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MAGNETIC HOLDING DEVICE

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1 Claim. (Cl. 33—75)

My present invention relates to a magnetic holding device, adapted to maintain two pieces of iron or steel in a desired relative position.

An object of this invention is to provide a device for securely holding in position, at a selected angle to each other, two pieces of ferrous metal to be joined together by welding, soldering or other temporary or permanent bonding processes.

Another object of this invention is to provide a device of this character having means for immediately and precisely indicating the angle enclosed by two work pieces held thereby.

In accordance with a feature of my invention I provide a holding device comprising a pair of pivotally interconnected, relatively swingable arms each bearing on its free end, remote from their pivot, a magnetic retaining head having a housing with a flat work face whence emanate the lines of force of one or more magnets positioned within the housing. The arms are provided with clamping means, such as a handle threadedly engaging a bolt serving as their pivot, for locking them in a selected relative angular position.

According to another feature of my invention there are provided two relatively movable indicator members, such as a scale and a pointer, respectively supported by the two arms so as to enable a direct reading of their relative angular position. Advantageously, the indicator members are calibrated to give a zero reading in a position of coplanarity of the two work faces. The arms may further be provided with co-operating abutment means establishing a limiting position therefor, this limiting position being preferably displaced by an angle of 90° from their position of coplanarity.

A further feature of my invention resides in a novel construction of each retaining head designed to furnish a maximum of magnetic flux paths adapted to be closed through a ferromagnetic member placed in contact with the gripper face. In accordance with this feature I position one or more magnets, preferably of the permanent type, in an annular zone spaced from the rim of the generally cup-shaped, ferromagnetic housing so that the pole face or faces thereof are flush with this rim, whereby a first annular air gap is formed between this zone and the rim; and I also insert into the housing a central ferromagnetic stud, spaced from the magnet or magnets, so that a second annular air gap is formed between this stud and the magnetic zone. The voids left between the rim, the stud and the magnet or magnets may be filled up, in whole or in part, with coplanar spacers of non-magnetic material which together with the former define the work face of the retaining head. The axes of the two work faces are preferably located in a common plane transverse to the pivotal axis of the swingable arms.

A device of this type may be employed not only in welding or otherwise joining two members together but also to facilitate the scribing of a ferrous body in a pre-

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determined angular position relative to a support, as well as for a variety of other uses.

The above and other objects, features and advantages of my invention will become more fully apparent from the following detailed description, reference being had to the accompanying drawing in which:

Fig. 1 is an elevational view, partly in section, of a device embodying the invention;

Fig. 2 is a top plan view, partly in section on the line II—II of Fig. 1, of the same device;

Fig. 3 is a bottom view of one of the grippers of the device, taken on the line III—III of Fig. 1; and

Figs. 4 and 5 are views similar to Fig. 3, showing two modifications.

The device shown in Figs. 1-3 comprises two arms 1 and 2, which are relatively swingable about a pivot constituted by a threaded bolt 14. Each of arms 1 and 2 has secured to it, by means of a screw 4, a magnetic retaining head 3. Arm 1 terminates, at its end opposite the one bearing its head 3, in a disk-shaped coupling element 5 integral with that arm and provided with a conical central boss 6; this boss has an axial bore 7 whose female threads 8 matingly engage the male threads on bolt 14. For its proper positioning inside the bore 7, bolt 14 is provided with a hexagonal socket 13 adapted to receive a complementary wrench not shown. It will be understood that threaded bore 7, which is only in part occupied by the bolt 14, may also receive male fastening means, such as a screw 32 (as shown in dot-dash lines), by which the device may be secured to an external support.

Arm 2 terminates, at its end opposite to the one bearing the other head 3, in a disk-shaped coupling element 9 integral with it and complementary to coupling member 5. Coupling element 9 is of frustoconical configuration and has an axial bore 10 which is unthreaded and large enough to be traversed by the bolt 14 with some clearance. The base of the frustocone is stepped to form shoulders 11 and 12 received in complementary recesses of coupling element 5. Thus, element 9 is positively maintained in a position of concentricity with element 5.

The projecting free end of bolt 14 is engaged by the internal threads 15 of a handle 16 adapted to clamp the two coupling elements tightly together when rotated into a locking position.

Each of the heads 3 comprises a generally cup-shaped housing 17 of soft iron in which is seated an annular permanent magnet 18 magnetized in an axial direction, its two poles having been indicated at N and S. The height of magnet 18 equals that of the cylindrical portion of housing 17 so that one of its poles (here the South pole S) lies flush with the rim of that housing. A soft-iron stud 19 is centrally positioned within housing 17 and magnet 18 and is held in position by the screw 4, its length equaling the axial length of the magnet. The voids formed between the magnet and its yoke 17, 19 are filled, at least in the region remote from the bottom of cup 17, by annular spacers 20 and 21 of non-magnetic material, e.g. brass, spacer 20 being interposed between boss 19 and magnet 18 while spacer 21 is inserted between the latter and housing 17. Thus, the aligned extremities of members 17-21 constitute an unbroken surface 23 against which a work piece, such as a sheet 26 or 27 as indicated in dot-dash lines in Fig. 1, may come to rest. The work faces 23 of the two retaining heads are parallel to the axis of pivot 14 and equidistant therefrom.

The flux emanating from magnet 18 has been indicated by lines of force 22 which emerge from the work face 23 and, in the absence of a work piece, close through the annular air gaps existing across the spacer rings 20

and 21. This flux will thus almost entirely pass through the work piece when the latter is operatively positioned against the retaining head, thereby firmly keeping this work piece attracted.

A degree scale 24, provided on the conical face of coupling element 9, and a pointer 25, provided on a peripheral zone of element 5 surrounding this scale, cooperate to indicate the relative angular position of the work faces 23 of the two heads 3. In the position illustrated in Figs. 1 and 2, the pointer 25 is aligned with the zero mark of scale 24 to indicate that the two work faces, and therefore the work pieces 26 and 27 held by them, are in exact alignment with each other. It will be noted that the general direction of the arms 1 and 2 is inclined relatively to their respective work faces so that an angle other than zero is enclosed by these arms in the illustrated position of operative alignment. The arms are, furthermore, provided with abutments 28, 29 which, by their mutual engagement, define a limiting angular position in which the work faces 23 are exactly perpendicular to each other, the pointer 25 then indicating an angle of 90° on the scale 24. The total range of relative rotation of the two arms, indicated by the arrows 30, is approximately 270°.

For a more accurate determination of the angular position of the work faces, the pointer 25 may form part of a vernier scale 31 provided on coupling element 5.

It will be noted that the largest radius of the coupling elements, i.e. the outer radius of the annular zone of element 5 bearing the vernier scale 31, is less than the distance of the plane of either face 23 from the pivotal axis of the arms 1 and 2 so that these elements will not interfere with the positioning of the work pieces 26 and 27 which are to be welded together or otherwise operated upon in a selected relative position.

In Fig. 4 I have shown a modified retaining head 103 whose housing 117, stud 119 and annular spacers 120, 121 are similar to the elements 17, 19, 20 and 21 of the preceding embodiment but wherein the single annular magnet 18 has been replaced by a series of rod magnets 118. The operation of this retaining head is similar to that of head 3 in that a strong magnetomotive force is again developed across the major portion of its working surface.

A retaining head according to the invention may also be provided with more than one annular magnetic zone. In Fig. 5 the head 203 is provided, between the periphery of its housing 217a and its center stud 219, with a dividing ring 217b of soft iron which together with the elements 217a and 219 of like material constitutes a three-legged yoke. Concentrically positioned between the legs of this yoke are two annular magnets 218a, 218b having

pole faces of like polarity (here their North poles) flush with the rim of housing 217a. Rings 220a, 220b and 221a, 221b of brass or other non-magnetic material serve as spacers between the magnets and the yoke, all the elements shown in Fig. 5 being level with one another to define again an unbroken work face.

Other modifications and adaptations of the principles herein disclosed will readily be apparent to persons skilled in the art and are intended to be embraced in the scope of my invention as defined in the appended claim. Thus, for example, it may be desirable (especially for larger devices) to use a larger number of magnetic zones and/or to replace the permanent magnets by electromagnets.

I claim:

15 A magnetic holding device comprising a generally cup-shaped first coupling member, a generally disk-shaped second coupling member concentric with and rotatably received in said first coupling member, a pair of arms each provided with a flat work face and extending from a respective one of said coupling members, said arms being swingable about the common axis of said coupling members and enclosing with each other an obtuse angle in a co-planar position of said work faces, said coupling members being provided on adjacent surfaces with co-
20 operating markings indicating the angle enclosed by said work faces in different relative angular positions of said arms, abutment means on said arms engaging each other in a limiting position in which said angle is 90°, said abutment means enabling a relative rotation of said arms
25 through an angle of substantially 270°, and locking means traversing said coupling members for releasably securing them in a selected angular position, said second coupling member having a conical face bearing some of said markings.

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