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E. W. MOUER ET AL
MAGNETIC CHUCK

2,922,933

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2 Sheets-Sheet 1

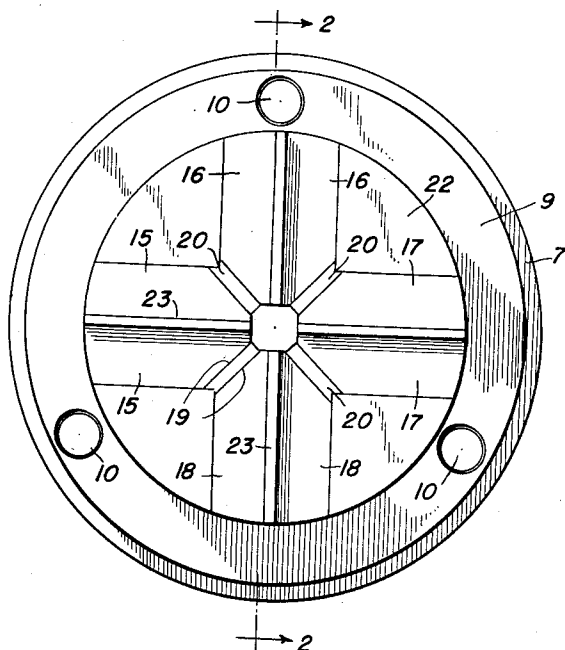


FIG. 1

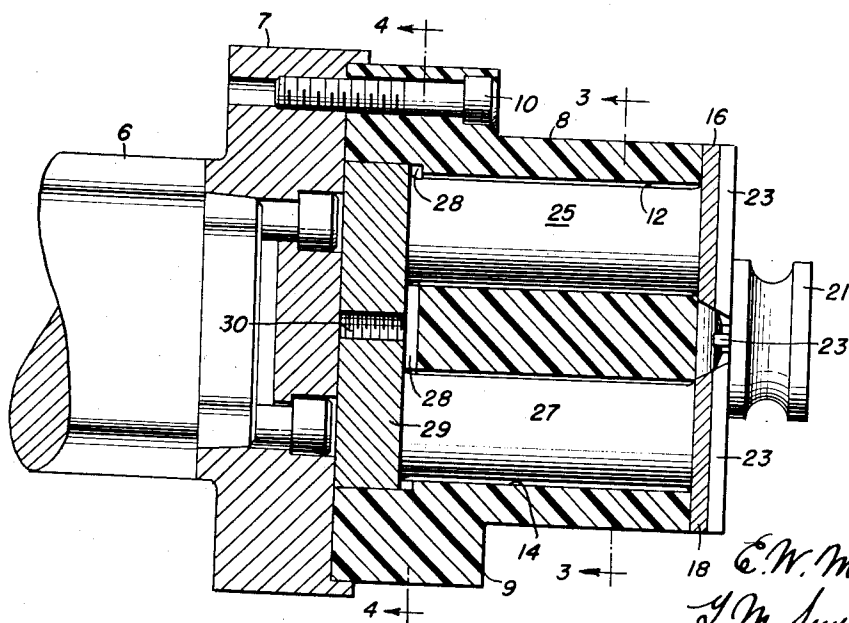


FIG. 2

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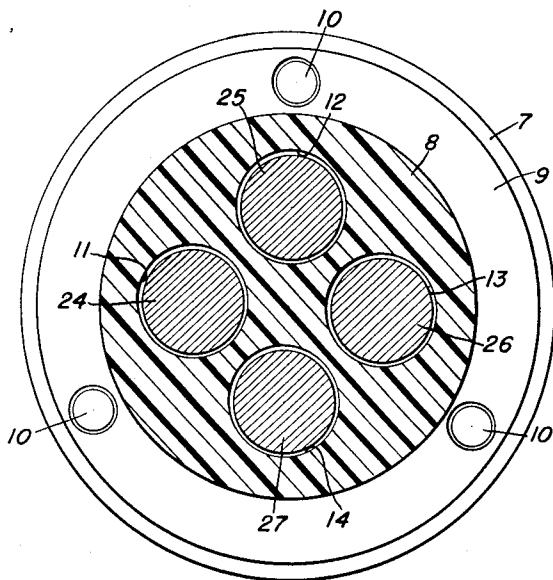


FIG. 3

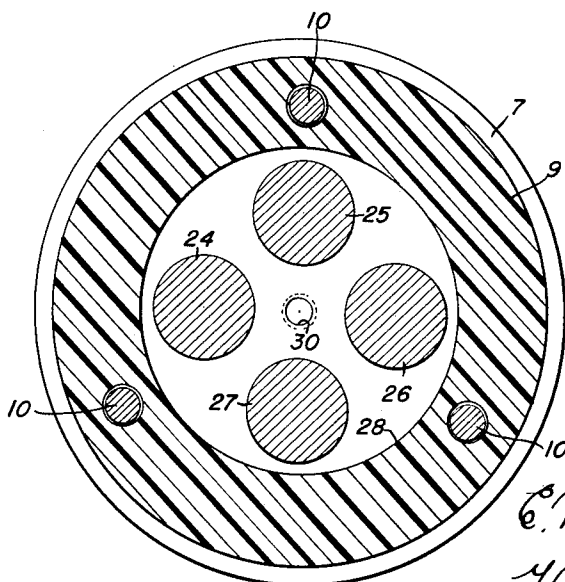


FIG. 4

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MAGNETIC CHUCK

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7 Claims. (Cl. 317—159)

The invention to which the following specification relates is that of a magnetic chuck for holding annular workpieces during grinding and other similar operations.

The magnetic chuck of this type should be readily attachable to the machine tool. It should also provide a strong magnetic field for holding the workpieces. This magnetism should be supplied without the necessity of drawing on a source of electric power. Magnetic chucks also are subject to considerable wear of the pole pieces. Maintaining the strength of the magnets demands a compact but adequate closed magnetic path.

The present invention meets the above requirements by providing for a chuck using permanent magnets easily replaceable or renewable, a common armature for them and also protection of the pole pieces against undue wear.

One object of this invention is to provide a magnetic chuck with readily removable permanent magnets for replacement or renewal, i.e. recharging.

Another object is to make the magnets removable with maximum ease.

A still further object of the invention is to utilize fixed pole pieces with the replaceable bar magnets.

Among the objects of the invention is to provide wear-resistant elements as a protection to the fixed pole pieces.

Finally, among the objects of the invention is that of providing a common armature for a series of bar magnets, thus concentrating the lines of magnetic flux between adjacent dissimilar magnetic poles.

By way of example the preferred form of the invention has been illustrated on the accompanying drawings in which:

Figure 1 is a front elevational view of the improved magnetic chuck;

Figure 2 is a longitudinal vertical section on the line 2—2 of Figure 1;

Figure 3 is a transverse section on the line 3—3 of Figure 2, and

Figure 4 is a similar section on the line 4—4 of Figure 2.

Briefly, stated, the invention consists in providing a body member in which fixed pole pieces are imbedded in the face for holding the work piece. At the same time use is made of a series of bar magnets arranged in parallel spaced formation in contact with the underside of said pole pieces. Finally, the rear ends of the bar magnets are in contact with a common armature in the form of a disk by which the lines of magnetic force are directed in the shortest possible paths between adjacent pairs of magnet poles.

In the drawings, a rotary headstock 6 has been shown as the base upon which the magnetic chuck is mounted. This headstock carries a removable face plate 7. Both the headstock and the face plate are of well known construction.

The magnetic chuck consists essentially of a shell or body member 8. This is made of non-magnetic material to which the pole pieces are brazed. The body member 8 has a circular base 9 proportioned to fit upon the face

plate 7 and to be removably attached thereto by means of bolts 10, 10.

The body member has a series of cylindrical chambers 11, 12, 13 and 14. These have been illustrated as four in number but a greater or fewer number may operate satisfactorily. The number of poles must be even so that there is always a north pole opposite every south pole.

A corresponding number of individual pole pieces 15, 16, 17 and 18 are imbedded in the front face of the member 8. Each pole piece is made of a metal having a high flux density. The pole pieces overlie individual chambers in the member. As shown in Fig. 1, the pole pieces extend radially to within a short distance of the center. Each pole piece has a pointed inner end 19. The angular shape of the inner ends is such that the side edges of adjacent pole pieces are parallel and slightly spaced apart. The reason for this shape is to make provision for the smallest possible work diameter and at the same time to keep the spacing between pole pieces sufficient to hold leakage to a minimum. Leakage is also kept down by the angle on the points of the pole pieces.

Spacers 20, preferably of brazing material, are provided by melting brazing rod to fill the gaps between the pole pieces 15, 16, 17, and 18. A workpiece 21, also of magnetizable metal such as iron or steel will readily attach itself to the faces of the pole pieces as shown in Figure 2. The sectors 22 on the end of the body member 8 are integral parts of the latter.

In order to protect the faces of the pole pieces 15, 16, 17 and 18, these are slotted radially to receive central radial ribs 23. These ribs are made of metallic carbide or other hardened material. They have their surfaces flush with the pole pieces and thus support the workpiece 21 and minimize the wear upon the pole pieces proper.

Bar magnets 24, 25, 26 and 27 fit just loosely enough within the chambers 11, 12, 13 and 14 respectively, so that they are not held by friction. The bar magnets are long enough so that when the front ends about the pole pieces, the rear ends project slightly into a counter-bored cavity 28 in the rear of the base 9.

A circular disk or armature 29 of soft iron or steel is fitted within the counterbored cavity 28 and rests against the inner ends of the bar magnets as shown in Fig. 2 when the base 9 is bolted to the face plate 7. When the base or body member 9 is bolted to face plate 7, there is a slight clearance between the surface of said face plate and that of said armature 29. A threaded hole through the center of armature 29 is provided for a purpose which will be described later.

A magnetic chuck constructed as above described is easily mounted on a headstock or the like without modification of the latter. A permanent magnet chuck requires no reliance upon outside sources of electric current. It encloses relatively strong permanent magnets positioned for maximum application of magnetic force to the face of the chuck. This chuck face serves as a pole piece.

The magnets are inserted with reverse direction of the poles so that alternate adjacent pole pieces are negative and positive respectively.

The common armature 29 closes in the rear ends of the magnets, and is held in position by magnetic force. However, the armature is readily removed by turning a screw forwardly in threaded hole 30 against the end of the body member 8 so that the armature is pushed back out of the body member 8, thus drawing out the magnets for replacement or recharging. Armature member 29 is of sufficiently greater mass than the pole pieces 15, 16, 17, and 18 that the attraction between the armature and the magnets is greater than between the pole pieces and

the magnet. As a result of this difference in attraction, when the armature 29 is removed, the attraction between the magnets and the pole pieces is broken and the magnets are removed with the armature.

The path of magnetic flux passes from the front end of one magnet and its pole piece to the workpiece. The flux returns from the workpiece to the adjacent pole piece and the magnet. The path is closed by that part of the armature or disk 29 which bridges the rear ends of the magnets being considered.

While the invention has been described in its preferred form, it will be well understood that minor changes of proportions, arrangement and materials are possible without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. A magnetic chuck comprising a non-magnetic body member having a base removably attachable to a headstock, said body member having a series of circumferentially spaced longitudinal chambers extending there-through, a radial pole piece imbedded in the front of the body member over each chamber and individually spaced apart, a permanent bar magnet removably carried in each chamber with their front ends in contact with the respective pole pieces and said ends arranged with alternate polarity, and an armature removably held in the base against the rear ends of the magnets.

2. A magnetic chuck comprising a non-magnetic body member having a base removably attachable to a headstock, said body member having a series of circumferentially spaced longitudinal chambers extending there-through, a radial pole piece imbedded in the front of the body member over each chamber and individually spaced apart, each pole piece having a non-magnetic radial wear-resistant bar flush with the surface of said pole piece, a permanent bar magnet removably carried in each chamber with their front ends in contact with the respective pole pieces and said ends arranged with alternate polarity, and an armature removably held in the base against the rear ends of the magnets.

3. A magnetic chuck comprising a non-magnetic body member having a base removably attachable to a headstock, said body member having a series of circumferentially spaced longitudinal chambers extending there-through, a radial pole piece imbedded in the front of the body member over each chamber, said pole pieces having pointed inner ends lying in spaced juxtaposition and extending toward the center of the chuck, and a permanent bar magnet removably carried in each chamber with its front end in contact with one of said pole pieces and said front ends of the magnets arranged with alternate polarity, and an armature removably held in the base against the rear ends of the magnets.

4. A magnetic chuck comprising a non-magnetic body member having a base removably attachable to a headstock, said body member having a series of circumferentially spaced longitudinal chambers extending there-through, a radial pole piece imbedded in the front of the body member over each chamber, each pole piece hav-

ing a pointed inner end, non-magnetic spacers between said inner ends, a permanent bar magnet removably carried in each chamber with their front ends in contact with the respective pole pieces and said ends arranged with alternate polarity, and an armature removably held in the base against the rear ends of the magnets.

5. A magnetic chuck comprising a non-magnetic body member having a base removably attachable to a headstock, said body member having a series of circumferentially spaced longitudinal chambers extending there-through, a radial pole piece imbedded in the front of the body member over each chamber and individually spaced apart, a permanent bar magnet removably carried in each chamber with their front ends in contact with the respective pole pieces and said ends arranged with alternate polarity, and a magnetically permeable disk removably held in the base against the rear ends of the magnets.

6. A magnetic chuck comprising a non-magnetic body member having a base removably attachable to a headstock, said body member having a series of circumferentially spaced longitudinal chambers extending there-through, a counterbored cavity in the base of the member overlying the rear ends of the chambers, a radial pole piece imbedded in the front of the body member over each chamber, a permanent magnet removably carried in each chamber with their front ends in contact with the respective pole pieces and said ends arranged with alternate polarity, and an armature disk removably held in said counterbored cavity in contact with the rear ends of said magnets.

7. A magnetic chuck comprising a non-magnetic body member having a base removably attachable to a headstock, said body member having a series of circumferentially spaced longitudinal chambers extending there-through, a radial pole piece imbedded in the front of the body member over each chamber and individually spaced apart, a permanent bar magnet removably carried in each chamber with their front ends in contact with the respective pole pieces and said ends arranged with alternate polarity, and an armature disk removably held in the base against the inner ends of the magnets, the magnetic attraction between said armature and the combined magnets being sufficient on removal of the armature to separate said magnets from the individual pole pieces and to withdraw said magnets from the chambers.

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