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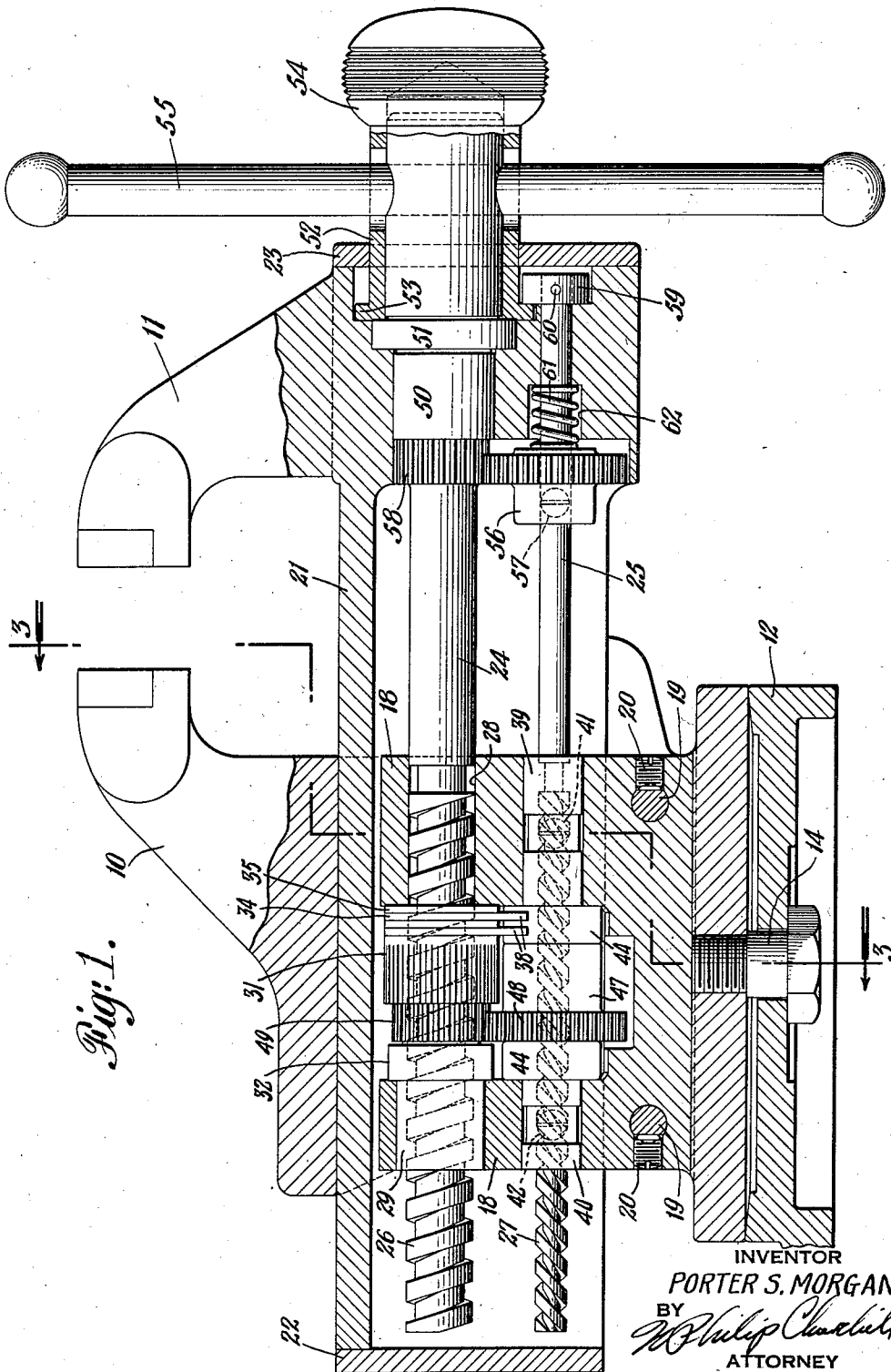
P. S. MORGAN

2,284,223

WORK-HOLDING APPARATUS

Filed Sept. 20, 1940

3 Sheets-Sheet 1



INVENTOR
PORTER S. MORGAN
BY
Philip Churchill
ATTORNEY

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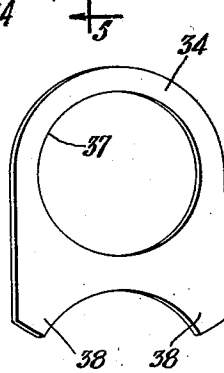
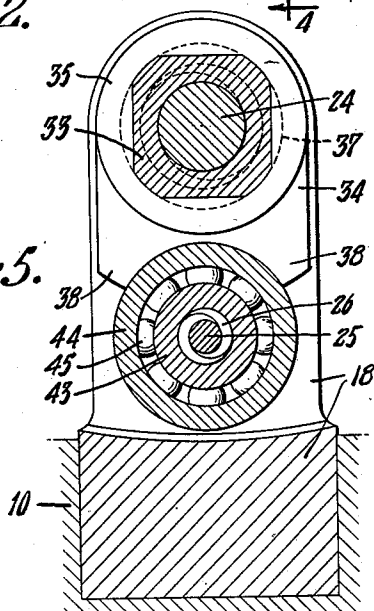
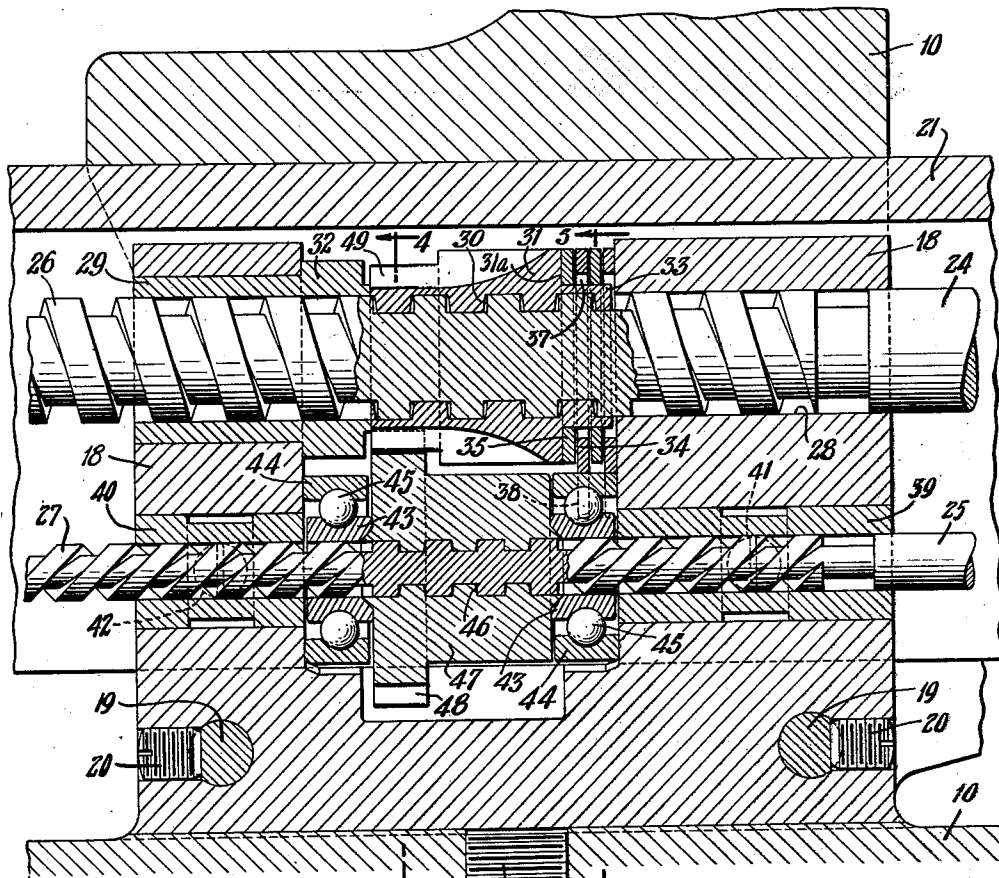
P. S. MORGAN

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3-Sheets-Sheet 2

**INVENTOR**

PORTER S. MORGAN

BY

BY
W. Philip Churchill
ATTORNEY

ATTORNEY

May 26, 1942.

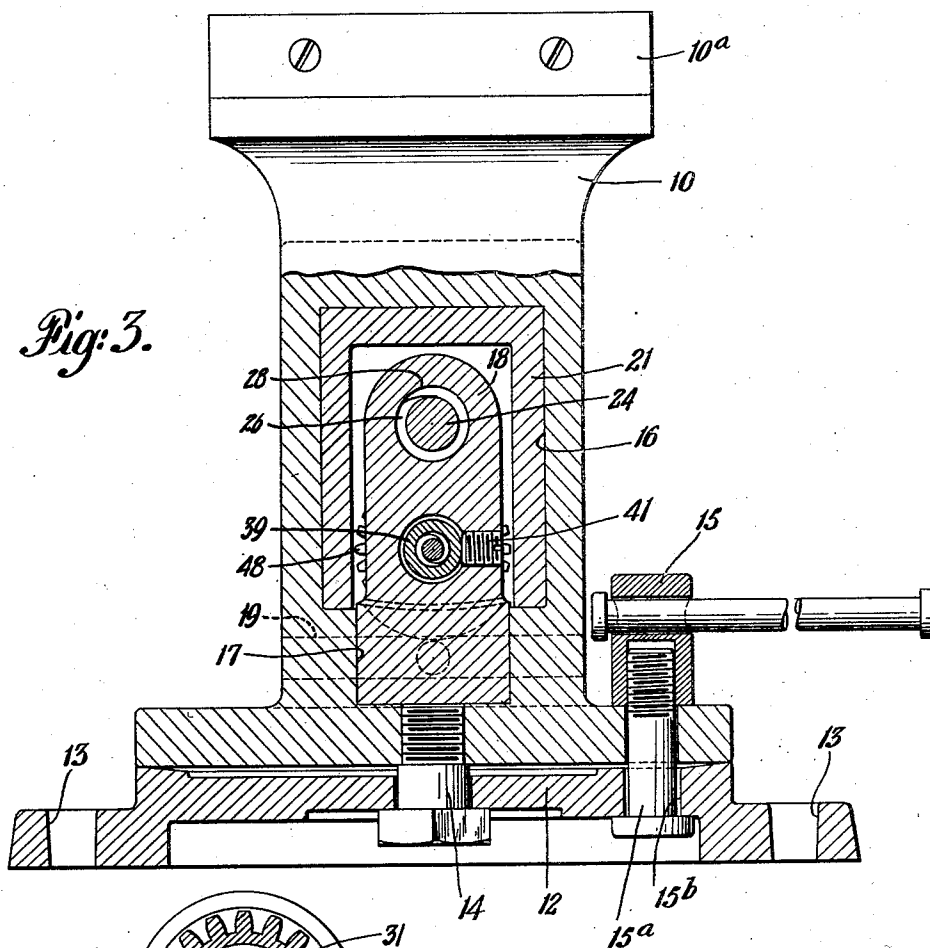
P. S. MORGAN

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3 Sheets-Sheet 3



INVENTOR
PORTER S. MORGAN
BY *Philip Churchill*
ATTORNEY

UNITED STATES PATENT OFFICE

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WORK-HOLDING APPARATUS

Porter S. Morgan, Hartford, Conn., assignor to
The Capewell Manufacturing Company, Hart-
ford, Conn., a corporation of Connecticut

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12 Claims. (Cl. 81—34)

This invention relates to work-holding apparatus, and more particularly to work-holding apparatus capable of being adjusted quickly to an open or closed position.

Attempts have been made, heretofore, to provide work-holding apparatus such as vises that could be quickly opened or shut, but such apparatus has sacrificed some other desirable quality for the quick adjustment, or has made the quick adjustment possible only by performing first some form of locking or unlocking to shift the apparatus from the normal operating position to the quick adjusting position or vice versa. Such arrangements have been unsatisfactory because the extra operations required to effect quick adjustment frequently have nullified any advantage that might have been obtained.

It is an object of this invention to provide work-holding apparatus in which the movable jaw can be either opened or closed quickly in a simple manner by merely pushing the jaws together or pulling them apart.

A further object is to provide such apparatus which can be quickly opened from a locked position by a simple and direct pulling motion.

Another object of my invention is to provide work-holding apparatus including fixed and movable jaw members in which the jaws may be clamped tightly against the work in the usual manner and in which the movable jaw can be moved quickly to an open or closed position at any time by a simple pulling or pushing operation.

In order that my invention may be more fully understood, a preferred embodiment thereof has been illustrated in the accompanying drawings, in which

Fig. 1 is a longitudinal vertical sectional view through approximately the center of a vise constructed in accordance with my invention and showing the upper portions of the jaw members in elevation.

Fig. 2 is a similar sectional view on an enlarged scale showing the mechanism inside the fixed jaw member of the vise.

Fig. 3 is a vertical sectional view, taken on the offset line 3—3 of Fig. 1.

Figs. 4 and 5 are vertical sectional views taken on the lines 4—4 and 5—5, respectively, of Fig. 2.

Figs. 6 and 7 are perspective views of clutch disc elements used in the assembly inside of the fixed jaw member.

The vise illustrated comprises a fixed jaw member 10 and a movable jaw member 11, with the

fixed jaw member mounted on a swivel plate 12 having suitable openings 13 for attachment to a bench or other support, and adapted to swivel about the bolt 14. Any suitable clamp, such as the hand adjustable clamp 15 and bolt 15a sliding in the arcuate slot 15b, may be provided for locking the fixed jaw member 10 with respect to the swivel base 12. If desired, of course, the fixed jaw member 10 may be mounted directly on a support or bench without any swivel support.

The fixed jaw member 10 is provided with an opening 16 extending through its shank that is formed somewhat narrower at its lower portion 17 than at the portion thereabove. Within this opening and fitting snugly inside the narrowed lower portion 17 is a housing member 18 held in place by a pair of rods 19 extending laterally therethrough and through the walls of the fixed jaw member 10, and by the set screws 20 holding the rods 19 in fixed relation to the housing 18 and fixed jaw member 10.

The movable jaw member 11 is made integral with or fixed to a channel bar 21 adapted to slide back and forth in the opening 16 in contact with the walls of said opening and providing a substantial clearance within its channel for the upper portion of the housing 18. The channel bar 21 may be closed at each end by suitable plates 22 and 23 movably held in place by bolts.

The lower portion of the movable jaw member 11 provides a housing inside the plate 23 for a pair of rods 24 and 25 having threads 26 and 27, respectively, which extend into the housing 18. The threaded portion of the rod 24 is supported within an opening 28 in one end section of the housing 18 and by a bushing 29 pressed into an opening in the other end section of the housing 18. Intermediate these end sections of the housing 18, the threaded portion of the rod 24 engages internal threads 30 of a rotatable nut 31. The space between the internal threads 30 is preferably made somewhat wider than the space between the threads on the rod 24, giving a substantial amount of play therebetween for a purpose described below. Movement of the nut 31 in one direction is limited by the bushing 29 which has a collar 32 holding it against axial movement, and in the other direction, movement of the nut is limited by the end section of housing 18.

The right end 33 of the nut 31 as viewed in Figs. 1 and 2 is reduced in diameter and is squared in cross section. Fitted over this squared

end 33 are alternately disposed fixed clutch plates 34 and rotary clutch plates 35. The rotary clutch plates 35 are provided with a squared opening 36 adapted to fit over the end 33 of the nut 31, so that these plates will rotate with the nut while permitting the plates to slide in an axial direction along the end of the nut. The fixed clutch plates 34 have circular openings 37 in which the end 33 of the nut 31 can rotate freely. The lower portions of the clutch plates 34 are formed with legs 38 by which these plates are held against rotation. The plates 34 and 35 fit loosely within the space between the shoulder 31a on nut 31 and the end portion of housing 18, thereby permitting the nut 31 a small degree of movement in an axial direction.

The threaded portion of the lower rod 25 is carried in suitable bushings 39 and 40 held in the end sections of the housing 18 by set screws 41 and 42. Intermediate these bushings, the threaded portion of the rod 25 passes through thrust bearings consisting in each case of an inner collar 43 in contact with the threads on the rod 25, an outer collar 44 and suitable ball bearings 45 therebetween. Between these thrust bearings, the threads on the rod 25 engage internal threads 46 of a gear 47 provided with external gear teeth 48 around one end. The gear teeth 48 mesh with gear teeth 49 cut into the left end of the nut 31, as viewed in Figs. 1 and 2. The gear teeth 49 are substantially wider than the gear teeth 48 to permit relative axial movement of the nut 31 and gear 47 without disengagement of these gear teeth.

The legs 38 of the fixed clutch plates 34 fit over one of the thrust bearings and are prevented thereby from rotating while allowing these plates to slide back and forth in the direction of the axis of rotation of rod 24.

It should be noted that the threads 26 on the rod 24 run in the opposite direction from the threads 27 on the rod 25 and are of a small enough pitch to be locked in place, i. e., an axial thrust on the rod 24 will not cause rotation either of the nut 31 or of the rod 24. The threads 27 on the rod 25, on the other hand, have a very steep pitch, such that an axial thrust of the rod 25 will cause rotation of the gear 47. The gear ratio of the gear teeth 49 and 48 should be proportioned in accordance with the ratio of the pitches of the threads 26 and 27 on the rods 24 and 25, so that when the rods 24 and 25 are moved simultaneously in an axial direction at the same speed, the nut 31 and gear 47 will be rotated synchronously without binding.

The end of the rod 24 associated with the movable jaw is supported in a bushing 50 in the lower portion of the movable jaw member 11 and carries a flange 51, or fixed collar, limiting axial movement of the rod 24 in a direction towards the fixed jaw member 10. The outermost end of the rod 24 projects through an opening in the plate 23 and supports in sliding engagement a sleeve member 52 provided with a flange 53 at its inner end and a serrated knob 54 at its outer end. The outer ends of the rod and sleeve member 52 are provided with a transverse opening for a slidable handle 55 used for rotating the rod 24 by hand.

The end of the rod 25 associated with the movable jaw 11 has a suitable gear 56 fixed thereto by the set screw 57 and arranged to mesh with the gear teeth 58 cut in the rod 24. The gear teeth 58 and the teeth of gear 56 correspond in ratio to the gear teeth 49 and 48, respectively.

The end of rod 25 supported in an opening in the movable jaw member 11 carries a suitable collar 59 held in place by a pin 60 and constantly urged into contact with the flange 53 on the sleeve 52 by the spring 61 set in a recess 62 in the lower portion of the movable jaw 11 and bearing against the gear 56.

The operation of the apparatus will be described, assuming that the jaws 10 and 11 are open and it is desired to clamp a piece of work between them. The work is placed between the jaws and the movable jaw 11 may be pushed up against the work by simply pressing it inwardly toward the fixed jaw 10. It is convenient to simply lean against or push on the knob 54 to bring the jaws together quickly on the work. Pressure on the movable jaw to clamp it against the work causes the lower rod 25 acting against the screw threads 46 inside the gear 47 to rotate this gear. The teeth 48 of this gear mesh with the gear teeth 49 and cause rotation of the nut 31 in the opposite direction, so that the two rods 24 and 25 are moved inwardly without either rod being rotated. To tighten the jaws on the work, it is then necessary simply to grasp the handle 55 and rotate the rod 24 in the usual manner of operating a vise. As the rod 24 is rotated by the handle 55, the nut 31 is pulled a slight distance toward the movable jaw 11, squeezing together the fixed and movable clutch plates 34 and 35.

By reason of the frictional engagement of these clutch plates, the fixed clutch plates 34, acting through the rotary clutch plates 35 that rotate with the nut 31, hold the nut 31 firmly against rotation, so that the rod 24 then turns against the internal threads 30 of the nut 31. As the jaws are pulled tighter and tighter together, the pressure on the clutch plates 34 and 35 is correspondingly increased and thus a firm grip of the jaws on the work may be obtained. The rod 25 in the meantime has started to rotate immediately upon rotation of rod 24 and in the opposite direction thereto by reason of the engagement of the gear teeth 58 with the teeth on gear 56. This in turn causes the rod 25 to rotate inside the stationary gear 47.

In the event that the jaws are firmly locked against the work and it is desired to release the work from the vise, it is simply necessary to grasp the knob 54 and pull it outwardly away from the fixed jaw member 10. The first movement of the knob 54 causes the sleeve 52 to slide over the end of the rod 24, and by reason of the engagement of flange 53 with the collar 59, the rod 25 is moved a slight distance in an axial direction away from the fixed jaw member 10. As the rod 25 begins to move, the engagement of the threads on the rod 25 with the threads 46 in gear 47 causes rotation of the gear 47 and a corresponding rotation of the nut 31 in a direction to loosen the grip of the clutch plates 34 and 35 upon each other. Continued pull on the knob 54 then causes the threads on rod 25 to continue rotating the gear 47 and the nut 31, so that the movable jaw member 11 may be moved quickly away from the fixed jaw member 10 without rotation of either rod 24 or rod 25.

Such a simplified operation of a work-holding device is extremely valuable in cases where it is desired to work rapidly or where a heavy piece of work is to be inserted between the jaws of the vise and requires both hands to hold the work in place during the closing of the vise. In such a case, it is simply necessary to hold the

work in place with both hands and lean against the knob 54, thereby pushing the movable jaw against the work and the grip on the work can then be tightened by a partial rotation of rod 24 using handle 55.

It will be apparent that a vise constructed according to my invention can be operated, if desired, simply by using the handle 55 to rotate the rod 24 in the usual manner. As the rod 24 is rotated by the handle 55 to close the jaws, the gear teeth 58 meshing with the teeth on gear 56 cause the rod 25 to rotate synchronously with the rod 24. Rotation of rod 24 creates a thrust on the nut 31, pulling it towards the movable jaw member 11. This thrust squeezes the clutch plates 34 and 35 together, thus holding nut 31 and the gear 47 stationary and pulling the movable jaw member 11 slowly but surely towards the fixed jaw member 10.

The purpose of the extra play or clearance between the threads 26 on the rod 24 and the internal threads 30 in nut 31 will now be apparent, since this permits the necessary relative axial movement between nut 31 and gear 47 to provide the locking action obtained by means of the clutch plate assembly, and also allows nut 31 to rotate freely around rod 24 when the nut is being rotated by gear 47 during the quick adjustment of the jaws to the open or closed position.

The terms and expressions which I have employed are used as terms of description and not of limitation, and I have no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof which fall within the scope of the invention claimed.

I claim:

1. Work-holding apparatus comprising a fixed jaw member, a movable jaw member, a pair of rods having continuous threads rotatably supported by and connecting said jaw members, means for rotating said rods synchronously to effect closing of said jaws, and means associated with both of said rods and rotated by one of said rods when said movable jaw member is pulled away from or pushed toward said fixed jaw member to permit quick adjustment of said jaw members.

2. Work-holding apparatus comprising a fixed jaw member, a movable jaw member, a pair of rods having continuous threads rotatably supported by and connecting said jaw members, and simultaneously rotatable members carried by one of said jaw members and having threaded engagement with said rods, one of said rods having threads of such a pitch as to cause rotation of said rotatable members and permit quick adjustment of said jaw members when said movable jaw member is pulled away from or pushed toward said fixed jaw member.

3. Work-holding apparatus comprising fixed and movable jaw members, a pair of rotatable rods having continuous threads connecting said members, and means carried by one of said members rotatably engaging threaded portions of both of said rods, one of said rods having threads of such a pitch as to lock said members in fixed relation to each other, and the other of said rods having threads of a greater pitch sufficient to cause rotation of said means upon movement of said other rod relative to said means in an axial direction.

4. Work-holding apparatus comprising fixed and movable jaw members, a pair of rotatable

rods connecting said members, and a pair of members carried by said fixed jaw member geared together for synchronous rotation and having internal threads engaging threaded portions of said rods, one of said rods having threads of a sufficiently steep pitch to rotate said geared members for quick adjustment of the jaw members upon movement of the rod in an axial direction.

5. Work-holding apparatus comprising fixed and movable jaw members, a pair of rotatable rods connecting said members, a pair of members carried by one of said jaw members geared together for synchronous rotation and having internal threads engaging threaded portions of said rods, and clutch means associated with one of said geared members to hold it stationary during tightening of said jaw members, the rod engaging said other geared member having a sufficiently steep pitch to cause rotation of said geared members upon relative movement between said rods and geared members in an axial direction.

6. Work-holding apparatus comprising fixed and movable jaw members, a pair of rotatable rods connecting said members, means for rotating said rods synchronously to close the jaw members, a pair of members carried by one of said jaw members geared together for synchronous rotation and having internal threads engaging threaded portions of said rods, and clutch means associated with one of said geared members to hold it stationary during tightening of said jaw members, the rod engaging said other geared member having a sufficiently steep pitch to cause rotation of said geared members upon relative movement in an axial direction between said other geared member and the rod engaged thereby.

7. Work-holding apparatus comprising fixed and movable jaw members, a rotatable rod connecting said members, a rotatable member carried by one of said jaw members having threads engaging threads on said rod for holding the jaw members in a given relative position, clutch means for holding said rotatable member against rotation to permit tightening of said jaw members, and means for releasing said clutch means to permit rotation of said rotatable member and opening of said jaws.

8. Work-holding apparatus comprising fixed and movable jaw members, a rotatable rod connecting said members, a rotatable member carried by one of said jaw members having threads engaging threads on said rod for holding the jaw members in a given relative position, clutch means for holding said rotatable member against rotation to permit tightening of said jaw members, and means for rotating said rotatable member releasing said clutch means and permitting quick opening of the jaw members.

9. Work-holding apparatus comprising fixed and movable jaw members, a rotatable rod connecting said members, a rotatable member carried by one of said jaw members having threads engaging threads on said rod for holding the jaw members in a given relative position, clutch means for holding said rotatable member to permit tightening of said jaw members, and a second rod movable lengthwise relative to said first mentioned rod to release said clutch means.

10. Work-holding apparatus comprising fixed and movable jaw members, a rotatable rod connecting said members, a rotatable member carried by one of said jaw members having threads

engaging threads on said rod for holding the jaw members in a given relative position, clutch means for holding said rotatable member to permit tightening of said jaw members, and means including a second rod movable relative to said first mentioned rod to release said clutch means and movable with said first mentioned rod to rotate said rotatable member for quick opening of said jaw members.

11. A quick adjusting vise comprising a pair of jaw members, a threaded rotary rod connecting said jaw members for adjusting the same relative to each other, rotatable means carried by one of said members and cooperating with the threads on said rod to hold said members in different relative positions, clutch means for holding said rotatable means during tightening

of said jaw members, and means for releasing said clutch means and rotating said rotatable means to effect quick opening of said jaw members.

12. A quick adjusting vise comprising a pair of jaw members, a threaded rotary rod connecting said jaw members, rotatable means carried by one of said members and cooperating with the threads on said rod to hold said members in different relative positions, clutch means for holding said rotatable means during tightening of said jaw members, and a second rod movable with one of said jaw members for rotating said rotatable means to release said clutch means and effect a quick opening or closing of said jaw members.

PORTER S. MORGAN.