

O. WINGAARD.
 PROCESS OF MAKING MAGNETIC POLE PIECES.
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1,017,031.

Patented Feb. 13, 1912.

Fig. 1

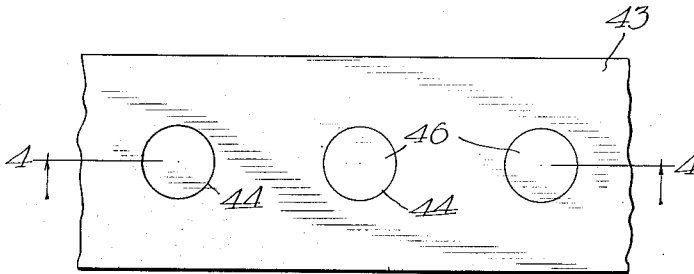


Fig. 2

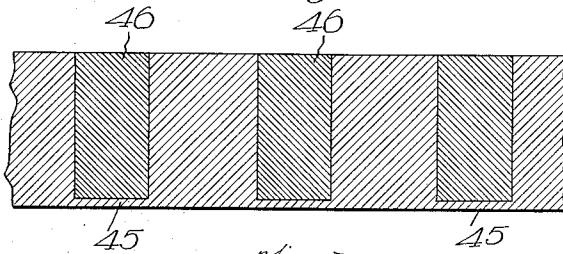


Fig. 3

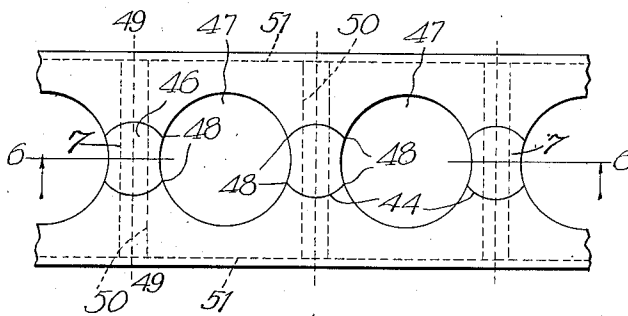


Fig. 4

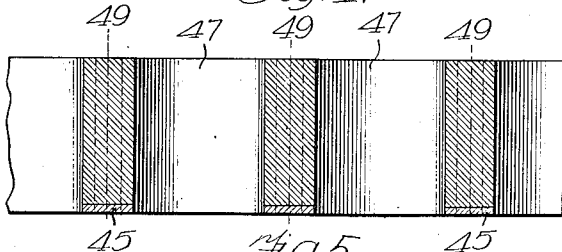
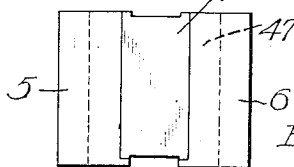


Fig. 5



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UNITED STATES PATENT OFFICE.

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PROCESS OF MAKING MAGNETIC POLE-PIECES.

1,017,031.

Specification of Letters Patent.

Patented Feb. 13, 1912.

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To all whom it may concern:

Be it known that I, OSCAR WINGAARD, a subject of the King of Norway, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Processes of Making Magnetic Pole-Pieces, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to a process of forming electric meter pole pieces and a product resulting therefrom.

The object of my invention is to provide a process which will make it possible to connect the pole pieces of electric meters with non-magnetic material in such manner that the pole pieces will be firmly held in position, and the magnetic field will remain of constant intensity and not be liable to variations on account of slight shifting of the position of the pole pieces.

It is well known that it is of great importance that the field formed between the pole pieces and core of an electric meter should be of constant intensity so that as the current flowing through the armature loop or coil varies, the indicating needle may be given a deflection exactly proportional to the current. Various devices have been used in the art in order to hold the pole pieces firmly in position, and various processes have been used in order to accomplish this result. These processes, however, have consisted chiefly in the assembling of finished parts, all of which processes embody the difficulty of obtaining an absolutely exact adjustment of the various parts. According to my improved process of manufacturing the pole pieces, however, the pole pieces are brazed or welded together by means of a layer of non-magnetic material, and the machine work is then performed on the pair of pole pieces, which are treated as a single unit. In this way very exact results are obtained and it is absolutely impossible that the relative positions of the two pole pieces should become changed.

As will be described more in detail hereafter, my process consists in boring holes at predetermined distances in a bar of steel. These holes pass to within a short distance of the bottom of the bar. These holes are

next filled with borax, and the bar is suitably heated, preferably in an oil of gas furnace. After the borax is melted, a small bar of brazing material, as, for example, low brass, is inserted in each of the holes, thereby causing the borax to overflow. On continued heating, this brass or other brazing material melts, and on account of the fluxing action of the borax brazes with the steel on the periphery of the hole. The next step consists in drilling holes through the bar between the areas containing the brazing material, so that the peripheries of the holes of this second series will intersect the peripheries of the holes containing the brass. The bar is then cut transversely through each of the first series of holes containing the brazing material, and in this way the pairs of pole pieces are first separated. The layer of steel which originally was left at the bottom of the holes containing the brass is now removed by suitable means so that no magnetic connection is left between the two pole pieces. The pair of pole pieces is next mounted on an arbor, and the faces are suitably milled, it being possible in this way to perform all of the necessary machine operations by working from the axis of the bore of the pole pieces. When the pole pieces are mounted between the poles of a permanent horseshoe magnet I also have means by which the core may be accurately adjusted between the pole pieces, as will be described hereafter.

A consideration of the principles which govern the operation of an electric meter of the style similar to that I use in my invention will immediately make the great advantages of my process of forming the pole pieces apparent.

The magnetic flux passes from one pole of the horseshoe magnet to the other through the medium of the pole pieces. According to my method an absolutely round opening is provided between these pole pieces, which are separated by sections of brass or other non-magnetic material. The core which is inserted between the pole pieces has a periphery which is absolutely parallel with and equally distant at all points from the inner faces of the pole pieces, and in this way a field is set up of great uniformity. As the current is caused to flow through the armature loop the reactive forces resulting

between the magnetic field and the current passing through the loop are very even and the indications of the needle are thereby rendered very accurate.

5 As will be described more in detail hereafter, I provide inexpensive and efficient means for holding the armature coil and the core in their positions. These and other advantages of my invention will be more apparent by reference to the accompanying drawings, in which—

Figure 1 is a plan view of the bar of steel from which the pole pieces are formed showing the first stage of the process. Fig. 2 is a longitudinal section on the line 4—4 on Fig. 3. Fig. 3 is a plan view showing later stages of the process. Fig. 4 is a longitudinal section on the line 6—6 on Fig. 5. Fig. 5 is a side elevation showing the method of joining the two pole pieces.

A bar of steel, 43, is drilled with holes, 44, these holes preferably passing to within a slight distance of the bottom of the bar, 43, thereby leaving in position a thin plate, 45, of steel at the bottom of each hole. In order to facilitate the brazing action, I now clean these holes from any oil which may be contained therein, this process being preferably performed by the use of gasolene, naphtha or some similar oil solvent. The holes, 44, are now filled with borax, and the bar is placed in an oil or gas furnace and heated until the borax melts. Short pieces of a rod of low brass or other similar brazing material of slightly smaller diameter than the diameter of the holes, 44, are now inserted in these holes, thus causing the borax to overflow. The heating is continued until the brazing mixture melts, and on cooling it is found that the holes have been completely filled with the brazing material, 46. As indicated in Fig. 3, the next step consists in drilling the holes, 47, the centers of which are approximately midway between the centers of the holes, 44, which were filled with brazing material, 46. The diameter of the holes, 47, is such that the circumferences of the holes, 44, are intersected, and the brazing material is thereby exposed on the arcs, 48, on the inner surfaces of the holes, 47. The next operation consists in removing the thin plates, 45, of steel which remain below the brazing material, 46. This operation is most readily performed on a milling machine. The next step consists in cutting the bar, 43, into sections on the lines, 49, these lines passing through the centers of the holes, 44. Each separate section which now consists of what will subsequently become a pair of pole pieces, is now mounted on an arbor fitting within the hole, 47, and the sides of the section are now milled. By mounting the section on an arbor it is possible to mill opposite sides to exactly the same extent, and the two pole

pieces are thus left in their final condition with precisely the same amount of metal in each of them. This milling operation is carried on until the metal has been removed approximately to what may be diagrammatically indicated in Fig. 3 as the lines, 50 and 51. The operation of forming the pole pieces themselves has now been completed, and, as shown in Fig. 5, I have two pole pieces, 5 and 6, with sections, 7, of non-magnetic material connecting them.

It will be apparent to those skilled in the art that, when the pole pieces are to be used in devices wherein the accurate distribution of the magnetic field is not necessary, the part 45 need not be removed, particularly if it is very thin. So long as any remaining magnetic material between the resulting pole pieces is so restricted as to form sufficient resistance to result in a difference in polarity, the presence of such a connecting strip would be negligible. Since the permeability of iron or steel is limited, after the tiny strip of metal becomes saturated it would have no more effect in short-circuiting the pole pieces than would so much air.

Having described the preferred method of carrying on my invention, I claim as new and desire to secure by Letters Patent:

1. The process of making magnetic pole pieces which consists in forming a longitudinal series of holes in a bar of magnetic material, filling said holes with a non-magnetic brazing mixture, removing magnetic material between the holes thus filled with said brazing mixture and cutting said bar transversely through the holes containing the brazing mixture.

2. The process of forming pairs of magnetic pole pieces which consists in forming a longitudinal series of holes in a suitable bar of magnetic material, filling said holes with non-magnetic material, fusing said non-magnetic material to the walls of the holes, boring said bar to intersect the non-magnetic material filling said holes, and cutting said bar transversely through the holes containing the brazing mixture.

3. The process of forming pairs of magnetic pole pieces, which consists in forming a longitudinal series of holes in a suitable bar of magnetic material, filling said holes with a non-magnetic material, fusing said non-magnetic material to the walls of the holes, boring said bar to intersect the non-magnetic material filling said holes, and then finishing the pole pieces into substantially prismatic form about the axis of said bore.

4. The process of making magnetic pole pieces which consists in forming a longitudinal series of holes in a bar of magnetic material, said holes not penetrating through said bar, filling said holes with a non-magnetic brazing mixture, removing magnetic material to break the magnetic connection

between the sides of said bar, and cutting said bar transversely through the holes containing the brazing mixture.

5 5. The process of making magnetic pole pieces which consists in drilling a longitudinal series of holes in a bar of magnetic material, placing a flux in said holes, heating said bar and said flux, adding a non-magnetic brazing mixture in said holes, removing magnetic material between the holes filled with said brazing mixture to break the magnetic connection between the sides of said bar, and cutting said bar transversely through the holes containing the brazing mixture. 15

6. The process of making pole pieces which consists in drilling a longitudinal series of holes in a bar of magnetic material, placing a flux in said holes, heating said bar and said flux, adding a rod of non-magnetic brazing material in each hole, heating said bar until said brazing material melts, allowing the bar to cool, thereby solidifying said brazing material, removing magnetic material between the holes filled with said brazing mixture to break the magnetic connection between the sides of said bar, and cutting said bar transversely through the holes containing the brazing material. 25

30 7. The process of making pole pieces which consists in forming a longitudinal series of holes in a bar of magnetic material, said holes not penetrating through said bar, placing a flux in said holes, heating said bar and said flux, adding a rod of non-magnetic brazing material in each hole, heating said bar until said brazing material melts, allowing the bar to cool, thereby solidifying said brazing material, removing magnetic material between the holes filled with said 40

brazing material and from the bottom of the holes filled with non-magnetic material to break the magnetic connection between the sides of said bar, and cutting said bar transversely through the holes containing the brazing material. 45

8. The process of making magnetic pole pieces which consists in inserting at intervals masses of non-magnetic material in an integral piece of magnetic material, and removing magnetic material from between said masses of non-magnetic material, thereby forming pairs of magnetic pieces mechanically joined but magnetically separated by said non-magnetic material. 50 55

9. The process of making magnetic pole pieces which consists in inserting a mass of non-magnetic material in a piece of magnetic material, and removing magnetic material adjacent said mass of non-magnetic material. 60

10. The process of making magnetic pole-pieces which consists in transversely inserting a mass of non-magnetic material in a bar of magnetic material, and removing magnetic material adjacent said mass of non-magnetic material. 65

11. The process of making magnetic pole pieces which consists in inserting at intervals masses of non-magnetic material in a piece of magnetic material, and removing magnetic material from between said masses of non-magnetic material. 70

In witness whereof, I hereunto subscribe my name this 2nd day of October, A. D. 1909. 75

OSCAR WINGAARD.

Witnesses:

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JNO. M. LEA.