April 9, 1968 G. L. GARVIN 3,376,769

CLAMP MEANS

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FIG. 1

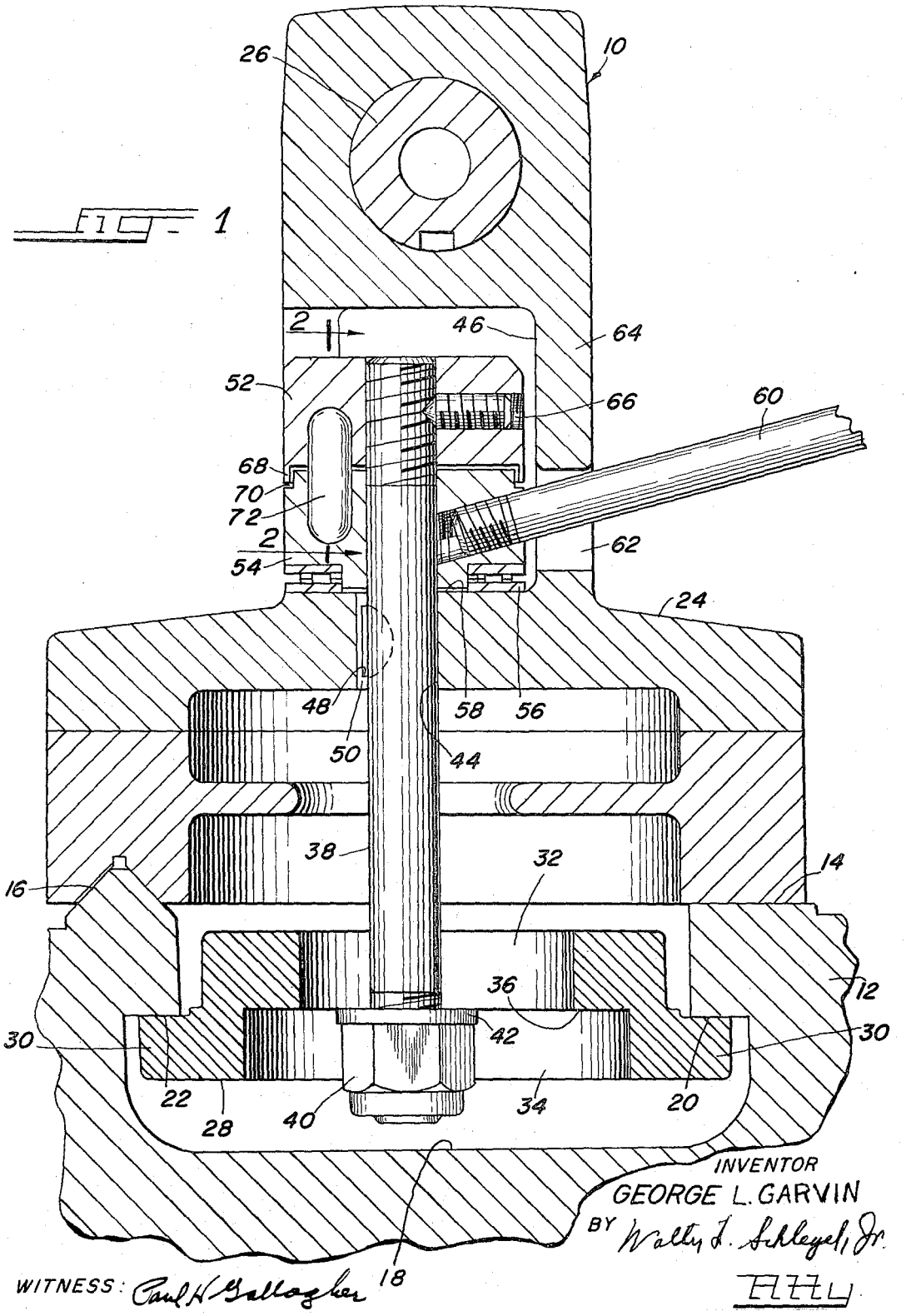

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Fig. 2

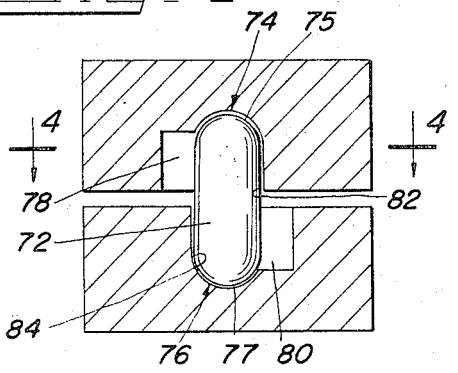


Fig. 3

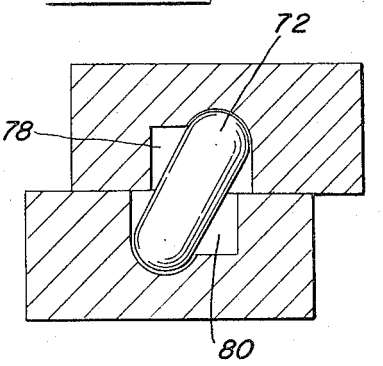


Fig. 4

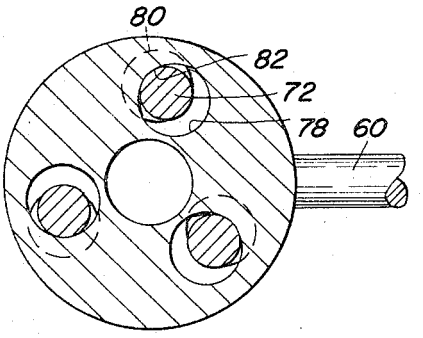
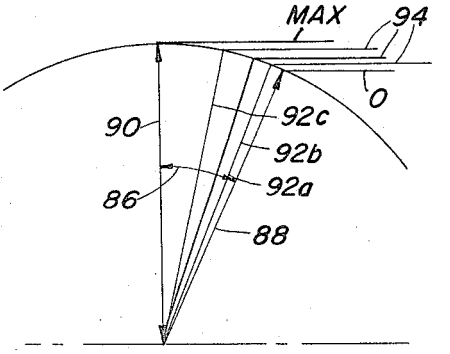


Fig. 5



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CLAMP MEANS

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4 Claims. (Cl. 82—31)

ABSTRACT OF THE DISCLOSURE

Certain machine tools require quick acting clamping and unclamping means and certain movable portions thereof such as a tailstock. Present clamping means not only includes means for adjusting the clamping pressure but has the advantage of being more easily manipulatable when the locking pressure is the greatest. The clamping means utilizes a plurality of lock pins interposed by the relatively rotatable members, the pins being movable from an unlocked portion wherein the pins are at an oblique angle with the center line of the locking shaft to a locked position wherein the pins are parallel with the center line of the locking shaft.

The present invention relates to clamp means.

The invention is especially adaptable to tailstock clamp means for a lathe, but is not limited thereto.

A broad object of the invention is to provide novel clamp means which is extremely quick-acting and convenient in operation.

Another object is to provide clamp means of the foregoing general character having high mechanical advantage, and a novel arrangement whereby the mechanical advantage becomes increasingly greater as the locking pressure increases, and therefore more easily manipulatable when the locking pressure is greatest, and conversely, in unlocking operation the mechanical advantage is greatest in the initial portion of the unlocking step when the unlocking pressure is greatest, and increasingly lessens as the locking pressure decreases.

Still another object is to provide clamp means of the foregoing general character having a novel arrangement enabling and facilitating adjusting the clamping pressure, and in which when it has been so adjusted, it remains in such adjusted position throughout repeated operations.

Still another object is to provide clamp means of the foregoing general character having a manually operated clamping lever therein, and in which operation of the clamp means entails an extremely small throw of the clamping lever, and additionally in which the clamp means may be easily arranged so that the clamping lever is in out-of-the-way position for convenience to the operator in operating a machine in which the clamp means is incorporated, such as a lathe, and additionally in which the clamping lever is in semi-fixed position in the clamping means whereby to eliminate accidental losing of the lever, as contrasted with other arrangements in which a separate and detached wrench is utilized for the clamping operation.

Other objects and advantages of the invention will appear from the following detail description taken in conjunction with the accompanying drawings in which—

FIGURE 1 is a vertical transverse sectional view of the clamp means of the invention, and showing a portion of a lathe to which the clamp means is applied;

FIGURE 2 is a sectional view taken at line 2—2 of FIGURE 1 and showing the clamp means in clamped position;

FIGURE 3 is a view similar to FIGURE 2 except that the clamp means is in released position;

FIGURE 4 is a sectional view taken at line 4—4 of FIGURE 2; and

FIGURE 5 is a schematic indication of the mechanical advantage involved in the operation of clamping the clamp means.

Referring now in detail to the drawings, FIGURE 1 shows the tailstock of a lathe incorporating the clamping means of the invention, and a fragment of the lathe bed. The tailstock is indicated in its entirety at **10** and rests on a lathe bed **12**, the latter having upper supporting surfaces **14** and **16** on opposite sides of a recess **18** running longitudinally of the lathe. The lathe bed has downwardly facing surfaces **20** and **22** utilized in the clamping operation as referred to again hereinbelow. The tailstock **10** includes a body portion **24** resting on the upper surface **14** and **16** of the lathe bed and supports the member **26** which supports the tail end of the workpiece. The tailstock member **10**, upon release of the clamping means, is moved by the operator along the lathe bed in the direction of the recess **18** according to the length of the workpiece, and then clamped in such position and again released to remove the workpiece from the lathe.

The clamp means of the invention includes a lowermost clamp member **28** positioned or extending into recess **18** and provided with laterally extended elements **30** engageable with the surfaces **20** and **22** of the lathe bed. The clamp member **28** is provided with an elongated slot **32** therethrough having a counterbore **34** at the lower portion thereof forming a downwardly facing shoulder **36**. This aperture receives a clamp stud **38** threaded at its lower end and receiving a nut **40** which upon turning thereof produces a clamping action as described hereinbelow. The nut **40**, through a washer **42** engages the shoulder **36** and thereby performs a clamping operation in one direction, on the clamp member **28**.

The clamp stud **38** extends upwardly and is slidably received through an aperture **44** in the tailstock body into a recess **46** therein. A key **48** is fixed in the clamp stud **38** and fitted in a keyway **50** in the tailstock body securing the clamp stud against rotation in the tailstock body, but enabling vertical shifting movements thereof.

Disposed in recess **46** are a top clamp member **52** and a cooperating bottom clamp member **54**, both of which may be circular as viewed in plan (FIGURE 4) and provided with central apertures receiving the upper end of the clamp stud **38**. The aperture of bottom clamp member **54** is greater in diameter than the stud which is freely rotatable therein. A needle roller thrust bearing **56** is interposed between the bottom clamp member **54** and the surface **58** of the tailstock in the recess **46**, supporting the bottom clamp member **54**, for facilitating rotation of the bottom clamp member **54** in the clamping and unclamping operations referred to below. A clamp handle **60** is threaded into the bottom clamp member **54** and extends outwardly through an aperture **62** in the wall element **64** of the tailstock member for use by the operator of the machine in manipulating the clamp means.

The top clamp member **52** is fixed to the clamp stud **38** as by a set screw **66**. If desired the top clamp member **52** may be provided with a downwardly depending surrounding skirt **68**, received in an annular recess **70** in the bottom clamp member to prevent the entrance of foreign matter between the clamp members.

Interposed between the top and bottom clamp members **52**, **54** are a plurality of clamp pins **72**, preferably three in number. The interfacing surfaces of the bottom and top clamp members are provided with mating recesses **74** and **76** respectively receiving corresponding ends of the clamp pins. The recesses are provided with eccentric counterbores **78** and **80** respectively. These arrangements of recesses and counterbores thus provide wall elements **82** and **84** respectively forming stop elements extending

from the depth of the recesses through the surfaces of the clamp members. These wall elements or stop elements provide limit means for limiting relative throw of the clamp members in clamping operation. FIGURE 2 shows the clamp members in clamped position, and FIGURE 3 shows them in released position. In the released position of FIGURE 3, the clamp pins are disposed at an angle to the axis of the clamp stud **38**, and the clamp members are in interengagement. In performing the clamping operation, the operator swings the clamp handle **60** in clamping direction, which as viewed in FIGURE 4 is counterclockwise. This rotates or rocks the bottom clamp member from the position of FIGURE 3 into that of FIGURE 2 and in doing so works against the clamp pins which are moved from their inclined position to a position substantially parallel with the clamp stud **38**. In this action the clamp pins effectively increase in length in direction of the axis of the clamp stud and the top and bottom clamp members are separated and perform the desired clamping operation. The clamp pins in moving to upright position, i.e., position parallel with the axis of the clamp stud, engage the wall elements or stop elements **82** and **84** which are so relatively positioned as to provide locking means preventing overthrow of the clamp members. These wall elements are of substantial depth to perform the desired stopping or limiting action. The clamping pressure is so great that the ends of the clamp pins remain in the lower spherical extremities **75** and **77** of the recesses and are not permitted to be thrown therefrom into the counterbores in which they would fulcrum about the outer extremities of the wall elements **82** and **84**. Thus these wall elements provide a positive action in locking the pins in the desired upright position.

The counterbores **78** and **80** of the recesses are of such diameter, or lateral extent, as to accommodate the clamp pins when the latter are in their extreme inclined position, the throw of the bottom clamp member in this releasing action being limited by the engagement of the two clamp members together.

In the clamping action just described, which effects separation of the top and bottom clamp members **52**, **54**, the bottom clamp member works downwardly through the surface **58** on the body member **24**, while the upward movement of the top clamp member **52** works upwardly on the clamp stud **38**, which in turn acting through the nut **40** and washer **42** on the under surface **36** of the block of the lowermost clamp member **28**, effects the clamping action through the latter on the lathe bed through the surfaces **20** and **22** on the latter.

The dimensions and proportions of the various parts are such that a very small angular throw of the bottom clamp member **54** results in full clamping action. FIGURE 5 shows an angle **86** which is substantially that through which the clamp handle **60** is thrown in the clamping and unclamping operations. The arrow **88** represents the released position of the clamp handle while the arrow **90** represents the clamped position thereof. This angle in the present instance is less than 30 degrees, and in the neighborhood of 25½ degrees, which is substantially less than the clamping devices heretofore known, such as ordinary bolt and nut arrangements, which require throw of in the neighborhood of 60 degrees.

The diagram of FIGURE 5 shows a plurality of lines **92***a*, **92***b*, and **92***c*, representing progressive positions of the clamp handle between the released position indicated by the arrow **88** and the clamped position indicated by the arrow **90**. It will be noted that these lines are spaced apart increasingly greater distances from the arrow **88** to the arrow **90**. However the spacing between the clamp members, as indicated by the lines **94**, is substantially equal, and therefore the mechanical advantage increases between released position and clamped position, being most notable between the position represented for example by the line **92***c* and the arrow **90** where the angular throw of the bottom clamp member is greatest for a uniform increment of separation of the clamp members. This works to a great practical advantage to the operation of the machine because, as will be understood, great clamping pressure is required for clamping the tailstock in the desired position. The converse is true in the unclamping or releasing position—to release the greatest locking pressure which exists in clamping position, the throw of the clamp handle is greatest for a given increment of spacing between the top and bottom clamp members.

Adjustment of the nut **40** provides for variation in the final clamping pressure provided by the clamp means. When this pressure is established, the operator need not be concerned with the question whether the desired clamping pressure is achieved in all cases of clamping; he merely throws the clamp handle to full clamping position and knows it will not be overthrown, because of the limiting action as described in connection with FIGURES 2 and 3. The action of the clamp means is also such that it can be released and clamped a great number of times for any given adjustment of the nut **40**, without variation in that adjustment. The present arrangement is in great contrast to a simple bolt and nut arrangement in which the mechanical advantage depends entirely upon the length of the wrench or tool utilized for performing the clamping step. In that case when the clamping pressure becomes greatest the mechanical advantage remains the same. Moreover, the operator has no sure way of determining whether the clamping action is the same in repeated clamping steps. In the present instance when the clamping action in repeated clamping operations is invariable, the operator is assured of accurate work duplication.

While I have herein shown and described a preferred form of the invention it will be understood that changes may be made therein within the spirit of the appended claims.

I claim:

1. Clamping means comprising a pair of members to be clamped, a pair of clamp members operatively connected with respective ones of the members to be clamped said clamp members having mating recesses in opposed surfaces and being relatively rotatable about a common axis, a plurality of lock pins interposed between the clamp members with their ends received in said recesses, the lock pins moving angularly about transverse axes in response to relative rotation of the clamp members and movable between a position in which their longitudinal axes are askew to said axis of the clamp members and in which the clamp members are enabled to move axially toward each other in releasing direction, and a position in which they are substantially parallel with said axis of the clamp members and in which the clamp members are in maximum spaced position wherein they exert maximum clamping pressure on the members to be clamped, said recess having walls extending substantially parallel to said axis, said walls being engageable with clamping portions of the lock pins and serving as stop means limiting overthrow of the limiting lock pins beyond said parallel-axis position thereby relative movement of the clamp members in clamping direction.

2. The invention set out in claim **1** wherein the lock pins have spherical end portions, the recesses have spherical innermost portions receiving the ends of the lock pins, the wall elements extend perpendicular to the corresponding faces of the clamp members and are effective for limiting the movement of the clamp members in clamping direction to a position which the clamp pins are substantially parallel to the axis of rotation of the clamp members.

3. The invention set out in claim **2** wherein said recesses include counterbores eccentric to said spherical inner portions and extending transversely away from said wall elements.

4. Clamping means comprising a pair of members to be clamped, a pair of clamp members operatively connected with respective ones of the members to be clamped,

the clamp members being relatively rotatable about a common axis, a plurality of lock pins interposed between the clamp members with their ends engaging respective ones thereof, the lock pins moving angularly about transverse axes in response to relative rotation of the clamp members and movable between a position in which their longitudinal axes are askew to said axis of the clamp members and in which the clamp members are enabled to move axially toward each other in releasing direction, and a position in which they are substantially parallel with said axis of the clamp members and in which the clamp members are in maximum spaced position wherein they exert maximum clamping pressure on the members to be clamped, a base having upper and lower surfaces and an instrument having a body and mounted on said upper surface for sliding movement therealong, a first of the clamp members engages said lower surface, a clamp stud is secured to the first clamp member and extends upwardly through said body, means slidably but non-rotatably securing the clamp stud to said body, the second of the top clamp members is secured to the upper end of the clamp stud, a bottom clamping member surrounds the clamp stud below the top clamp member and is rockable about the clamp stud, bearing means is disposed between the lower surface of the first clamp member and an upper surface of said body, said first and second clamp members have a plurality of pairs of interfacing recesses distributed around the clamp stud, and clamp pins are disposed in said pairs of recesses and movable angularly

about transverse axes in response to relative rotation of the clamp members, being movable between a position in which their longitudinal axes are askew to said axis of the clamp members and in which the clamp members are enabled to move axially toward each other in releasing direction and a position in which they are substantially parallel with said axis of the clamp members and in which the clamp members are in maximum spaced position and in which they exert maximum clamping pressure, said members having depressions receiving the ends of the lock pins and side walls engaging the lock pins throughout the depths of the recesses and throughout a substantial portion of the length of the lock pins on respective sides limiting over-throw of the lock pins beyond said parallel-axis position, and said recesses having counterbore portions on the other sides of the depressions shallower than said depressions and receiving the lock pins when the clamp members are relatively moved toward releasing position.

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