(No Model.)

5 Sheets—Sheet 1.

# A. W. MESTON.

## ARMATURE FOR DYNAMO ELECTRIC MACHINES.

No. 387,432. Patented Aug. 7, 1888.

Fig. 1.

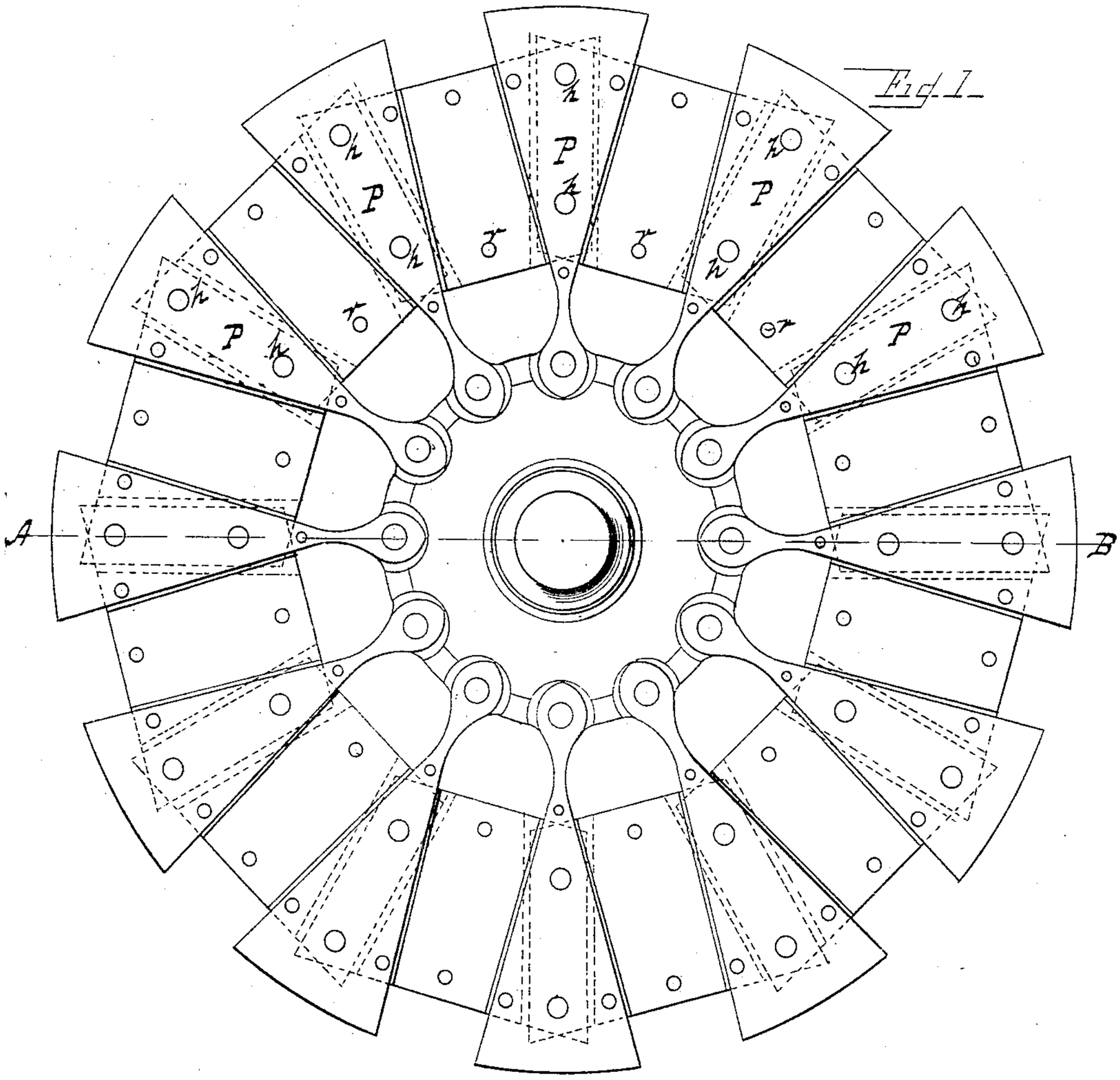
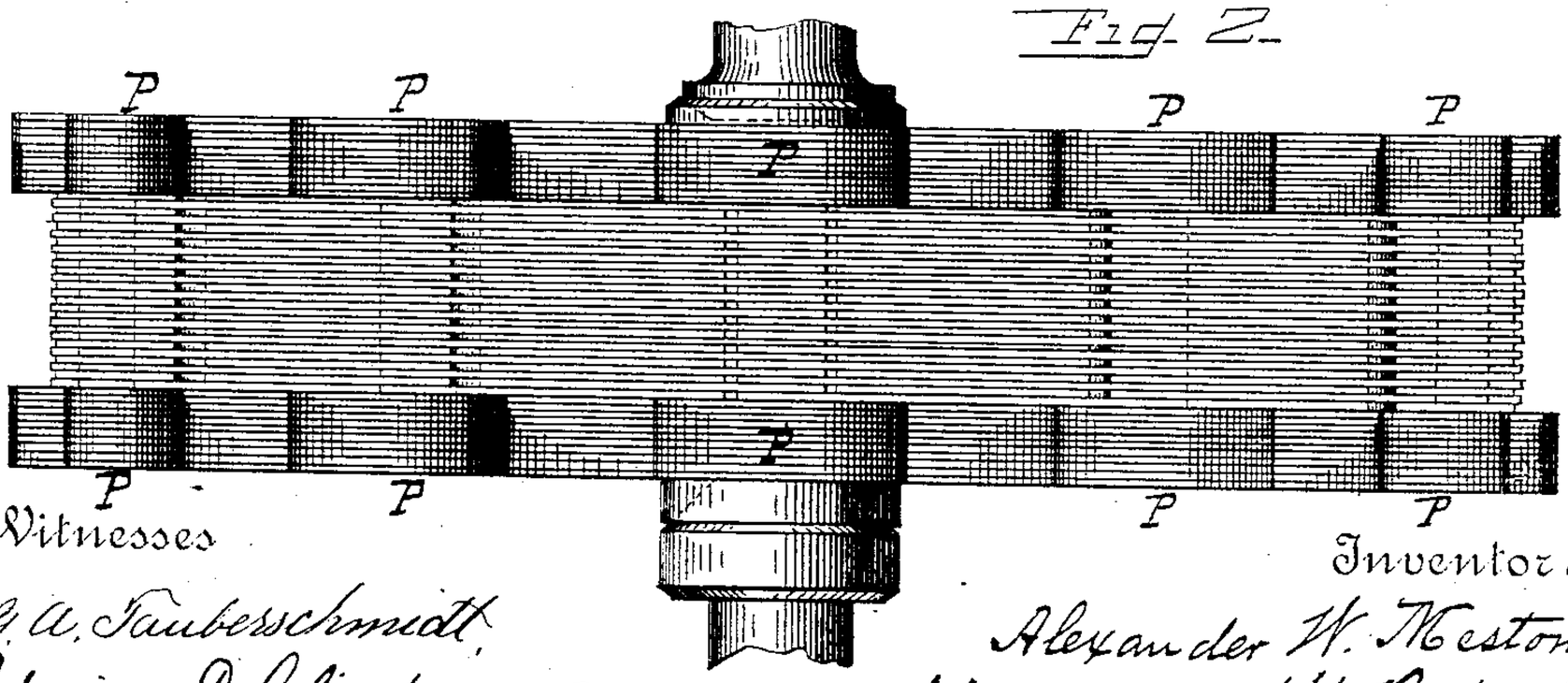



Fig. 2.




Witnesses

G. A. Taubenschmidt.

Edwin S. Clarkson.

Inventor.

Alexander W. Meston.

By his Attorney F. H. Ritter & Co.

(No Model.)

5 Sheets—Sheet 2.

# A. W. MESTON.

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Fig. 3.

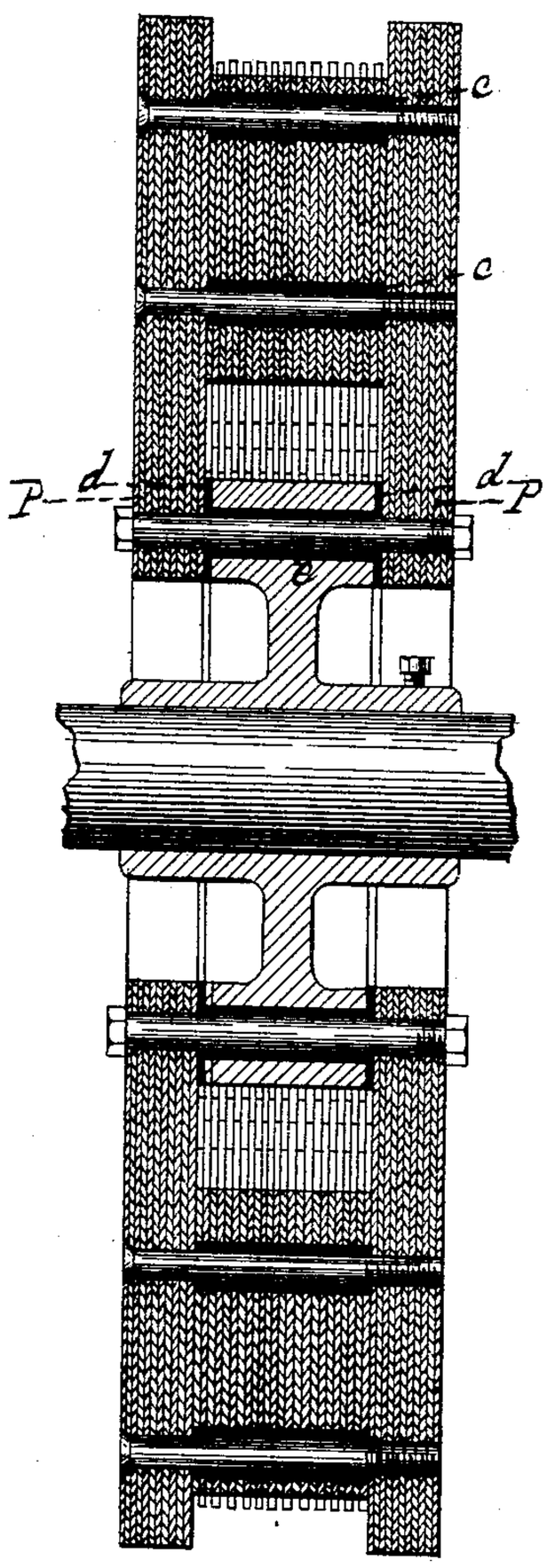
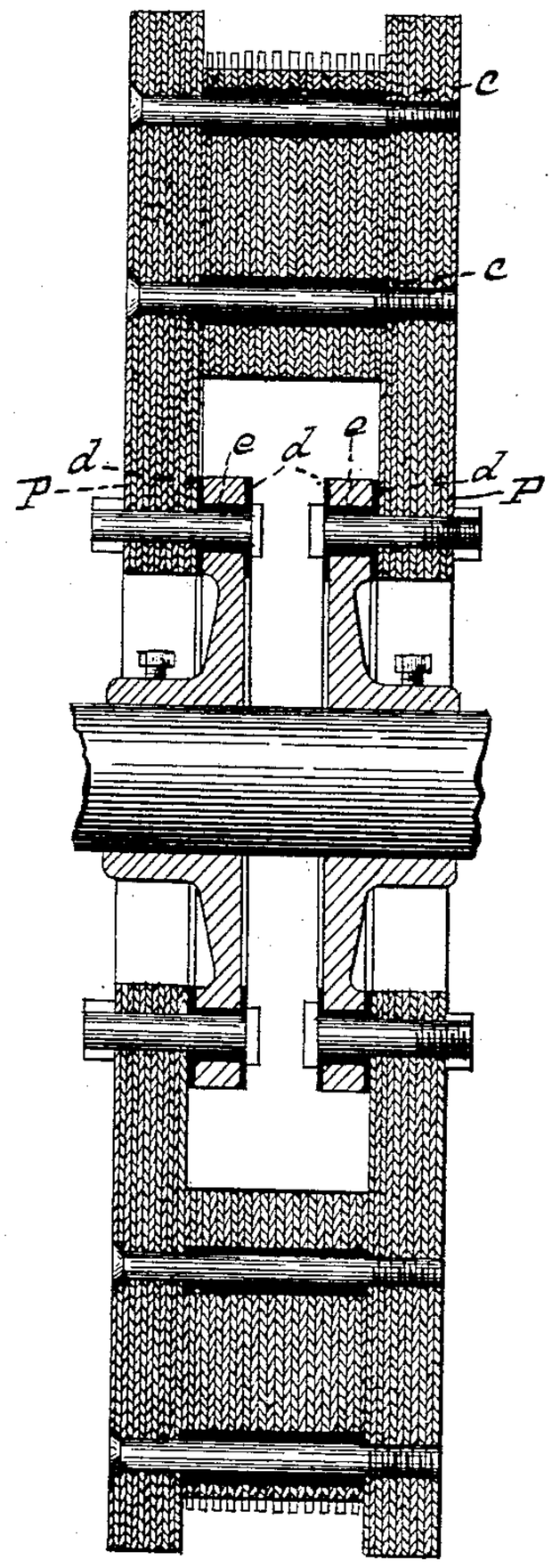



Fig. 4.




Witnesses

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(No Model.)

5 Sheets—Sheet 3.

# A. W. MESTON.

## ARMATURE FOR DYNAMO ELECTRIC MACHINES.

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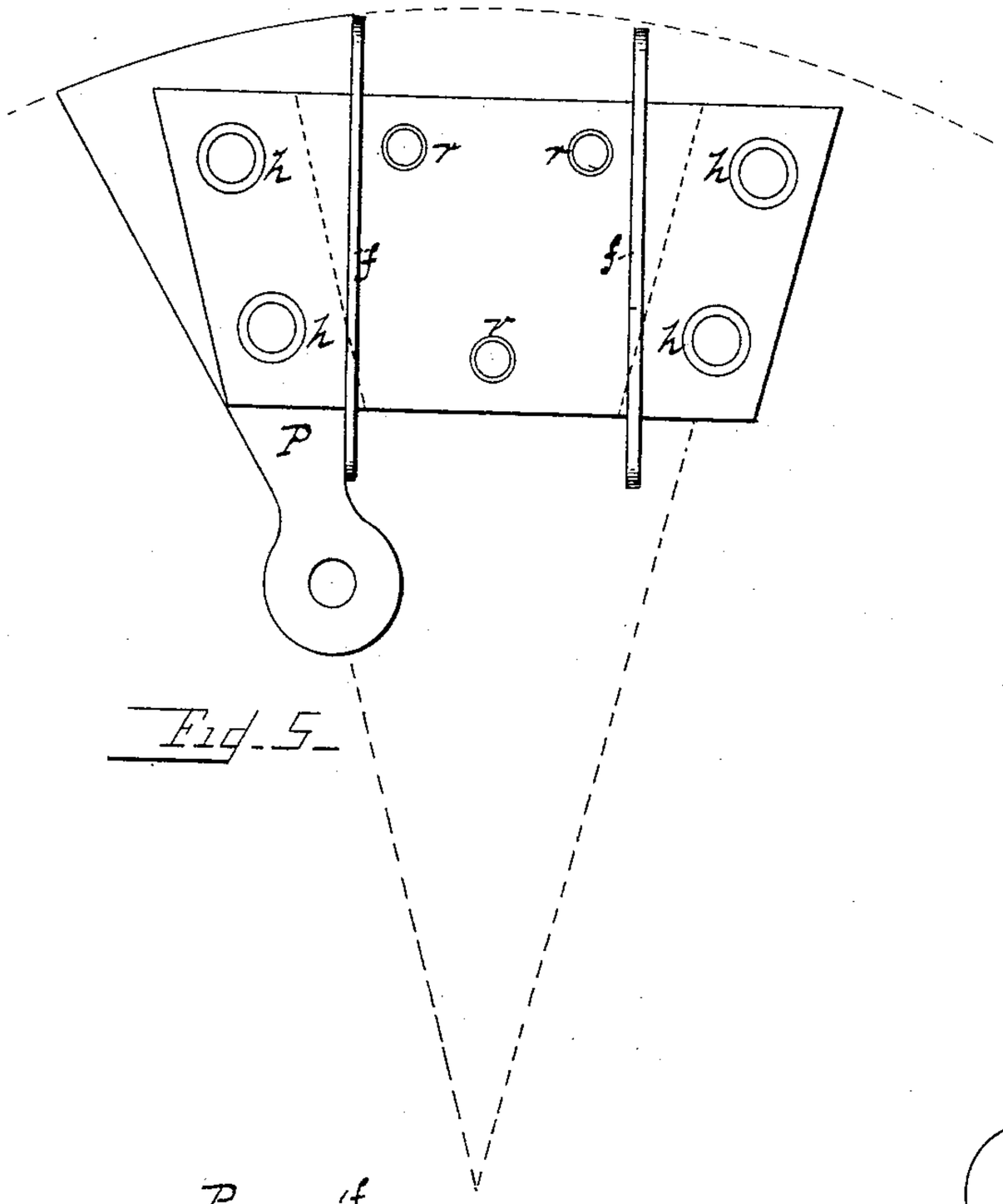


Fig. 5.

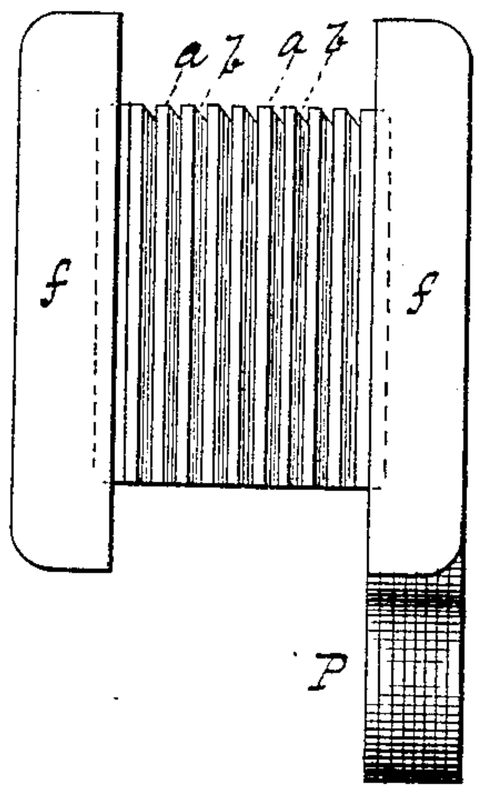


Fig. 6.




Fig. 7.

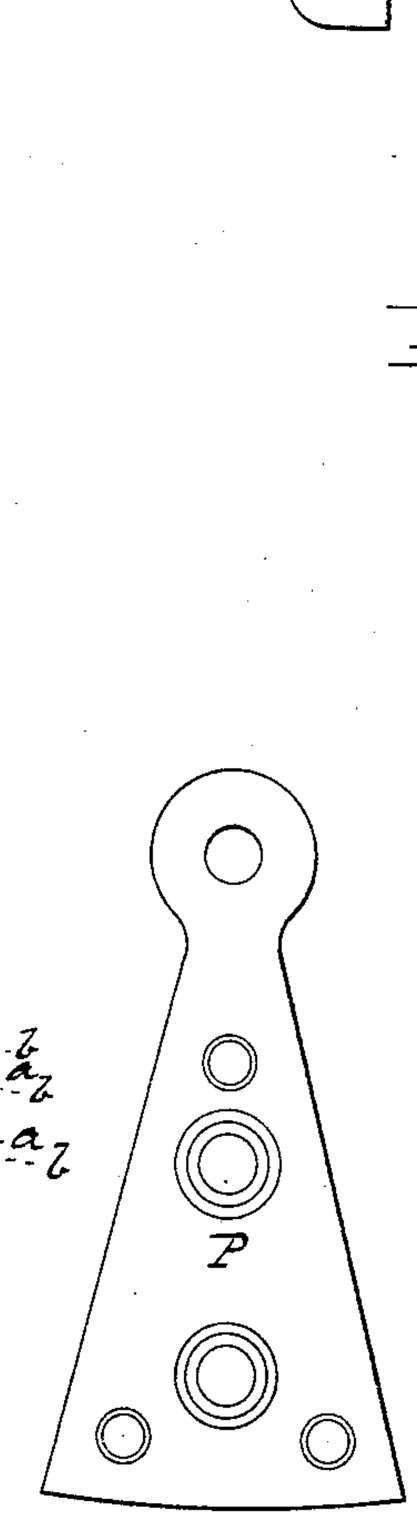


Fig. 8.

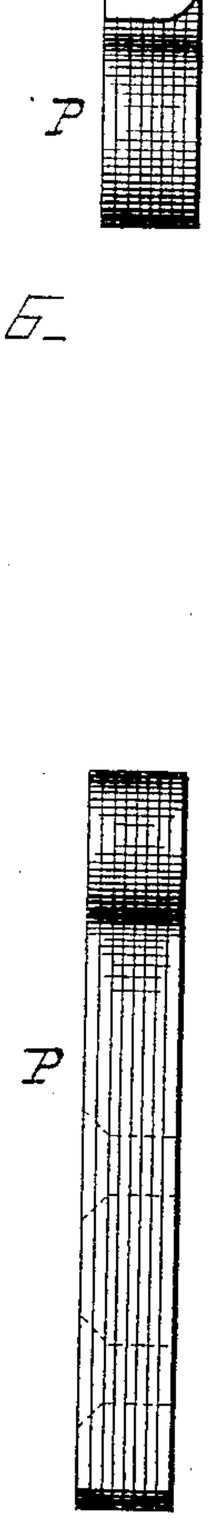


Fig. 9.

Witnesses,

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Inventor,

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By his Attorney F. W. Ritter Jr

(No Model.)

5 Sheets—Sheet 4.

# A. W. MESTON.

## ARMATURE FOR DYNAMO ELECTRIC MACHINES.

No. 387,432. Patented Aug. 7, 1888.

Fig. 10.

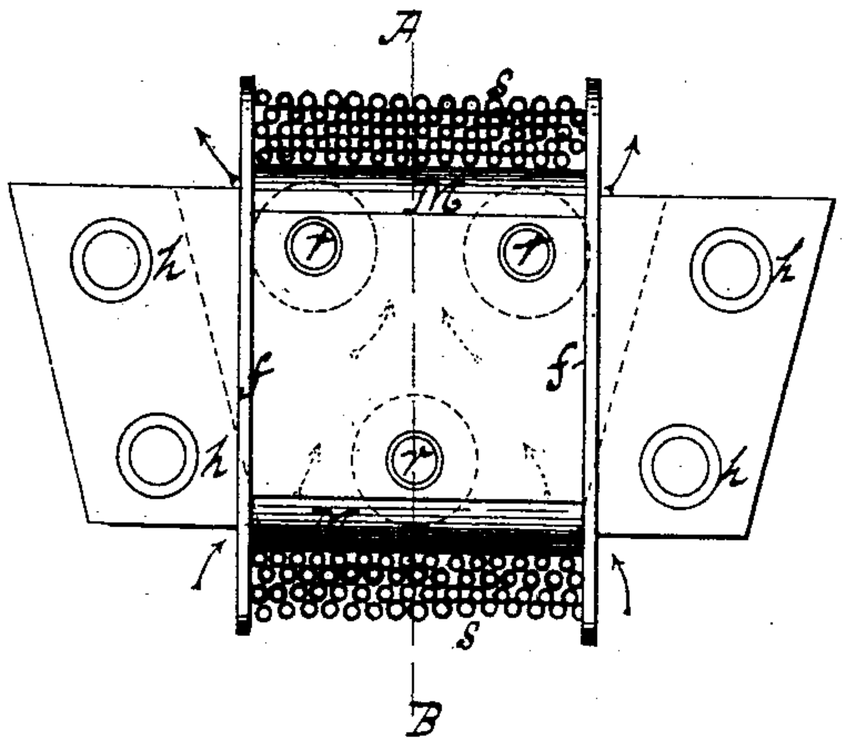



Fig. 11.

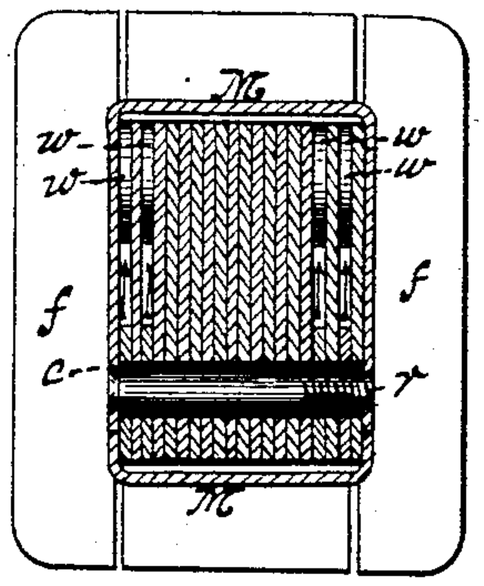



Fig. 12.

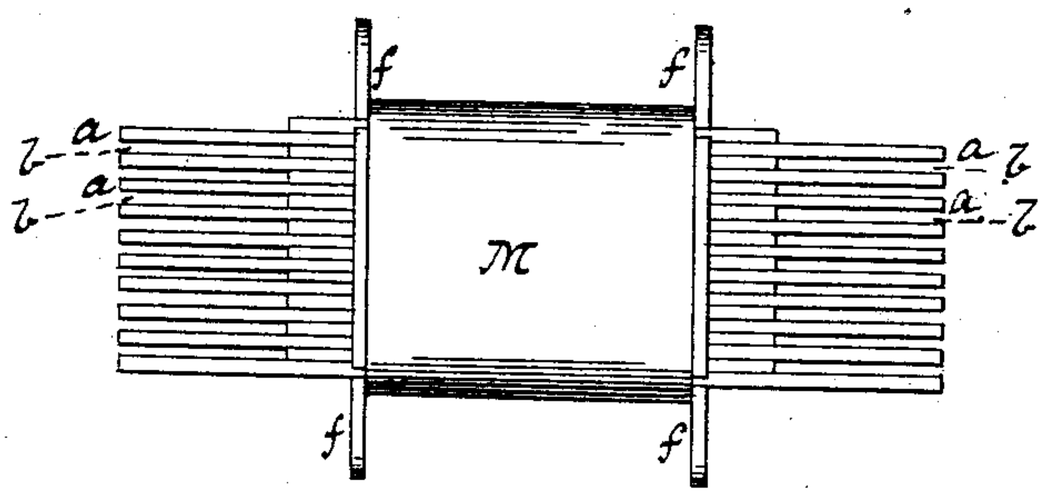
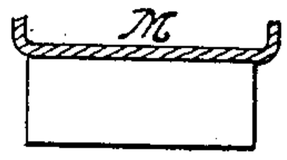



Fig. 13.




Witnesses.

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(No Model.)

5 Sheets—Sheet 5.

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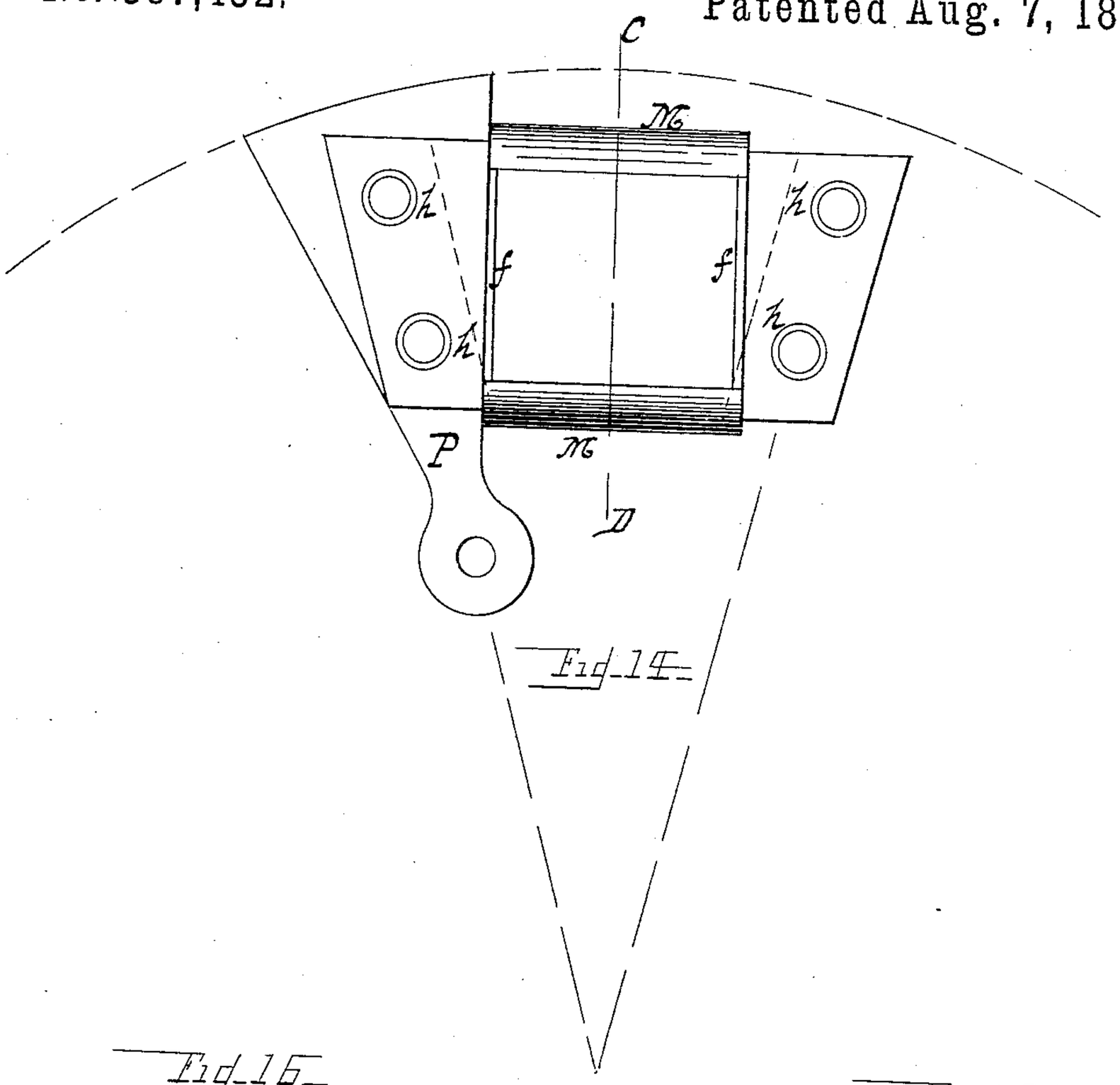



Fig. 14.

Fig. 16.

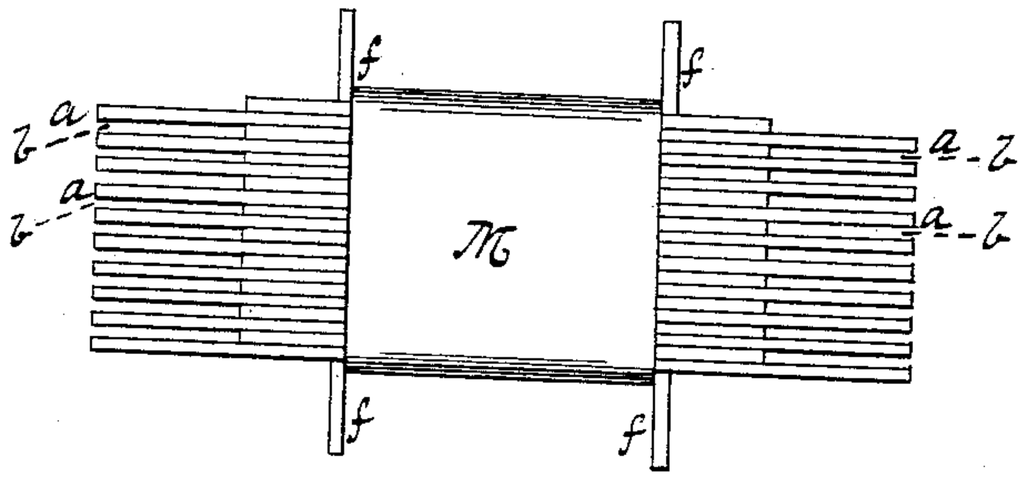
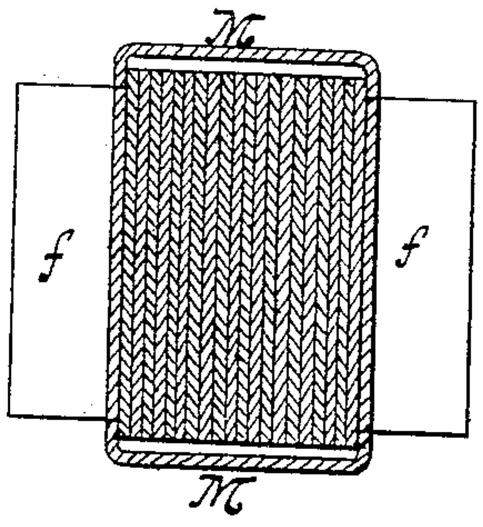



Fig. 15.




Witnesses.

G. A. Taubenschmidt.
Edwin S. Clarkson.

Inventor,
Alexander W. Meston.
By his Attorney F. W. Ritter Jr.

# UNITED STATES PATENT OFFICE.

ALEXANDER W. MESTON, OF ST. LOUIS, MISSOURI.

## ARMATURE FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 387,432, dated August 7, 1888.

Application filed December 7, 1887. Serial No. 257, 240. (No model.)

*To all whom it may concern:*

Be it known that I, ALEXANDER W. MESTON, a citizen of the United States of America, residing at St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Armatures for Dynamo-Electric Machines; and I hereby declare the following to be a full, clear, and exact description of the same, reference being made to the accompanying drawings, wherein like letters refer to like parts throughout the several views.

This invention relates to improvements in that class of armatures known as "ring-armatures," and applies particularly to the flat or Pacinotti type of such armatures.

The objects of the invention are, first, to provide means in flat ring-armatures whereby sections thereof, comprising one or more coils which have become damaged, may be readily replaced by duplicate and perfect sections, and to have such sections of such dimensions and form as will allow of their being revolved in an ordinary lathe or other suitable machine for the purpose of winding the armature-coils, doing away with the slow and laborious method of hand-winding, which the form of the ordinary ring-armature necessitates; second, improvement in the construction of laminated flat ring-armatures, whereby, without materially affecting their strength and without materially increasing the magnetic resistance of the core, sections or portions of the ring having one or more coils wound thereon can be readily detached and taken out and duplicate sections inserted; third, improvement in the construction of laminated sectional ring-armatures, whereby interchangeability of parts is attained; fourth, to combine with the foregoing features a perfect insulation of the laminæ composing such armatures and of the sections from each other without materially affecting the magnetic continuity of the core; fifth, to combine in a laminated sectional ring-armature strength, rigidity, and accuracy of structure and cheapness of manufacture; sixth, to provide for the ventilation of such armatures, and, seventh, improvement in the manner of attaching such armatures to the spiders on which they are mounted, providing at the same time for the insulation of the armature from the spider.

Laminated armatures of the flat ring or Pacinotti type have hitherto usually been so constructed as to form a continuous ring, upon which the coils are wound. Their form of course precludes all possibility of winding such armatures otherwise than by hand, literally winding the wire around the core, which is a slow, tedious, and expensive operation. It thus becomes necessary, should any accident occur to one or more coils, to abandon the use of the entire armature until these coils can be laboriously unwound and rewound in the manner stated, which in large machines is an undertaking requiring several days to perform, during which time the machine is useless. Such a loss of time is generally a very serious inconvenience to those operating dynamos or motors, and often causes grave doubts to be cast upon the reliability of this class of machinery. It is therefore chiefly with the object of facilitating and cheapening their repair and manufacture that I have devised the armatures herein described, and also with the object of improving the construction of sectional laminated ring-armatures, as regards efficiency, cost, strength, stiffness, and accuracy. The methods which I employ to attain these objects are illustrated in the accompanying drawings, wherein—

Figure 1 is a side view of an entire armature without the wire. Fig. 2 is an edge view of the same. Fig. 3 is a sectional view of the same through the line A B in Fig. 1. Fig. 4 is a like sectional view showing a modified form of spiders. Fig. 5 is a side view of a detached section with the radial pole-piece attached. Fig. 6 is an end view of the section shown in Fig. 5. Fig. 7 is a top view or plan of same. Figs. 8 and 9 are side and edge views of the radial pole-piece P. Fig. 10 is a side elevation of a detached section, in which provision is made for ventilating the interior of the core, and in which the wire coils are shown in section for the purpose of indicating how the coils are wound on the section. Fig. 11 is a sectional view of the same through the line A B in Fig. 10, the wire coil omitted. Fig. 12 is a top view or plan of the same. Fig. 13 is a detached sectional view of the bent plate M through the line A B in Fig. 10. Fig. 14 is a side view of a modified form of section. Fig.

15 is a sectional view of same through line C D in Fig. 14. Fig. 16 is a top or plan view of same.

The section shown in Figs. 5, 6, and 7 has a solid core composed of alternate long and short layers or plates of sheet-iron fastened together by a suitable number of rivets, as *r r r*. These plates so arranged form at each end of the section alternate tongues *a a a*, &c., and recesses *b b b*, &c. The short plates leave recesses, into which the tongues formed by the projecting plates of the adjoining section fit, bringing the holes *h h* in the interjacent tongues of the two sections opposite each other. A pole-piece, P, is then placed on each side, fitting into the radial recesses formed between the coils. The whole is then fastened together by countersunk headed bolts passing through one of the pole-pieces, through the holes *h h* in the interjacent tongues of both sections, and screwed into the pole-piece on the oppposite side. The lug of the pole-piece, which projects inward, is then bolted to the spider, as shown in Figs. 1, 3, and 4. The remaining sections are mounted and fastened together in the same manner until the ring is completed. The complete ring mounted on the shaft is shown in Figs. 1, 2, 3, and 4. The two outside plates of each section are of a suitable shape, and are bent up at the ends to a right angle to form the flanges *f f*, between which the armature-coils *s* are wound, and which keep the coils in position when the section is detached from the armature and confine and form the coil-wire during the process of winding. These flanges also serve as a guide when slippping the coil into its place and protect the insulation of the coil from injury, and aid materially in stiffening the armature by fitting against the sides of the inserted pole-pieces. The coils *s* are insulated from the core in the usual way.

The plates composing the sections may be insulated from one another by any suitable material to prevent the generation and flow of Foucault currents. To make the insulation of these plates perfect, the rivets by which they are held together, and the bolts passing through the pole-pieces and holding the sections together, may be insulated from the core by means of vulcanized fiber or other non-conducting bushings, as *c c c*, &c. The pole-pieces may be insulated from the spider by means of non-conducting washers, as shown by *d d* in Figs. 3 and 4, and by insulating the bolts with bushings, as *e e* in the same figures. The spider should be made of brass, gun-metal, bronze, or other non-magnetic material, that it may not form a conductor by which the magnetic lines of force can escape across from one pole of the field to the other without being traversed by the wire of the armature-coils.

The pole-piece P (shown detached in Figs. 8 and 9) I prefer to make of separate plates of soft sheet-iron, as indicated in the drawings, which may be insulated and riveted in the same manner as the sections. By doing this and using dies to stamp out the sheets and holes perfect uniformity of shape and also in the position of the holes is attained. This could not be done if they were cast or forged in one piece without much skilled and correct labor. A better quality of iron, more perfectly annealed, can also be secured by this means.

In the section shown in Figs. 10, 11, and 12 provision is made for ventilating the interior of the core. It is constructed in the same general way as the solid section, with the exception that several of the plates—preferably several near the outside of the core—are omitted and their places occupied by the detached washers *w w w* or other pieces suitably shaped to allow a free circulation of air, as shown in the drawings. In this construction the outside plates, which are bent up to form the flanges *f f*, are cut somewhat narrower than the other sheets of the core. This leaves a shallow recess or groove along each corner of the core, into which the bent shield-plates M M fit. These plates cover the edges of the core, and, being a short distance from said core, leave an air-space, allowing a free circulation of air between said plate and the core and communicating with the spaces in the interior of the core kept open by the washers *w w w*. When the armature revolves, a current of air is set up, flowing in under the shield-plate M, covering the inner edge of the core, up through the spaces in the core, and out under the shield-plate M, covering the outer edge of said core, as indicated by arrows in the drawings.

In the construction of the section illustrated by Figs. 14, 15, and 16 the bent shield-plate M is employed, as in Figs. 11, 12, and 13, but merely for the purpose of covering the sharp edges of the plates of the core to prevent abrasion of the insulation between them and the wire of the coils *s*. It may, however, be placed some distance from the core, as in Figs. 11, 12, and 13, to allow a partial ventilation of the coil.

If as many tongues and recesses as there are plates in the section are not desired, two or more plates may be used for each tongue and recess. While the joining is not so strong nor so perfect, magnetically, as if every plate formed a tongue or recess, still, where the core has considerable thickness and is composed of many plates, the strength and magnetic intimacy would be ample. It will be seen that this method of interleaving the plates gives great strength, as the bolt holding the sections together would have to be sheared as many times as there are tongues before the sections could be pulled apart.

The armature may be mounted upon two separate spiders, as shown in Fig. 4, instead of one, as shown in Fig. 3. This provides means of adjustment for various thicknesses of cores.

The flange shown on the bent shield-plate M, forming a continuation of the flange *f*, may

or may not be used, as desired. Neither need the flange *f* extend farther than the edge of the core.

If the armature is not required for heavy duty, or where high efficiency is not important, it is not necessary to insulate the laminæ of the sections nor to use the method of ventilation herein described; but it is desirable to do so where these conditions do not exist, to prevent the armature from heating, by breaking up the Foucault current-circuits in the interior of the core, and also by the cooling influence of air-currents. I consider that the best method of insulating the laminæ is to cover them, either in the sheet or after they have been cut to shape, with a thin coating of some insulating compound, such as Japan, asphaltum, varnish, or other suitable mixture.

I attain several desirable advantages in sectional armatures by the construction herein described.

By building the sections up of alternate long and short sheets of iron, so that the same sheet forms the tongue at both ends, great strength and safety, and also accuracy and uniformity of dimensions, are secured, as the long plates form a continuous ring when joined together, and neither the strength nor the length of the section depends upon the screws or rivets which hold the plates together. Where interchangeability of section is desired, the last-mentioned feature is very important.

The form and strength of the ring are preserved entirely independent of the spider upon which it is mounted, and the joining of the sections is separate from and in no way connected with their fastening to the spider. The non-magnetic spider does not extend into the magnetic core of the sections, but is wholly within the internal diameter of said core.

I am aware that sectional armatures have been devised wherein the sections are bolted or otherwise fastened directly to projecting arms or lugs of the non-magnetic spider, which extend out into the magnetic core of the sections for the purpose. These non-magnetic arms or lugs occupy space which might otherwise be filled to advantage with iron and decrease the magnetic conductivity of the core. This is a grave disadvantage which I obviate in my construction, as the sectional ring is mounted upon the spider by means of the magnetic pole-pieces extending inward to said spider, which is wholly within the inner circumference of the magnetic ring. In this way I get a maximum amount of iron in the core and pole-pieces, which greatly increases the efficiency of the armature by lowering its magnetic resistance and preserving throughout the magnetic section of the core. By this method of mounting I am also enabled to get the greatest possible amount of wire on the sections, as the necks of the magnetic pole-pieces by which the ring is mounted upon the spider emerge from between the coils at the outside, where by reason of the curved form of the coils there is always an opening, even when the coils are close together at their inner edges.

The most serious fault which has heretofore existed in sectional armatures is the imperfectness of the magnetic connection and intimacy of the sections. None of the armatures of which I have knowledge combine a perfect insulation of the sections from each other, and at the same time maintain the magnetic continuity of the ring. By making a great many laminations in the core, so that the greatest possible number of tongues and recesses is formed, I am enabled to break up the induced currents by insulating the laminæ and the sections from one another without decreasing the magnetic conductivity of the ring, because by so doing a very large surface of the plates of the adjacent sections is brought into close proximity, thus almost eliminating the magnetic resistance of the insulation.

I am aware that sectional ring-armatures have heretofore been made, and I have no intention of broadly claiming such a construction. I am not aware, however, of any armatures embodying the improvements and advantages possessed by the armature herein described; and,

Having thus fully and clearly explained the objects, construction, and operation of my invention, I claim and desire to secure by Letters Patent—

1. A flat ring-armature composed of laminated sections, having one or more coils of wire wound on each section, any of such sections being detachable, said sections composed of alternate long and short plates fitting and joined together by means of the tongues and recesses formed thereby, substantially as and for the purposes specified.

2. A flat ring-armature composed of laminated sections, the laminæ thereof being insulated from each other, having one or more coils of wire wound on each section, any of such sections being detachable, said sections composed of alternate long and short plates, fitting and joined together by means of the tongues and recesses formed thereby, substantially as and for the purposes specified.

3. A flat ring-armature composed of laminated sections, having one or more coils of wire wound on each section, any of such sections being detachable, said sections fitting together by means of tongues and recesses, in combination with a spider and detachable magnetic pole-pieces, by means of which the armature-ring is mounted on the spider, substantially as and for the purposes specified.

4. A flat ring-armature composed of laminated sections, the laminæ thereof being insulated from each other, having one or more coils of wire wound on each section, any of such sections being detachable, said sections fitting and joined together by tongues and recesses, in combination with a spider and detachable magnetic pole-pieces, substantially as and for the purposes specified.

5. A flat ring-armature composed of laminated sections, having one or more coils of wire wound on each section, any of the such sections being detachable, said sections fitting and joined together by tongues and recesses, in combination with a spider and detachable magnetic pole-pieces, said pole-pieces being insulated from the spider, substantially as and for the purposes specified.

6. A flat ring-armature composed of laminated sections, the laminæ thereof being insulated from each other, having one or more coils of wire wound on each section, any of such sections being detachable, said sections fitting and joined together by tongues and recesses, in combination with a spider and detachable magnetic pole pieces, said pole-pieces being insulated from the spider, substantially as and for the purposes specified.

7. A flat ring-armature composed of laminated detachable sections having flanged outer plates, and having one or more coils of wire wound thereon, said sections fitting and joined together by tongues and recesses, substantially as and for the purposes specified.

8. A flat ring-armature composed of laminated detachable sections, the laminæ thereof insulated from each other, provided with flanged outer plates, having one or more coils of wire wound thereon, said sections fitting and joined together by tongues and recesses, substantially as and for the purposes specified.

9. A flat ring-armature composed of laminated detachable sections, provided with flanged outer plates, and having one or more coils of wire wound thereon, said sections fitting and joined by tongues and recesses, in combination with a spider and detachable magnetic pole-pieces, by means of which the ring is mounted on the spider, substantially as and for the purposes specified.

10. A flat ring-armature composed of laminated detachable sections, the laminæ thereof insulated from each other and the outer plates flanged, said sections fitting and joined by tongues and recesses, and having one or more coils of wire wound thereon, in combination with a spider and detachable magnetic pole-pieces, by means of which the ring is mounted on the spider, substantially as and for the purposes specified.

11. A flat ring-armature composed of laminated detachable sections, fitting and joined together by tongues and recesses, having flanged outer plates, one or more coils of wire wound thereon, in combination with a spider and detachable magnetic pole-pieces, by means of which the ring is mounted on the spider, said pole-pieces being insulated from the spider, substantially as and for the purposes specified.

12. A flat ring-armature composed of laminated detachable sections, joined and fitted together by tongues and recesses, the laminæ thereof insulated from each other, the sections having flanged outer plates and having one or more coils of wire wound thereon, in combination with a spider and detachable magnetic pole-pieces, said pole-pieces being insulated from the spider, substantially as and for the purposes specified.

13. In a flat ring-armature, the combination of detachable laminated core-sections, a spider, and detachable laminated pole-pieces, by means of which the ring is mounted on the spider, substantially as and for the purposes specified.

14. A dynamo-armature section composed of laminæ, the outer plates of the laminæ being flanged, and shield-plates which are arranged between the flanged plates and cover the edges of the laminæ, substantially as and for the purposes specified.

15. A dynamo-armature section composed of laminæ, having its outer plates flanged for the coil, and flanged shields to cover the edges of the laminæ and complete the coil-flanges, substantially as and for the purposes specified.

16. The combination, in an armature, of a laminated core, two independent or separate spiders, and two independent sets of pole-pieces which connect the respective spiders with opposite sides of the laminated core, substantially as and for the purposes specified.

17. The combination in an armature, of laminated core-sections, two independent or separate spiders, and two independent sets of laminated pole-pieces which connect the opposite sides of the core-sections with their respective spiders, substantially as and for the purposes specified.

In testimony whereof I affix my signature, in presence of two witnesses, this 5th day of December, 1887.

ALEXANDER W. MESTON.

Witnesses:

HENRY W. EHLERT,

WM. MORGAN.