(No Model.) 3 Sheets—Sheet 1.

A. L. RIKER.

FORMER FOR WINDING ARMATURE COILS.

No. 604,843. Patented May 31, 1898.

Fig. 1.

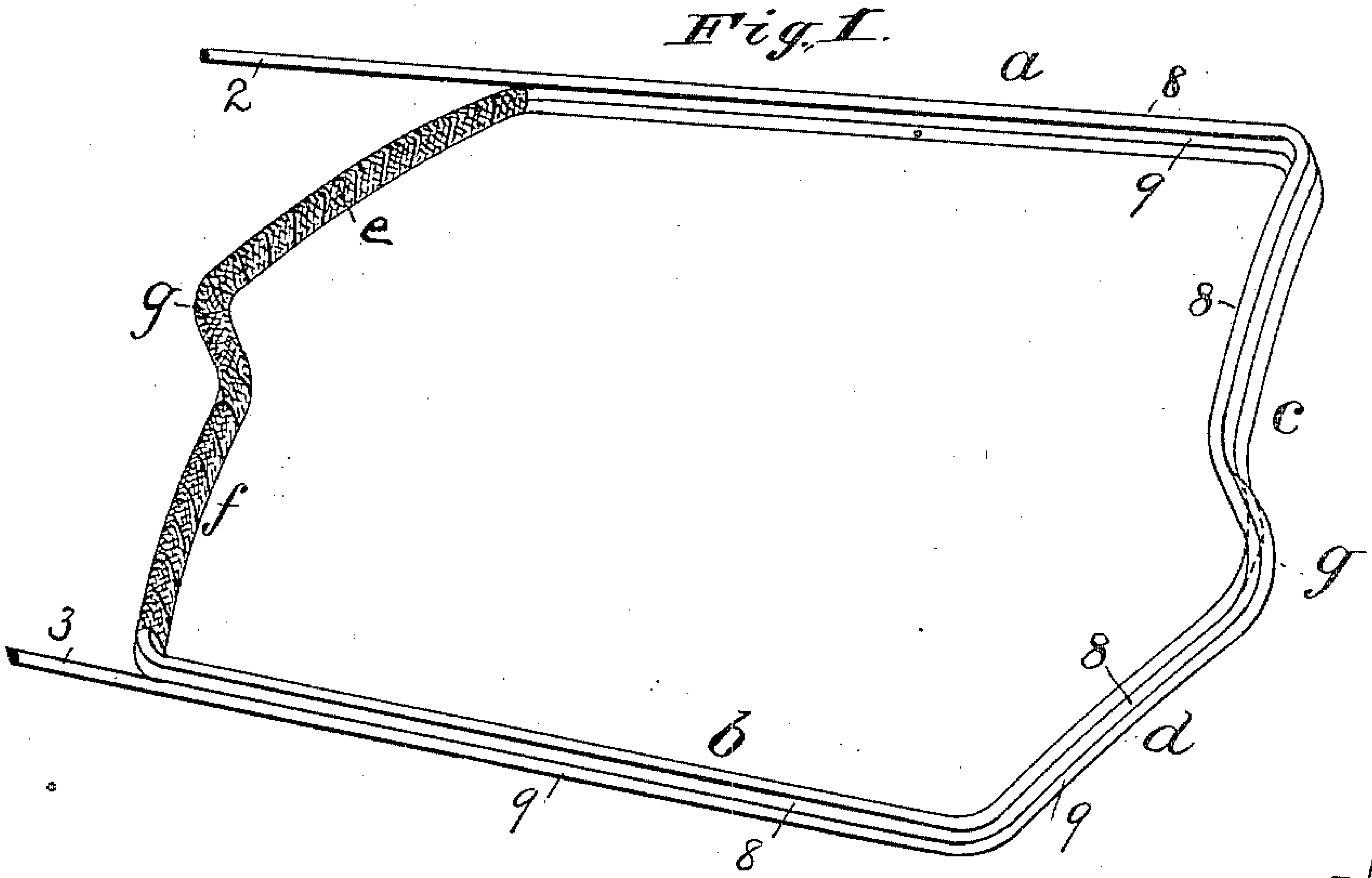
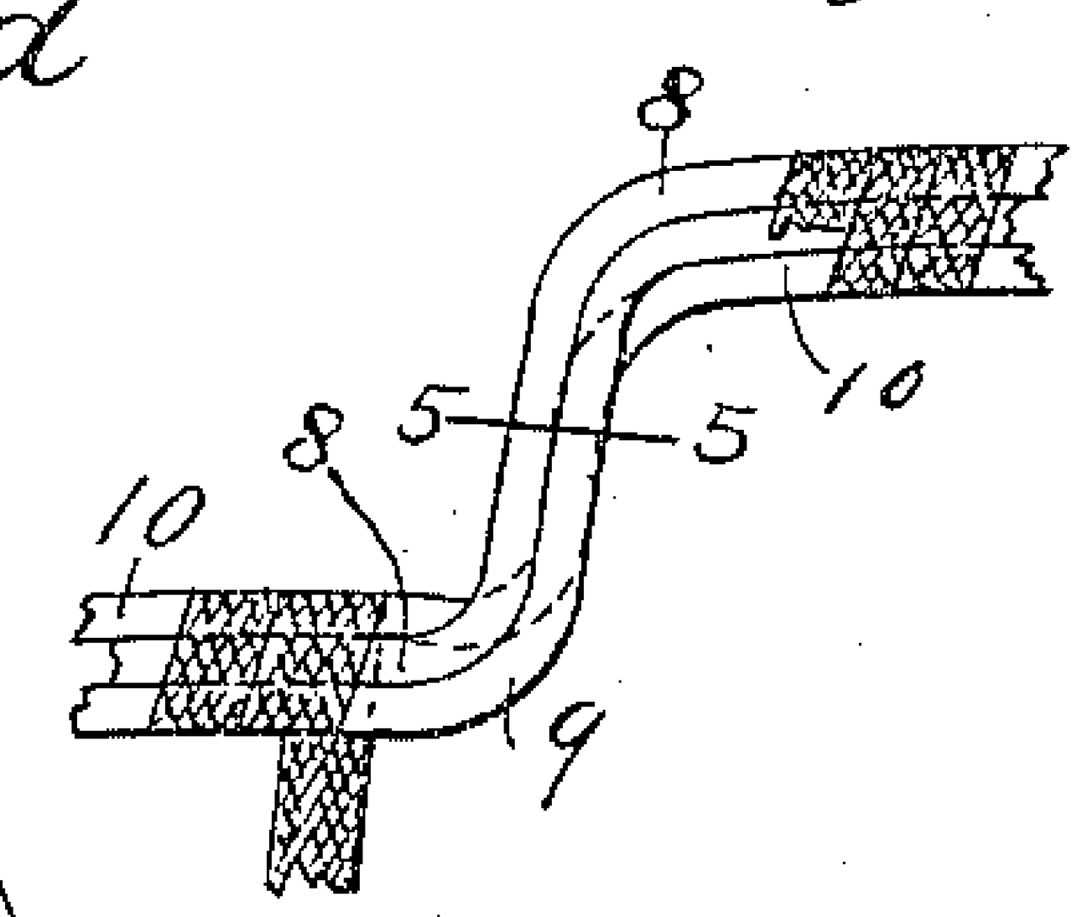


Fig. 3.



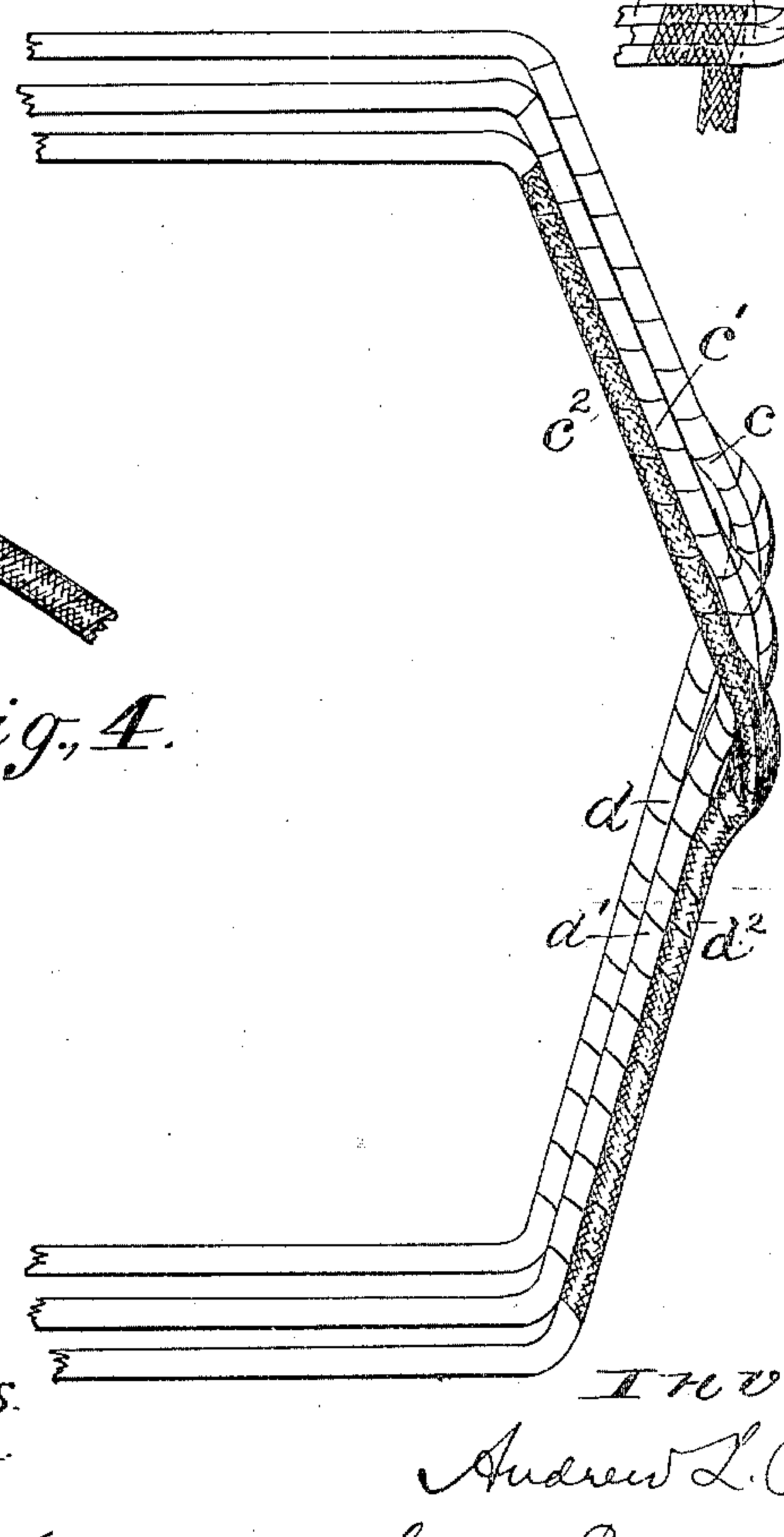


Fig. 2.

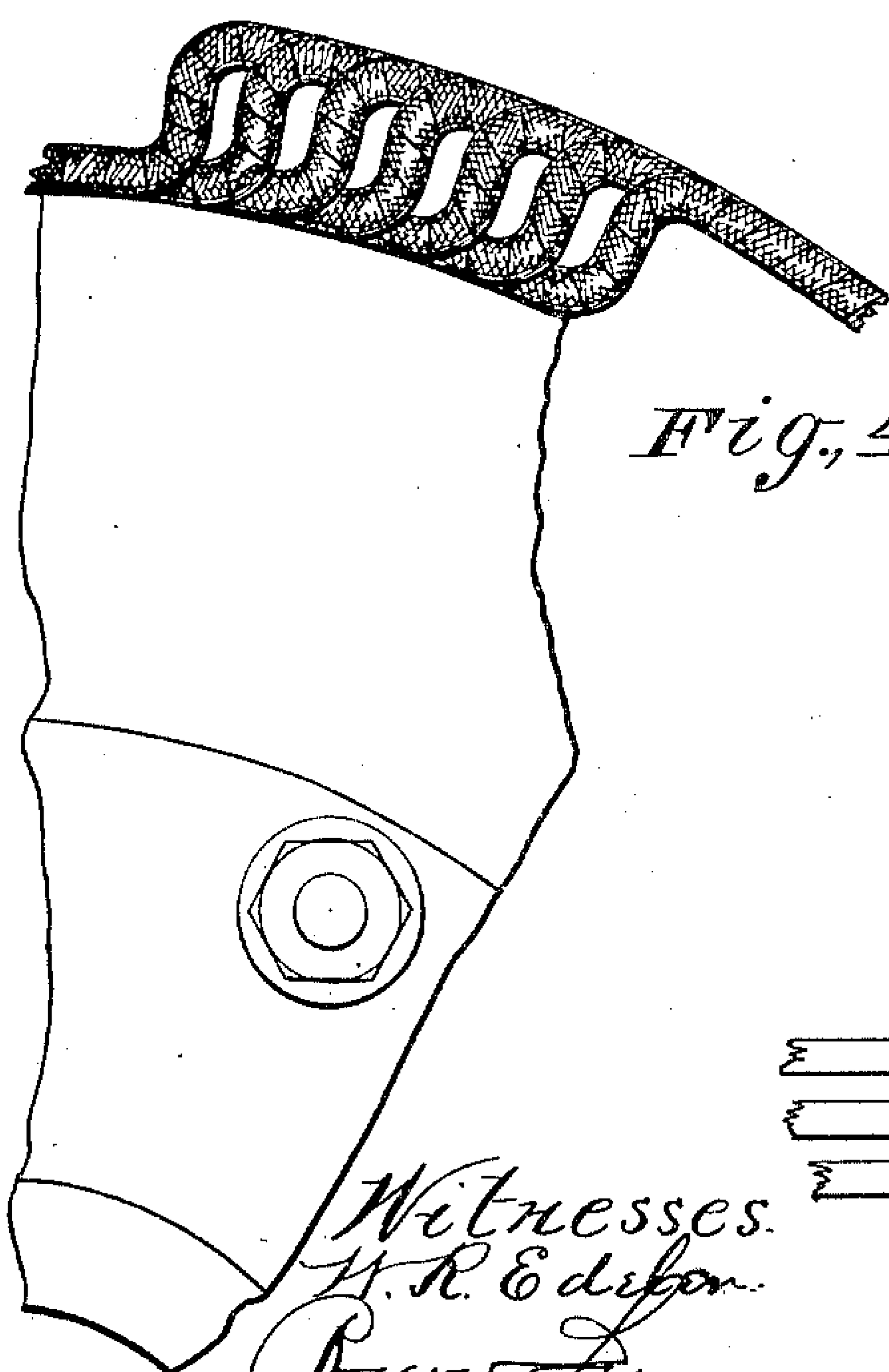


Fig. 4.

Witnesses.
[illegible]
[illegible]

Inventor
Andrew L. Riker
by Pollok & Mauro
his attorneys.

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Fig. 5.

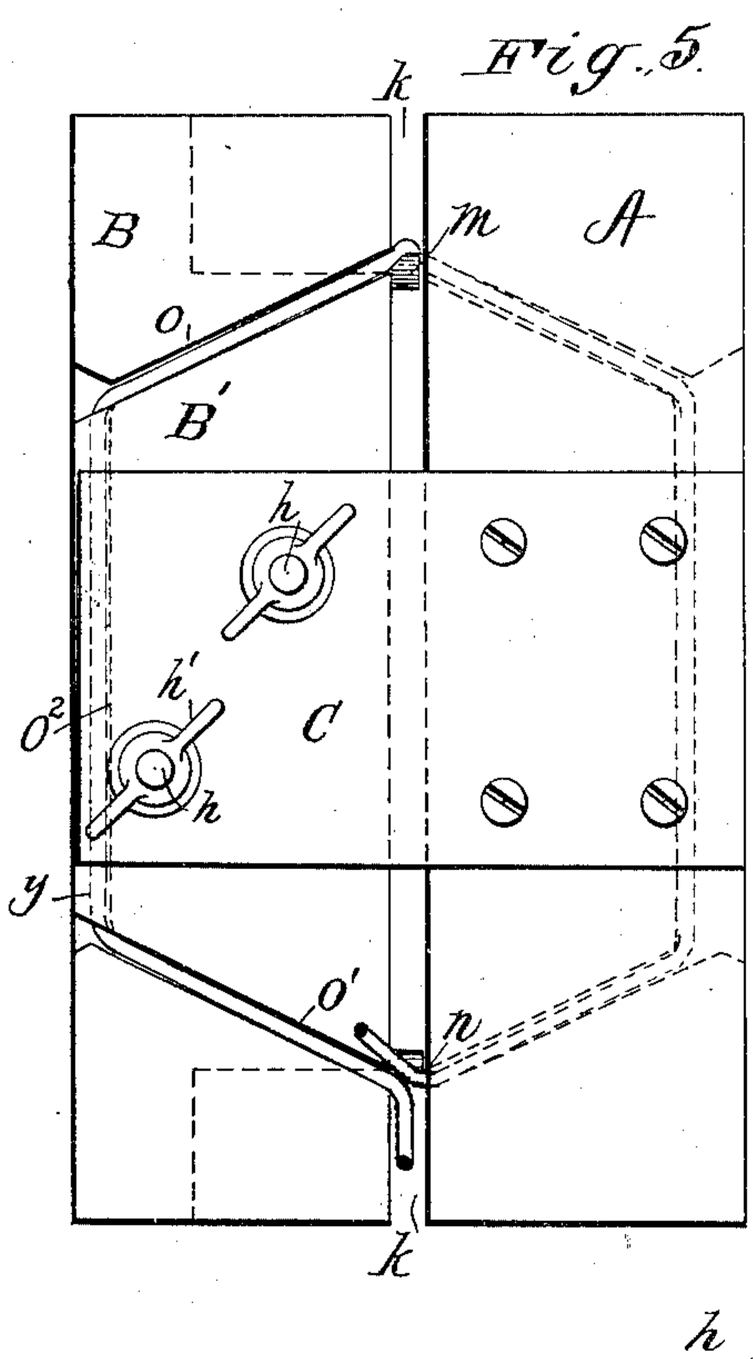


Fig. 7.

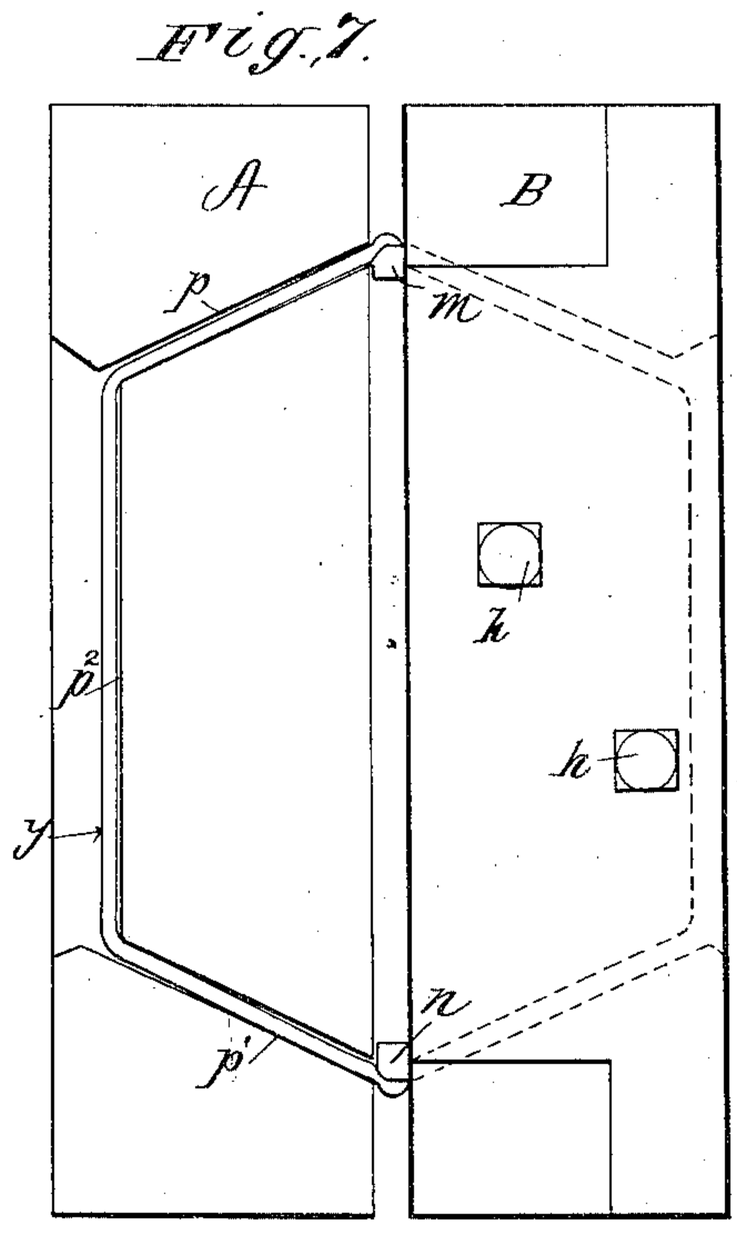


Fig. 6.

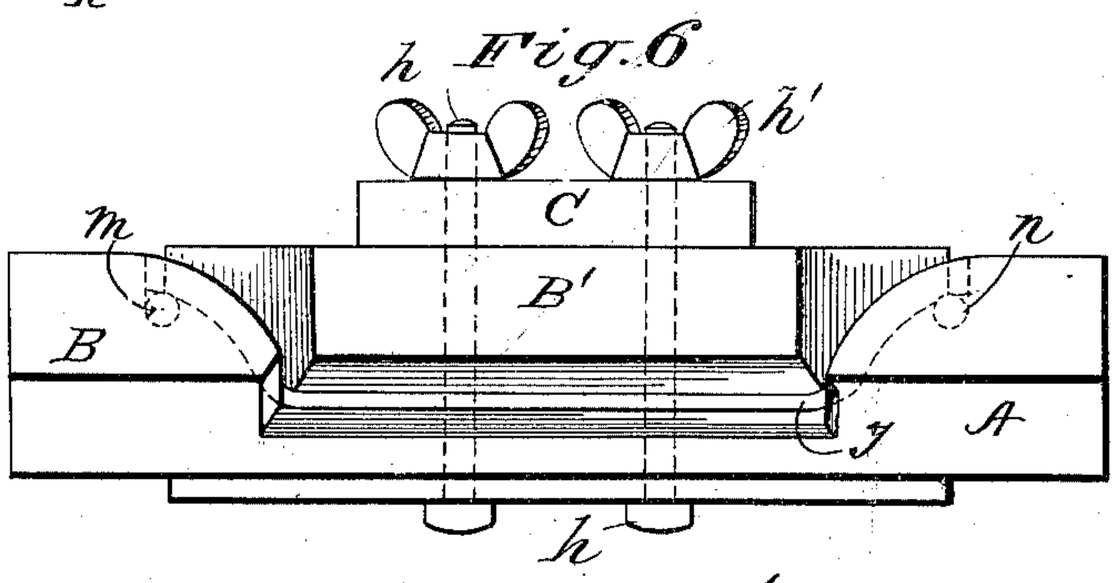
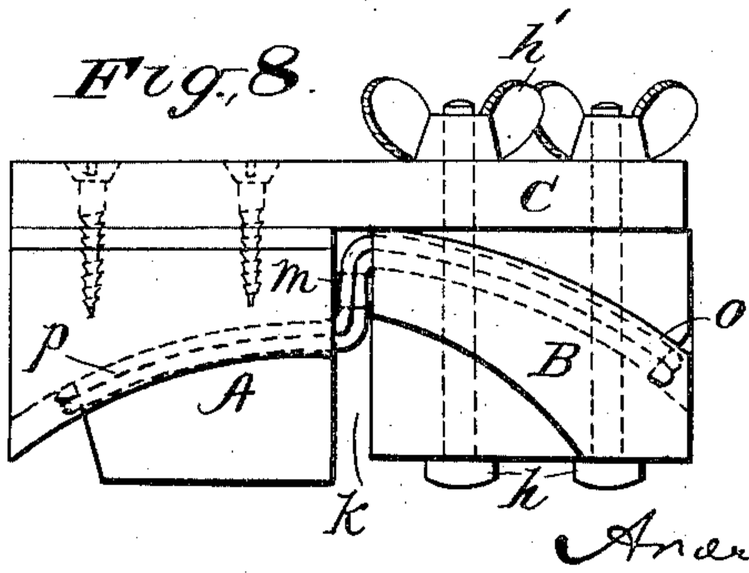


Fig. 8.



Witnesses.
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Geo. Lewis

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(No Model.) 3 Sheets—Sheet 3.

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FORMER FOR WINDING ARMATURE COILS.

No. 604,843. Patented May 31, 1898.

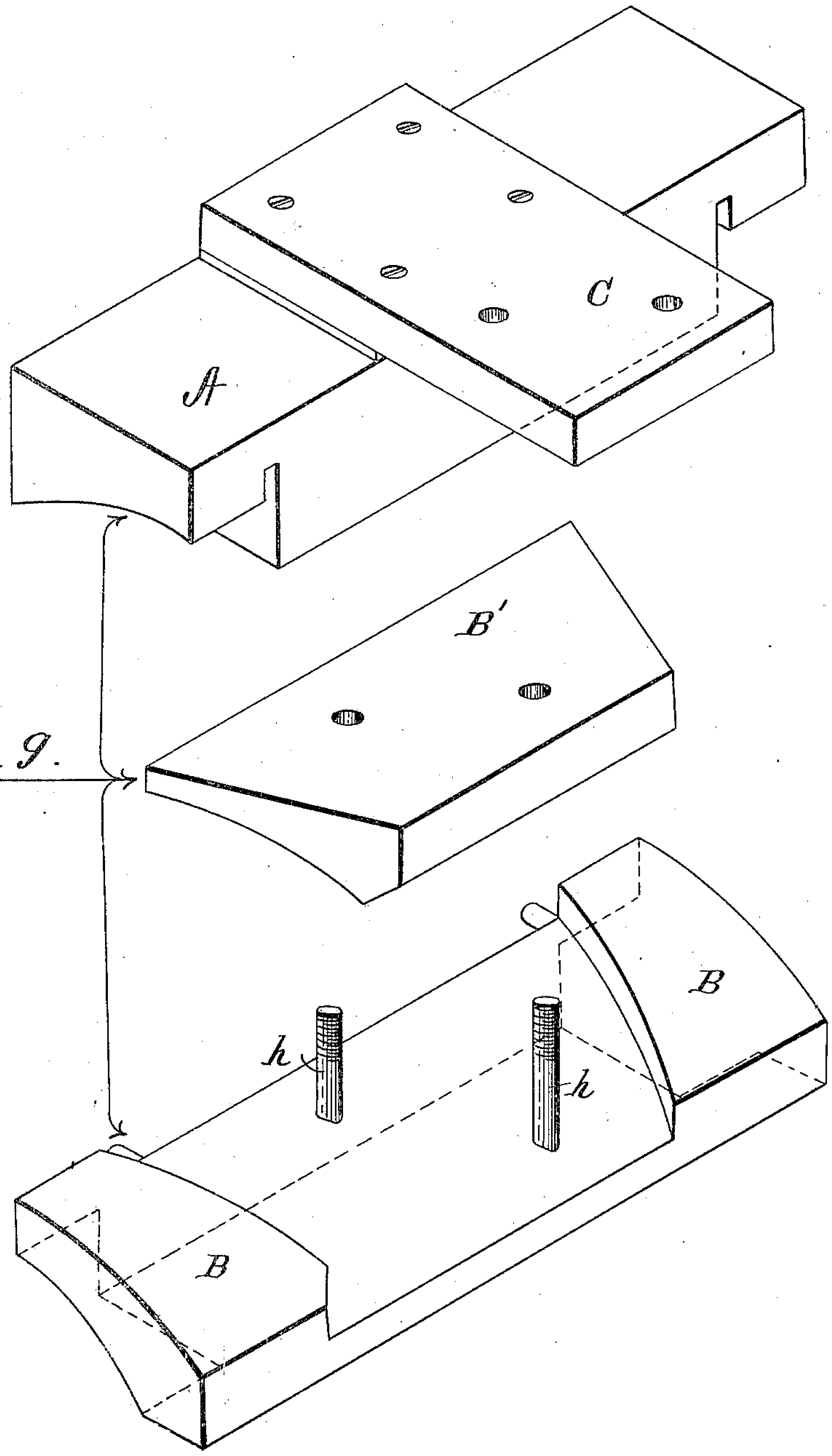

Fig. 9.

Witnesses.
W. R. Edelen.
[signature]

Inventor.
Andrew L. Riker
by Pollok & Mauro
his attorneys

UNITED STATES PATENT OFFICE.

ANDREW L. RIKER, OF NEW YORK, N. Y.

FORMER FOR WINDING ARMATURE-COILS.

SPECIFICATION forming part of Letters Patent No. 604,843, dated May 31, 1898.

Application filed November 19, 1897. Serial No. 659,163. (No model.)

To all whom it may concern:

Be it known that I, ANDREW L. RIKER, of New York, N. Y., have invented new and useful Improvements in Coiling-Frames for Armature-Windings, which improvements are fully set forth in the following specification.

This invention has reference to means for winding armature-coils; and it consists of a coiling frame or former of special construction designed particularly for use in making such coils. Heretofore coils of this general character have been made in various ways, a common procedure being to wind the wire upon a former, giving the coils the dimensions and approximate shape desired, and then, by hand or otherwise, bringing it to final shape and imparting to it the necessary bends or offsets to admit of grouping the several coils upon the armature-core, according to the plan adopted. According to the present invention the coil is wound complete upon a single former of special construction, and this device forms part of the invention.

In the accompanying drawings, which form part of this specification, Figure 1 represents in perspective one of the coils as completed and ready for application to an armature-core. Fig. 2 is a plan view of a group of such coils, showing how they fit together. Fig. 3 is an end elevation of the bend of a coil, the covering-tape being partly removed. Fig. 4 is an end elevation of part of an armature constructed in accordance with the invention. Fig. 5 is a front elevation of a former upon which the coils are wound. Fig. 6 is an edge view thereof. Fig. 7 is a rear elevation thereof. Fig. 8 is a top view thereof. Fig. 9 is an isometric perspective of the several parts of the former dismembered.

The coil shown in the drawings is composed of three turns of round wire, but the number may of course be greater or less. The coil is hexagonal in shape. The opposite parallel sides *a b*, Fig. 1, are the parts which occupy slots in the armature-core. The remaining sides of the hexagon *c d e f* are the connecting parts which lie beyond the ends of the core. It will be observed that the three wires lie one above the other (not side by side)—that is to say, when lying in a slot they will all be in the same plane radial of the cylinder. It will also be observed that the connecting sides *c d e f* are not bent inward toward the axis of the core, but extend outward in substantially the same plane as the sides *a b*.

Following the course of the coil illustrated in Figs. 1 and 3 from the end 2 it will be observed that the upper wire (marked 8) and the adjacent wire 9 continue in the same relative positions—the wire 9 under wire 8, around the coil until wire 9 ends at the terminal 3, which is at the bottom of the coil. These wires do not cross or shift positions at the vertical drop or bend, but, as shown in Fig. 3, continue in parallelism. Otherwise the ends 2 3 instead of being respectively at the top and bottom of the coil would both be at the top. The coil is distinguished by the fact that the thickness of all parts of the coil—*i. e.*, the dimension measured on a horizontal transverse line—is equal to one thickness of wire, except at the vertical part, where it is equal to two thicknesses, as shown at the line 5 5, Fig. 3. This is true irrespective of the number of turns (in excess of two) of which the coil is composed. As shown in Figs. 1 to 3 which illustrate a coil of three turns, the third wire at the vertical part lies behind the wires 8 9, a fourth wire would be alongside thereof, and in case of a greater number they would lie in pairs one behind another, leaving the thickness at this part always twice that of the other parts of the coil.

The winding of the complete armature may be considered as composed of segments equal to the number of poles of the machine, each segment being composed of a group of coils and each coil of a plurality of turns. The extent to which the connecting parts extend beyond the ends of the core is controlled by the number of coils in each group and will be somewhat greater than the sum of the thicknesses (or smallest cross-sectional dimensions) of the group of coils.

At the ends of each coil—for instance, at the point *g*, where the side *c* meets the side *d*, Fig. 1—is an offset or drop, and Fig. 2 clearly illustrates how this offset and drop permit the symmetrical arrangement of the coils in the manner already explained. Considering the relative positions of the two coils, if the side *c* is within the corresponding side of the other coil—that is, between it and the end of the

core—its side *d* will be outside of the corresponding side of such other coil, and vice versa. In other words, the sides of adjacent coils occupy reversed positions on opposite sides of the bend or offset. This is shown in Fig. 2, where the sides of one coil are marked *c d*, of another *c' d'*, and of a third c^2 d^2. Owing to the vertical drop the sides *d* are in a plane just beneath that of the sides *c*, but only so far beneath as to permit the wires to cross each other—that is, to enable the wires composing a coil after making the turn at the angle *g* to pass inside of those wires which before the turn were outside of it, and vice versa. The construction at the two ends being identical it is unnecessary to repeat the description for the other ends of the coils formed by the sides *e* and *f*.

The manner of and means for producing this coil will now be explained with reference to Figs. 5 to 9. The winding frame or former is composed of two separate parts A and B. A cross-piece C is permanently fastened to part A and detachably fastened to part B, as by bolts *h* and wing-nuts *h'*, so that by withdrawing the bolts the two parts may be separated. When put together for use, the two parts are separated by a slit or winding-space *k*, which space is crossed by two pins or bearing-surfaces *m n*. These pins mark the angles at which the drops or offsets occur, and the distance between them fixes the extreme length of the coil longitudinally of the armature-shaft. Looking at the front of the former, Fig. 5, a groove *o* is seen formed in the part B, this groove inclining downwardly from the point where it intersects the winding-space *k*, which is just opposite pin *m*. This groove is just wide enough to receive one thickness of the insulated wire, (designated as *y* in these figures,) so that successive turns of wire laid therein will lie one on top of the other. Starting from pin *n* and inclined in the opposite direction is another groove *o'*. These grooves are connected by a channel o^2 running along the side of part B, as shown in Fig. 5. These grooves or guides besides being inclined in the plane of the face of part B are also curved in a plane transversely thereof, as clearly shown in Fig. 8, this curvature being that of the armature-core. The entire cheek-piece B', which is bounded by the grooves *o o'* and channel o^2, is removable from part B in the plane of the coil, so as to facilitate removal of the latter when completed. Piece B' is held in place by the same bolts and nuts as attach parts A and B together. Fig. 9 shows the former dismembered. Looking now at the rear of the former, Fig. 7, similar guiding-grooves *p p'* are seen extending respectively from pins *m* and *n*; but these grooves are in part A, and they, with the channel p^2, (which is parallel with o^2,) constitute the remaining three sides of the hexagonal figure to which the outline of the complete coil conforms. The parallel sides *a b* of the coils are formed in the channels o^2 p^2, and the connecting parts—that is, sides *c d e f*—are formed in the grooves *o o' p p'*.

In winding a coil the operator passes the wire *y* into the winding-space *k*, bending it at about its middle over one of the pins—say *m*. (It is a matter of indifference which of the pins serves as the starting-point.) The ends of the wire then project on opposite sides of the former. The forwardly-projecting end is now carried through the groove *o*, channel o^2, and groove *o'*, and its end put through the space *k* from front to rear, around pin *n*, thus completing one half-turn. The operator now completes the other half of the same turn by reversing the former and carrying the other end of the wire, beginning again at the pin *m*, through groove *p*, channel p^2, and groove *p'*, and reaching pin *n* he thrusts the wire through space *k* from rear to front. Thus, as at the start, the two wires project through space *k* in opposite directions, having met and passed each other at pin *n*.

It is necessary to proceed in the the manner pointed out, first winding half a turn on the front of the former and then half a turn on the back thereof (or vice versa) instead of completing a turn with the end of the wire first manipulated. If the latter course were followed, the wires of adjacent turns would not occupy their proper relative positions. The winding now continues from the pin *n* in a manner or direction the reverse of that just traced for the first turn until a coil having the desired number of turns is made up. The nuts and bolts *h h'* are then withdrawn and parts A B B' separated, after which the coil can readily be removed.

It will be observed that the wire in passing from groove *o* to groove *p* makes a bend over the pin *m* and also a slight deflection in the space *k*. The turn around pin *m* (or *n*) brings the wire into a different plane, the distance between the two planes being the diameter of the pin as the grooves *o p* start, respectively, from opposite sides of the pin *m*. The same observations apply to the pin *n* and the grooves *o' p'* adjacent thereto. The width of winding-space *k* is just sufficient to permit two wires to lie side by side across pin *m*, (or *n*,) as shown in Fig. 8. In this way are secured the proper relative positions of the wires and the structural characteristics of the coil pointed out in describing Figs. 1 and 3, and from this explanation of the former and of the manner of winding a coil thereon it will be clearly understood that no matter what the number of turns in the coil it will always have a thickness of two wires at the vertical part and of one wire at other parts.

In Figs. 5 to 8 a wire *y* is shown wound as far as the completion of the first turn. After removing the coil from the former the connecting parts are preferably wrapped spirally with an insulating-tape *q*, which holds the wires in their proper relative positions.

The manner of applying the coils to the armature-core C will be readily understood.

The core is provided with the usual longitudinal slots, and the coils are applied successively in the slots until the workman has gone completely around the core. These slots are of such depth as to receive the width of two coils. He then goes around it again, so that at the completion there are parts of two coils in each slot.

Obviously the invention is susceptible, in part at least, of embodiment in formers designed to produce coils differing in shape from that herein shown and described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A coiling frame or former comprising two parts having a winding-space between them, and grooves or winding-channels in each part transverse to the plane of the winding-space, those in one part being on the face of the former, and those in the other part in the rear thereof, substantially as described.

2. A coiling frame or former comprising two parts and means for attaching the two parts rigidly together and for detaching them when desired, said former having at each end a winding space or slit through which the wire can pass from front to rear, grooves or channels in each part, those in one part being in the face, and those in the other part in the rear, so that the coil, when completed, lies partly on one side of the former and partly on the other, substantially as described.

3. A two-part former having slits or winding-spaces extending through the same, and pins or bearings crossing said slits, the face of one part being provided with two oblique grooves leading from the respective pins, and with a channel connecting the grooves, the rear of the other part having corresponding grooves and channel, substantially as described.

4. A former composed of two detachable parts, one of said parts having a detachable cheek-piece, bounded by grooves or channels in which the coil is wound, the other part having on its opposite side corresponding winding-grooves, slits or spaces being provided for the passing of the wire from the face to the rear of the former, and vice versa, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ANDREW L. RIKER.

Witnesses:
SAML. RIKER, Jr.,
JNO. M. RICHARDS.