April 18, 1944. J. T. BEECHLYN 2,347,023

PERMAMENT MAGNET CHUCK

Filed Feb. 7, 1941 2 Sheets-Sheet 1

Fig. 1

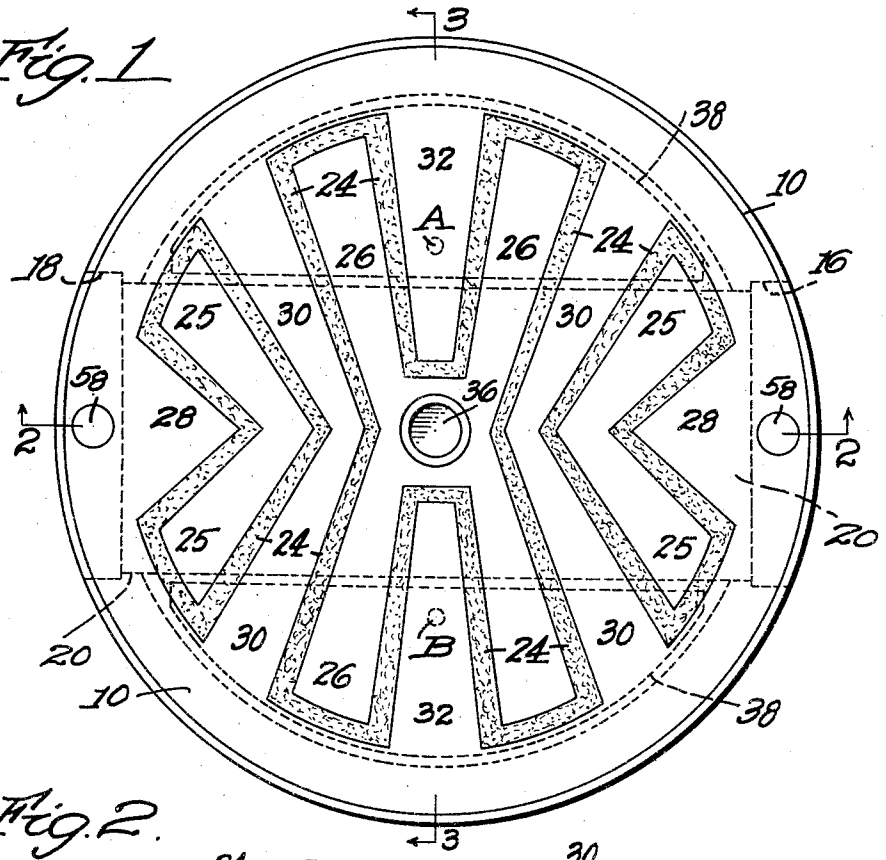
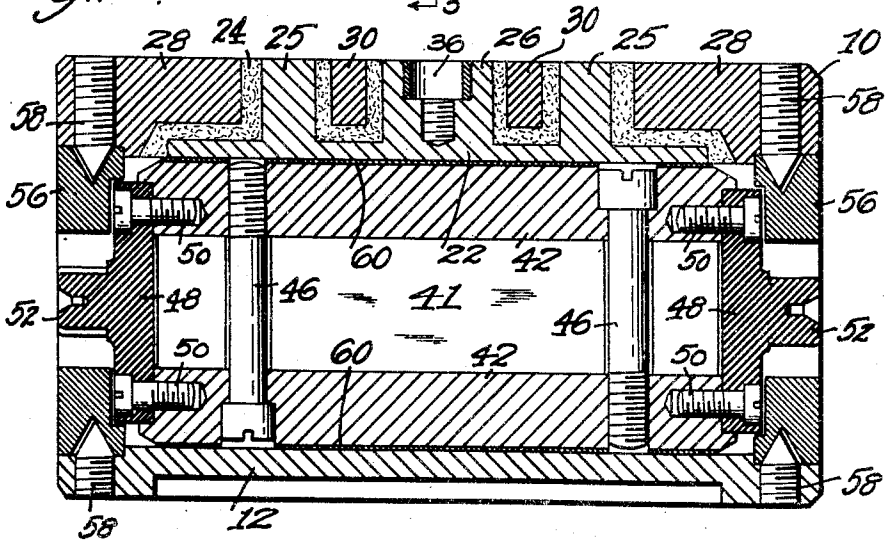


Fig. 2.



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Fig. 3.

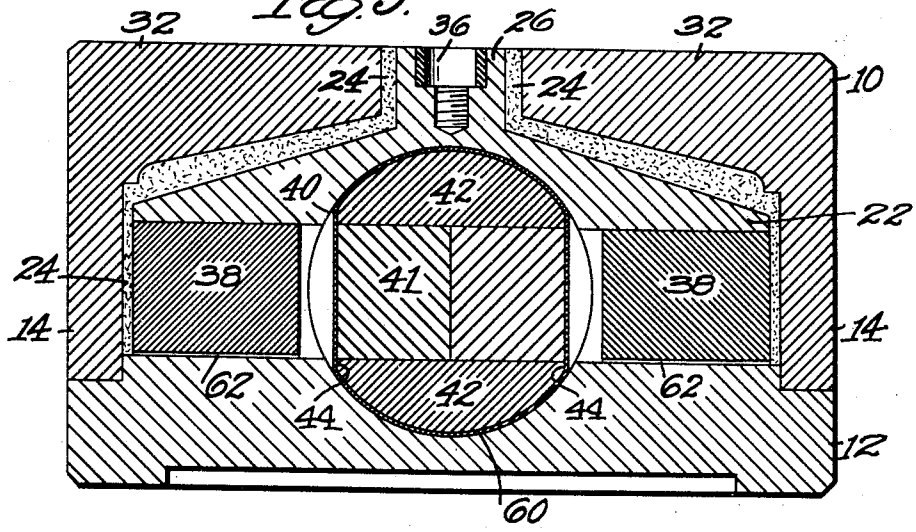


Fig. 4

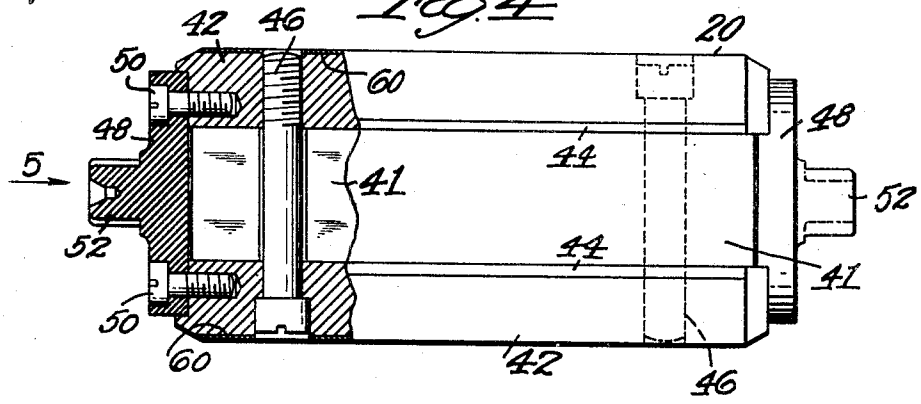
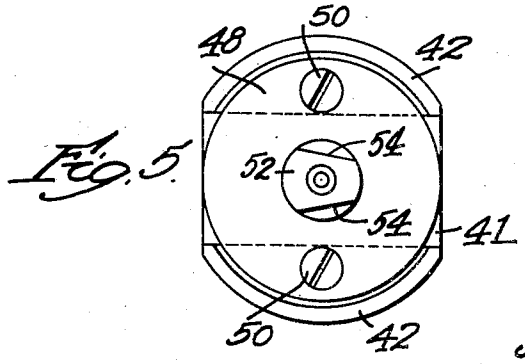


Fig. 5.



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UNITED STATES PATENT OFFICE

2,347,023

PERMANENT MAGNET CHUCK

John T. Beechlyn, Worcester, Mass., assignor to O. S. Walker Co. Inc., Worcester, Mass., a corporation of Massachusetts

Application February 7, 1941, Serial No. 377,865

10 Claims. (Cl. 175—367)

This invention relates to permanent magnet chucks of the rotary type and is particularly directed to such a chuck having a through diametrical magnet turnable on its axis to hold or release the work in combination with stationary magnets at either side of the turnable magnet, said stationary magnets being in the general shape of semi-circular pieces to extend substantially throughout the working area of the chuck.

Objects of the invention include the provision of a rotary chuck as above recited; the provision of a permanent magnet chuck having a bore and a rotary magnet turnable on its axis in said bore, said magnet having a thin coating of non-magnetic or high reluctance material to provide a uniform gap and bearing surface for the magnet; the provision of a novel pole pattern which allows greater and more advantageous utilization of the magnetic flux than heretofore possible; and the provision of means at each end of the rotary magnet to form a one-way fit for a wrench or other tool whereby the magnet may be turned to effect holding or release of the work by identical turning movements of the tool regardless of from which end of the magnet it is desired to turn it.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings, in which

Fig. 1 is a top plan view of a chuck constructed according to the present invention;

Fig. 2 is a section on line 2—2 of Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 1;

Fig. 4 is a side elevational view of the rotatable magnet, parts being in section; and

Fig. 5 is an end view of the magnet looking in the direction of arrow 5 in Fig. 4.

The top plate assembly comprises a generally cylindrical iron member 10 which rests on the round bottom plate 12 as shown in Fig. 3 by its depending flange 14. This flange extends around the periphery of the chuck but is interrupted at 16, 18, where it is recessed to form a partial circular opening for admission of the rotary magnet assembly 20.

The work holding surface of the member 10 is formed as shown in Fig. 1, with non-parallel and non-radial openings for the reception of the similarly shaped pole pieces of the pole section 22. These pole pieces are of less dimensions than the openings in the member 10, thus leaving gaps 24 filled with non-magnetic metal filling to render the pole section and member an integral unit. A description of the pole pieces will be seen to illustrate the openings in member 10, but it is pointed out that the gaps 24 are not uniform but widen in a direction away from the center of the chuck.

End pole pieces 25 are similar in shape but reversed and each resembles a V having its arms gradually widening away from the apex, which is clearly to one side of the chuck center. Pole piece 26 is H shaped but is deformed by being pinched in at the waist or cross-bar of the H. This construction leaves opposite triangular pieces 28, arms 30 extending on two sides of the triangles, and diametrically opposite free-ended fingers 32 stopping short of the chuck center, which is tapped and counterbored at 36 to provide a centering depression.

An important aspect of the pole pattern is the fact that the edges of the openings in member 10, the gaps 24, and the pole pieces, when taken below line 2—2 in Fig. 1, all converge toward a small area A on the opposite side of the line, and the corresponding parts above line 2—2 converge toward a like small area B. It will be seen that the pole pattern just described, in effect, combines the usual radial and parallel pole patterns, and allows the utilization of the advantages of each of these types.

A pair of segment-shaped permanent magnets 38 are positioned to rest on the base plate 12 with their curved edges parallel to and adjacent the peripheral flange 14 of the chuck, and their straight edges are spaced from and parallel to the rotary magnet assembly 20. A portion of the gap 24 extends down and lies between the curved edges of the stationary magnets and the flange 14, while the base of the pole section 22 rests on the top flat surfaces of these magnets. this base is formed as shown in Fig. 3 with a central recess 40 to accommodate the rotary magnet, and base 12 is likewise recessed to complete a bore, thus providing a round internal bearing for the rotary magnet.

The rotary magnet 41 comprises a flat sided rectangular bar magnet having soft iron top and bottom pieces 42 at opposite sides to provide a generally circular means to rotatably support the bar magnet in its bore, and to prevent direct sliding contact of the magnet and the iron members 12 and 22. The pieces 42 are relieved at points 44, where the magnet most closely approaches the walls of the bore, and the magnet itself is of a width less than the diameter of the bore, so that there is no possibility of any contact of the magnet and the walls of the bore.

Through-bolts 46 secure the magnet and pieces 42 together, and round plates 48 are attached to the ends of pieces 42 by screws 50 or other means. Centrally of each plate 48, there is an outstanding tang 52 having non-parallel sides 54 so that a complementary wrench or other tool can be placed on the tang in but one position. The tangs have their corresponding ends located oppositely, that is, wide end of the tang at the right in Fig. 4 is toward the observer and the wide end of the left hand tang is away from the observer.

End plates 56 are set into recesses 16, 18 and these plates are centrally apertured to permit access to tangs 52. Conical screws 58 extending thru the base 12 and member 10 locate and hold the end plates in position.

The magnet assembly 20 is provided with a thin plating of copper or other non-magnetic material as shown at 60, in the neighborhood of .003 to .008 inch, and this plating provides a bearing means whereby the magnet assembly is accurately centrally located in its bore. In the absence of such a coating, the magnet assembly would tend to get off-center of its bore by being attracted to one side or the other thereof, thus producing unwanted friction and flux variations. The copper plating provides a bearing and spacing surface which avoids this difficulty by introducing an element of reluctance on each side of the magnet which can only vary by a slight percentage.

A gap 62 is provided on the bottom surface of each stationary magnet 38 to match the effect of the coating 60 and to insure that magnet 41 will be effectively of greater magnitude than the combined strengths of the stationary magnets for the reasons pointed out in my co-pending application Serial No. 351,564, filed August 6, 1940, Patent No. 2,268,011, which relates to a permanent magnet chuck having flux producing and reversing means similar to those here disclosed.

A wrench of the socket type is used to fit over the tangs 52, in such a manner that the wrench handle will lie normal to the chuck axis in either on or off positions, and this wrench can only be placed on the tanks in one direction. Clearly, the directions of the wrench handles will be opposite as applied to both tanks, by reason of the opposite configurations thereof. When the chuck is placed on a lathe face plate, it will lie on a horizontal axis, and with the magnet 41 horizontal, the wrench handles will be vertical. As the handles point in opposite directions at the opposite sides of the chuck, they will both point in the same rotational direction of the chuck. Hence it will be observed that if an operator stays at one side of the lathe, he will always operate either tang in exactly the same manner to turn the holding flux from on to off. By arranging the tangs oppositely, i. e., with the narrow ends of the tangs both pointing either clockwise or counterclockwise of the rotation of the chuck body, it is very easy to correctly operate the magnet 41, and it will not be necessary for the operator to stop and think each time about which side of the chuck is toward him in order to tell whether the flux is in holding or releasing position.

Of course, but one wrench is necessary, the mention of two wrenches above being illustrative, to point out the effect of the tang conformation.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:

1. In a permanent magnet chuck of the rotary type, the combination of a cylindrical-walled housing having a top plate and a bottom plate; with a magnet adapted to be rotated on its axis, said axis being normal to the chuck axis, and a second magnet fixed in said housing and having an edge substantially parallel to the axis of the first magnet and another edge conforming to the cylindrical wall of the housing, said second magnet being lunar shaped.

2. In a permanent magnet chuck of the rotary type, the combination of a generally cylindrical housing embodying a circular top plate having elongated non-radial pole pieces and a bottom plate; with a magnet located diametrically of the housing and adapted to be turned on its axis, and a stationary lunar shaped magnet lying to one side of the axis of the turnable magnet and shaped to conform to the working area of the top plate.

3. In a permanent magnet chuck of the rotary type, the combination of a cylindrical-walled housing having a circular top plate; with a magnet rotatably mounted in said housing diametrically thereof, and a fixed magnet at either side of said rotatable magnet, each said fixed magnet having an edge adjacent and parallel to said rotatable magnet, and an opposite edge of arc shape, said opposite edge lying adjacent and being in general conformance with a part of the cylindrical wall of said housing, both magnets being of lunar shape.

4. A permanent magnet work-holding device comprising a housing having a work-holding surface, means forming a bore in said housing, a magnet rotatably mounted with slight clearance in said bore, and thin sheet of uniform reluctance non-magnetic material of uniform thickness between said magnet and bore, said sheet being effective to minimize flux variations on opposite sides of the magnet as caused by axial displacement incidental to said clearance, whereby tendency of the magnet to be attracted to any particular adjacent iron element is minimized.

5. In combination with a magnetic chuck of the rotary type, a top plate comprising a plurality of elongated, interfitting, spaced, flux-carrying members, at least some of said members being formed to converge from adjacent the periphery of the chuck toward a small area located eccentrically to the center of the chuck, a magnetic flux source in said chuck, and a flux control device arranged diametrically of said chuck and substantially transversely to said flux-carrying members.

6. In combination with a magnetic chuck, a top plate comprising a plurality of generally V-shaped spaced members, certain of said members being located to one side of the center of the plate and converging toward points located eccentric to the center, a flux source in said chuck, and a flux control in said chuck extending substantially through said center transversely to the V-shaped members.

7. In combination with a magnetic chuck, a top plate comprising a plurality of interfitting spaced members arranged symmetrically to either side of a line thru the center of the plate, members to one side of said line converging toward a small area at the other side, members on the latter side converging toward a small area on the one side, said small areas being located ad-

jacent a center line of the plate at right angles to the first named center line, and a flux control element located parallel to and including said first named center line.

8. In a magnetic chuck, a circular top plate comprising a plurality of interfitting spaced iron members extending across the plate, each member comprising a V-shaped element, the several elements having their apices situated at successive points along a plate diameter and pointing toward the plate center, and a flux control element substantially coextensive with and located parallel to said plate diameter.

9. In a rotary chuck, a circular housing, a magnet positioned diametrically of said housing and adapted to be turned on its axis to provide for reversing the direction of its flux, means at each end of said magnet to receive a wrench, said means being effective to receive said wrench in one position only, said positions being opposite as respects the magnet but the same as respects the rotative direction of the housing.

10. In a permanent magnet chuck having a cylindrical chuck body adapted for coaxial mounting on a horizontal spindle, a rotatable work release control member extending transversely thruout said chuck body, a tang on each end of said control member, each of said tangs formed to provide a one-way fit for a wrench, said tangs being effective to receive the wrench only in positions opposite to each other with respect to the rotatable control member per se but in the same direction with respect to the direction of rotation of the spindle, magnetic means cooperative with said control member to cause respectively holding and release of the work when the member is turned by one of said tangs to assume respectively one of two positions 180° apart, whereby identical procedure in motion is required when either tang is brought into service, as determined by orientation of the spindle with respect to a given position of the operator.

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