained between the parts in which barrier-plates of hard insulating material are interposed at regular intervals and separated by strips of similar material.

In testimony whereof, I have hereunto subscribed my name this 12th day of December, 1905.

JESSE E. MATEER.

Witnesses:
DEAN HARVEY,
BIRNEY HINES.