July 28, 1964 G. N. LEVESQUE 3,142,787

PERMANENT MAGNETIC BLOCK

Filed April 27, 1962

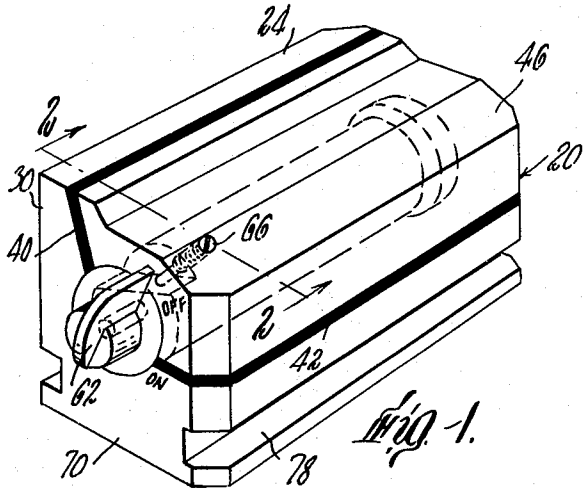


Fig. 1.

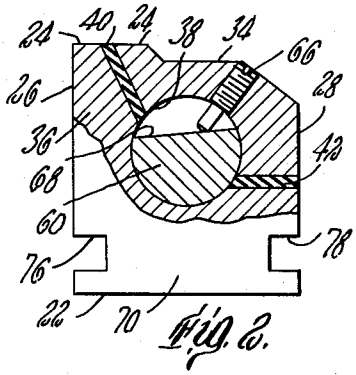


Fig. 2.

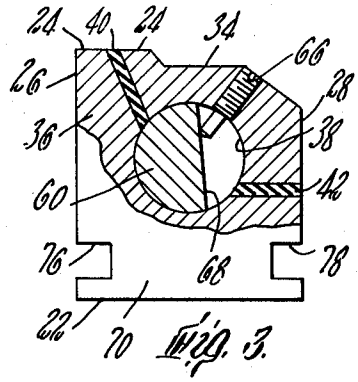


Fig. 3.

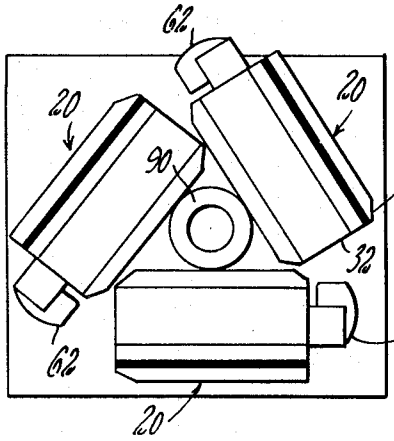


Fig. 4.

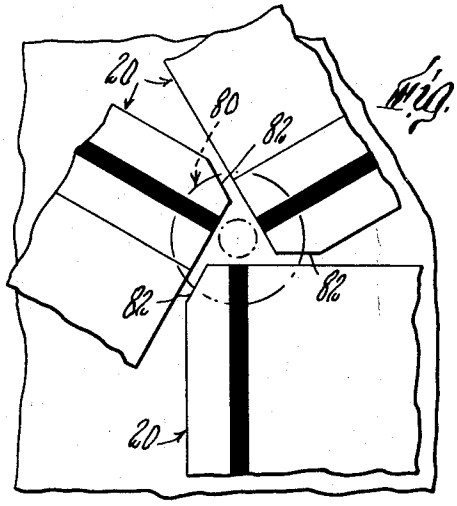


Fig. 5.

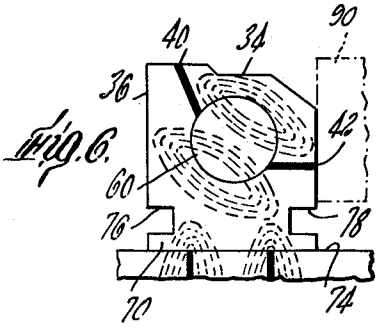


Fig. 6.

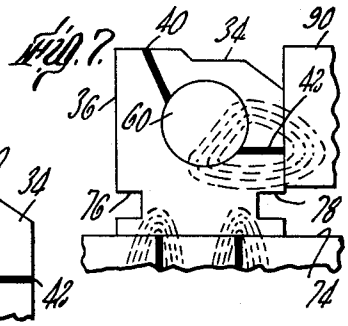


Fig. 7.

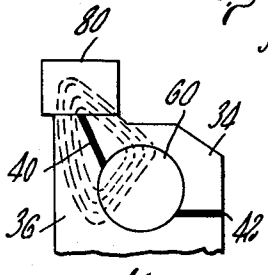


Fig. 8.

United States Patent Office 3,142,787 Patented July 28, 1964

3,142,787

PERMANENT MAGNETIC BLOCK

George N. Levesque, Warwick, R.I., assignor to Brown & Sharpe Manufacturing Company, Providence, R.I., a corporation of Rhode Island

Filed Apr. 27, 1962, Ser. No. 190,626
4 Claims. (Cl. 317—159)

The present invention relates to an improved permanent magnet block and more particularly to such a block adapted for use in sets of three for the support of articles of small size above and separated from the surface of a magnetic chuck.

For the performance of an operation extending entirely through the central area of a small work piece, as for example, an internal grinding operation, it may be preferred to locate the work piece on the face of a magnetic chuck, but separated therefrom, to permit the tool to be passed completely through the work piece without being brought into contact with the face of the chuck. For purposes of illustration a small tubular work piece is shown upon which an internal grinding operation is to be performed.

It is a principal object of the invention to provide a permanent magnet block adapted for use with two other identical blocks in a set of three such blocks grouped for the support of a small work piece over a central unsupported area, said blocks being located upon and held against the face of a rotary magnetic chuck while each block in turn provides a separate source of holding power which can be independently turned on for supporting a work piece in a properly oriented position on the grouped blocks.

It is more specifically an object of the invention to provide a permanent magnet block of the simple construction shown which is adapted when grouped with two other similar permanent magnet blocks in the manner described, to develop a maximum holding power for the holding of a small work piece, and further adapted to be unaffected by the holding flux emanating from the supporting chuck face on which the permanent magnet blocks are mounted.

With these and other objects in view as may hereinafter appear a feature of the invention consists in the provision of a universal permanent magnet block having a longitudinally extending cross-magnetized cylindrical magnet and two magnetic spacers extending from diametrically opposite sides of said magnet to the surface thereof, thereby dividing said blocks into two separate flux carrying segments extending the length of the block. In accordance with the invention, one of said separating spacers is so located as to divide the top surface of the block longitudinally adjacent one edge thus forming a top holding area which extends along one side of the top surface to the end thereof. The other of said separating spacers projects downwardly and laterally to divide the side surface remote from the top edge thus forming a side holding area extending along the length of the block. The side surface of the block having the top holding area adjacent thereto is beveled inwardly at one end at an angle of about 30° thus bringing the top holding area still closer to the edge at the corner.

A further feature of the invention consists in the provision of three such blocks adapted to be grouped about an unsupported area to provide a holding surface of maximum strength for the support of a work piece on said blocks over said unsupported area. For a preferred grouping of said blocks, the blocks are grouped with the end surfaces thereof facing inwardly so that the beveled corners and holding areas of said blocks abut said open area to provide a holding surface of maximum strength for the support of the work piece thereon.

In another grouping of said blocks the blocks are located with said side surface holding areas facing inwardly abutting said open area and with said side holding areas engaged respectively with peripheral portions of said work piece which is thus held in a raised position with respect to a base supporting area.

The several features of the invention consist also in the devices, combinations and arrangement of parts hereinafter described and claimed which together with the advantages to be obtained thereby will be readily understood by one skilled in the art from the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of a permanent magnet block embodying in the preferred form the several features of the invention;

FIG. 2 is a view partly in section taken on a line 2—2 of FIG. 1 illustrating the magnet in the off position;

FIG. 3 is a view similar to FIG. 2 showing the magnet in its on position;

FIG. 4 is a plan view illustrating one arrangement of three blocks grouped in such a manner that the work piece is held against the sides of the blocks;

FIG. 5 is a plan view on an enlarged scale showing three blocks grouped in such a manner that the end portions of said blocks face inwardly for the support of a work piece on the top faces of the grouped blocks;

FIG. 6 is a diagrammatic view of a magnet showing the permanent magnet block held on a chuck face and with its magnet in the OFF position;

FIG. 7 is a diagrammatic view similar to FIG. 6 but with the cylindrical magnet turned to its ON position holding a work piece held against the side face thereof; and

FIG. 8 is a diagrammatic view showing the cylindrical magnet in its ON position holding a work piece on the top face of the block.

The permanent magnet block **20** which forms the subject matter of the present invention is of a generally rectangular shape having a bottom or base surface **22**, a magnetic holding top surface **24**, a side surface **26** and a magnetic holding side surface **28**. The two ends of the block indicated at **30**, **32** are squared with relation to the top, bottom and sides. The block comprises two segments **34**, **36** of magnetic material which are separated longitudinally of said block by a cylindrical bore **38**. The segments **34**, **36** are further separated by two separating non-magnetic spacers **40**, **42** which extend outwardly from opposite sides of said bore along its length.

Spacer **40** extends diagonally upwardly to intersect the top surface **24** of the block adjacent the edge formed with side face **26** thus providing a holding area which extends along the top surface adjacent said edge to the ends of the block. The spacer **42** extends outwardly from the bore **38** in a horizontal direction to intersect the side surface **28** thus forming a side magnetic holding area extending along the length of said side surface **28** from one end of the block to the other.

The permanent magnet block above described is provided with a cross-magnetized cylindrical magnet **60** which is mounted in the bore **38** and is provided at one end with a handle **62** for manual rotative adjustment of the magnet between ON and OFF positions. In the OFF position shown in FIGS. 1 and 2, and in the diagrammatic FIG. 6, magnetic flux travels between the north and south poles in short circuited paths through the segments **34** and **36** which act as keepers for the magnet. When the magnet is shifted angularly to the ON position shown in FIG. 3, and in the diagrammatic FIGS. 7 and 8, a magnetic flux flows between the north and south poles around the separators **40**, **42** through any work piece which may be mounted on the holding area provided by the top holding

surface **24**, or which may be engaged with the holding area provided by the side holding surface **28**.

A radially inwardly extending stop pin **66** screw threaded into the segment **34** (see FIGS. 2 and 3) engages an arcuate slot **68** formed in the periphery of the magnet **60** to limit the rotational movement of the magnet from one to the other of its ON and OFF positions.

The permanent magnet block illustrated is provided with a relatively heavy base portion **70** which is approximately twice the thickness of those portions of the segments **34, 36** through which flux emanating from the magnet **60** flows. This relatively thick base is employed to receive flux from the surface of a magnetic chuck by means of which the permanent magnet block **20** is adhered thereto. The dimensions of the block are such that separate flux paths are provided for flux emanating from the magnet **60** and for the flux which emanates from the holding surface **74** of the chuck to which the block is attached (see FIGS. 6 and 7). In the form of the device shown the base portion **70** is also provided with two transverse grooves **76, 78** by means of which the magnet block can be bolted in the conventional manner to a holding tool surface.

A particularly advantageous arrangement of three blocks in accordance with the invention constructed and arranged as herein set forth is shown in FIG. 5 in which the blocks are closely grouped with their end surfaces facing inwardly so that the corner magnetic holding areas abut a central open area to support over said unsupported area a small work piece generally designated at **80** upon which an internal grinding or similar centrally disposed operation is to be performed entirely through the work. As shown in FIG. 5 the blocks are located with the top surface separators **40** disposed along radial lines from the axis of the work piece and with the end faces **32** of said permanent magnet blocks facing inwardly in a triangular relation. To facilitate said grouping operation the side face **26** of each block is sloped inwardly at a 30° angle to form a bevel **82** at its inner end, which has the effect of shortening that portion of the end surface formed by the segment **36** and of permitting each block to be moved further inwardly along a radial line without contacting the side face of the adjacent block. The offset position of the top spacer **40** at one side of the top surface **24** taken in combination with the bevel **82** provides a holding arrangement of the permanent magnet blocks of maximum efficiency. When the magnet **60** is turned to the ON position a maximum amount of flux is drawn from the body of the permanent magnet block along its length and is concentrated in the tapered end area of the top surface **24** and in the work piece mounted thereon which bridges the separator **40**.

An alternative use of three such permanent magnet blocks is shown in FIG. 4 in which the blocks are grouped with the magnetic side surfaces **28** in a position of tangency to a circular work piece generally designated at **90**, the work piece being held in a position raised from the surface of the underlying chuck as shown in FIG. 7 to permit free movement of a tool as, for example, an internal grinding wheel entirely through the work piece without contacting the surface of the chuck. In the arrangement shown in FIG. 5 the operator would first position the three blocks with their end faces in the desired position and with the magnets turned off in each of the individual blocks while a work piece is being centered thereon. In the embodiment shown in FIG. 4, on the other hand, it is assumed that the blocks are assembled with the work piece **90** and are then individually energized so that the blocks and work piece are held together as a unit which can be slid freely over the face of the underlying chuck to an accurately gaged position therein whereupon the underlying chuck magnets are shifted to the holding position.

The invention having been described what is claimed is:

1. For use on a horizontally disposed magnetic flux holding surface, a permanent magnet block support for mounting a small work piece over a central open area which comprises three identical permanent magnet blocks closely grouped on said magnetic holding surface about a focal point at equal distances from said focal point providing a central open area and spaced at equal distances from one another and in identical angular positions about said focal point in which a corresponding magnet flux holding surface of each said block is most nearly adjacent said focal point, each said block comprising a rotatable cylindrical magnet extending the length of the block centrally thereof, said cylindrical magnet being magnetized so that the poles of said cylindrical magnet are on opposite sides of the magnet and extend longitudinally thereof, spacer separated flux bearing segments providing a substantial holding flux receiving base area, and rectangularly disposed external top, side and end surfaces of said block, a horizontal bore receiving said cylindrical magnet through a portion of said block above said holding flux receiving base area, a spacer extending from said bore and intersecting said top surface adjacent the edge of said top surface formed with one side of the block providing a magnet flux holding area across said spacer in said top surface adjacent said edge along the length of the block, a second spacer extending from the opposite side of said bore and intersecting the side surface opposite said above-mentioned side surface providing a magnet flux holding area across said spacer in said last mentioned side surface along the length of the block, corresponding vertical corners between each said side surface and an end surface of each said block being bevelled to facilitate said close grouping of said blocks.

2. For use on a horizontally disposed magnetic flux holding surface, a permanent magnet block support for mounting a small work piece over a central open area which comprises three identical permanent magnet blocks closely grouped on said magnetic holding surface about a focal point at equal distances from said focal point providing a central open area, and spaced at equal distances from one another and in identical angular positions about said focal point in which a corresponding top magnet flux holding surface of each said block is most nearly adjacent said focal point, each said block comprising a rotatable cylindrical magnet extending the length of the block centrally thereof, said cylindrical magnet being magnetized so that the poles of said cylindrical magnet are on opposite sides of the magnet and extend longitudinally thereof, spacer separated flux bearing segments providing a substantial holding flux receiving base area, and rectangularly disposed external top, side and end surfaces of said block, a horizontal bore receiving said cylindrical magnet passing through a portion of said block above said holding flux receiving base area, a spacer extending from said bore and intersecting said top surface adjacent the edge formed with one side of the block providing a magnet flux holding area across said spacer in said top surface adjacent said edge along the length of the block, the vertical corner between said side surface and an end surface of the block being bevelled and each said block having said end surface with the bevelled edge facing said focal point, and having said bevelled edge located closely adjacent the corresponding end surface of an adjacent block of the group.

3. For use on a horizontally disposed magnetic flux holding surface, a permanent magnet block support for mounting a small work piece over a central open area which comprises three identical permanent magnet blocks closely grouped on said magnetic holding surface about a focal point at equal distances from said focal point providing a central open area, and spaced at equal distances from one another and in identical angular positions about said focal point in which a corresponding magnet flux holding surface of each said block is most nearly adjacent said focal point, each said block com-

prising a rotatable cylindrical magnet extending the length of the block centrally thereof, said cylindrical magnet being magnetized so that the poles of said cylindrical magnet are on opposite sides of the magnet and extend longitudinally thereof, spacer separated flux bearing segments providing a substantial holding flux receiving base area, and rectangularly disposed external top, side and end surfaces of said block, a horizontal bore receiving said cylindrical magnet through a portion of said block above said holding flux receiving base area, a spacer extending from one side of said bore and intersecting a side surface of said block along the length of the block providing a magnet flux holding area across said spacer in said last mentioned side surface along the length of the block, a vertical corner between said side surface and an end surface of the block being bevelled, and each said block having the side surface with the spacer forming a magnet flux holding area therein facing said focal point, and with said bevel located adjacent the flux holding side surface of the adjacent block of the group.

4. A permanent magnet block for use as one of a set of three identical such blocks closely grouped on a flat magnetic flux holding surface as a permanent magnet block support for mounting a small work piece over a central open area at equal distances from a focal point, and spaced at equal distances from one another and in identical angular positions about said focal point, said block comprising a rotatable cylindrical magnet extending the length of the block centrally thereof, said cylindrical magnet being magnetized so that the poles of said

cylindrical magnet are on opposite sides of the magnet and extend longitudinally thereof, spacer separated flux bearing segments providing a substantial holding flux receiving base area, and rectangularly disposed top, side and end surfaces of said block, a horizontal bore receiving said cylindrical magnet through a portion of said block above said holding flux receiving base area, a spacer extending from one side of said bore and intersecting said top surface adjacent the edge of said top surface formed with one side of the block providing a magnet flux holding area across said spacer in said top surface adjacent said edge along the length of the block, a second spacer extending from the opposite side of said bore and intersecting the side surface opposite said above mentioned side surface providing a magnet flux holding area across said spacer in said last mentioned side surface along the length of the block, and vertical corners between each said side surface of the block and an adjacent end surface being bevelled to facilitate a close grouping of said blocks with the adjacent blocks in said group of three identical such blocks.

References Cited in the file of this patent

UNITED STATES PATENTS

2,243,616	Bing et al.	May 27, 1941
2,280,437	Levesque	Apr. 21, 1942
2,561,770	Anderson	July 24, 1951

FOREIGN PATENTS

335,222	Switzerland	Feb. 14, 1959