

Workpiece clamping fixture

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

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Generic clamping fixtures serve particularly to clamp in place workpieces precisely positioned for machining, the clamping fixture usually featuring a workpiece pallet to mount or clamp each workpiece.

- 10 The workpiece pallet can either be directly secured to the work table of the machine tool or by means of a chuck, the workpiece pallet in the latter case featuring means for locking in place to the chuck and means for defining the position precisely located at the chuck. Especially the latter means needs to ensure exact positioning in both the X and Y as well as the Z direction.

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In series production the workpieces – blanks – to be machined are usually inserted directly into the machine tool, for example by a 6-axes robotic attachment. In small series production the workpieces to be machined are clamped on pallets manually or automatically changed in the machine tool, whereas in medium series
20 production clamping the workpieces in place is either complicated or the clamping fixture or pallet is relatively expensive.

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The object of the invention is thus to create a clamping fixture configured in accordance with the preamble of claim 1 which is particularly suitable for medium series production whilst having a simple configuration and being cost-effective in production so that the workpieces to be machined can now be clamped in place thereby in the workpiece pallet both quickly, simply and reliably safe.

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This object is achieved by a clamping fixture having the features as set forth in the characterizing clause of claim 1.

By the clamping fixture now featuring a workpiece pallet comprising at least two material-elastic excursionable clamping jaws for holding the workpieces, the basic

requirement for a clamping fixture of simple configuration is satisfied, by means of which the workpieces to be machined can now be clamped in place quickly, simply and reliably safe.

- 5 Preferred embodiments of the subject matter of the invention read from the sub-claims 2 to 15.

Thus, it is provided for in one preferred further embodiment that the clamping jaws are provided with fitted jaws for shifting and arresting transversely to the slot so
10 that the gap L between the fitted jaws is variable. A clamping fixture configured as such finds universal application.

The invention will now be detailed by way of an example embodiment as shown in the drawings in which:

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FIG. 1 is a view in perspective of a workpiece pallet;

FIG. 2 is a side view of the workpiece pallet as set forth in FIG. 1;

20 FIG. 3 is a cross-sectional view through the workpiece pallet;

FIG. 4 is a view illustrating the clamping fixture comprising the workpiece pallet as set forth in FIG. 1 as well as an actuator merely indicated;

25 FIG. 5 is a view in perspective from underneath of the workpiece pallet, and

FIG. 6 is a view of the workpiece pallet as shown in FIG. 2 but together with a workpiece clamped in place and indicating a chuck.

30 Referring now to FIGs. 1 and 2 there is illustrated the basic configuration of the clamping fixture in accordance with the invention as will now be detailed, namely as regards the workpiece pallet 2. In addition to the workpiece pallet 2 the clamping fixture comprises an actuator not shown in the first two FIGs. which will

be detailed later with reference to FIG. 4. FIG. 1 shows the workpiece pallet 2 in a view in perspective, whilst FIG. 2 shows the workpiece pallet 2 from the side. The workpiece pallet 2 serving to clamp the workpieces in place comprises a substantially cylindrical configured main body 3 having a central slot 6 to form two clamping jaws 4, 5. The slot 6 bottoms into a round concavity 7. To tweak the excursion force or achievable clamping force needed for material-elastic excursion of the two clamping jaws 4, 5 radial incisions 8, 9 can be machined into the main body 3 on both sides of the concavity 7 oriented parallel to the slot 6. To avoid stress cracks the cited concavities 7, 8, 9 are preferably engineered round. The main body 3 is configured in one piece and is made preferably of hardened, stainless steel.

Machined in the main body 3 on both sides of the slot 6 is a conically tapered concavity 11, 12 each for insertion of a splaying tool – plug – for splaying the two clamping jaws 4, 5. The two splaying tools form a component of the actuator as is detailed later on.

Each clamping jaw 4, 5 is topped by a fitted jaw 13, 14 which can be shifted and locked in place transversely to the slot 6 relative to each clamping jaw 4, 5, as indicated by the double arrows, so that the gap between the two fitted jaws 13, 14 is variable. For shifting each fitted jaw 13, 14 three setscrews are provided for each clamping jaw 4, 5 (not shown). The fitted jaws 13, 14 are secured to each clamping jaw 4, 5 by means of a linear slide guide. Preferably the fitted jaws 13, 14 can not only be shifted but also replaced to comply with the changing requirements.

Where necessary, the two clamping jaws 4, 5 may be additionally connected to each other by a pull-rod. One such pull-rod is material-elastically extended in splaying the two clamping jaws 4, 5, it serving to increase the material-elastic restoring force of the two clamping jaws 4, 5 after removal of the splay tools which, of course, also correspondingly adds to the clamping force. It is understood that the material of the pull-rod as well as its dimensions can be selected and varied as required. When the main body 3 is correspondingly dimensioned it is possible, of

course, to do away with a pull-rod.

In the present example, the workpiece mount is configured as a workpiece pallet 2 bottomed with supporting feet 17 and a centering disc 18. The centering disc 18 features four centering openings to precisely locate the workpiece pallet 2 on a chuck. The supporting feet 17 serve to secure the centering disc 18 to the main body 3. In addition, the supporting feet 17 act as a Z mount when clamping the workpiece pallet 2 to the chuck. The supporting feet 17 are directly threaded in the main body 3.

Referring now to FIG. 3 there is illustrated a cross-sectional view through the workpiece pallet 2. Particularly evident from this view is how the main body 3 is engineered in one piece. In addition to this, it is evident how the centering disc 18 is secured by means of the supporting feet 17 to the underside of the main body 3.

Furthermore evident are the setscrews 20, 21 serving to adjust each of the fitted jaws 13, 14 on each of the clamping jaws 4, 5. Provided in each of the fitted jaws 13, 14 is a total of three setscrews 20, 21 by means of which the fitted jaws 13, 14 can be shifted transversely to the slot. The setscrews 20, 21 are preferably engineered self-locking so that each of the fitted jaws 13, 14 after being shifted into position is locked and remains in place even after repeated splaying of the clamping jaws 4, 5. It is understood, of course, that also separate locking means may be provided by means of which the setscrews 20, 21 and/or the fitted jaws 13, 14 can be locked in place in each position.

Additionally evident is how the fitted jaws 13, 14 are provided with sharp protuberances 22, 23 in the form of spikes. These protuberances 22, 23 promote positively locking in place a workpiece by biting into the surface of each workpiece. The protuberances 22, 23 are preferably made of a very hard material. Lastly evident on the underside of the main body 3 is a chucking spigot 25 secured by means of a thread, by means of which the workpiece pallet 2 can be locked in place on the chuck (not shown).

To set the fitted jaws 13, 14 to the thickness of the workpiece to be clamped in place a reference element 26 is preferably inserted in the workpiece pallet 2 and the fitted jaws 13, 14 shifted by means of the setscrews 20, 21 until they are in snug contact with the sides of the reference element 26. The reference element 26
5 is dimensioned such that the gap L between the two fitted jaws 13, 14 is adjusted to be less (by a few tenths of a millimeter) than the thickness of the workpiece to be clamped in place. To clamp a workpiece in the workpiece pallet 2, the two clamping jaws 4, 5 must first be splayed by the cited amount of a few tenths of a millimeter so that the workpiece to be clamped in place can be inserted between
10 the fitted jaws 13, 14. It is understood that reference elements are available differing in thickness for the workpieces likewise differing in thickness.

In the unloaded starting position of the workpiece pallet 2 the clamping faces 13a, 14a (FIG. 2) of the fitted jaws 13, 14 facing each other are oriented in the Z
15 direction preferably not completely parallel. Instead, the gap between the two clamping faces 13a, 14a slightly increases inwards in the Z direction. This inclination of the clamping faces 13a, 14a is selected so that they are oriented parallel when in active effect, since the two clamping jaws 4, 5 for locking in place a workpiece are slightly splayed when actively effective.

20 Referring now to FIG. 4 there is illustrated the complete clamping fixture 1 comprising the workpiece pallet 2 as well as the actuator 27 depicted diagrammatically. The actuator 27 includes in particular two splaying tools in the form of splaying plugs 28, 29 serving to splay the two clamping jaws 4, 5. The two
25 splaying plugs 28, 29 are secured to a mechanical fixture (not shown) by means of which they can be inserted axially into conical concavities 11 translating sideways into the slot to provide the material-elastic excursion of the two clamping jaws 4, 5. A material-elastic excursion or pivoting of the clamping jaws 4, 5 is understood to be an elastic, i.e. reversible change in shape of the main body 3 in the region of
30 the clamping jaws 4, 5. The conicity of the splaying plugs 28, 29 is selected so that no self-locking effect occurs in each of the concavities 11, it usually being the case that the two clamping jaws 4, 5 are material-elastically splayed by means of the actuator 27 by a few tenths of a millimeter. Once the two clamping jaws 4, 5 have

been splayed by the cited amount a workpiece can be inserted between the two fitted jaws 13, 14. After release or removal of the actuator the two clamping jaws 4, 5 return inwards to their starting position, thereby locking in place the cited workpiece due to the material-elastic restoring force of the main body 3 made of steel.

Referring now to FIG. 5 there is illustrated the workpiece pallet 2 in a view in perspective as seen from underneath. Particularly evident in this view is how the centering disc 18 is secured by means of the supporting feet 17 to the underside of the main body 3. The centering disc 18 features four centering openings 18a making it possible to precisely position the workpiece pallet 2 in the X and Y direction at a chuck. When clamping the workpiece pallet 2 to the chuck the flat face of the supporting feet 17 acts as a Z mount. The workpiece pallet 2 is clamped to the chuck by means of the chucking spigot 25.

Referring now to FIG. 6 there is illustrated the workpiece pallet 2 as shown in FIG. 2 together with the workpiece 30 clamped therein and, merely indicated, a chuck 31. After the two clamping jaws 4, 5 of the workpiece pallet 2 have been splayed by a few tenths of a millimeter more than the thickness of the workpiece 30 to be chucked, the workpiece 30 can be inserted between the two clamping jaws 4, 5 or fitted jaws 13, 14 respectively. As soon as the workpiece 30 is correctly positioned, the two splaying plugs 28, 29 (FIG. 4) can be removed, causing the clamping jaws 4, 5 to spring back to their starting position to lock the workpiece 30 in place. When clamped in place, a workpiece 30 is usually located with a clamping force of several to a few dozen kilonewtons.

Clamping a workpiece in the workpiece pallet 2 is usually done in tooling up, this station being provided for this purpose with the actuator 27 as described above for splaying the clamping jaws 4, 5. By splitting up the clamping fixture 1 into a passive workpiece pallet 2 and an active actuator 27 the clamping fixture 1 can be configured particularly simple.

The clamping fixture 1 configured in accordance with the invention is cost-effective

to manufacture and permits workpieces to be locked in place both simply, speedily and precisely located. Splitting the clamping fixture 1 into a passive workpiece pallet 2 and an active actuator puts a ceiling on the costs of the clamping fixture, namely of each workpiece pallet 2. In addition to this, the adjustable fitted jaws
5 ensure that workpieces differing in thickness are defined and held in place on the workpiece pallet 2.

Instead of the example embodiment as shown other variants of the clamping fixtures are, of course, feasible in the scope of the invention. For instance, the
10 workpiece pallet 2 could be configured such that the two clamping jaws first need to be pressed together material-elastically so that a workpiece can be locked in place to the outer side of the clamping or fitted jaws. For this purpose the workpiece could feature, for example, a concavity for insertion of the clamping jaws. Instead of conical concavities the workpiece pallet could also be provided
15 with protuberances for engaging by the actuator.

Where necessary, the slot 6 and/or the concavity 7 could be filled with an elastomer. This would, for one thing, reduce the tendency to soilage and, for another, the vibration response of the workpiece pallet 2 would be improved by the
20 damping effect of the elastomer.

Making use of the material-elasticity of the main body, namely the material-elastic restoring force of the clamping jaws, for clamping in place a workpiece does away with the need of separate actuating elements for shifting and clamping the
25 clamping jaws.

Although the clamping fixture in accordance with the invention is particularly suitable for medium series production, it can of course, because of its flexibility, also be used in small and large series production.

List of Reference Numerals

	1	clamping fixture
	2	workpiece pallet
5	3	main body
	4	clamping jaw
	5	clamping jaw
	6	slot
	7	round concavity
10	8	radial incision
	9	radial incision
	10	
	11	conical concavity
	12	conical concavity
15	13	fitted jaw
	14	fitted jaw
	17	supporting feet
	18	centering disc
20	18a	centering openings
	19	
	20	setscrew
	21	setscrew
	22	spike
25	23	spike
	24	
	25	chucking spigot
	26	reference element
	27	actuator
30	28	splaying plug
	29	splaying plug
	30	workpiece
	31	chuck

Claims

1. A clamping fixture (1) featuring a workpiece pallet (2) for holding workpieces for machining, the workpiece pallet (2) comprising means (25) for locking in place
5 on a chuck (31) as well as means (18,18a) for precisely defining the position at the chuck (31), **characterized in that** the workpiece pallet (2) comprises at least two material-elastic excursionable clamping jaws (4,5) for holding workpieces (30).
2. The clamping fixture (1) as set forth in claim 1, characterized in that the
10 workpiece pallet (2) comprises a main body (3) provided with a slot (6) defined by the clamping jaws (4,5), the clamping jaws (4,5) being material-elastic excursionable transversely to the slot (6) and each workpiece (30) can be locked in place by means of the material-elastic restoring force of the clamping jaws (4,5).
- 15 3. The clamping fixture (1) as set forth in claim 2, characterized in that the main body (3) is configured in one piece and made of metal, particularly of hardened or stainless steel.
4. The clamping fixture (1) as set forth in claim 2 or 3, characterized in that the
20 clamping jaws (4,5) are provided with fitted jaws (13, 14) for shifting and arresting transversely to the slot (6) so that the gap (L) between the fitted jaws (13, 14) is variable.
5. The clamping fixture (1) as set forth in any of the preceding claims,
25 characterized in that the clamping fixture includes an actuator (27) for material-elastic splaying and/or contraction of the clamping jaws (4,5), the clamping jaws (4,5) being material-elastic excursionable by the actuator (27) for receiving a workpiece (30) to such an extent that the workpiece (30) after release of the actuator (27) can be locked in place by the material-elastic restoring force of the
30 clamping jaws (4,5).
6. The clamping fixture (1) as set forth in claim 5, characterized in that the main body (3) of the workpiece pallet (2) is provided with concavities (11) and/or

protuberances for engaging by the actuator (27) for material-elastic excursion of the clamping jaws (4,5).

7. The clamping fixture (1) as set forth in claim 6, characterized in that
5 machined on both sides of the slot (6) is a conically concavity (11) in the main body (3) and that the actuator (27) comprises two splaying plugs (28, 29) each for insertion into each of the concavities (11) to splay the clamping jaws (4,5).

8. The clamping fixture (1) as set forth in any of the claims 4 to 7,
10 characterized in that the clamping fixture (1) includes a reference element (26) for setting the gap between the fitted jaws (13, 14).

9. The clamping fixture (1) as set forth in any of the claims 4 to 8,
15 characterized in that the fitted jaws (13, 14) are configured replaceable.

10. The clamping fixture (1) as set forth in any of the preceding claims,
characterized in that the clamping jaws (4,5) or fitted jaws (13, 14) are configured
to positively and/or non-positively lock in place a workpiece (30), the clamping
force being generated by material-elastic excursion of the clamping jaws (4,5) or
20 their material-elastic restoring force.

11. The clamping fixture (1) as set forth in claim 2, characterized in that the slot
(6) bottoms into a round concavity (7).

25 12. The clamping fixture (1) as set forth in any of the claims 4 to 7,
characterized in that the fitted jaws (13, 14) are provided with protuberances (22,
23) and/or recesses for achieving a positive connection with the workpiece (30) to
be clamped in place.

30 13. The clamping fixture (1) as set forth in any of the preceding claims,
characterized in that the workpiece pallet (2) is provided at the underside with a
chucking spigot (25) for locking it in place at a chuck (31).

14. The clamping fixture (1) as set forth in any of the preceding claims, characterized in that the workpiece pallet (2) is provided at the underside with at least three centering openings or centering pegs to precisely define the position at the chuck (31).

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15. The clamping fixture (1) as set forth in claim 14, characterized in that the main body (3) is provided at the underside with a centering disc (18) inserted into centering openings (18a), the centering disc (18) being secured by means of supporting feet (17) forming the Z mount at the main body (3).