

The present invention relates to a device for clamping workpieces in which at least a shaft portion has a round or prismatic shape, particularly for clamping electrode body blanks for electroerosive machining apparatuses.

Electrode bodies for electroerosive machining apparatuses are tools that have to be clamped to the machining apparatus with extremely great precision, not only with regard to centricity, but also with regard to torsion relative to their central axis. Such electrodes are manufactured from blanks, e.g. from prismatic, square or round copper bars, by turning and/or milling and/or grinding, the blank having to be clamped in the turning, milling or grinding machine while being thus machined. Machining the blank defines a theoretical central axis in the tool which serves as a reference during the electroerosive machining process.

The blank having been clamped and shaped into an electrode body, said theoretical central axis is well defined with reference to the clamping apparatus, and it is most desirable to not now have to remove the electrode body from the clamping apparatus. Each subsequent clamping of the tool, even if the clamping apparatus is manufactured to an extremely high standard of precision, results in a more or less pronounced shift of said theoretical central axis relative to the axis of the clamping apparatus, which is, of course, highly undesirable in view of the high precision demanded in electroerosive machining processes.

Suitable coupling devices for the clamping of electrode bodies to electroerosive machining apparatuses are known which allow highly precise central positioning, including exactly maintaining a predetermined desired angular position of the tools on the erosion machines. In many cases, however, it is not possible to fasten the electrode

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blank directly to a coupling device of such an apparatus, so that it is necessary to interpose a clamping device. Besides the stability and precision required, such a clamping device also has to be as inexpensive as possible, since electrodes for electroerosive machining systems sometimes have to be stocked in lots of several hundred.

From French Patent 514,448 a supporting and clamping apparatus for workpieces that are to be machined is known, comprising an essentially cylindrical support member provided with a V-shaped groove and carried by a plain flange provided with fastening holes, said support member exhibiting an essentially annular clamping element equipped with a clamping screw. Said clamping element can be pushed onto the support member in three different positions depending on the type and design of the workpiece to be held by the support member. This apparatus is comparatively complicated and therefore expensive to manufacture, even if only modest requirements have to be met in terms of the precision of the clamping. Moreover, the fact that the support member is elongate and only anchored to the mounting flange on a relatively small front face means that the stability offered by this apparatus is far from adequate where extremely high machining accuracy has to be demanded, as for instance with electrodes for erosion machines.

Other clamping devices for prismatic or round bodies may well be known that are able to meet the demands made of them regarding precision and stability, but these are disproportionately expensive and thus cannot be considered suitable for the purpose envisaged, since to stock several hundred electrodes clamped in such clamping devices would be too costly a procedure. However, it is not usually possible to stock just the electrodes themselves, in the unclamped state, because removing the electrode from the

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fixture and subsequently reclamping it usually prevents the necessary precision in terms of maximum accuracy of positioning from being achieved.

It is therefore an object of the present invention to provide a clamping device of the type mentioned at the start and described in more detail in the preamble of Claim 1, which not only has the desired characteristics with regard to stability and clamping accuracy, but is in addition very inexpensive to manufacture and thus constitutes a cheap component that can be stocked even in large quantities without tying up a large amount of capital. This dispenses with the need for unclamping and reclamping the electrodes and thereby ensures a degree of precision satisfying even the most stringent demands.

It is a further object of the invention to provide a clamping device of the above-mentioned type that is universally suitable for round or prismatic workpieces, or those with a round or prismatic shaft portion, and which can be used with various workpiece or shaft sizes and at the same time allows the workpiece to be quickly clamped with ease.

In a clamping device of the type mentioned at the start these objects of the invention are achieved by the features listed in the characterising part of Claim 1. Refinements and particular embodiments of the clamping device of the invention are defined in dependent Claims 2 to 7.

One working example of the subject-matter of the invention will now be described in more detail with reference to the accompanying drawings, in which:

Fig. 1 is a graphical representation of a clamping device with a prismatic workpiece blank clamped therein,

Fig. 2 is a view of the empty clamping device from the clamping side,

Fig. 3 is a cross-section through the clamping element in which a workpiece is clamped,

Fig. 4 is a partially cut-away side view of an empty clamping element, and

Fig. 5 shows various insert plates.

The clamping device designated overall by 1 includes as the clamping element a clamping block 2, which is essentially cubical and is preferably manufactured from steel. The lower surface 3 of the clamping block 2 in Fig. 1 has been machined to be exactly plain and is provided with means for attachment to a coupling device, machining apparatus, or similar; said means will be described in more detail below. A clamping chamber 5 is recessed in the surface 4, opposite the lower surface 3, of the clamping block 2. Said clamping chamber has an essentially square cross-section, the corners being provided with rounded recesses 6. The depth of the chamber 5 is somewhat less than the height of the clamping block 2, so that the chamber 5 is sealed by a floor 7 integrally formed with the clamping element 2.

The clamping chamber 5 is thus delimited by four walls 8, 9, 10 and 11, which together with the floor 7 form the clamping element proper. In the present example the outer contour of the clamping block 2 is of square cross-section, but a rectangular or round cross-section is

equally possible. The lateral edges of the clamping block 2 are provided with chamfers 12 which extend along part of its height, facing the upper surface 4.

Two adjacent walls of the clamping block 2, in the present example walls 8 and 11, are each provided with a clamping screw, 13 and 14 respectively, which are received in a threaded drillhole passing right through the respective wall. These clamping screws are used to clamp a workpiece, which in the example shown in Fig. 1 has the shape of an elongated rod 15 with rectangular cross-section. The workpiece may be a copper rod, of the sort used as blanks for producing erosion electrodes for erosion machines. The cross-section of the rod 15 is in all dimensions less than the cross-section of the clamping chamber 5. A pair of insert plates 16 and 16', the design of which will be described in more detail below, are used to clamp the rod 15 at least approximately centrally.

The essential point is that after the clamping screws 13 and 14 have been tightened, the rod 15 is pushed against the plates 16 and 16' and thereby against the inner surface of the opposing wall, 9 and 10 respectively. The requirements that have to be set with regard to plainness and angular orientation of the inner faces of the walls 8 to 11 are not very stringent; it is only important for the workpiece, e.g. the rod 15, to be immovably and more or less centrically held in the clamping chamber 5.

As can be seen from Fig. 5, the clamping device includes a set of a plurality of insert plates 16a.....16x, the height c of which roughly corresponds to the depth C (Fig. 4) of the clamping chamber 5. The width b of the plates 16a.....16x is dimensioned so as to correspond to just over half the lateral length B (Fig. 2) of the clamping chamber cross-section. This ensures, as can also be seen

from Fig. 3, that each insert plate 16a.....16x, irrespective of how it is placed in the clamping chamber 5, always covers the centre of the associated side wall 8 to 11.

The thickness a of the individual plates varies; the thickness of the individual plates 16 may be graduated by 0.5 or 1 mm. In the present example the thickness of plate 16a is 0.5 mm, that of plate 16b 1 mm, that of plate 16c 2 mm, and that of each subsequent plate 16d.....16x increases by 1 mm. Preferably this set of insert plates includes several plates 16 each of the same thickness, but at least two plates 16a.....16x each of the same thickness. Plate 16x may be of a thickness slightly less than half the gap between two opposing walls 8 and 10 or 9 and 11, thereby also enabling workpieces of very small dimensions to be clamped. Of course, there is also the alternative of combining several stacked plates 16 on each side in order to reach the desired overall thickness.

The procedure for clamping a workpiece 15 with rectangular cross-section is as follows: The gap B (Fig. 2) between opposing walls 8 and 10 or 9 and 11 of the chamber 5 is known; the two cross-sectional dimensions y and z of the workpiece 15 can be measured. As plate 16 (Fig. 1), one is selected from the set with a thickness corresponding to half the difference between the value B and value y . Correspondingly, as plate 16', one is selected from the set with a thickness corresponding to half the difference between the value B and the value z . Thus the centre of the rod 15 lies at least approximately in the centre of the clamping chamber 5 and thus of the clamping block 2. If the centricity of clamping of the workpiece has to meet very high requirements, additional insert plates may be provided with a thickness in the range 1/100 to 1/10 mm and which may be inserted in the clamping chamber 5 in

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addition to the more coarsely graduated plates 16a.....16x. Usually, however, it is of no great importance whether the workpiece now lies exactly in the centre of the clamping apparatus, since the blank will only subsequently be machined and it is then that the exact theoretical central axis will be determined.

The only important point is that once it has been clamped therein the workpiece 15 must remain immovably and securely clamped in the clamping device, on the one hand while it is machined and on the other while it is stored. In the present case this is ensured by the robust, simple design of the clamping block 2.

Fig. 3 shows the clamping of a round workpiece 15a. For this purpose an additional clamping screw 17 is provided, arranged in the vicinity of one corner of the clamping chamber 5, preferably the corner enclosed by the walls 8 and 11 equipped with the clamping screws 13 and 14. In other respects the design and the procedure for clamping are exactly the same, two plates 16 and 16' of the same thickness logically being used. The chamfers 12 mentioned above facilitate the positioning of the additional clamping screw 17, which runs essentially diagonal to the cross-section of the clamping chamber 5.

It can be seen from the illustration in Fig. 4 that the lower surface 3 of the clamping block 2 is provided with recesses 18 and threaded holes 19. These serve to receive means (not shown) for fixing and centering the clamping block 2 on a machining apparatus.

The clamping device proposed in accordance with the invention provides a simple, accurate and robust means of quickly and securely clamping erosion electrodes in particular, or alternatively the blanks for manufacturing

them. The dimensions of the clamping chamber 5 can generally be selected so as to accommodate almost all sizes of electrode; this naturally makes them simpler to manufacture and store, as only one type of clamping block 2 is required for the most varied electrodes. The insert plates are simple components which can be inexpensively manufactured with the required precision, thus allowing a large selection to be kept in stock.

One surface only of the clamping block 2, viz. surface 3, has to be very accurately machined, e.g. face-ground, as it is only by means of this face or the means fixed thereon that the clamping device 1 will be attached. Once fully machined, the electrode always remains clamped in the clamping device 1, even if it is put into storage. This is possible without entailing great capital expenditure because the clamping device is a cheap component, while the fact that it is not now necessary to unclamp and then reclamp the electrode ensures that the latter is positioned with the required high precision.

The closed design of the clamping block 2, which is preferably manufactured from free-cutting steel, makes the clamping device very strong, so that the workpieces are safely and immovably anchored by tightly screwing down clamping screws 13 and 14, and 17.

CLAIMS

1. A device for clamping workpieces in which at least a shaft portion is round or prismatic in shape, particularly electrode body blanks for an electroerosive machining apparatus, said device comprising a clamping element incorporating a plainly machined surface (3) adapted to rest on a receiving member of a machining apparatus, characterised in that the clamping element is constituted by an essentially cubical clamping block (2), the surface (4) thereof opposite to said plainly machined surface (3) having a centrally recessed clamping chamber (5) of at least approximately square cross-section, clamping screws (13, 14) being provided at least in two adjacent walls (8, 11) of the clamping chamber (5) and penetrating said walls, and that the device further includes a set of plate-type spacer bodies (16) of different thicknesses which are adapted to be inserted into the clamping chamber (5).

2. The clamping device according to Claim 1, characterised in that the corners of the clamping chamber (5) are provided with recesses (6) of cylindrical shape.

3. The clamping device according to one of Claims 1 or 2, characterised in that a further clamping screw (17) is provided in the corner enclosed by the two walls (8, 11) that are equipped with clamping screws (13, 14), said further clamping screw (17) extending essentially diagonal to the clamping chamber (5) and projecting into the latter.

4. The clamping device according to one of the preceding claims, characterised in that the set of plate-type spacer



bodies includes a plurality of insert plates (16a.....16x) which differ in thickness (b) from one to the other by 0.5 or 1 mm.

5. The clamping device according to Claim 4, characterised in that a plurality of additional insert plates (16) is further provided which have a thickness in the range 1/100 to 1/10 mm.

6. The clamping device according to Claim 4 or 5, characterised in that the length (c) of the insert plates (16a.....16x) corresponds to the depth (C) of the clamping chamber (5) recessed in the clamping element (2).

7. The clamping device according to one of Claims 4 to 6, characterised in that the width (a) of the insert plates (16a.....16x) is greater than half the width of the walls (B) of the clamping chamber (5).



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