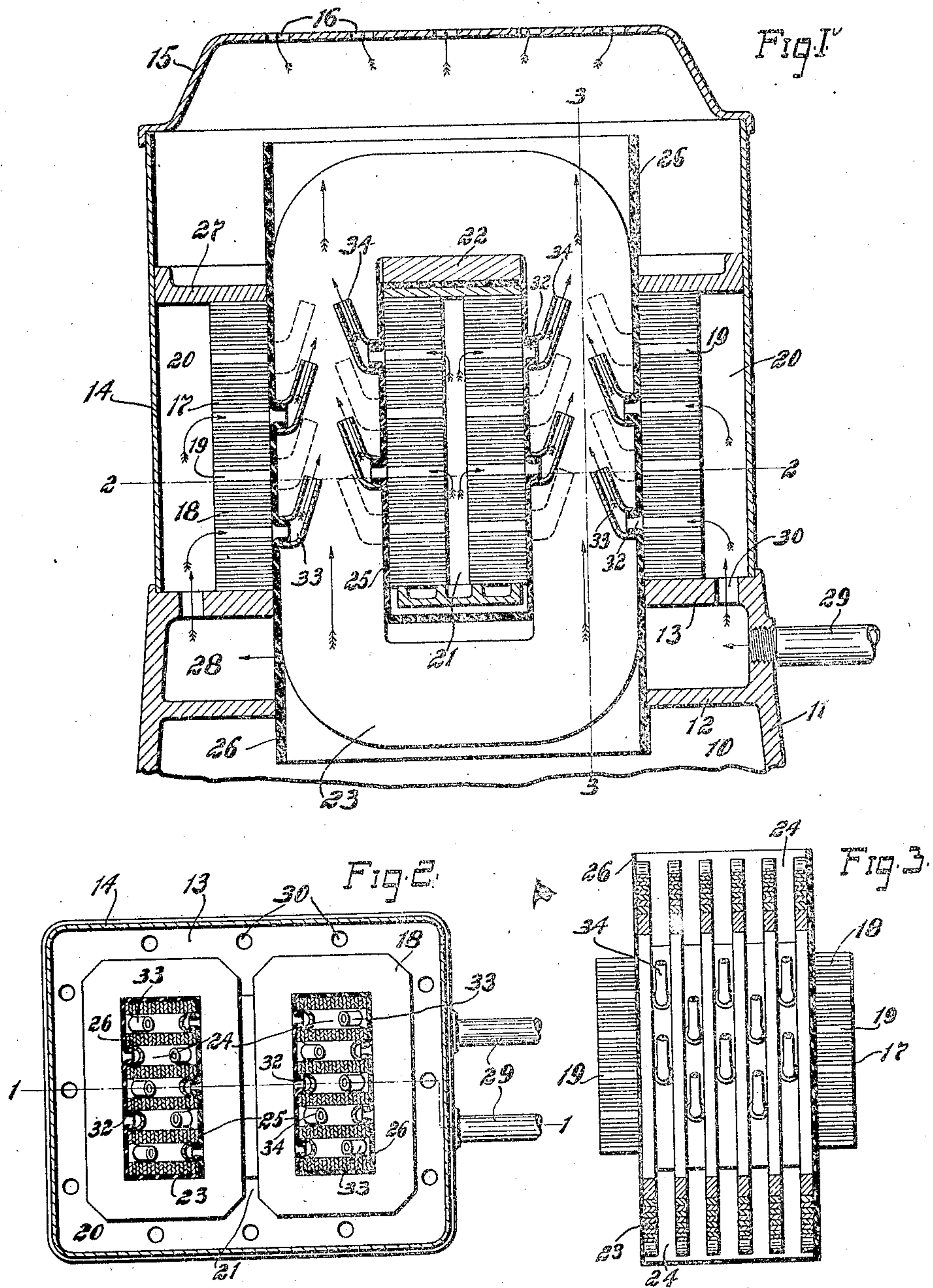


No. 834,148.

PATENTED OCT. 23, 1906.

C. E. LORD.
TRANSFORMER.

APPLICATION FILED OCT. 19, 1905.



WITNESSES:

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TRANSFORMER.

No. 834,148.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES E. LORD, a citizen of the United States, residing at Norwood, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Transformers, of which the following is a full, clear, and exact specification.

My invention relates to transformers for high-voltage alternating currents, and especially to those transformers which are cooled by a forced circulation of air.

The object of my invention is to provide an improved air-blast ventilating means whereby both the core and coils can be effectively cooled by a single forced circulation of air.

In carrying out my invention I maintain a forced circulation of a cooling medium through the passage-ways in the core and coils successively and provide means whereby the said medium is cooled after it has passed through the passage-ways in one of said members.

More specifically considered my invention consists in a transformer having a laminated core provided with horizontal passage-ways, primary and secondary coils spaced apart forming vertical passage-ways, a plurality of upwardly-extending nozzles leading from the passage-ways in the core to the passage-ways between the coils, whereby air can be forced successively through the passage-ways in the core, through the nozzles, and through the passage-ways between the coils in such a manner that cooling air-currents will be drawn upward through the last-named passage-ways, so as to mix with and cool the first-named air-currents.

My invention still further consists of the details of construction and combinations of elements described in the specification and set forth in the appended claims.

For a better understanding of my invention reference is had to the accompanying drawings, in which—

Figure 1 is a section of my improved transformer, taken approximately along the line 1 1 of Fig. 2. Fig. 2 is a transverse section, on a reduced scale, taken along the line 2 2 of Fig. 1; and Fig. 3 is a section, on a reduced scale, taken along the line 3 3 of Fig. 1.

Referring to the figures of the drawings, I have shown a cast-metal base 10, consisting of an outer wall 11 and two horizontal spaced

flanges 12 and 13, extending inward from all sides of the wall, forming a central rectangular opening in the base. Resting on the base and secured thereto in any desired manner is the casing 14, provided with a cap 15, having a plurality of air-outlet openings 16.

Resting on the base is the transformer-core 17, consisting of punched laminæ 18, arranged in groups which are spaced apart, so as to form the horizontal passage-ways 19. Between the core and the casing 14 is the continuous air passage-way 20, which communicates with the air passage-ways 19 between the groups of laminæ 18. The core is divided into two portions forming the air passage-way 21. Supported on the core, preferably by the wooden block 22, are the primary and secondary coils 23, made in this case of concentrically-wound strap-copper. The coils are divided into sections, which are spaced apart, so as to form the vertical air passage-ways 24. The coils extend down into the rectangular opening in the base.

The inner portions of the coils are separated from the core by the plates or sheets of insulating material 25, and the outer portions of the coils are separated from the core by the sheets of insulation 26, forming an insulating-casing which extends through the end plate 27 at the top of the core and through the opening in the base, fitting tightly against the flanges 12 and 13. The lower end of the casing 26 communicates with the outside. It will be seen that the casing 26 and walls 11, 12, and 13 of the base form a continuous air passage-way 28, which does not communicate with the passage-ways between the coils. Communicating with this air passage-way are a plurality of air-inlet tubes or pipes 29. The flange 13 is provided with a large number of openings 30, whereby air entering the air passage-way 28 by the tubes 29 will pass readily into the air passage-way 20.

The portions of the insulating-sheets 26 between the horizontal passage-ways 19 in the core and the vertical passage-ways 24 between the coils are perforated, there being a plurality of openings or perforations for each horizontal passage-way 19. As shown in Fig. 3, the perforations or openings in the different rows are staggered with respect to each other. The insulating material is spread outward, forming short neck por-

tions 32. Secured to the insulating-sheets and surrounding each neck portion 32 is a bent tube or nozzle 33. All these nozzles are bent or directed upward and inward, as shown. By means of these perforations and nozzles the air-currents which enter the passage-ways 19 and 20 pass directly into the passage-ways between the coils.

The plates or sheets 25, which separate the inner portions of the coils from the core, are perforated in a similar manner. Nozzles 34, similar to the nozzles 33, attached to the plates 26, are secured to the plates 25 over each perforation. The perforations or openings and nozzles in each row are staggered with respect to the openings and nozzles in the adjacent rows, as in the preceding case. Thus the air-currents which enter the passage-way 21 can pass directly into the spaces between the coils.

The operation of my improved ventilating device and the action of the upwardly-extending nozzles are as follows: Air from any suitable fan or blower is led to the passage-way 28 by the tubes 29, from which passage-way it passes to the passage-ways 20 and 21 and from these passage-ways to the horizontal passage-ways 19 in the core. The air after cooling the core passes through the nozzles and is directed upward through the passage-ways between the coils and passes out of the casing through the perforations 16 in the cap 15, as is indicated by the arrows in Fig. 1. The streams of air passing upwardly from the nozzles through the spaces between the coils tend to create a vacuum below the nozzles, and thereby draw cool air through the bottom of the base and insulating tubular extension, to the spaces between the coils, as indicated by the vertical arrows in Fig. 1. In other words, currents of cool air are induced in the spaces between the coils by the streams of air from the nozzles in a manner substantially the same as fluid is drawn into an injector for feeding water to boilers.

The induced currents of air mix with the warmer air which has passed through the core and lowers the temperature of the latter currents of air to a sufficient degree to maintain the coils at a suitably low temperature.

The details of my invention are susceptible of various modifications and changes, and I aim in my claims to cover all such modifications which do not depart from the spirit of my invention.

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

1. In a transformer, a core provided with ventilating passage-ways, primary and secondary coils having ventilating passage-ways, and means whereby air forced through the passage-ways in the core and coils will be cooled after it has passed through part of said passage-ways.

2. In a transformer, a core provided with

ventilating passage-ways, coils mounted on the core and provided with ventilating passage-ways, and means whereby air forced through the passage-ways in the core and coils will be cooled after it has passed through the passage-ways in one of said members.

3. In a transformer, a core provided with ventilating passage-ways, coils mounted on the core and provided with ventilating passage-ways, and means whereby air forced through the passage-ways in the core and coils will be cooled after it has passed through the passage-ways in said core.

4. In a transformer, a core provided with ventilating passage-ways, primary and secondary coils separated by ventilating passage-ways, and means whereby a forced circulation of a cooling medium through the passage-ways in one of said members will induce air-currents in the passage-ways of the other member.

5. In a transformer, a core provided with ventilating passage-ways, primary and secondary coils separated by passage-ways, the passage-ways between the coils communicating with the passage-ways in the core, so that a cooling medium can be forced first through the passage-ways in the core and then through the passage-ways between the coils, and means whereby the flow of the cooling medium will induce air-currents in the passage-ways between the coils, which air-currents mix with and lower the temperature of the cooling medium.

6. In a transformer for alternating currents, a core provided with ventilating passage-ways, primary and secondary coils separated by ventilating passage-ways which communicate with the first-named passage-ways, and means whereby air forced through the passage-ways of the core into the passage-ways of the coils will induce air-currents in the latter passage-ways, which air-currents mix with the air from the core passage-ways.

7. In a transformer for alternating currents, a core provided with ventilating passage-ways, primary and secondary coils spaced apart forming ventilating passage-ways, insulating-sheets between the passage-ways in the core and coils, and nozzles leading from the passage-ways in the core and extending upward into the passage-ways between the coils, whereby air-currents passing through the passage-ways between the coils will induce cooling air-currents in said last-named passage-ways which mix with and cool the first-specified air-currents.

8. In a transformer, a core composed of laminae arranged in groups forming horizontal ventilating passage-ways, primary and secondary coils spaced apart forming vertical ventilating passage-ways, and a plurality of upwardly-directed nozzles extending from each horizontal passage-way in the core to

the several passage-ways between the coils, whereby air forced successively through the passage-ways in the core, through the nozzles, and through the passage-ways in the coils will cause an upward flow of cooling-air through the passage-ways between the coils.

9. In a transformer, a core provided with ventilating passage-ways, primary and secondary coils spaced apart forming ventilating passage-ways which communicate with the passage-ways in the core, and means for connecting the passage-ways in the core with a source of air-supply, said passage-ways in the coils communicating at the top and bottom with the outer atmosphere, whereby there may be a free circulation of air through the coils in addition to the forced circulation of air.

10. In a transformer, a core provided with ventilating passage-ways, coils spaced apart forming ventilating passage-ways, sheets of insulating material surrounding the sides of the coils and forming a casing open at its top and bottom, means for connecting the passage-ways in the core with a source of compressed air, and means for directing the air from the core passage-ways into the coil passage-ways in an upward direction, whereby cooling air-currents will be drawn into the

passage-ways between the coils from the lower end. 30

11. In a transformer, a core provided with ventilating passage-ways, coils spaced apart forming ventilating passage-ways which communicate at the sides of the coils with the passage-ways in the core, and at the ends of the coils with the atmosphere, means for connecting the passage-ways in the core with a source of air-supply, and means for directing the forced air toward the top of the passage-ways between the coils, whereby air will be drawn into the said passage-ways from the bottom. 35 40

12. In a transformer, a core provided with ventilating passage-ways, and primary and secondary coils having ventilating passage-ways, the whole being so constructed and arranged, that air forced through the passage-ways in the core into the passage-ways in the coils will induce air-currents in the latter passage-ways. 45 50

In testimony whereof I affix my signature in the presence of two witnesses.

CHARLES E. LORD.

Witnesses:

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ARTHUR F. KWIS.