Clamping Fixture

The present invention relates to a clamping fixture configured as set forth in the preamble of claim 1.

Such clamping fixtures are put to use for chucking tools, workpieces or workpiece pallets positionally defined, the chuck usually being fixedly located on a work table of a machine tool or a press whilst the workpiece pallet is repeatedly releasably located precisely positioned at the chuck.

Known from EP 0 111 092 B2 is a coupling device for rotatably connecting replaceable a workpiece to a machining apparatus. The device comprises two coaxial centering members sandwiching a driving plate. The one coupling member is provided with a round centrically arranged driving pin as well as an elongated eccentrically arranged driving pin. The centrically arranged driving pin comprises a shell surface in the shape of a truncated cone whilst the eccentrically arranged driving pin features to each other side faces oriented radius parallel inclined to the axis of rotation of the coupling member. The driving plate features a centric circular opening as well as an eccentrically arranged substantially oval opening, each opening corresponding in shape and location to the corresponding driving pin. Arranged on one coupling member are three beads the surfaces of which protrude from the cross-section contacting the surface of the other coupling member when the coupling device is clamped. The driving plate is made of spring steel, the openings machined therein being oriented to correspond with the two driving pins such that the driving plate is axially elastically deformed in the region of the openings when the coupling device is clamped.

The invention is aimed at sophisticating a clamping fixture having a chuck and a clamping pallet releasably secured thereto such that the clamping fixture is practically immune to dirt, the clamping pallet permits repeated precision location at the chuck and the centering members are simple and cost-effective to make.

For this purpose a clamping fixture in accordance with the invention is provided as set forth in claim 1.

Preferred embodiments and further aspects of the subject matter of the invention read from the dependent claims 2 to 15.

To ensure that the clamping pallet is chucked positioned with high absolute repeatable accuracy at least three pairs of centering members are provided which cooperate such that the clamping pallet is positioned relative to the chuck in the X and Y direction as well as relative to the angular position about the Z axis, resulting in the line contact of the side faces of the centering pins with the sidewalls of each centering opening, rendering the fixture practically immune to becoming dirty.

To achieve high stability in the chucked clamping pallet four spacer pins are preferably provided, located relatively far outwardly.

Claimed in claim 16 is, in addition, a clamping pallet for use in a clamping fixture configured as set forth in any of the claims 1 to 15. Preferred further aspects of the clamping pallet are defined in the claims 17 and 18.

Defined in claim 19 is a centering plate suitable for use in a clamping fixture as set forth in any of the claims 1 to 15 by being particularly preferred for attachment to a base body of a clamping pallet. Preferred further aspects of the centering plate are recited in the dependent claims 20 to 22.

A preferred example embodiment of the clamping fixture in accordance with the invention will now be detailled with reference to the drawings in which:

FIG. 1 is a diagammatic illustration of the clamping fixture during centering;

FIG. 2 is again a diagammatic illustration of the clamping fixture as shown in FIG. 1 but after centering;

FIG. 2a is a detail on a magnified scale taken from FIG. 2;

FIG. 2b is a view in perspective of two centering members;

FIG. 3 is a diagrmmatic illustration of the clamping fixture consisting of a chuck and a clamping pallet, and

FIG. 4 is an illustration of a centering plate as a preferred example embodiment.

Referring now to FIG. 1 there is illustrated the clamping fixture in a diagammatic cross-section to assist in detailling how the centering members work. The clamping fixture comprises a chuck 1 and a clamping pallet 6. The chuck 1 features a mechanism for chucking a clamping pin arranged at the clamping pallet 6, the clamping means required for this purpose not being shown. The clamping pallet 6 serves in general to mount workpieces or tools at the chuck 1 repeatably precisely positioned. Both the chuck 1 and the clamping pallet 6 are provided with a solid base body 2, 7. The chuck 1 features first centering members in he form of centering pins 3 whilst the clamping pallet 6 features further centering members in the form of centering openings 9. It is understood that although only one centering pin 3 and one centering opening 9 are evident in the present example, the chuck 1 is usually provided with four centering pins 3 and the clamping pallet 6 with a corresponding number of centering openings 9.

In the present example the centering openings 9 are machined in a centering plate 8 the function of which is detailled below. By means of studs 12 the centering plate 8 is located spaced away from the frontal face 6a of the base body 7 of the clamping pallet 6 such that the centering plate 8 is deflectable in the direction of the base body 7. The front end 13 of each stud 12 forms a Z

stop for the clamping pallet 6. The base body 2 of the chuck 1 is provided with flats 4 for abutting the front end 13 of the studs 12. Each centering pin 3 is provided with two conically tapered side faces 3a, 3b contacting the side walls 9a, 9b of the centering plate 8 defining each centering opening 9 sideways. The centering pins 3 are made of a harder material than that of the centering plate 8. This has the advantage that wear of the side faces 3a, 3b of the centering pins 3 is minimized so that even after a high number of clamping actions the positioning accuracy is still not detrimented. Any wear of the side walls 9a, 9b of the centering plate 8 merely results in the face – line – contact with the centering pins 3 becoming somewhat wider which has no appreciable effect on the positioning accuracy.

Referring now to FIG. 2 there is illustrated the chuck 1 together with the clamping pallet 6 defined thereby. When chucking the clamping pallet 6 in the chuck 1 each centering pin 3 enters the corresponding centering opening 9, the side faces 3a, 3b of the centering pins 3 coming into contact with the side walls 9a, 9b of the centering plate 8 defining the centering openings 9 and resulting in the centering pins 3 and clamping pallet 6 respectively being oriented relative to the chuck 1. By four centering pins 3 and a corresponding number of centering openings 9 being provided the clamping pallet 6 is oriented in the X and Y direction as well as angularly about the Z axis when chucked in the chuck 1.

In the condition as shown in which the two conically tapered side faces 3a, 3b of the centering pins 3 come into contact with the side walls 9a, 9b of the centering plate 8 defining the centering openings 9 sideways, line contact is achieved between each centering pin 3 and each side wall 9a, 9b. For this purpose the centering pins 3 are dimensioned so that the centering plate 8 is slightly deflected by each centering pin 3 in the direction of the base body of the clamping pallet 6 before the studs 12 abut the flats 4 of the chuck 1 by their front end 13. Referring now to FIG. 2a there is illustrated in a cross-section on a magnified scale how a side face 3a of the centering pin 3 abuts the side wall 9a of the centering plate 8 defining the opening sideways. As evident in cross-

section a punctiform contact materializes between the side face 3a of the centering pin 3 and the side wall 9a of the centering opening 9.

Referring now to FIG. 2b there is illustrated in a view in perspective the centering pin 3 engaging a centering opening 9, the line contact between the base body 2 and the walls defining the centering openings 9 sideways being indicated by the cross-hatched lines L1, L2. Such a line contact – unlike a face contact – has the advantage that the centering members 3, 9 are practically immune to becoming dirty because of a high face loading causing any dirt to be scraped or forced away on insertion of the centering pins 3 into the centering openings 9. But, in any case, it is in this way that a high absolute and also repeatable accuracy is achieved every time the centering pin 3 is centered in the centering opening 9 and thus of the clamping pallet 6 relative to the chuck 1. The centering plate 8 is preferably made of a stainless sheet metal, the centering openings 9 preferably being machined by precision stamping. The thickness of the centering plate 8 is in the range of approx. 0.8 to 1.5 mm. Such a centering plate 8 is relatively cost-effective in production, the side faces 3a, 3b of the centering pins 3 being machined, particularly ground, with high precision.

Referring now to FIG. 3 there is illustrated a preferred embodiment of the clamping fixture consisting of the chuck 1 and the clamping pallet 6 for secure clamping thereto. The chuck comprises a cylindrical base body 2 mounting four centering pins 3 extending in the Z direction. Both the four centering pins 3 and the four centering openings 9 are arranged on a circle K1, K2 each spaced away from each other by 90°, it being evident how each centering opening 9 is enclosed on all sides by the centering plate 8. For chucking a clamping pin arranged on the clamping pallet 6 the chuck 1 usually features a chucking mechanism, neither this nor the clamping pin being evident in this FIG. Machined in the surface of the base body 2 are flats 4 for supporting the studs 12 by their face end.

The clamping pallet 6 comprises a centering plate 8 secured to the base body 7 by means of spacers 15. The spacers 15 may be configured as separate

elements secured to the base body 7. As an alternative they may be engineered integral with the base body 7. In a further alternative the base body 7 is provided with a substantially flat face machined recessed only in the region of each centering opening 9.

Actual fastening of the centering plate 8 is done by means of studs 12, the face end of which serves to stop the clamping pallet 6. The studs 12 are preferably provided with a rear thread by means of which they can be fixedly located in a female thread of each spacer 15 and base body 7 respectively. The studs 12 are located relatively far outwardly to attain high stability of the clamping pallet 6 clamped in the chuck 1. Preferably the studs 12 are arranged in the outer quarter of a virtual circle K3 located at the radially outermost points of the clamping pallet 6.

The longitudinal centerlines of the centering pins 3 as well as of the centering openings 9 are oriented radius parallel to the Z axis Z1 of the chuck 1 and clamping pallet 6 respectively. In any case, this arrangement of the centering members 3, 9 permits repeatedly precise positioning of the clamping pallet 6 relative to the chuck 1 in the X and Y direction as well as relative to the angular position about the Z axis. In addition to this, providing the studs 12 as described in contact with the flats 4 of the chuck 1 also achieves high precise positioning in the Z direction.

Referring now to FIG. 4 there is illustrated the centering plate 8 engineered integrally. For securing the centering plate 8 by means of the studs a fastener drilling 16 in the centering plate 8 is provided in the middle between two adjacent centering openings 9.

Claims

1. A clamping fixture comprising a chuck (1) for chucking a clamping pallet (6), with centering members (3) arranged at the chuck (1) cooperating with further centering members (9) arranged at the clamping pallet (6) such that the clamping pallet (6) when chucked in the chuck (1) is oriented in the X and Y direction, the one centering members being formed by centering pins (3) devised to engage the other centering members configured as centering openings (9), **characterized in that** the clamping fixture comprises at least three centering openings (9) and a corresponding number of centering pins (3), each of the centering pins (3) featuring two conically tapered side faces (3a, 3b) and each centering opening (9) being defined by two side walls (9a, 9b) oriented parallel to each other configured such that the conically tapered side faces (3a, 3b) of each centering pin (3) come into contact therewith linely.

2. The clamping fixture as set forth in claim 1, characterized in that the clamping fixture comprises four centering openings (9) and a corresponding number of centering pins (3).

3. The clamping fixture as set forth in claim 1 or 2, characterized in that the centering openings (9) are machined in a one-piece centering plate (8), the latter being flexible compliant at least in the region of the centering openings (9) in the Z direction.

4. The clamping fixture as set forth in claim 3, characterized in that the centering plate (8) is secured by means of studs (12) to a base body (7) of the clamping pallet (6).

5. The clamping fixture as set forth in claim 4, characterized in that the studs (12) are provided with a thread and are screwed into the base body (7) of the clamping pallet (6) and that the front end (13) of each stud (12) forms a Z stop for abutting the chuck (1).

6. The clamping fixture as set forth in claim 3, characterized in that each centering opening (9) is defined sideways by a side walls (9a, 9b) flexible compliant in the Z direction.

7. The clamping fixture as set forth in any of the claims 3 to 6, characterized in that the centering plate (8) is made of a stainless sheet metal.

8. The clamping fixture as set forth in any of the claims 3 to 7, characterized in that the centering plate (8) is made of a softer material than that of the centering pins (3).

9. The clamping fixture as set forth in any of the claims 3 to 8, characterized in that the centering openings (9) are cut out from the centering plate (8) by precision stamping.

10. The clamping fixture as set forth in any of the claims 3 to 9, characterized in that the centering plate (8) is maximally 2 mm, particularly 0.8 to 1.5 mm thick.

11. The clamping fixture as set forth in any of the preceding claims, characterized in that the side faces (3a, 3b) of the centering pins (3) are machined, particularly ground with high precision.

12. The clamping fixture as set forth in any of the preceding claims, characterized in that the centering members (3, 9) are arranged uniformly distributed on a circle K1, K2,

13. The clamping fixture as set forth in any of the preceding claims, characterized in that the clamping pallet (6) is provided spaced away from its front end with a centering plate (8) provided with four centering openings (9), each centering opening (9) being enclosed on all sides by the centering plate (8).

14. The clamping fixture as set forth in claim 5, characterized in that the chuck (1) is provided with a base body (2) featuring flats (4) for abutting the studs 12.

15. The clamping fixture as set forth in any of the preceding claims, characterized in that the centering plate (8) is securing to a base body (7) of the clamping pallet (6) by means of four threaded studs (12), the front end (13) of each stud (12) forming a Z stop for abutting against the chuck (1).

16. A clamping pallet (6) for use in a clamping fixture configured as set forth in any of the claims 1 to 15.

17. The clamping pallet (6) as set forth in claim 16, characterized in that the clamping pallet (6) comprises a base body (7) to which a one-piece centering plate (8) configured with at least three centering openings (9) is secured such that it is flexible compliant in the Z direction in the region of the centering openings (9).

18. The clamping pallet (6) as set forth in claim 17, characterized in that the clamping pallet (6) is configured as a workpiece pallet.

19. A centering plate (8) for attachment to a base body (7) of a clamping pallet (6) for use in a clamping fixture as set forth in any of the claims 1 to 15, characterized in that the centering plate (8) is configured in one piece and comprises at least three centering openings (9) and that it features at least three drillings for securing to a base body (7) of a clamping pallet (6).

20. The centering plate (8) as set forth in claim 19, characterized in that the centering plate (8) is provided with four centering openings (9) arranged on a circle K2 each spaced away from the other by 90°, each centering opening (9) being defined sideways by two side walls (9a, 9b) oriented parallel to each other.

21. The centering plate (8) as set forth in claim 19 or 20, characterized in that machined in the centering plate (8) between each two adjacent centering openings (9) is a fastener drilling (16).

22. The centering plate (8) as set forth in any of the claims 19 to 21, characterized in that the centering openings (9) are produced by precision stamping.