PATENT SPECIFICATION

DRAWINGS ATTACHED

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Index at acceptance: —Class 35, A2(E2: E4: E9: F).

International Classification: —H02k.

COMPLETE SPECIFICATION

Improvements in and relating to Dynamo-electric Machinery

We, C. A. PARSONS & COMPANY LIMITED, of Heaton Works, Newcastle-upon-Tyne, 6, in the County of Northumberland, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to dynamo-electric machinery particularly turbo-generators.

In our co-pending Patent Application 842,702 (21033/56) the stationary winding of a dynamo-electric machine comprises conductors housed in slots in a stator core, end portions of the conductors extending beyond said core at each end thereof, said end portions of the conductors being housed in a plurality of boxes of electrical insulating material, a cooling fluid being supplied to the boxes at one end of the conductors and collected in boxes situated at the other end of the conductors.

In the above application pipes for conveying the liquid coolant to the boxes and the phase and earth connections for the windings were kept separate; it is known to make these connections hollow and to use them as the pipes conveying the coolant to the conductors in conventional arrangements.

The main object of the present invention is to provide an adaptation or modification of a dynamo-electric machine or stationary winding therefor, having boxes in accordance with the aforesaid patent application.

The invention consists in a dynamo-electric machine or winding in accordance with the preceding paragraph in which phase and earth connections form inlet and outlet pipes for liquid coolant.

The invention also consists in a stationary winding for a dynamo-electric machine which winding comprises conductors housed in slots in a stator core, end portions of the conductors extending beyond said core at each end thereof, said end portions of the conductors being housed in a plurality of boxes of electrical insulating material, a cooling fluid being supplied to the boxes at one end of the conductors and collected in boxes at the other end of the conductors, each box being associated with a phase and having two apertures therein to one of which is connected a hollow conductor which constitutes a phase or earth connection for the conductors located in the box and which conveys cooling liquid to the box whilst the other aperture is plugged, the phase or earth connection carrying the cooling liquid being connected electrically in series with the other conductors of the box by means of a link connection.

The invention also consists in a modification of a dynamo-electric machine or stationary winding in accordance with either of the preceding two paragraphs in which instead of having boxes at each end of the stator the boxes are all at one end and the flow in the conductors at the other end is reversed.

The invention also consists in dynamo-electric machinery or stationary windings substantially as described below with reference to drawings.

Referring to the drawings accompanying the provisional specification:—

Figure 1 is an end view partly in section of the end of a stator of a turbo-generator in accordance with one form of the present invention;

Figure 2 shows a cross-section through an end portion of a stator winding in accordance with one form of the present invention;

Figure 3 is a section through one of the boxes in which the ends of the conductors are located.

Referring to the drawings accompanying this complete specification:—

Figure 4 illustrates a modification where boxes are all arranged at one end of the generator;

[*Price* 3*s.* 6*d.*]

Figure 5 illustrates an end view of the generator showing phase and earth connections to the boxes with the arrangement of Figure 4; and

Figure 6 is a cross section in plan through phase and earth connections of Figure 5.

In carrying the invention into effect in the forms illustrated by way of example and referring first to Figure 1, casing 1 is the main outer casing of a turbo-driven alternating current generator. The ends of hollow conductors 2 constituting the stator winding are located in manifold boxes 3 of which there are six, each box being associated with one half of a phase. A similar number of boxes is disposed at the other end of the stator. As in the aforesaid copending patent application these boxes are preferably of a cast epoxy resin.

The conductors in each box are connected in series by links 4 at each end of the stator core. Liquid preferably water is supplied to the boxes 3 at one end of the stator, flows through the hollow conductors 2 and is collected in boxes at the other end of the stator. In the present arrangement phase and earth connections 5 linking the conductors 2 with output terminals of the generator are used at the same time to convey cooling liquid to or from the conductors.

In Figure 1 the insulated phase and earth connections 5 are hollow and three are used to convey the cooling liquid from inlet manifold 6 to three of the boxes through hollow terminal bushings 7, secured to the stator casing 1. The remaining phase or earth connections shown in Figure 1 convey cooling liquid from the remaining three boxes to manifold 8. At the oposite end of the stator a manifold corresponding to manifold 6 is an outlet manifold whilst that corresponding to 8 is an inlet manifold. The arrangement can, however, be varied to suit circumstances. For example, both manifold 6 and 8 can be inlet manifolds at one end of the stator and outlet manifolds at the other end or separate manifolds can supply each phase.

The phase and earth connections 5 are coupled at 9 to an electrical conducting member or stalk 10 in the terminal bushing 7, by a suitably insulated coupler 11 fulfilling the necessary electrical and mechanical requirements, that is to say it should prevent leakage of the cooling liquid and should provide a good electrical conducting path.

The terminal bushings 7 are connected to the earthed manifolds 6 and 8 through tubes of electrical insulating material 12 which serve to reduce to safe proportions any current leaking from the terminal bushes 7 to the earthed manifolds 6 and 8. The manifolds 6 and 8 may be metallic or non-metallic material.

The terminal bushings 7 are connected according to phase by links 13 which convey the current to output connections or leads. The terminal bushings 7 and the links 13 can be arranged in other accepted ways to suit electrical requirements for example phase terminals at one end of the stator and earth terminals at the other end.

Insulated tubes 12 are shown connected to the stalks 10 of the terminal bushings 7 and to the manifolds 6 and 8 by means of bolted flanges 14, but these insulating tubes 12 may be connected in any other manner applicable to non-metallic tubing.

The connections to insulating tubes 12 and manifolds 6 and 8 are disposed in a manner which eliminates the possibility of cooling liquid leakage coming into contact with electrical parts.

The phase or earth connections 5 are of electrical conducting material, for example copper, and are surrounded by insulation 15.

The coupling of the phase and earth connections 5 with the individual boxes 3 is best shown in Figures 2 and 3.

The boxes 3 are supported by means of cast epoxy resin support brackets 16 as in the aforesaid copending patent application and these support brackets serve to support and space the conductors 2 and to carry and locate the phase and earth connections 5 as they pass around the end face of the stator to their respective terminal positions. An end view of the support bracket 16 is shown in a part section in Figure 1, and Figures 1 and 2 show how the brackets 16 can be attached to each other to form a conical ring which is located by and rigidly secured to core end plate 17. The number of brackets forming this conical ring can be arranged to suit the stator winding and these brackets can be cast with integral protrusions enabling the end windings to be accurately pitched and located around the conical periphery, or they can be cast with radial grooves to permit the inclusion of keybars or other tightening devices which can be employed for the purpose of clamping and securing the end windings.

This conical ring of support brackets is employed to support and locate the boxes 3. Each box 3 is shaped in such a way that two additional apertures 18, 18*a* (Figure 3), can be provided through one of which a phase or earth connection 5 is led and connected to the conductors in the box by means of link 19 or 19*a*. The other aperture is plugged. By this means standard boxes can be made which will allow for variation in the end of the box to which the phase or earth connections are coupled.

With the arrangement described with reference to the drawings the cooling fluid passes from a manifold 6 or 8 through the pipes 12 through the terminal bushings 7 into phase and earth connection 5 into space 20 in box 3 and thence through the conductor 2 to a box at the other end of the stator.

Instead however of having boxes at each end of the stator they may be all at one end

and the flow in the conductors be reversed at the other end.

An arrangement of this kind is shown in Figures 4 and 5. In Figure 4 both ends of each conductor are at the same end of the generator and each box 3 of the form shown in Figure 1 is replaced by two boxes 3*a*, 3*b* displaced from each other in the radial direction. In the form illustrated in Figure 4 the connecting links 4 are shown outside the boxes but they can be inside the boxes if desired. The cooling liquid enters box 3*b* flows through the conductor 2 to the other end of the generator and then flows in the reverse direction to enter box 3*a*.

Figure 5 as stated above shows an end view of the generator showing the phase and earth connections to the boxes with the arrangement of Figure 4. In this arrangement manifolds 6 and 8 are arranged one behind the other and also the phase and earth connections 5 so that in Figure 5 only one manifold and its associated phase and earth connections can be seen.

Figure 6 illustrates as stated a cross section in plan through the phase and earth connections of Figure 5 showing the manifold boxes 6 and 8 with their associated phase and earth connections arranged one behind the other; also included on Figures 4, 5 and 6 are indications of the connections to the various boxes given by references A1, A1*a*, B1, B1*a*, and the like.

WHAT WE CLAIM IS:—

1. A dynamo-electric machine or winding with boxes in accordance with our co-pending Patent Application No. 842,702 (21033/56) in which phase and earth connections form inlet and outlet pipes for liquid coolant.

2. A stationary winding for a dynamo-electric machine which winding comprises conductors housed in slots in a stator core, end portions of the conductors extending beyond said core at each end thereof, said end portions of the conductors being housed in a plurality of boxes of electrical insulating material, a cooling fluid being supplied to the boxes at one end of the conductors and collected in boxes at the other end of the conductors, each box being associated with a phase and having two apertures therein to one of which is connected a hollow conductor which constitutes a phase or earth connection for the conductors located in the box and which conveys cooling liquid to the box whilst the other aperture is plugged, the phase or earth connection carrying the cooling liquid being connected electrically in series with the other conductors of the box by means of a link connection.

3. A modification of a dynamo-electric machine or stationary winding, as claimed in either of Claims 1 or 2 in which instead of having boxes at each end of the stator the boxes are all at one end and the flow in the conductors at the other end is reversed.

4. A dynamo-electric machine or stationary winding substantially as described with reference to Figures 1, 2 and 3 comprising the drawings accompanying the provisional specification.

5. A dynamo-electric machine or stationary winding substantially as described with reference to Figures 4, 5 and 6 of the drawings accompanying this complete specification.

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PROVISIONAL SPECIFICATION

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The invention consists in a dynamo-electric machine or winding in accordance with the preceding paragraph in which phase and earth connections form inlet and outlet pipes for liquid coolant.

The invention also consists in a stationary winding for a dynamo-electric machine which winding comprises conductors housed in slots in a stator core, end portions of the conductors extending beyond said core at each end thereof, said end portions of the conductors

being housed in a plurality of boxes of electrical insulating material, a cooling fluid being supplied to the boxes at one end of the conductors and collected in boxes at the other end of the conductors, each box being associated with a phase and having two apertures therein to one of which is connected a hollow conductor which constitutes a phase or earth connection for the conductors located in the box and which conveys cooling liquid to the box whilst the other aperture is plugged, the phase or earth connection carrying the cooling liquid being connected electrically in series with the other conductors of the box by means of a link connection.

The invention also consists in a modification of a dynamo-electric machine or stationary winding in accordance with either of the preceding two paragraphs in which instead of having boxes at each end of the stator the boxes are all at one end and the flow in the conductors at the other end is reversed.

The invention also consists in a dynamo-electric machine or stationary winding substantially as described below.

Referring to the accompanying drawings:—

Figure 1 is an end view partly in section of the end of a stator of a turbo-generator in accordance with one form of the present invention;

Figure 2 shows a cross-section through an end portion of a stator winding in accordance with one form of the present invention;

Figure 3 is a section through one of the boxes in which the ends of the conductors are located.

In carrying the invention into effect in the forms illustrated by way of example and referring first to Figure 1, casing 1 is the main outer casing of a turbo-driven alternating current generator. The ends of hollow conductors 2 constituting the stator winding are located in manifold boxes 3 of which there are six, each box being associated with one half of a phase. A similar number of boxes is disposed at the other end of the stator. As in the copending patent application these boxes are preferably of a cast epoxy resin.

The conductors in each box are connected in series by links 4 at each end of the stator core. Liquid preferably water is supplied to the boxes 3 at one end of the stator, flows through the hollow conductors 2 and is collected in boxes at the other end of the stator. In the present arrangement phase and earth connections 5 linking the conductors 2 with output terminals of the generator are used at the same time to convey cooling liquid to or from the conductors.

In Figure 1 the insulated phase and earth connections 5 are hollow and three are used to convey the cooling liquid from inlet manifold 6 to three of the boxes through hollow terminal bushings 7, secured to the stator casing 1. The remaining phase or earth connections shown in Figure 1 convey cooling liquid from the remaining three boxes to manifold 8. At the opposite end of the stator a manifold corresponding to manifold 6 is an outlet manifold whilst that corresponding to 8 is an inlet manifold. The arrangement can, however, be varied to suit circumstances. For example, both manifolds 6 and 8 can be inlet manifolds at one end of the stator and outlet manifolds at the other end of separate manifolds can supply each phase.

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end plate 17. The number of brackets forming this conical ring can be arranged to suit the stator winding and these brackets can be cast with integral protrusions enabling the end windings to be accurately pitched and located around the conical periphery, or they can be cast with radial grooves to permit the inclusion of keybars or other tightening devices which can be employed for the purpose of clamping and securing the end windings.

This conical ring of support brackets is employed to support and locate the boxes 3. Each box 3 is shaped in such a way that two additional apertures 18, 18*a* (Figure 3), can be provided through one of which a phase or earth connection 5 is led and connected to the conductors in the box by means of link 19 or 19*a*. The other aperture is plugged. By this means standard boxes can be made which will allow for variation in the end of the box to which the phase or earth connections are coupled.

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Instead however of having boxes at each end of the stator they may be all at one end and the flow in the conductors be reversed at the other end.

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blished at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

881908 PROVISIONAL SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 1 & 2

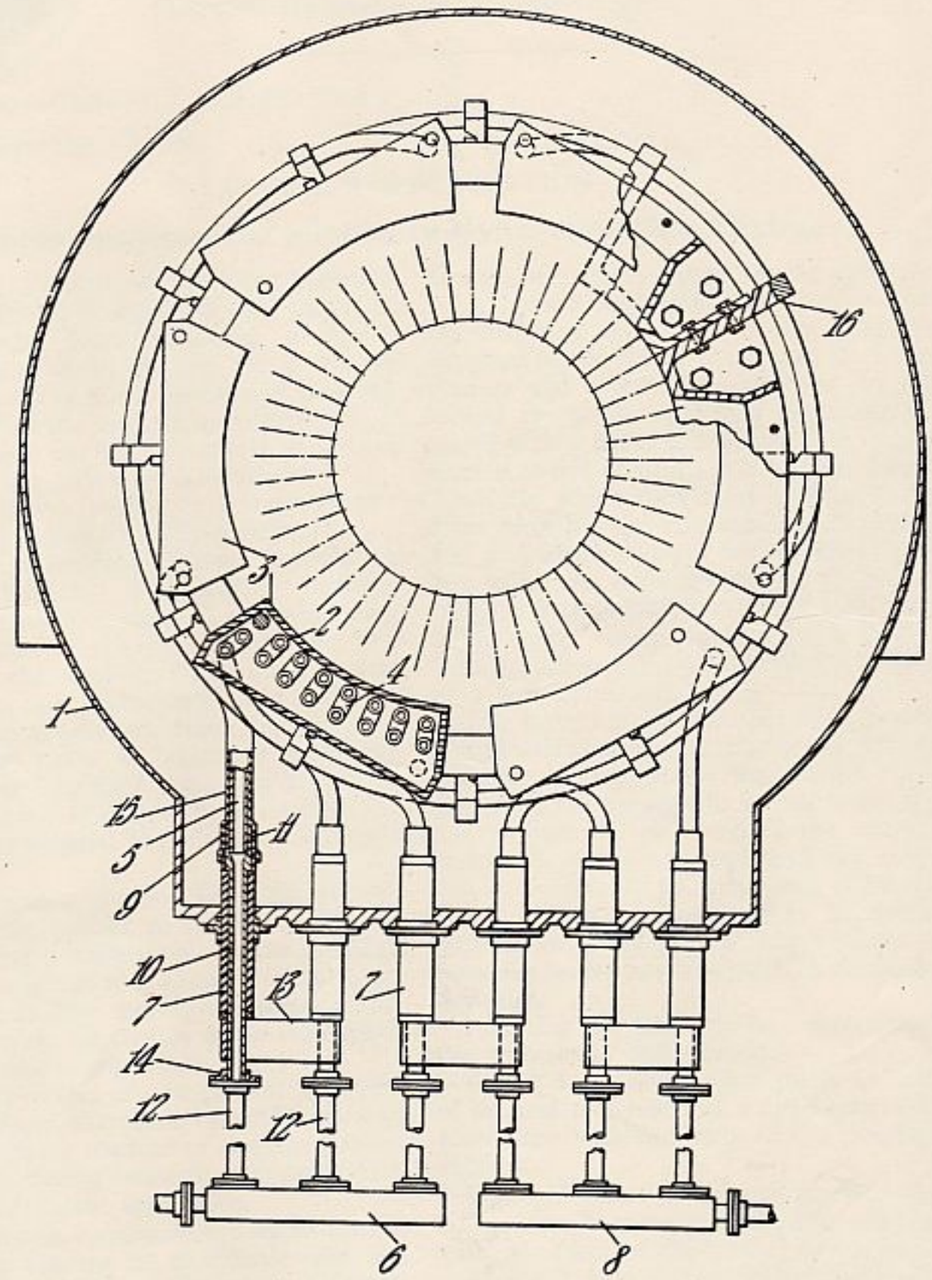

Fig. 1.

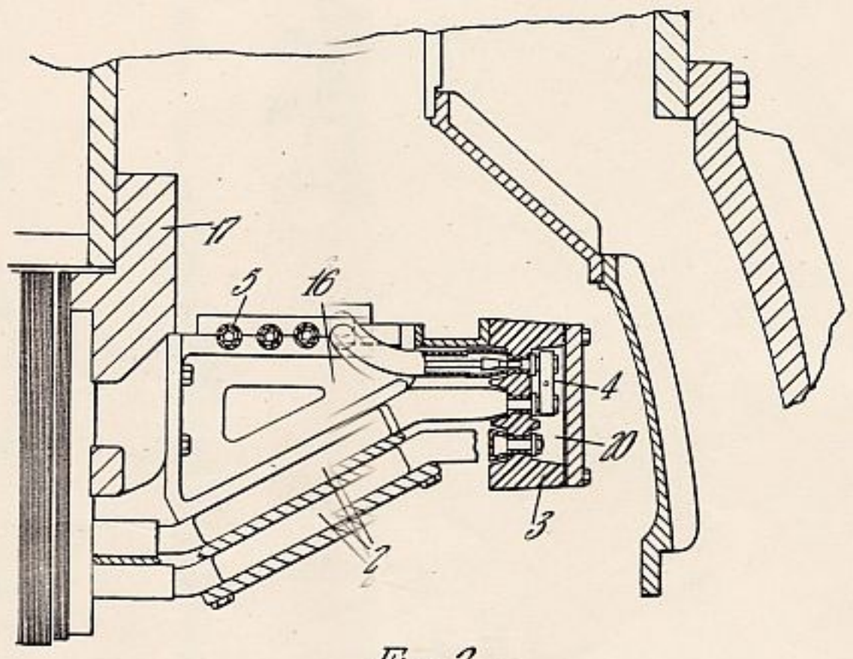

Fig. 2.

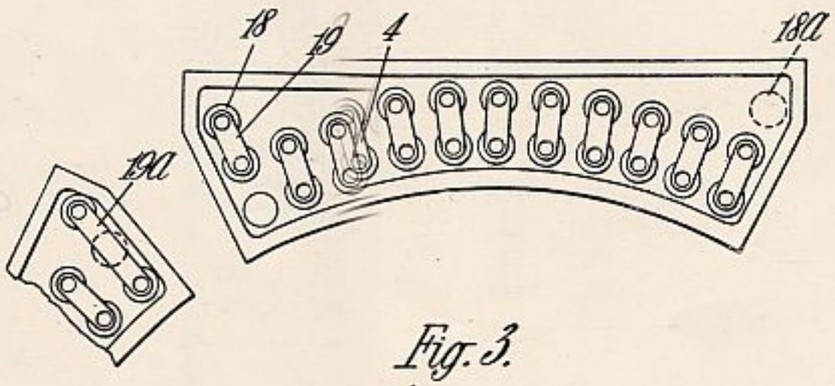

Fig. 3.

881908 COMPLETE SPECIFICATION
1 SHEET

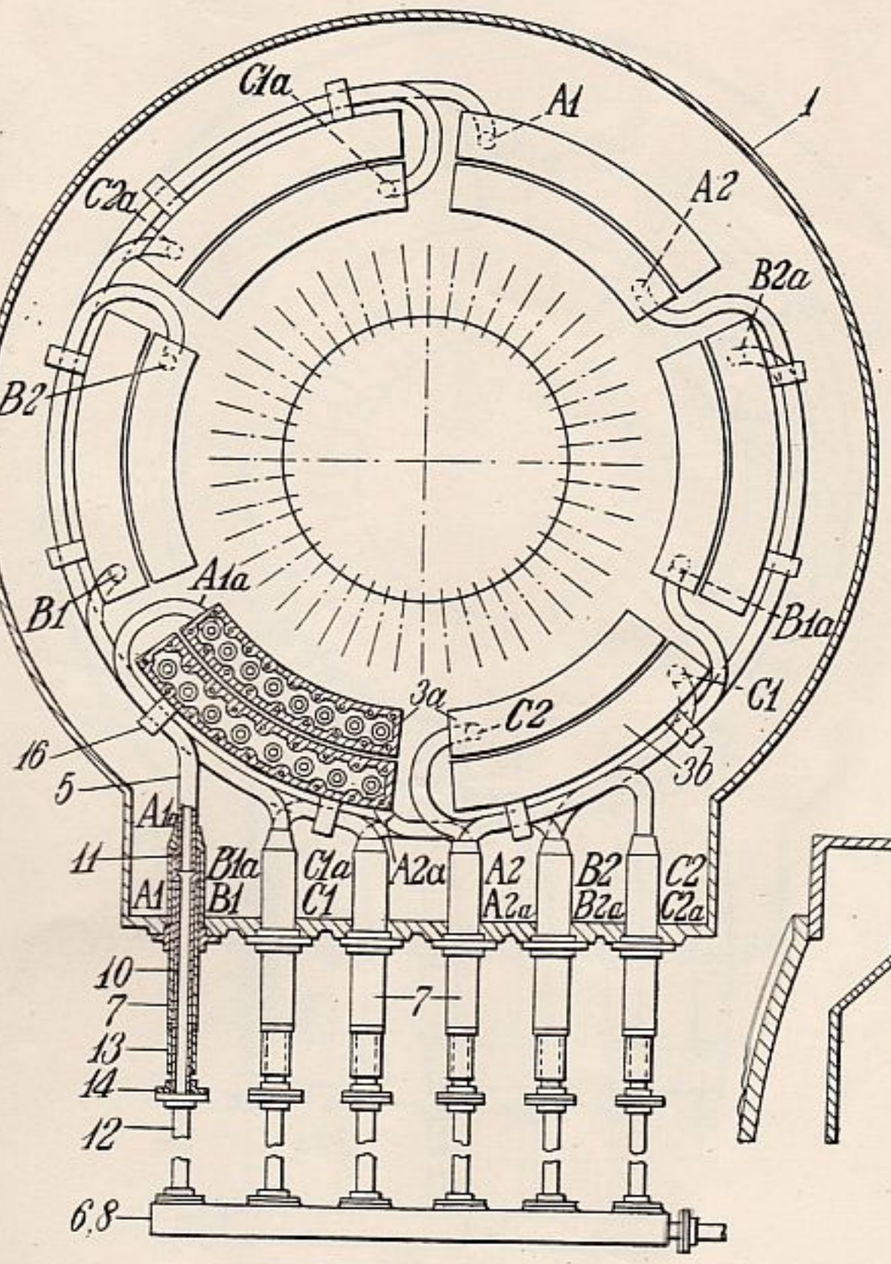

Fig.5

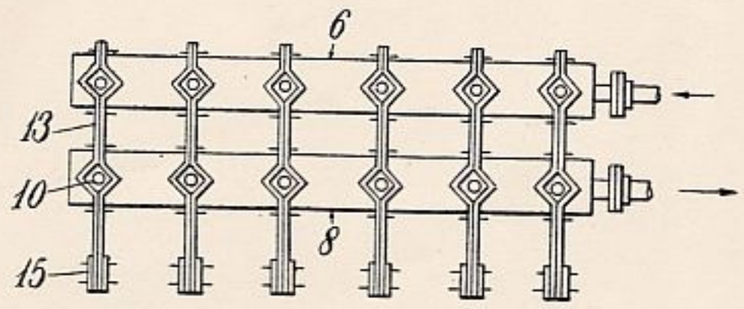

Fig.6

Fig.4