

Background of the Invention

The present invention relates to a clamping device for parts, workpieces, molds, as defined by the preamble of claim 1.

A known clamping device of this type comprises a base plate, which consists of a single piece and which is equipped, in the central portion of its bottom, with an inclined nut which is engaged by the lower portion of a screw with right-hand thread; while the upper portion of the same screw, which is provided with a left-hand thread, engages a nut of a jaw seated in prismatic guides in the base plate. The prismatic guides provided on both sides of the jaw are formed integrally with the base plate, the prismatic guides, and the screws as well, extending obliquely from the upper rear in downward and forward direction so that when the clamping jaw is adjusted it automatically moves in downward and forward direction (DE-C-145 123).

It may be a problem of this known clamping device that the

prismatic guide must be worked into the base plate by a laborious process and that, if a certain degree of precision is to be achieved regarding the straight-line motion of the jaw, both the prismatic guide and the complementary surfaces of the clamping jaw engaging the latter must be produced with corresponding precision. Still, it can never be excluded that increased wear may occur in constant use because the prismatic guides for the clamping jaw consist of the same cast material as the base plate.

Another known low-pressure clamping device (see leaflet "Sind hohe Vorrichtungskosten und Rüstzeiten Ihr Problem" ("Do you have problems with high tooling costs and set-up times?"), blüco technik 86, page 20) comprises a base body arranged to be fixed on a base plate forming part of a modular clamping system, for example by means of screw bolts or hexagon socket screws. The base body carries a bearing block comprising two successive inclined sliding surfaces disposed in axially spaced arrangement. A clamping element seated on the bearing block exhibits similar inclined sliding surfaces so that it can be fixed, depending on its position relative to the bearing block, either in a forward - viewed toward the workpiece - and lower position or in a more rearward and, then, higher position. For fixing purposes and for the purpose of producing the pressure required, for example, for clamping a workpiece, there is provided a screw which can be screwed into the bearing block so as to exert a pressure upon the clamping element from above, via the screw head which is considerably enlarged by a corresponding washer, so that the clamping element is urged downwardly and toward the workpiece along the inclined surfaces forming oblique planes. However, this forward movement of the clamping element is rendered possible only

because the bore receiving the clamping screw in the clamping element offers ample play, in any case in the direction of displacement, which means that it takes the form of an oblong hole. The displacement is, however, limited in this case by the contour of the oblong hole, and generally it may be a problem with the known low-pressure clamping device that the clamping element is held only loosely, at any rate as long as it does not engage the workpiece to be clamped under pressure, which means that being merely retained in an oblong hole it is not guided in any manner on the bearing block.

As regards the clamping technology for workpieces, parts, molds, or the like - the field where the present invention also finds its preferred applications - reference is made generally to the following publications: Paper by Gallien/Hammer entitled "Wirtschaftlich Rüsten von Baukastenvorrichtungen am Arbeitsplatz" ("Setting up modular devices economically at the workplace") published in "tz für Metallbearbeitung" 1983, No. 5, or the paper by Schwolgin entitled "Rasterspannsystem mit CAD-gestützter Programmkontrolle reduziert Maschinenrüstzeiten" ("Modular clamping system with CAD-assisted program control reduces machine set-up times") published in "dima", No. 6/86, pages 126-134.

Apart from the known low-pressure clamping device, there are a number of other clamping devices suited for mounting dies or workpieces on modular clamping plates which find their application in the construction of jigs and fixtures, in metal cutting processes, in the preparation of operations at bench workplaces, or the like, for example a particular "blüco" clamping device, see page 19 of the before-mentioned

leaflet, which comprises a clamping element which is held in the bearing block to pivot about a fulcrum point and which is urged forwardly, by a threaded bolt, about the fulcrum point and toward the workpiece, the threaded bolt acting from the outside upon the pivoted clamping element and being held only by threaded engagement with the bearing block, or a ball-type clamping device comprising a clamping strip which is held above the base strip and which can be urged downwardly by the screwing action of nuts or studs so as to exert a pressure in the area of two forward semi-spheres.

Now, it is the object of the present invention to provide a clamping device where the clamping element is guided in the bearing block precisely and yet substantially free from friction.

Advantages of the Invention

The present invention achieves this object with the aid of the characterizing features of the main claim and provides the advantage that the clamping elements can be guided and displaced in the bearing block with particular precision. This is due to the fact that in the case of the arrangement according to the invention the movement of the clamping element is guided over its full length by separate journals - in contrast to the case where lateral studs are provided only in the area of the nut, as in the case of the clamping element according to the before-mentioned DE-C 145 123, where moreover the prismatic guides receiving these studs on both sides are formed integrally with the base plate and the other nut.

By designing the journals, which are received precisely and safely in the U shape of the bearing block, as separate units one succeeds in fixing the clamping element also against the action of high back pressures and in ensuring easy, low-friction motion in the compound clamping direction. In the case of the clamping jaw known from DE-C 145 123 it has in fact to be feared, if the angle of movement is very flat, that the usually high back pressure may lead to tilting and mayby even to detachment from the prismatic guide areas, which are only very short, whereas the invention enables even very flat relative sliding movements between the clamping element and the bearing block, for example at an angle of only 15° from the upper rear in downward and forward direction, to be effected without giving rise to any disadvantageous effects.

The precise lateral guide rails, which are effective over the full length of the clamping element, provide in this case a perfect, non-tilting guide, which due to the journals being produced, heat-treated and surface-finished separately, combines in itself the advantages of close tolerances and perfect sliding properties.

Further, the lateral journals enclosing between them the clamping element may, preferably, have the shape of hardened, special-finish, for example mirror-finished round guide tubes which are arranged in semi-circular recesses in the bearing block, which for this purpose has a generally U-shaped design, and which engage the rear connecting piece of the two legs of the bearing block over a length sufficient to ensure a precisely fixed and secured position of the journals.

According to another embodiment of the invention, the sliding pins may be fastened in the bearing block in addition by clamping screws, preferably hexagon socket screws, inserted from the rear. The clamping element as such is provided in this case with the lateral, correspondingly inclined, preferably integrally formed recesses of likewise semi-circular shape which then permits the clamping element to perform its combined sliding motion via the sliding pins.

Description of the drawing

One embodiment of the invention will be described hereafter in greater detail with reference to the drawing in which:

- Fig. 1 shows a top view of the base body of the clamping device and
- Fig. 2 shows a front view, and partial section, of the base body illustrated in Fig. 1;
- Fig. 3 shows a top view of the bearing block to be fastened on the base body illustrated in Fig. 1 and
- Fig. 4 shows a rear view of the bearing block illustrated in Fig. 3, i.e. a view from the operating side of the clamping element retained in the bearing block, and
- Fig. 5 shows a section through the bearing block illustrated in Fig. 3, taken along line V-V in Fig. 3;

- Fig. 6 shows a side view of the clamping element guided in restrained relationship in the bearing block and
- Fig. 7 shows a rear view of the clamping element illustrated in Fig. 6, i.e. from the left viewed in the drawing plane of Fig. 6;
- Fig. 8 shows a side view of, and partial section through, the assembled embodiment of the clamping device;
- Fig. 9 shows a rear view of, and partial section through, the assembled clamping device illustrated in Fig. 8; and
- Fig. 10 shows the threaded actuating element by means of which the displacement of the clamping element in the bearing block is effected.

Description of the embodiments

The basic concept of the invention consists in guiding the clamping element forcedly in the bearing block at the desired inclination by means of lateral guide rails, retaining it safely and with high precision in its guides, even against the action of high back pressures, and providing at the same time trouble-free operation, i.e. permitting the clamping elements to be displaced in the combined clamping directions.

In the illustration of Fig. 1, the base body of the clamping device 10 (see Figs. 8 and 9), which receives and carries the bearing block in adjustable relationship, is designated by reference numeral 11. The base body 11 comprises means permitting it to be mounted on the base plate of a modular clamping system, for example, in the form of stepped threaded bores 12 which in the case of the substantially rectangular block shape of the base body used in this case may consist of four threaded bores provided in suitable distribution. These threaded bores serve to mount the base body in the conventional manner on a suitable modular clamping plate or another base plate. To this end, screws, preferably hexagon socket screws, of a suitable size may be screwed into the said threaded bores down to the shoulder 12a so that they will not make themselves felt in a disturbing manner when the clamping device is completed later and during adjustment of the clamping element.

The upper face of the base body 11 carries a bearing block 13 (see Figs. 3 to 5) which is connected with the base body 11 by means of two external threaded bolts. The bearing block 13 rests on external, raised longitudinal areas 14a, 14b of the base body 11 including between them a slightly recessed surface 15. The raised portions 14a, 14b are provided with an upwardly directed toothing 16, for example a prismatic 90° toothing with a pitch of 1/16". This upwardly directed toothing 16 on the two longitudinally extending carrying surfaces 14a, 14b is matched by a downwardly directed toothing 17 on the bearing block 13 (see Fig. 5), which provides a first possibility for coarse adjustment of the position of the bearing block 13 on the base body 11. This coarse adjustment is effected by placing the bearing block on the base body in the desired position, which is then fixed against displacement by the matching toothings 16, 17,

and mounting it thereafter finally by means of one threaded bolt provided on each side which is passed through corresponding threaded openings 18a, 18b in the bearing block and through oblong holes 19a, 19b provided on both sides of the base body. There are further provided two sliding blocks 20 (see Fig. 9) which take the form of nuts extended in the direction of the oblong holes 19a, 19b (for preventing rotational movement) and which secure these threaded bolts (not shown in the drawing) fastening the bearing block 13 from the bottom in the oblong holes 19a, 19b of the base body 11. The sliding blocks 20 rest against the lower shoulders 21 in the oblong holes 19a, 19b.

As is apparent from Fig. 3, the bearing block 13 which rests on the base body 11 and which is connected with the latter in the manner described before, exhibits the general shape of a U consisting of two legs 13a and 13b which are interconnected by a web portion 13c. The two stepped bores 18a, 18b for receiving the threaded mounting bolts are provided in each of the legs 13a, 13b in an approximately central position. Further, as can be seen best in Fig. 5, the bearing block is provided on both inner faces of the legs with recesses 22a, 22b which are inclined, relative to the horizontal plane, from a rearward to a forward point (forward means in this case in the direction of the object to be clamped), i.e. which exhibit an inclination at a given angle. In the embodiment illustrated in the drawings, these recesses 22a, 22b serve to receive sliding pins which are to be engaged therein.

In the area of the web portion of the U, the recesses 22a, 22b take the form of bores. To facilitate their production, they are, therefore, given a semi-circular cross-section in the areas of the inner faces of the legs. These semi-circular recesses 22a, 22b serve to receive the guide pins - not shown in the drawing for the sake of clarity - forming the guide rails or round guide tubes whose complementary cross-section is then received on both sides by the semi-circular recesses 22a, 22b and also, over a pre-determined length, by the extension of the bores 22a', 22b' in the web portion 13c. This arrangement can be seen best in Fig. 5 which, although representing a cross-section through a central threaded bore, indicates in dashed lines the bore 22a' in the background. This bore extends a distance A from the inner face of the web portion of the U into the latter. It is then followed by an inwardly protruding annular projection 23 followed by a portion 24 where the diameter of the bore is enlarged again, for example to the same diameter as before. The reason for this arrangement is to be seen in the fact that the sliding pins which are inserted on both sides of the legs into the bores 22a' to the depth A abut against the annular projection 23, while a screw, preferably a hexagon socket screw, is introduced from the other side, i.e. into the bore 24, and screwed into a matching central threaded bore provided in each sliding pin to secure the sliding pins against displacement initially in the semi-circular recesses 22a, 22b of the two legs 13a, 13b and then of course also in the full bores in the web portion 13c.

The structure of the bearing block 13 is then completed by a central bore 25 provided in the web portion 13c and comprising an internal thread serving to receive a set screw for displacing the clamping element. The set screw is shown at 26 in Fig. 10 and will be described in greater detail further below.

For reasons resulting from the oblique displacement of the clamping element, which will be described in greater detail further below, the rear surface 27 of the connecting web 13c is inclined in such a manner that the surface extends perpendicularly to the threaded bore 25 and, besides, also to the bores 22a', 22b'. Further, the upper surface 28 of the connecting web is also inclined downwardly to match the inclination of a counter-face 29 of a rear projection 30 provided on the clamping element 31, as shown in Fig. 6.

Finally, it should be noted that the two legs 13a, 13b comprise on their front ends, i.e. in the direction of the object to be clamped, a substantially rectangular or square recess 29 which in the completely retracted position of the clamping element, as shown in Fig. 8, matches the stepped shape of the forward face of the clamping element so that the latter has easy access to the object to be clamped.

The clamping element as such is designed in the manner illustrated by the side view of Fig. 6. It fits snugly into the space formed between the two legs 13a, 13b of the U shape of the bearing block and is provided with lateral recesses 32a, 32b matching the sliding pins projecting semi-circularly from the inner faces of the bearing block so that the clamping element received between the two legs of the bearing block is permitted to slide along the guide rail arrangements provided on its both sides, simultaneously from the front to the rear and from the top to the bottom, following the inclination of the sliding pins which can be adjusted at desire and which in the present case has been set to, preferably, 15°.

The clamping element 31 exhibits a block shape comprising mutually stepped front faces 33 and 34 intended to engage the object or the workpiece to be clamped. Preferably, both front clamping faces 33, 34 are toothed to prevent slipping.

A rear stop face 35 comes to rest against the inner inclined face 35' of the connecting web 13c of the bearing block 13 when the clamping element 31 is in its fully retracted position. In this position, the rearwardly protruding projection 30 of the clamping element 31 also occupies a position fully above the upper inclined face 28 of the connecting web 13c. This projection covers the inner space of the U shape of the bearing block also when the clamping element occupies its extreme forward position, preventing in this manner foreign matter, for example chips in the case of metal cutting operations, from penetrating into this space.

The fine adjustment of the clamping element 31 is then effected by engagement of the threaded element 26 shown in Fig. 10 - which has already been mentioned before - with the threaded bore 25 in the bearing block on the one hand and a correspondingly aligned central threaded bore 36 in the clamping element 31 on the other hand. The two external threads 26a, 26b of the threaded element 26 are oppositely directed, i.e. one left-hand and one right-hand thread, and the threads of the bores 25 and 36 are designed correspondingly so that while being designed as fine threads with small pitch they nevertheless permit the clamping elements to be displaced along their lateral sliding pins both sensitively and quickly, by rotating the threaded element 26. This rotation is effected on the bearing block 13 from the rear where the threaded element, which preferably is provided in this case with a hexagon screw socket 37, can be seen in the representation of the assembled condition of Fig. 9.

According to a variant, the journals are mounted stationarily on the clamping element and engage the matching semicircular receiving recesses 22a, 22b disposed on the inner faces of the legs 13a, 13b of the U-shape of the bearing block 13 in sliding relationship.

Further, it is also possible to provide the threaded element 26 only with a single thread and to mount it in this case stationarily in one of the parts performing the mutual relative movement, i.e. the bearing block or the clamping element, for example by engagement of an inner annular shoulder of the bore in an annular recess provided on the threaded element, so that during rotation the displacement is effected only by the engagement of the one thread with the said other part.



C L A I M S

1. Clamping device for parts, workpieces, moulds, in particular a low pressure clamping device for grid clamping systems, in toolroom work, for deformation by chip removal, with a bearing block (13) which can be secured in different positions, and with a clamping element (31) which is slidably displaceable in the bearing block (13) and which engages on the part to be clamped; wherein the clamping element (31) is guided laterally on both sides in slide rails which extend slopingly from the top at the rear to the bottom at the front, and which are mounted stationarily in the bearing block or on the clamping element, and wherein, for adjustment of the clamping element (31), a screw element (26) is provided, which stands in screwthreaded engagement with at least one of the parts, that is to say, the bearing block (13) and/or the clamping element (31), characterised in that:

the bearing block (13) can be secured in different positions on a base member (11) which is intended to be secured on a support base,

the bearing block (13) is of U-shaped construction, with two lateral limbs (13a, 13b) and with a rear connecting web (13c) which connects the two limbs together,

the slide rails are formed by separate sliding journals which are received in interior lateral semicircular recesses (22a, 22b) in the two limbs (13a, 13b), and

the semicircular recesses (22a, 22b), which are in the interior surfaces of the limbs and which receive the sliding journals, continue in the connecting web (13c) of the bearing block (13) as full bores (22a', 22b').

2. Clamping device according to claim 1, characterised in that the base member (11) which supports the bearing block (13) is secured in its turn, with the aid of securing means, on a grid clamping plate, a support base, or the like.
3. Clamping device according to claim 1 or 2, characterised in that the base member has lateral slots (19a, 19b) through which there engage clamping screws which extend starting from the bearing block which is displaceable relatively thereto in the direction of the slots in the base member, and which are held in the slots by lower sliding blocks (20).
4. Clamping device according to claim 3, characterised in that the superimposed surfaces of the lower base member (11) and of the bearing block (13) which is secured thereon have intermeshing toothings (16, 17) for mutual relative fixation.
5. Clamping device according to claim 1, characterised in that the semicircular recesses (22a, 22b) and also the full bores (22a', 22b') which continue in the connecting web (13c) are arranged so as to extend slopingly from the rear to the front, falling at a predetermined angle (15°).
6. Clamping device according to any one of claims 1-5, characterised in that the full bores (22a', 22b') in the connecting web (13c), which continue the semicircular recesses (22a, 22b) in the lateral limbs (13a, 13b) in the bearing block (13), are interrupted by an inwardly projecting annular projection (23), against which there lie the sliding journals, which extend from the limbs and which form the guide rails for the adjustment of the



clamping element, and securing screws which extend from the outer surface of the connecting web (13c) and which are screwed into the sliding journals for the fixation thereof.

7. Clamping device according to any one of claims 1-6, characterised in that the clamping element is received close-fittingly in the interspace formed by the two limbs (13a, 13b) of the bearing block (13) and, with lateral semicircular recesses which follow the sloping position of the sliding journals or guide rails, receives the sliding journals or the guide rails and slides therealong.

8. Clamping device according to any one of claims 1-7, characterised in that the screw element (26) which adjusts the clamping element has, on both sides, screwthreads which extend in contrary directions up to a central separating indentation and which engage into correspondingly contrarily extending screwthreads of a central screwthreaded bore (25) in the connecting web (13c) and/or of a screwthreaded bore (36) in the clamping element (31), in such a manner that when a twisting adjustment-movement of the screw element is performed, this [element] simultaneously is rotated out of the bearing block and/or thereinto, and conversely, is rotated into the clamping element and/or out of it, in such a manner that the relative adjustment speed between the bearing block and the clamping element is twice as great, per revolution of the screw element.

9. Clamping device according to any one of claims 1-8, characterised in that the clamping element (31) has a rear projection (30) which, in the extended state, covers the interspace between the limbs, and covers the guide parts.

