

No. 753,916.

PATENTED MAR. 8, 1904.

G. W. RICHMOND.  
SHUNT RESISTANCE.

APPLICATION FILED JULY 10, 1903.

NO MODEL.

Fig. 1.

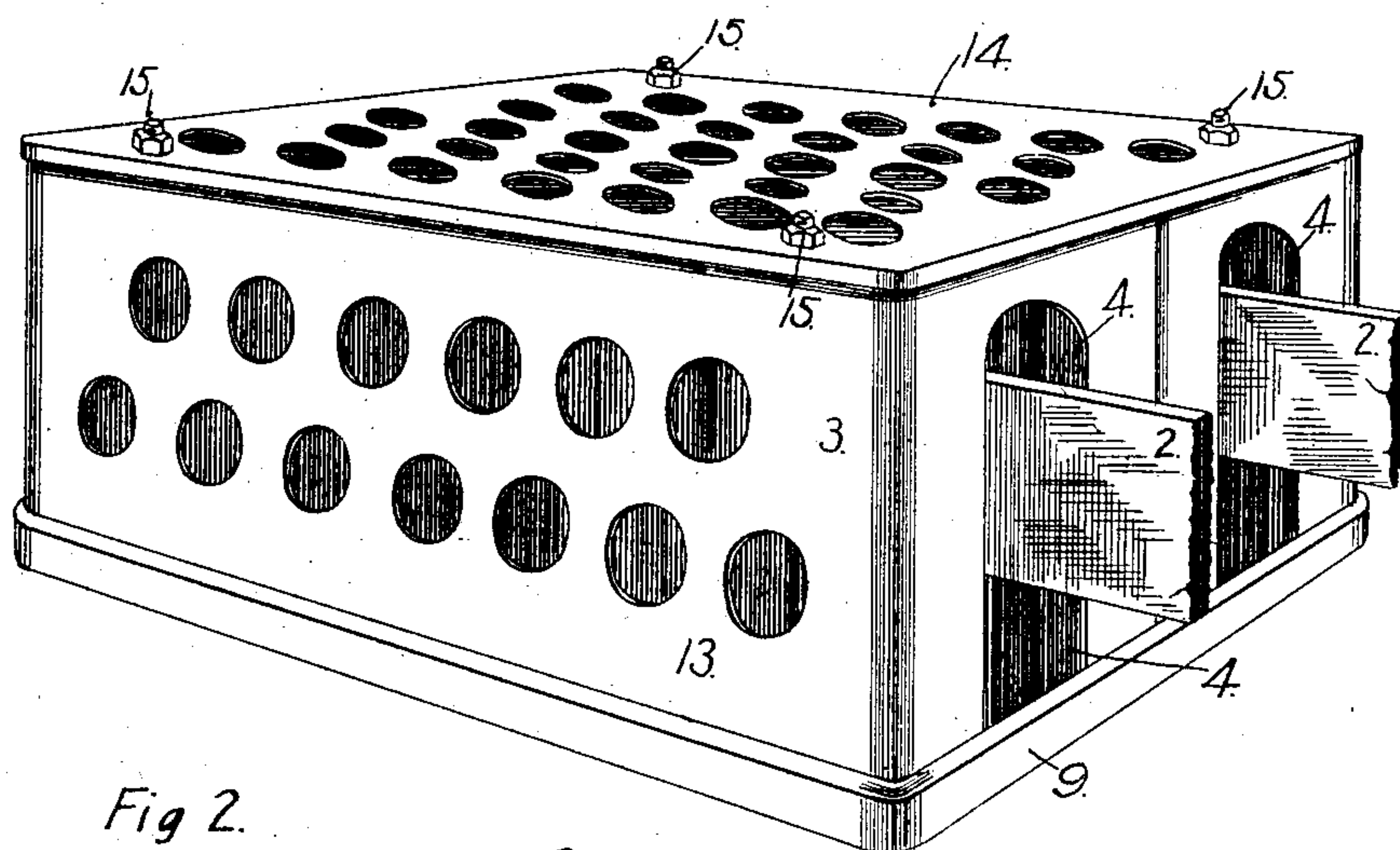


Fig. 2.

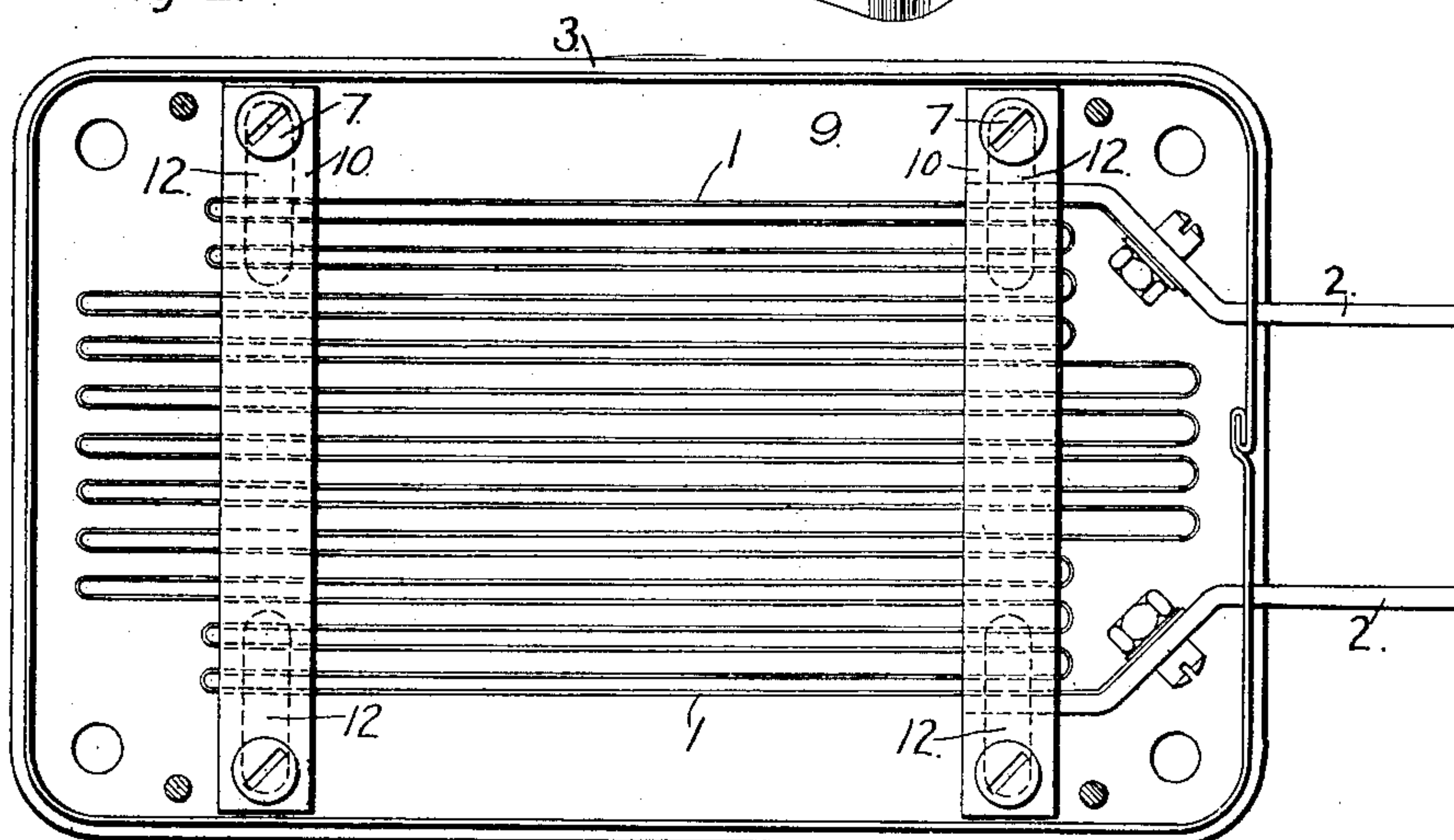


Fig. 3.

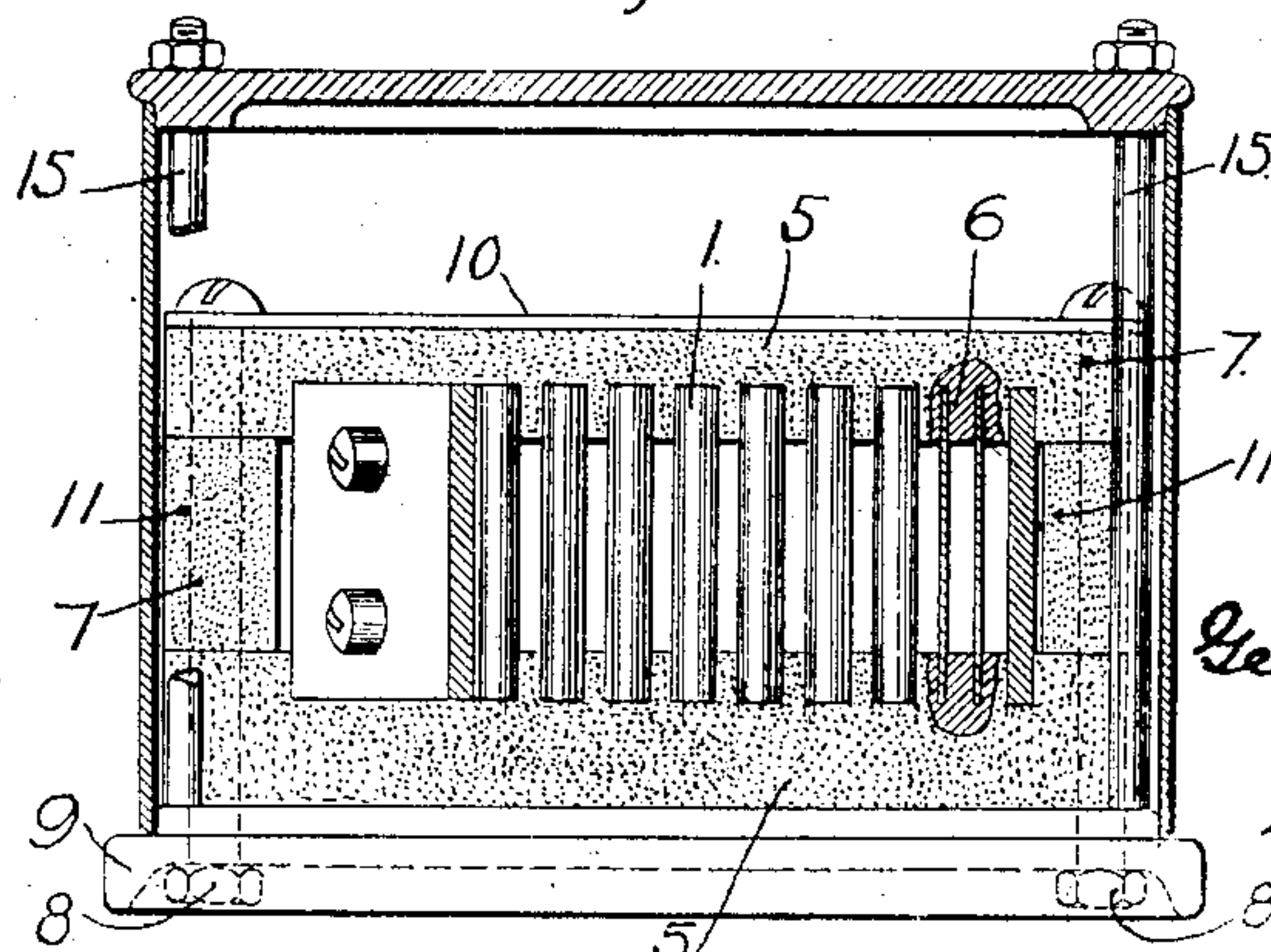
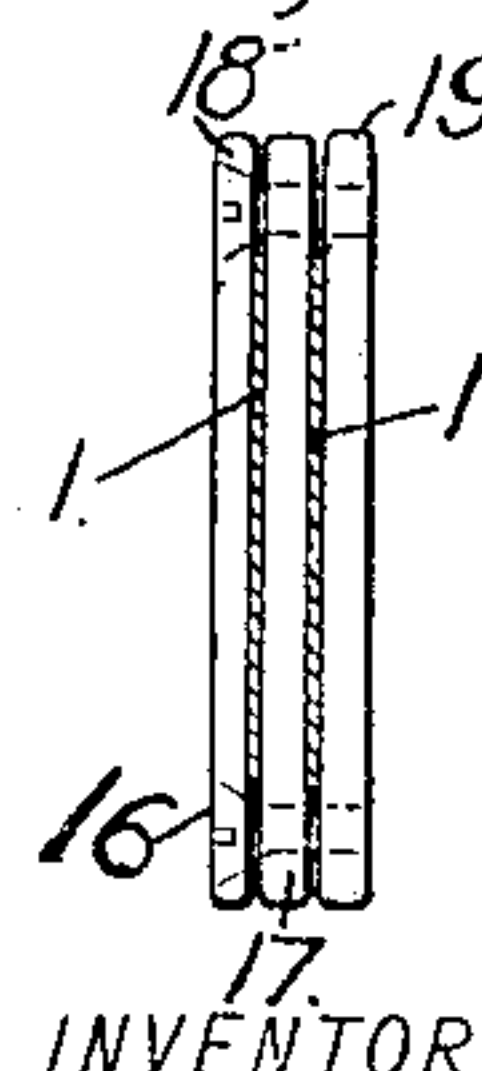


Fig. 4.



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# UNITED STATES PATENT OFFICE.

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## SHUNT RESISTANCE.

SPECIFICATION forming part of Letters Patent No. 753,916, dated March 8, 1904.

Application filed July 10, 1903. Serial No. 165,027. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE W. RICHMOND, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Shunt Resistances, of which the following is a specification.

My invention relates to variable-resistance apparatus, and particularly to such apparatus as is generally used in connection with dynamo-electric machines for varying their field strengths, though not necessarily limited to such use.

It has for its object to provide a simple and economical means for so supporting and protecting the resistance elements that certain parts may be made standard and interchangeable.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a view in perspective of a complete resistance-box constructed in accordance therewith. Fig. 2 is a plan view of the same with the cover removed, and Fig. 3 is a view in end elevation with the inclosing box or case in section. Fig. 4 is a detail view of a short-circuiting clamp and a portion of the resistance-strips in section.

In the design and manufacture of electrical machines having shunt and series field-magnet windings it is often impracticable to provide exactly the proper number of series turns for the field-magnet winding in order to obtain the desired compounding. Compound-wound generators are often run in parallel, in which case it becomes necessary to provide means for varying the field strength of the individual machines in order that the load may be divided equally between or among them or in proportion to their capacities, and in the operation of a single machine it is often desirable to be able to vary the field-magnet excitation. It is usual to vary the field-magnet excitation by means of a variable resistance in shunt with the series turns, and this resistance ordinarily consists of a thin strip of German silver or other suitable resistance

material which is coiled or bent, so as to occupy a minimum amount of space.

Referring now to Figs. 1 to 3, inclusive, the resistance material 1, consisting of a strip of German silver or other resistance material of suitable dimensions, is bent and folded into a zigzag formation, substantially as shown, in order that it may occupy a minimum amount of space. It is folded into an even number of portions in order that said portions may be paired, adjacent pairs being more widely separated than the two portions of each pair, substantially as shown, for reasons to be more fully explained hereinafter. To the ends of the resistance element 1 copper leads 2 are bolted or otherwise secured and are brought out of the inclosing case 3 through apertures 4 provided for that purpose, said leads being so bent as not to come into contact with the case or other conducting materials. The resistance element 1 is supported and spaced by means of a plurality of pairs of blocks 5, consisting of pressed asbestos or other suitable non-conducting material, each of said blocks being provided with a plurality of saw cuts or grooves 6, properly spaced to receive the edges of the resistance material 1. These blocks are placed on both edges of the resistance-strip 1 and are held in position by means of bolts 7, which pass through both blocks comprising a pair and are fastened by means of nuts 8 on the under side of the supporting-base 9, substantially as shown. A strip of metal 10 is placed along the top of the upper spacing-block 5 in order to stiffen it and to provide a suitable bearing-surface for the heads of the bolts 7. Ferrules 11, of pressed asbestos or other suitable non-conducting material, are employed to keep the spacing-blocks 5 of each pair the proper distance apart. As many pairs of spacing-blocks may be employed as are necessary to keep adjacent portions of the resistance material from coming into contact, although I have shown only two pairs, one at each end of the box. The supporting-base 9 is slotted at 12, where the bolts 7 pass through it, in order that spac-



ing-blocks of different lengths may be employed without necessitating a special base for each length. The inclosing sides of the case consist of an apertured piece of sheet metal 13, bent into the proper shape and clamped between the apertured top and bottom castings 14 and 9 by means of a plurality of bolts 15.

The resistance is varied by means of short-circuiting clamps, (shown separately in Fig. 4,) which severally consist of three strips of conducting material which may be clamped together by means of screws 16 at both ends thereof. Two portions of the resistance-strip comprising a pair are respectively clamped between the inner spacing-strip 17 and the outer strips 18 and 19. The adjacent lengths of the resistance-strip constituting pairs are so spaced from each other that the clamps may never come in contact. Any desired number of said clamps may be employed, and the resistance may be varied by sliding them along the pairs of resistance-strips.

It is seen from the description and drawings that the length and the width of the resistance-strip may be varied greatly and that the only changes required in connection with different resistances are in the spacing and supporting blocks and in the short-circuiting clamps. The remainder of the parts may be employed in connection with resistances which vary in dimensions through a considerable range. It will be also understood that a plurality of resistance-strips, connected to operate in parallel, may be employed in lieu of a single strip, if desired, the form and arrangement of parts being otherwise substantially the same as here shown.

I claim as my invention—

1. A resistance apparatus comprising a strip of suitable resistance material of zigzag formation the lengths of which are spaced in pairs, a short-circuiting, clamping device for each pair of said lengths, a plurality of pairs of supporting and spacing blocks therefor composed of non-conducting material and having a plurality of grooves in their edges into which the edges of the resistance-strip fit, and adjustable supporting means for said blocks.

2. A resistance apparatus comprising a strip of suitable resistance material of zigzag formation the lengths of which are spaced in pairs, a plurality of pairs of supporting and spacing blocks therefor composed of non-conducting material and having a plurality of grooves in their edges into which the edges of the resistance-strip fit, and an adjustable support for said blocks.

3. A resistance apparatus comprising a strip of suitable resistance material of zigzag formation the lengths of which are spaced in pairs and a plurality of pairs of supporting and spacing blocks therefor composed of non-conduct-

ing material and having a plurality of grooves in their edges into which the edges of the resistance-strip fit.

4. A resistance apparatus comprising a resistance-strip of zigzag formation and supporting-blocks composed of non-conducting material and having grooved edges for the reception of the edges of said strip.

5. A resistance apparatus comprising a resistance-strip of zigzag formation, supporting-blocks composed of non-conducting material and having grooved edges for the reception of the edges of said strip, and a base which is interchangeable in connection with resistance-strips of widely-different dimensions.

6. A resistance apparatus comprising a resistance-strip of zigzag formation, supporting-blocks composed of non-conducting material and having grooved edges for the reception of the edges of said strip, a base which is interchangeable in connection with resistance-strips of widely-different dimensions, and clamps for short-circuiting adjacent portions of said resistance-strip.

7. A resistance apparatus comprising a zigzag strip of resistance material, supporting-blocks having grooves to receive the edges of said strip and means for clamping said blocks in position.

8. A resistance apparatus comprising a zigzag metal strip or ribbon, non-conducting blocks having grooves to receive the edges of said strip or ribbon, and means for clamping said parts in position comprising bolts and a slotted base-plate.

9. A resistance apparatus comprising a zigzag metal strip, non-conducting blocks having grooves to receive the edges of said strip, a casing having a slotted base, bolts extending through the blocks and the base-slots and spacing-ferrules on the bolts between the blocks.

10. A resistance apparatus comprising a zigzag strip of resistance material, supporting-blocks disposed transversely to the lengths of said strip and having grooves in which the edges of the strip are seated.

11. A resistance apparatus comprising a zigzag, flexible strip of resistance material, and non-conducting blocks adjacent to both ends of said strip having grooves in which the edges of the strip are seated.

12. A resistance apparatus comprising a zigzag, flexible strip of resistance material, and a plurality of non-conducting blocks transversely disposed at both ends of the zigzag strip and having grooves in which both edges of the strip are seated.

In testimony whereof I have hereunto subscribed my name this 8th day of July, 1903.

GEO. W. RICHMOND.

Witnesses:

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