

No. 776,654.

PATENTED DEC. 6, 1904.

J. W. FARLEY.  
COIL FOR ELECTRICAL APPARATUS.  
APPLICATION FILED MAR. 16, 1904.

NO MODEL.

Fig. 1.

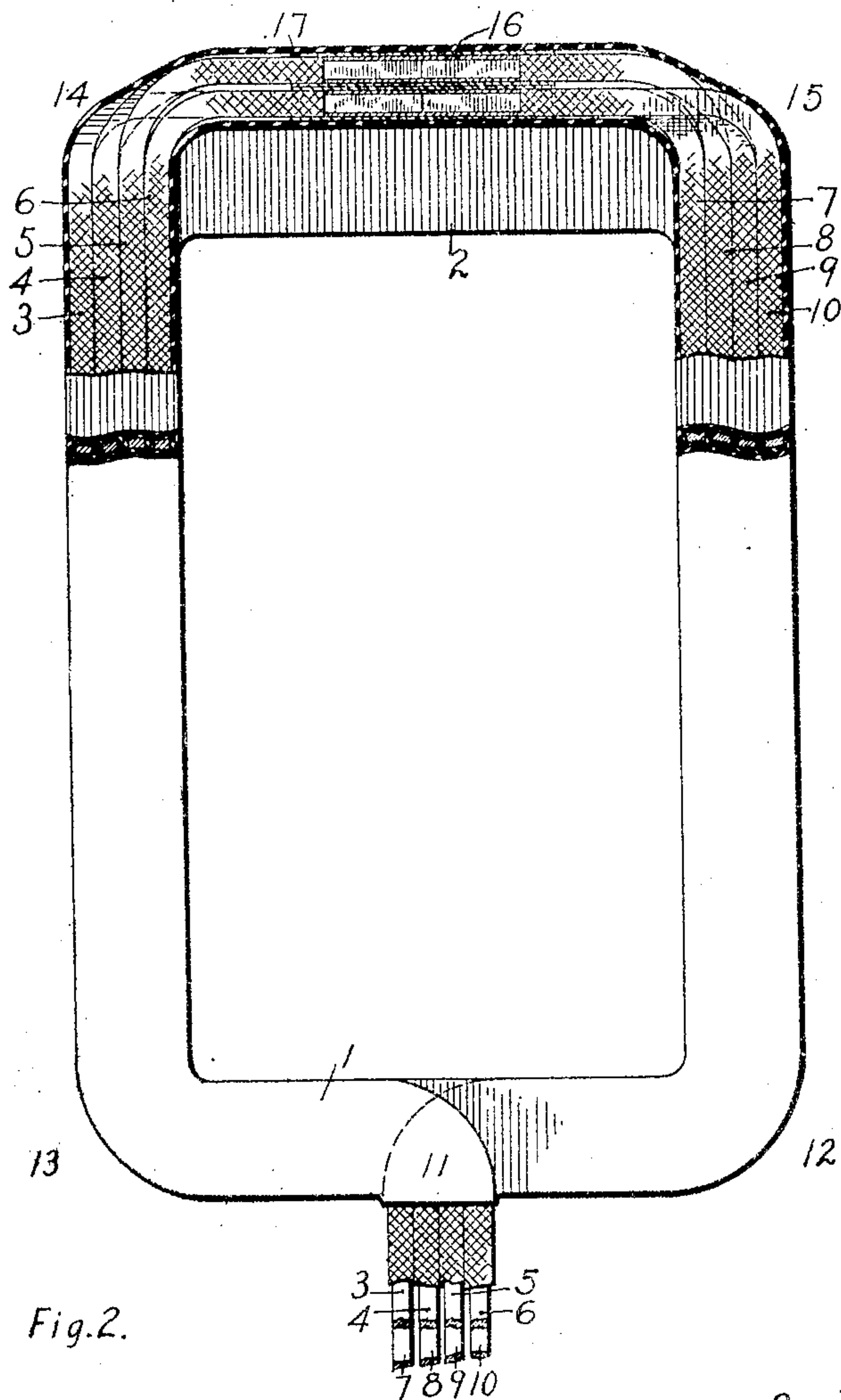
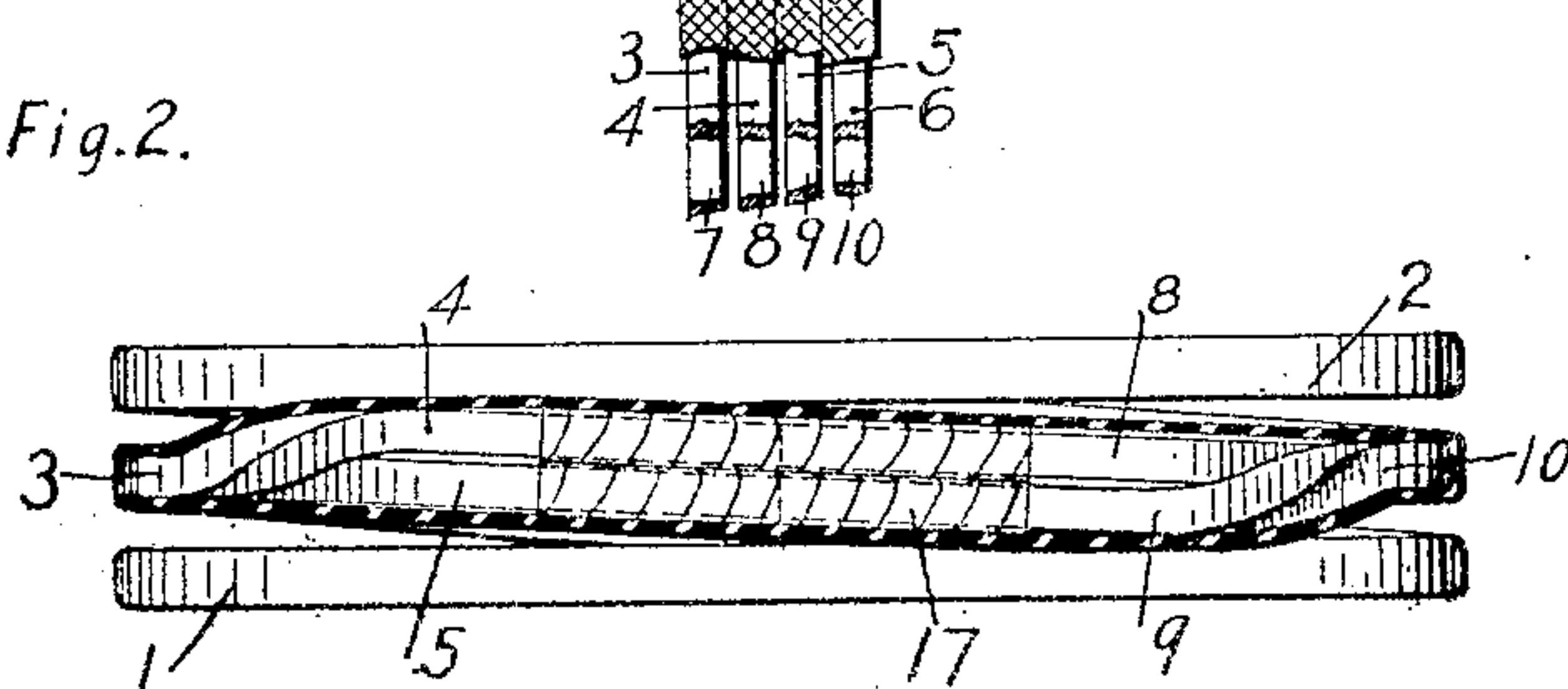


Fig. 2.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

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## COIL FOR ELECTRICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 776,654, dated December 6, 1904.

Application filed March 16, 1904. Serial No. 198,507. (No model.)

*To all whom it may concern:*

Be it known that I, JOSEPH W. FARLEY, a citizen of the United States, and a resident of East Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Coils for Electrical Apparatus, of which the following is a specification.

My invention relates to windings for electrical apparatus, and particularly to the windings employed in transformers.

It has for its object to provide a simple and compact winding of such construction as will effectively prevent local and eddy currents in the conductors constituting such winding.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of a coil constructed in accordance therewith, the turns being separated to show the structure more clearly. Fig. 2 is a plan view of the coil shown in Fig. 1.

Transformers employed for transforming comparatively small currents at high voltages into very large currents at low voltages have but few turns in the secondary winding, and consequently the conductor must have a large cross-sectional area. If the conductor consists of only a single bar or strap wound edge-wise, the electrical path at the outer edge thereof is of greater length than that at the inner edge, and local currents may therefore be produced in the conductor, the effect of which is to cause undue heating and possible injury to adjacent parts and also to absorb power, and thus reduce the efficiency of the transformer.

It is well known that excessive eddy-currents may be avoided by employing a plurality of relatively small insulated conductors wound in parallel instead of a single conductor having the same cross-sectional area, and it is by similar means that I am enabled to provide a conductor in which the production of local currents is reduced to a minimum.

In the construction of transformers of the "shell" type it is a customary practice to employ flat coils placed side by side in paral-

lel planes, so that if several conductors are wound in multiple it is desirable and generally necessary to wind them one outside of another. It follows from this method of construction that the outer strands have more resistance than the inner ones, because of their greater lengths, and hence local currents are likely to result. To avoid these difficulties, I have devised a coil of such construction that the parallel strands composing the conductor are approximately of the same length, and hence have substantially the same resistance.

Two similar coil-sections 1 and 2 are formed of the same number of turns of a plurality of strands of covered or insulated wires 3, 4, 5, and 6, and 7, 8, 9, and 10, wound in multiple and one outside of another. The two sections are then reversed in position and assembled face to face, so that the strands of each section constitute one and one-half turns. Section 1 extends from the point 11 in a single plane clockwise to the point 12 and is then bent laterally to the point 13. From that point to the point 14 it occupies a plane parallel to that of the first turn. Section 2 extends in a single plane counter-clockwise from the point 11 to the point 13 and is then bent laterally to the point 12. From that point to the point 15 it occupies the same plane as the portion of section 1, which is between the points 13 and 14. Adjacent to the point 14 the strands 3 and 4 of section 1 are bent laterally and somewhat abruptly out of the plane in which they were wound and are respectively joined to the strands 7 and 8 of section 2, the latter being deflected slightly in order to meet the ends of strands 3 and 4, but having no abrupt bends. Adjacent to the point 15 the strands 9 and 10 of section 2 are bent laterally and somewhat abruptly from the plane in which they were wound and toward the opposite face of the coil from that toward which the strands 3 and 4 are bent. The ends of the strands 9 and 10 are respectively joined to the ends of strands 5 and 6 of section 1, the latter being slightly deflected, but having no abrupt bends.

Any suitable means for making good elec-



trical joints between the meeting ends of the strands may be employed; but, as here shown, the meeting ends of each two strands are surrounded by a sleeve 16, which is soldered in position and then covered with a layer of tape 17. The joints in the strands are distributed so as to avoid bulging, and the strands are bent and overlapped in a manner which enables the cross connections between the sections to occupy a minimum space, substantially as shown. By bending a part of the strands in one direction out of the plane of winding and the remainder in the opposite direction the dimensions of the complete coil are reduced to a minimum.

It is to be understood that my invention is not limited to any particular number of strands, turns, or sections to be joined, the number shown being selected merely for simplicity of illustration and description. The sections may have unequal numbers of turns, and the crossovers may occur in any desired position with reference to the outline of the coil. The strands may be bent and connected otherwise than as shown, and the sections may have any desired form and may be composed of strands of any desired form of cross-section.

My invention may be employed in the construction of coils for other purposes, its application to transformer-windings being particularly advantageous, but not exclusive.

It is evident from the description and drawings that by providing parallel paths of approximately equal length and resistance I have provided a simple and efficient means for reducing to a minimum the local and eddy currents which occur in conductors of large cross-section, and I do not wish my invention limited except by such restrictions as are imposed by the prior art.

I claim as my invention—

1. A coil for electrical apparatus comprising two similarly-wound sections each composed of a plurality of suitably-insulated

strands arranged one outside of another, the strands of one section being joined to those of the other section in reverse order so that the longer and the shorter strands are connected to form turns of substantially uniform length.

2. A coil for electrical apparatus comprising two similar sections, one being reversed with respect to the other, the conductors of each section being composed of a plurality of suitably-insulated strands arranged one outside of another, the inner strand of one section being joined to the outer strand of the other and the remainder of the strands in the two sections being joined consecutively in like manner.

3. A coil for electrical apparatus comprising two similar sections, one being reversed with respect to the other, the conductors of each section being composed of a plurality of suitably-insulated strands and those of one section being connected to those of the other in such manner that the several active lengths thereof become approximately equal.

4. A coil for electrical apparatus comprising two like sections severally composed of a plurality of insulated strands and reversely disposed, the strands of each section being divided at one end, bent out of their normal planes and joined to those of the other in reverse order so as to provide turns of substantially the same length.

5. A coil for electrical apparatus comprising two like sections severally composed of a plurality of insulated strands disposed in a single plane, the strands of each section being divided at one end and joined to those of the other in reverse order so that all the turns of the coil are of substantially the same length.

In testimony whereof I have hereunto subscribed my name this 12th day of March, 1904.

JOSEPH W. FARLEY.

Witnesses:

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BIRNEY HINES.