SWIVEL PAD CONSTRUCTION FOR C CLAMPS AND THE LIKE

Filed Aug. 24, 1960

INVENTOR.
JACK M. BUTLER

BY
Wolfe, Hubbard, Diet & Deaver
ATTYS.
The present invention relates to C clamps and more particularly to an improved swivel pad construction for use therewith.

It is an object of the present invention to provide an improved swivel pad construction for a C clamp or the like which provides a free ball-and-socket action but which, once attached to the seat of the clamp, will not come off in use, even in the face of hard and extended usage. It is another object to provide a swivel pad which is capable of swiveling action over a wide angle, on the order of 45°, but which nevertheless has a large cross section of metal evenly distributed about the ball maintaining the pad securely captive in spite of the dislodging forces which may be applied and in spite of the wear which may take place over the life of the tool.

It is another object of the invention to provide a swivel pad construction which is easily and quickly installed on the ball of the screw, requiring but a simple squeezing action for upsetting the metal to form a generally spherical retaining pocket. It is a related object to provide a swivel pad which may be installed by inexperienced or unskilled help with complete assurance that the upsetting will be carried out to the optimum degree, with the pad neither so tight as to cause binding nor so loose as to run the risk that the pad might come off during use. More specifically, it is an object to provide a pad which is locked in place simply by squeezing two portions thereof together so that they bottom on one another, with the bottoming being visual, not that the two parts are positively coupled together. In this connection it is an object to provide a swivel pad which requires application of an upsetting force but which is not at all critical as to the amount of the force and in which the necessary deformation may be caused to take place either all at once by use of a special squeezing tool or progressively using a vice or by employing a hammer and punch. Because readily available tools may be used for installation of the swivel pad, it is well suited for use as replacement on clamps which have lost their pads or which are equipped with pads of conventional design.

It is a further object of the invention to provide a swivel pad which is inherently strong and in which there is no danger that the metal will be cracked or overstressed during the upsetting operation, hence there need be no rejections during the course of quantity production manufacture. Hence the fact that the upsetting of the metal is always optimum, casual inspection prior to packing and shipping is sufficient.

It is yet another object of the invention to provide a swivel pad which may be simply turned from bar stock as a screw machine part, which has a pleasing functional appearance and which adds substantially to the sales appeal of the clamp.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIGURE 1 is a perspective view of a C clamp having the improved swivel pad construction;

FIG. 2 is a vertical section taken along the axis of the pad prior to the squeezing or upsetting operation;

FIG. 3 is an axial section similar to FIG. 2 but showing the result of the upsetting operation;

FIG. 4 is another section similar to FIG. 3 but illustrating the range of the ball and socket swivel action;

While the invention is described in connection with a preferred embodiment, it will be understood that it is not limited to the embodiment shown, and I intend to cover all modifications as well as alternative and equivalent constructions falling within the spirit and scope of the appended claims.

Turning to the drawings, a typical C clamp employing the present invention is shown at 10 in FIG. 1. It includes a frame 11 having a threaded portion 12 at its upper end and a seat 13 at its lower end. Threaded in the portion 12 is a screw 15 having a bar or handle 16 and terminating in a ball 17 which is integral with the screw and which is connected to the screw by a narrow neck portion 18. Held captive on the ball and capable of swiveling on the ball is a pad 20 which is constructed and installed in accordance with the present invention, reference being made to the remaining figures in the series for the details of construction.

As shown in FIG. 2 the pad 20 is of frustoconical shape having a flat base 21 and an inwardly tapering conical side wall 22, terminating in an upper end 23 of reduced diameter. Centrally formed in the upper end of the pad is a bore 25 having a diameter which is capable of freely accommodating the ball 17 of the screw and having a depth which exceeds the ball diameter.

In accordance with the present invention the pad is formed with an annular groove spaced downwardly a small amount from the upper end of the pad to define a lip which overhangs the body of the pad and which is connected to the body by a neck of limited wall thickness so that when pressure is axially applied to the lip to close the groove, the wall buckles inwardly to form a generally spherical pocket for retaining the ball. In the present instance the pad has a groove 30 which is cut to a sufficient depth so as to define a neck 31 of limited thickness. The groove 30 preferably is rounded at the root as indicated at 32, and the walls of the groove preferably have a slight amount of draft. In addition to defining the neck 31, the groove 30 defines an upper lip portion 35 which is chamfered along its inner edge as indicated at 36.

In carrying out the present invention an axial squeezing force F is applied to the upper edge of the lip 35 sufficient to buckle the neck portion 31 while leaving the lip 35 and the body of the pad relatively intact so that the metal of the neck portion is compressed inwardly to leave a smooth internal bead 40 (FIG. 3) having an inner diameter substantially less than the diameter of the ball 17. Force is preferably applied until the walls of the groove are bottomed upon another. The amount of force used in non-critical since, once the seating or bottoming takes place the pad is exceptionally strong in the axial direction and no further deformation can take place. Using proportions about as shown in the drawing, sufficient metal is displaced so that the cylindrical bore is converted to a generally spherical shape thereby providing free ball-and-socket action without any tendency of the ball to wedge upwardly between the inwardly deformed walls.

It is found when using the above construction that the buckling or upsetting of the metal tends to take place inwardly into the bore in a uniform and symmetrical fashion, and there is no tendency for the metal to buckle outwardly into the groove 30. This is believed due to the fact that the metal of the neck 31 undergoes initial bending as well as axial compression. Thus when a force F is applied, closure of the groove 30 starts to take place first about the periphery of the groove rather than at the root. As the walls of the groove 30 become non-parallel, slight bending takes place in the metal of the neck 31. The direction of the bend is the same as that which would occur in a flaring operation. Once this bending starts, the force
concentrated at the neck 31 is no longer purely axial but consists of two components, one axial and the other directed radially inward. Thus, when the metal begins to buckle or flow, it flows inwardly rather than outwardly, and since the part is perfectly symmetrical, the inward flow takes place smoothly and symmetrically. The initial bending action is facilitated by the chamfer 36 which concentrates the force along the outer edge of the lip.

With regard to the width and depth of the groove, the thickness of the remaining neck 31, and the downward spacing of the groove from the top edge of the pad, these are matters subject to such minor adjustment as one skilled in the art might find to be necessary with the present teachings in mind. Where material is used having characteristics which do not differ markedly from ordinary mild steel, the proportions shown in the drawing may be adhered to with satisfactory results over a range of sizes. In general, it might be said that the depth of the groove should exceed the thickness of the neck 31 so that when force is applied there will be sufficient concentration of stress in the neck so as to insure prompt and uniform buckling action as the walls of the groove are bottomed together. In other words, the groove should preferably be cut more than half way into the metal. The axial height of the lip portion 35 should be made short as shown so that the pad is free to swivel through a relatively wide angle, for example, an angle of about 40° as shown in FIG. 4. The present construction insures a relatively wide swivel angle even though the neck 18 on the screw is relatively short and stubby.

It is to be noted that an appreciable amount of metal flows into ball-obstructing position, which not only prevents removal of the pad other intentionally or unintentionally but which insures that no amount of wear, even in the presence of abrasive, can affect the positive retention of the pad.

It is one of the features of the present construction and procedure that assembly of the pad on the screw may be carried out reliably even by untrained or unskilled help. For production line manufacture, a suitable squeezing tool 45 may be provided (FIG. 2) consisting of two or more jaws straddling the screw just above the upper edge of the pad. Such jaws cooperate with a suitable support 46 and any desired means, mechanical or hydraulic, may be employed to develop the necessary squeezing force. The force is simply applied until the bottoming shown in FIG. 3 occurs. Such bottoming may be noted by the operator as indicating that the pad is ready to be released; however, in production line manufacture, a thrust producing means may be employed which develops a maximum force which is somewhat greater than that required to achieve bottoming for a given range of sizes. After bottoming occurs, the part is exceptionally strong so that no further deformation takes place, and there is no need, then, for the operator to apply any discretion whatever. That the deformation has taken place to the right degree for satisfactory results may be confirmed by casual visual inspection upon wrapping the tools for shipment.

The above procedure and process is to be contrasted with conventional procedures which employ upsetting the metal to maintain a pad captive and in which the degree of upsetting must be carefully controlled by the judgment of the operator or by careful control of the applied force in order to prevent binding between the pad and the ball on the one hand or loss of the pad on the other.

While it is preferable, and faster, to apply the squeezing pressure simultaneously around the periphery of the lip 35, it is one of the features of the construction that such simultaneous application of pressure is not necessary, and, if desired, the deformation may take place in several steps. It is possible, for example, to nip the pad between the jaws of a vise to squeeze the lip into bottomed position first on one side and then on the other until bottoming occurs uniformly all of the way around. Or, if desired, a hammer with a punch or bar may be employed to apply the necessary pressure. Because of the fact that simple tools may be used for installing the present pad, it will be apparent that its use is not limited to new construction but it may be employed for replacement purposes on a clamp which has lost a pad or on a clamp to replace a pad of conventional design.

In spite of the concentrated forces which are employed in upsetting the metal, experience has shown that there is no risk of developing stresses which are sufficiently high as to give rise to cracks or incipient failure. As stated, the root 32 of the groove 30 is preferably rounded, which tends to avoid the sharp corners which might give rise to undue stress concentration. Each unit of the present design may be counted upon to perform reliably over the entire life of the clamp and there is no difficulty with failures or rejects. Nor is the present construction limited to use with mild steel. Any desired ferrous or non-ferrous metal may be employed, provided only that it have slight malleability and the ability to flow in the cold condition under stress.

The present pad may be produced in quantity from plain bar stock on a screw machine or the like so that the unit cost may actually be less than the unit cost of pads of conventional design.

It will be apparent from the drawing that the final result has a neat, symmetrical and workmanlike appearance, an appearance which differs from that of other commercially available clamps. The structure is eye-catching and invites speculation on the part of the prospective purchaser as to how the result has been brought about. For this and the other reasons discussed above, the device has sales appeal.

I claim:

In a C-clamp or the like having a frame, the combination comprising a screw having a thread for threading in said frame, a ball tip connected to the screw by a narrow neck portion, a frustoconical pad on said ball, said pad having a bore axially formed in the smaller end thereof of a diameter suitable for freely accommodating the ball and having a depth which substantially exceeds the diameter of the ball, the pad having an external annular groove of uniform depth spaced downwardly a small amount from the smaller end of the pad to define a lip which overlies the body of the pad and which is connected to the body of the pad by a neck of limited wall thickness which will buckle inwardly to deform the bore into a generally spherical pocket for permanently retaining the ball when pressure is actually applied to the lip squeezing the groove to closed position.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>392,062</td>
<td>Pederson</td>
<td>Oct. 30, 1888</td>
</tr>
<tr>
<td>1,724,509</td>
<td>Nelson</td>
<td>Aug. 13, 1929</td>
</tr>
<tr>
<td>2,396,823</td>
<td>Burbank et al.</td>
<td>Mar. 9, 1946</td>
</tr>
<tr>
<td>2,711,167</td>
<td>Richard</td>
<td>June 21, 1955</td>
</tr>
<tr>
<td>2,894,548</td>
<td>Peck et al.</td>
<td>July 14, 1959</td>
</tr>
</tbody>
</table>