No. 838,916. PATENTED DEC. 18, 1906.

L. H. THULLEN.

INDUCTIVE BOND.

APPLICATION FILED FEB. 27, 1906.

3 SHEETS—SHEET 1.

Fig: 1.

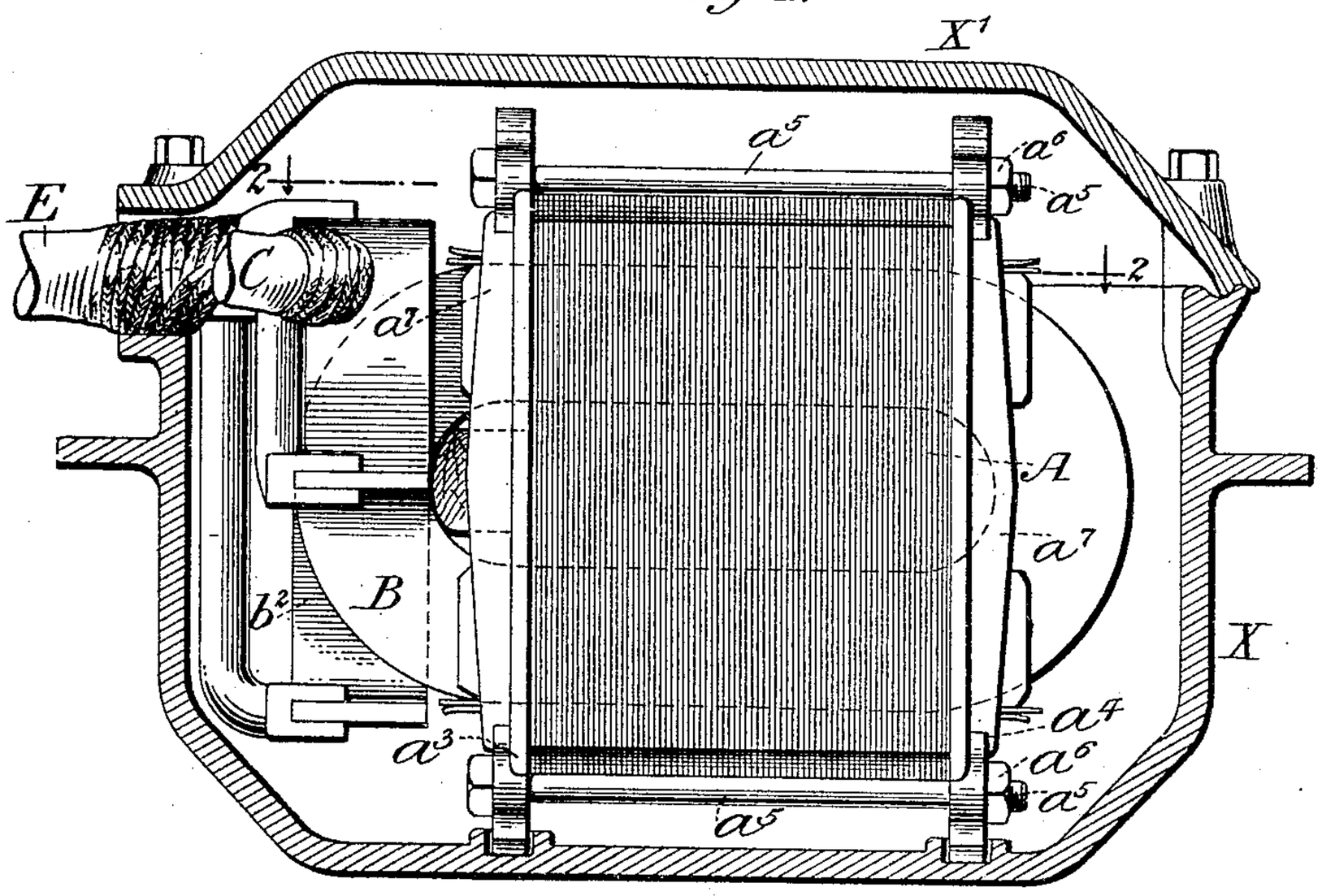
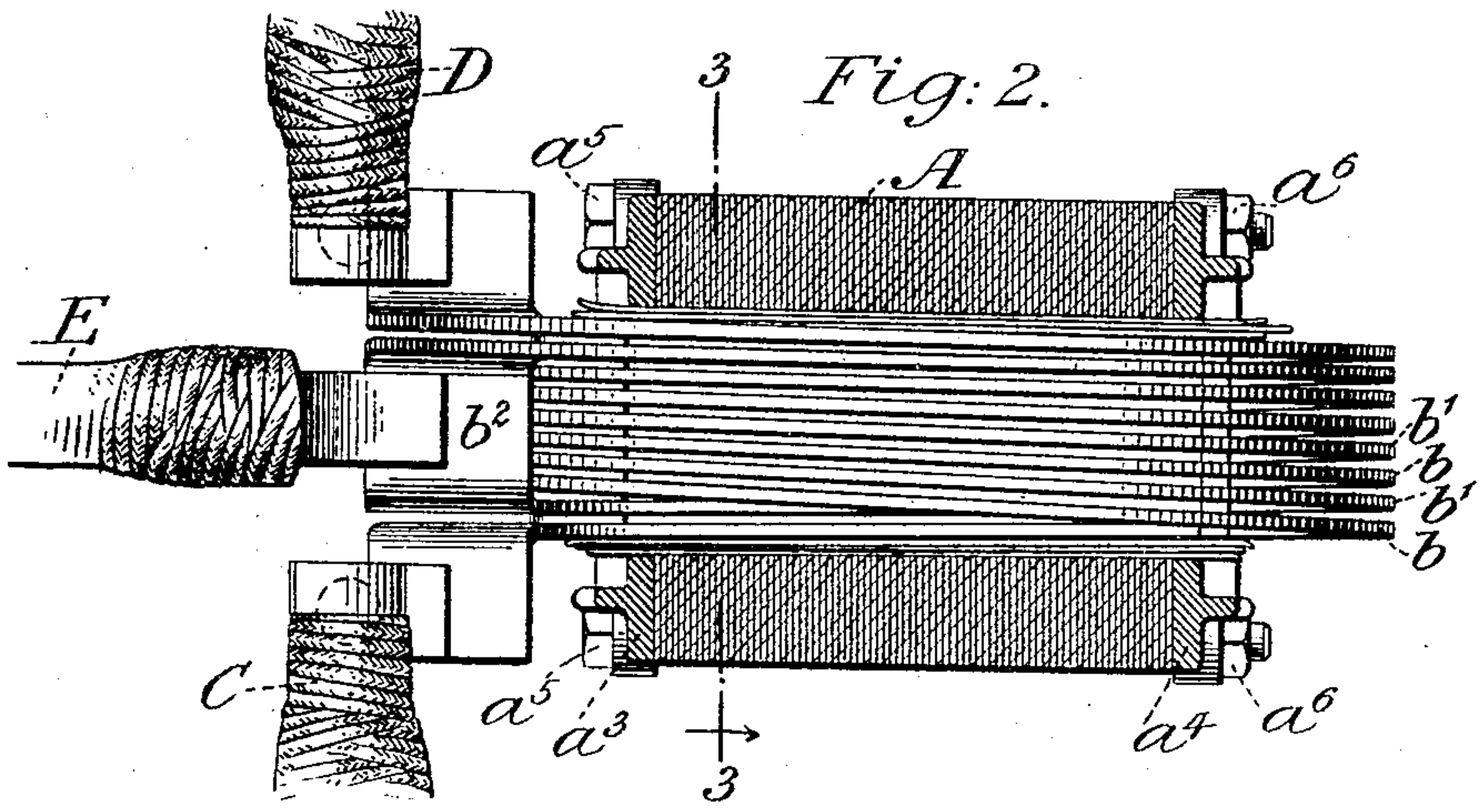


Fig: 2.



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Inventor:
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3 SHEETS—SHEET 2.

Fig: 3.

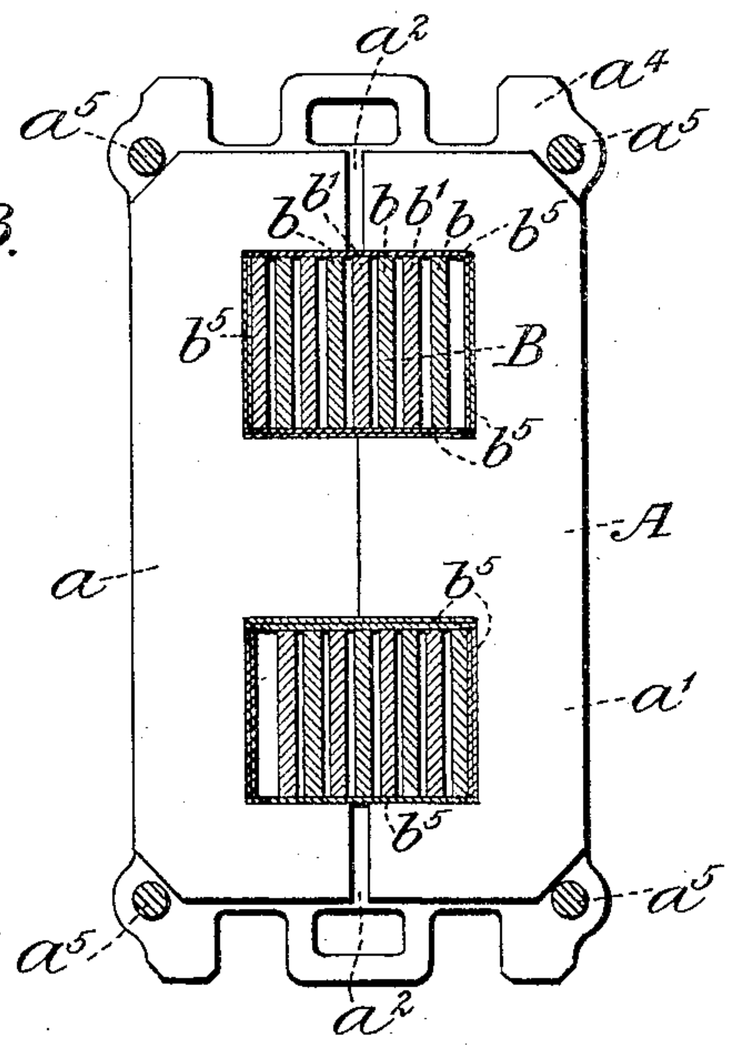
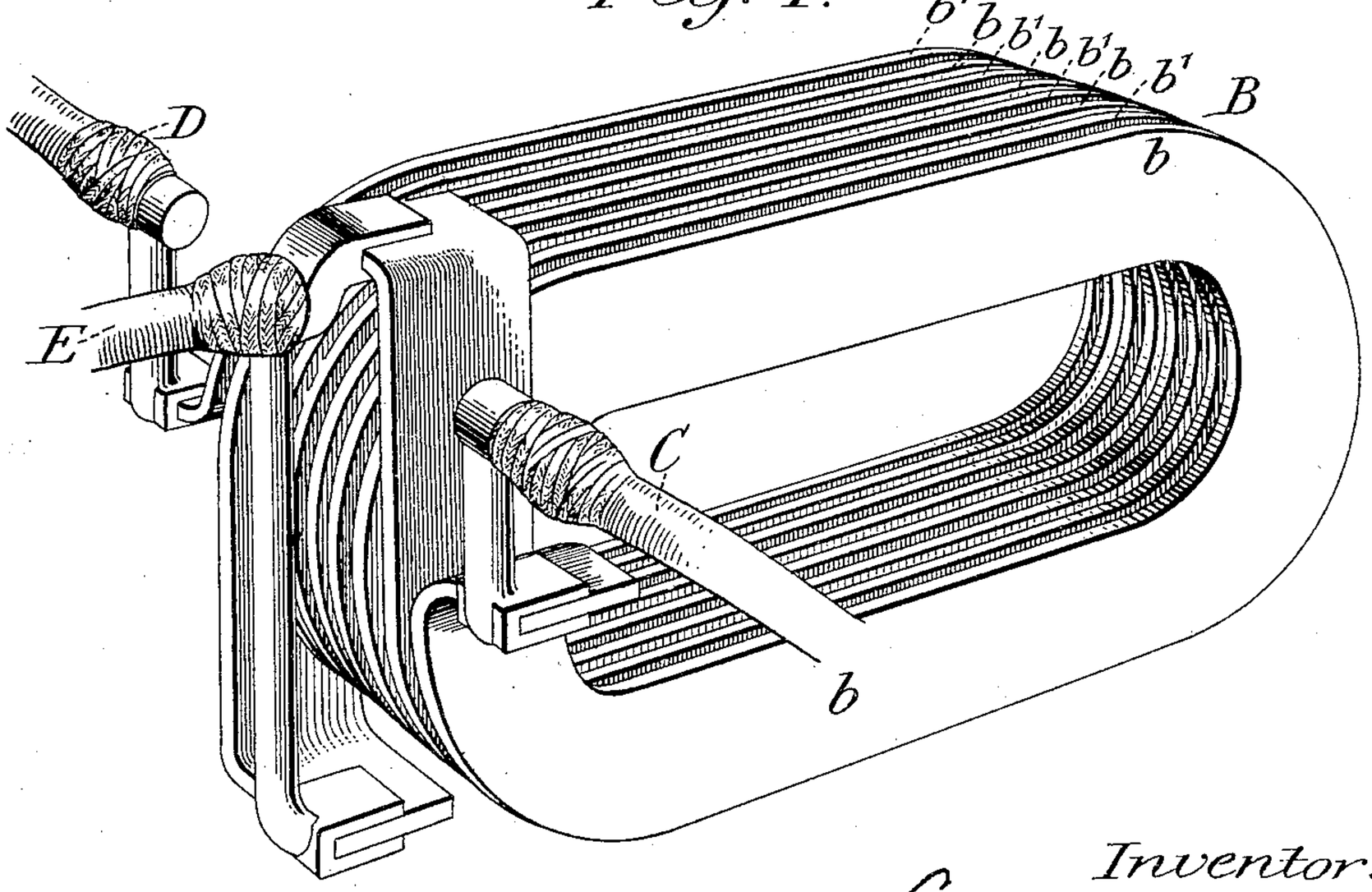


Fig: 4.



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3 SHEETS—SHEET 3.

Fig: 5.

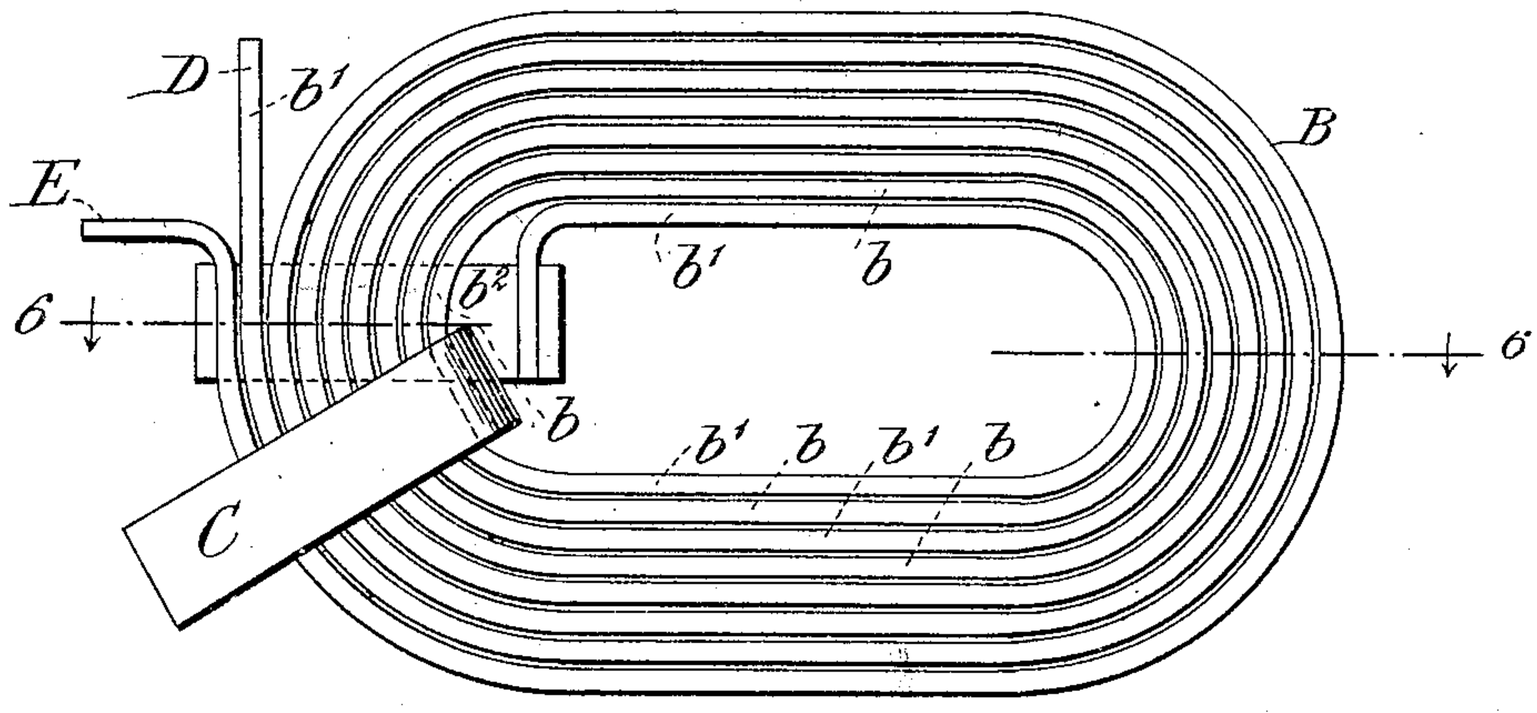


Fig: 6.

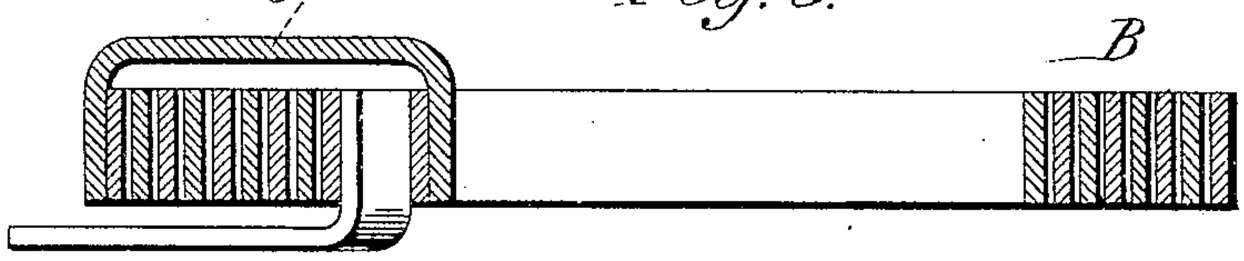
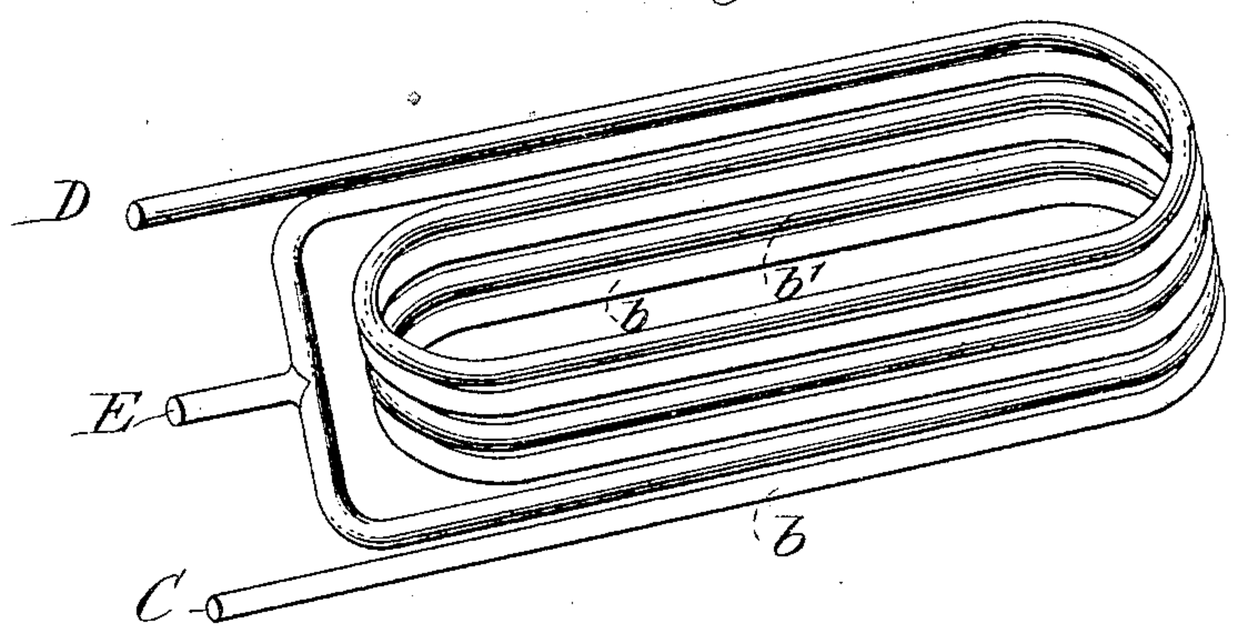


Fig: 7.



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UNITED STATES PATENT OFFICE.

LOUIS H. THULLEN, OF EDGEWOOD, PENNSYLVANIA.

INDUCTIVE BOND.

No. 838,916. Specification of Letters Patent. Patented Dec. 18, 1906.

Application filed February 27, 1906. Serial No. 303,155.

To all whom it may concern:

Be it known that I, LOUIS H. THULLEN, a citizen of the United States, residing at Edgewood, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Inductive Bonds, of which the following is a specification.

My invention relates to inductive bonds.

I will describe an inductive bond embodying my invention and then point out the novel features thereof in claims.

In the accompanying drawings, Figure 1 is a side elevation of an inductive bond embodying my invention, the inclosing case being in vertical section. Fig. 2 is a horizontal section taken on the line 2 2, the casing being omitted. Fig. 3 is a central sectional view taken on the line 3 3 and looking in the direction of the arrow. Fig. 4 is a perspective view of the winding of the bond illustrated in Figs. 1 to 3. Figs. 5 and 6 are detail views showing a different arrangement of the turns of the winding. Fig. 7 is a detail perspective view showing another arrangement of the turns of the winding.

Similar reference characters designate corresponding parts in all of the figures.

The inductive bond constituting my invention is intended, primarily, for use in the track of electric railways when the track is divided at points by insulation for signaling purposes and is used as part of the return path or conductor for the car-propulsion current. These bonds are arranged in the track at the points of insulation and are for the purpose of conducting the propulsion-current around these insulation-points. The use of these bonds in the above and other connections have been set forth in my copending applications, filed February 5, 1904, Serial Nos. 192,145, and 192,146, my application filed April 23, 1904, Serial No. 204,565, and my application filed September 26, 1905, Serial No. 280,176. In these applications the inductive bonds have only been generally described as to their construction. The particular construction of inductive bond herein described and illustrated may be used in the system described in the foregoing applications with particular advantage.

Referring now to the drawings, A designates a core having a plurality of legs or parts, and B a winding provided on one leg or part of the core. Suitable insulation b^5, (see Fig. 3,) which may be paper, is provided between the winding B and adjacent parts of the core.

C D E are conductors connected, respectively, to the ends and middle point of the winding B. The core and winding are inclosed in a suitable form of casing X, having a removable portion X′, which affords access to the core and winding. The casing may or may not be filled with oil, as desired.

The core A is laminated for reasons well understood in the art. It comprises two sets a a' of E-shaped stampings of sheet metal, the middle leg or arm of which is slightly longer than the end legs or parts. The purpose of this is that when the two sets of stampings are brought together, as shown in Fig. 3, so as to have the middle legs or parts of the two sets abut, air gaps or spaces a^2 will be formed between the end legs or parts. Thus an open magnetic circuit is provided for the bond which will not readily become saturated. In other words, a magnetic circuit of high reluctance as compared with the reluctance of the iron portion alone is formed. Instead of air-spaces wood, brass, or other material having a high reluctance may be used in the magnetic circuit afforded by the core. Also in some uses of the bond it may be preferable to have the core so arranged as to form a closed magnetic circuit. The stampings of each set are held in position one against the other and the two sets in their relative position by means of the plates a^3 a^4, having strengthening-webs a^7 and bolts and nuts a^5 a^6. The two plates a^3 a^4 are drawn together tightly by the bolts and nuts to clamp between the stampings and to prevent relative displacement of the individual plates in each set, as well as the relative displacement of the two sets. The bolts extending along the edges of the stampings in each set and through the plates assist in preventing relative displacement of the two sets. This is so clearly shown in the drawings as to require no further description.

The winding B is of copper. Its cross-sectional area may vary according to the amount of current it will be required to conduct from one point to another. In the drawings the winding has its ends connected to two conductors C D to receive currents from them simultaneously at its ends, which current will flow through the two paths of the winding to its middle point and to the conductor E. Conversely, it may receive current at its middle point from the conduc-

tor E, where the current will divide and flow through the two halves of the windings to its ends and then into the conductors C D. For convenience in manufacture the winding is made in two parts b b', each preferably of the same number of turns and both wound in the same direction. An end of one part or half b is electrically connected with an end of the other part or half b', the connection being designated b^2. It will be seen then that the two parts or halves when connected form, in effect, a single winding all the turns of which are in the same direction and that the point of connection b^2 between the two parts or halves is the middle point of the single winding.

As shown in Figs. 2, 3, and 4, the winding B is arranged as a helix. More particularly each part or half of the winding is a helix and the two helices are interlaced or interwoven. This is illustrated more particularly in Fig. 4. The purpose of this arrangement is to keep the turns of the winding in close inductive relation one to the other, and thereby reduce magnetic leakage. This is a particular advantage when the winding of the bond is to be used as a conductor for one current and the winding and the core of the bond are to be used as an impedance to another current. To do this, it will be seen that the one current when traversing the winding of the bond should not tend to magnetize the core, thereby leaving the core in such condition that it can, with the winding, act as an impedance. Should then there be any considerable magnetic leakage, the core might become magnetized and its efficiency as an impedance impaired. This will be better understood should it be explained that owing to the turns of the winding being in the same direction and receiving current at its ends simultaneously to deliver at its middle point or, conversely, receiving current at its middle point, where it will divide and be delivered at its ends, the flow of the current through the two parts or halves of the windings will be in opposite or reverse directions, so that the magnetizing effect of one part or half will oppose or neutralize the magnetic effect of the other part or half. Thus it will be seen that the flow of one current will not appreciably magnetize the core. Should, however, there be any magnetic leakage, the core might become magnetized by the current flowing in its winding, and should the core become highly magnetized or magnetically saturated the efficiency of the bond as an impedance is impaired. Hence it is advantageous to have the turns of the winding in close inductive relation.

In Figs. 5 and 6 I have shown a different arrangement of the two parts or halves of the windings. Each part is in the form of an elongated spiral, the turns of one part being arranged between the turns of the other part. In other words, the turns of the two parts are interlaced or interposed, as in Fig. 1, the main difference being that in Figs. 1 to 4 the turns are arranged as a helix, while in Figs. 5 and 6 they are arranged as a flat and elongated spiral.

In Fig. 7 I have shown still another arrangement of the two parts or halves of the winding and their method of connection. The arrangement of the turns in this figure is quite similar to the arrangement shown in Figs. 1 to 4. In Figs. 1 to 4 the cross-section of the material of the winding is rectangular, while in Fig. 7 its cross-section is circular. The cross-section of the material of the winding is of no particular consequence, nor is the material of the winding, though I prefer copper. The number of turns of the winding is also immaterial.

What I claim as my invention is—

1. An inductive bond comprising a core having a plurality of legs or arms, a winding for said core all the turns of which are arranged on the same arm or leg of the core, all the turns of which are in the same direction and are in close inductive relation, and a conductor leading from the middle point of the winding.

2. An inductive bond comprising a core having a plurality of legs or arms, a winding for said core all the turns of which are arranged on the same leg or arm of the core, said winding being in two parts, the turns of which are all in the same direction, and are interposed one with the other and an end of one part electrically connected to the end of the other part to form a middle point of the winding, and a conductor leading from said middle point of the winding.

3. An inductive bond comprising a core having a plurality of legs or arms, a winding for said core all the turns of which are in the same direction, on the same leg or arm of the core, and are interposed one with the other, and a conductor leading from the middle point of the winding.

4. An inductive bond comprising a core having a plurality of legs or arms, and a magnetic circuit of high reluctance, a winding for said core, all the turns of which are in the same direction, on the same leg or arm of the core, and are interposed one with the other, and a conductor leading from the middle point of the winding.

In testimony whereof I have signed my name to this specification in the presence of two subscribed witnesses.

LOUIS H. THULLEN.

Witnesses:

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D. J. MCCARTHY.