(No Model.) 3 Sheets—Sheet 1.

S. H. SHORT.

ARMATURE FOR DYNAMO ELECTRIC MACHINES.

No. 587,765. Patented Aug. 10, 1897.

Fig. 1.

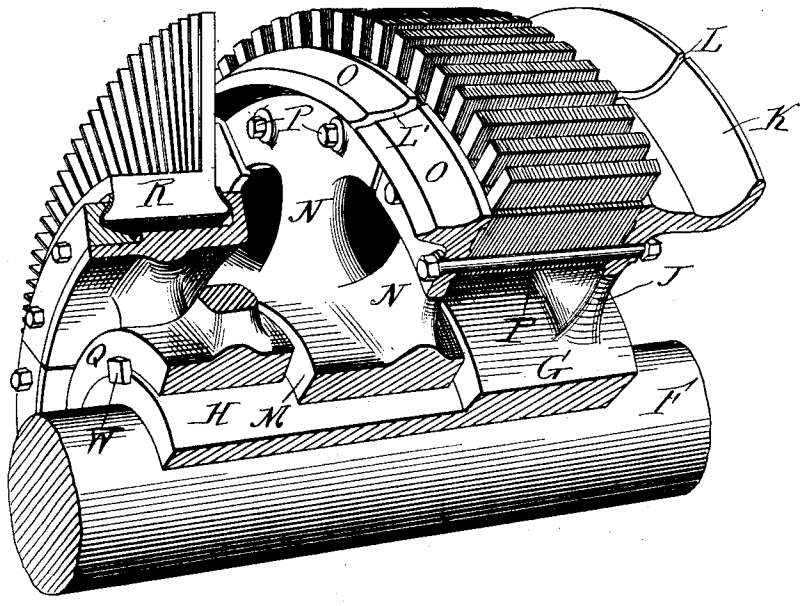


Fig. 2

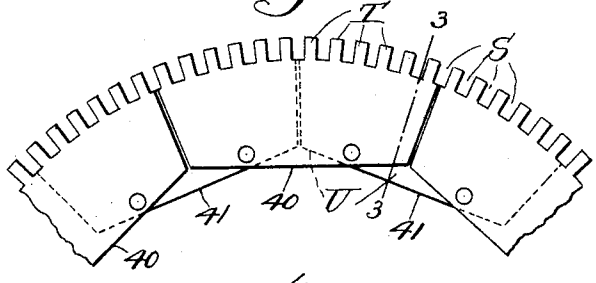


Fig. 3

Fig. 4

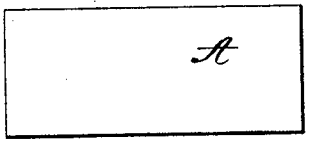
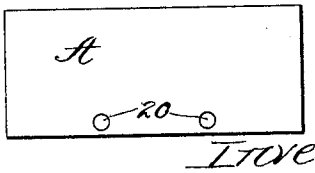


Fig. 5.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 6.

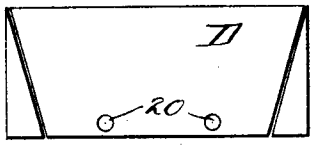


Fig. 7

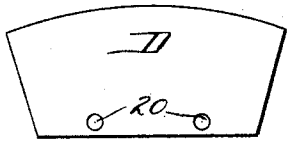


Fig. 8

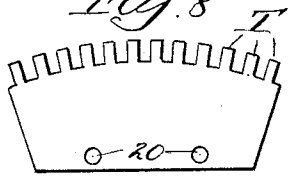


Fig. 9

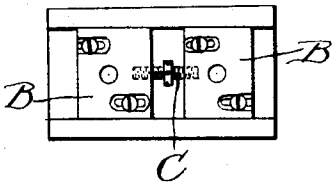


Fig. 11.

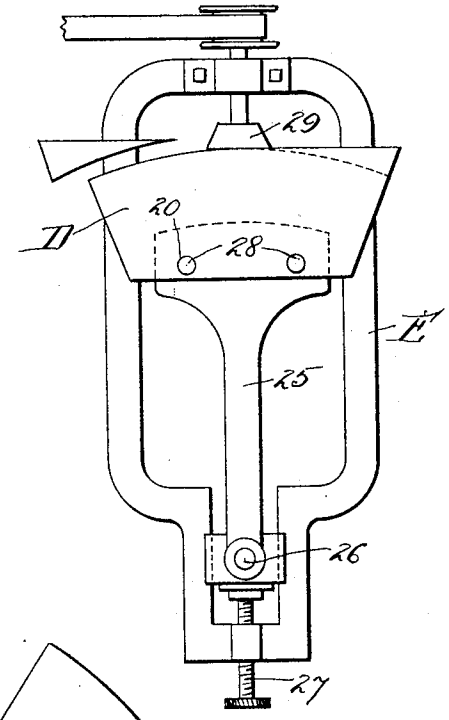
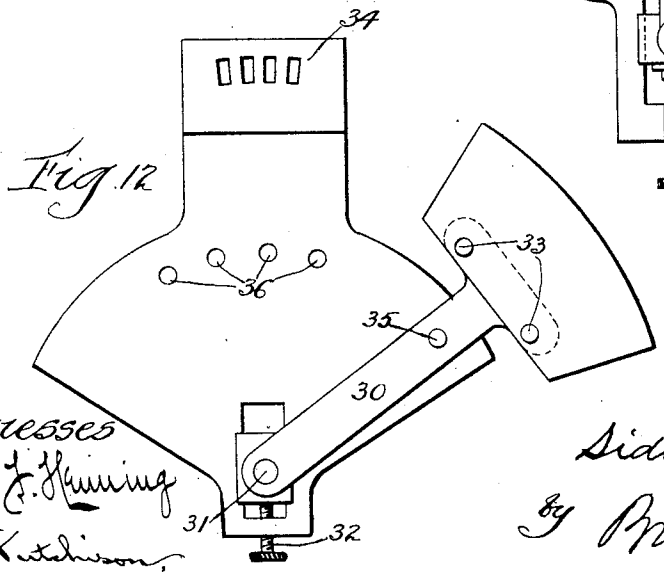


Fig. 12



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S. H. SHORT.

ARMATURE FOR DYNAMO ELECTRIC MACHINES.

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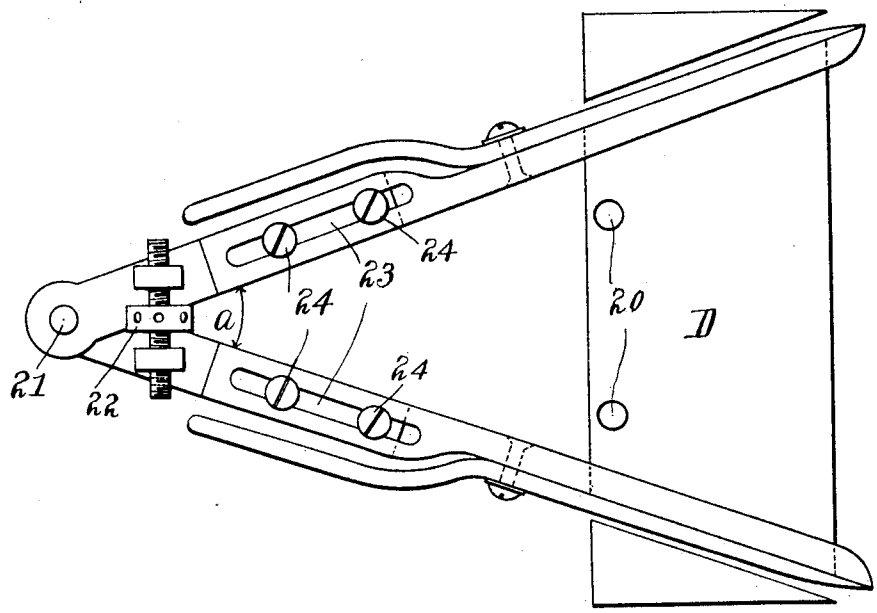
Fig. 10.



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UNITED STATES PATENT OFFICE.

SIDNEY H. SHORT, OF CLEVELAND, OHIO.

ARMATURE FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 587,765, dated August 10, 1897.

Application filed March 29, 1897. Serial No. 629,780. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY H. SHORT, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful Armature for Dynamo-Electric Machines, of which the following is a specification.

This invention relates to armatures for dynamo-electric machines and the manufacture thereof.

The object of the invention is to provide an armature for dynamo-electric machines wherein ample provision is made for expansion and contraction of the parts, wherein shrinkage strains in the castings are avoided, and wherein a desirable ventilation is secured.

A further object of the invention is to so improve the manufacture of armatures as to provide standard relations of parts whereby variations in the size and capacity of machines may be readily and easily secured.

A further object of the invention is to provide an armature of simple and improved construction, thoroughly efficient, and the parts of which may be readily and easily assembled.

Other objects of the invention will appear more fully hereinafter.

The invention consists, substantially, in the construction, combination, location, relative arrangement of parts, and mode of procedure, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally specifically pointed out in the appended claims.

Referring to the accompanying drawings and to the various views and signs appearing thereon, Figure 1 is a view in perspective, parts being broken out, of an armature constructed in accordance with my invention. Fig. 2 is a detached detail view illustrating the manner of assembling the laminations or plates. Fig. 3 is a detached detail sectional view of the same on the line 3 3, Fig. 2. Fig. 4 is a view illustrating the form of plate employed in the construction of my armature before it has been subjected to any of the several steps for reducing the same to proper condition for use. Fig. 5 is a similar view of the same after being provided with the perforations. Fig. 6 is a similar view illustrating the plate after the ends thereof have been beveled. Fig. 7 is a similar view after the outer edge of the plate has been reduced to circular contour. Fig. 8 is a similar view after the plate is provided with the slots and teeth for receiving the armature-windings. Fig. 9 is a view in bottom plan of a suitable form of die for perforating the plates. Fig. 10 is a view illustrating an operative form of means for beveling the ends of the plates. Fig. 11 is a similar view of an illustrative form of means for reducing the outer edge of the plate to circular contour. Fig. 12 is a similar view illustrating an operative form of means for providing the outer edge of the plate with slots or teeth.

The same part is designated by the same reference-sign wherever it occurs throughout the several views.

In the practical and economical manufacture of armatures for dynamo-electric machines it is important to provide a standard construction and arrangement of parts. In order to carry this idea into practical effect, I provide in the present invention a standard lamination sheet—that is, standard as to width and depth of slot and width and depth of tooth, into which slots are received standard sections of inductors, the only differences for different sizes, speeds, or capacities of machines being in the angle of bevel of the ends of the laminations and in the radius of circle to which the outer edge of the laminations is cut—that is to say, in accordance with the principle of my invention if a machine is to be constructed to give a certain output at a certain speed I build up the armature thereof with a certain number of plates or laminations arranged peripherally. Now if it should be desired to build a larger or smaller machine with a different output or different speed I increase the number of the peripherally-arranged laminations or plates correspondingly, as the output or speed is to be increased or decreased, and I also slightly increase or decrease, as the case may be, the width of the armature-face and also the number of poles the machine is to have. Thus I avoid the necessity of a multiplicity of dies and tools and different sizes of plates or laminations for the armature-core, and I produce a standard armature-core lamination which

may be kept in stock, thus providing an excellent economical practical system.

In carrying my invention into practice I provide an ordinary sheet A, of iron, Fig. 4, which sheet may be about two feet long by about twelve inches wide. The first step in the operation of preparing said sheet for use is to provide the same with holes or perforations. These may be formed in any suitable or convenient manner and preferably as near one of the sides thereof as possible, as indicated in Fig. 5, so that they will lie wholly within the outline of the plate for a purpose presently to be described. The location of the perforations is so relatively arranged that the centers thereof will be one-fourth of the distance from the ends of the plate after the said ends are properly beveled, as will presently be described. Many different constructions and forms of apparatus may be employed for producing the holes or perforations in the plates or laminations.

As illustrative of a simple and convenient form of operative means I have shown in Fig. 9, in plan, a form of standard die for accomplishing the desired purpose, and in order to adapt the same to different sizes and relative arrangement of perforations I may, if desired, make the punches B B relatively adjustable, as shown, by suitable adjusting means, as shown at C. Thus the same die may be employed for punching the plates or laminations in the various sizes of machines which it may be desired to construct.

After the perforations 20 are formed in the plates the next step in the operation of producing standard plates is to reduce the ends of the plates to the proper bevels to produce the desired size of armature-core. In order to carry out the idea of a standard construction, it is important that the two ends of each plate be reduced to such bevels that each of such ends will lie in the radius of a circle the center of which concides with the axis of the armature-shaft in the completed machine, and since the machines vary in circumference according to the capacity, output, and speed it is important that the bevels of the ends of the plates, in order to secure uniform and standard results, should vary in relative inclination according to the size of the machines and the number of its poles. This idea may be carried into practical effect in many different ways, and many different forms of mechanism may be devised to carry the same out practically.

In Fig. 10 I have shown as an illustration of an operative arrangement for accomplishing the desired object two pairs of coöperating shears. These pairs of shears, in the particular form shown, are mounted for relative adjustment about a center 21, which should be so related as to correspond with the axis of the armature-shaft in the completed machine. I so arrange the shears that the angle a between them corresponds to the angle included between the two ends of the plate when built up into an armature-core, and for varying conditions in this respect such angle may be adjusted by relatively adjusting the shears about the center 21, as by means of a screw 22, and the cutting portion of the shears may be adjusted radially with respect to the center 21, as by means of the slots 23 and bolts 24, to suit the requirements of practice. The sheet may be supported in suitable or convenient position to be operated on by the shears, and in practice the perforations 20, previously formed therein, may be employed for such purpose.

In Fig. 6 I have shown the plate D after having the ends thereof reduced to the desired bevel.

The next step in the operation is to reduce the outer edge of the plate to the required or desired curvature corresponding to the circumference of the armature after completion. This may be accomplished in many different ways.

In Fig. 11 I have shown as illustrative of an operative means a frame E, in which is pivotally mounted an arm 25 upon a pivot 26, corresponding to the geometric center of the armature when completed, and which pivot may be adjustable, as shown, as by means of an adjusting-screw 27, to suit different sizes of armatures. The arm carries a pair of pins 28, adapted to receive the perforations 20 of the plates D, by which said plates are properly held in suitable standard relation to a cutter 29, of suitable construction. By swinging the arm 25 about its pivot the cutter 29 effects a proper reduction of the outer edge thereof to the desired curvature. The plate after being thus reduced is shown in Fig. 7.

The next step in the operation of producing the standard plates or laminations is to provide the slots S and teeth T in the outer or curved edge thereof. In Fig. 12 I have shown as illustrative of operative means for accomplishing this desired object an arm 30, pivotally mounted, as at 31, said pivot corresponding to the geometric center of the complete armature and made adjustable, as shown at 32, to suit different sizes of armatures. The plate D, with the perforations and having its ends beveled and its outer edge reduced to the proper curvature, is arranged to receive the pins 33, carried by said arm 30 in the perforations thereof in order to secure a standard relation of the plates to a suitable punching-die 34, by which the teeth and slots are produced in the outer or curved edge of the plate. A pin suitably inserted through a perforation 35 in arm 30 and into any one of the perforations 36 of frame 37 serves to hold the arm in proper position for the die 34 to operate on the plate.

In Fig. 8 I have shown the plate or lamination D after being provided with the teeth and slots in the curved edge thereof.

From the foregoing description it will be seen that I produce standard sizes of plates or laminations, the perforations, the beveled

ends, curved outer edges, the teeth, and the slots of all the plates of any particular size of plate being exactly duplicated throughout all the plates of that size and the inner edge of all the plates being straight. The plates are now ready to be built up into an armature, and since for any particular size of machine the plates are all exact duplicates the work of assembling the plates to form the core is greatly facilitated and simplified.

I will now describe the construction and arrangement of armature-core embodying my invention, particular reference being had to Figs. 1, 2, and 3, wherein reference-sign F designates the armature-shaft, upon which is adapted to be slipped the hub G. This hub is reduced in external diameter for a portion of the length thereof, as indicated at H. Cast integrally with hub G are a series of spokes J, carrying flanges K, for supporting the ends of the inductor-sections. These flanges are separated from each other by the slits or openings L, which may be produced by inserting in the mold in which the hub, spokes, and flanges are cast sheets of asbestos or of iron lined on both sides with asbestos at the proper points. After the armature is completed these slits may be filled with wooden blocks or strips and finally finished over so that they may not be seen. By the provision of these slits or openings L, I avoid the serious objection of shrinkage strains in the casting and also allow for expansion and contraction of the parts. Over the reduced portion H of the hub I slip another hub or spider M, having the integral spokes N and flanges O, with slots L′ between contiguous portions of the flanges and spokes similar to the above-described construction and arrangement with reference to hub G and its spokes and flange portions. Thus in both cases each spoke and its integral flange portion are entirely free from the adjacent spoke and its flange portion. Through each spoke on both hubs G M are formed a pair of holes or openings through which I pass the bolts P. These bolts are for the purpose of supporting the laminations or plates and for clamping the same together and between the opposing faces of flanges K O. Upon the reduced portion H of hub G is also mounted a hub or spider Q, which may be spoked, if desired, and which carries the commutator-bars R with their leads, to which the armature-windings or inductor-sections after being placed in the slots S of the plates are connected in the usual manner. The same key W may be employed to pass through hubs Q and M to secure the same against relative rotation with respect to hub G, and by this means the relative positions of the several hubs will not be disturbed should the entire armature be slipped from the shaft F. Since all the laminations or plates D have their ends beveled on lines radial to the axis of shaft F, and since the outer edge of each plate lies in the circumference of the same circle struck from the axis of the shaft F as a center, and since the two holes or perforations of each plate correspond exactly in relative position to the same holes in each of the other plates, it is an exceedingly easy matter to build up the armature by successively stringing the plates on the bolts P.

In practice I prefer to lap-joint the successive layers of plates or laminations, as indicated in Fig. 2, in which case the inner or straight edges 40 of the laminations of one layer will be angular with respect to the straight edges 41 of the laminations of the next succeeding layer, thereby leaving on the inner surface of the armature a series of pockets or cavities U, formed at the abutting ends of the laminations of each layer, the next adjacent layers forming the side walls of such cavities or pockets, as clearly shown in Figs. 2 and 3. These cavities or pockets with their surfaces exposed to the air provide an excellent means for radiating and dissipating the heat developed in the armature-core, and thus avoids the necessity of providing ventilating ducts or passages through the armature, as has heretofore been the custom. In order that this lap-jointing may be effected with facility, it will of course be understood that the distance between the two bolts P, which pass through each arm N of the hub, must be the same as the distance each of said bolts and the adjacent bolt of the next spider-arm N, and this distance must correspond exactly with the distance between the holes 20 in the plates or laminations. By placing the bolt-holes 20 close to the inner straight edge of the plate or lamination the bolts P will be entirely within that portion of the lamination which forms the magnetic ring. Therefore it is impossible for any of the lines of force to pass inside of these bolts and set up currents of any strength in them.

Having now set forth the object and nature of my invention and the method of carrying the same into practical effect, I desire it to be understood that I do not limit or confine myself to the exact details of construction and arrangement or order of steps herein set forth, as many variations therefrom and changes therein would readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of my invention; but

What I claim as new and useful and of my own invention, and desire to secure by Letters Patent of the United States, is—

1. A plate or lamination for armature-cores, having the ends thereof beveled to lines radial to the armature center, the outer edge curved to the circumference of a circle struck from the center of the armature, and the inner edge straight, as and for the purpose set forth.

2. A plate or lamination for armature-cores having the ends thereof beveled to lines radial to the armature center, the outer edge curved to the circumference of a circle struck from the center of the armature, and having teeth

and slots formed therein, said plates having their inner edge straight and provided with perforations, as and for the purpose set forth.

3. The method of manufacturing standard plates or laminations for armatures, which consists in reducing the ends of suitable plates to bevels corresponding to lines radial to the center of the armature, reducing the outer edge of such plates to the circumference of a circle struck from the geometric center of the armature, and forming in such outer edge teeth and slots, and forming in such plates holes or perforations near the inner edge thereof, as and for the purpose set forth.

4. In an armature, a hub having integral spokes and flange portions, the individual spokes and flange portions being separated from each other, as and for the purpose set forth.

5. In an armature, a built-up or laminated core, the inner edges of said laminations being straight, adjacent layers of such laminations being lap-jointed, as and for the purpose set forth.

6. In an armature, a hub or spider having integral radial spokes and flange portions, the individual spokes and flange portions being separated from each other, a coöperating hub or spider having similar separated spokes and flange portions, bolts arranged to pass through perforations in said spokes, and a series of laminations or plates perforated to receive said bolts therethrough, said plates being interposed between said hubs, as and for the purpose set forth.

7. In an armature, a hub or spider having the outer circumference of a portion of the end thereof reduced, a second hub or spider mounted on said reduced portion, said hubs provided with separated and corresponding spokes and flanges, a series of toothed and slotted plates interposed between said hubs, and bolts arranged to support said plates and to clamp the same together and between said hubs, as and for the purpose set forth.

8. In an armature, a hub or spider having the outer circumference of a portion of the end thereof reduced, a second hub or spider mounted on said reduced portion, laminations interposed between said hubs, bolts for supporting the same and clamping said hubs together, as and for the purpose set forth.

9. In an armature, a hub or spider having the outer circumference of a portion of the end thereof reduced, a second hub mounted on said reduced portion, laminations interposed between said hubs and adapted to support the inductor-sections, bolts arranged to support said laminations and adapted to clamp the same between said hubs, and a commutator-hub also mounted on said reduced portion, and means for keying said several hubs together, as and for the purpose set forth.

In witness whereof I have hereunto set my hand this 20th day of March, 1897, in the presence of the subscribing witnesses.

SIDNEY H. SHORT.

Witnesses:
M. A. KENSINGER,
JOHN J. BEVER.