No. 742,548. PATENTED OCT. 27, 1903.

G. WRIGHT.

TRANSFORMER.

APPLICATION FILED FEB. 20, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

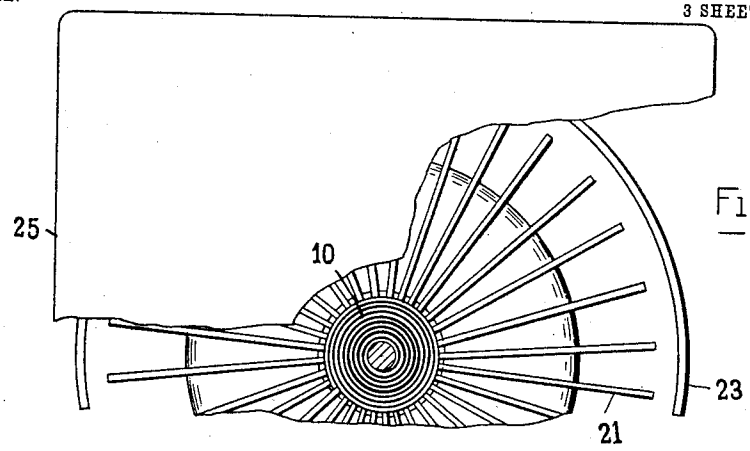

Fig. 2

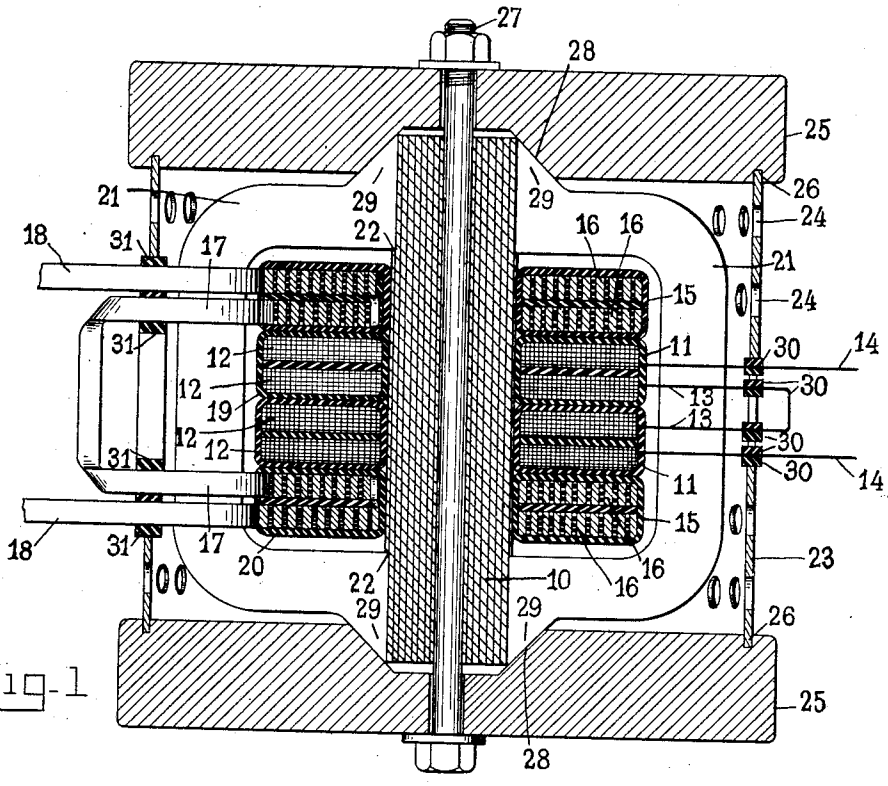

Fig. 1

WITNESSES—

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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NO MODEL. 3 SHEETS—SHEET 2.

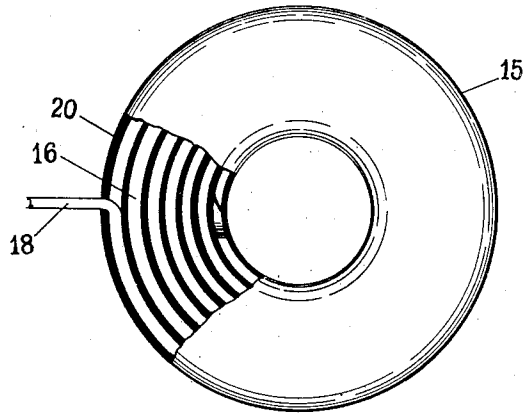

Fig-3

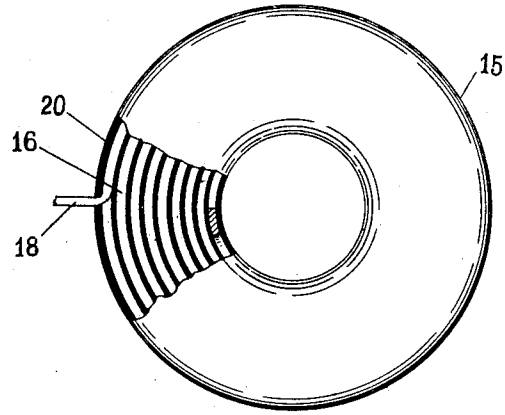

Fig-4

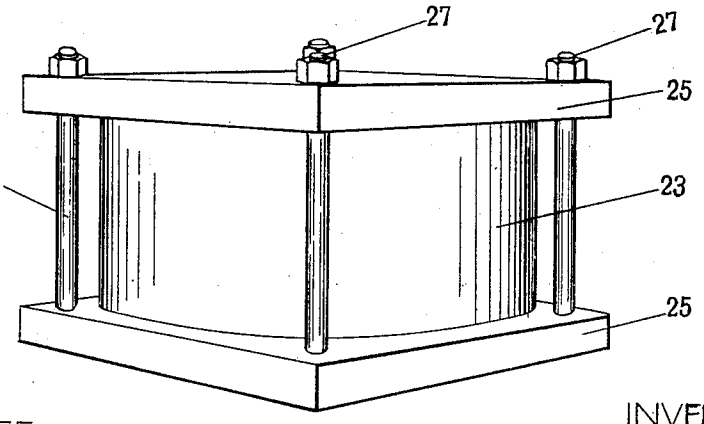

Fig-5

WITNESSES—

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No. 742,548. PATENTED OCT. 27, 1903.

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TRANSFORMER.

APPLICATION FILED FEB. 20, 1903.

NO MODEL. 3 SHEETS—SHEET 3.

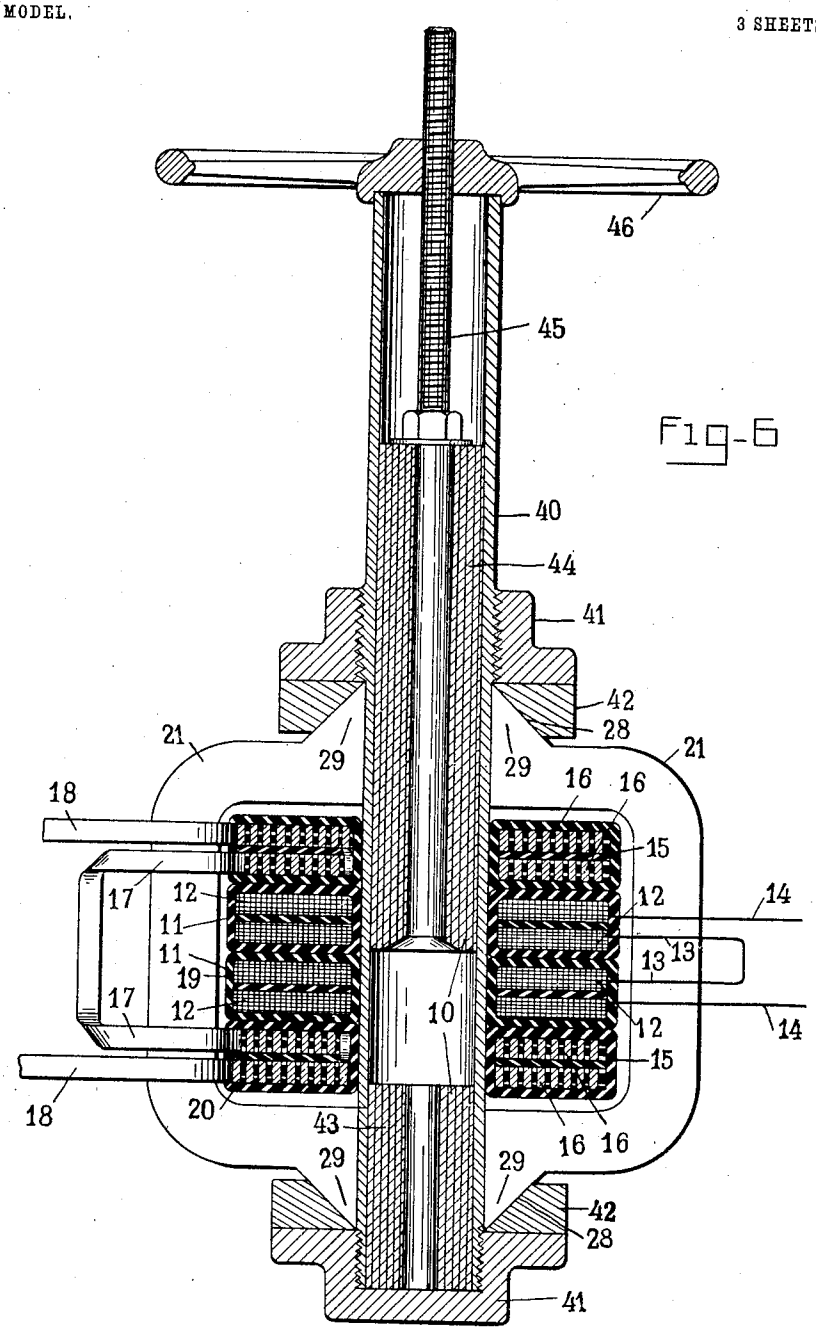

Fig-6

WITNESSES—

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No. 742,548. Patented October 27, 1903.

UNITED STATES PATENT OFFICE.

GILBERT WRIGHT, OF PITTSFIELD, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO CHARLES C. MORGAN, OF PITTSFIELD, MASSACHUSETTS.

TRANSFORMER.

SPECIFICATION forming part of Letters Patent No. 742,548, dated October 27, 1903.

Application filed February 20, 1903. Serial No. 144,273. (No model.)

To all whom it may concern:

Be it known that I, GILBERT WRIGHT, of Pittsfield, in the county of Berkshire and State of Massachusetts, have invented certain new and useful Improvements in Transformers, of which the following is a specification.

This invention relates to electric-current transformers; and it consists in an improvement the chief aim of which is to secure simplicity and compactness of construction and reduce the cost of manufacture, though in so doing I may incidentally increase efficiency by shortening electric and magnetic circuits.

Of the accompanying drawings, Figure 1 represents a vertical axial section of a transformer embodying my improvements. Fig. 2 represents a plan view thereof, partly in section. Figs. 3 and 4 represent plan views, partly in section, of two adjoining sections of the secondary coil. Fig. 5 represents a perspective view showing a modification in the manner of holding together the case of the transformer. Fig. 6 represents an axial section showing a modified construction of the transformer in which the central core is adjustable to vary the intensity of the magnetic field.

The same reference characters indicate the same parts in all the figures.

In the drawings, 10 is a central iron core laminated by virtue of being wound in spiral form, the convolutions, if desired, being insulated from each other, as by means of varnishing them or with interposed layers of an insulating substance, such as paper. The core when complete is of cylindrical form and may be bound together in a suitable manner. The smaller winding, usually employed as the primary, is shown in the form of two flattened annular coils 11 11, surrounding the cylindrical core 10, and each, as shown, composed of two parallel sections 12 12, one a right-hand wound spiral and the other a left-hand wound spiral, with their inner ends connected. This leaves four terminals projecting from the outside of the two coils, which I carry through insulators 30 30 in the body 23 of the transformer-casing. The terminals 13 13 of the adjoining sections of the two coils are connected to each other outside of the casing, while the terminals 14 of the remote sections constitute the leads of the primary winding. The four coil-sections are thus all in series, and the current flows in a single direction around the central core during each alternation. By building up a sectional winding in the manner described I can make outside connections between the coils which do not cross the winding.

At the two ends of the small winding is placed the large winding, usually employed as the secondary and consisting, as here shown, of two coils 15 15 of a flat annular form and each composed of two parallel sections 16 16. The secondary winding is mad of a wire or ribbon of flat or rectangular section, and the two sections of each coil are right and left hand spirals, as indicated in Figs. 3 and 4, with inner ends joined and outer ends leading outside of the coils. The terminals 17 17 of the adjacent sections of the two coils are connected to each other, and the terminals 18 18 of the remote sections constitute the leads of the secondary winding, the said terminals passing through insulators 31 31 in the body of the casing. The several primary and secondary coils 12 15 are surrounded by insulation 19 20, and the metallic convolutions of the coils are of course separated by suitable insulation. The coils of the winding being circular in shape may be machine-wound and machine-insulated, and thus manufactured cheaply. The spiral iron core 10 may also be cheaply made by appropriate machine methods. It will be understood that I do not limit myself to any particular number of coils in either the primary or secondary windings, nor to any particular number of sections in each coil, nor do I restrict myself to the particular cross-sectional shapes (round and flat, respectively) of the conductors in these coils as I have shown them.

21 21 are U-shaped iron laminæ or yoke-sections embracing the primary and secondary windings of the transformer and radiating from the central core 10, their ends being in magnetic contact with said core and held from axial movement by means of shoulders 22 on the core, formed by slightly reducing the ends of the latter. This construction affords a magnetic circuit or series of circuits completely encircling the primary and sec-

ondary windings, and the spaces between the yoke-sections 21 afford large heat-dissipating surfaces and allow for the circulation of air or other cooling or insulating medium. With in the term "radiating" as applied to the arrangement of the yoke-sections it will be understood that I include arrangements of these elements which are not strictly radial in a geometrical sense, but which have the same effect or purpose.

23 is the cylindrical body of a casing, shown here as formed with perforations 24 24 for the circulation of air, and 25 25 are insulating end pieces or plates circularly grooved at 26 26 to receive the edges of the body 23 and held together by a bolt 27, passing through holes in the end pieces and through the hollow center of the core 10. The bolt may be of soft iron and form a part of the magnetic circuit. The end pieces are formed with conical-sided recesses 28, which fit complemental conical projections 29 on the ends of yoke-pieces 21 and serve to hold said pieces in assembly against the central core 10. The conical surfaces of the end pieces exert an inward centripetal wedging action on the yoke-pieces as said pieces are drawn together by the bolt 27. The case-body 23 being cylindrical in form may be economically and cheaply constructed of sheet metal, with a seam or without, by well-known manufacturing methods.

In Fig. 5 I show a modification in which instead of tying the case together by a single bolt at the center I employ four bolts 27, connecting the end pieces 25 at the corners of the case outside of the case-body 23. The central-bolt construction, however, is preferred in some respects, as it is simpler than the latter and makes the task of assembling and disconnecting the case an easy matter.

In Fig. 6 is represented a second modification in which a part of the central core is made axially adjustable, so as to provide a variable air-gap in the magnetic circuit, and thus increase or decrease the intensity of the magnetic field and the output of the transformer. The construction shown for the primary and secondary windings is the same as in Fig. 1. Within the windings, however, is located a thin tube 40, of non-magnetic material, to which the U-shaped yoke-pieces 21 are clamped by means of nuts 41, screwing on the tube, and washers 42, having conical recesses 28, fitting the complemental wedge-shaped projections 29 of the yoke-pieces. The washers 42 thus constitute end pieces whose clamping function is the same as that of the end pieces 25 in Fig. 1; but in Fig. 6 I have omitted the casing and have made the end pieces smaller in extent. The central spirally-laminated core 10 is made with a fixed section 43 within the tube 40 opposite the lower ends of the yoke-pieces and an axially-movable sliding section 44, secured to a stem 45, which is screw-threaded and engaged with a hand-wheel 46, the latter having a hub which constitutes a nut screwing on said stem and abutting the end of the tube 40. By manipulating said hand-wheel the movable core-section 44 is raised or lowered and the air-gap in the magnetic circuit varied, thereby varying the output of the transformer for a given strength of primary current. The tube 40 in this construction constitutes the hollow stem of a bolt, and the members 41 constitute the nuts of said bolt.

I claim—

1. A transformer comprising a central magnetic core, U-shaped radiating magnetic yoke-sections disposed around said core, and primary and secondary coils encircling the core and embraced between the arms of the yoke-sections.

2. A transformer comprising a cylindrical magnetic core, annular primary and secondary coils surrounding the same, and a magnetic yoke spanning said coils.

3. A transformer comprising a central magnetic core, primary and secondary coils, radiating magnetic yoke-pieces projecting from said core and having ends formed with wedging members, complemental wedging end pieces which crowd the yoke-pieces inwardly, and means to draw said end pieces together.

4. A transformer comprising a central magnetic core, primary and secondary coils surrounding the same, magnetic yoke-pieces embracing said coils, end pieces which hold said yoke-pieces in assembly with the core, and a bolt concentric with the core and connecting said end pieces.

5. A transformer comprising primary and secondary coils, U-shaped radiating magnetic yoke-sections embracing said coils, and an axially-movable central core member.

6. A transformer comprising primary and secondary coils, radiating magnetic yoke-sections embracing said coils, and a central magnetic core having a fixed portion located between the one ends of the several yoke-sections and a portion axially movable toward and away from said fixed portion past the other ends of said yoke-sections.

7. A transformer comprising a tube, primary and secondary coils surrounding the same, U-shaped radiating magnetic yoke-pieces having their ends secured to said tube, and a magnetic core member slidingly mounted in said tube.

8. A transformer comprising a tube, primary and secondary coils surrounding the same, radiating magnetic yoke-sections embracing said coils and having wedging members, complemental wedge-formed end pieces, and relatively adjustable members on said tube for holding the tube, yoke-pieces and end pieces in assembly.

In testimony whereof I have affixed my signature in presence of two witnesses.

GILBERT WRIGHT.

Witnesses:
CHARLES C. MORGAN,
C. A. RAYMOND.