O. S. WALKER & I. F. WILLIAMS.

MAGNETIC CHUCK.

APPLICATION FILED MAR. 30, 1914.

1,199,947.

Patented Oct. 3, 1916.

3 SHEETS—SHEET 1.

Fig. 1.

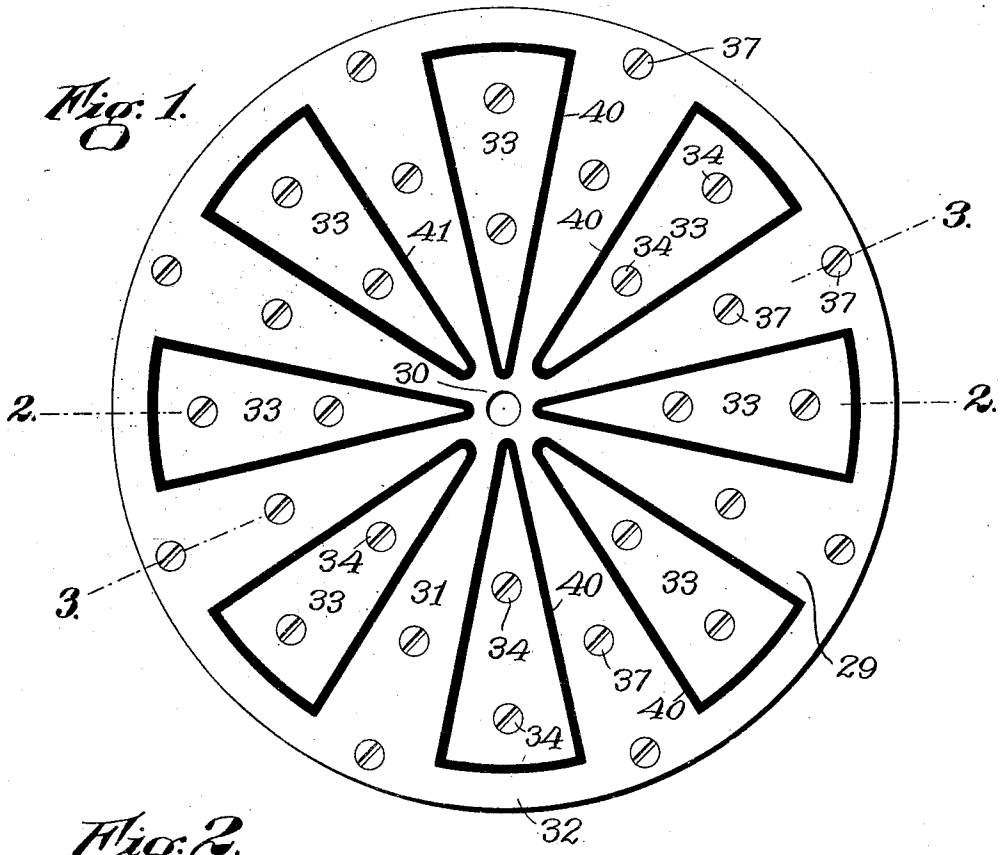
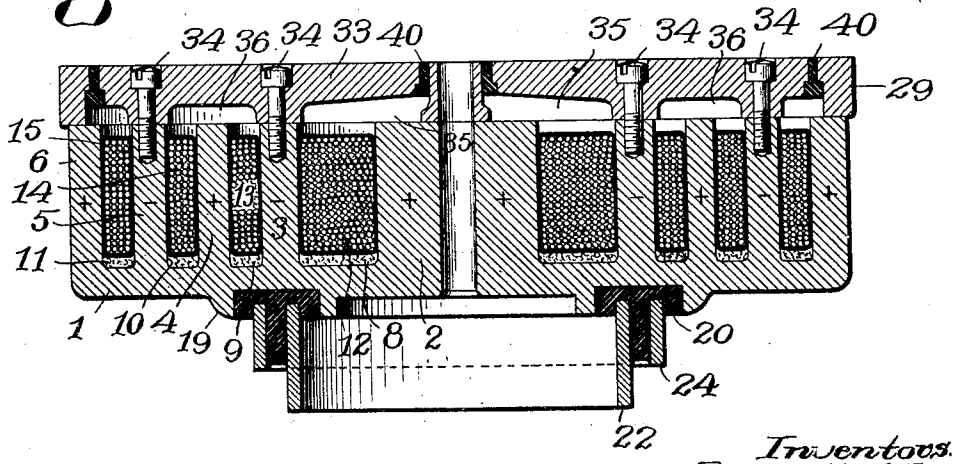


Fig. 2.



Witnesses.

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3 SHEETS—SHEET 2.

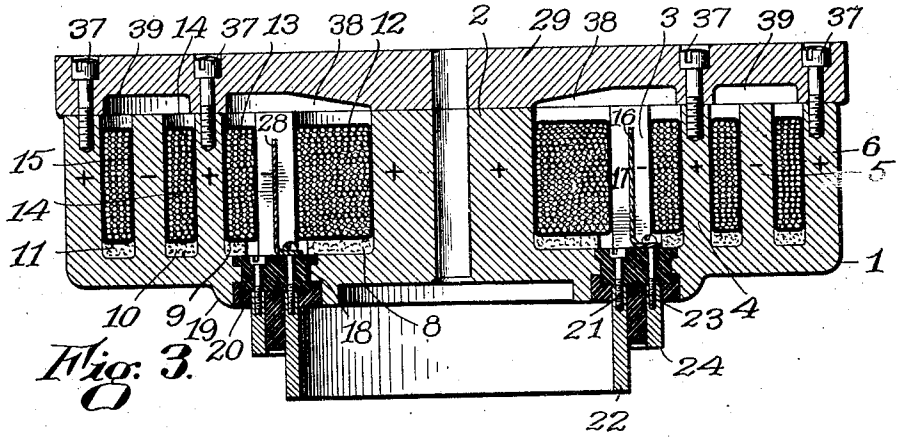


Fig. 3.

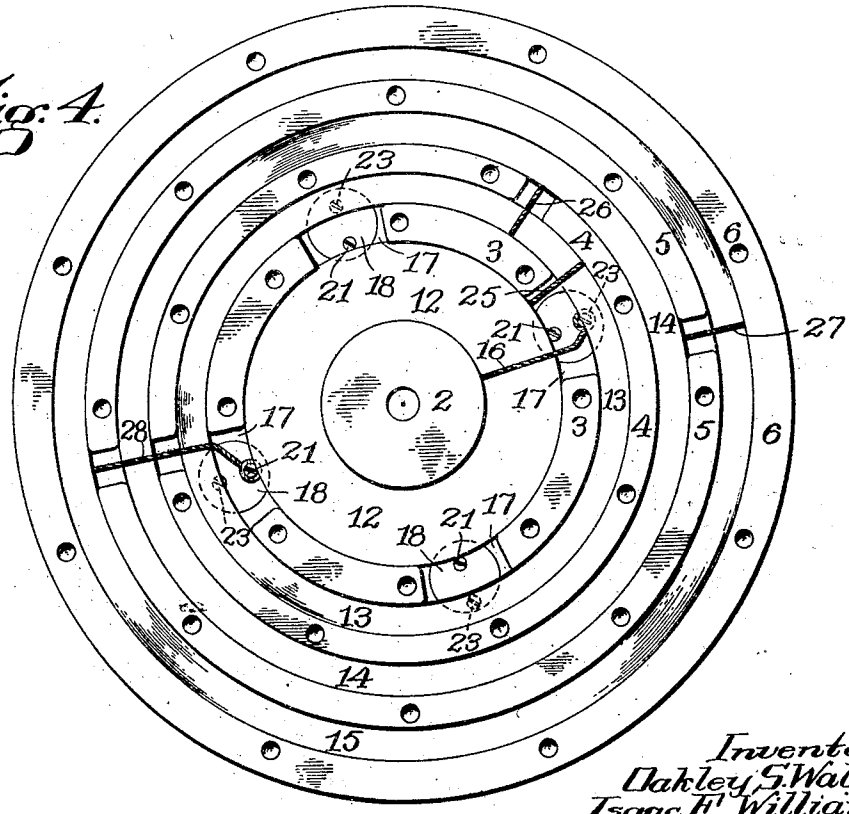


Fig. 4.

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3 SHEETS—SHEET 3.

Fig. 5.

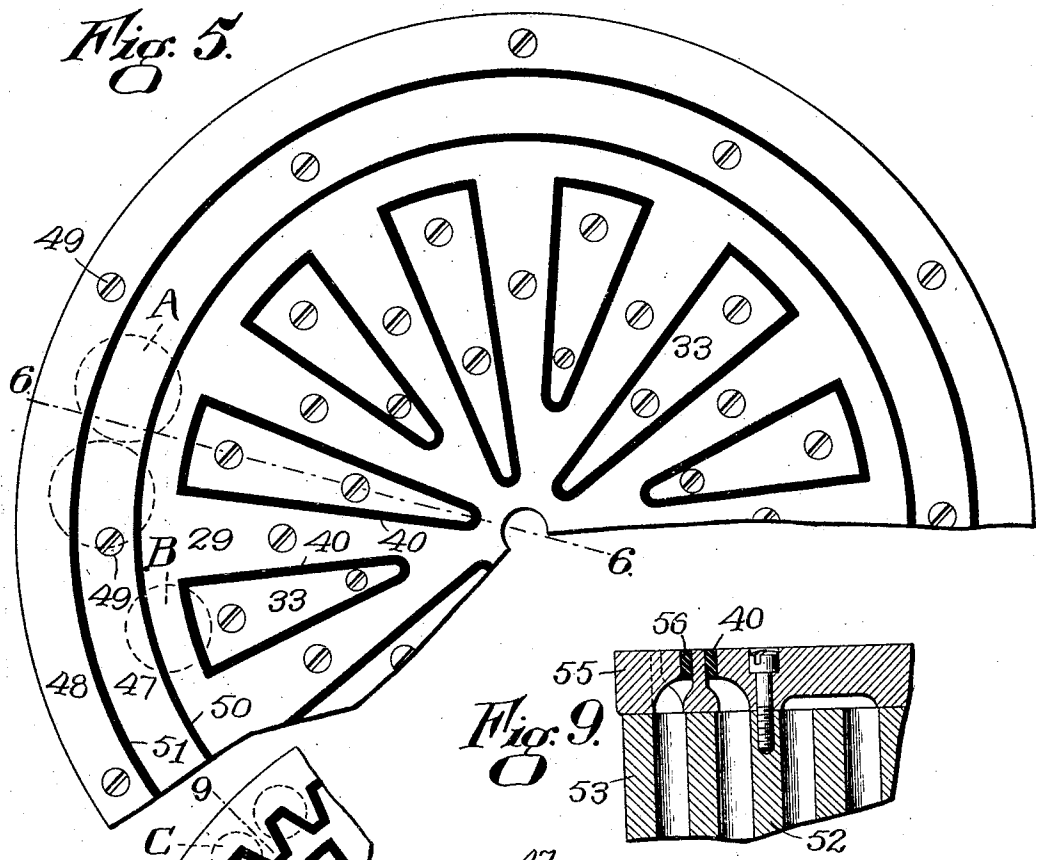


Fig. 9.

Fig. 7.

Fig. 6.

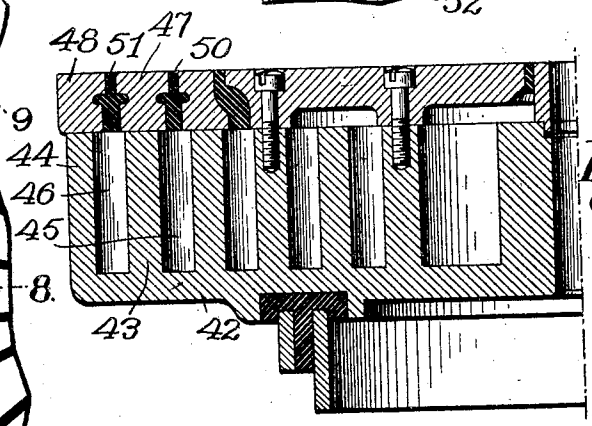
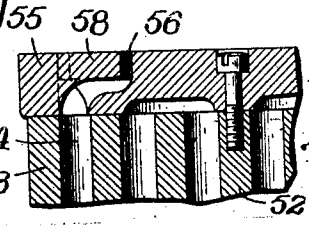


Fig. 8.



Witnesses.

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UNITED STATES PATENT OFFICE.

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MAGNETIC CHUCK.

1,199,947. Specification of Letters Patent. Patented Oct. 3, 1916.

Application filed March 30, 1914. Serial No. 828,287.

To all whom it may concern:

Be it known that we, OAKLEY S. WALKER and ISAAC FOWLER WILLIAMS, both citizens of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in Magnetic Chucks, of which the following, taken in connection with the accompanying drawings, is a specification.

The present invention relates to the construction of a revolving magnetic chuck provided with a circular work holding face, which is adapted to carry the iron or steel pieces to be operated upon, and it consists in the construction and arrangement of parts hereinafter described and pointed out in the annexed claims.

In the accompanying drawings, Figure 1 is a top plan view of a chuck embodying our invention. Fig. 2 is a central vertical section on line 2—2, Fig. 1. Fig. 3 is a central vertical section on line 3—3, Fig. 1. Fig. 4 is a plan view of the chuck shown in Fig. 1, the face plate thereof being removed to disclose the interior construction. Fig. 5 is a fragmentary top plan view of a modified form of chuck. Fig. 6 is a central vertical section on line 6—6, Fig. 5. Fig. 7 is a fragmentary top plan view of another modified form of chuck. Fig. 8 is a fragmentary vertical section on line 8—8, Fig. 7. Fig. 9 is a similar section on line 9—9, Fig. 7.

Like reference characters are used to designate like parts in the different views.

Referring particularly to Figs. 1, 2, 3 and 4, the numeral 1 denotes a circular iron base, to which is adapted to be secured, by any suitable means, the upper end of a rotatable spindle, or shaft, not shown. The base 1 has projecting therefrom, and preferably integral therewith, a centrally disposed hub 2 and a concentric series of spaced annular flanges 3, 4, 5 and 6 equal in height with said hub. The annular space 8 thus formed between hub 2 and flange 3, and the annular spaces 9, 10 and 11 thus formed between the flanges 3 and 4, 4 and 5, and 5 and 6, respectively, contain the several magnetizing coils 12, 13, 14 and 15 of the chuck. These coils are similarly wound and are adapted for connection in an electrical circuit as follows:—One terminal of the inner coil 12, in the present instance the inner terminal, is connected to a conductor 16, which is led downwardly, as shown in Fig. 3, through a cutaway portion or gap 17 of the flange 3. Flange 3 is similarly entirely cut away or divided at a number of portions 17 of its circumference, in the present instance four, and at such points the base 1 is provided with drilled holes to receive plugs 18 of suitable non-conducting material, preferably fiber. The holes through the base are counterbored to provide shoulders adapted to receive the flanged upper ends of said plugs, and on the under face of the base, a suitably formed annular flange 19, concentric with the circular series of holes through the base, is provided with an annular recess 20 into which all of said plugs 18 project. Passing through each plug is a screw 21 adapted to support a conducting ring 22, and a screw 23 adapted to support a second conducting ring 24, suitably spaced from the conducting ring 22. After the attachment of the conducting rings 22 and 24, the annular recess 20 and the annular space between the two rings are filled with a suitable non-conducting substance to retain the plugs and conducting rings in proper position. The conductor 16 is attached in the present instance to one of the screws 23, as shown in Figs. 3 and 4, thereby being placed in electrical connection with the ring 24, which is adapted to rotate in contact with a stationary brush, not shown, included in the electrical circuit which is used to energize the chuck. The outer terminal of coil 12 is connected by a conductor 25 with the outer terminal of the next adjacent coil 13, and the inner terminal of coil 13 is connected with the inner terminal of coil 14 by a conductor 26. The outer terminal of coil 14 is connected to the outer terminal of coil 15 by a conductor 27, and the inner terminal of coil 15 is connected by a conductor 28 to one of the screws 21, as shown in Figs. 3 and 4, and is thereby electrically connected to the ring 22 which is adapted to rotate in contact with a second stationary brush of the said electrical circuit, not shown. Each conductor 26, 27 and 28 is passed through suitable gaps formed in the intervening annular flanges 4 and 5. As previously stated, the several coils are similarly wound, and, it will be apparent from

the above, are connected together in series. However, by reason of the above described connection of like terminals of adjacent coils, the magnetizing effect of the current passing therethrough is relatively opposite for any two adjacent coils. This is apparent from the effect produced on the hub 2 and the several flanges 3, 4, 5 and 6 which constitute, in effect, the cores of the several coils. Assuming that the passage of current through coil 12 renders the hub 2 of positive polarity, and the flange 3 of negative polarity, as indicated by the + and — signs on Figs. 2 and 3, it will be apparent that the magnetizing effect of the current in coil 13, which is relatively opposite to that in coil 12, imparts negative polarity to flange 3 and positive polarity to the next adjacent flange 4. The above is true for each of the several flanges, which for convenience have been designated with the + and — signs alternately.

The work holding face of the chuck is constituted by a circular skeleton plate 29, of iron, comprising an annular center 30 with radiating bars 31, united at their outer ends by an annular rim 32, which is substantially co-extensive with the outer flange 6 of the base 1. The face plate is completed by inserting in the triangular openings thus formed the several triangular iron pole pieces 33, which are somewhat smaller than the triangular openings, in the manner hereinafter described. Each triangular pole piece 33 is rigidly connected on its under side to the flanges 3 and 5 by countersunk screws 34, the under side of each piece being recessed as at 35 and 36, shown in Fig. 2, so as to be spaced away from and out of contact with the underlying hub 2 and flange 4 of the base 1. With the triangular pieces thus suitably spaced and secured to the base 1, to form in the present instance the negative poles of the work holding face of the chuck, the skeleton plate 29 is then mounted in position, with its triangular openings surrounding the pole pieces 33. The skeleton plate is arranged to make contact only with the hub 2, and flanges 4 and 6, the radiating bars 31 being secured to the latter by the countersunk screws 37, and being provided with annular recesses 38 and 39, as shown in Fig. 3, on their under sides so as to be spaced away from and out of contact with the underlying flanges 3 and 5 of the base 1. The plate 29 thereby constitutes the positive pole of the work holding face. The gaps between the edges of the triangular openings of the plate and the edges of the triangular pole pieces 33 are filled with some suitable non-magnetic material, such as Babbitt metal, as represented by the heavy black lines 40, Fig. 1, in order to prevent the admission of foreign matter to the interior of the chuck. The work holding face of the chuck thereby presents a continuous surface for the support of the work, and upon the connection of the contact rings 22 and 24 with the source of electrical supply, the magnetic force of the chuck will be exerted across all of the babbitt filled gaps 40 between the surface of the skeleton plate 29 and the surfaces of the several pole pieces 33 to firmly hold any work which is located on the chuck face in a position to span any portion of one or more of said gaps.

In Figs. 5 and 6 we have illustrated a modified form of chuck, the principle of operation and certain details of construction of which are substantially identical with the form shown in Figs. 1–4 inclusive. In this modified form, the base 42 is extended peripherally and is provided with annular flanges 43 and 44 in addition to the flanges 3, 4, 5 and 6 shown in the first described form of chuck. Additional concentric coils are provided in the annular spaces 45 and 46 thus formed, said coils being connected in the manner previously described with the other coils of the chuck. The work holding face of this chuck is substantially identical with the work holding face of the first described chuck, except for the addition of two concentric rings 47 and 48, outside the outer periphery of the skeleton plate 29 and secured to the said flanges 43 and 44 respectively by countersunk screws 49. A circular babbitt filled gap 50 is provided between the outer periphery of plate 29 and the concentric ring 47, the latter being of the opposite polarity to said plate owing to its connection with flange 43, which constitutes in the present instance a negative pole. A similar gap 51 is provided between the two rings, the outer ring 48 being of positive polarity, due to its connection with flange 44. The provision of these two additional surfaces of opposite polarities renders such a chuck capable of holding a plurality of pieces of work on its outer edge in position to bridge portions of either or both of gaps 50 and 51, in addition to the work carried nearer the center of the work holding face and bridging the gaps 40. We have indicated two small pieces of work, such as washers, located on Fig. 5 in position to span a pair of gaps, at A and B. It will be obvious that the above described construction multiplies the number of sections of opposite polarity near the periphery of the face plate, thereby enabling a large number of small articles to be held in juxtaposition to each other.

In Figs. 7, 8 and 9 we have illustrated still another modified form of chuck, in which a single concentric ring, similar to the two rings 47 and 48, shown in Figs. 5 and 6, is disposed outside the periphery of the skeleton plate of the work holding face. The base 52 of this form of chuck is provided with a single additional flange 53,

forming an annular space 54 for the reception of an additional concentric coil, connected to the other coils of the chuck in the manner previously described. A ring 55 is secured to flange 53, the babbitt-filled gap 56 between the outer edge of the skeleton plate and the inner edge of the ring taking the sinuous form shown in Fig. 7 owing to the formation of interlocking tooth-like projections on said edges. Between each triangular pole piece 33 of the work holding face the skeleton plate has a deep notch 57 for the reception of a long tooth 58 provided on the ring 55. It will be apparent that the above described type of construction not only multiplies the number of sections of opposite polarity near the periphery of the work holding face but, furthermore, enables a large number of articles smaller than the articles A and B, shown on Fig. 5, to be held in juxtaposition thereon. We have indicated a number of such articles, in position to span a pair of gaps at C, D and E on Fig. 7. Furthermore, the configuration of the gap 56 as determined by the deep notches and teeth 57 and 58 makes it possible to provide additional sections of opposite polarity for work of an annular character, which is too narrow to span more than one gap 50 or 51 on the work holding face shown in Fig. 5.

It will be noted that in each of the above described forms of chuck, the apexes of alternate triangular pole pieces are extended nearer the center of the chuck face than the others. By this arrangement it is possible to hold a small piece of work near the center of the chuck. It is clear that if all the pole pieces 33 were equal in length, their apexes could not be brought as close to the center of the chuck face as the apexes of the alternate pole pieces shown, for instance, in Fig. 5.

We claim,

1. In a magnetic chuck, a work holding face consisting of two sections of opposite polarity, one section comprising a skeleton plate, and the other section comprising a series of separated pole pieces energized independently of said skeleton plate and disposed within openings through said skeleton plate and a ring outside the periphery of said skeleton plate.

2. In a magnetic chuck, a work holding face consisting of two sections of opposite polarity, one section comprising a skeleton plate, and a ring spaced beyond the periphery of said skeleton plate, and the other section comprising a series of pole pieces disposed within openings formed in said skeleton plate and a second ring disposed between the periphery of the skeleton plate and the first ring.

3. In a magnetic chuck, a work holding face consisting of two sections of opposite polarity, one section comprising a plate, and the other section comprising an independently energized ring in interlocking engagement with the periphery of said plate, with a non-magnetic gap between said sections.

4. In a magnetic chuck, a work holding face consisting of two sections of opposite polarity, one section comprising a skeleton plate, and the other section comprising a series of pole pieces disposed within openings in said skeleton plate and a ring in interlocking engagement with the periphery of said plate.

5. In a magnetic chuck, a work holding face consisting of two sections of opposite polarity, one section comprising a skeleton plate having radial blades, and the other section comprising a ring having sets of teeth in interlocking engagement with the periphery of said plate between adjacent blades, and a single tooth of greater depth disposed within a corresponding notch in each blade.

6. In a magnetic chuck, a work holding face consisting of sections of opposite polarity, one of said sections comprising a skeleton plate having a circular series of radially disposed openings therein, each alternate opening extending nearer the center of said plate than the other openings, and the other section comprising a series of pole pieces disposed within and conforming to the shape of said openings, with non-magnetic gaps between said sections.

7. In a magnetic chuck, a series of spaced annular cores and a series of spaced annular coils in alternating relation, and a detachable work holding face for said chuck consisting of two sections of opposite polarity, each of said sections being disposed so as to contact with alternate cores of said series.

8. In a magnetic chuck, a series of spaced cores, and a work holding face consisting of two sections of opposite polarity, one of said sections comprising a skeleton plate superimposed upon said series of cores, and provided with recesses corresponding to alternate cores of said series.

9. In a magnetic chuck, a series of spaced cores, and a detachable work holding face consisting of two sections of opposite polarity, one of said sections comprising a series of separated pole pieces superimposed upon said series of cores, and provided with recesses corresponding to alternate cores of said series.

10. In a magnetic chuck, a series of spaced concentric cores, and a work holding face consisting of sections of opposite polarity, one of said sections comprising a plate in contact with a portion of the cores of said series, and the other section comprising a series of pole pieces each in contact with the other cores of said series.

11. In a magnetic chuck, a series of spaced concentric cores, and a work holding face consisting of sections of opposite polarity, one of said sections comprising a plate in contact with alternate cores of said series, and the other section comprising a ring in interlocking engagement with said plate and in contact with the outermost core of said series.

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