Feb. 1, 1966 F. SIEGLER 3,232,101

JIG INCLUDING TORQUE MEASURING MEANS

Filed Feb. 18, 1963 4 Sheets-Sheet 1

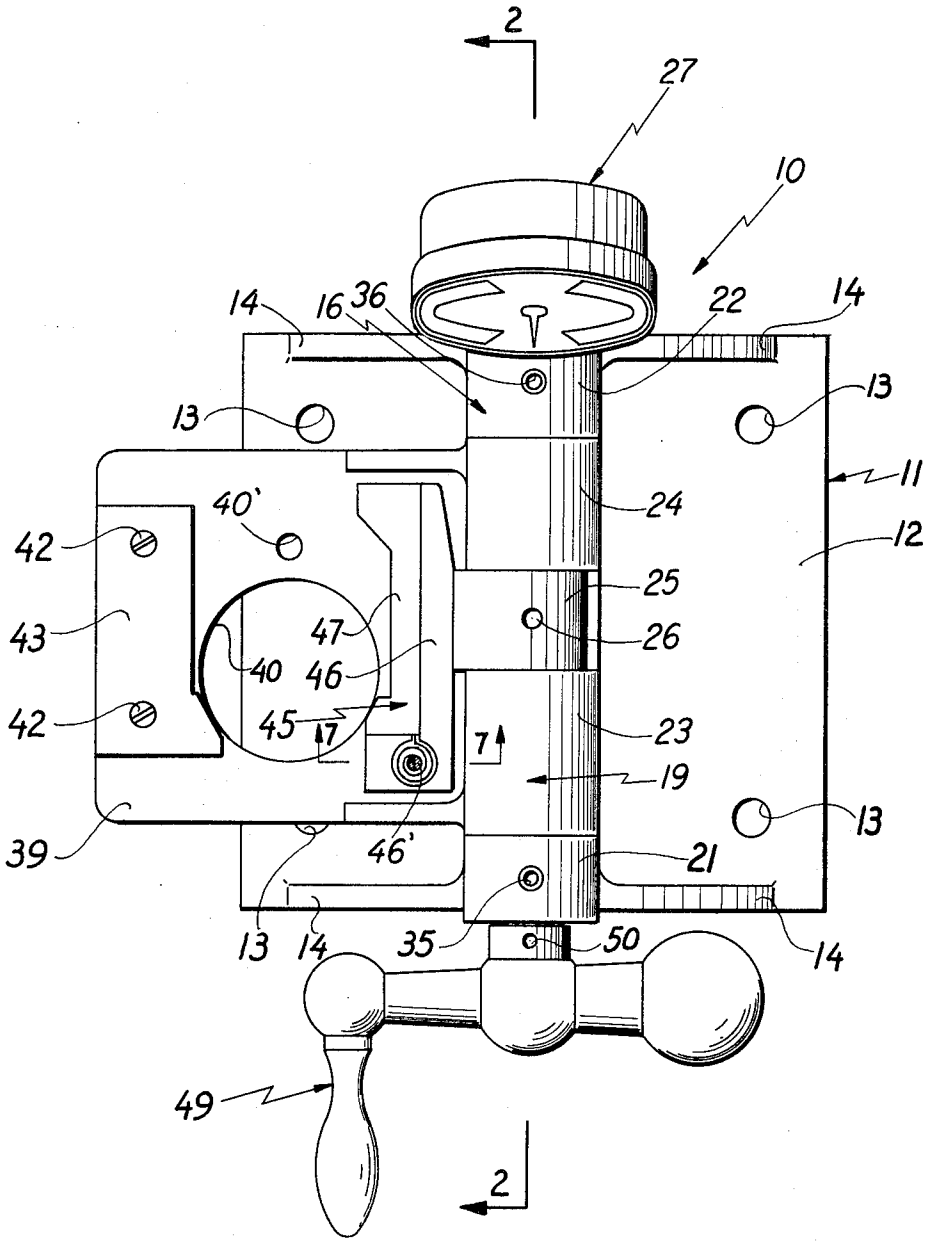


FIG. 1.

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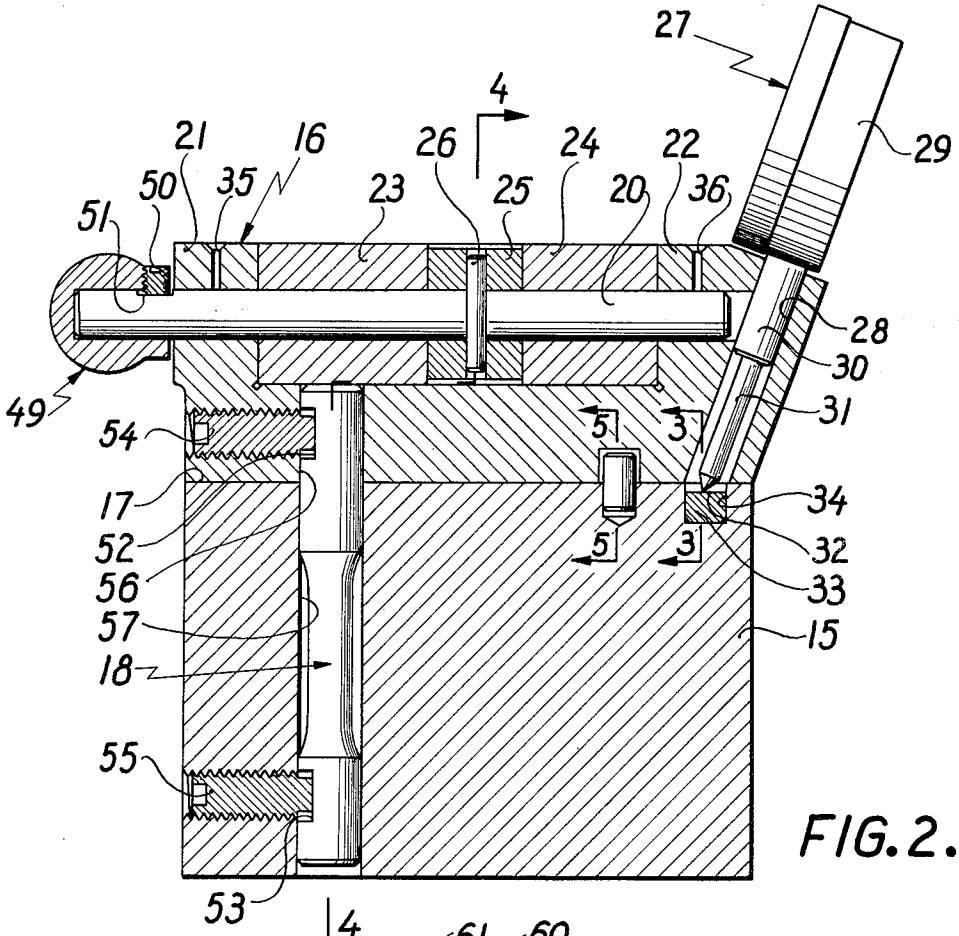


FIG. 2.

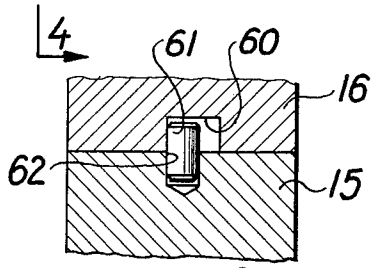


FIG. 5.

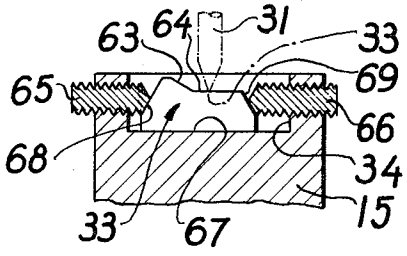


FIG. 3.

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JIG INCLUDING TORQUE MEASURING MEANS

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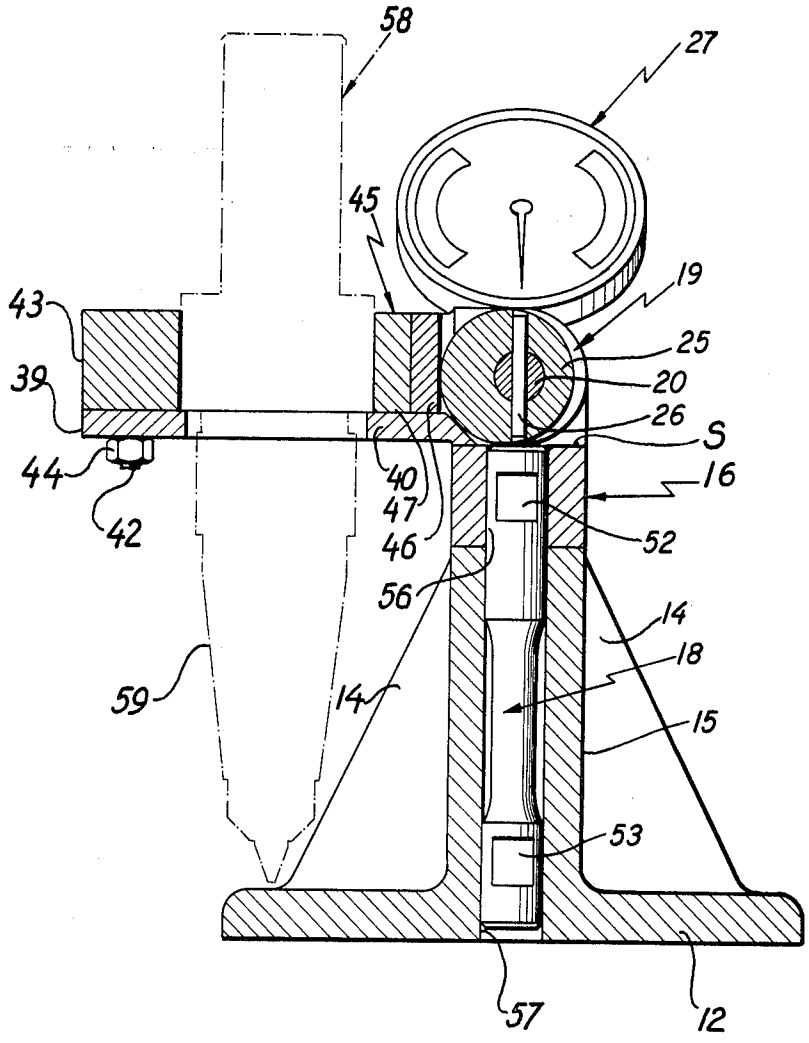


FIG. 4.

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JIG INCLUDING TORQUE MEASURING MEANS

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FIG. 6.

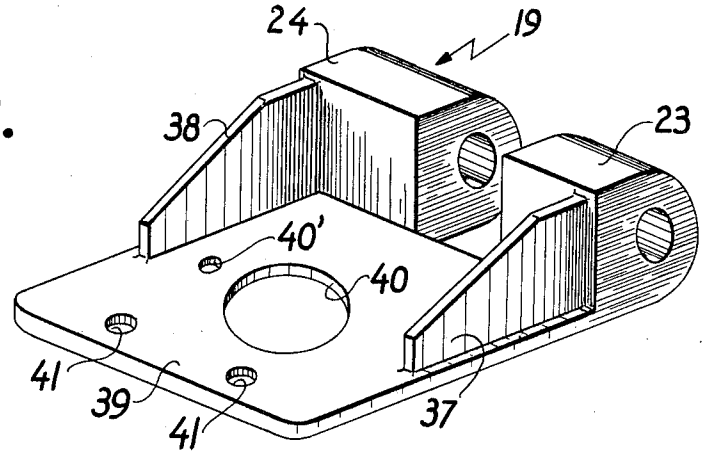


FIG. 8.

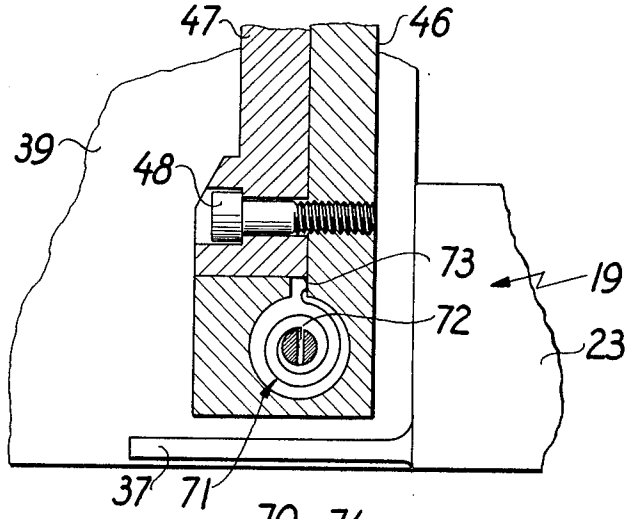
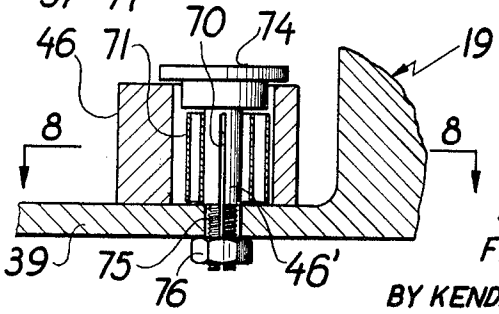


FIG. 7.



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United States Patent Office 3,232,101 Patented Feb. 1, 1966

3,232,101

JIG INCLUDING TORQUE MEASURING MEANS

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3 Claims. (Cl. 73—134)

This invention relates to the art of assembling and disassembling mechanical structures in their production or maintenance, and more particularly to a simple, yet unusually effective device for holding a work piece body while separate component parts of a unitary whole are mounted thereon or are removed therefrom.

Although this invention may have a great many applications other than those specifically described herein and therefore should not be limited thereto for this reason, the present invention has been found to be especially useful in the assembly of a type of fuel injector unit for a diesel engine having an injector nut threaded to an injector body. When the nut is tightened, it holds all the internal parts of the injector in their respective operating positions. Such an injector is manufactured and sold by the General Motors Corporation. Notwithstanding this utility of the present invention, it may also be found to be useful in jigging a diesel engine fuel injector unit of a different type employing a threaded injector cup from which the fuel is sprayed through pin holes therein. In this latter type of injector, the cup is also threaded to the injector body. The Cummins Engine Company manufactures and sells this type of injector.

In the assembly of an injector incorporating either an injector nut or an injector cup, for the satisfactory operation of each, it is necessary to apply a torque to the nut or cup within a predetermined range.

Complicated torque measuring devices employing helical compression springs have been employed in the prior art.

In the assembly or disassembly of either type of such injectors it has also been necessary to employ a particular kind of injector jig to allow for easy access to either end of an injector.

In the past, jigs have been provided for injector units. However, the same have required a considerable number of complicated component parts. In addition, such jigs have been provided with torque indicators having only one range. For this reason, the same have not been versatile. That is, it has not in the past been possible to use the same jig to assemble or disassemble two different kinds of injector units.

In the prior art, a rotatable plate was provided which was rotatable about an axis through its center rather than at the edge of the plate. This therefore made it necessary, when an injector unit was fixed relative to the plate by a pair of vise jaws carried thereby, to provide locking means for the plate in each of its two horizontal positions. That is, the plate was held in one position 180° from its other position to provide for easy access to each end of an injector unit.

The above described and other disadvantages of the prior art are overcome by providing a jig having relatively few uncomplicated component parts. Further, the jig of the present invention is provided with an adjustable meter cam to facilitate the use of the jig thereof in the assembly or disassembly of more than one type of injector unit.

In accordance with one feature of the present invention, a jig is provided including a base, a plate having means thereon to hold a work piece, means mounting the plate on the base in a position rotatable about a horizontal axis at one edge thereof and in a position such that the plate may be supported on said base in either one of two horizontal positions extending in corresponding opposite directions from the base. In this case, the plate is simply flipped from one side to the other to provide for easy access to either end of an injector unit which may be held on the plate by a pair of vise jaws. Thus, the prior art latching mechanism is obviated in that the weight of the plate and injector keep the plate in either one of two horizontal positions extending from the base in positions 180° apart from each other. For this reason, stop means may be provided to limit the rotation of the plate employed in the jig of the present invention.

In accordance with another feature of the present invention, a jig is provided including a base and carriage at the upper end thereof having spaced shoulders thereon, a yoke including a yoke plate having a pair of spaced shoulders at one edge thereof to fit between the carriage shoulders, a cam shaft rotatably mounted through all of the shoulders, a cam having a curved surface, the cam being fixed to the cam shaft in a position between the yoke shoulders, a crank assembly fixed to the cam shaft to rotate the same, and jaw means on the yoke plate movable to engage a work piece by rotation of the cam on said cam shaft. From the foregoing, it will be appreciated that an extremely simple yet effective jig is provided wherein the rotatable character of the yoke plate is achieved about a cam shaft on which a vise jaw cam is positioned.

According to another feature of the present invention, a torque measuring device is provided including base means, carriage means rotatable about an approximately vertical axis on the base means, means to resist yieldingly rotation of the carriage means, a mechanical deflection indicator having a case and a member movable into and out of said case to operate the indicator, the case being fixed to one of said base and carriage means, and a meter cam fixed to the other of the base and carriage means, the meter cam having an inclined surface to engage the member and to move the member relative to the case approximately in proportion to the amount of rotation of the carriage means on said base means.

In this case, a conventional mechanical deflection indicator may easily be employed economically.

According to still another feature of the present invention, a torque measuring device is provided including a base, a carriage rotatable about an approximately vertical axis on the base, meter means to indicate the amount of rotation of the carriage on the base, and a torsion rod having one of its ends fixed to the base and the other end thereof fixed to the carriage. In this case, torsion rod is employed in lieu of the complicated prior art compression spring system.

In accordance with a feature of the present invention, the torsion rod is positioned adjacent one end of a base supporting web and the mechanical deflection indicator positioned at the other end of the web to increase the amount of deflection for a given torque.

The above-described and other advantages of the present invention will be better understood from the following description when considered in connection with the accompanying drawings.

In the drawings which are to be regarded as merely illustrative:

FIG. 1 is a top plan view of the jig of the present invention;

FIG. 2 is a longitudinal sectional view of the jig taken on the line 2—2 shown in FIG. 1;

FIG. 3 is a view partly in section of a portion of a meter cam taken on the line 3—3 shown in FIG. 2;

FIG. 4 is a tranverse sectional view taken on the line 4—4 shown in FIG. 2;

FIG. 5 is a view partly in section of a stop taken on the line 5—5 shown in FIG. 2;

FIG. 6 is a perspective view of a yoke which is employed in the jig of the present invention;

FIG. 7 is a broken away sectional view of a vise jaw biasing spring taken on the line 7—7 shown in FIG. 1; and

FIG. 8 is a horizontal sectional view of the vise jaw biasing spring taken on the line 8—8 shown in FIG. 7.

In the drawings in FIG. 1, the jig of the present invention is indicated generally at **10** including a base **11**. Base **11** includes a base plate **12** which has four bolt holes **13** therethrough by means of which jig **10** may be mounted to a flat surface. Base **11** also includes four triangularly shaped webs **14** which brace a body web portion **15** upon which a carriage **16** is mounted.

Carriage **16** is rotatable to a certain extent upon an upper substantially flat surface **17** of web **15**. Carriage **16** is rotatable about a vertical axis of a torsion rod **18** shown in FIG. 2. Carriage **16** carries a yoke **19** as shown in FIG. 1 which is rotatable about the axis of a cam shaft **20** shown in FIG. 2.

Carriage **16** is provided with a pair of shoulders **21** and **22** adjacent which shoulders **23** and **24**, respectively, of yoke **19** are positioned. Shoulders **23** and **24** of yoke **19** are themselves spaced apart. A cam **25** is positioned therebetween.

Cam shaft **20** extends through all of the shoulders **21**, **22**, **23** and **24** and also through cam **25**. A pin **26** is press fit into a position extending transversely through cam **25** and cam shaft **20** that holds cam **25** in a fixed position relative to shaft **20**. A conventional mechanical movement indicator **27** is supported in a bore **28** in carriage **16**, indicator **27** having a case **29** with a shank portion **30** press fit into bore **28**. A pin **31** extends outwardly of meter body shank **30** and is movable thereinto depending upon the position of a pinpoint **32** on the upper surface of a meter cam **33** which is located in a recess **34** in web **15**.

As shown in FIG. 1, shoulders **21** and **22** of carriage **16** are provided with oil holes at **35** and **36** respectively for cam shaft **20**.

As shown in FIG. 6, yoke **19** is provided with webs **37** and **38** respectively, fixed to shoulders **23** and **24** and to a yoke plate **39**. Yoke plate **39** is provided with an opening **40** to receive an injector unit. A hole **40'** is provided through yoke plate **39** to hold an injector unit in a certain angular orientation relative to yoke plate **39**. For this reason, locating hole **40'** is selected to fit a particular type of injector unit appendage. Yoke plate **39** also is provided with bolt holes **41** through which bolts **42** project that hold a fixed jaw **43** in the position on yoke plate **39** shown in FIG. 1. As shown in FIG. 4, nuts **44** are threaded to the lower ends of bolts **42**.

A second vise jaw **45** is rotatably mounted on yoke plate **39** about a vertical axis of a bifurcated pin **46'**. Jaw **45** is provided with a body portion **46** and a face plate **47** which are held together by means of an Allen head screw **48** as shown in FIG. 8. Cam shaft **20** is rotated about its axis by means of a crank assembly **49** which is fixed to cam shaft **20** by means of an Allen head set screw **50** that seats on a flat keyway surface **51** on cam shaft **20** as shown in both FIGS. 1 and 2.

As shown in FIG. 2, torsion rod **18** is provided with upper and lower flat keyway surfaces at **52** and **53** against which Allen head screws **54** and **55** fit, screws **54** and **55** being threaded respectively through carriage **16** and through web **15** into bores **56** and **57**, respectively, of carriage **16** and web **15**. Torsion rod **18** is in fact located in web bore **57** and extends upwardly into carriage bore **56**.

In the operation of the jig **10**, an injector unit is positioned between vise jaws **43** and **45**. Crank assembly **49** is then rotated to the left as viewed from the crank assembly end of the jig **10** shown in FIG. 1 to bring jaw **45** in engagement with an injector unit. An injector unit, when so held between jaw **43** and **45** is so indicated in dotted lines at **58** in FIG. 4. The upper end of the injector as viewed in FIG. 4 may then be worked upon in the position shown in FIG. 4. The entire yoke **19** may then be rotated 180° with cam shaft **20** because with the injector in place items **58**, **19**, **20**, **25** and **49** are locked together but can rotate in piece **16**, so that the lower end of injector unit **58** as shown in FIG. 4 will be uppermost. In this case, said lower end of injector unit **58** may be worked upon.

In either position, the injector nut, which actually includes the entire lower assembly indicated at **59** of injector unit **58**, may be tightened. Carriage **16** in this case will rotate about the axis of torsion rod **18**. Rotational movement of carriage **16** about the axis of torsion rod **18** is limited to the width of a stop pin slot **60** in carriage **16**, as shown in FIG. 5. A stop pin **61**, in this case, is press fit into a bore **62** in web **15**. Stop pin **61** then projects upwardly into slot **60** in carriage **16**. As shown in FIG. 3, meter cam **33** is provided with an inclined surface **63** and a surface **64**, which is also inclined, but the inclination of which is not visible to the eye in the drawings, because of the relatively small angle of its inclination.

Surfaces **63** and **64** are the only surfaces upon cam **33** which pinpoint **33** contacts during the operation of the jig **10**. The position of cam **33** in recess **34** is adjustable with a set screws **65** and **66** which also wedge cam **33** against the bottom surface **67** of recess **34** by engagement of screws **65** and **66** respectively with tapered surfaces **68** and **69** on meter cam **33**.

As is evident from FIGS. 2 and 4, torsion rod **18** is symmetrical about its vertical axis with the exception of the keyway surfaces **52** and **53**.

As shown in FIG. 7, pin **46'** is provided with a slot **70** into which the end of a spiral spring **71** is positoned at **72** as shown in FIG. 8. The other end of the spring **72** is hooked into vise jaw body **46** at **73**. Pin **46'** is provided with a head **74** which has been removed in FIG. 1 to illustrate the function of spiral spring **71**.

The lower end of pin **46'** is threaded at **75**. A nut **76** is threaded to pin end **75** to hold pin **46'** in a substantially fixed position relative to yoke plate **39**.

From the foregoing, it will be appreciated that, if desired, jaws **43** and **45** may be made in a shape such that the same may be interchangeable.

In accordance with an outstanding feature of the present invention, stop means are provided on the lower ends of shoulders **23** and **24** to engage the flat surface of carriage **16** at S as shown in FIG. 4 to hold yoke plate **39** in the position shown in FIG. 4 or in a position rotated about cam shaft **20** 180° to the right as viewed in FIG. 4, whereby easy access to either end of injector unit **58** may be provided. In accordance with another outstanding feature of the present invention, cam **25** is provided on the self same cam shaft **20** about which yoke plate **39** is rotatable. Still another outstanding feature of the present invention resides in the use of meter **27** which may be conventional and which therefore may be economical to acquire and put to use in the jig **10** of the present invention.

Still another feature of the present invention resides in the use of the torsion rod **18** in lieu of the complicated helically coiled compression springs of the prior art. Still further, the use of torsion rod **18** at one end of web **15** and the use of meter **27** at the other end thereof provides for a large deflection of meter **27** in response to a relatively small torque applied to injector nut **59**. In accordance with another feature of the present invention, meter cam **33** is easily adjustable to provide two range readings for meter **27** due to the two different slopes of cam surfaces **63** and **64** shown in FIG. 3. Different tubes of injector units therefore may be assembled and disassembled on the self same jig **10**.

Although only one specific embodiment of the present invention has been described and illustrated herein, many changes and modifications will of course suggest them-

selves to those skilled in the art. This single embodiment has been selected for this disclosure for the purpose of illustration only. The present invention should therefore not be limited to the embodiment so selected, the true scope of the invention being defined only in the appended claims.

What is claimed is:

1. A torque measuring device comprising: base means; carriage means rotatable about an approximately vertical axis on said base means; means to resist yieldingly rotation of said carriage means; a mechanical deflection indicator having a case and a member movable into and out of said case to operate the indicator, said case being fixed to one of said base and carriage means; a meter cam fixed to the other of said base and carriage means, said meter cam having an inclined surface to engage said member and to move said member relative to said case approximately in proportion to the amount of rotation of said carriage means on said base means; mounting means to retain said meter cam in a position slidable in a direction transverse to the axis of said movable member; and adjustable means to hold said meter cam in a fixed position in said mounting means, said meter cam having two surfaces of two different slopes, either one of said surfaces contacting said movable member depending upon the position of said meter cam as it is moved by said adjustable means.

2. A torque measuring device comprising: base means; carriage means rotatable about an approximately vertical axis on said base means; means to resist yieldingly rotation of said carriage means; a mechanical deflection indicator having a case and a member movable into and out of said case to operate the indicator, said case being fixed to one of said base and carriage means; a meter cam fixed to the other of said base and carriage means, said meter cam having an inclined surface to engage said member and to move said member relative to said case approximately in proportion to the amount of rotation of said carriage means on said base means; mounting means to retain said meter cam in a position slidable in a direction transverse to the axis of said movable member; and adjustable means to hold said meter cam in a fixed position in said mounting means, said meter cam having two surfaces of two different slopes, either one of said surfaces contacting said movable member depending upon the position of said meter cam as it is moved by said adjustable means, said mounting means including a recess with a flat surface at the bottom thereof in one of said base and carriage means, the ends of said meter cam being tapered toward each other away from flat surface, said mounting means including a set screw at each end of said meter cam to engage corresponding ones of said tapered meter cam ends to hold said meter cam in a fixed position wedge against said flat surface.

3. A jig comprising: a base and a carriage at the upper end thereof having spaced shoulders thereon; a yoke including a yoke plate having a pair of spaced shoulders at one edge thereof to fit between said carriage shoulders; a cam shaft rotatably mounted through all of said shoulders; a cam having a curved surface, said cam being fixed to said cam shaft in a position between said yoke shoulders; a crank assembly fixed to said cam shaft to rotate the same; jaw means on said yoke plate movable to engage a work piece by rotation of said cam on said cam shaft; a torsion rod having one of its ends fixed to said base means and the other end thereof fixed to said carriage means, said carriage means being rotatable on said base means about an approximately vertical axis the same as that of said torsion rod; and meter means to indicate the amount of rotation of said carriage means on said base means.

References Cited by the Examiner

UNITED STATES PATENTS

599,522	2/1898	Barus	73—135
2,127,708	2/1915	Wilbur	269—76 X
1,409,266	3/1922	Werth	269—73 X
2,700,298	1/1955	Anderson	73—9
2,788,687	4/1957	Ridge	269—229 X
2,833,145	5/1958	McCullough	73—144
2,969,231	1/1961	Mills	269—69
3,026,724	3/1962	Gstalder	73—136

FOREIGN PATENTS

858,045	5/1940	France.
1,207,946	9/1959	France.
838,542	6/1960	Great Britain.

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