

The present invention relates to a device for the specifically positioned clamping of a workpiece on a machining table according to the preamble of Patent Claim 1, as known, for example, from GB-A-2 033 263.

5 By the term "specifically positioned clamping" is here meant, in the broadest sense, that an object, especially a workpiece to be machined, is fastened in an exactly known, defined position within a machining device. More specifically, an exactly defined position of
10 the object in two directions lying perpendicularly to each other, the X-axis and the Y-axis, and with respect to a twisting in the X-Y plane is primarily intended to be achieved. Finally, in a refinement of the subject of the invention, a positioning in the Z-axis, which posi-
15 tioning is less critical per se but is nonetheless just as important, is also intended to be assured.

For the clamping of small workpieces, devices are known which, in general, likewise possess relatively small dimensions, comprising a workpiece fixture to which
20 a workpiece support can be fastened. The positioning is herein ensured by protruding centring pins on the fixture and correspondingly arranged centring orifices on the support, in which orifices the centring pins engage. If a positioning in the direction of the Z-axis is dis-
25 regarded for the moment, then it is sufficient in this case to provide two pin/orifice pairs which respectively interact with each other, one pair in each case fixing the positional bearings in the X- or Y-direction and the interaction of the two pairs fixing the angular position
30 about the Z-axis.

An essential precondition in known clamping devices of this kind is that the centring pins, on the one hand, and the centring orifices, on the other hand, should be disposed in very precise arrangement with
35 respect to their position relative to each other, so that a satisfactory interaction of pins and orifices and hence the desired positioning of the support in relation to the fixture (known in terms of its position) is assured. This entails a highly complex production and hence high costs,

especially when unusually high positioning accuracy requirements are imposed, such as is the case, for example, in the spark machining of workpieces. Moreover, an arrangement of this kind is often geometrically overdetermined, especially when, as in most cases, conical centring pins are used, since here both pin/orifice pairs, theoretically independently of each other, fix the position in the X/Y-directions.

These drawbacks have a particularly serious effect when relatively large workpieces are to be clamped. In the interest of a stable position, the individual centring pins or centring orifices should be arranged as far apart as possible. If this is done, variances brought about by thermal expansion or contraction already become apparent in the range of 20 - 40 cm distance between the individual pin/orifice pairs, which variances impair the satisfactory seating of the one or other centring pin in the associated centring orifice. The result of this is that the extremely high positional accuracy which is demanded, especially in tool construction, is no longer assured.

A further problem presents itself when, on one and the same fixtures, various supports are to be fastened which may possibly derive from different manufacturing batches and which therefore possess dimensional variances, which variances, even if small, are still discernible under extremely high precision requirements. For the aforementioned reasons, an exact positional precision is, once again, not assured.

From GB-A-2 033 263, a device for the specifically positioned clamping of a workpiece on a machining table is known, having a workpiece fixture on which the workpiece is releasably fastened and which is provided with centring orifices which interact with centring pins arranged correspondingly on the machining table and protruding over it. The device which is there described is provided with four V-shaped grooves (V-grooves 70) which are located in the region of the corners of the pallet to be clamped and correspond analogously to the

centring orifices of the subject of the application, which grooves interact with protruding pins (V-blocks 23, 24, 26, 28) in order to position the pallet in the X- and Y-directions (and even also in the Z-direction). There is
5 thus a group of four wide-apart orifice/pin pairs present which takes charge of the entire centring function. It is evident that the centring accuracy of the pallet on the machine table depends solely upon the machining accuracy and the current position of the "V-blocks" and "V-
10 grooves". The arrangement is geometrically overdetermined and, even where there are very small variances in the position of the V-shaped grooves in the pallet, the exactly identical position is never set whenever a number of pallets, for example from different manufacturing
15 batches or with different temperatures, are clamped one after the other.

From DE 31 15 586 A1, a pallet-changing and centring device for a tool-making machine has become known, comprising a feed path on which the pallets laden
20 with the workpiece make their way to a pallet-receiving and workpiece-machining station. Once the pallet has arrived there, the station is lowered until the pallet rests, on the one hand, on the surface of Z-axis-centring pins, which do not, however, perform any centring func-
25 tion in the X-, Y- or angular directions. Upon the lowering of the station, conically configured top edges of centring pins engage, on the other hand, in correspondingly conically configured bushes. The bushes are mounted resiliently in the axial direction, but rigidly
30 in the radial direction. An "accurate alignment of the pallet on the securing pin in the radial direction" is thereby intended to be achieved.

Using this arrangement, it is not possible to achieve an accurate centring in the X/Y-directions and
35 with respect to the angular position, especially when the axial spacings of the centring pins, on the one hand, and of the bushes, on the other hand, do not exactly conform. When, namely, the distance between the centring pins, on the one hand, and the bushes, on the other hand, does not

conform entirely accurately, the position of the pallet is undefined, since, depending on the starting position of the pallet prior to the engagement of the pins in the bushes, either the one or the other pin-bush pair interlocks in a defined manner; this inevitably results, however, in two different positions of the pallet, which, according to the invention, is specifically intended to be prevented.

The object of the present invention is to avoid the aforementioned drawbacks and to refine a device of the type specified in the preamble of Patent Claim 1 such that, even given reduced precision in the manufacture of the fixture or support, especially with respect to the reciprocal spacing of the centring pins or centring orifices, and under the influence of thermally caused dimensional variations to the support and/or fixture, the desired, high positioning accuracy of the support on the fixture is achieved or maintained.

This object is achieved by the measures specified in Patent Claim 1. In particular, it is thereby assured that in the case of two groups of centring orifices and centring pins, for example, the one group assumes the task of the X-Y positioning and the fixing of the approximate angular position about the Z-axis and hence accurately fixes the reference for the Z-axis, whereas the other group exactly positions the tool fixture with respect to its twisting alignment around the Z-axis. The reciprocal distance between the two groups of centring orifices/centring pins thereby becomes uncritical by virtue of the fact that the distance between the centring pins of two groups and the distance between the centring orifices of these two groups does not need to conform exactly. As a result of this, manufacturing tolerances, thermal variations in dimension and the like are absorbed and a geometric overdetermination of the position of the tool fixture on the machining table is prevented.

Refinements of the subject of the invention and preferred embodiments are described in the dependent claims 2-16.

- An illustrative embodiment of the device according to the invention is explained in greater detail below, with reference to the appended drawings, in which:
- Fig. 1 shows a top view onto a work table of a workpiece finishing machine having four groups of centring pins;
- Fig. 2 shows a view of a first illustrative embodiment of a workpiece fixture from below, having four groups of centring orifices;
- Fig. 2a shows a view of a second illustrative embodiment of a workpiece fixture from below, having two groups of centring orifices;
- Fig. 3 shows a partially cut side view of the work table and of the workpiece fixture in the direction of the arrows A in Figs. 1 and 2;
- Fig. 4 shows a view of a supporting body having four outer and four inner centring pins;
- Fig. 5 shows a side view of the supporting body of Fig. 4;
- Fig. 6 shows a partial view of a tool fixture having two groups of centring orifices, from below;
- Fig. 7 shows a section along the line VII-VII in Fig. 6;
- Fig. 8 shows an enlarged part-section through a centring pin;
- Fig. 9 shows a view of that side of a centring plate confronting the tool fixture;
- Fig. 10 shows an enlarged part-section through a centring plate and a centring pin before the engagement of the centring pin; and
- Fig. 11 shows a section as in Fig. 10, but after the engagement of the centring pin.

In Fig. 1, the work table 1 of a tool-making machine is represented diagrammatically. On the surface of the work table 1 there are arranged four supporting bodies 2, 3, 4 and 5, which are each provided with a plurality of centring pins. The precise configuration of the supporting bodies 2-5 is discussed in further detail below, in association with Figs. 4 and 5. Expediently, all four supporting bodies 2-5 are identically configured.

In Fig. 2, a workpiece-fixture frame 6 is represented diagrammatically in a view from below, i.e. with a view onto the side confronting the work table. The frame 6 is provided, in the region of each of its four corners, with a group of centring orifices; their precise configuration is likewise discussed in further detail below.

In Fig. 2a, a similar workpiece-fixture frame 7 as in Fig. 2 is represented diagrammatically in corresponding view, but this frame is provided only with two groups of centring orifices. The frame 7 can be used on the same work table 1, only two supporting bodies, for example the two supporting bodies 4 and 5, being used in this case. Whenever the frame 7 is fastened on the work table 1, the cross-tie 8 of the frame 7 rests on a prop element 9 of the work table, which element is expediently equipped with a compressed-air outlet orifices 10 in order, when the frame 7 is mounted, to blow away any dirt between the cross-tie 8 and the surface of the prop element 9.

According to Fig. 2, the workpiece-fixture frame 6 comprises two cross-ties 11 and 12, interconnected by two longitudinal ties 13 and 14. To the two longitudinal ties 13 and 14 can be fastened receiving members for the workpieces to be machined (not represented); the configuration of the said receiving members does not need to be discussed further within the context of this description. The two cross-ties 11 and 12 are each provided with two centring members 15 and 16 and 17 and 18, the construction of which is described yet more accurately below. The frame 7 according to Fig. 2a possesses the same cross-tie 11 having the two centring members 15 and 16, two shorter longitudinal ties 13a and 14a and the aforementioned cross-tie 8, which has no centring members.

Whereas the frame 6 according to Fig. 2 finds application for larger workpieces or for a large number of smaller workpieces and, due to its dimensions, is secured in the region of its four corners on the work

table 1, the frame 7 according to Fig. 2a is suited to smaller workpieces or to a low number of small workpieces; consequently, it is sufficient for it to be fastened at two points, the cross-tie 8 being simply able
5 to rest loosely on the prop element 9.

In Fig. 4, a supporting body 2 is represented in a view from above, whereas in Fig. 5 the same supporting body can be seen in a side view. The supporting body 2 possesses a cylindrical bottom part 19 and an essentially
10 square top part 20, the four corners of which are chamfered. Formed onto the surface of the top part 20 are four projecting mouldings 21, which run along the two middle lines of the square. Formed, in turn, onto the surface of the mouldings 21 are the actual centring pins.
15 In the represented illustrative embodiment, the mouldings 21 support four inner centring pins 22 and four outer centring pins 23. The centres of the four inner, somewhat narrower centring pins 22 lie on a circle of smaller diameter and the centres of the four outer, somewhat
20 wider centring pins 23 lie on a circle of larger diameter. The centring pins 22 and 23 are generally of wedge-shaped configuration and are arranged such that the free wedge edges 24 of mutually opposite centring pins each lie on a line, the two imaginary lines intersecting
25 at right-angles.

In the centre of the supporting body 2 there is provided a ball chuck 25 having spring-loaded, pneumatically operated spherical clamps 26, which ball chuck serves for the reception of a tie bolt. Ball chucks of
30 this kind are known per se and do not need here to be discussed.

Four diagonally running surface regions 27 of the top part 20 of the supporting body are exactly surface-ground and serve as a bearing surface for spacer bolts
35 forming part of the centring members 15-18 of the workpiece-fixture frame 6 or 7.

In Fig. 8, a part-section through a centring pin 23 is represented; the centring pins 22 have the same cross-section. The centring pin 23 formed onto the

moulding 21 has lateral faces inclined symmetrically to each other: a region 30 adjacent to the moulding 21 and having parallel lateral faces is adjoined by a region 29 of lower inclination, which region merges into a head region 28 of higher inclination. As will be further explained, the centring pins 23 interact with centring slots. The head region 28 of higher inclination serves to facilitate the introduction of the centring pins into the slots, whereas the regions 29 of lower inclination perform the actual centring function.

The construction of the centring members 15 and 16 can be seen from Figs. 6, 7 and 9. These figures respectively show a top view, a part-section along the line VII-VII in Fig. 6 and a view of the centring plate 32 from the side confronting the cross-tie 11.

On the cross-tie 11 there is fitted, for each centring member 15 and 16, a circular, protruding rim 31, which serves as a bearing surface for a dirt and moisture-protecting hood (not represented). Within the rim 31 of the centring member 15, there is fastened a generally circular centring plate 32 possessing a central orifice 33. A tie bolt fixture 34 penetrates the orifice 33 and is fastened, by means of screws 35 for example, on the cross-tie 11. The fixture 34 supports a perpendicularly projecting tie bolt 36, which is configured such that it fits into the ball chuck 25 of the supporting bodies 2-5.

The centring plate 32 is fastened by four screws 37 to the cross-tie; the screws 37 serve simultaneously as spacer bolts and rest with their surface on the surface-ground surface regions 27 of the supporting bodies 2-5 whenever the workpiece-fixture frame 6 is fastened on the work table 1. They thus determine the position of the frame 6 and hence of the thereto fastened workpiece in the Z-direction. At those places 38 where the centring plate 32 is screwed to the cross-tie 11, the centring plate is configured somewhat thicker, as is clearly evident from Fig. 7.

The thickened regions 38 of the centring plate 32 are interconnected, in the case of the centring member

15, by means of thin webs 40. All webs 40 have a thickened, central portion 41, which is provided with a centring slot 39. The thickness of the central portion 41 is somewhat less than the thickness of the thickened regions 38, so that the central portions 41 do not rest on the surface of the cross-tie 11; this can be clearly seen in Fig. 7. Each two opposing centring slots 39 lie on a straight line; these two straight lines intersect at right-angles. The centring slots 39 extend over the full width of the webs 40 and the depth of the centring slots 39 measures around 50-70% of the thickness of the central portions 41. Finally, the central portions 41 are each provided, from the bottom side of the centring plate 32, with a pocket bore 42, the position of which, in the exemplary case, corresponds to the position of the outer centring pins 23 of the supporting bodies 2-5 and the diameter of which is somewhat larger than the largest dimension of the centring pins 23, viewed in a section parallel to the surface of the top part 20. The width of the centring slots 39 corresponds approximately to the width of the centring pins 23, measured in the middle of the region 29 of lower inclination.

By virtue of the chosen configuration of the centring plate 32 having the thin webs 41, the central portions 41 having the centring slots 39 are elastically pliable in the axial direction, yet in the peripheral direction, i.e. within the plane of the centring plate 32, are absolutely rigid. The height of the centring pins 23 is herein dimensioned such that, when they engage in the centring slots 39, they force the central portions 41 by a small amount towards the cross-tie 11. This displacement is sufficiently small for the stability in the peripheral direction not to be adversely affected.

The centring member 16 is basically constructed exactly the same, with the following differences:

Only two mutually opposite centring slots 39a are provided, which lie in the extension of the straight line through those two centring slots 39 of the centring member 16 which run horizontally in the drawing, Fig. 6,

i.e. in the direction of the extent of the cross-tie 11. Consequently, in the case of the centring member 16, the webs 40 and the thickened, central portion 41 are omitted; instead, the two upper (in Fig. 6) and the two lower, thickened regions 38 of the centring plate 32 are continuously interconnected to form a thickened region 38a. Finally, the bore 42a, in contrast to the pocket bores 42 in the centring plate 32 of the centring member 15, is continuous.

10 The centring member 17 (Fig. 2) is identical to the centring member 16, i.e. it likewise has only two centring slots 39a. By contrast, the centring plate 32 of the centring member 17 is fitted such that it is twisted by 90° in relation to that of the centring member 16, so
15 that the centring slots 39a of the centring member 17 run in the longitudinal extent of the longitudinal tie 13.

 Finally, the centring plate 32 of the centring member 18 possesses no centring slots at all, but only four continuous bores 42b corresponding, with respect to
20 position, to the centring pins 23. Otherwise, the construction is the same as that of the remaining centring members.

 In Figs. 10 and 11 there is represented, in the part-section, the situation before and after the
25 workpiece-fixture frame 6 is mounted and clamped onto the work table 1 equipped with the supporting bodies 2-5. In Fig. 10, the centring plate 32 is in the non-tensioned rest position and the centring pin 23 is pictured shortly before penetrating into the centring slot 39. In the
30 situation according to Fig. 11, the workpiece-fixture frame 6 is clamped on the work table 1. The centring pin 23 has penetrated into the centring slot 39 and, in so doing, has displaced the central region 41 of the centring plate 32 axially in the direction of the cross-tie
35 11. The less inclined lateral regions 29 of the centring pin 23 rest against the edges of the centring slot 39 and thus bring about the centring of the workpiece-fixture frame 6.

 Whenever a frame 6 is clamped onto the work table

1, the X/Y reference position is defined by the point of intersection of the two straight lines through the opposite centring pins 23 of the supporting body 5 onto which the centring member 15 is mounted. In actual fact, 5 the angular position of the centring member 15 and hence of the frame 6 is also in theory determined, but, owing to the relatively large dimensions of the said frame, with insufficient accuracy; due to the elasticity of the frame material, the position of that corner of the frame 10 6 lying diagonally opposite the centring member 15 might vary inadmissibly. For this reason, by the interaction of those two centring pins 23 of the supporting body 4 lying in the X-direction with the two centring slots 39a of the centring member 16, the Y-position of the centring member 15 16 is additionally fixed. The remaining two centring pins 23 of the supporting body 4 have no function in this case, since they intrude into the continuous bores 42a in the centring plate 32 of the centring member 16. Correspondingly, as a result of the interaction of those two 20 centring pins 23 of the supporting body 3 lying in the Y-direction with the two centring slots 39b of the centring member 17, the X-position of the centring member 17 is additionally fixed. The remaining two centring pins 23 of the supporting body 3 have no function in this 25 case, since they intrude into the continuous bores 42a in the centring plate 32 of the centring member 17. Finally, the centring pins 23 of the supporting body 2 have no effect at all, since they intrude all together into the continuous bores 42b in the centring member 18. As a 30 result of the interaction between the supporting body 2 and the centring member 18, only the Z-position is fixed, in that the spacer bolts 37 rest on the surface-ground surface regions 27 of the supporting body 2.

When the frame 7 of the embodiment according to 35 Fig. 2a is mounted onto the work table 1 according to Fig. 1, only two of the supporting bodies 2-5 enter into use - depending on the size of the frame 7 and depending on the desired alignment, the supporting bodies 2 and 3, the supporting bodies 2 and 4, the supporting bodies 4

and 5 or the supporting bodies 3 and 5. The X-Y reference is herein formed and the angular position about the Z-axis herein fixed by the one of the two stressed supporting bodies, to be precise that which receives the centring member 15, whereas the other supporting body, on which the centring member 16 rests, additionally fixes the X or Y-position, depending on the alignment of the frame 7. This suffices in practice, by virtue of the relatively smaller dimensions of the frame 7.

10 For reasons of simplicity and in order to create the facility, depending on the workpiece-fixture frame which is used, for having any one of the supporting bodies 2-5 interact with the centring member 15, all supporting bodies 2-5 are identically configured, 15 although only in the case of one of the supporting bodies do all four centring pins enter into use.

Any variances in the distance between the geometric centres of two adjacent supporting bodies and those of two adjacent centring members, whether resulting from thermal expansion or contraction or from machining 20 tolerances, have no influence upon the accuracy of the centring. The X/Y position of the Z-axis is fixed simply by the interaction of a single supporting body (for example 5 in Fig. 1) with the centring member 15. The 25 position of the centring member 16 (Fig. 2), for example, which comes to rest on the supporting body 4 can vary in the X-direction, since the centring slots 39a are sufficiently long and the pocket bores 42 sufficiently large to absorb any variances.

30 In the present illustrative embodiment, only the respective four outer centring pins 23 of the supporting bodies 2-5 are used. The reason lies in the fact that the centring members of the frame shown as an example are designed for relatively high stresses and maximum stiffness. 35 In the case of lesser stresses and smaller dimensions of the workpiece fixture, more simple centring members can be used, which can also possess smaller dimensions. Thus, for example, instead of the centring plate shown in the drawings, a simple spring-steel disc

can be used, which is provided with four rectangular orifices, disposed in cross-cross arrangement, in which the inner centring pins 22 of the supporting bodies 2-5 engage. Care must naturally be taken to ensure that the
5 spring-steel disc, during clamping, can be elastically deformed, in the region of the orifices, in the axial direction, whether by spaced arrangement of the spring-steel disc on the cross-tie or by the fitting of recesses in the cross-tie, which recesses are located in the
10 region of the orifices of the spring-steel disc. In any event, the same supporting bodies 2-5 can be used with both types of centring members.

The device according to the invention offers, along with extraordinary flexibility in the shaping of
15 the workpiece fixture, a very high level of precision with respect to positional accuracy. It is simple and inexpensive to produce, insensitive to pollution, since the centring pin-centring slot system is self-cleaning, and insensitive to wear. Should the centring pins and/or
20 the centring slots wear out somewhat after long usage, then the centring plate 32 with its central portion 41 is merely deformed somewhat less in the axial direction, whereby the positional accuracy, however, is not affected.



PATENT CLAIMS

1. Device for the specifically positioned clamping of a workpiece on a machining table (1) with a workpiece fixture (6; 7), on which the workpiece is fastened
5 releasably and which is provided with centring orifices (39) which cooperate with centring pins (22, 23) arranged correspondingly on the machining table (1) and projecting above the latter, there being provided a first group of centring orifices (39) and centring pins (22; 23) which
10 defines the position of the workpiece fixture (6; 7) in the X- and Y-direction and consequently the reference of the Z-axis, characterized in that there is provided at least one further group of centring orifices (39a; 39b) and centring pins (22; 23) which is arranged at a dis-
15 tance from the first group and which fixes the position of the workpiece fixture (6; 7) only in respect of the angular position about the Z-axis.

2. Device according to Claim 1, characterized in that, in addition to the first group of centring orifices
20 (39) and centring pins (22; 23), there are provided as further groups a second group of centring orifices (39b) and centring pins (22; 23) which is located with its centre on the Y-axis and which fixes the position of the workpiece fixture (6; 7) in the X-direction only, and a
25 third group of centring orifices (39a) and centring pins (22; 23) which is located with its centre on the X-axis and which fixes the position of the workpiece fixture (6; 7) in the Y-direction only.

3. Device according to Claim 1 or 2, characterized
30 in that the groups of centring pins have a supporting body (2; 3; 4; 5) which is provided with at least four wedge-like centring pins (22; 23) arranged uniformly spaced along a circle, the free wedge edges (24) of two mutually opposite centring pins (22; 23) being aligned
35 along a first line running in the X-direction, and the free wedge edges (24) of the other two mutually opposite centring pins (22; 23) being aligned along a second line running in the Y-direction.



4. Device according to Claim 1 or 2, characterized in that the groups of centring pins have a supporting body (2; 3; 4; 5) which is provided with four wedge-like centring pins (22) arranged uniformly spaced along a first smaller circle and with four wedge-like centring pins (23) arranged uniformly spaced along a second larger concentric circle, the free wedge edges (24) of four mutually opposite centring pins (22; 23) being aligned along a first line running in the X-direction, and the free wedge edges (24) of the other four mutually opposite centring pins (22; 23) being aligned along a second line running in the Y-direction.

5. Device according to Claim 3 or 4, characterized in that the surface of the supporting bodies (2; 3; 4; 5) which is provided with the centring pins (22; 23) is surface-ground at least in regions (27).

6. Device according to Claim 3 or 4, characterized in that the supporting bodies (2; 3; 4; 5) are provided with a central receiving orifice (25) and with holding means (26) known per se for a tie bolt (36).

7. Device according to one of Claims 3 to 6, characterized in that the centring pins (22; 23) possess first lateral surface regions (29) of lower inclination confronting the supporting-body surface and second lateral surface regions (28) of higher inclination adjoining the wedge edge (24).

8. Device according to one of the preceding claims, characterized in that the workpiece fixture (6; 7) is provided with at least two centring members (15, 16, 17, 18) which are arranged at a distance from one another and which each have a centring plate (32), the centring plate (32) of a first centring member (15) being provided with four centring slots (39), the arrangement of which corresponds to four centring pins (22; 23) of a supporting body (2; 3; 4; 5), and the centring plate (32) of at least one further centring member (16; 17) being provided with two centring slots (39) which lie on the connecting line through the centre of the first centring member (15) and through the centre of the further centring member (16



or 17).

9. Device according to Claim 8, characterized in that the tool fixture has the form of a rectangular frame (6), in each of the four corners of which a centring member (15, 16, 17, 18) is arranged.

10. Device according to Claim 9, characterized in that the frame (6), with a first centring member (15) having four centring slots (39), is provided in each of the two adjacent corners with a further centring member (16, 17) having two centring slots (39a, 39b) and is provided in the opposite corner with a centring member (18) without centring slots.

11. Device according to one of Claims 8 to 10, characterized in that the centring plates (32) of all the centring members (15, 16, 17, 18) are each fastened to the tool fixture (6, 7) by means of four spacer bolts (37).

12. Device according to one of Claims 8 to 11, characterized in that the centring plates (32) of the centring members (16, 17, 18) are provided with two (39a, 39b), or no, centring slots having continuous bores (42a, 42b) through which the centring pins (23) pass when the centring members (16, 17, 18) rest on the associated supporting bodies (2, 3, 4).

13. Device according to one of Claims 8 to 11, characterized in that the centring plate (32) of the first centring member (15) has four thickened regions (38) located in the region of the spacer bolts (37) and four central portions (41) which are located respectively in the middle between two adjacent thickened regions (38) and which are connected to the thickened regions (38) via thin resiliently elastic webs (40) and are provided with centring slots (39).

14. Device according to one of Claims 8 to 11, characterized in that the centring plates (32) of the second and third centring member (16, 17) has two mutually opposite thickened regions (38) extending between two adjacent spacer bolts (37), and two central portions (41) which are located respectively in the



middle between the two thickened regions (38) and which are connected to the thickened regions (38) via thin resiliently elastic webs (40) and are provided with centring slots (39a, 39b).

5 15. Device according to Claim 13 or 14, characterized in that the central portions (41) are somewhat thinner than the thickened regions (38) and are set back relative to the surface of the thickened regions (38) which confronts the workpiece fixture (11), so that the central
10 portions (41) can spring elastically towards the workpiece fixture (11).

16. Device according to one of Claims 8 to 15, characterized in that the centring members (15, 16, 17, 18) are each provided with a central projecting tie bolt
15 (36) known per se.