

June 4, 1940.

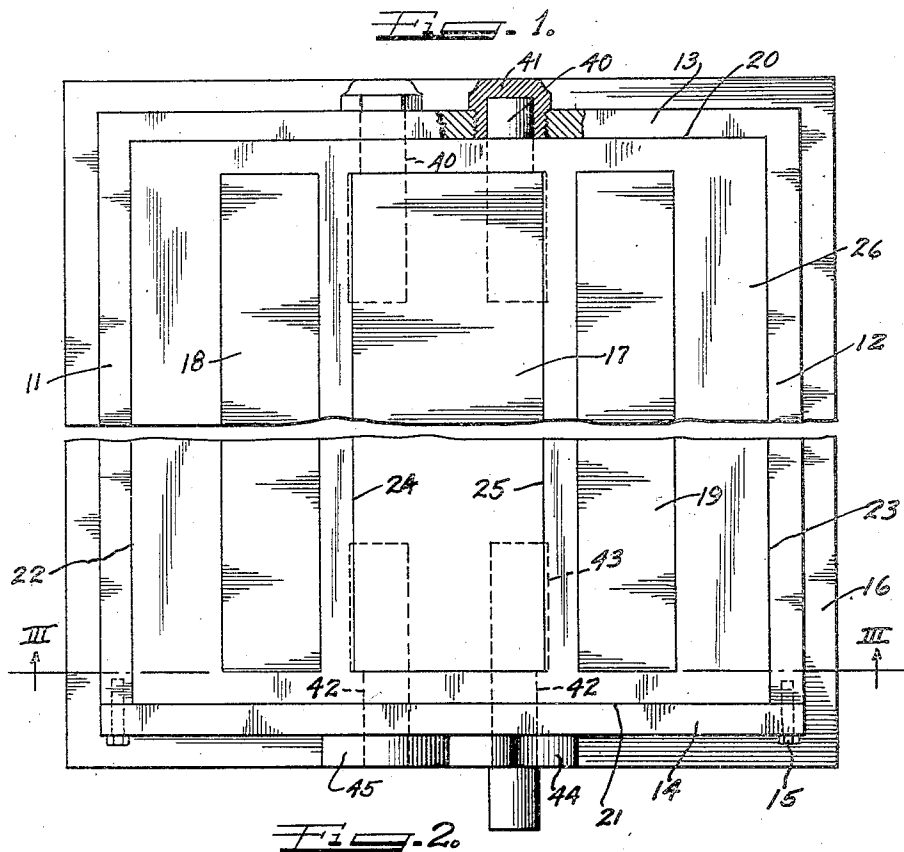
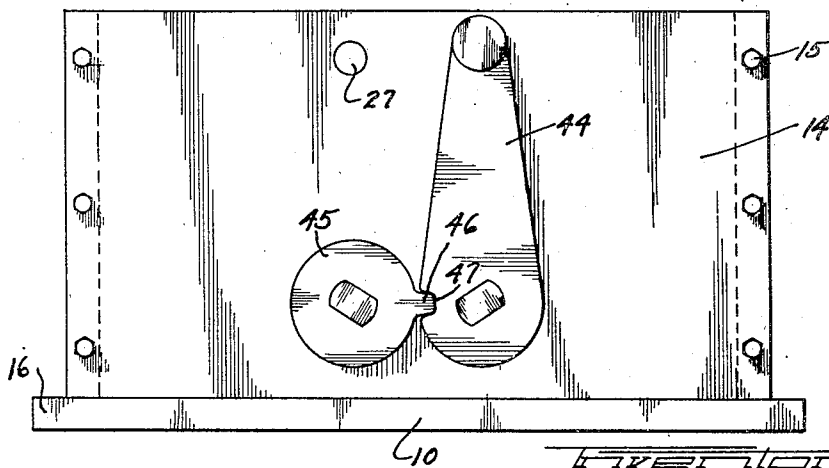
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2,203,512

MAGNETIC CHUCK

Filed Feb. 23, 1939

2 Sheets-Sheet 1



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Fig. 3.

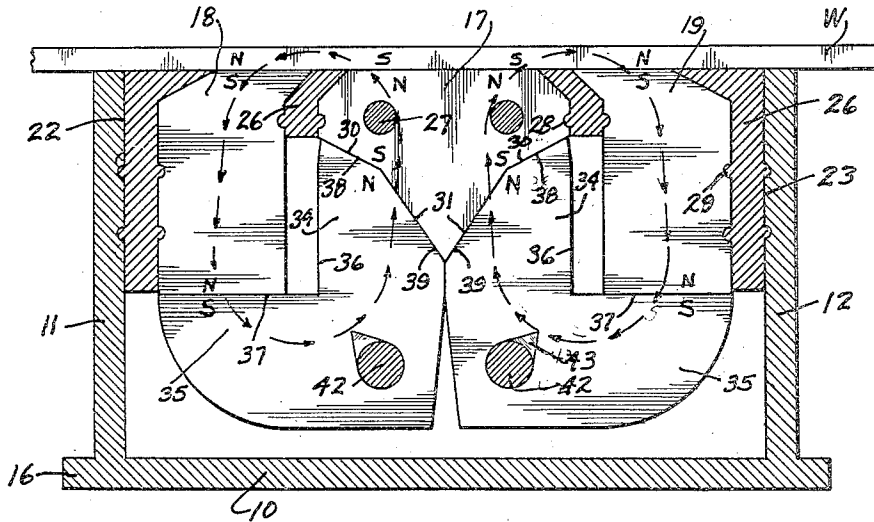


Fig. 4.

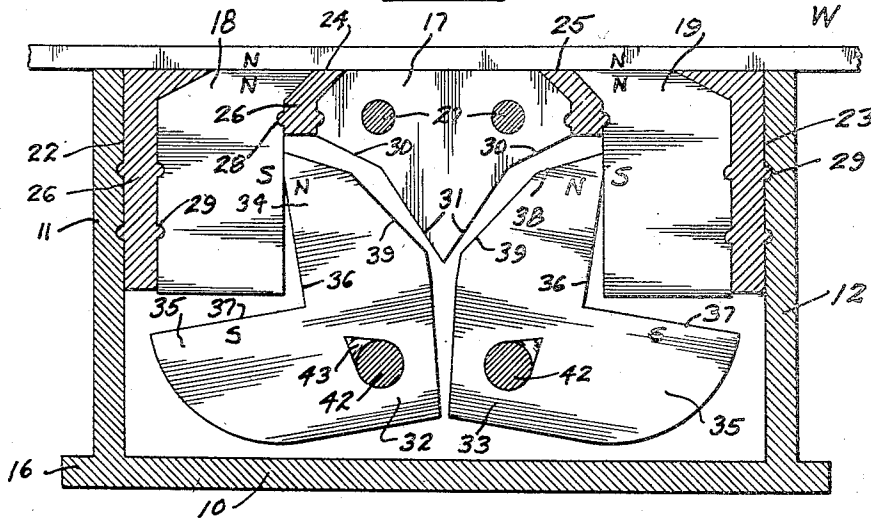
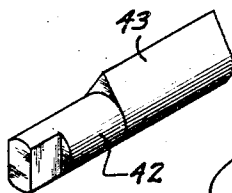


Fig. 5.



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## UNITED STATES PATENT OFFICE

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## MAGNETIC CHUCK

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2 Claims. (Cl. 175—367)

My invention relates to magnetic chucks adapted particularly for holding work which cannot be conveniently clamped or secured in ordinary chucks, as for example, steel plates or similar work pieces which are to be ground, polished, or otherwise finished.

An important object of the invention is to utilize permanent magnet structures for providing the magnetic flow through the work for holding it in place on the chuck, and I preferably utilize permanent magnet elements of so-called "Alnico" steel, that is an alloy comprising aluminum, nickel, cobalt, and iron, such permanent magnets being very powerful.

A further important object of the invention is to associate such powerful permanent magnet elements with work supporting pole pieces in such manner that the permanent magnet elements may be moved into engagement with the pole pieces for closure of magnetic circuits through the magnets and the pole piece and the work for holding the work to the chucks, and with the magnet elements movable to break the magnetic work holding circuits and to cooperate with pole pieces for creation of reverse polarity at the work supporting surfaces of the pole pieces, so that the resulting magnetic repulsion will enable the work to be readily removed from the chucks.

My invention also incorporates other features of construction and arrangement, and all these features are shown embodied in the structure illustrated on the drawings, in which drawings:

Figure 1 is a plan view of the chuck;

Figure 2 is an end view;

Figure 3 is a section on plane III—III, Figure 1, showing the permanent magnet elements in magnetic circuit closing position;

Figure 4 is a view like Figure 3 but with the permanent magnet elements in work releasing position; and

Figure 5 is a perspective view of one of the pins for supporting the movable magnet elements.

The chuck structure shown comprises a rectangular box-like housing or casing structure having a base wall 10, side walls 11 and 12; the rear end wall 13 integral with the side walls, and the front end wall 14, which is detachable and secured in place as by pins or screws 15. The base wall 10 extends beyond the side and end walls to provide flanges 16 by which the chuck may be conveniently secured on the bed of a grinding or other machine for operation on the work piece W applied to the chuck.

In the arrangement shown, I have provided an inner pole piece 17 and outer pole pieces 18 and

19, these pole pieces being parallel and extending longitudinally in the casing with their upper surfaces in the plane of the upper edge of the casing. The pole pieces are shorter than the casing so as to leave a gap 20 between their rear ends and the rear end wall 13, and a gap 21 between their front ends and the front end wall 14. The outer pole pieces 18 and 19 are spaced from the casing side walls 11 and 12 by gaps 22 and 23 respectively and these pole pieces are also spaced away from the middle pole piece 17 by gaps 24 and 25 respectively. These gaps are filled with suitable non-magnetic material 26 which will hold the pole pieces accurately relatively aligned within the casing with their upper faces flush with the upper faces of the casing side walls. Preferably the middle pole piece 17 is more securely held in position by pins 27 extending into the pole piece through the end walls 13 and 14. The adjacent faces of the middle pole piece and the side pole pieces may be provided with recesses 28 and the opposed outer faces of the side pole pieces and the side walls of the casing may be provided with recesses 29 for receiving the filler material 26 so that the pole pieces may be more securely anchored by the filler material. The filler material upper surface is flush with the upper pole faces of the pole pieces and fills the various gaps between the pole pieces and the casing walls so as to exclude dirt, moisture, grindings or other foreign material from the casing.

On the structure shown, the outer pole elements 18 and 19 are of substantially rectangular cross section while the portion of the middle pole piece 17 below the pins 27 is of substantially conical cross section to present the inclined intermediate faces 30 and the lower faces 31.

The permanent magnet elements 32 and 33 shown are in the form of angle bars which parallel the pole pieces, each permanent magnet bar comprising an upwardly extending leg 34 and a laterally outwardly extending leg 35, the legs having their inner faces 36 and 37 substantially at right-angles with each other, the legs 34 extending upwardly between the middle pole piece and the outer pole pieces, and the legs 35 extending below the outer pole pieces. The legs 34 at their upper ends are shaped to provide the surfaces or faces 38 and 39 for cooperation with the respective faces 30 and 31 of the middle pole piece, and the faces 37 of the lateral legs of the permanent magnet are below the lower faces of the outer pole pieces. The magnet bars 32 and 33 are pivoted to be swung into position shown

in Figure 3 with the faces 38 and 39 thereof in engagement with the faces 30 and 31 of the middle pole piece, and with their faces 37 in engagement with the lower faces of the side pole pieces, and the bars may be swung to the position shown in Figure 4 in which these various faces are disconnected from the pole pieces and with the upper legs of the bars in engagement at their ends with the outer pole pieces.

As a means for pivoting the permanent magnet bars, pins 40 secured in the bars extend into bearing bushings 41 having threaded engagement in the casing end wall 13, and these bushings are preferably in the form of cap members for excluding dust and dirt from the bearings. At their front ends, the magnet bars have pins 42 inserted therein which extend forwardly through the front end wall 14, the pins having key extensions 43 thereon to be rigidly secured to the bars, one of the pins having a lever 44 secured to its outer end and the other pin having a disk 45 secured thereto and connected with the lever so that upon swing of the lever both pins will be turned for simultaneous swing of the magnet bars. As shown the disk 45 has a tooth 46 extending into a recess 47 in the hub of the lever 44. Upon swing of the lever, the magnet bars may be readily swung to the position of Figure 3 or of Figure 4.

In order that the permanent magnet elements 32 and 33 may create powerful magnetic flow for securing the work to the chuck, these elements are preferably of so-called "Alnico" steel, that is, an alloy of aluminum, nickel, cobalt, and iron, properly treated and magnetized. The pole pieces are of material having high magnetic permeability, such as soft iron or soft steel.

Referring to Figure 3, when the magnets are in engagement with the middle and outer pole pieces, magnetic circuits will be closed which include the magnets, the pole pieces and the work, as illustrated by arrows on Figure 3. As indicated on Figure 3, the ends of the upwardly extending legs of the magnets are of north polarity and the laterally extending legs are of south polarity. The upper ends of the outer pole pieces 18 and 19 will then be of south polarity and the upper end of the middle pole piece will be of north polarity, the portions of the work engaging the outer pole pieces being of north polarity and the portions engaging with the middle pole piece being of south polarity, the work being thus strongly attracted and held against the faces of the pole pieces while the work is being ground or otherwise finished or operated on. In order to effect concentration of the magnetic flow through the work, the upper portion of the middle pole piece has its sides beveled, and the upper portions of the outer pole pieces are contracted and deflected inwardly as clearly shown.

To release the work so that it may be removed from the chuck, the lever 44 is operated for outward swing of the permanent magnets with the ends of their upper legs into engagement with the outer pole pieces adjacent to their upper ends, as illustrated by Figure 4. The permanent magnets being thus separated by air gaps from the middle pole piece, this pole piece will rapidly demagnetize for its release of the work. The separation of the lateral legs of the permanent magnets from the lower ends of the outer pole pieces will remove the south poles of the magnets from the pole pieces, and the north pole ends of the magnets, by their engagement with the outer pole pieces, will create south polarity

therein resulting in north polarity adjacent to the faces of the pole pieces contacted by the work, and this north polarity will repel the north polarity in the work which was created therein when the permanent magnets were in the positions shown by Figure 3 to close the magnetic flow circuits. The work being of magnetic material, such as iron or steel, this north polarity may be retained therein for awhile after movement of the permanent magnets to open the magnetic flow circuits, and then the repulsion of this north polarity by the north polarity created in the outer pole pieces by the magnets, will have the effect of magnetically repelling the work so that it may be very easily removed from the chuck. In other words, when the permanent magnets are moved to the positions shown in Figure 4, there will be complete magnetic neutralization along the contact plane of the work with the pole pieces and sufficient magnetic repulsion of the work for easy removal thereof from the chuck.

Although I have shown two permanent magnet elements for establishing two magnetic circuits through the work, it is evident that only one permanent magnet could be employed for cooperation with two pole pieces for the generation of one magnetic flow circuit and the change of magnetic conditions for effecting release of the work. Other changes and modifications could also readily be made without departing from the scope of the invention, and I do not therefore desire to be limited to the exact construction, arrangement and operation shown and described.

I claim as my invention:

1. A magnetic chuck comprising a pair of pole pieces in the form of comparatively long bars parallel with each other and adapted to support a work piece of magnetizable material, a permanent magnet bar below said pole pieces and of angular cross section to provide a substantially vertical pole arm below the first pole piece and a substantially horizontal pole arm below the second pole piece, means pivoting said permanent magnet bar for swing on an axis intermediate its pole arms, swing of said magnet bar in one direction engaging its vertical and horizontal pole arms with said first and second pole pieces respectively for closure of a magnetic flow circuit including the work piece whereby said work piece will be held attracted to the pole pieces, swing of said permanent magnet in the opposite direction disengaging the horizontal pole arm from said second pole piece and disengaging the vertical pole arm from said first pole piece and engaging said vertical arm with said second pole piece at a point near the work piece whereby to effect reversal of polarity at said point for ready removal of the work from the pole pieces.

2. A magnetic chuck comprising a middle pole piece and left and right pole pieces adjacent the sides of said middle pole piece but magnetically insulated therefrom, said pole pieces being of magnetizable material and terminating at their upper faces in a common plane for supporting a work piece of magnetizable material, two permanent magnets below said pole pieces, each magnet comprising an upwardly extending pole arm and a laterally extending pole arm, the upwardly extending pole arms of said magnets normally engaging with said middle pole piece and the laterally extending pole arms of said magnets normally engaging against the lower ends of

said left and right pole pieces respectively whereby two magnetic flow circuits are formed including a work piece on said pole pieces for holding said work piece to the pole pieces, and  
5 means for effecting simultaneous swing of said magnets for disconnection of their upwardly extending and laterally extending arms from said middle pole piece and left and right pole pieces

respectively whereby to open said magnetic flow circuits and for engaging their upwardly extending pole arms with the left and right pole pieces respectively at points near the upper ends of said pole pieces whereby to effect reversal of  
polarity at said points for ready removal of the work piece from the pole pieces. 5

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