The invention relates to a hand lever with a fixing element, for a spindle, axle or the like, the hand lever and the fixing element being axially coupled in rotationally rigid manner in a longitudinal direction of the axis of rotation of the lever by means of two coupling elements, the hand lever consisting of a softer material than the fixing element which is produced from metal, the coupling element which is on the hand lever side consisting of metal and being rotationally rigidly anchored in the material of the hand lever, coupling members of the coupling element which is on the hand lever side being adapted to be coupled together with matching coupling members on the coupling element which is on the fixing element side. Such a hand lever with a fixing element was disclosed in DE-B-1 278 860. The coupling is constructed as a ratchet coupling and is disposed inside the spindle in which there is a central lined bore. Because this hand lever is rotationally symmetrically shaped, there is no need to heed any particular alignment in the direction of rotation and in relation to the axle or the like. Theoretically, by virtue of the special construction of the catch-type coupling connection, there are two possibilities of assembly which are offset by 180° in respect of each other.

If the hand lever is intended to occupy in relation to the spindle or axle a plurality of positions which are angularly offset in relation to one another, then this prior art construction cannot be used. There are for example fields of application in which a hand lever which is in particular provided with a radially projecting gripping portion must, prior to commencement of rotation or possibly even after a certain partial rotation, assume a preset position again in respect of the spindle, axle or the like. A preferred field of application is that of clamping levers such as are used in industry, particularly in conjunction with machine tools, or in clamping devices for gripping work pieces which are to be machined on such machine tools.

It is indeed possible according to another proposal of this prior publication to couple the hand lever by a fixing screw to the drive shaft or the like via a frictional fitting, but the reversal of such a hand lever would always necessitate undoing the fixing screw. This is not practicable and for this reason there is no provision for it in the case of that particular hand lever with fixing element.

CH-A-309 659 disclosed another hand lever with a fixing element which admits of reversal of the hand lever by small angles of rotation in respect of the spindle or axle. A coupling element on the same side as the hand lever is pushed into a bore in the hand lever so that it is not very rotationally rigidly held in the direction of rotation. By virtue of the thin-walled nature of this sleeve and the displaceable mounting of the fixing element which is located in it, there is no question of a close press fit with any corresponding friction force. There, too, the external biasing of the spring represents a problem for the axially loaded coupling.

The problem on which the invention is based resides in so further developing a hand lever with a fixing element according to the preamble to Claim 1 that it is possible to reverse the hand lever in respect of the fixing element by small angles of rotation, the coupling of both parts being rugged while the two coupling elements are securely mounted on the hand lever on the one hand and on the fixing element on the other.

To resolve this problem, it is according to the invention proposed that the hand lever with fixing element according to the preamble to Claim 1 is constructed in accordance with the characterising part of this Claim. Because the coupling members in a per se known manner are constituted by internally cut and externally cut teeth, the hand lever can according to the tooth pitch, be moved by in each case small angles of rotation in

respect of the fixing element. The spring loading of the axial coupling ensures reliable engagement according to the setting. The spring force is thereby reliably transmitted to the fixing element on the one hand and the coupling element of the hand lever on the other. Furthermore, the coupling element on the hand lever side is by virtue of the anchoring elements reliably anchored in the comparatively softer material of the hand lever so that for example when this hand lever is used as a clamping lever, it is also possible to apply the necessary hand force without any danger of damage. By reason of the use of metal for the two coupling elements, the transmission of the force is within the framework of conventional loadings of such a hand lever possible without any deformation. Disengagement of the coupling takes place in an axial direction of the fixing element while the coil thrust spring is simultaneously tensioned. After release of the hand lever and a precedent relative rotation in respect of the fixing element, its force then ensures engagement of the coupling. The use of synthetic plastics material for the hand lever provides the usual known advantages, particularly low weight and the favourable cost of manufacture. Furthermore, no surface finishing or possibly machining will be needed.

Last but not least, the shape and size of the anchoring elements will depend upon the material of the hand lever and upon the way the coupling element on the hand lever side is fixed in the material of the hand lever. Expediently, the coupling element on the hand lever side is sprayed or injection moulded with the synthetic plastics material of the hand lever. It goes without saying that the coupling teeth must be kept clear in the process, so that there is no need for secondary work to be carried out on them.

The construction of the coupling employing internally cut teeth and externally cut teeth leads to teeth of maximum size and thus to a toothed joint which can bear heavy loadings. In the case of the bracing element for the end of the spring which

is remote from the fixing element, this may for instance be a screw of which the underside of the head constitutes the bracing surface for the thrust spring which is advantageously constructed as a coiled thrust spring. Consequently, the unit can be installed in a particularly simple way. Furthermore, the axial relative movement between hand lever and fixing element can be limited in that the spring is in the blocked position after a predetermined pressure movement of the hand lever.

In a further development of the invention, it is proposed that the anchoring elements of the coupling element on the hand lever side consist of studs, pegs or similarly projecting elements which are evenly distributed over the outer periphery. "Over the outer periphery" does not however mean that the studs or the like have to project in a radial direction. Instead, particularly in the case of the example of embodiment of the invention, there is provision for projection in an axial direction from the relevant annular surface.

A further embodiment of the invention resides in that the mating coupling elements which match the coupling element on the same side as the fixing element are constituted by the teeth of an externally toothed pinion which is mounted, particularly integral with the inner end of the fixing element, the teeth of the coupling members and matching coupling members being adapted to be engaged and disengaged in the longitudinal direction of the teeth, the coupling being spring loaded axially in the engagement direction. By virtue of the spring loading, the hand lever and the fixing element are always coupled to each other in rotationally rigid manner so that with a rotationally rigid connection of the fixing elements to a spindle, axle or the like, a rotation of the hand lever will also produce a rotation of the spindle or the like. If, then, the hand lever has to be moved in a rotary direction in relation to the position of the spindle or the like at that moment, then with the spindle firmly gripped, it is lifted against the resistance, for example

upwardly and away from the fixing element and is rotated about the envisaged angle of rotation. The teeth however permit of only a step-wise movement. In the case of most applications however this is not without its disadvantages.

A further development of the invention envisages the fixing element being constructed as a sleeve or a pot-shaped element with an internal pot bottom which is mounted for longitudinal displacement and rotation in a sleeve-like projection of the hand lever. If a screw is used as the bracing member, then it is possible to provide in the bottom of the pot-shaped member a central nut thread into which the screw can be turned. It is ideal for the screw to have a screw thread over only a part of its shank so that it is possible to establish the depth of screw-in penetration by referring to the length of the screw-threaded part.

The invention will be explained in greater detail hereinafter with reference to the accompanying drawings which show by way of example an embodiment of the invention. In the drawings:

Fig. 1 is a longitudinal median section through the hand lever with the fixing element,

Fig. 2 is a plan view of the hand lever in Fig. 1 and

Figs. 3 & 4 are plan views of the top and bottom of the coupling element on the hand lever side.

The hand lever 1 consists of a material of comparatively minimal hardness, particularly a synthetic plastics material. At its end which is towards the fixing element 2, it has a sleeve-like form adjacent to which is the cross-sectionally

U-shaped gripping portion. The free end has somewhat longer U-shaped flanks and is strengthened by an intermediate wall 3. As is shown particularly in Fig. 1, the fixing element 2 has a substantially sleeve-like form at its outer end, it carries a nut thread 4 and at its inner end it has a nut thread 5. This latter is substantially shorter and its diameter is substantially smaller than the nut thread 4. It accommodates the shank portion 6 of a screw 7 which carries a screw thread. The non-threaded part 8 of the shank is enclosed by a conical coiled thrust spring 9. Its smaller-diameter end is braced on the underside of the screw head 10 while the large spring end bears on the facing annular surface of a coupling element 11 which is on the hand lever side.

The coupling element 11 on the hand lever side which is shown in detail in Figs. 3 and 4 is embedded in the material or synthetic plastics material of the hand lever 1 or of the sleeve-like hand lever part 12 or to a certain extent has synthetic plastics material injected around it. On its side which is directed away from the fixing element 2, the coupling element 11 has, distributed particularly evenly over its periphery and serving as a means of anchoring in the synthetic plastics material, stud or peg-like anchoring elements 13. On the oppositely disposed underside of the coupling element 11 there is an integral ring gear 14 having inwardly directed teeth which form coupling members 15. These latter extend accordingly parallel with the axis 16 of a spindle 17 or the like which is to be connected to the fixing element 2 and they form matching coupling members. The female screw thread 4 of the fixing element 2 is the means by which it is screwed onto the upwardly projecting end of the spindle.

Integrally moulded on the upwardly directed inserted inner end of the fixing element 2 is a coupling element 18 which is on the fixing element side. It takes the form of a pinion with externally cut teeth. In their shape, size and pitch, the

teeth 19 of this pinion correspond to those of the ring gear 14. The pinion and the ring gear engage each other by virtue of the force of the thrust spring 9, i.e. the hand lever and the fixing element 2 are coupled to each other via these two parts. For disengagement, while the spindle 17 is held fast, the hand lever 1 is pulled in the direction of the arrow 20 and upwardly, so that the spring 9 is compressed possibly as far as a blocked position. Subsequently, the hand lever 1 can be rotated through a predetermined angle at a right angle to the image plane and in respect of the fixing element 2. As soon as the teeth and the tooth gaps of the two coupling parts are again in the proper relationship, the coupling is engaged once again when the hand lever 1 is released, due to the tension of the spring 9.

As the fixing element 2 consists of a solid or hard material, preferably metal, and since the coupling element 11 on the hand lever side also consists of metal, for example a pressure die cast metal, this tooth coupling is capable of transmitting considerable forces. A reliable anchoring of the coupling element 11 which is on the hand lever side in the material of the hand lever 1 is achieved via the anchoring elements 13. An additional or alternative anchoring could also be achieved via a roughened outer periphery on the cylinder or by anchoring elements which are mounted thereon.