May 6, 1969 N. PARAPETTI 3,442,478

UNIVERSALLY ADJUSTABLE DIAL INDICATOR HOLDER

Filed June 20, 1967

FIG. 1

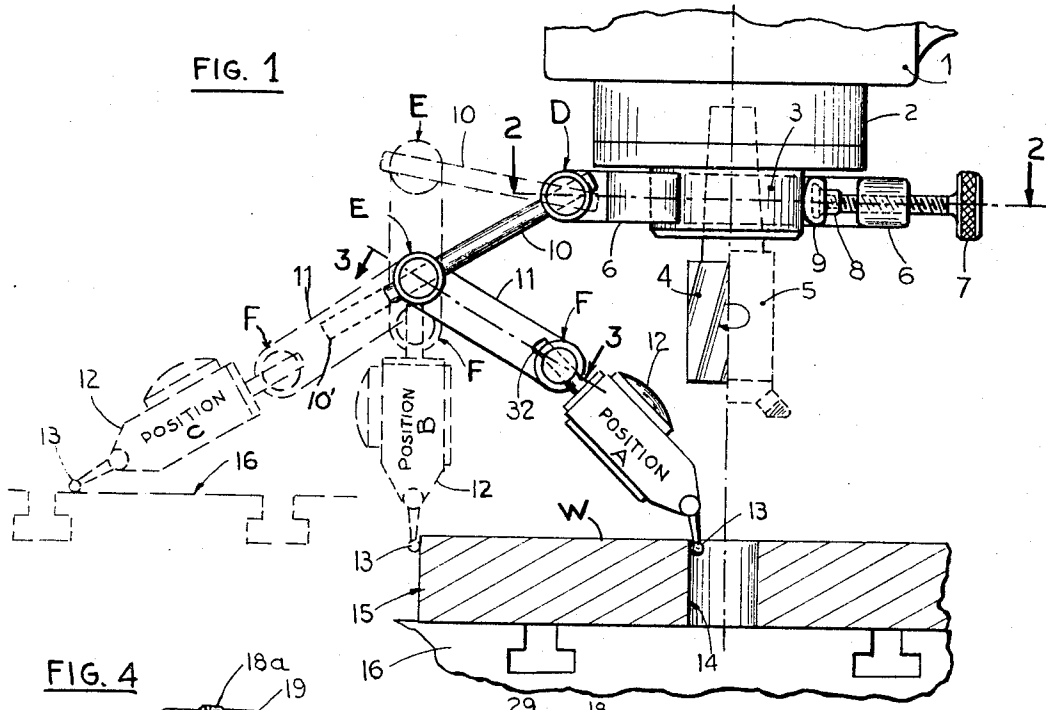


FIG. 4

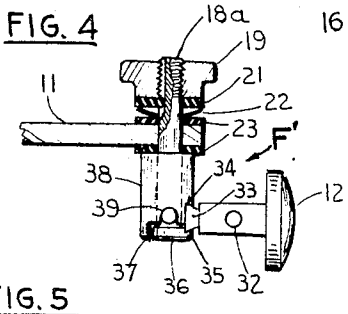


FIG. 6

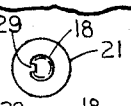


FIG. 2

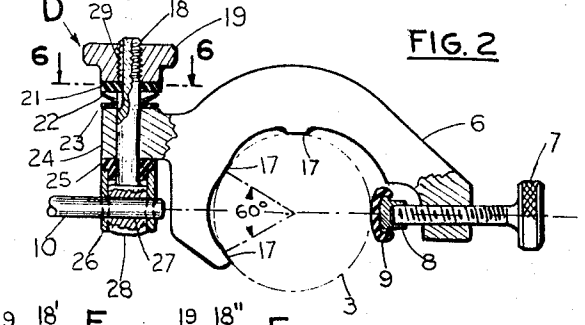


FIG. 5

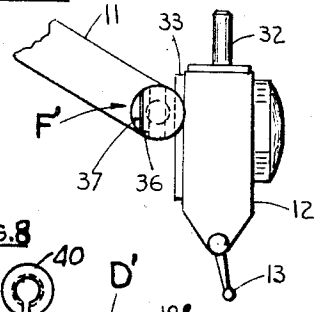


FIG. 8

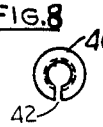


FIG. 7

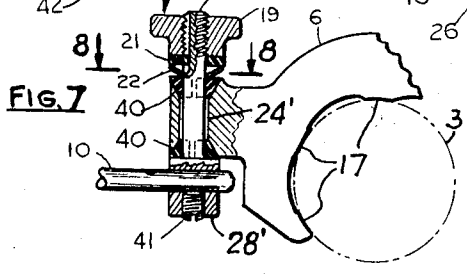
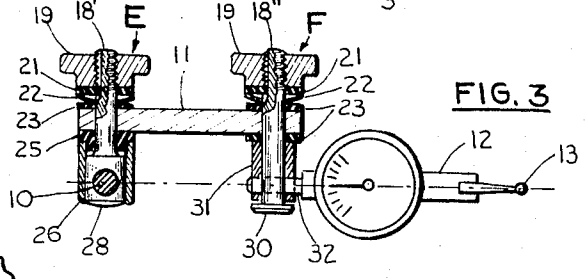


FIG. 3



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UNIVERSALLY ADJUSTABLE DIAL INDICATOR HOLDER

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ABSTRACT OF THE DISCLOSURE

This universally adjustable dial indicator holder comprises a C-clamp easily applicable from either side to a spindle on a vertical milling, boring, or grinding machine without disturbing the tooling on the spindle at given setting thereof, the clamp carrying on one side thereof a first swivel bolt joint with respect to which a rod is extensibly or rotatably adjustably clamped, the rod having swivelled on its outer end a second swivel bolt on which one end of a link is swivelled, the link carrying on its other end a third swivel bolt adjustably supporting a dial indicator. The latter mounting may be of a form utilizing a dovetail sliding connection for endwise adjustability of the dial test indicator relative to the swivel. Each of the three swivel bolts has a manually adjustable nut thereon for tightening a spring tensioned friction joint, whereby the articulated assembly is adapted for holding the dial indicator reliably in practically any position of adjustment.

This invention relates to a device for mounting a dial indicator of the type commonly known as a dial test indicator.

More particularly, my invention relates to a clamp and its articulated assembly as an attachment for holding such an indicator in any desired position. It is also adapted for other applications, but has been designed principally for use on vertical milling, boring, and grinding machines.

In the general practice in tool rooms and production shops the indicators and their attachments are mounted in a collet or chuck that fits into the machine spindle. This operation obviously requires removal of the working tool from the collet or chuck (a time consuming step, particularly when the collet's internal diameter does not fit the indicator mounting means), tightening the supporting means of the indicator, doing the reading, and then removing the indicator and remounting the working tools necessary for the planned operation. Failure to notice then, when removing such working tools, if these tools were preset for diameter or depth, means that the entire setup time is lost for there is always a possibility the tool cannot be relocated exactly in the same position as it was prior to the indicator reading.

The present device, the object of this invention, does not require disturbing the working tool, for the device can readily be clamped on the machine quill, and thus bypass the working tool, saving all the time previously lost.

The clamp includes at least two bearing points properly spaced on a V and a pressure screw symmetrically arranged opposite to those bearings, thereby securing the required rigidity of the mounting. A plastic swivel shoe on the screw avoids marring the outside diameter of the quill. An extension of this clamp provides the articulation for the adjustable rod that holds at its other end a second articulation that holds a link that also at its other end carries a third articulation that mounts the indicator's shank or indicator mounting dovetail. These three articulations, as shown in the drawing, are each frictionally mounted by means of a compressible spring washer

applying pressure on plastic bearings. The pressure is adjustable to get the desired stiffness in the assembly and is not affected by the pivoting of these three articulations.

This assembly is very flexible and, after tightening of the clamp, permits the indicator to be brought into the desired reading position where it can cover a broad area of surfaces to be checked. The construction of this device also allows the indicator to be maintained on the center line of the spindle.

The types of readings performed by the indicator are (1) concentricity positioning of the work relative to the spindle center line, (2) alignment of the edge of the work with the longitudinal or transverse movement of the machine tables, and (3) checking the perpendicularity of the spindle center line relative to the surface of the table.

The above mentioned general objects of my invention are attained by the device illustrated in the accompanying drawing, wherein similar reference numerals or letters are applied to corresponding parts, and wherein:

FIG. 1 is an exploded side elevational view of the device mounted on the spindle of a vertical milling or boring machine;

FIG. 2 is a section of the clamp and articulation D on line 2—2 of FIG. 1;

FIG. 3 is a section of the attachment through articulations E and F of FIG. 1, on line 3—3 of FIG. 1;

FIG. 4 is a view like FIG. 3 but a modification of the clamping mechanism at articulation for mounting an indicator by its body dovetail;

FIG. 5 is a side elevation of FIG. 4;

FIG. 6 is a plan view of one of the washers of articulation D, taken on line 6—6 of FIG. 2;

FIG. 7 is a view like FIG. 2 showing a modification of articulation D, and

FIG. 8 is a plan view of one of the tapered split friction washers, taken on line 8—8 of FIG. 7.

The dial indicator **12** shown in full lines in FIG. 1 in position A illustrates how the center line of a bore **14** in work W can be checked for concentricity relative to the center line or axis of spindle **3**. For this the spindle **3**, on which the clamp **6** is mounted, will be rotated slowly through 360° and the side of the bore will be checked by sliding engagement therein of the feeler contact **13** of the indicator. Position B shows how the edge **15** of the work W mounted on the table **16** of the machine can be checked for parallelism relative to the movements of the table **16** of the machine. Position C shows how the surface of the machine table **16** can be checked for squareness with the spindle axis or center line by having the machine table left stationary and the spindle locked in its elevation with respect to the table, while slowly rotating the spindle (with my device mounted on it) through 360°. The indicator point **13** will sweep the table and check to determine if its surface is exactly on a plane parallel to the plane generated by the rotation of the spindle.

On the left side of FIG. 1 the machine table **16** shown in dotted lines is represented at a different level from that same table shown in full lines on the right side of FIG. 1, this being only for convenience of illustration. FIG. 1 shows also two different types of working tools mounted on the spindle **3** of the machine. The left side shows a cutter **4** and the right side a boring tool **5**, this serving to illustrate that these tools do not interfere with the mounting of the indicator holder **6**, and consequently when either of these tools is in use it can be left in place.

Referring to FIG. 1, a portion of the frame of the machine is shown at **1** with a quill **2** projecting downwardly therefrom, along with a spindle **3** in coaxial relationship to the quill and carrying a cutter **4** by means of its tapered shank indicated largely in dotted lines, a half portion of a boring tool being also indicated in

dotted lines at 5 to indicate interchangeability of tools when the clamp 6 of the universal indicator holder of my invention is in use, the clamp 6 being generally C-shaped as appears in FIG. 2 and therefore readily applicable to the spindle 3 from either side while any tool, as shown at 4 or 5, is in place in the spindle. The clamp 6 is fastened by tightening the screw 7 against one side of the spindle, clamping pressure being applied by the shoe 8, which is threaded tightly onto the screw to the jam point and preferably is equipped with a swivelled nylon protective pad 9 fitting over the shoe and having non-marring contact with the spindle on the diametrically opposite side from the two flat bearing surfaces 17 that are provided in relieved relationship to the inner diameter of that side of the C-clamp and are spaced approximately 60° apart as shown, 30° on opposite sides of the center line of the screw, to provide three-point bearing contact between the spindle and the clamp 6 when the screw 7 is tightened. A third flat bearing surface may be provided at the 90° position as shown, to bear on the spindle 3 the same as the other surfaces 17 and make for still greater rigidity of the clamp 6. When a smaller diameter spindle 3 is encountered, only the first two bearing surfaces 17 will contact the spindle.

The first of three articulations, D, E, and F, is provided on that side of clamp 6 opposite the screw 7 and has an adjustable radius or extension rod 10 extending therefrom in the same vertical plane with screw 7, as shown in FIG. 2, to the second articulation E, rod 10 as will soon appear being slidable endwise with respect to articulations D and E for a shorter or longer radius, the construction also permitting turning of articulation E about rod 10 as an axis or turning of rod 10 relative to articulation D. The rod 10 may be longer as seen at 10' in FIG. 1, to provide as long a radius of operation as needed. A flat link 11 interconnects articulations E and F, between the outer end of rod 10 or 10' and the dial indicator 12.

Referring next to the left side of FIG. 2, boss 24 projects from the clamp 6 and constitutes the bearing for the transversely disposed metal swivel bolt 18, which serves as the axis of the first of the three articulations shown at D in addition to providing part of the means for clamping the extension rod 10 in its adjusted angular and endwise relationship to articulation D. A flat nylon washer 23 slips over the threaded D-section end of bolt 18 for abutment with an arched spring metal washer 22 disposed between it and another flat nylon washer 21 for compression of the spring washer to the desired extent by the manual tightening of knurled nut 19 relative to the bolt 18 to provide the desired amount of frictional resistance to turning of bolt 18, and, at the same time, provide a similar friction hold against slippage of the end of extension rod 10, which passes through diametrically opposed holes in the metal sleeve 26 that bears against a shouldered nylon washer 25 abutting the opposite side of boss 24 from washer 23, the rod 10 passing through a cross-hole 27 in the enlarged cylindrical head end 28 of bolt 18 that fits inside sleeve 26. The compressible spring washer 22 may be a Belleville type spring washer. A key-way 29 provided in the threaded D section end of bolt 18 slidably receives a key projection on washer 21, as clearly appears in FIG. 2, so that the nut and washer turn with the bolt 18 and there is no danger of the nut loosening by reason of the bolt being turned in the adjustment of the indicator to a desired position.

The construction of the two other articulations, E and F, is closely similar, as seen in FIG. 3, and corresponding parts have therefore been correspondingly numbered. The swivel bolt 18' is shorter than bolt 18, due to the difference in thickness of link 11 in relation to boss 24. Bolt 18'' has no need for an enlarged cylindrical head 28 thereon, but has a flat head 30 on its outer end to retain the sleeve 31 before the shank 32 of the indicator 12 is inserted in the registering holes in bolt 18'' and sleeve 31 for mounting the indicator 12 thereon.

Referring to FIGS. 4 and 5, these show a modification of the clamping means in articulation F' for mounting an indicator by its dovetail 33, one side of which is engaged in a half-dovetail groove 34, the other half 35 of which is provided in the D-shaped head 36 provided on the end of swivel bolt 18*a*. The D-shaped head 36 cooperates with a projection 37 on the end of the metal sleeve 38 to hold the two parts against turning with respect to one another in the same way as if the shank 32 on the indicator 12 were inserted through the registering holes in the bolt 18*a* and sleeve 38 indicated at 39. The holes 39 to receive the shank 32 are always kept in register by virtue of the way the D-shaped head 36 cooperates with the projection 37 on the sleeve 38.

FIGS. 7 and 8 show another modification designed to give greater rigidity, in which the first articulation D' on bearing boss 24 has its swivel bolt 18*b* extending loosely through a longitudinal bore in the boss and supported in tapered nylon bearing bushings 40 fitting in tapered bearing openings in the opposite ends of the bore in the boss, the bushings being split, as seen at 42 in FIG. 8, to clamp the bolt frictionally, more or less firmly depending upon the tightness of adjustment of nut 19 compressing the spring washer 22. The head 28' has the extension rod 10 or 10' extending freely through a cross-bore therein and clamped in adjusted position by a set screw 41.

In operation, assuming that all of the nuts 19 on the swivel bolts in the three articulations, D (or D'), E, and F, have been tightened properly, the operator can adjust the articulated assembly of the holder relative to the clamp 6 to set the indicator 12 with its contact 13 in proper relationship to the work with full confidence that the indicator will not shift its position during the taking of a reading, regardless of which one of the three positions illustrated in FIG. 1 is used, or any other position. Naturally if, in order to get the indicator 12 in a particular relationship to the work, it becomes necessary to shorten or lengthen the operating radius of rod 10, then one or both of the nuts 19 on the swivel bolts at articulations D and E must first be loosened to permit the change in effective length of the rod (or substitution of a longer rod) and then retightened to restore the previous setting for frictional resistance to movement of the parts relative to one another. The fact that the clamp 6 can be applied to the spindle 3 from either side without disturbing the cutter 4 or 5 prior to taking readings with the indicator is a most important advantage, and, of course, the clamp can be removed again after taking the readings, with equal facility. In that way the operator loses no time and does not disturb whatever previous work may have been done for setup purposes, as previously mentioned.

It is believed the foregoing description conveys a good understanding of the objects and advantages of my invention.

I claim:

1. For use on the spindle of a machine tool behind and independent of any tooling carried by and extending from said spindle, a universally adjustable holder for a dial indicator comprising a C-clamp applied from either side of and adapted to be clamped to the spindle in a plane normal to the axis of rotation thereof and having a bearing projecting therefrom, a first swivel bolt swivelled in said bearing and carrying clamping means thereon on one end, a cylindrical radius rod mounted at one end in said clamp means for swivel and endwise adjustability, a nut threaded on the other end of said bolt adjustable to vary the compression of spring means compressing friction washer means on the bolt between the bearing and said nut resisting turning of the bolt, a link substantially in parallel relation to said radius rod adapted to support the dial indicator on one end and adapted to be supported at its other end on the outer end of said radius rod for swivel and endwise adjustability relative thereto, a second swivel bolt pivotally connecting one end of the link with the outer end of said radius rod, a third swivel bolt in paral-

lel relation to the second bolt for pivotally connecting the other end of said link to the dial indicator, said second and third swivel bolts both having clamp means on one end thereof, one of said clamp means adapted for receiving a portion of a dial indicator to mount the same thereon, and the other of said clamp means receiving the outer end of the aforementioned radius rod with freedom for swivel and endwise adjustability relative thereto, and a nut threaded on the other end of each of said bolts adjustable to vary the compression of spring means compressing friction washer means on the bolts resisting turning thereof.

2. A structure as set forth in claim 1, wherein one of the friction washers next to the nut on each of said swivel bolts is keyed to the swivel bolt so that these washers turn with the bolts and nuts in the swivel adjustments, reducing likelihood of any of the nuts loosening and requiring readjustment.

3. A structure as set forth in claim 1, wherein the third swivel bolt on which the dial indicator is mounted has a head provided thereon retaining a sleeve and a friction washer between the head and the link, the rod and sleeve having registering holes provided therein through which a stem on the dial indicator is extensible for clamping when the nut on the other end of the swivel bolt is tightened for spring loading of the friction washer means.

4. A structure as set forth in claim 1 wherein the first swivel bolt has a head provided thereon inside a sleeve, the sleeve bearing on a friction washer between it and the bearing, the head and sleeve having registering holes provided therein through which one end portion of the radius rod extends and is adjustable endwise and rotatably and is clamped when the nut on the remote end of said bolt is tightened for spring loading of the friction washer means.

5. A structure as set forth in claim 1, wherein the second swivel bolt in the connection between the radius rod and the link has a head thereon inside a sleeve, the sleeve bearing on a friction washer between it and the link, the head and sleeve having registering holes provided therein through which the outer end of the radius rod extends for endwise and rotary adjustability and is clamped by the tightening of the nut on the remote end of the bolt for spring loading of the friction washer means.

6. A structure as set forth in claim 1, wherein the swivel bolt on which the indicator is mounted has a head provided thereon retaining a sleeve on the bolt and a friction washer between the sleeve and the link, the bolt and sleeve having registering holes provided therein adapted to receive a stem provided on the dial indicator, the sleeve having one side of a dove-tail groove provided thereon on one side thereof, the other side portion of the dove-tail groove being provided in the head on said bolt, the dial indicator having a dove-tail portion thereon for reception in the dove-tail groove provided in said sleeve and head for adjustably clamping the dial indicator in a selected position of adjustment relative to said swivel bolt and link when the nut is tightened on the remote end of the bolt for spring loading of the friction washer means.

7. A structure as set forth in claim 1, wherein the swivel bolt on which the indicator is mounted has a head provided thereon retaining a sleeve on the bolt and a friction washer between the sleeve and the link, the bolt and sleeve having registering holes provided therein adapted to receive a stem provided on the dial indicator, the sleeve having one side of a dove-tail groove provided thereon on one side thereof, the other side portion of the dove-tail groove being provided in the head on said bolt, the dial indicator having a dove-tail portion thereon for reception in the dove-tail groove provided in said sleeve and head for adjustably clamping the dial indicator in a selected position of adjustment relative to said swivel bolt and link when the nut is tightened on the remote end of the bolt for spring loading of the friction washer means, the structure including means holding the swivel bolt and sleeve against turning relative to one another whereby to maintain the holes for the stem in register and also maintain the two sides of the dove-tail groove in proper register with respect to one another.

8. A structure as set forth in claim 1, wherein the swivel bolt on which the indicator is mounted has a head provided thereon retaining a sleeve on the bolt and a friction washer between the sleeve and the link, the bolt and sleeve having registering holes provided therein adapted to receive a stem provided on the dial indicator, the sleeve having one side of a dove-tail groove provided thereon on one side thereof, the other side portion of the dove-tail groove being provided in the head on said bolt, the dial indicator having a dove-tail portion thereon for reception in the dove-tail groove provided in said sleeve and head for adjustably clamping the dial indicator in a selected position of adjustment relative to said swivel bolt and link when the nut is tightened on the remote end of the bolt for spring loading of the friction washer means, one side of the head being flat and the sleeve having a projection thereon disposed in abutment with the flat side of the head to hold the swivel bolt and sleeve against turning relative to one another, thereby maintaining registration of the holes in the sleeve and bolt and proper register of the two sides of the dove-tail groove.

9. A structure as set forth in claim 1, wherein the first swivel bolt has a head provided thereon in which a diametrically extending hole is provided slidably and rotatably adjustably receiving one end of said radius rod, there being means securing the rod in adjusted relationship to said head, the head bearing against a friction washer between it and the bearing on the clamp, said washer being clamped when the nut on the remote end of said bolt is tightened for spring loading of the friction washer means.

10. A structure as set forth in claim 1, wherein the first swivel bolt is mounted in the bearing projection on the C-clamp in split tapered bearing bushings entered in tapered bearings in the bearing projection, whereby the bushing are compressible on the bolt to eliminate play and give added friction when the nut on the bolt is tightened for spring loading of the friction washer means.

11. A structure as set forth in claim 1, wherein the C-clamp has a clamping screw on one end of the C-clamp, the bearing projection being provided on the other end of the C-clamp, the radius rod swivelled relative to said bearing being movable in coplanar relationship to said clamping screw in a plane normal to the plane of said C-clamp.

12. A device as set forth in claim 1 wherein the C-clamp has a clamping screw threaded in one end of the C-frame of said clamp and has two inwardly embossed flat bearing surfaces on the inner circumference of the other end of the C-frame spaced approximately 30° on opposite sides of a center line extended from said screw, these surfaces being tangent to a circle of a predetermined radius for a spindle small enough to enter between said surfaces and said screw for clamping engagement of the C-clamp.

13. A device as set forth in claim 1 wherein the C-clamp has a clamping screw threaded in one end of the C-frame of said clamp and has two inwardly embossed flat bearing surfaces on the inner circumference of the other end of the C-frame spaced approximately 30° on opposite sides of a center line extended from said screw, these surfaces being tangent to a circle of a predetermined radius for a spindle small enough to enter between said surfaces and said screw for clamping engagement of the C-clamp, there being also a third flat inwardly embossed bearing surface on the inner circumference of said C-frame tangent to the same circle as the other two flat bearing surfaces and disposed approximately 90° from the center line of said screw.

14. A device as set forth in claim 1 wherein the cylindrical radius rod is of a predetermined length but is

removable and interchangeable with another cylindrical radius rod of a different length.

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U.S. Cl. X.R.

33—172; 287—54.1; 248—226