Title: A DEVICE FOR CLAMPING WORK PIECES

A device for clamping work pieces comprises at least three levers (2) having at least two arms (3, 4). Each of the levers is pivotably connected to an operating member (5) movable generally radially in a reciprocating manner relative to the base of the device. A mechanism is provided to move the operating parts simultaneously to clamp or release a work piece. The levers are in engagement with jaws (9) in such a way that each jaw is radially operable by one of the arms (3, 4) of two levers (2).
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A DEVICE FOR CLAMPING WORK PIECES

TECHNICAL FIELD

This invention relates to a device for clamping work pieces comprising at least three levers having at least two arms, each of said levers being pivotally connected to an operating member movable generally radially in a reciprocating manner relative to a base of the device, and a mechanism to move the operating parts simultaneously to clamp or release a work piece, each of the two arms of each of the levers engaging and operating a jaw for contacting the work piece.

BACKGROUND ART

A device of this kind is disclosed in the US patent specification 2 921 796 and makes it possible to obtain efficient clamping, especially of work pieces having an irregular shape.

However, said prior art device has a severe disadvantage, especially when rather few jaws, e.g. four, are used. Since the levers as well as the jaws are radially movable towards and away from a centre of the device, the levers will subject the jaws to operating forces which are directed at an angle to the longitudinal direction of the guides in which the jaws are movable. Thus, not only a component force in the direction of movement of the jaws will occur, but also a component force directed transversely thereto. This transverse component force will cause a considerable
wear of the jaws and their guides and this wear may result in
inacceptable play or even jamming of the jaws. In order to make
the device operable again, expensive reconditioning work is
required.

5 DISCLOSURE OF INVENTION

The object of the invention is to eliminate this disadvan-
tage as far as possible. According to the invention, this object
is obtained in that two of said levers have their one arms engaging
the same jaw. In this way, the clamping force on each jaw will
be applied by two levers. The transverse clamping force subjected
to the jaw from one of said levers may be balanced by the com-
ponent force applied by the other lever so that the resulting
clamping force of the jaw will be directed generally in parallel
with the direction of movement of the jaw. The result is of
course that the wear will be minimized.

Other advantageous features of the invention are defined in
the appended, dependent claims.

BRIEF DESCRIPTION OF DRAWINGS

With reference to the appended drawings, a specific descrip-
tion of an embodiment example of the invention will follow here-
after.

In the drawings;
Fig 1 is a perspective view of the clamping device according
to the invention;

Fig 2 is a view similar to Fig 1, but partially cut, of the
clamping device;

Fig 3 is a partially cut front view of the device according
to Fig 1 and 2; and

Figs 4 and 5 are partially sectioned views along the line

IV-IV and V-V respectively in Fig 3.

BEST MODE OF CARRYING OUT THE INVENTION

The clamping device illustrated in the drawings is designed
as a lathe chuck and has a base 1 which at the rear side in Fig 1 is connectable in the usual manner to a lathe spindle. As appears from Figs 2 and 3 the chuck comprises levers 2, the number of which is four in the example and which have two arms 3, 4. The levers 2 are pivotally connected to operating members 5 movable radially and reciprocatingly in the base 1. A tightening mechanism generally denoted 6 serves to move the levers 2 to clamp a work piece 7 (Fig 1) or 8 (Fig 3).

Each of the two arms 3, 4 of each of the levers is connected to a jaw generally denoted 9 for contacting a work piece. Two adjacent levers 2 have always their one adjacent arms 3 and 4 respectively in engagement with the same jaw 9. The arms 3, 4 of each lever 2 extend at an angle, preferably a right angle, to each other.

Axle pins 10, which are inserted in the operating members 5 by e.g. screwing, protrude through apertures in the levers, which are pivotable about said pins. The operating members 5 are movable in grooves or guides in base 1, which comprises a rear part 12 connected to a front part 13 by screws not illustrated. The four guides 11, one for each operating member and lever, are provided in front part 13. The guides 11 have guide grooves 14 for corresponding guide projections on operating members 5.

Also the jaws 9 are movable in radial grooves or guides 15 in front part 13. The jaws 9 have guide grooves 16 receiving guide projections 17 on front part 13. Thus, front part 13 has four radial guides 11 for the operating parts 5 and four radial guides 15 for the jaws 9. These two sets of guides 11, 15 are provided alternatingly about the periphery of front part 13 and extend to a central circular aperture 18 in front part 13. Each jaw 9 has a guide member 19 movable in guide 15 and a clamp member 20 connected thereto. The clamp member is adapted to engage the work piece and may comprise a number of steps 21 in the usual way to simplify the clamping.

The two arms 3, 4 of the levers are received in recesses 22
in guide members 19 and pivotally supported therein in a plane perpendicular to the axes of pins 10. More specifically, the two adjacent arms 3, 4 (Fig. 2, 5) of two adjacent levers are located side by side, as viewed in the direction of movement of the guide member 19, in the recess 22 in the same guide member 19. Each of said two arms is located between two slide bearing elements 23, 24 having a first, suitably planar surface 25 engaging the arm in view and a circularly curved second surface 26 engaging a circularly curved seat surface 27 of guide part 19. The extent of the bearing elements 23, 24 along pins 10 corresponds to the extent or width of the arms 3, 4 in same direction. Thus, the arms 3, 4 in same recess 22 may be inclined in relation to each other while causing the respective pair of bearing elements to slide against their seat surfaces 27. In addition, the arms 3, 4 may slide on the surfaces 25.

The recess 22 comprises, apart from the portion adapted to lodge the part-cylindrical bearing elements 23, 24, an outer rectangular recess portion 28, in which there is located a T-shaped adjustment member 29 having a portion or flange 30 received in a recess in clamping member 20. The relative location between guide member 19 and clamping member 20 is determined in this way. Each guide member 19 has two radially directed dead end holes 31, in which there are introduced cylindrical nuts 32 having a threaded hole 33 extending perpendicularly to the axes of the nuts.

The clamping members 20 have holes 35 extending parallel to an axis 34 of rotation of the chuck and having a portion with a greater diameter to receive the head of screws 36 and a portion with a smaller diameter to receive the shank of the screws. There are two slots 37 in each guiding part 19 to allow passage of the shanks of the two screws 36, said shanks having threaded portions engaging the threaded holes 33 in nuts 32. Thus, clamping members 20 are efficiently connected to guiding members 19 and this connection is adjustable so that the mutual location between each guiding member 19 and clamping member 20 may be adjusted. This adjustment may be carried out by releasing the screws 36, re-
moving clamping part 20 and replacing the adjustment member 29 by another adjustment member having its portion or flange 30 for engagement with clamping part 20 displaced in the direction of movement of guide member 19 in relation to the flange 30 on the adjustment member originally used. When the clamping part 20 is again applied against guide member 19 and engaging adjustment member 29, clamping part 20 will assume a position relative to guide member 19 which is displaced along the direction of movement of guide member 19 in relation to the original position. This new position is affixed by tightening the screws 36 in the nuts 32 which have been displaced in the holes 31. This adjustability of clamping members 20 is an important advantage if e.g. eccentric clamping of a work piece relative to the axis 34 of rotation of the chuck is desired. It is evident that two or more of the clamping members 20 may be readjusted relative to guide members 19 in the described manner. Although only three and two levers clearly appear in Figs 2 and 3 respectively, it is to be understood that the chuck exemplified comprises four levers and that said levers are adapted to operate the four jaws 9, each of which is provided between the operating members 5 for two levers 2. The levers 2 are relatively displaced in the direction of axis 34 so that an arm 3 of one lever may be located beside another arm 4 of an adjacent lever. More specifically, two diametrically opposite levers are displaced similarly in the direction of axis 34 in relation to the two other diametrically opposite levers. The location of the upper right lever in Fig 2 along pin 10 is obtained by a sleeve 38 thereabout. In a corresponding manner similar spacer sleeves for the other levers are provided on one or the other axial side of the levers to obtain the desired position along axis 34.

As is apparent from Fig 1, a circular cover 39 is provided about front part 13 and levers 2. This cover is connected to the periphery of front part 13 by screws and provided with radial recesses 40 for jaws 9 and a central recess 41 in the area where recesses 40 meet each other. As is apparent from Fig 4, the cover
39 may, apart from the outer flange 39, have portions 43 abutting portions of the front part 13. As is apparent from Fig 4, the sleeve 38 is held in place in that the inside of the cover is located near the outer end of pin 10. This is valid for two of the levers; the other two levers have their sleeves located between themselves and the operating members 5 and thus, these two levers will be located nearest the inside of the cover.

It appears from Figs 4 and 5 how front part 13 abut rear part 12. In front part 13 an angular recess is provided which faces the rear part 12 and in which there is located a ring 44 having a spiral thread 45 towards operating members 5 which each has a corresponding threading 46 engaging the spiral thread 45. On the side opposite the thread 45, the ring 44 has a gear ring 47 which is slightly inclined relative to the plane of the ring 44 and has generally radial teeth engaging the teeth of a corresponding gear 48 housed within a recess 49 in rear part 12. The gear 48 is mounted at one end of a shaft 50, the other end of which is located at the periphery of rear part 12 and has a design adapted to receive an adjustment key. Thus, the shaft 50 forms an adjustment screw. As appears from Fig 5, the gear ring 47 is received in an annular, smaller recess 51 in rear part 12 beside the recess 48. It is obvious that two or more gears 48 and shafts 50 may be provided to enable adjustment at several locations about the periphery of the chuck. It is to be noted that only the operating members 5 are in engagement with the thread 45 of the ring 44. The guide members 19 of jaws 9 do not engage ring 44.

The operation of the clamping device described is now evident. By rotating shaft 50 and gear 48 by means of a key, ring 44 will be rotated and the spiral thread thereof will move the four operating members 5 radially. If e.g. the work piece 7 in Fig 1 is to be clamped at its square section the shaft 50 is rotated to move operating members 5 radially inwardly. These will carry the four levers 2 with them and by the arms 3, 4 thereof also the jaws 9 until the jaws all are positively abutting the
work piece. By the cooperation between levers 2 and jaws 9 an automatic adaptation to the shape of the work piece will occur. This will now be described with reference to Fig. 3 in which a work piece 8 having a rectangular section is indicated by dashed lines. When the operating members 5 and levers 2 are moved radially inwardly, the left and the right jaw 9 will first engage the work piece 8. On continued inward travel of the operating members 5 the left and the right jaw can not move further and the levers 2 will pivot about the pins 10 during the continued movement of the operating members 5. Thus, the upper and lower jaw 9 will continue to move until they engage the work piece 8, whereafter it is efficiently clamped by means of all jaws 9. During the pivoting of the levers their arms will of course change their position relative to the jaws which is possible due to the provision of the bearing elements 23, 24 described with reference to Fig. 2.

The device may of course be modified; thus, it may have three as well as more jaws and a corresponding number of levers. More than two levers may also be provided to operate each jaw. The levers may have a considerable length parallel to their pivot shafts and each of the levers may also have four or more arms spaced, possibly in pairs, along the pivot shaft of the levers.
CLAIMS

1. A device for clamping work pieces, comprising at least three levers (2) having at least two arms (3, 4), each of said levers being pivotably connected to an operating member (5) movable generally radially in a reciprocating manner relative to a base of the device, and a mechanism (6) to move the operating members simultaneously to clamp or release a work piece (7, 8), each of the two arms (3, 4) of each of the levers (2) engaging and operating a jaw (9) for contacting the work piece, characterized in that two of said levers (2) have their one arms (3, 4) engaging the same jaw (9).

2. Device according to claim 1, characterized in that the arms (3, 4) of the levers extend generally perpendicularly to each other.

3. Device according to claim 1 or 2, characterized in that the jaws (9) comprise a guide member (19) movable in a guide (15) in the base and a clamping member (20) adjustably connected to the guide member.

4. Device according to claim 3, characterized in that the arms (3, 4) of the levers (2) are received in a pivotable manner in recesses (22) in the guiding members (19).

5. Device according to claim 1, characterized in that two adjacent arms of two adjacent levers (2) are located side by side in a recess (22) in the same jaw (9) and that each of said arms is located between two bearing elements (23, 24) having a first surface (25) engaging the arm and a second circularly curved surface (26) engaging a circularly curved seat surface (27) of the jaw (9).

6. Device according to claim 1, characterized in that it comprises four levers (2) with associated operating members (5) and that said levers are adapted to operate four jaws (9), each of which is provided between two levers and engaging the adjacent arms of said two levers.
7. Device according to claim 1, characterized in that the mechanism (6) comprises a rotatable body (44) having a spiral thread (45) on a radial face, said thread engaging a threaded portion of the operating members (5) to enable radial movement thereof upon rotation of the body.

8. Device according to claim 7, characterized in that the body (44) has a gear ring (47) engaging a gear (48) rotatable from the exterior of the base (1) to enable rotation of the body.

9. Device according to claim 8, characterized in that the gear (48) has an axis of rotation perpendicular to the axis of rotation of the body (44).
I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)

According to International Patent Classification (IPC) or to both National Classification and IPC

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II. FIELDS SEARCHED

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Documentation Searched other than Minimum Documentation to the extent that such documents are included in the Fields Searched

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT

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IV. CERTIFICATION

Date of the Actual Completion of the International Search 3

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Date of Mailing of this International Search Report 5

1979-12-05

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Signature of Authorized Officer 20

Arne Klevegås