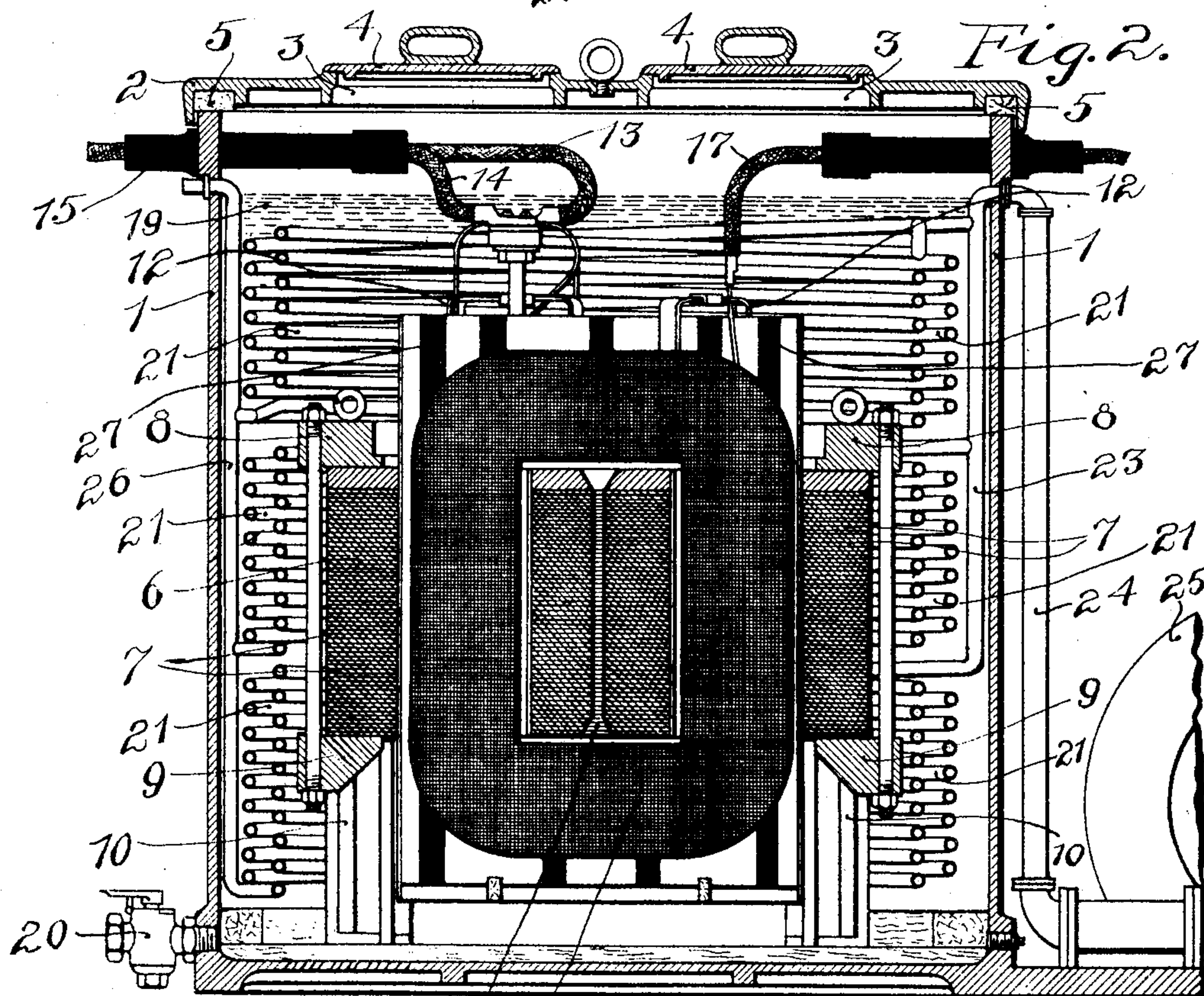
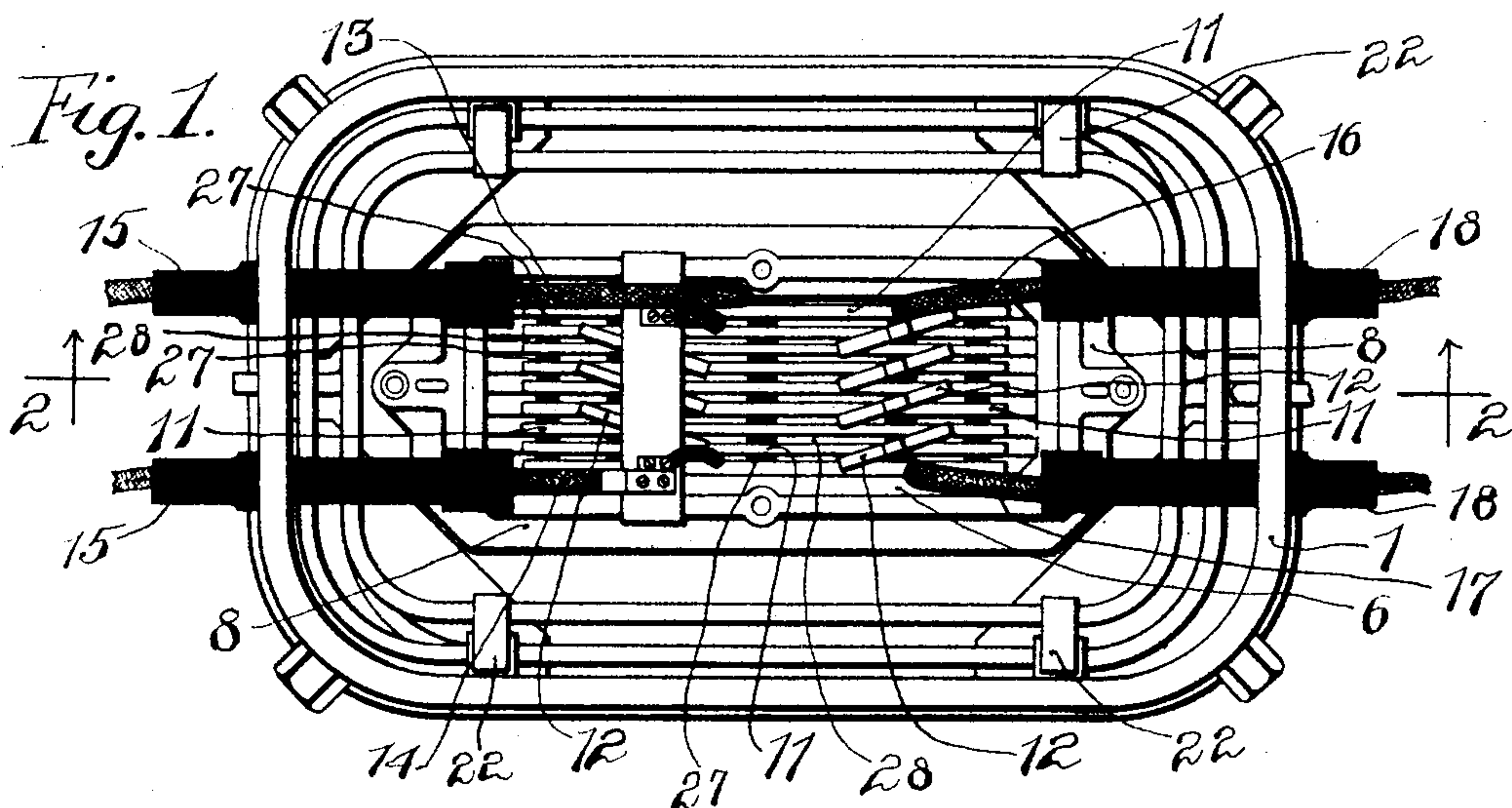


W. L. WATERS.
TRANSFORMER.

APPLICATION FILED APR. 28, 1905.



Witnesses:

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UNITED STATES PATENT OFFICE.

WILLIAM L. WATERS, OF MILWAUKEE, WISCONSIN.

TRANSFORMER.

No. 799,423.

Specification of Letters Patent.

Patented Sept. 12, 1905.

Application filed April 28, 1905. Serial No. 257,836.

To all whom it may concern:

Be it known that I, WILLIAM L. WATERS, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Transformers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to transformers, and has for its object the provision of improved cooling means therefor.

Transformers have been used in which an air-blast was directed directly about the windings to carry therefrom the heat; but transformers thus cooled can be made to operate satisfactorily only on low voltages. The insulation in transformers thus cooled becomes dry and quickly deteriorates, and the danger from fire is very great, a slight spark being quickly spread over the entire insulation by the air-blast. Transformers have also been employed in which the windings are immersed in oil, and another class of transformers also employs oil; but this oil is cooled by the passage therethrough of water-pipes. Where the oil alone is used, the transformer cannot be kept cool, and where the water-cooling is provided there is great danger of deterioration of the oil, due to leaky pipes, and also of cooling the transformer below the temperature of the surrounding atmosphere, which causes the casing and the cooling-coils to sweat. In my arrangement I propose to blow air through cooling-coils which pass through the oil surrounding the windings, and a transformer thus provided eliminates all the dangers and disadvantages of the classes above enumerated.

My invention will be best understood by reference to the accompanying drawings, in which—

Figure 1 is a plan view of the transformer; and Fig. 2 is a sectional view thereof, taken on plane 2 2 of Fig. 1.

The inclosing casing 1 is provided with a cover 2, having hand-holes 3, provided with lids 4, a gasket 5 being carried by the cover 2. Within the casing is the core 6, built of laminations 7 7, held between the clamping ends 8 and 9, the entire core structure being carried on the supporting-legs 10, which may extend from the lower clamping end 9. The windings are composed of sections or panels

11 11, suitably connected together by connecting ends 12. The terminals 13 and 14 of the primary winding may pass through the insulating-bushings 15, extending through the casing-wall, while the terminals 16 and 17 of the secondary winding may pass through the insulating-bushings 18, also extending through the casing-wall. The casing is filled with oil 19, and a drain-cock 20 may be provided at the bottom thereof.

To cool the oil and the transformer parts, coils 21 of piping are supported within the casing from hangers 22 and surround the core and windings, the coils being connected, through the interior pipe 23 and exterior pipe 24, with a blower 25, which may be mounted on the base-piece of the casing. The several coils discharge into the interior pipe 26, which passes through the casing to the outside. The air from the blower at atmospheric temperature circulating through the several coils will convey away the heat and maintain the transformer parts cool. The air may pass serially and successively through the various coils or, as shown, may pass in parallel therethrough from the supply-pipe 23 to the exhaust-pipe 26. In order to cool the oil in all parts, these coils extend downwardly to the bottom of the casing, and the cooled oil circulates about the core parts and windings. To facilitate this circulation, spacers 27 are placed between the panels to form passage-ways 28 between them, and a passage-way 29 may also extend through the interior of the core. The oil extends over the top of the coils, and the feed and exhaust pipes preferably extend through the casing above the oil-level, whereby leakage is prevented through defective joints. These coils may be used all or only in part, depending upon the amount of cooling desired, and, as before stated, may be connected in series or parallel or in any other combination to give the best results for varying conditions.

A transformer cooled in this manner is free from the disadvantages and dangers present in other transformers of the prior art. The oil maintains the insulation of the parts and is at all times kept cool by the air circulating through the coils, and as only air passes through the pipes there can be no deterioration of insulation due to water or other fluid leaking from the coils into the oil. As the air passing through the coils is at atmospheric temperature, the coils and transformer-

casing will not sweat. The transformers when cooled by air in this manner also are much more easily and safely handled than when cooled by water flowing through the pipes.

5 I do not wish to be limited to the exact arrangement and form of the parts herein shown; but

I claim as new and desire to secure by Letters Patent—

10 1. In a transformer, the combination with an inclosing casing containing oil, of a transformer-core and windings immersed in said oil and supported within said casing, cooling-coils surrounding said core and windings from
15 the top to the bottom thereof, and means connected with said coils for causing circulation of cooling air therethrough.

2. In a transformer, the combination with an inclosing casing, of a core and windings
20 thereon supported within said casing and immersed in oil therein, coils of piping entirely surrounding said core and windings, and a blower having its outlet connected with said piping for blowing air therethrough to cool
25 the core and windings.

3. In a transformer, the combination with an inclosing casing, of a core and windings thereon supported within said casing and immersed in oil therein, coils of piping im-
30 mersed in said oil and surrounding said core and windings from top to bottom thereof, and a blower secured to the casing and having its outlet connected with the piping for causing circulation of air at atmospheric pressure
35 through said coils.

4. In a transformer, the combination with an inclosing casing, of a core and windings thereon supported within said casing and im-
40 mersed in oil therein, a wall of piping entirely surrounding said core and windings and immersed in said oil, means for causing circulation of air at atmospheric pressure through said piping to cool the transformer parts and oil, and passage-ways through said core and

between said windings for allowing circula- 45
tion of cooled oil.

5. In a transformer, the combination with an inclosing casing, of a core and windings thereon supported within said casing and im-
50 mersed in oil therein, sections of piping encircling said core and windings from top to bottom thereof and immersed in said oil, and a blower having its outlet connected with said piping for causing circulation of air through
55 said sections to cool the oil and transformer parts, said sections being connected in multiple.

6. In a transformer, the combination with an inclosing casing, of a core and windings thereon supported within said casing and im-
60 mersed in oil therein, convolutions of piping entirely surrounding said core and windings and immersed in said oil, a blower having its outlet connected with said piping for causing
65 circulation of air through said piping, said winding being in the shape of panels suitably connected together, and spacers for forming passage-ways between said panels through which the oil may circulate.

7. In a transformer, the combination with 70
an inclosing casing, of a core and windings thereon supported within said casing and immersed in insulating fluid therein, coils of piping extending from top to bottom of the
75 transformer and surrounding said core and windings, a blower connected with said piping for causing circulation of air through said piping to cool said fluid, said winding being
80 formed of sections, and passage-ways through said core and between said sections for allowing circulation of oil.

In witness whereof I hereunto subscribe my name this 24th day of April, A. D. 1905.

WILLIAM L. WATERS.

Witnesses:

JOHN E. HUBEL,
J. F. DIXON, Jr.