

Description

The present invention relates to a coupling device for the torsionally fixed connection of a workpiece to a machining apparatus. When a workpiece is connected to a machining apparatus, e.g. to a lathe, a milling machine, a grinder or the like, it is a priority that the workpiece to be machined must permit exactly defined clamping with reference to an axis of the machining apparatus. On a lathe, for example, this is the rotational axis of the chuck, and the angular position of the workpiece with respect to said rotational axis is unimportant. However, high standards of centricity are imposed. In the case of a grinding or milling machine not only is centricity important, but care must also be taken to see that the workpiece is positioned at the proper angle to the machining apparatus.

In precision toolmaking the machining accuracy of a workpiece has to meet extremely exacting requirements. In particular it must be ensured that a workpiece that is to be machined can be clamped in a machining apparatus in an exactly defined position.

Small eccentricity tolerances can be achieved using the known cone-type seats. These ensure highly accurate positive centring, but they do get dirty easily. When a cone seat gets dirty either its accuracy is diminished or else it cannot be removed, or is extremely difficult to remove, owing to excessive self-locking. Nor does the cone seat meet the requirement that the tool be clamped at the proper angle.

The situation is similar in the case of conventional chucks; they too get dirty easily and offer no solution as far as clamping the workpiece at the proper angle is concerned.

Given the strict requirements governing centricity, it is furthermore necessary to manufacture the clamping means - whether a cone seat or a chuck - with extremely high accuracy. This, of course, involves great expense and pushes up costs, especially where a large number of such clamping devices are required.

Finally, one difficulty that has still not been satisfactorily resolved is that of how to clamp a workpiece in turn in a number of different machining apparatuses in order to perform a plurality of machining operations on the same workpiece, while ensuring that the workpiece is clamped perfectly centrically and with angular accuracy in each of the machining apparatuses. This requirement occurs, for instance, in the manufacture of electrode bodies for erosion machines, which in general demands a large number of machining operations on various machining apparatuses. The requirements governing dimensional accuracy are in the order of just a few thousandths of millimetres, and the workpieces should be transferred from one machining station to the next as quickly and simply as possible.

A coupling device is known from DE-B-12 57 496 which has two coaxial coupling members and interposed between them a driving plate which is rigid in the peripheral direction, one of the coupling members being provided with two driving pins which project from the coupling surface and the jacket surface of the driving pins being conical in shape. However, this coupling device is totally unsuitable for the purpose according to the invention, viz. resolving the difficulties outlined above, as it cannot ensure the required centricity of the connection and in terms of the wording of the technical problem itself cannot satisfy the requirement that the connection be easily removable while at the same time ensuring high repeat accuracy when the connection is restored.

It is the object of the present invention to provide a coupling device in accordance with the prior art that on the one hand no longer presents the drawbacks outlined above and on the other hand ensures, in addition to highly accurate centric clamping, an exactly defined angular position of the workpiece with reference to the machining apparatus, particularly when the connection is frequently removed and restored again. Furthermore it is also to be ensured that a clamped workpiece can quickly be removed from a machining apparatus and fixed to a subsequent machining apparatus, at the same time providing a high degree of immunity to dirt.

The invention starts from a coupling device of the type specified initially, which in the known manner exhibits two coaxial coupling members and interposed between them a driving plate which is rigid in the peripheral direction, one of the coupling members being provided with at least two driving pins projecting from the coupling surface and the jacket surface of the driving pins being at least partially conical in shape. In accordance with the invention this device is characterised in that the driving plate consists of a spring steel disc torsionally fixed to the other coupling member at a distance from the coupling surface thereof and is provided with openings arranged to correspond with the driving pins and the edges of which at least partially encompass the conical jacket surfaces of the driving pins.

Preferred embodiments of the device according to the invention are defined in Claims 2 to 17.

One working example of the coupling device according to the present invention will now be described in detail with reference to the accompanying drawings, wherein:

Fig. 1 is an axial section through the coupling device while unclamped,

Fig. 2 is an axial section through the coupling device while clamped,

Fig. 3 is a partial section along line A-A in Fig. 1,

Fig. 4. is a partial section along line B-B in Fig. 2,

Fig. 5 is a view of one of the coupling members with the driving plate positioned on it,

Fig. 6 is a view of the other coupling member,

Fig. 7 is a section along line C-C in Fig. 6, and

Fig. 8 is a partial section along line D-D in Fig. 6.

Fig. 1 is a sectional view of the coupling device of the invention in the unclamped position. It includes a first coupling member 1, substantially plate-shaped and provided with a central tapped hole 2. In addition a second coupling member 3 is provided, likewise substantially plate-shaped and provided with a central tapped hole 4. The latter is traversed by a screw 5, the free end of which engages in the thread of the hole 2. Tightening the screw 5 draws together the two coupling members 1 and 3 in the axial direction. In the state represented in Fig. 1 the screw 5 is not tightened and the two coupling members 1 and 3 rest only loosely against one another.

Between the two coupling members 1 and 3 is inserted a driving plate 6. This is torsionally fixed to coupling member 3. Coupling member 1 is coupled to a machining apparatus by means not illustrated, e.g. to the spindle of a lathe, grinding machine or similar. The other coupling member 3, however, carries the workpiece to be machined, using aids likewise not illustrated. When the coupling device is in the clamped

position coupling member 1 thus acts as the driving member, while coupling member 3 acts the driven member.

As can further be seen from Fig. 1 and in particular also from Figs. 6 to 8, one side of coupling member 1 is provided with a centrically arranged driving pin 7 and with an eccentrically arranged driving pin 8. The centric pin 7 and the eccentric driving pin 8 project past the coupling surface 9 of coupling member 1. The outer surface of the centrically arranged pin 7 is conical in shape and consists of two portions, viz. a first portion 10 in the shape of the jacket of a truncated cone, adjacent to coupling member 1, and a second portion 11 in the shape of the jacket of a truncated cone, adjacent to the front face 12 of the pin 11. In the section shown in Fig. 7 the inclination of the first portion 10 is less than that of the second portion 11. In other words this means that portion 11 which adjoins the front face 12 is more conical than portion 10 following it, which adjoins the surface 9 of coupling member 1. The purpose of this division will be explained in more detail below.

Driving pin 8, which is arranged eccentric to the rotational axis X of coupling member 1, has two lateral faces 13 extending parallel to the radius which are inclined with respect to the rotational axis X of coupling member 1. In the region of the front face 14 of driving pin 8 these inclined faces 13 merge into two further faces 15, more sharply inclined with respect to the rotational axis X and likewise extending parallel to the radius.

The second coupling member 3 has an annular bead 17 arranged concentric to the hole 4 and proud of the coupling surface 16, the driving plate 6 resting against the front face of said bead. The driving plate 6 is connected in torsionally fixed manner to the bead 17 and lies a certain distance from the surface 16 of coupling member 3. As can be seen from Fig. 5

in particular, the driving plate 6 on the one hand has a central, circular opening 19 and on the other an eccentrically arranged, substantially oval opening 20. The latter has two parallel side edges 21 which extend parallel to the radius to the rotational axis X of the coupling device. It can be seen from Fig. 1 that the diameter of the central opening 19 is such that the edge thereof partially encompasses the portion 10 of coupling member 1 which is shaped like the jacket of a truncated cone. However, the two parallel edges 21 of the opening 20 are arranged at a distance from one another such that they partially overlap the inclined, plane lateral faces 13 of driving pin 8 as shown in Fig. 3. It will readily be understood that in this way pin 7 cooperates with opening 19 to ensure that coupling member 3 is centred with respect to coupling member 1, while pin 8 is jointly responsible with opening 20 for the angular position of coupling member 1 with respect to coupling member 3.

Coupling member 3 is equipped with spacing pins 22, the surfaces 23 of which are proud of the coupling surface 16 of coupling member 3 and which when the coupling device is clamped come to rest on the surface 9 of coupling member 1. This ensures that the two coupling members 1 and 3 lie exactly parallel to one another when the coupling device is clamped.

The latter state is represented in a sectional view in Fig. 2. The desired three-dimensional relative positioning of the two coupling members 1 and 3 is achieved as follows:

- The distance between the two coupling members 1 and 3 and their parallel alignment is defined by the surfaces 23 of spacing pins 22 resting on the coupling surface 9 of coupling member 1;
- the concentricity of the two coupling members 1 and 3 is assured by engagement of the pin 7 in the opening 19 of the

driving plate 6. As already mentioned, the edges of the opening 19 partially overlap the conical jacket face 10 of pin 7 when loosely positioned thereon. When the coupling device is clamped, as shown in Fig. 2 the edges of opening 19 in the driving plate 6 abut against the jacket face 10, so that the driving plate 6 deforms in the region of its opening 19. At the same time this produces a self-cleaning action by the surface of pin 7.

- The angular position of coupling member 3 with respect to coupling member 1 is defined by the edges 21 of opening 20 in the driving plate resting on the conical lateral faces 13 of pin 8. This too produces a deformation of the driving plate 6 when the coupling device is clamped, as shown in Fig. 2, and hence forcible pressing of the edges 21 on the faces 13 to produce a self-cleaning action.

The more sharply inclined peripheral portions, i.e. portions 11 of centric pin 7 and portions 15 of pin 8, make it easier to place the coupling member 3 equipped with the workpiece to be machined onto coupling member 1. They are unimportant as far as the function of the coupling device in itself is concerned, unless the openings 19 and 20 are at the absolute lowest limit of their dimensional tolerance, so that the edges of said openings come to lie on the above-mentioned peripheral areas 11 and 15 of the two pins.

As can be seen from Fig. 5, the driving plate 6 has a slot 24 extending perpendicular to a line between central opening 19 and eccentric opening 20. This slot 24 ensures that the central portion of the driving plate 6, around the central opening 19, is able to deform elastically around the opening 20 independently of the peripheral portion. This gives a high-precision, exactly defined position of coupling member 3 relative to coupling member 1 both with reference to centrality and with reference to angular accuracy.

The advantage of the coupling device proposed in accordance with the invention is in particular the fact that only coupling member 1 with the protruding pins 7 and 8 calls for great manufacturing accuracy. The other coupling member 3 with the driving plate positioned on it may display comparatively great manufacturing tolerances without having to risk compromising on centring and angular accuracy so long as central opening 19 is exactly circular and the two edges 21 of eccentric opening 20 are exactly parallel. This, however, can be achieved at little cost, the more so since the absolute dimension of the diameter of central opening 19 and also that of the distance between the two edges 21 are of secondary importance.

Claims

1. Coupling device for the torsionally fixed connection of a workpiece to a machining apparatus, having two coaxial coupling members (1, 3) and interposed between them a driving plate (6) which is rigid in the peripheral direction, one of the coupling members (1) being provided with at least two driving pins (7, 8) projecting from the coupling surface and the jacket surface of the driving pins (7, 8) being at least partially conical in shape, characterised in that the driving plate (6) consists of a spring steel disc which is torsionally fixed to the other coupling member (3) at a distance from the coupling surface thereof and being provided with openings (19, 20) which are arranged so as to correspond with the driving pins (7,8) and the edges (21) thereof at least partially overlapping the conical jacket surfaces (10, 13) of the driving pins.

2. Coupling device according to Claim 1, characterised in that the first coupling member (1) is equipped with one centrically arranged (7) and one eccentrically arranged (8) driving pin.

3. Coupling device according to Claim 2, characterised in that the outer surface (10 and 11, respectively) of the centric driving pin (7) is at least partially the shape of the jacket of a truncated cone.

4. Coupling device according to Claim 3, characterised in that the outer surface of the centric driving pin (7) is the shape of the jacket of a first truncated cone in a first base portion (10) adjacent to coupling member (1), and the shape of the jacket of a second truncated cone in a second portion (11) adjacent to its front face (12).



5. Coupling device according to Claim 4, characterised in that the aperture angle of the associated cone is smaller in the case of the first portion (10) than that of the associated cone in the case of the second portion (11).

6. Coupling device according to Claim 2, characterised in that the eccentrically arranged driving pin (8) comprises two opposing surface portions (13, 15), each constituted by at least one plane that is parallel to the radius and inclined with reference to the axis of the coupling device.

7. Coupling device according to Claim 6, characterised in that each of the two surface portions (13, 15) is constituted by two planes (13 and 15, respectively) which are inclined to the axis of the coupling device at different angles.

8. Coupling device according to Claim 7, characterised in that the plane (15) adjacent to the front face (14) of the pin (8) is more sharply inclined with respect to the axis of the coupling device than the plane (13) adjacent to the coupling surface (9) of the coupling member.

9. Coupling device according to Claim 2, characterised in that the driving plate (6) is provided with a first, centrically arranged, circular opening (19) and a second, eccentrically arranged opening (20), the latter comprising two edges (21) which extend parallel to the radius.

10. Coupling device according to Claims 1 to 5 and 9, characterised in that the diameter of the circular opening (19) is smaller than the base diameter of the centric pin (7), but greater than its diameter at the front face (12).



11. Coupling device according to Claim 10, characterised in that the diameter of the circular opening (19) has a value that is between the maximum and the minimum diameter of that truncated cone-shaped jacket portion (10) of the centric driving pin (7) which is adjacent to the coupling surface (9).

12. Coupling device according to Claims 1 and 2 and 6 to 9, characterised in that the distance between the two edges (21) of the eccentric opening (20) which extend parallel to the radius is smaller than the base width of the eccentric pin (8), but greater than the width thereof at the front face (14), both values measured perpendicular to the radius.

13. Coupling device according to Claim 12, characterised in that the distance between the edges is a value between the base width of the pin (8) and its width where it merges from the less inclined (13) to the more sharply inclined (15) plane.

14. Coupling device according to Claim 2, characterised in that the second coupling member (3) is provided with an annular, concentric bead (17) proud of the coupling surface (16), the driving plate (6) being torsionally fixed to the front face of said bead.

15. Coupling device according to one of the preceding Claims, characterised in that one (13) of the two coupling members (1, 3) is provided with three spacing pins (22) proud of the coupling surface (16), the front faces (23) of said pins abutting against the coupling surface (9) of the other coupling member (1) when the coupling device is engaged.

16. Coupling device according to Claim 1, characterised in that the driving plate (6) is provided with slots (24) between the openings (19, 20).



17. Coupling device according to Claims 9 and 16, characterised in that a slot (24) is provided which extends perpendicular to a line between the two openings (19, 20) and is positioned between the centric and the eccentric opening (19, 20).

