United States Patent [19]

Taylor et al.

[11] **3,758,100**

[45] **Sept. 11, 1973**

[54] **CLAMPING DEVICES**

[76] Inventors: **David John Taylor**, 6 Overtons Close; **Aris Mednis**, 8 Overtons Close, both of Redford Semele, Leamington Spa, England

[22] Filed: **Mar. 16, 1971**

[21] Appl. No.: **124,882**

[30] **Foreign Application Priority Data**

Mar. 23, 1970 Great Britain 14,009/70
Oct. 1, 1970 Great Britain 46,670/70

[52] **U.S. Cl.** ..... **269/203**, 269/238, 269/240, 269/321 ME

[51] **Int. Cl.** **B25b 1/02**, B25b 1/10

[58] **Field of Search** 269/166–171.5, 189, 203–206, 216, 217, 238–240

[56] **References Cited**

UNITED STATES PATENTS

1,187,109	6/1916	Stevernagel	269/204
1,639,561	8/1927	Hargrave	269/171.5
3,149,860	9/1964	Hallesy	285/382 X

FOREIGN PATENTS OR APPLICATIONS

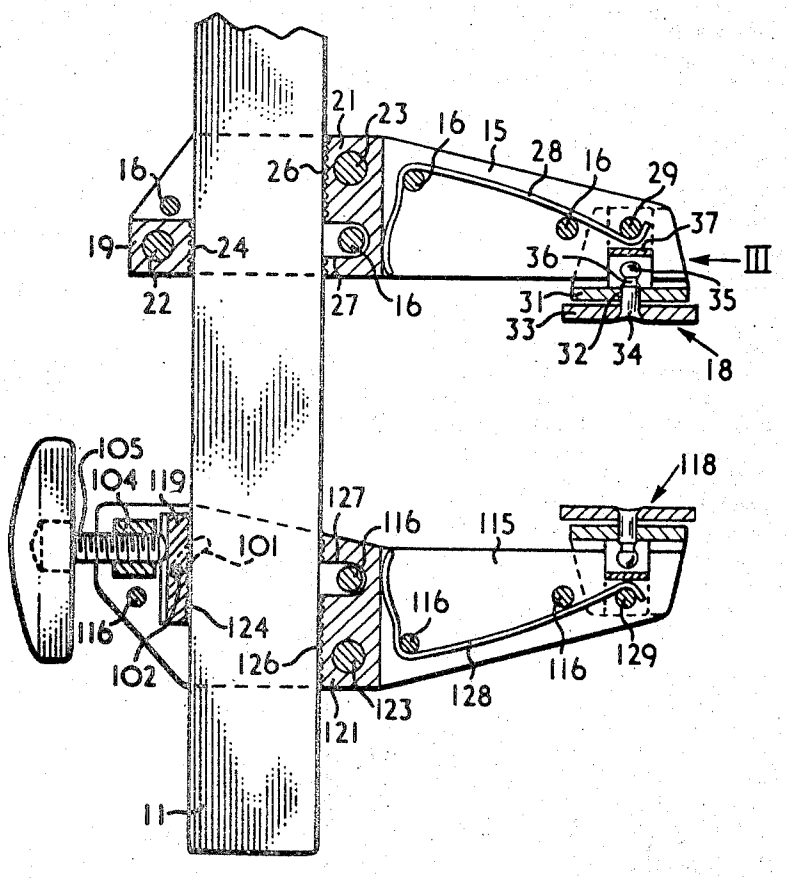
838,619	12/1938	France	269/204

Primary Examiner—Harold D. Whitehead
Assistant Examiner—Neil Abrams
Attorney—Kenway, Jenney & Hildreth

[57] **ABSTRACT**

A clamping device comprising two clamping jaws each slidable along a shank to a desired clamping location on the shank and then engaging with the shank and exerting a clamping force which is reacted through the shank. Each clamping jaw comprises an elongated jaw member having a shank receiving aperture at one end portion thereof and a clamping pad at the other end portion thereof for exerting the clamping force on a workpiece. Each jaw member carries a first contact pad for frictional engagement with a side of the shank adjacent the clamping pad and a second contact pad for frictional engagement with the side of the shank remote from the clamping pad at a position along the shank in the direction of said clamping force from the first clamping pad. The contact pads have a surface for engaging the shank incorporating projections of substantial crest radius such that in use the projections elastically deform the surface of the shank into depressions corresponding to the crests of the projections. At least one clamping jaw is also provided with means for moving its second contact pad in a direction towards the shank to thereby tend to pivot the jaw member to produce the clamping force on the workpiece.

7 Claims, 5 Drawing Figures



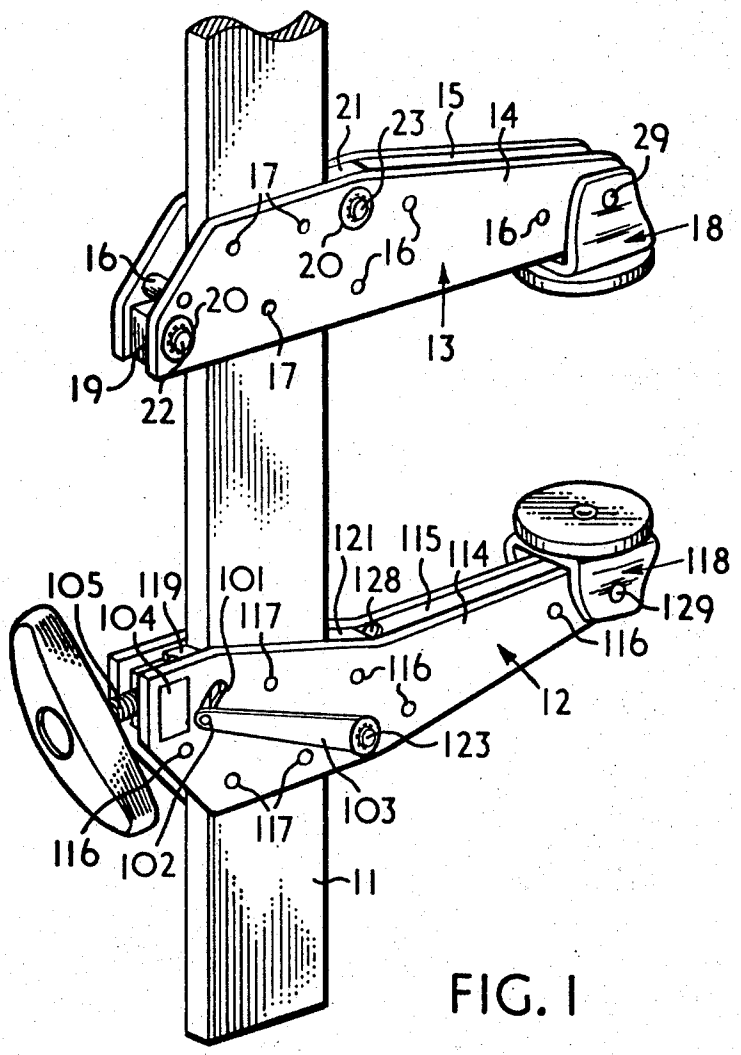


FIG. 1

David J. Taylor
& Aris Mednis
by Kenway, Jenney & Hildreth
Attys

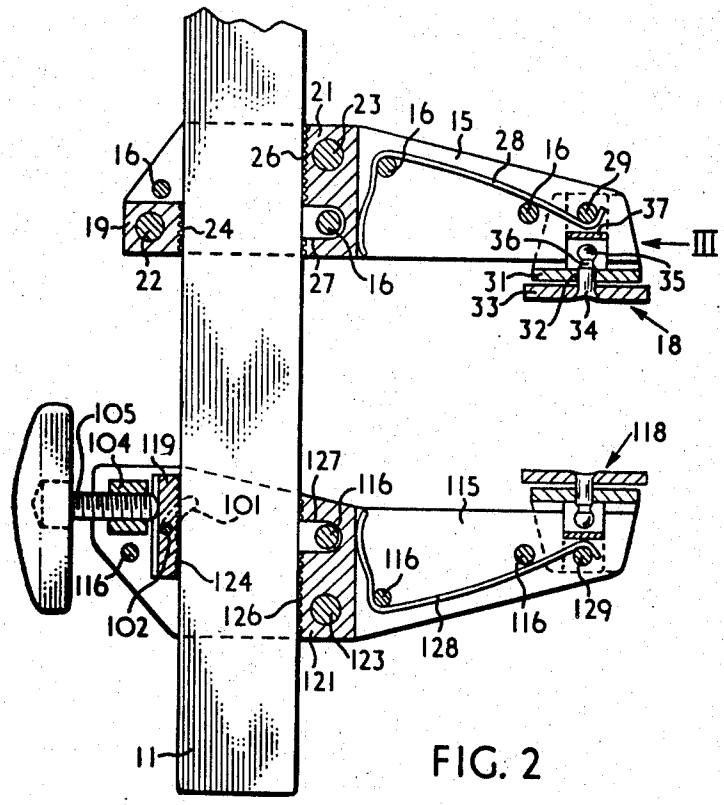


FIG. 2

David J. Taylor
&
Aris Medenis
by Conway, Jenney & Hildreth
Attys.

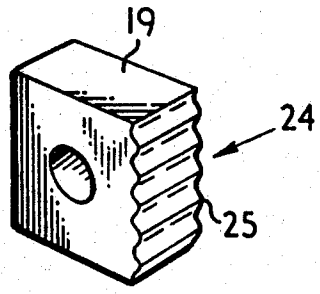


FIG. 4

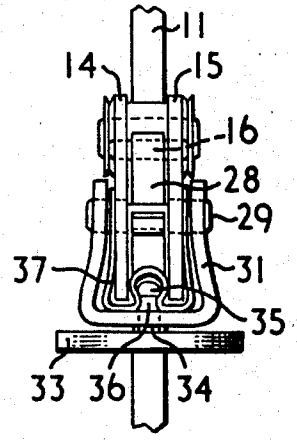


FIG. 3

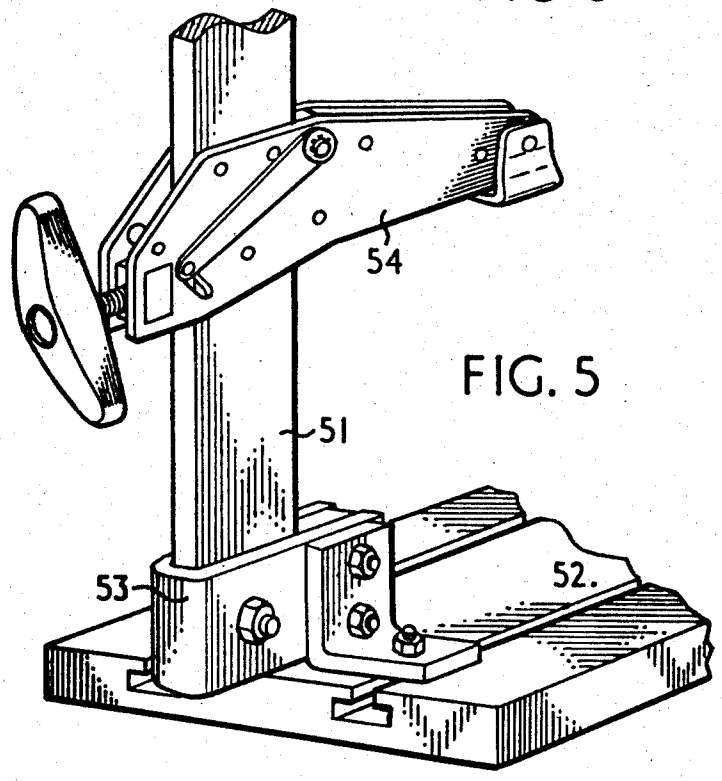


FIG. 5

David J. Taylor
& Aris Medvis.
by Kenway, Jenney & Hildreth
Att'ys

CLAMPING DEVICES

BACKGROUND OF THE INVENTION

The invention relates to clamping devices and is particularly concerned with clamping jaws for sliding along a shank to a desired clamping location and then engaging with the shank.

A complete clamp assembly may be made up of a shank and two co-operating clamping jaws, but alternatively a single clamping jaw may be used to clamp a workpiece against a fixed support. Thus the invention is concerned with individual clamping jaws as well as with complete clamping assemblies.

A complete clamping assembly normally comprises a reactive clamping jaw which remains fixed while clamping pressure is being applied, and an active clamping jaw at least part of which is forced towards the workpiece in order to clamp the workpiece. Throughout the specification the words "active" and "reactive" as applied to clamping jaws have the meaning given to them in this paragraph.

Currently one method of anchoring an active jaw on a shank consists of pivotally mounting the active jaw at a position intermediate its end portions about one of a series of rack teeth arranged along a side edge of the shank, the jaw being angularly motivated about the pivot by mechanical means such as a screw in the jaw, the end of which bears against the opposite side edge of the shank. Rotation of the screw in one direction causes rotation of the jaw to apply a clamping force. This form of cramp is commonly referred to as the *CARVER' cramp.*

One of the drawbacks of this arrangement is that, due to the spacing between each tooth on the shank, initial coarse adjustment of the position of the active jaw, governed by the positions of the teeth is often insufficient to bring the movable jaw into contact with the workpiece or really close to the workpiece with the result that excessive movement of the screw (and therefore the movable jaw) is necessry to achieve the final clamp, hence the arrangement is unsuitable as a quick action mechanism. Another disadvantage is the cost incurred in forming the rack teeth.

As an alternative, it has been proposed to construct the active jaw with a collar or ring near one end which embraces the shank and to support a clamping pad on a screwed shaft located in a threaded bore near the other end of the jaw; the clamping pad representing the operating face of the jaw.

Initial course adjustment of the jaw is by sliding it along the shank. On subsequent rotation of the screwed shaft in one direction, to force the clamping pad against the workpiece, a reaction is produced which forces the jaw angularly relative to the shank, causing one set of diagonally opposed corners of the collar or ring to frictionally grip opposed faces of the shank to produce a reactive force which governs the final clamp between the jaws.

In this construction, the efficiency of the locking action on the shank increases with an increase in the ratio between the effective axial length of the collar, i.e. the distance in a direction along the shank between the diagonally opposed corners of the collar and the distance between the opposed faces of the shank. However, the effective axial length of the collar cannot be reduced to a small distance since the jaw must be capable of withstanding the stresses set up in operation. These two

conflicting requirements detract from the value of this design.

Another disadvantage of this type of clamp is that the application of a vibratory or impact generated motion to the clamp or to the workpiece on which it is engaged will cause the frictional grip of the collar or ring to be overcome, and the resultant movement of the collar or ring under the effect of the resilience of the material will result in a reduction in or total loss of clamping force.

BRIEF SUMMARY OF THE INVENTION

A primary object of the present invention is to provide an improved form of clamping device. Particular objects are to provide a clamping device which is readily adjustable, which operates by virtue of frictional engagement between a shank and a clamping jaw and which remains effective in a vibratory environment.

According to one aspect of the present invention there is provided a clamping jaw for sliding along a shank to a desired clamping location and then engaging with the shank and exerting a clamping force which is reduced through the shank, the jaw comprising an elongated jaw member with a shank receiving aperture at one end portion thereof and a clamping pad at the other end portion thereof for exerting a clamping force on a workpiece in one longitudinal direction of the shank, a first contact pad for frictional engagement with the side of the shank adjacent the clamping pad and a second contact pad for frictional engagement with the side of the shank remote from the clamping pad at a position along the shank in the direction of said clamping force from the first contact pad, the first contact pad having a surface for engaging the shank incorporating projections of substantial crest radius such that in use the projections elastically deform the surface of the shank into depressions corresponing to the crests of the projections on the first contact pad.

Preferably both contact pads have surfaces for engaging the shank incorporating projections of substantial crest radius such that in use the projections elastically deform the surface of the shank into depressions corresponding to the projections on both of the contact pads.

As a result of the nature of the frictional engagement between the first contact pad or both contact pads and the shank an exceptionally good frictional engagement between the clamping jaw jaw the incorporate can be achieved without damaging the surface of the shank. The use of conventional teeth in place of radiused projections would result in substantial damage to the surface of the shank after extensive use as a result of permanent deformation of the shank surface by the teeth. It has been found that a sufficient frictional engagement can be achieved to render the clamping jaws effective even in a vibratory environment.

The clamping force may be exerted on the jaw as a reaction force by forcing the workpiece againt the jaw in which case the jaw is a reaction jaw. Alternatively the member may provision a mechanism for forcing the clamping pad towards a workpiece when the jaw is assembled on a shank in which case it is an active jaw. For this purpose the first contact pad may be in a fixed position with respect to the jaw member and the second contact pad may be movable with respect to the jaw member, force exerting means being provided for forc-

ing the second contact pad towards the shank with respect to the jaw member. As this movement results in a tilting of the jaw member, the second clamping pad tends to move in an arc with respect to the jaw member and provision to permit this movement should be provided.

Preferably both contact pads are free to pivot with respect to the jaw member so that in operation they become accurately aligned with the surfaces of the shank and in the case of an active jaw they maintain this accurate alignment despite pivotal movement of the jaw member.

Preferably the means to provide movement of the second contact pad with respect to the jaw member comprises a link pivoted at one end about the centre of pivotal movement of the first clamping pad, and at the other end pivotally supporting the second clamping pad.

For practical convenience the link may be formed as two parallel link members, one at each side of the jaw. The link serves to guide the second contact pad to ensure that it adopts a position where an effective clamping action occurs. It has been found by experience that in the absence of such a link there is a tendency for the active jaw as a whole to slide along the shank away from the workpiece during a clamping operation due to the reaction from the clamping force between the clamping pad and the workpiece before a substantial frictional engagement becomes established between the contact pads and the workpiece. This appears to be because the frictional engagement between the contact pads and the shank tends to be disturbed by the initial part of the clamping operation. However, once a substantial clamping force has built up the substantial frictional forces hold the jaw with respect to the shank, irrespective of the provision of the link. Thus the link is preferably provided with a small amount of free play so that it becomes free once a substantial clamping force has been established and plays no further part in the operation of the clamping device.

In many situations an active clamping jaw and a reactive clamping jaw both in accordance with the invention will be used together in conjunction with a single shank. However, a reactive jaw in accordance with the invention or an active jaw in accordance with the invention may be used individually in some circumstances. For example, an active jaw may be used in conjunction with a fixed shank to exert a clamping force on a workpiece to clamp it against a fixed support. A reactive jaw on a shank may be used in a jig to support part or all of a component to be operated on, irrespective of whether the workpiece is clamped against the reactive jaw by an active jaw in accordance with the invention.

According to a further aspect of the invention there is provided an active clamping jaw for sliding along a shank to a desired clamping location and then exerting a clamping force which is reacted through the shank, the jaw comprising an elongated jaw member with a shank receiving aperture at one end portion thereof and a clamping pad at the other end portion thereof for exerting a force on a workpiece in one longitudinal direction of the shank, a first contact pad for frictional engagement with the side of the shank adjacent the clamping pad and a second contact pad for frictional engagement with the side of the shank remote from the clamping pad and a second contact pad for frictional engagement with the side of the shank remote from the clamping pad at a position along the shank in the direction of said clamping force from the first contact pad, the first contact pad being pivoted to the jaw member and the second contact pad being guided by guide means to be free to move on an arcuate path with respect to the jaw member centred on the pivot of the first jaw member, lateral force exerting means for exerting a force on the second contact pad towards the shank with resepct to the jaw member such that during a clamping operation the two contact pads frictionally engage the shank and the jaw member is caused to move angularly with respect to the contact pads to apply the clamping force at the clamping pad.

According to another aspect of the invention there is provided a clamp assembly comprising two jaws each having a clamping pad and means for relatively forcing the clamping pads together, the clamping pads each comprising a rotatable work-engaging portion, the two clamping pads being aligned or alignable such that the rotatable portions are free to rotate about a common axis.

By this means a workpiece clamped between the two rotatable portions can be rotated without disturbing the clamping action. The same considerations apply to rotation of a clamping device with resepct to a workpiece.

Relative rotation between a workpiece and a clamping device can occur as a result of applied vibrations and thus utilisation of this latter aspect of the invention is an important contributory factor in making a clamping device effective in a vibratory environment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a clamping device in accordance with the invention;

FIG. 2 is a sectional view of the clamping device shown in FIG. 1;

FIG. 3 is an end elevation of part of the clamping device of FIGS. 1 and 2 in the direction of arrow III in FIG. 2;

FIG. 4 shows the surface of a contact pad in more detail; and

FIG. 5 shows a modified form of clamping device in accordance with the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The clamping device shown in FIGS. 1 to 4 incorporates a shank 11, an active clamping jaw 12 and a reactive clamping jaw 13.

The shank 11 is a length of standard rolled steel strip and may, for example, be 1¼ inches by ¼ inch strip. As this standard steel strip is readily available, it is possible to use a variety of lengths of shank in conjunction with the same active and reactive jaws, to form either a compact clamping device or a clamping device with a large distance between the jaws. Although it is envisaged that clamping devices comprised by one active jaw, one reactive jaw and one shank may be sold and used as a unit, many users will require to purchase a series of active and passive jaws and use these in conjunction with separately purchased steel strip. For example, if the clamping device is to be incorporated into a jig the jig may be built up from suitable rectangular steel strip with a series of active and reactive jaws applied at suitable locations.

The reactive jaw 13 is constructed primarily of two sheet steel pressings 14 and 15 which are secured together with a space therebetween by four transverse pins 16. The space between the two pressings 14 and 15 is a little more than the thickness of the shank 11 and most of this clearance is taken up by a series of dimples 17 pressed inwardly of the perssings 14 and 15. These dimples guide the reactive jaw during sliding movement between the jaw and the shank. The two pressings 14 and 15 together with the pins 16 form a jaw member.

At one end portion of the reactive jaw member there is a clamping pad 18 which will be described in more detail hereinafter.

At the end portion of the reactive jaw member remote from the clamping pad 18 there are two contact pads 19 and 21 which are supported with respect to the jaw member by means of transverse pivot pins 22 and 23 respectively. The pivot pins 22 and 23 may be located axially by suitable spring clips 20. The first contact pad 19 is positioned on the lower part of the depth of the jaw in the configuration shown in which the clamping pad 18 exerts a downward clamping force on the workpiece. In this configuration the second contact pad 21 is, in effect, above the contact pad 19 although a portion of the contact pad 21 does extend down to the level of the pad 19.

FIG. 4 shows the contact pad 19 on a larger scale and shows details of the surface thereof which, in use, engages the shank 11. This shank engagement surface 24 incorporates a series of lateral ribs or projections 25. These projections are shown diagrammatically and are not to scale. For engagement with mild steel it has been found that suitable dimensions are as follows:

Pitch between adjacent projections: 0.060 inches
Depth of projections from crest to root: 0.10 inches
Radius of curvature of crests: 0.10 inches or 0.15 inches

These dimensions, and particularly the pitch and the depth of the projections are not critical and any dimensions generally of this order should be suitable. The important aspect of these dimensions is that the radius of curvature of the crests should be such that in use the surface of the shank 11 is deformed elastically by engagement therewith of the projections. If the radius of curvature of the crest of the projections is too small, exceptionally high surface loadings would occur, resulting in permanent deformation of the shank surface. On the other hand, if the radius of the projections is unduly large, then the extent of the surface deformation will be very limited and the frictional force generated between the shank and the contact pads may be insufficient to provide an effective clamping action, particularly in a vibrator environment. The material of the contact pads should be sufficiently had to prevent any substantial deformatio of the contact pad in use. High grade tool steel or other materials normally used for cutting tools would be suitable.

Although the above description of a contact pad has made particular reference to the contact pad 19 the contact pad 21 is similar to the contact pad 19 and also the cpntact pads of the active jaw 12 also correspond.

Returning to FIGS. 1 and 2, the contact pad 19 is so arrange with respect to one of the transverse pins 16 that the angular rotation of the contact pad about its pivot pin 22 is restricted. This ensures that the surface of the contact pad which engages the surface of the shank 11 is always the surface 24.

The second contact pad 21 has a shank engaging surface 26 corresponding to the shank engaging surface 24. This surface 26 is recessed at 27 to accommodate one of the transverse pins 16 with a clearance. A single leaf spring 28 engages the rear face of the contact pad 21 and urges it towards the shank 11. When the shank is removed the pin 16 in the recess 27 prevents the spring 28 from moving the contact pad 21 through a substantial distance. The spring 28 engages over a further transverse pin 16 and also engages with a pivot pin 29 associated with the clamping pad 18.

The clamping pad 18 will now be described in more detail with reference to FIGS. 2 and 3. The clamping pad comprises a pressed steel yoke 31 which has two upwardly extending limbs which pass one each side of the outer ends of the plates 14 and 15. The pivot pin 29 passes through aligned holes in the yoke 31 and the plates 14 and 15 in order to pivotally mount the yoke about a transverse axis on the jaw member. The lower part of the yoke joining the two limbs is flat and incorporates a central circular hole 32. A freely rotatable clamping disc 33 is mounted for rotation in the hole 32 by means of an upwardly extending pin 34. The pin 34 has a head 35 of the same diameter as the general diameter of the pin 34, the head being formed by a waist 36 in the pin immediately below the head. A spring clip 37 which is located by the pivot pin 29 engages with the waist 36 and thus holds the pin 34 of the clamping disc 33 in the hole 32. However, the clamping disc may be removed by a straight axial pull and then can be snapped into position again.

In many specialised clamping operations it is desirable to exchange the clamping disc for an alternative work engaging device adapted to the shape of the workpiece. The simple clip-in and clip-out action of the clamping disc clamping this exchange to be effected in a very simple manner.

The pivot pin 29 has a central portion of slightly reduced diameter and the spring 28 engages this reduced diameter portion so that the spring 28 locates the pin 29 laterally.

The active jaw 12 corresponds in many respects to the reactive jaw 13. Where individual parts correspond closely they have been given reference numbers corresponding to those of the reactive jaw but with the prefix '1' added to these reference numerals. Thus the reactive jaw incorporates two pressings 114 and 115 joined by a series of pins 116. There is a clamping pad 118. Similarly there are two contact pads 119 and 121.

The fundamental distinction between the active and the reactive jaws concerns the mounting of the contact pad 119. This contact pad 119 is free to move its position with respect to the jaw member. The two stampings 114 and 115 incorporate arcuate clearance slots 101 which receive a pin 102 which passes through the contact pad 119. A pair of links 103 pivoted about the pivot pin 123, of the contact pad 121 are also pivoted to the pin 102 so that this pin is free to move on an arc centred about the pivot pin 123. The arcuate slots 101 do not come into contact with the pin 102 except at the extremities of its movement. A rectangular nut 104 is supported in two corresponding rectangular apertures in the pressings 114 and 115 at a position behind the contact pad 119 and this nut carries a manually operable screw 105 which is threaded in the nut 104 and in

use bears against the rear surface of the contact pad **119.** This rear surface of the contact pad **119** is in the form of a vertical arcuate groove and the end of the bolt **105** which runs in this groove has a corresponding part spherical surface of slightly smaller radius than the groove. This ensures that contact between the bolt **105** and contact pad **119** does not prevent relative vertical movement between these components and that forces between these components are substantially within a vertical central plane.

The operation of the clamping device will now be described, starting with the reactive jaw **13.** When a workpiece is engaged between the two clamping pads **18** and **118** the pad **118** can be caused to exert a clamping force as will be described hereinafter. This force is reacted by the clamping pad **18** of the reactive jaw. A vertical upward force on the clamping pad **18** in the configuration shown in the drawing tends to rotate the reactive jaw about its mounting on the shank **11** which, in turn, generates substantial pressure forces between the contact pads and the shank as a reaction against the applied moment. These substantial pressure forces result in limiting friciton forces in a direction along the shank which are substantially greater than the force applied to the clamping pad **18** with the result that the reactive jaw maintains its position irrespective of the load applied to the clamping jaw. The spring **28** results in a slight initial gripping of the shank by the contact pads so that the reactive jaw will maintain its position even without any applied load. When a typical clamping load has been applied the reaction forces between the shank and the contact pads are sufficient to cause the projections **25** (see FIG. **4**) to be pressed into the surface of the shank and thereby improve the frictional grip. The deformation of the shank is of an elastic nature so that the surface of the shank is not damaged. Due to the fact that the contact pads are pivotally mounted, the forces between the contact pads and the shank are evenly distributed over the surface.

The active jaw could be used as a reactive jaw and in such a case the operation would be as described above for the reactive jaw. However, the primary intended use of the active jaw is to enable a clamping force to be applied by movement of the clamping pad **118** in a direction towards the workpiece. In order to effect this clamping operation the screw **105** is rotated in such a direction that it tends to force the contact pad **119** towards the shank **11.** Considered another way, this screwing operation tends to draw the upper left hand part (in the drawing) of the active jaw member towards the left in the drawing, away from the shank. Thus the whole jaw member tends to rotate about the pivot pin **123** thereby causing the clamping pad **118** to press against the workpiece. Pressure and friction forces between the contact pads **119** and **121** and the shank **11** corresponding to the similar forces of the reaction jaw tend to develop as a result of the rotation of the jaw member and the creation of a force on the workpiece by the clamping pad **118.** The clamping force can be increased by further rotation of the screw **105** and the resulting increase in clamping force on the workpiece results in corresponding increasing forces between the shank and the contact pads **119** and **121.**

During initial tightening of the screw **105** to apply an initial clamping force there would, in the absence of the links **103,** be a tendency for the active jaw **12** to slide bodily down the shank **11** as a reaction to the initial clamping force on the workpiece before any positive engagement had been established between the contact pads and the shank. It is believed that the reason for this is that the balance between the clamping force and the frictional forces can be upset during the initial part of the clamping operation by practical factors such as slight irregularities in the surfaces between the screw and the contact pad **119.** However, the provision of the links **103** tends to hold the contact pad **119** in its desired location so that it is a simple matter to establish the required clamping forces. The links **103** do not take any substantial part of the main clamping load and due to the fact that they have slightly oversize holes for engaging in the appropriate pins these links tend to become free and take no load whatsoever as the clamping force is increased.

A clamping device as shown in FIGS. **1** to **4** remains effective in a vibratory environment despite the fact that it relies on frictional forces. The nature of the engagement between the contact pads and the shank has been found to stand up to vibration without any tendency for the clamping forces to be reduced by sliding of one or other of the clamping jaws along the shank. In addition, any vibration tending to rotate the workpiece is free to rotate the workpiece due to the nature of the clamping pads and this rotation does not tend to twist the workpiece out of the clamping device.

An alternative application of an active clamping jaw is shown in FIG. **5.** A shank **51** is secured to a work table **52** by means of a bracket **53.** An active jaw **54** is positioned on the shank **51.** This active jaw may be used to clamp a workpiece of any height within the limits of the shank **51** to the work table **52.**

Active and reactive jaws in accordance with the invention and as described in detail above may be used in a wide variety of applications in conjunction with suitable shanks.

We claim:

1. An active clamping jaw for sliding along a shank to a desired clamping location and then exerting a clamping force which is reacted through the shank, the jaw comprising:

an elongated jaw member,

jaw member portions defining a shank receiving aperture at one end portion of the jaw member,

a clamping pad secured to the opposite end portion of the jaw member for exerting a force on a workpiece in one longitudinal direction of the shank, a first contact pad pivotally mounted on said jaw member and arranged for frictional engagement with a side of the shank adjacent the clamping pad,

a second contact pad carried by said jaw member and arranged for frictional engagement with the side of the shank remote from the clamping pad at a position along the shank in the direction of said clampin force from the first contact pad,

guide means operatively interconnecting the second contact pad to the jaw member such that it is free to move on an arcuate path with respect to the jaw member centred on the pivot of the first jaw member,

lateral force exerting means carried by the jaw member and arranged for exerting a force on the second contact pad towards the shank with respect to the jaw member,

the arrangement being such taht during a clamping operation the two contact pads frictionally engage

the shank and the jaw member is casued to move angularly with respect to the contact pads to apply the clamping force at the clampin pad.

2. A clamping jaw for sliding along a shank to a desired clamping location and then engaging with said shank and exerting a clamping force which is reacted through szid shank, said jaw comprising:

an elongate jaw member,

a clamping pad secured at one end portion of said jaw member for exerting a clamping force on a work piece in one longitudinal direction of said shank,

a first contact pad and a second contact pad carried at the opposite end portion of said jaw member, said contact pads defining between them a shank receiving space, a surface of said first contact pad being arranged for frictional engagement with a side of said shank adjacent said clamping pad and said second contact pad being arranged for frictional engagement with the side of said shank remote from said clamping pad at a position along said shank in the direction of said clamping force from said first contact pad, and one of said contact pads being mounted on said jaw member for pivotal movement about an axis fixed with respect to said jaw member, and the other of said contact pads being movably mounted on said jaw member,

being connected between said that of said contact pads and said jaw member for moving said other of said contact pads relative to said jaw member in a direction towards said shank and thus pivoting said jaw member with clamping to said shank for applying clamping force to said workpiece, said jaw member pivoting about said axis about which said one of said contact pads is mounted for pivoting with respect to said jaw member.

3. A clamping jaw as claimed in claim 2 wherein said other of said contact pads is mounted for pivoting relative to said jaw member so that in use it is permitted to align itself accurately with said shank.

4. A clamping jaw as claimed in claim 2 and including a spring operatively connected between said jaw member and said one contact pad in one rotational direction to enable said one contact pad to grip said shank between it and said other contact pad whereby even in the absence of a clamping force said clamping jaw retains itself in a fixed position on said shank.

5. A clamping jaw as claimed in claim 1 wherein said guide means comprises a link pivoted at one end thereof to the jaw member and at the other end thereof to the second contact pad to control the movement of the second contact pad with respect to the jaw member.

6. A clamping jaw as claimed in claim 5 in which the first contact pad is pivoted to the jaw member and in which the link is pivoted to the pivotal axis of the first contact pad.

7. A clamping assembly comprising a shank and two clamping jaws for sliding along said shank to desired clamping locations and then engaging with said shank and exerting a clamping force which is reacted through said shank, each of said jaws comprising:

an elongated jaw member,

a clamping pad secured at one end portion of said jaw member for exerting a clamping force on a work piece in one longitudinal direction of said shank,

a first contact pad and a second contact pad carried at the opposite end portion of said jaw member, said contact pads defining between them a shank receiving space, a surface of said first contact pad being arranged for frictional engagement with a side of said shank asjacent said clamping pad and said second contact pad being arranged for frictional engagement with the side of said shank remote from said clamping pad at a position along said shank in the direction of said clamping force from said first contact pad, one of said contact pads being mounted on said jaw member for pivotal movement about an axis fixed with respect to said jaw member, and the other of said contact pads being movably mounted on said jaw member,

means for being connected between said other of said contact pads and said jaw member for moving said other of said contact pads relative to said jaw member in a direction towards said shank and thus pivoting said jaw member with respect to said shank for applying clamping force to said work piece, said jaw member pivoting about said axis about which said one of said contact pads is mounted for pivoting with respect to said jaw member,

said clamping pad of each of said jaws including a work engaging portion, said clamping pad being pivotally connected to the jaw member for movement about an axis transverse to the length of the jaw member and to the length of the shank and said work engaging portion being rotatable with respect to said clamping pad.

* * * * *

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,758,100 Dated September 11, 1973

Inventor(s) David John Taylor and Aris Mednis

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 2, line 24, change "reduced to - reacted -

line 38, change "corresponing" to - corresponding -

line 49, cancel "jaw the incorporate" and insert - and the shank -

line 62, cancel "the member may provision" and insert - the jaw may incorporate -

Col. 4, line 10, change "resepct" to - respect -

line 26, change "resepct" to - respect -

Col. 5, line 7, change "perssings" to - pressings -

line 55, change "vibrator" to - vibratory -

line 56, change "had" to - hard -

line 57, change "deformatio" to - deformation -

line 63, change "cpntact" to - contact -

line 65, change "arrange" to - arranged -

Col. 8, line 67, (claim 1) change "taht" to - that -

Col. 9, line 1, (claim 1) change "casued" to - caused -

Col. 9, line 31, (claim 2) cancel "clamping" and insert - respect -

Col. 10, line 23, (claim 7) change "asjacent" to - adjacent -

Signed and sealed this 2nd day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents