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[54] CLAMPING DEVICE

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[52] **U.S. Cl.** **269/92,** 269/93, 269/239

[51] **Int. Cl.** **B23q 3/02**

[58] **Field of Search**.....269/90–94, 239

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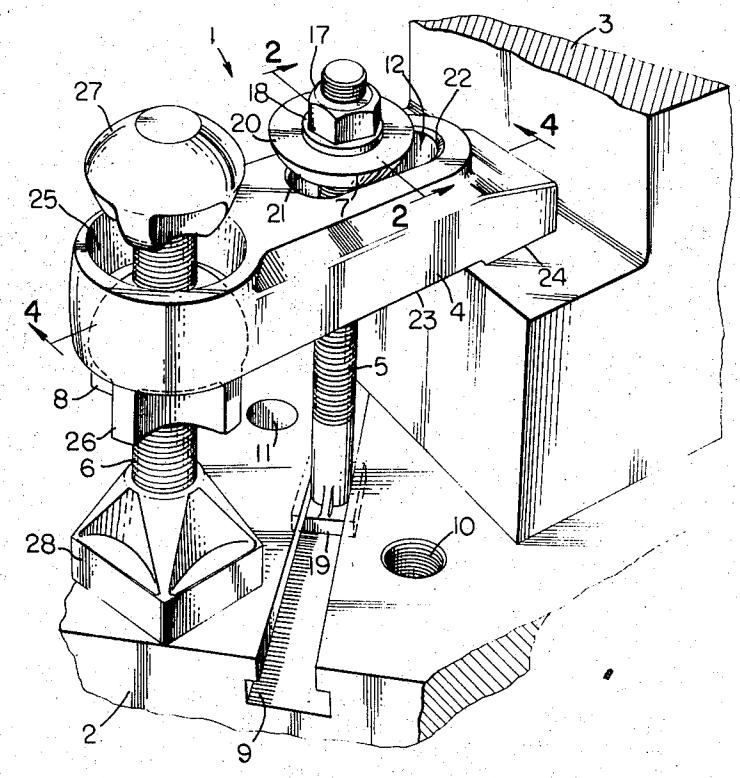
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[57] **ABSTRACT**

This invention involves a device for clamping items to be worked on in relation to a support and comprises an elongated clamp provided with a lower receiving means, a shaft and a rod extending through the clamp, and a pair of fittings carried by the shaft and rod for respective cooperation with an upper portion or bearing area of the clamp and with the receiving means in a manner whereby the clamp may be caused to readily tilt and adjust itself to the work for clamping it to the support.

14 Claims, 9 Drawing Figures



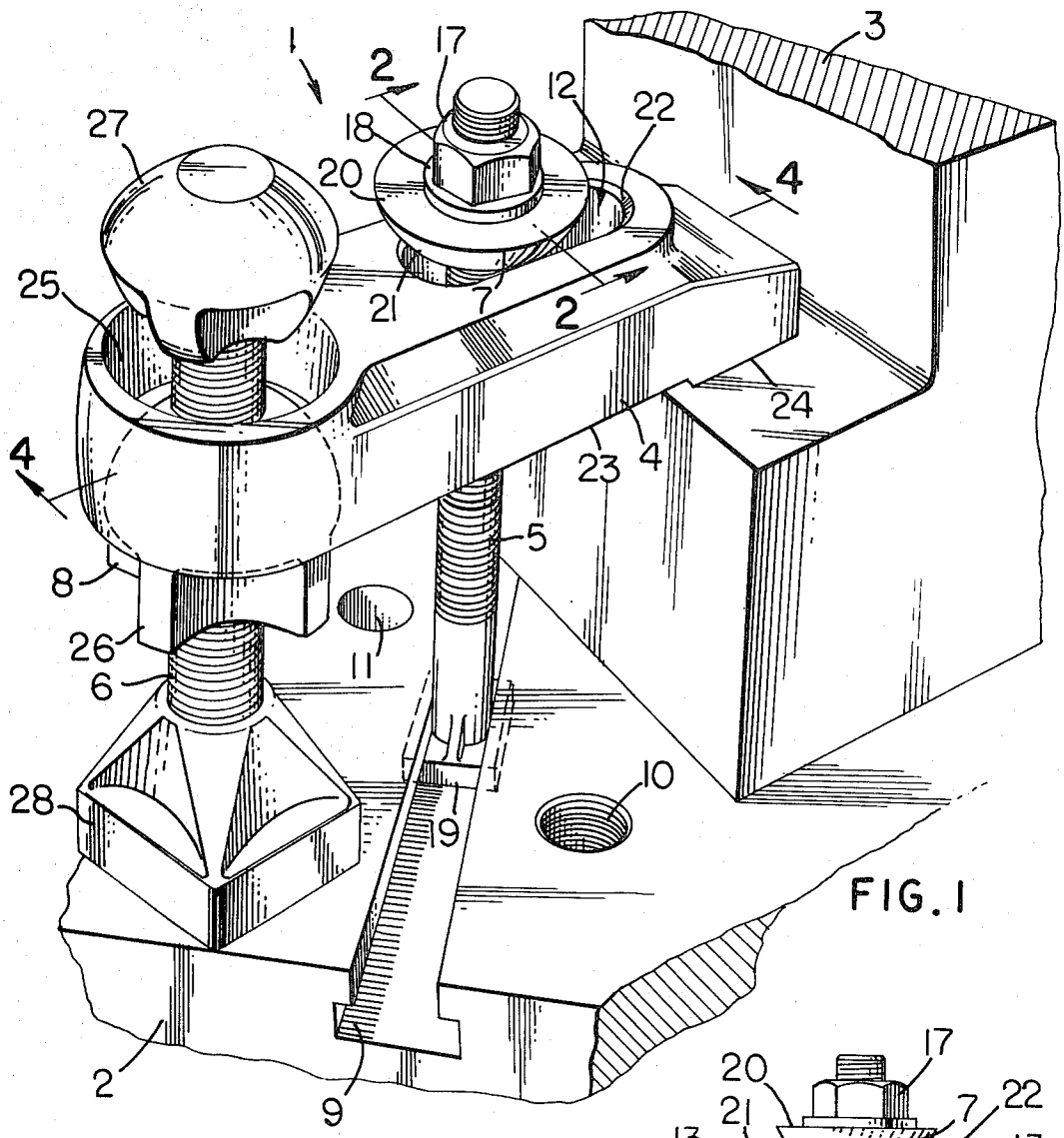


FIG. 1

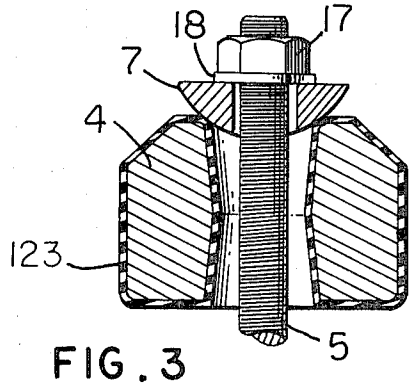


FIG. 3

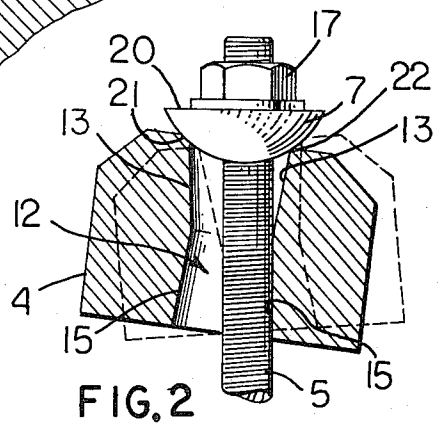


FIG. 2

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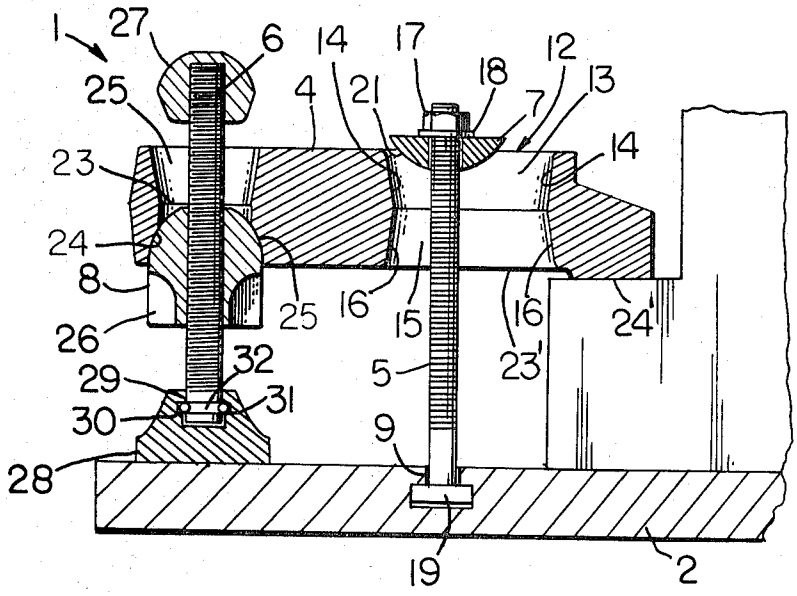


FIG. 4

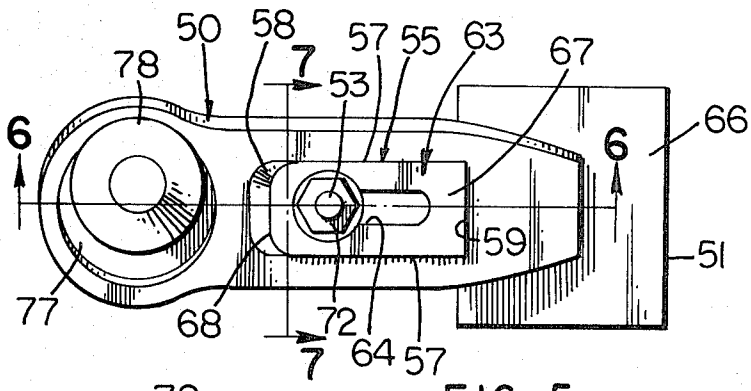


FIG. 5

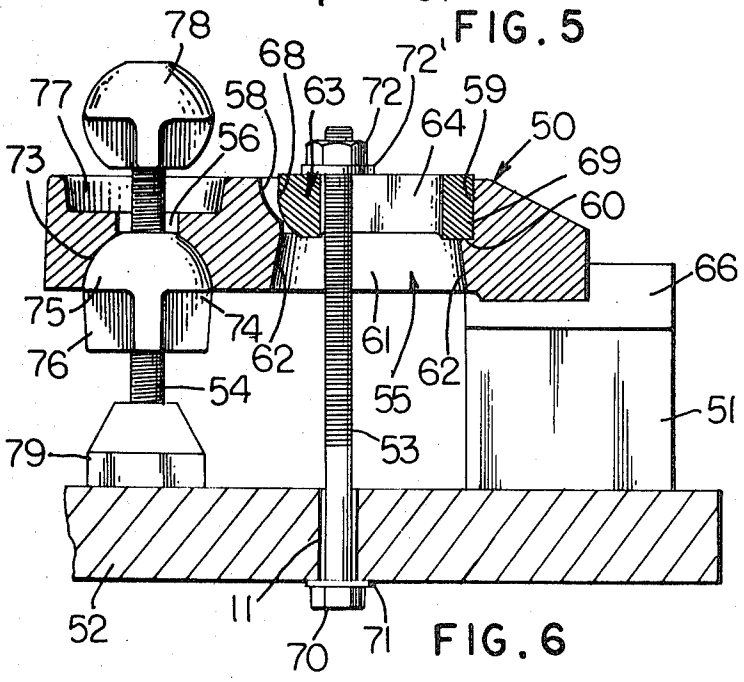


FIG. 6

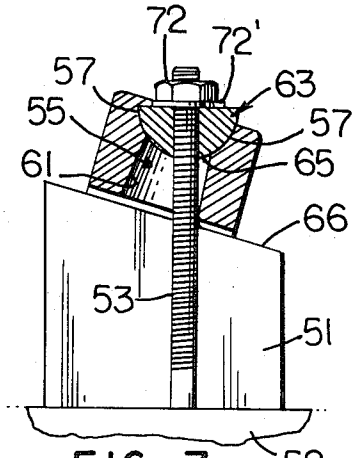


FIG. 7

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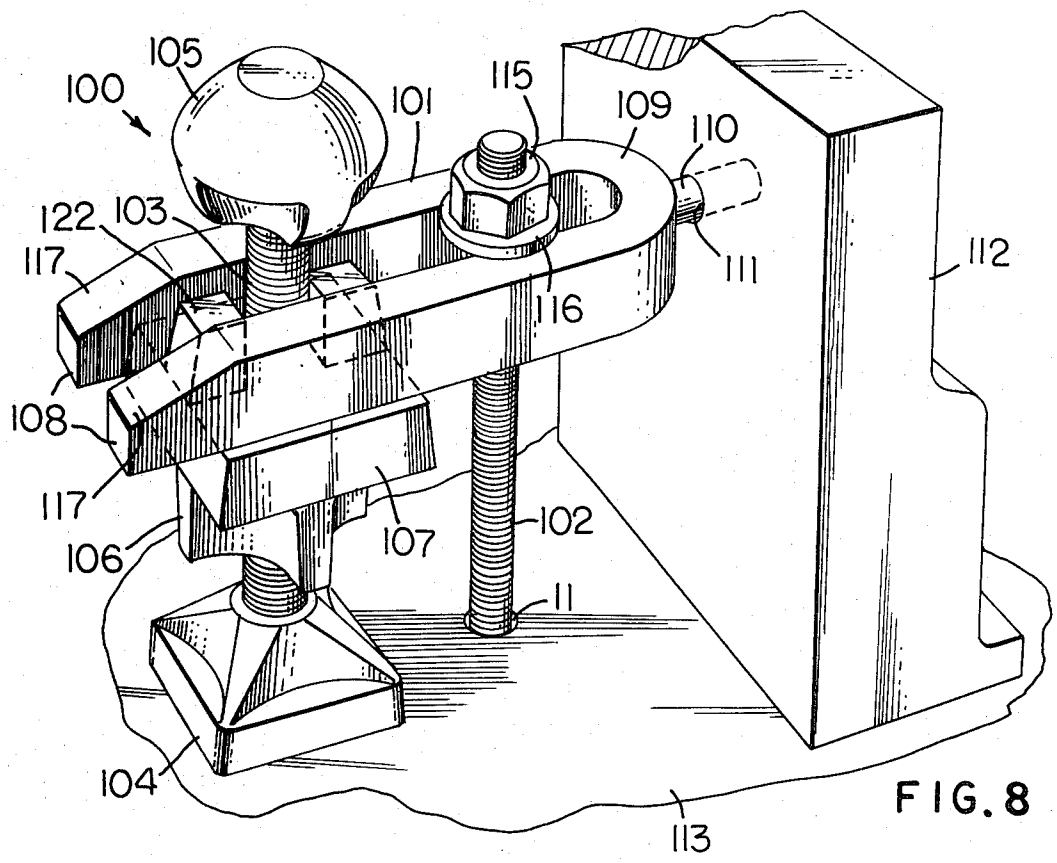


FIG. 8

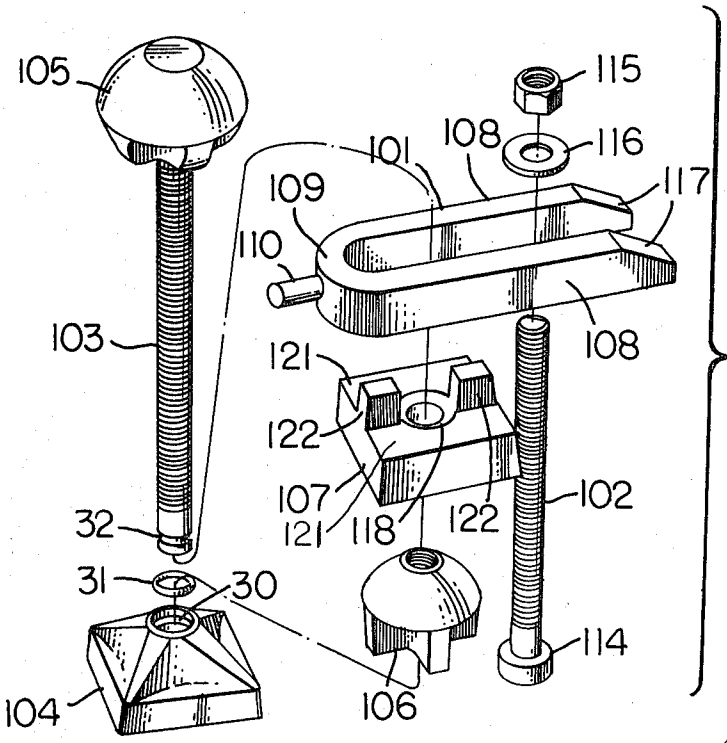


FIG. 9

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CLAMPING DEVICE

The invention is directed generally to clamping equipment and more particularly, is directed to a clamping device which may be utilized where ever applicable but is preferably adapted for use in machine shops for firmly holding work or items to be worked or operated on in relation to a conventional support.

The device embodying the subject invention may be designed and constructed in various ways but, as disclosed herein, preferably comprises an elongated clamp having an upper means and a lower receiving means with a hole and opening respectively extending therethrough, a shaft and a rod which respectively extend transversely through the receiving means and upper means and hole and opening therein, and fittings or members which are adjustable relative to the shaft and rod for respectively engaging the upper means and receiving means in a manner whereby the clamp may be caused to readily automatically tilt and adjust itself to the work as well as with respect to the fittings for efficiently holding the work between the clamp and a support, such as a table or bed when the fittings are being correctly adjusted.

One of the objects of the invention is to provide a device in which the lower receiving means, above referred to, is preferably in the form of an annular concave recess or cavity having an aperture extending therethrough through which the shaft extends and the upper means of the clamp is preferably in the form of a bearing or receiving area or a longitudinal recess through which the rod extends.

A specific object of the invention is to provide a setup in which the rod is preferably threaded throughout the major portion of its length, the fitting on the end of the rod is preferably an element having a curved surface, and the lower end of the rod is provided with means which may be in the form of a threaded extremity which may engage any one of a plurality of threaded apertures provided therefor in a support or extend through a hole in the support and carry a nut for engaging an underside of a support, or in the form of a connector for reception in a conventional T-slot provided therefor in an upper surface of a support.

Another object of the invention is to provide an organization in which the shaft, above referred to, is preferably threaded throughout the major portion of its length, the fitting carried thereby is preferably in the form of a nut having a convex surface for engaging the concave recess in the clamp, a pressure member is adjustably carried by a lower end of the shaft for engaging a support, and the upper end of the shaft is provided with a handle for manipulation whereby to facilitate positioning of the clamp in relation to the work to be held.

A significant specific feature of the invention resides in making the fitting on the shaft of a sufficient length so that a lower extremity thereof will project below the clamp in order to provide a handle whereby to facilitate rapid manipulation or adjustment of the fitting on the shaft.

A further object of the invention is to provide a modified device in which the upper area or receiving means of the clamp is preferably in the form of an elongated substantially semi-cylindrical recess or cavity having a longitudinal slot extending therethrough and a slotted element having a lower semi-cylindrical surface which engages the recess and a rod extends through the slot in the clamp and the slot in the element to afford relative movement between the clamp and element whereby the clamp may readily accommodate or adjust itself to the work and thereby better anchor or hold a work in place. Otherwise expressed, the specific relationship of the components is such that work having variable surface contours or faces may be engaged by the clamp for effectively holding or anchoring the work in place.

A further object of the invention is to provide a clamping device in which the clamp thereof is protected with a layer of resilient material, such as a plastic, whereby to prevent marring of the work and/or a support as well appreciably reduce the noise factor during the use of the device as well as assist in holding the clamp relative to the work.

The invention also offers advantages with respect to design and construction, assembly and disassembly of the components, ease in operation, efficiency and durability.

Additional objects and advantages of the invention or inventions as embodied in the clamping devices will become apparent after the description hereinafter set forth is considered in conjunction with the drawings annexed hereto.

Referring to the drawings:

FIG. 1 is a perspective view showing a clamping device attached to a support and holding work thereon;

FIG. 2 is a transverse section taken substantially on line 2—2 of FIG. 1 illustrating an adjustable feature of the device;

FIG. 3 is a transverse section similar to FIG. 2 showing a clamp of the device protected by a layer or coating of plastic or equivalent material;

FIG. 4 is a vertical section taken substantially on line 4—4 of FIG. 1;

FIG. 5 is a top view of a modified form of clamping device;

FIG. 6 is a vertical section taken substantially on line 6—6 of FIG. 5;

FIG. 7 is a transverse section taken substantially on line 7—7 of FIG. 5;

FIG. 8 is a perspective view of a further modified clamping device; and

FIG. 9 is an exploded view showing the relationship of the components of the device shown in FIG. 8.

Referring first to FIGS. 1 through 4 of the drawing and particularly to FIG. 1, there is shown a clamping device generally designated 1 operatively associated with a support 2 for holding work 3 on the support so that, for example, some desired manual work or machine may be applied to the work.

The device may be designed and constructed in various ways but preferably includes an elongated clamp 4, a rod 5 and a shaft 6 which respectively extend transversely through the clamp, and fittings 7 and 8 which are respectively associated with the rod and shaft for cooperation with the clamp whereby to facilitate adjustment of the clamp to the work.

The support 2 may, for example, be in the form of a table when the operation on the work is to be performed manually or in the form of a bed of a machine when the operation is to be performed by a component thereof. The support is preferably provided with an

upper planar horizontal surface which may be provided with a T-slot **9** and/or a plurality of various apertures, one of which, for example, may be threaded as indicated at **10** or a plain cylindrical one as indicated at **11**.

The clamp **4** is generally rectangular in shape and substantially generally rectangular in cross-section and has a fore extremity which is generally squared for engaging the work, a rear extremity which is preferably rounded as shown, and a lower surface which is planar. The clamp is provided with an opening, upper area or receiving means intermediate its length preferably in the form of a medial longitudinal slot generally designated **12** having upper downwardly converging planar side surfaces **13** and end surfaces **14**, and lower downwardly extending divergent side surfaces **15** and end surfaces **16**.

The rod **5** above referred to, is preferably externally threaded throughout the major portion of its length and extends transversely through the slot **12** and the side and end surfaces **13** through **16** of this slot afford clearance for the rod and to allow for tilting or adjustment of the clamp relative to the rod. The upper end of the rod preferably carries a nut **17** and a washer **18** and its lower end is preferably provided with means which may be in the form of a connector **19** adapted for slidable movement in the T-slot **9** in the support for adjustably attaching the rod to the support. In this respect, attention is directed to the fact that, if so desired, the lower end of the rod may be threaded for connection with the threaded aperture **10** provided in the support or it may be extended through the aperture **11** and provided with a nut for engaging an underside of the clamp, as depicted, for example, in FIG. **6**. These different arrangements offer a setup whereby the device may be operatively associated with various conventional supports.

The upper end of the rod, as noted above, is provided with the fitting **7**. This fitting is preferably in the form of a round element having an upper planar surface **20** and a lower curved or convex surface **21** for disposition in the upper receiving means or slot **12**, for engaging a chamfered edge **22** of the slot and thereby affords a setup whereby the fore extremity of the clamp may be brought into engagement with the work and the nut **17** tightened to cause the clamp to adjust or tilt itself with respect to the rod, depending on the shape or character of the portion of the work which is to be engaged by the clamp. It should be noted that a lower portion of the clamp is preferably removed or undercut as indicated at **23'** so that an underside of the fore extremity of the clamp is provided with a pad or bearing surface **24'** for engagement with the work. If the work has an upper planar surface which is horizontal to the surface of the support the clamp will substantially be in a horizontal position while it is holding the work in place as shown in FIG. **4**, but if the surface to be engaged is inclined as shown for example in FIGS. **6** and **7** the clamp will automatically adjust itself with respect to such inclined surface so that the clamp will assume a generally tilted position as illustrated in FIG. **2**. Otherwise expressed, the clamp will automatically adjust itself with respect to the rod and the fitting thereon depending on the character of the work that is engaged by the clamp. In most instances the clamp will be adjusted to a slightly inclined position against the work so that the pad on the fore extremity of the clamp will efficiently engage the work. In other words, the clamp may be adjusted so that its fore extremity in a holding position is lower than its rear extremity and/or in either of the inclined positions depicted in FIG. **2**.

The rear extremity of the clamp is preferably provided with a transverse aperture or hole **23** through which the shaft **6** extends. This rear extremity is also provided with a receiving means preferably in the form of a lower annular concave recess **24** and its upper side with a tapered cylindrical recess **25** which affords clearance for the shaft when the clamp is adjusted relative to the fitting **8**. The shaft is preferably externally threaded throughout the major portion of its length and when extended through the hole **23** is generally in parallel relation to the rod. The fitting **8** is preferably generally cylindrical in shape and provided with an axially extending threaded aperture for threadedly engaging the shaft. An upper extremity of the fitting is provided with a curved or convex surface **25** for engaging the recess **24** and a lower extremity of the fitting is of a sufficient length to provide a fluted handle **26** located below the undersurface of the clamp whereby to facilitate manual adjustment of the fitting of the shaft. This feature of the device is considered to constitute a meritorious advance in the art. Obviously, the handle may be provided with means other than the flutes shown to facilitate gripping of the handle.

The upper end of the shaft is provided with a handle **27** preferably in the form of a fluted knob whereby to facilitate manual turning or adjustment of the shaft **6** relative to the clamp **4** and/or the fitting **8**. The lower end of the shaft is preferably provided with a pressure engaging member, base or foot **28**. This member may be attached to the shaft in various ways but as depicted in FIG. **4** it is provided with a lower planar surface for engaging the support **2** and an upper cylindrical recess **29** having an internal annular groove **30** which has a diameter somewhat greater than that of the recess for partially receiving an O-ring **31** and the lower end of the shaft is provided with an external annular groove **32** which receives a portion of the O-ring when the shaft is inserted into the recess, all for the purpose of providing an adjustable connection between the member and the shaft when the clamp is being clamped against the work. In other words, this relative movement is dependent to some degree on the character or surface of the work to be engaged by the clamp.

To utilize the clamping device, as exemplified in FIG. **1**, the device is moved on the support **2** in relation to the work **3** by inserting and sliding the connector **19** on the rod in the slot **9** and the member **28** on the shaft along the upper planar surface of the support, following which the fitting **7** on the rod may then be adjusted for use by manipulating the nut **17** so that the fore extremity of the clamp may be positioned for clamping. The fitting **8** may then be adjusted at the desired elevation on the shaft so that the pad **24'** of the clamp will engage the work, whereupon the handle **27** on the shaft and/or the fitting may be manipulated to cause the clamp to bear with sufficient force against the work for anchoring it in place and/or the nut **17** on the rod may be tightened to force the washer **18** against the fitting and the latter against the clamp with sufficient force to hold

the work in place. The clamp may be readily released from the work by merely loosening the nut 17 on the rod and/or the shaft by manipulating the handle 27 of the fitting 8 on the shaft.

Referring to the modified form of clamping device exemplified in FIGS. 5, 6 and 7 of the drawing, there is shown a clamp generally designated 50 having a fore extremity for engaging work 51 on a support 52 with a rod 53 and a shaft 54 respectively extending transversely through an opening generally designated 55 and a hole 56 provided in the clamp.

More specifically, the opening 55 in the clamp is preferably in the form of an elongated slot having upper concave side surfaces 57, a curved downwardly extending end surface 58 and a vertical end surface 59 located adjacent a curved abutment 60. This slot is also provided with lower downwardly extending divergent side surfaces 61 and downwardly extending divergent end surfaces 62. The upper surfaces define what may be referred to as a receiving means, cavity or a substantially semi-cylindrical recess and an elongated fitting or element generally designated 63 is seated in the recess and provided with an opening preferably in the form of an elongated slot 64 which is somewhat shorter in length and of less width than the slot in the clamp. The rod extends transversely through both slots and the lower surfaces of the slot in the clamp afford clearance for the rod to allow for tilting of the clamp relative to the fitting, rod and the work to be clamped.

The fitting 63 may be desgnated and constructed as desired but preferably is formed to provide a lower substantially semi-cylindrical surface 65 which nests or seats in the semi-cylindrical recess in the clamp and engages the curved abutment 60 whereby to afford movement of the clamp relative to the fitting and rod, when, for example, the fore extremity of the clamp is engaging an inclined surface 66 of the work 51, as depicted in FIG. 7. The fitting is also provided with an upper planar surface 67, a curved end surface 68 disposed in relation to the end surface 58, and a fore end 69 for engaging the vertical end surface 59 and of the opening 55.

The rod 53 is preferably in the form of a bolt having a lower extremity which extends through the aperture 11 in the support 52 and has a head 70, below the support, with a washer 71 interposed between the support and head. The upper end of the rod is preferably threaded, and provided with a nut 72, with a washer 72' interposed between the fitting 63 and the nut.

The clamp is provided with the hole 56 through which the shaft 54 extends and also with a lower receiving means preferably in the form of an annular concave recess 73. A generally cylindrical fitting 74, substantially corresponding to the fitting 8, above referred to, has an upper convex surface 75 engaging the recess and a lower extremity 76 which is of a sufficient length, size or character whereby to facilitate manipulation of the fitting on the shaft. The clamp is further provided with an upper annular recess 77 having a diameter which is somewhat greater than the diameter or cross-dimension of the lower recess and affords clearance for the shaft when the clamp is tilted relative thereto, as well as clearance for a handle 78 on the shaft when, for example, the clamp has been adjusted to substantially its maximum elevation. The lower end of the shaft is provided with a pressure member or foot 79 for engaging the support. This member may be attached to the shaft in a manner substantially corresponding to that employed in connection of the shaft 6 and member 28 as described above.

The modified device shown in FIGS. 5, 6 and 7 provides a unique setup which offers greater stability to the clamping device and particularly to the holding action of the clamp through the agency of the larger bearing surfaces between the fitting 63 and the upper receiving means accommodating the same. This modified device has proven very efficient, for example, in firmly clamping work, such as 51, which has the inclined surface 66 and which, when engaged by the fore extremity of the clamp, allows the clamp to adjust with respect to the fittings 63 and 74 and thereby firmly holds the work in place as shown in FIG. 7. Otherwise expressed, the tilting of the clamp compensates for the incline and serves to appreciably prevent the clamp from sliding down such incline when the clamp is being applied to the work.

Referring to FIGS. 8, 9 and 10 of the drawing there is depicted a modified form of clamping device generally designated 100, which may be utilized for clamping work in three different ways. The device preferably includes, an elongated clamp 101, a rod 102, and a shaft 103 provided with a pressure member 104, a handle 105 and a fitting 106, with a block 107 adapted for disposition between the clamp and fitting.

More particularly, the clamp is preferably constructed in the form of an elongated U having corresponding parallel legs 108 joined by a curved or bight portion 109 provided with a cylindrical extension 110 adapted for disposition, for example, in a hole 111 provided in work 112 for holding the latter in relation to a support 113. This support is provided with an aperture 11 and the rod, which is preferably in the form of a bolt, extends through this aperture and the clamp, and has a head 114 for engaging the underside of the support and an upper end which carries a nut 115 and a washer 116, the latter of which is adapted for disposition between the nut and clamp in a conventional manner. The legs of the clamp define an elongated opening, which is open at one end so that the rod and shaft may be inserted broadside into the opening in lieu of threading the rod and shaft through separate openings or holes in a clamp as described above. The block 107 is also insertable into the opening along with the shaft and rod. The free ends of the legs are preferably bevelled as indicated at 117 and the ends serve to engage work when the clamp is reversed, in which event, the extension 110 would not be utilized for holding purposes.

The shaft 103 and the member 104, fitting 106 and handle 105 thereon substantially respectively correspond to those employed in connection with the clamping devices described above and therefore need not be described in detail.

The block or adapter 107, above referred to, is substantially square in shape and provided with a center opening 118 through which the shaft extends, a lower receiving means preferably in the form of an annular concave recess (not shown) which receives an upper convex portion 120 provided on the fitting 106 as shown in FIG. 9. The sides of the block are preferably slightly bevelled, as shown, and its upper side is pro-

vided with a pair of planar bearing surfaces **121** and a pair of upstanding squared projections or lugs **122** located diametrically on opposite sides of the opening **118**. When the block is correctly assembled with the clamp, its bearing surfaces **121** engage the undersurfaces of the clamp and the projections **122** extend upwardly between the legs of the clamp to prevent rotation of the block relative to the clamp and shaft. This organization is unique as the block enables an operator to utilize the fitting **106** with a conventional U-clamp, such as **101**, and thereby promote the factor of adaptability. When the fitting is adjusted on the shaft, the block is normally moved therewith. As exemplified in FIG. **8**, all of the components of the device are correctly operatively associated so that when the extension **110** on the clamp is located in the hole **111** in the work the latter may be clamped on the support by tightening the nut **115** on the rod and/or by manipulating the shaft **103** or fitting **106** thereon.

In some instances, the work to be clamped may be of such a character that the curved or bight end **109** of the clamp may be applied to the work for holding in lieu of the extension **110**. Also, as alluded to above, the clamp **101** may be reversed so that the ends of the legs of the clamp may be readily utilized for engaging and clamping work in place on the support **113**.

In view of the foregoing, it will be manifest that the clamping device **100** offers a setup whereby the clamp may readily adjust itself relative to the fitting **106** through the agency of the block **107** as well as with respect to the work to be clamped.

As illustrated in FIG. **3** of the drawing, the clamp **4** is shown as being provided with a protective layer **123** of suitable material, such as plastic, and of sufficient thickness for the purpose of reducing noise, preventing marring and promoting the clamping action by preventing slippage. The clamps of the other clamping devices **50** and **100** may also be protected by a layer of such material and a layer may also be applied to the pressure members **28**, **79** and **104**.

In all of the clamping devices disclosed, the clamp, due to its relationship with the fitting on the shaft, may tilt lengthwise and/or widthwise. More specifically, the clamp may be caused to take an inclined position with its fore extremity being lower than its rear extremity and/or in an inclined tilted position such as shown in FIG. **7**. Otherwise expressed, the transverse axis and/or the longitudinal axis of the clamp may be inclined, depending in some instances, on the character of the work to be clamped.

Having thus described my invention, it is obvious that various modifications may be made in the same without departing from the spirit of the invention and, therefore I do not wish to be understood as limiting myself to the exact forms, constructions and arrangements, and combinations of parts herein shown and described.

I claim:

1. An assembly for the purpose described comprising: an elongated clamp having a fore extremity provided with an integral rigid end for engaging work adapted to be mounted on a horizontal support, said extremity also being provided with a longitudinal opening extending transversely therethrough for receiving a rod having a lower end for attachment to a horizontal support and an upper end provided with means for applying pressure to said clamp, said clamp also having a rear extremity having an aperture extending transversely therethrough, said aperture being countersunk to provide a concave seat at the under side of said clamp, a threaded shaft extending through said aperture and having a lower end provided with a pressure foot for engaging a horizontal support and an upper end provided with a handle whereby to facilitate manipulation of said shaft, and an elongated nut carried by said shaft and interposed between said clamp and said pressure foot, said nut having an upper convex portion for disposition in said seat and a lower portion extending appreciably below said clamp for manual engagement whereby to facilitate rapid manipulation of said nut relative to said shaft and clamp to assist in adjusting said clamp in relation to work to be clamped by said rigid end.

2. The assembly defined in claim **1**, in which said longitudinal opening is countersunk at the upper side of said clamp and said pressure applying means includes a fitting having a convex surface for engaging the material defining said countersunk opening.

3. The subassembly defined in claim **1**, including resiliently flexible material interposed between the material defining said concave seat and said convex portion of said nut whereby to facilitate locking of said convex portion in said seat.

4. The assembly defined in claim **1**, in which said aperture is also countersunk at the upper side of the clamp in order to provide clearance so said clamp may tilt relatively to said shaft.

5. The assembly defined in claim **1**, in which said opening and said aperture are respectively countersunk at the upper side of said clamp and said pressure applying means on said rod includes a fitting having a convex surface for engaging the material defining said countersunk opening, the arrangement being such that said countersink of said aperture at said upper side provides clearance for said shaft and said countersink of said opening at said upper side and the convex surface of said fitting will allow tilting of said clamp relative to said rod and shaft.

6. The assembly defined in claim **1**, in which said opening is countersunk both at the upper and under side of said clamp and said aperture is countersunk at the upper side of said clamp whereby to facilitate tilting of said clamp relative to said rod and said shaft.

7. The assembly defined in claim **1**, in which said pressure applying means including an elongated fitting having a slot therein through which said rod extends and said pressure applying means also includes an element whereby said fitting may be forced against said clamp.

8. A subassembly for the purpose described comprising: an elongated clamp having a fore end for engaging and clamping work against a support and a rear end provided with an opening extending transversely therethrough, said opening being countersunk at the under side of said clamp to provide a concave recess of appreciable depth, a threaded shaft extending through said opening and having an upper end provided with an enlargement forming a handle which serves to facilitate manual operation of said shaft and limit its downward movement through said opening, said opening also

being countersunk to provide clearance at the upper side of said clamp whereby to facilitate tilting of said clamp relative to said shaft, said shaft also having a lower end provided with a pressure foot loosely connected thereto for engaging a support, and an elongated nut carried by said shaft provided with an upper convex integral portion of appreciable axial extent for reception in said recess and a lower portion for disposition an appreciable axial distance below said clamp when said convex portion is seated in said recess whereby to facilitate manipulation of said nut relative to said shaft and clamp to assist in adjusting said fore end of said clamp in relation to the work to be clamped.

9. The subassembly defined in claim **8**, including resiliently flexible means which is interposed between said recess and said convex portion of said nut.

10. The subassembly defined in claim **8**, in which said clamp is provided with a layer of resiliently flexible material which serves to reduce noise and assist in locking said convex portion of said nut in said concave recess.

11. The subassembly defined in claim **8**, in which said pressure foot is detachably connectible with said shaft.

12. A clamping device of the character described comprising: an elongated clamp provided with a hole extending transversely through one extremity thereof and a threaded shaft extending loosely through said hole, said clamp also being provided with a clamping end portion and an opening extending lengthwise of the clamp and transversely through its other extremity, a rod extending loosely through said opening for free axial movement therein and free displacement to and from said shaft and having a lower end for free slidable adjustment and securement in a slot provided in a horizontal support, said rod also having a threaded upper end, manually adjustable pressure applying means carried by said threaded end for movement relative thereto for applying pressure against said clamp, said hole being countersunk to provide a concave recess in the under side of said clamp, said threaded shaft having a pressure foot loosely connected to a lower end thereof for adjustably engaging a horizontal support, a handle fixedly secured to an upper end of said shaft whereby to facilitate its manipulation, an elongated nut threadedly connected to said shaft and having an upper convex portion for disposition in said concave recess and a lower portion extending appreciably below the under side of said clamp for manual engagement whereby to facilitate rapid axial adjustment of said nut relative to said shaft and said clamp whereby to assist in adjusting the clamping end portion of said clamp against work adapted to be held on a horizontal support.

13. The device defined in claim **12**, including resiliently flexible means which is interposed between said concave recess and said convex portion of said nut.

14. The device defined in claim **12**, in which said clamp is protected with a layer of resiliently flexible material and so said convex portion of said nut may engage such material in said concave recess.

* * * * *