

Description

The invention relates to a roller for a roll stand with an interchangeable rolling ring and a split roller body, both parts of which form a respective clamping flange for the rolling ring and are pulled together by central connection means, and also with axial clamping means which comprise a threaded device for the transmission and basic adjustment of the forces acting between the two parts of the roller body, a hydraulic clamping device for clamping the assembly and a mechanical securing device for securing the hydraulically generated clamping condition. A roller of this type is known from EP-A-0 343 440.

It is known (US-A-4,117,705, US-E-31,554) to clamp one or more rolling rings on a roller body by means of an axial clamping device which comprises three elements, that is say, firstly, a nut, by means of which the rolling ring and the assembly provided for its axial clamping can be brought into a basic setting, from which the clamping condition is developed, and the force generated for clamping the rolling ring is transmitted to the roller body; secondly, a hydraulic clamping device for clamping the assembly; and, thirdly, a mechanical securing device, by means of which the hydraulically generated clamping condition is secured before the hydraulic clamping device is released. This assembly requires a substantial amount of space in axial direction, which is not available in short rollers intended for modern compact roll stands. However, to enable the principle of axial rolling ring clamping to be used even in compact roll stands, the known design indicated in the introduction has been proposed, which has a split roller body. Each of the two roller body parts forms a clamping flange connected in one piece therewith for axial clamping of the rolling ring. This clamping is effected by means of a tie bolt which is provided in the centre of the roller and which is extended through a bore of a roller body

part and out of the latter, so that at the end of the roller, beyond a bearing of said roller, the aforementioned axial clamping means can be accommodated (public prior use). It has been found, however, that in this design the rolling ring is not retained sufficiently rigidly in many cases, which is possibly associated with a bending elasticity of the roller body which is inherent in the design.

The invention is based on the object of devising a roller which is suitable for a compact roll stand and which does not have these disadvantages. Starting from the roller indicated in the introduction, this object is achieved in that the two parts of the roller body inside the rolling ring are extended by mutually opposed hollow cylindrical extensions each of which have a thread, by means of which threads they are joined together directly or indirectly via a threaded journal or a threaded sleeve, and in that the hydraulic clamping device and the mechanical securing device are disposed on the outer periphery of the roller.

The manner in which this object is achieved is based on four essential principles. The first principle lies in the knowledge that the space requirement of the axial clamping means is principally brought about by the nut, whereas the hydraulic clamping device and the mechanical securing device can be formed with little axial space requirement on the roller periphery near the rolling ring, if the design principle disclosed in EP-0 343 440, for example, is used. The second principle lies in the idea that it is not necessary for the axial clamping means to be conceived as a structural unit and, therefore, that the nut can also be accommodated at another location. The third principle lies in the idea that the nut or a threaded device replacing it can take the form of part of the connection means which necessarily has to be provided so as to pull together the two parts of the roller body. Finally, the last principle of the inventive idea lies in that, as a result of the invention, the connection means can be limited to the central region of the roller body and does not have to

extend axially from the roller in the form of a tie bolt, and in that the linear elongation of the roller body parts subject to tension, which is associated with the loading of the roller, is thereby decisively reduced. The long, comparatively thin tie bolt of the known design, which extends axially from the roller body, does in fact act as a tension spring which softens the entire design. Since, of course, clearance has to be provided between the tie bolt of the known design and the sleeve surrounding it, these parts can also move relative to one another, which under the high operating load results in mutual "working" of the roller body elements and thus in inadequate securing of the rolling ring. If, however, the connection means according to the invention is limited to the longitudinal extension which is necessary for the connecting operation, firstly, a long thin member which is readily extensible in longitudinal direction is avoided and, moreover, the structural freedom is gained to design the connection means to be so simple and compact that mutual clearance in the individual members is almost or completely eliminated. The design is also simplified because the threaded device, which serves to replace the nut of the axial clamping means, is used simultaneously for the connection means of the roller body parts.

As is known per se, it is advantageous for the rolling ring to be clamped not only axially but also to provide it with radial support. For this purpose, in the known design radial seating surfaces, which co-operate with the bore of the rolling ring, are provided on the two parts of the roller body adjacent the axial clamping flanges. To enable it to be supported more reliably, the radial seating has to co-operate without play with the bore of the rolling ring. This can only be accomplished by an interference fit which, on the one hand, can result in surface damage to the co-operating surfaces during assembly and, on the other hand, can be formed only short axially, so that the high-stressed central region of the rolling ring remains radially unsupported. According to one example of embodiment of the

invention, this disadvantage can be obviated in that a radial seating for the bore of the rolling ring is formed by at least one of the two roller body parts, which can be expanded by means of a wedge device provided in the connection means under the pulling force transmitted by the connection means, so as to obviate the assembly clearance. In fact, in principally axially operating devices for clamping rolling rings it is known to provide additionally a radial support based on wedging action. However, what is novel is the use of the knowledge that the pulling force transmitted in the connection means of the two roller body parts can be used directly to expand the radial seating.

This expanding action can be achieved with cone devices which, however, are affected by the fundamental drawback that cones which are subjected to axial tension have to accommodate the maximum tensile stress at that end at which they have the smallest cross-section. This is particularly undesirable in the context of the invention in which with respect to the rigidity of the structure is dependent on the largest possible cross-sections. The invention obviates the drawback in that it uses the inclined flanks of a thread as the wedge assembly; a thread of this type can be readily accommodated within the radial seating or radial seatings, wherein the cross-sections and diameter and flank angle of the thread are of such dimensions that under the tensile force prevailing between the two roller body parts at least the assembly clearance between the radial seating surfaces and the bore of the rolling ring is compensated for. Furthermore, if desired, a certain degree of radial preloading of the rolling ring can also be generated.

The presence of an assembly clearance makes it possible to extend the radial seating or radial seatings to be extended axially as desired, thereby enabling a portion of any size desired of the rolling ring bore to be supported. Advantageously, the rolling ring is supported

over the majority of its length and, even more advantageously over more than three quarters of its length.

The radial support of the rolling ring and the rigidity of the structure is beneficial insofar as the substantially hollow cylindrical parts, which form the radial seating or radial seatings, can be supported over their entire length by a threaded pin passing through them. This support is effective despite the thread necessarily originally including assembly clearance, because it transmits the substantial axial force and, therefore, the thread flanks of the co-operating parts are held together rigidly and without clearance. Although the roller body within the rolling ring comprises several parts, it thus behaves rigidly as a one-piece body.

The invention will be described in more detail below with reference to the drawings which illustrate embodiments of the invention schematically and by way of example. Figures 1 to 3 of the drawing show different embodiments by way of example in longitudinal section.

The roller comprises a rolling ring 1 and a roller body retaining the bearing member and forming two journals 2, which roller body consists of parts 3 and 4 which are of substantially symmetrical construction. Each of them has a flange 5 and 6 respectively, which co-operates with a respective end face of the rolling ring 1 so as to clamp the latter axially. Inside the rolling ring 1 the parts 3, 4 of the roller body are extended by mutually opposed hollow cylindrical extensions 7 which will be designated as radial seatings in the following, because their outer periphery 9 forms a radially supporting seating surface, seating the bore 10 of the rolling ring 1. The diameter of the periphery 9 in the relaxed condition is slightly smaller than the diameter of the bore 10. The difference is of the order of magnitude of a few hundredths to a few tenths of a millimetre. A journal 11 is provided inside the radial seatings 7, the radial seatings 7 and the journal 11 being provided with a co-operating thread 12, preferably an acme

screw-thread. The elimination of the assembly clearance in the rolling ring ensures that the two roller body parts are centred accurately in alignment.

Whereas the flange 5 is of solid construction, the flange 6 is assembled from a part 13 formed in one piece with the core of the roller body part 3, a securing ring 14 and an abutment ring 15. The abutment ring 15 includes an annular piston-cylinder device 16 which is supplied with hydraulic pressure medium via a passage 17. The securing ring 14 and the abutment ring 15 have, in the surface on which they co-operate, complementary inclined surfaces 18 extending in peripheral direction. The already mentioned EP-A 0 343 440 may be referred to for details of this arrangement.

During assembly, firstly the threaded journal 11 is screwed into the threaded bore of the roller body part 3. The rolling ring 1 is mounted on the seating 7 of this roller body part. The roller body part 4 is inserted with its radial seating 7 into the rolling ring 1 and at the same time is screwed on to the journal 11. When the securing ring 14 and the abutment ring 15 are situated in their initial position, which is characterised by minimal common length, the two parts 5, 6 of the roller body are screwed together until the rolling ring 1 is securely clamped between them. Subsequently, the hydraulic clamping device 16 is pressurised so as to clamp the assembly. The clamping forces, which are transmitted from the abutment ring 15 via the rolling ring 1, the flange 5, the radial seating 7 of the roller body part 4 and the flange 6 back to the piston 16 of the abutment ring, result in these parts expanding and thus in a clearance being formed between the abutment ring 15 and the securing ring 14. When the desired clamping condition is achieved, this is secured by the securing ring 14 being rotated until it abuts against the flanks 18. The hydraulic clamping device is then slackened, whereupon the clamping condition is maintained by the securing ring 14.

The flank angle of the thread 12, the thickness of the radial seating parts 7 and the clearance between the surfaces 9 and 10 are of such dimensions that under the clamping acting in the thread 12 and the wedging action at the threads the radial seatings 7 are expanded to such an extent in radial direction that the assembly clearance between the surfaces 9 and 10 disappears and, optionally, a certain degree of radial preloading is applied to the rolling ring 1.

It is apparent that this arrangement results in a friction-resistant connection not only between the rolling ring 1 and the flanges 5, 6 but also between the bore 10 of the rolling ring 1, the outer surface 9 of the radial seatings 7 and also between the co-operating thread flanks of the radial seatings 7 and of the journal 11. It is readily possible for these parts to be of such dimensions that, under the prevailing tensions, relative movements between them are excluded. Therefore, the roller behaves as a one-piece rigid body.

The embodiment according to Figure 2 differs from that according to Figure 1 in that the third member 20 connecting the two roller body parts 3, 4 is in the form of a sleeve 20, whereas the roller body parts have corresponding journals 21 which co-operate with the sleeve 20 via a thread 12. The sleeve 20 and the flank angle of the thread 12 and also the assembly clearance between the outer surface of the sleeve 20 and the bore of the rolling ring 1 are of such dimensions, just as in the aforementioned example of embodiment, that the assembly clearance disappears in the clamped condition of the arrangement. As an alternative it is possible to provide for the sleeve 20 to have, at ambient or operating temperature, the same diameter as the rolling ring bore or even a certain oversize and a temperature difference between these two parts is used to effect assembly. The expanding effect at the sleeve 20 may then be dispensed with or it may be of correspondingly smaller dimensions.

In the embodiment illustrated by way of example in Figure 3 the radial seating 22 is merely formed by one of the two roller body parts, whereas the journal 23 is a part of the other roller body part.

Unless otherwise stated, the explanations relating to the first embodiment also applied to the embodiments illustrated by way of example in Figures 2 and 3. In particular, these embodiments have substantially the same advantages.



CLAIMS

1. A roller for a roll stand with an interchangeable rolling ring (1) and a split roller body, both parts (3, 4) of which form a respective clamping flange (5, 6) and are pulled together by central connection means (7, 11, 12; 20, 21, 12; 22, 23, 12), and also with axial clamping means which comprise a threaded device for the transmission and basic adjustment of the forces acting between the two parts (3, 4) of the roller body, a hydraulic clamping device (15, 16) for clamping the assembly and a mechanical securing device (14, 15, 18) for securing the hydraulically generated clamping condition, characterised in that the two parts (3, 4) of the roller body inside the rolling ring (1) are extended by mutually opposed hollow cylindrical extensions (7; 21; 22, 23) each of which have a thread (12), by means of which threads they are joined together directly (Fig. 3) or indirectly via a threaded journal (11) or a threaded sleeve (20), and in that the hydraulic clamping device (15, 16) and the mechanical securing device (14, 15) are disposed on the outer periphery of the roller.

2. A roller according to Claim 1, characterised in that at least one of the two roller body parts (3, 4) forms a radial seating (7) which co-operates with a bore (10) of the rolling ring under the effect of an assembly clearance and which can be expanded by means of a wedge device provided in the connection means (7, 11, 12; 20, 21, 12; 22, 23, 12) under the pulling force transmitted by the connection means, so as to obviate the assembly clearance.



3. A roller according to Claim 1, characterised in that the two roller body parts (3, 4) each form an expandable radial seating (7).

4. A roller according to any one of Claims 1 to 3, characterised in that the radial seating or the radial seatings support the rolling ring (1) over the majority of its length.

5. A roller according to any one of Claims 1 to 4, characterised in that the wedge device is formed by the inclined flanks of a thread (12) within the radial seating or seatings.