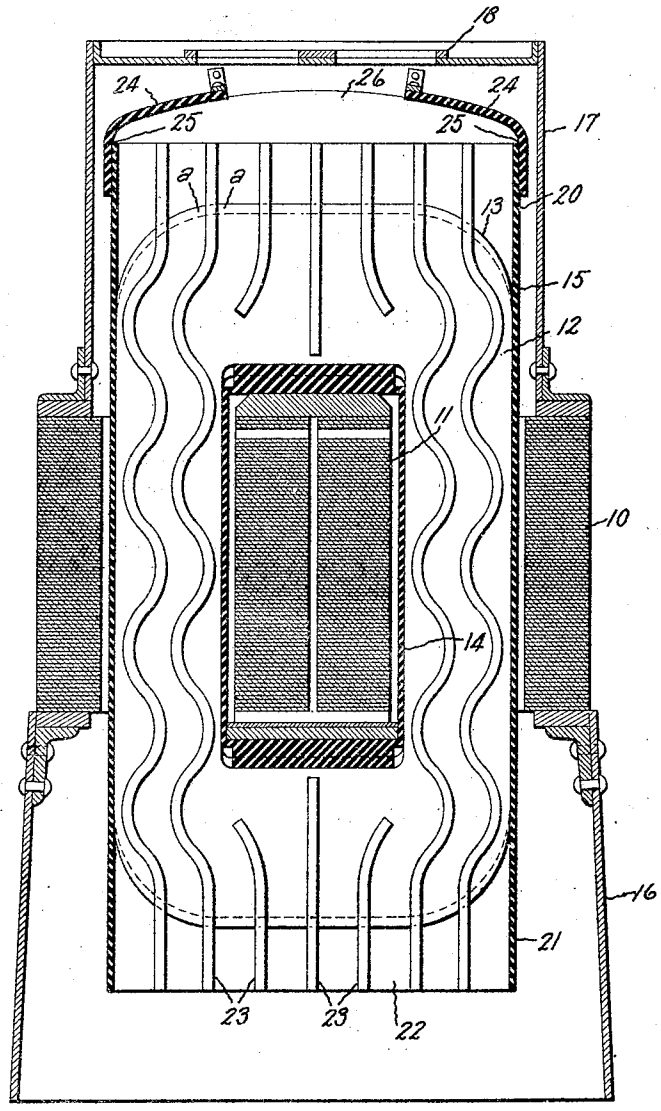
April 13, 1926. 1,580,811

L. H. BURNHAM

STATIONARY INDUCTION APPARATUS

Filed Oct. 23, 1920 2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

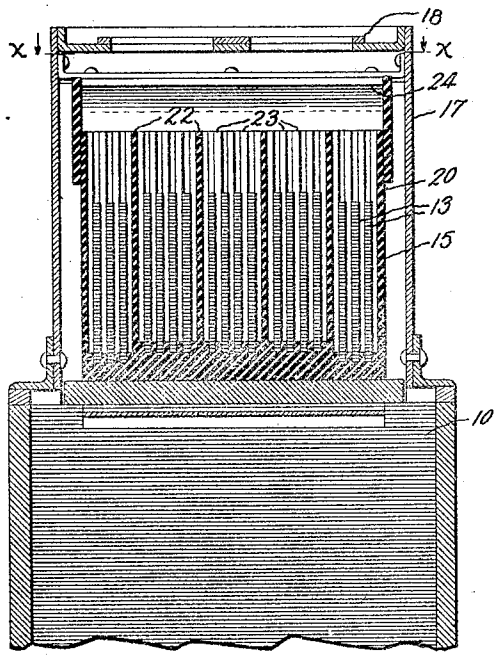
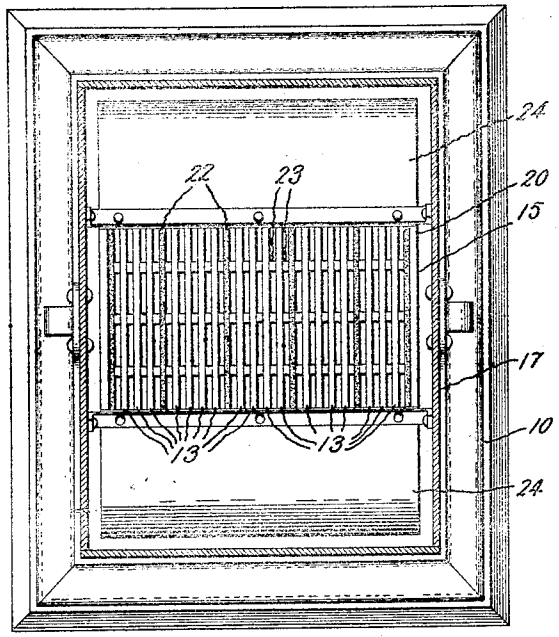


Fig. 3.



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Patented Apr. 13, 1926. 1,580,811

UNITED STATES PATENT OFFICE.

LOCKE H. BURNHAM, OF PITTSFIELD, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

STATIONARY INDUCTION APPARATUS.

Application filed October 23, 1920. Serial No. 419,007.

To all whom it may concern:

Be it known that I, LOCKE H. BURNHAM, a citizen of the United States, residing at Pittsfield, in the county of Berkshire, State of Massachusetts, have invented certain new and useful Improvements in Stationary Induction Apparatus, of which the following is a specification.

My invention relates to stationary induction apparatus, such as transformers, autotransformers, some reactances and the like, which are cooled by forcing a cooling medium over the windings. More particularly my invention relates to stationary induction apparatus of the shell type in which blasts of air as the cooling medium are forced or circulated over the windings.

The object of this invention is to provide an improved arrangement of parts which is economically and readily manufactured and which increases the cooling effects had from the circulated air so as to exceed those had with the prior arrangements.

In shell type transformers, and similar electrical apparatus which are cooled by air blasts, it has been found that what may be termed straight line paths for the course of the cooling air are most satisfactory considered from the standpoint of length of uninterrupted service. As a result straight and simple paths for the air blasts characterize the design of all modern electrical apparatus of this type.

It is known, however, that straight unimpeded air channels permit the most rapid movement of the air at the centre of the channel while that nearest the walls of the channel is apparently stagnant or bound by surface tension with the consequence that, in air blast electrical apparatus having straight line air passages, the maximum cooling effect is not had from a given volume of air circulated.

In the practice of my invention, the heat absorbing capacity of a given volume of air circulated is greatly enhanced by the provision of a baffling means which does not alter the straight line character of the air passages but which does cause the air in the passages to eddy and break up the stagnant and surface-bound portions of the air columns therein thereby avoiding local hot spots in the winding.

For a more complete understanding of the nature and objects of my invention reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

Fig. 1 is a vertical section through a shell type transformer constructed to embody my invention; Fig. 2 is a fragmentary vertical section, in a plane at right angles to the plane of Fig. 1; while Fig. 3 is a horizontal section of the transformer taken on the line x—x looking in the direction of the arrows in Fig. 2.

Referring now to the drawings, 10 represents a shell type core composed of horizontally disposed laminations of magnetic material having a central leg 11 surrounded by windings 12.

The windings 12 are shown as composed of so-called "pan-cake" coils 13 which are supported and encased in insulating boxings 14 and 15. The core itself surmounts a base 16 which at the place of installation fits over an air chamber whence is received the supply of air to be circulated over the windings 12 for cooling purposes. On top of the core and exterior to the boxing 15 is fitted the housing 17.

The insulating boxing 14 surrounds the leg 11 of the core and holds the coils 12 in proper spaced relation therefrom, while the insulating boxing 15 has rectangular projecting upper and lower ends 20 and 21 respectively which not only serve to support and insulate the windings but to guide the air currents as they pass from the base 16 into the housing 17 whence they find egress through the valved structure shown at 18.

The sides of this boxing 15 are shown as formed to extend through the windows in the core 10, and accordingly fit snugly against and about the boxing 14.

The coils 12 in the boxing 15 are preferably divided into groups by means of vertically disposed separators, as shown at 22. The coils themselves are spaced apart by suitably interposed insulating spacers 23 which may be of any convenient type, those shown being sometimes termed "wavy spacers."

In order to baffle the air currents passing up between the spacers 23 in accordance with my invention so as to cause them to eddy but without changing the generally straight line character of passages thus formed, I provide air deflectors 24 which are secured to the upper end of the boxing 15 and pro-

ject partially thereover so as to impede the egress of the air emerging from the channels between the coils and spacers on the interior of the boxing. The deflectors 24 may have any convenient shape but are shown as of a curved configuration meeting the edges of the boxing 15 as at 25. The walls of boxing 15 are also preferably extended by semi-elliptical pieces 26 which meet the deflectors 24 thus closing in the sides.

Just after emerging from the side channels in the boxing 15, the air is deflected and caused to eddy by the deflectors 24. These deflectors 24 are disposed close to the exits of the side channels, the distance being sufficiently small to cause the eddying and turbulence of the air under the deflectors to be communicated effectively to the air inside the channels. This eddying or turbulence of the air within the channels breaks up the stagnant surface-bound air adhering to the insulation of the coils 13 and to the spacers 23, thus more efficiently absorbing heat which might otherwise cause hot spots as at the points *a* in Fig. 1. The deflectors 24 should not, of course, be so close to the exits of the channels as to obstruct too much the flow of cooling air through the channels or the decrease in the flow of air would offset the advantage due to its turbulence. The proper and most efficient relative sizes and locations of parts are approximately indicated in the drawing and can readily be determined in any particular case by simple tests.

The deflectors 24 are also effective in increasing the cooling of the coil surfaces exposed in the intermediate or central channels which are over the central core leg 11 and where the flow of air is impeded by this core leg. As the air from the side channels strikes the deflectors, it is not only caused to eddy as has been described but some of it at least is deflected back toward the exits of the intermediate channels and actually enters these channels for some distance. This increases the absorption of heat at this point also, the deflected air later emerging from the channels with the air flowing through these channels from below.

Having now described an embodiment of my invention which is at present the best means known to me for carrying the same into effect, I would have it understood that this is merely illustrative and that I do not mean to be limited thereby to the precise details shown, nor restricted in the choice of recognized equivalents except as defined in my claims hereunto annexed.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A stationary induction apparatus having windings disposed in spaced relation to form ventilating passages to conduct a cooling medium, and deflectors for deflecting the cooling medium leaving the side portions of the exits of said passages to direct it toward the intermediate portions of said exits, said deflectors being arranged sufficiently close to said exits to cause said deflected cooling medium to increase the disturbance of said medium in the intermediate portions of said passages, whereby the cooling effect of said medium is increased.

2. A stationary induction apparatus having windings disposed in spaced relation to form ventilating passages to conduct a cooling medium, and curved deflectors for deflecting the cooling medium leaving the side portions of the exits of said passages to direct it toward the intermediate portions of said exits, said deflectors being arranged sufficiently close to said exits to cause said deflected cooling medium to increase the disturbance of said medium in the intermediate portions of said passages, whereby the cooling effect of said medium is increased.

3. A stationary induction apparatus comprising a shell-type core having windings surrounding a leg thereof and disposed in spaced relation therealong, inner and outer insulating members disposed about said windings and arranged to provide ventilating passages therethrough, and deflecting means secured to said outer member and arranged adjacent to the exits of said passages to cause said medium to eddy as it emerges from the passages, said deflecting means being sufficiently close to said exits to cause the eddying of said medium to produce turbulence in the medium within said passages before emerging therefrom.

4. A stationary induction apparatus comprising a shell-type core having windings surrounding a leg thereof and disposed in spaced relation therealong, inner and outer insulating members disposed about said windings and arranged to provide ventilating passages therethrough, and curved deflectors secured to said outer member and arranged to project over the exits of said passages and to meet the same at their outer edges to cause said medium to eddy as it emerges from the passages, said deflectors being sufficiently close to said exits to cause the eddying of said medium to produce turbulence in the medium within said passages before emerging therefrom.

5. A stationary induction apparatus having windings disposed in spaced relation to form ventilating passages to conduct a cooling medium, and means for deflecting the cooling medium leaving the side portions of the exits of said passages to direct it toward the intermediate portions of said exits, whereby the cooling effect of said medium is increased.

6. A stationary induction apparatus having windings disposed in spaced relation to form ventilating passages to conduct a cooling medium, means for separating the spaces

between said windings into channels, and means for deflecting the cooling medium leaving the channels at the side portions of said passages to direct it toward the exits of the intermediate channels, whereby the cooling effect of said medium is increased.

7. A stationary induction apparatus having windings disposed in spaced relation to form ventilating passages to conduct a cooling medium, and deflectors projecting over portions of the exits of said passages and arranged sufficiently close to said exits to increase the disturbance of said medium within the passages, whereby the cooling effect of said medium is increased.

8. A stationary induction apparatus having windings disposed in spaced relation to form ventilating passages to conduct a cooling medium, and curved deflectors projecting over portions of the exits of said passages and arranged sufficiently close to said exits to increase the disturbance of said medium within the passages, whereby the cooling effect of said medium is increased.

9. A stationary induction apparatus having windings disposed in spaced relation to form ventilating passages to conduct a cooling medium, means for separating the spaces between said windings into channels, and deflectors extending in front of the side channels from the outer edges of said passages, said deflectors being sufficiently close to the exits of said side channels to increase the disturbance of said medium within the passages, whereby the cooling effect of said medium is increased.

In witness whereof, I have hereunto set my hand this 20th day of October, 1920.

LOCKE H. BURNHAM.