Aug. 20, 1968 W. G. KUBAN 3,397,880

VISE CLAMP

Filed May 10, 1966

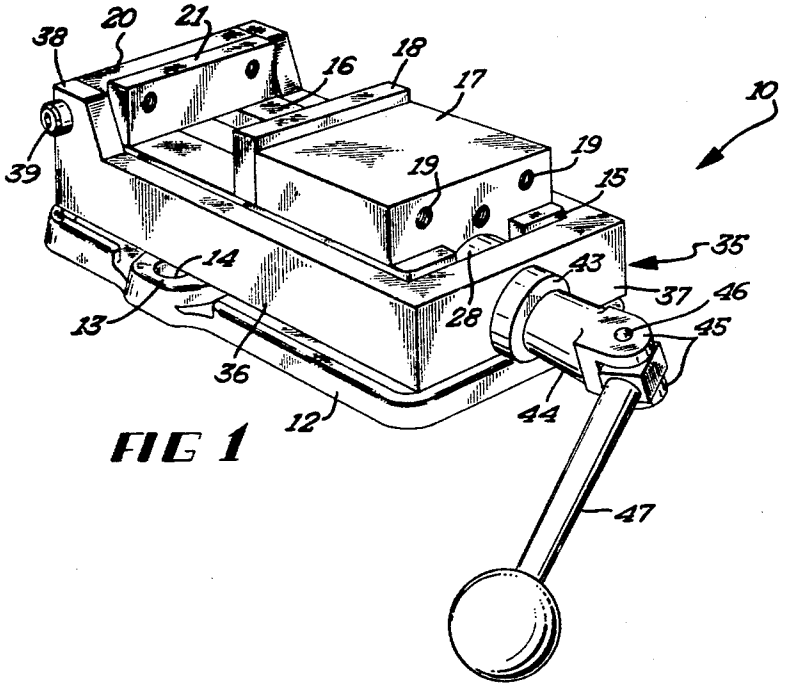

FIG 1

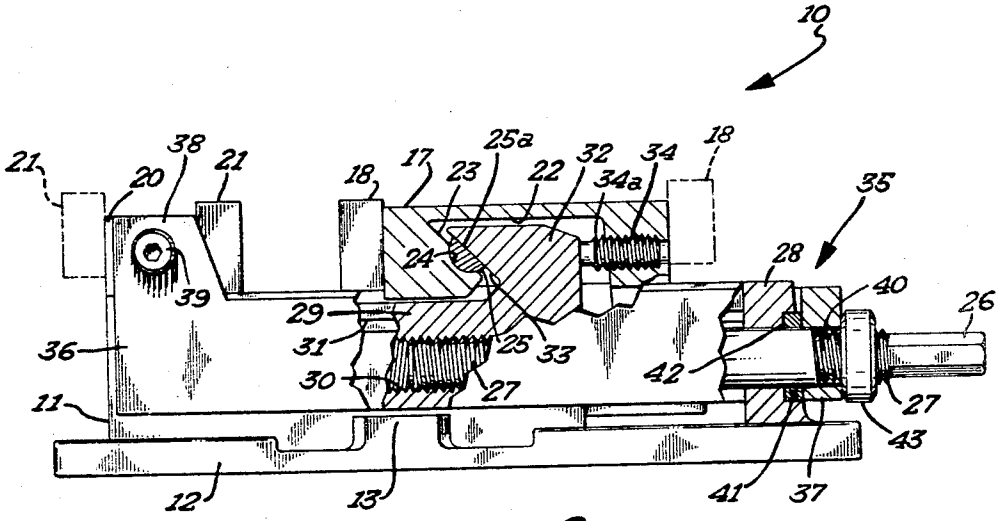

FIG 2

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VISE CLAMP

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ABSTRACT OF THE DISCLOSURE

A precision machine vise comprising a body having a fixed jaw rigidly mounted thereon and having a movable jaw slidably mounted thereon for sliding movement toward and away from said fixed jaw. An elongate actuating screw revolvably mounted on said body and an actuating nut threadedly engaging said screw and being movable relative to said body. Said actuating nut having an inclined surface interlocking a complementary inclined surface on said movable jaw. An elongate stress receiving frame structure disposed exteriorly of said body and being connected at one end to said fixed jaw and being connected at its other end to said body. Said stress receiving frame structure being operable to receive reaction forces produced in the fixed jaw and to thereby stabilize the fixed jaw against these reaction forces.

An object of this invention is to provide a novel precision machine vise, of simple and inexpensive but very durable construction, wherein the jaws of the vise, when in gripping relation with respect to a workpiece are not only completely immobilized, but the reaction forces which are produced in the jaws in response to the compression forces are transmitted to an exterior clamping structure which is capable of some deformation or yielding movement without affecting the clamping jaws of the vise. More specifically, the clamping structure to which the reaction forces are transmitted is carried by the base of the vise but is located exteriorly thereof and does not therefore require the vise to be altered substantially when the clamping structure is applied thereto. By having these reaction forces transmitted to a stress receiving clamping structure capable of some yielding movement, these forces therefore will not cause movement of the jaws of the vise and the workpiece may be maintained in its preset position. It is essential in precision work that the workpiece be immobilized against movement from a preset position.

These and other objects and advantages of this invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a perspective view of the novel vise; and

FIG. 2 is a side elevational view with certain parts thereof broken away for clarity.

Referring now to the drawings, it will be seen that one embodiment of my novel vise, designated generally by the reference numeral **10**, is there known. The vise **10** includes a body **11**, comprised of a base **12**, preferably formed of high ductile cast iron and provided with a pair of outwardly projecting embossed elements **13**, each having an aperture **14** therethrough through which suitable nut and bolt assembly project to permit mounting of the vise upon a suitable machine. The body **11**, as pointed out above, is preferably formed of a high quality ductile iron in a casting operation and includes a pair of upstanding laterally spaced apart slide structures **15** which project upwardly from the base **12**. The upper surfaces of the slide structures are machined and hardened by flame

treatment to define smooth guideways **16** upon which is slidably mounted the movable jaw **17**. It will be seen that the movable jaw **17** is of generally reactangular configuration and is provided with a generally rectangular jaw plate **18**, which is detachably secured thereto by suitable bolts. It is pointed out that opposite end faces of the movable jaw **17** has a pair of thread recesses **19** therein to permit the jaw plate **18** to be selectively attached to one end or the other, as best seen in FIG. 2.

A fixed or stationary jaw **20** of generally rectangular configuration is rigidly affixed to the slide structures **15** of the body **11** adjacent one end thereof, and it will be noted that the stationary jaw **20** is disposed in confronting opposed relation with respect to the movable jaw **17**. This stationary jaw is preferably secured to the body **11** by means of bolts which project upwardly through threaded recesses in the slide structures **15** and engage threaded recesses in the stationary jaw **20**. With this arrangement, the stationary jaw may be removed and replaced when desired. The stationary jaw **20** is also provided with threaded recesses to permit a jaw plate **21** to be secured thereto by suitable securing means such as bolts. The jaw plate **21**, which is also of rectangular shaped configuration, is identical in construction to the jaw plate **18**, and it will be seen that this jaw plate may also be selectively attached to either end of the stationary jaw **20**.

Referring again to FIG. 2, it will be seen that the movable jaw **17** has a downwardly facing recess **22** therein, and this recess defines a generally upwardly inclined surface **23**. The inclined surface **23** also has a smaller generally hemispherical upwardly opening recess **24** therein, in which is positioned a generally hemispherical segment or element **25**. It is pointed out that the segment **25** is capable of movement within the recess **24** for a purpose to be defined more fully hereinbelow.

An elongate shaft **26** which has one end thereof threaded as at **27**, extends through a cast bearing **28** integrally formed with and between the slide structures **15** adjacent one end thereof. The threaded end portion **27** of the shaft **26** threadingly engages the threaded bore **30** of an actuating nut **29** which is positioned between the respective slide structures **15** and is movable longitudinally of the base **12**. To this end, it is pointed out that the actuating nut **29** has a pair of shoulders thereon extending longitudinally along the upper surface thereof. Each of the shoulders on the actuating nut engages a longitudinally extending downwardly facing shoulder **31** located on one of the slide structures **15**. It will therefore be seen that the actuating nut **29** is supported on the actuating shaft **26**, and is held against the downwardly facing shoulders **31** of the guide structures **15**.

It will also be noted, that the actuating nut **29** has an upwardly projecting portion **32** which projects into the recess **22** of the movable jaw **17**. The upwardly projecting portion **32** has an inclined face **33** which is disposed in confronting relation with respect to the incline surface **23** defined by the recess **22**. It will also be noted that the incline face or surface **33** is disposed in engaging relation with the flat surface **25***a* of the hemispherical segment **25**. It will further be seen that the inclined face or surface **33** is urged into engagement with the flat surface **25***a* of the hemispherical segment **25** by a threaded adjusting screw **34***a* that is disposed in threaded engagement with a threaded recess **34** formed in one end of the movable jaw **17**. The threaded adjusting screw **35** actually engages the upwardly projecting portion **32** of the actuating nut **29** to urge and retain the same in engaging relation with respect to the flat surface of the hemispherical segment **25**. Thus, the actuating nut **29** is not only held against the shoulders **31** of the slide structures **15**, but the actuating

nut also cams or urges the movable jaw **17** downwardly against the guideways **16**. Thus, as the work is engaged between the jaw plates of the movable and fixed jaws, the actuating nut imparts a downward component of force on the movable jaw to prevent any tendency of the same to tilt upwardly. In the embodiment shown, this downward component of force is approximately one-half the magnitude of the horizontal component of force exerted on the gripped workpiece by the movable jaw **17**. This vector force relation may be varied by changing the angle of inclination between the actuating nut and movable jaw.

Means are also provided for receiving reaction forces produced in the jaws of the vise and thereby present deformation or yielding of the jaws and body of the vise. It has been found that by having these reaction forces produced in the jaws and body of the vise transmitted to stress receiving means, which itself is capable of limited yielding movement, the work which is clamped between the vise jaws may be maintained in a preset position and thereby permit a precision operation to be carried out upon the work.

This stress receiving means comprises a generally U-shaped frame structure **35** which, as shown, is disposed exteriorly of the body **11**. The frame structure **35** includes a pair of elongate longitudinal frame members **36**, which are rigidly interconnected at one end by transverse frame member **37**, each of the longitudinal frame members **36** is being positioned exteriorly of the slide structures **15**. It will also be noted, that the transverse frame member **37** is positioned exteriorly of the ends of the slide structures **15** and outwardly of the cast bearing **28**.

Opposite ends of the longitudinal frame members **36** have upwardly extending portions **38** integrally formed therewith, which are apertured and through which project suitable attachment bolts **39** that engage threaded recesses in the fixed jaw **20**. These bolts **39** permit pivotal or rotary movement of the frame structure **35** relative to the fixed jaw. The transverse frame member **37**, on the other hand, has an opening **40** therein through which projects the actuating shaft **26**, so that the stress receiving frame structure **35** is actually securely connected to the fixed jaw of the vise and is secured at its opposite end substantially against movement by the shaft. It is pointed out though, that the longitudinal frame members in the embodiments shown are slightly spaced from the slide structures **15** and that the transverse frame member **37** is spaced outwardly of the ends of the slide structures **15** and the cast bearing **28**.

Referring again to FIG. 2, it will be seen that the shaft **26** has an annular member **41** thereon which is disposed within an annular recess **42** formed in the outer surface of the cast bearing **28**. Therefore, since the annular shoulder is interposed between the cast bearing **28** and the transverse member **37** longitudinal movement of the shaft is prevented. The actuating shaft **26** also has an adjusting collar **43** detachably secured thereto exteriorly of the transverse member **37**. Thus, it will be seen that the frame structure **35** is secured to the fixed jaw of the vise and is also secured or anchored to the actuating shaft **26** of the vise while permitting revolving movement of the shaft.

Means are provided for facilitating rotation of the actuating shaft, and to this end, it will be seen that a suitable handle structure may be provided comprised of a sleeve **44** which may be disposed in telescoping relation around the outer end of the shaft **26** and which has a pair of ears **45** projecting longitudinally therefrom. It will be seen, that the ears **45** are suitably apertured and one end of a handle **47** is positioned between the ears and is pivotally connected thereto by pivot **46** to permit relative pivot of movement between the sleeve **44** and the handle **47**. Thus, it will be seen that the actuating shaft **26** may be readily revolved by means of the handle structure in the event that a manual operation is desired. It is further pointed out that a suitable hydraulic electric power actuating means may also be provided for revolving the actuating shaft **26** and for moving the actuating nut **29**.

During operation of my novel vise **10**, a workpiece may be clamped between the jaw plates of the respective jaws. It will be seen that as the movable jaw **17** is moved into gripping relation with respect to the workpiece, any tendency of the movable jaw to tilt upwardly will be completely overcome by the coaction of the actuating nut **29** with the movable jaw **17**. To this end, it will be noted that the upwardly projecting portion **32** will engage the flat surface *25a* of the spherical segment so that as the movable jaw clamps the workpiece against the fixed jaw with a predetermined component of force, a downward component of force will be exerted by the actuating nut on the movable jaw so that the latter is constantly urged downwardly. By utilizing a spherical segment having a flat surface, a highly effective mating abutting relationship between the inclined face **33** of the upwardly projecting portion **32** and the movable jaw may be effected. Since the spherical element may swivel or revolve to permit mating of the flat surfaces, a highly effective alignment of the surfaces is assured.

The capabilities of the vise to grip workpieces of varying size becomes apparent because of the ability of attaching the jaw plates of the respective jaws selectively at opposite ends of the jaws. This is illustrated by dotted line configuration in FIG. 2. To this end, it is pointed out that the jaw plate of each jaw may be mounted in one of two positions thus permitting a relatively wide range of adjustment in addition to the relative movement between the respective jaws.

As the workpiece is gripped between the respective jaws, the reaction forces which develop in response to the compression forces will be produced in the fixed jaw, and will tend to cause the latter to distort or yield slightly in a horizontal direction as the compression forces increase. However, the reaction force produced in response to the compression forces in the fixed jaw will be readily transmitted to the stress receiving frame structures **35**. The longitudinal frame members of this exterior frame structure will tend to bend since the ends of the frame structure are anchored against movement, but since these longitudinal frame members are positioned exteriorly of the vise and are, in fact, disposed in slightly spaced relation from the body **11** of the vise, the longitudinal members may undergo slight deformation or bowing. This deformation, in no way, produces any corresponding horizontal movement in the stationary jaw **20**. Thus, the jaw **20**, even though it is substantially smaller dimensionally than the larger movable jaw, will remain immobile even when subjected to extremely high compression forces. Therefore, the vise **10** is arranged and constructed for highly accurate precision work since the movable jaw is immobilized against tilting and the fixed jaw is immobilized against yielding or deformation in a horizontal direction by the reaction forces produced therein when gripping a workpiece.

It will be seen from the preceding paragraphs that by utilizing an exteriorly located stres receiving frame structure, which in effect serves as a clamp, it is unnecessary to construct the vise of massive dimensions even though the device is intended for use in a precision operation.

It will further be noted that the use of an exteriorly located stress receiving frame structure or clamping means, does not require that the vise itself be specifically constructed or tailored to accommodate this stress receiving structure.

Thus, it will be seen that I have provided a novel and improved vise, which is not only of simple, inexpensive and rugged construction, but one which functions in a more efficient manner for high precision work than any heretofore known comparable device.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What I claim is:

1. A vise comprising a body, a fixed jaw on said body, a movable jaw mounted on said body for sliding movement towards and away from said fixed jaw, means for shifting said movable jaw comprising a shiftable nut engaging said body for shifting movement relative thereto, interlocking inclined surfaces on said movable jaw and nut so that the latter imparts a downward component of force on said movable jaw as the movable jaw is urged into gripping relation with a workpiece gripped between said jaws, an actuating screw engaging said nut for shifting the same, an elongate stress receiving frame structure disposed exteriorly of said body, means connecting one end portion of said frame structure to said fixed jaw, the other end of said frame structure being connected with said body remote from said fixed jaw, whereby reaction forces produced in said fixed jaw will be transmitted to said stress receiving frame structure.

2. The vise as defined in claim 1 wherein said frame structure is of generally U-shaped configuration, including a pair of longitudinal frame members and a transverse frame member extending between and interconnected to said longitudinal frame members.

3. The vise as defined in claim 2 wherein said transverse frame member of said frame structure comprises one of said anchoring elements.

4. The vise as defined in claim 2 wherein said longitudinal frame members are spaced slightly from said body structure.

5. The vise as defined in claim 1 wherein each jaw has a pair of mounting faces, each face being located at one end of the associated jaw, a pair of jaw plates, means for selectively mounting each jaw plate on one of said mounting faces of each jaw.

References Cited

UNITED STATES PATENTS

2,880,638	4/1959	Muggli	269—241 X
3,232,602	2/1966	Bernhard	269—250 X

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