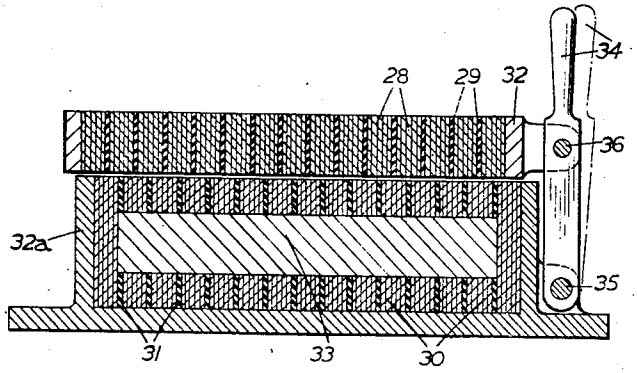
July 23, 1946. S. I. HITCHCOCK 2,404,710

PERMANENT MAGNET STRUCTURE

Filed July 2, 1943



INVENTOR

Stanley Isaiah Hitchcock

BY

Robert S. Waters

ATTORNEY

Patented July 23, 1946 2,404,710

UNITED STATES PATENT OFFICE

2,404,710

PERMANENT MAGNET STRUCTURE

Stanley Isaiah Hitchcock, London, England

Application July 2, 1943, Serial No. 493,238
In Great Britain July 14, 1942

4 Claims. (Cl. 175—367)

1

This invention relates to permanent magnet structures wherein a permanent magnet is associated with a soft iron or other armature member separated from the pole faces of the magnet by an intervening air gap or layer of insulating material.

It has been found in the course of experiments that if the poles of a permanent magnet are joined by a soft iron or other member of magnetic material having a high initial permeability such as "Mu-metal" which is divided up into sections, the sections being separated by non-magnetic material, that the lines of magnetic force will pass through the sections, although the sections with the intervening layers of non-magnetic material will have a higher reluctance than in the member comprised of a single piece of soft iron or other magnetic material.

It is proposed therefore in accordance with the present invention to provide a permanent magnet with such a flux path, and to construct another member for use with such a magnet, in a similar manner, said other member being separated from the sectioned member providing the flux path by an air gap or a layer of non-magnetic material, said other member and permanent magnet being relatively movable to permit of the sections comprising the flux path and the other member to lie opposite one another or to occupy a position in which they lie in staggered relationship. In this way the degree of attractive force between the permanent magnet and the other member can be varied as it has been found as a result of experiments, that when the various sections are oppositely arranged the lines of magnetic force pass mainly through the flux path, the attractive force exerted on the other member being nil or small whilst when the sections occupy a staggered position the lines of magnetic force take a zig-zag path through the flux path and the other member, the attractive force being then materially increased.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be further described with reference to the accompanying drawing, wherein the single figure is a sectional view disclosing a magnetic bench constructed in accordance with the present invention.

The application of this invention that is shown in the figure comprises a magnetic bench which includes a base and an upper member or table on which a workpiece or workpieces can be placed and retained firmly in position thereon during a machining or other operation. The table comprises members 28 composed of soft iron or other magnetic material having a high initial permeability and intervening spacing members 29 of non-magnetic material, the members 28 and 29 being enclosed within a surrounding frame 32 which may conveniently be die-cast from a suitable non-magnetic material.

2

The table is slidably mounted on a base likewise built up of members 30 of soft iron or other magnetic material having a high initial permeability and intervening non-magnetic spacing members 31, the members 30 and 31 being also enclosed within a surrounding frame 32a composed of non-magnetic material and formed for example by a die-casting process. The members 28 and 30 may if desired be of laminated construction.

Located within the base is a permanent magnet 33 the end faces of which adjacent the poles contact the adjacent members 30. The upper, lower and lateral faces of the magnet may either be in contact with the members 30 or separated therefrom by intervening spacing members of non-magnetic material or alternatively separated by an intervening air gap. The members 30 and 31 and permanent magnet are contained within a surrounding frame 32a which may be conveniently die-cast from a non-magnetic material.

The upper member or table when not in operation occupies the position shown in the figure in which position the members 28 of the table in the absence of the workpiece fulfill the function of a keeper, the members 28 absorbing the unwanted magnetic flux, the lines of magnetic flux following a zig-zag path of least reluctance through the members 30 and 28, the lines of magnetic flux being confined to the inner ends of the members 28. When the table is moved into a position in which the members 28 and 30 are in alignment, the lines of magnetic flux emanating from the poles of the magnet 33 pass upwardly through the aligned members 30 and 28 into the workpiece thus exerting a powerful attractive force on the workpiece and maintaining it in position on the table. When it is desired to increase the magnetic attraction to maintain the workpiece in position, the table is moved into a position in which the parts 28 and 30 are disposed in alignment, movement being effected by the lever 34 which is pivotally connected with the base at the point 35 and pivotally connected to the upper part or table at the point 36.

What I claim and desire to secure by Letters Patent of the United States is:

1. A permanent magnet structure comprising a permanent magnet having a flux leakage path between its poles, and an armature member for use therewith said flux leakage path and armature member being constructed in a similar manner and being built up of a series of members composed of soft iron or other magnetic material having a high initial permeability and intervening spacing members of non-magnetic material, and means for moving said armature member endwise from a position in which the soft iron members of the armature and flux leakage path lie opposite or in line into a position in which the parts occupy a staggered position and vice versa, for the purpose of controlling the passage of the lines of magnetic force emanating from the permanent magnet, through the armature member, and thereby increasing or decreasing the attractive force between the permanent magnet and its associated armature member.

2. A magnetic workbench comprising an upper member or table and a lower member or base, the table including a series of members composed of soft iron or other magentic material having a high initial permeability and separated by intervening members of non-magnetic material, the lower member likewise comprising a series of soft iron or like members with intervening non-magnetic spacing members, the lower member containing a permanent magnet and means for imparting relative movement to the upper and lower members to bring the soft iron or like members in the upper and lower members into a position in which they occupy a relatively staggered postion, or an inline position for the purpose of causing the permanent magnet to exert a sufficiently high degree of magnetic attraction on a workpiece placed on the table to retain it in position thereon, or to so reduce the magnetic attraction to permit of the workpieces removal.

3. A permanent magnet structure comprising two elements each including a like series of members of high initial permeability separated by intervening members of non-magnetic material, one of said elements overlying the other with the members of both elements extending in the same direction, one of said elements containing a permanent maget, and means for imparting movement to the other of said elements to shift the members of high initial permeability of said element to and from staggered position with respect to the like members of the other element to thereby vary the density of the magnetic field existing between the two elements.

4. A magnetic workbench comprising a table for the reception of the work, and a base, said table and said base each including a series of members of high permeability material separated by intervening members of non-magnetic material, the members of said table and said base extending in the same direction, the members included in said base enclosing a permanent magnet, the members included in said base and said table being each enclosed within a surrounding frame of non-magnetic material, and means for imparting movement to said table in a direction at right-angles to the length of said members to move the members included in said table into and out of staggered relationship with regard to the members included in said base to thereby control the lines of magnetic flux emanating from the permanent magnet, the members when in line permitting the maximum number of lines of magnetic flux to pass through the work, and the work to be held firmly on the table, the members when in a staggered position providing an alternative path for the lines of magnetic flux of a lower reluctance than that which they would have to take to pass through the work, the number of lines of magnetic flux passing through the work being thus reduced to a minimum, thereby enabling the work to be removed from the table without difficulty.

STANLEY ISAIAH HITCHCOCK.