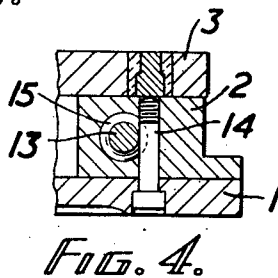
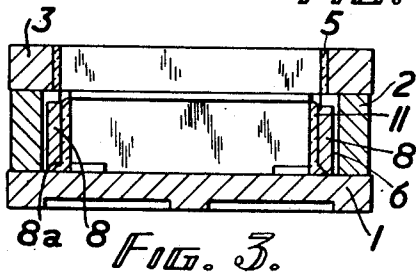
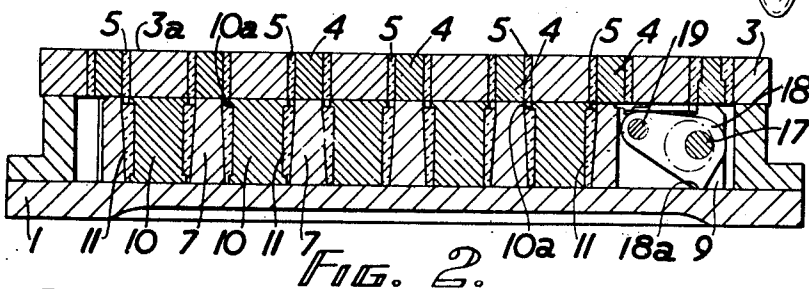
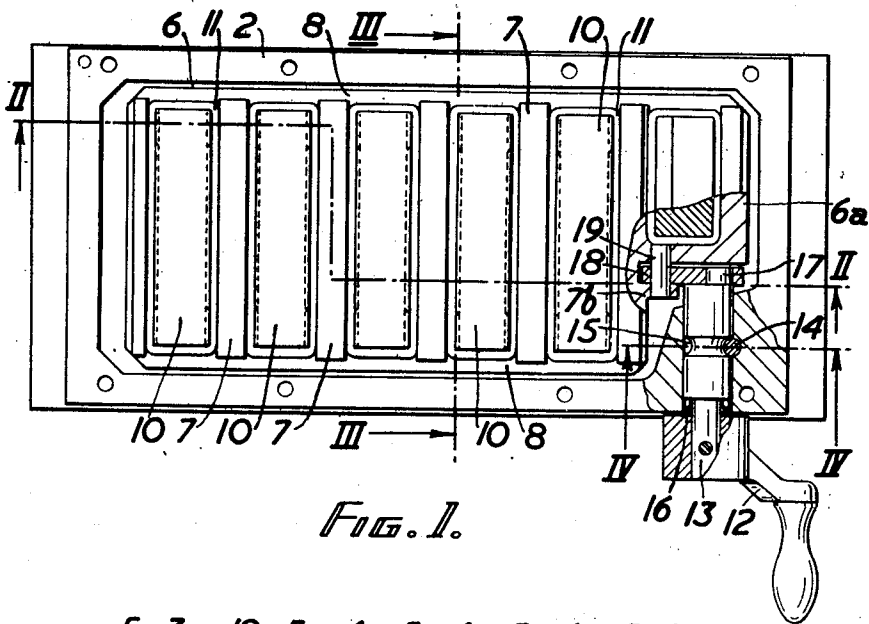


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MAGNETIC WORK HOLDER
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MAGNETIC WORK HOLDER

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1 Claim. (Cl. 175—367)

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This invention relates to magnetic work holders in which the magnetic holding force is produced by permanent magnets and mechanically movable means are provided for diverting the magnetic flux so as to demagnetise substantially the holding surface and thus facilitate removal of the work.

As at present manufactured the elements of a work holder of this type, i. e., the magnets, conductor bars of magnetic material and the necessary insulation between them, are all separately formed and then assembled into a pack and secured together by through bolts. In manufacturing such articles in numbers it is, of course, important to achieve maximum efficiency and regularity of performance as between individual work holders of a batch constructed to a common specification for a given duty, and this involves both precision in the manufacture of the elements themselves and precision in their assembly into the magnet pack, and from the point of view of magnetic efficiency the best and fullest use possible of the magnetic elements.

The present invention is designed to achieve these objects and moreover to provide a method of manufacture which will be more rapid and economical than that hitherto adopted. The conception underlying the invention is that by suitable methods the non-magnetic material necessarily employed for isolation purposes can also be used for the consolidation of the parts into a solid unitary structure.

The preferred method of accomplishing this according to the invention is by first forming the conductor bars or magnets in the form of a grid and then positioning the magnets or conductor bars of magnetic material as the case may be and casting the non-magnetic material—usually white metal—into this grid-like pack so that the whole is mechanically consolidated with the magnet and conductor bar elements united but magnetically isolated from one another.

This method of manufacture results in advantages both in the expedition of assembly and in both mechanical and magnetic efficiency, since apart from the solidity and regularity of the finished packs the conductor bars can be cast in tapered form and the necessity for rolling special taper section material, as would otherwise be necessary if this taper form is adopted, is avoided; and since there are no bolts passing through the structure there is no diminution of the magnetic material and a smaller and more compact structure for a given duty results.

The invention, therefore, in its broadest aspect

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consists of a magnetic work holder of the type defined wherein the magnets and conductor bars of magnetic material forming the magnet assembly or pack are united mechanically and isolated magnetically by non-magnetic material cast into the spaces between them.

In its preferred form, a chuck according to the invention consists of a casting of magnetic material comprising a series of conductor bars formed as a grid, permanent magnets inserted in the grid spaces between the conductor bars, said magnets being isolated from the conductor bars by cast-in non-magnetic material.

The invention also comprises the method of manufacture of magnetic work holders of the type defined according to which the conductor bars of magnetic material and magnets are positioned in predetermined spaced relation and united into a solid structure by casting non-magnetic material into the spaces between them.

The accompanying drawings illustrate by way of example a preferred form of magnetic work holder according to the invention.

In the drawings:

Figure 1 is a plan view partly in section of the improved magnetic work holder,

Figure 2 is a section on the line II—II of Figure 1,

Figure 3 is a section on the line III—III of Figure 1,

Figure 4 is a part section of Figure 1 on the line IV—IV.

The holder comprises a hollow rectangular casing built up from a mild steel base plate 1, a rectangular frame of aluminium bronze 2 which constitutes the walls of the casing and a top plate 3 whose upper face constitutes the work holding surface. The top plate is formed with seven parallel slots extending across almost the full width of the interior of the casing and within each of these slots there is located a pole piece 4 which is of the same thickness as the body of the top plate and like it is made of high permeability magnetic material. The pole piece is slightly narrower and shorter than the slot in which it is located, the gap between the pole piece and the body of the top plate being completely filled by casting in white metal 5, so that the pole pieces 4 are integrally united with the body of the top plate 3 but are magnetically isolated from it.

The magnet assembly is slidably disposed within the casing and its construction constitutes the present invention. In the particular construction illustrated the assembly or pack comprises

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a grid of silicon iron which is an integral casting, but may be regarded as composed of seven transversely disposed conductor bars 7 of magnetic material, which extend the full depth of the interior of the casing, connected together at their ends by longitudinal members 8, which are of lesser depth so that they are clear of the top plate. Six of the magnetic material conductor bars are of the same length as the inserts in the top plate but the bar at one end is shorter, leaving at one corner of the grid an approximately rectangular recess 9 which accommodates the control gear described below. The spaces between the conductor bars 7 receive five long and one short permanently magnetised bars 10 which are of the same depth as the conductor bars, so that their polar faces engage the base and top plates respectively. The permanent magnets are slightly narrower and shorter than the spaces in the grid within which they are accommodated, and after they have been positioned the gaps between them and the magnetic material conductor bars of the grid are filled by casting in white metal 11, so that the magnets are mechanically united with the grid to form a solid block or pack, but are magnetically isolated from the grid. In order that the white metal may securely hold the magnets in position in the grid, the longitudinal members 8 of the grid 5 have the inner side of their lower edges beveled off as at 8a and the bars 7 are slightly tapered in thickness in the upward direction to the level, or adjacent the level, of the top of the longitudinal member. This tapering of the bars is advantageous in that by the dispersion of the magnetic flux over the major portion of the length it permits the use of a material such as silicon iron and enhances results where high permeability materials are employed. The permanent magnets are formed with projecting flanges 10a which extend along the whole length of their upper edges and for a short distance from each end of their lower edges.

The operating gear is accommodated in the cut away corner of the magnet assembly. It comprises a crank handle 12 secured on the reduced outer end of a horizontal shaft 13 which passes rotatably through a thickened part of the side wall 2 of the casing. The shaft is retained in position by a vertical bolt 14 which engages an annular groove 15 in the shaft. The reduced outer end of the shaft is surrounded by a cup washer 16 which prevents the escape of oil from the casing. Integrally formed on the inner end of the shaft is an eccentric pin 17 which engages rotatably in a hole in the outer end of a connecting link 18 extending longitudinally of the casing. The inner end of this link is received between the short longitudinal member 8a of the grid which bounds the space for the short magnet and a lug 7b projecting from the adjacent magnetic material conductor bar, the link being connected to these parts by a pivot pin 19 preferably offset from the centre line of the eccentric pin 17. Rotation of the shaft through 180° produces the required longitudinal displacement of the magnet assembly, the movement being limited by the engagement of a projecting portion 18a of the connecting link with the base plate 1 of the casing.

When the operating handle is in the "on" position, the upper faces of the permanent magnets 10, which are arranged with like poles uppermost, lie immediately beneath and in contact with the under surfaces of the portions 3a of the top plate 3 left standing between the slots in that plate,

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these portions of the top plate being of the same width (measured longitudinally of the casing) as the upper surfaces of the magnets. The upper faces of the magnetic material conductor bars 7 lie immediately beneath and in contact with the inserted pole pieces 4 of the top plate, those pole pieces being of the same width (measured longitudinally of the casing) as the upper surfaces of the intermediate bars 7; the two end bars are of lesser width. Thus, when the magnet assembly is in the position described and a work piece of magnetic material is resting on the upper face of the top plate 3, a magnetic circuit is established from the upper pole of a magnet 10, through the body of the top plate 3, the work piece, an inserted pole piece 4 of the top plate, a magnetic material conductor bar 7 of the grid and the base plate 3, back to the lower pole of the magnet. When the operating handle is moved to the "off" position, the magnet assembly is shifted towards the other end of the casing through such a distance that the gaps between the permanent magnets 10 and the magnetic material conductor bars 7 are bridged on one side of the magnets by the body of the top plate 3 and on the other side of the magnets by the inserted pole pieces 4 of the top plate. A magnetic circuit from the upper to the lower pole of each magnet is thus completed through the top plate 3, magnetic material conductor bars 7 and base plate 1, substantially the whole of the magnetic flux being shunted out of the work piece, which can accordingly be removed readily.

The invention is not of course limited to the precise construction described above, many modifications being possible so long as the fundamental conception of first arranging a grid structure of the magnets and magnetic material conductor bars and then consolidating and uniting the parts into a solid structure by casting in the non-magnetic material is preserved. For example, in the construction shown and described the conductor bars are formed as an integral casting. It would, of course, be possible, but with less advantage to form this grid structure from separate parts welded or riveted together. It would also be possible, again with less advantage, to form the grid of the magnet material and then position separate magnetic material conductor bars as inserts and unite by casting in the non-magnetic material.

It will be understood that for large sizes the grid structure may be made up of two or more grid units connected together prior to the casting in of the non-magnetic material to effect the unity and consolidation of the magnets and the conductor bars.

By means of the invention the necessity for securing bolts in the magnet assembly is entirely eliminated the non-magnetic material being utilised to perform the two fold function of effecting the necessary isolation of the parts and their amalgamation into a solid structure.

I claim:

A magnetic work holder, comprising a top plate of magnetic material formed with a plurality of transversely disposed parallel slots therein, an equal plurality of pole pieces of magnetic material, each disposed in one of said slots in said top plate, each of said pole pieces having a thickness equal to that of said top plate and a length and a width less than those of the corresponding slot, thereby forming an annular gap about each pole piece, non-magnetic material filling the annular gaps between said pole pieces and said

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top plate, a base plate of magnetic material disposed in spaced parallel relation to said top plate, a frame of non-magnetic material extending between said top plate and said base plate and secured to each of them, said top plate, frame and base plate together constituting a closed hollow casing, a grid of magnetic material slidably disposed within said casing, said grid including a plurality of transversely disposed parallel tapering conductor bars of magnetic material extending the full length of the interior of the casing, said conductor bars tapering in an upward direction so that the bases of said bars are wider than their upper ends, and a pair of longitudinal members connecting together the ends of said conductor bars and of lesser depth so as to be spaced apart from said top plate, said conductor bars and longitudinal members together defining a plurality of transverse recesses extending through the thickness of said grid, a plurality of permanent magnets, each disposed in one of said recesses and having their polar faces engaged with the inner surfaces of said top and base plates respectively, each of said magnets having a length and width less than

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those of the recess in which it is disposed so as to be spaced apart both from the conductor bars and from the longitudinal members of the grid, non-magnetic, low-melting-point metal cast into the annular gaps between said magnets and said grid and uniting said magnets with said grid to form a solid block, and means extending through the wall of said hollow casing for causing longitudinal sliding movement of said block within said casing.

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