Feb. 1, 1966 J. BERNHARD 3,232,602

JAW VICES

Filed Nov. 27, 1963

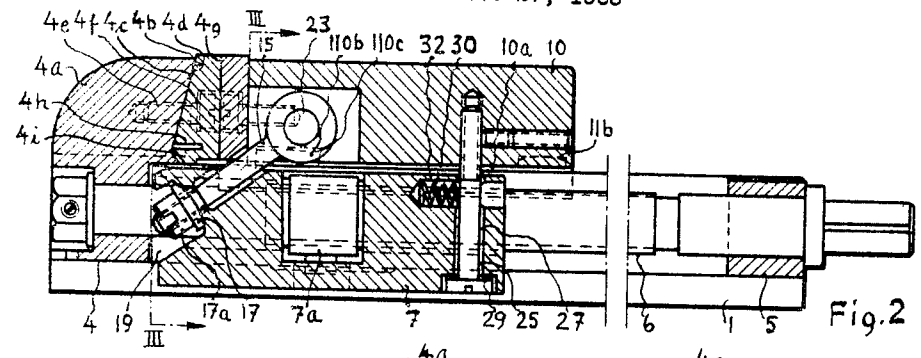

Fig.2

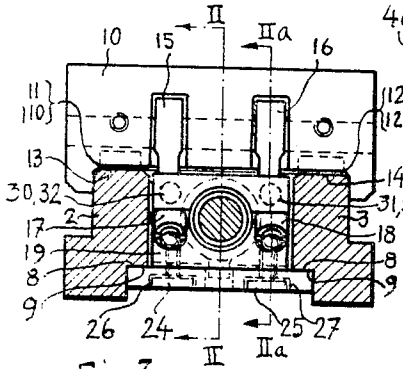

Fig.3

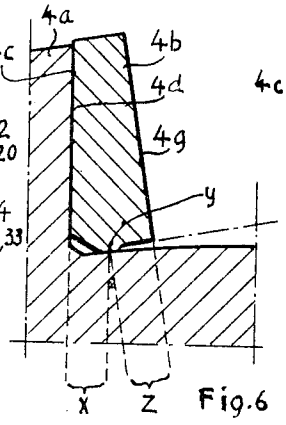

Fig.6

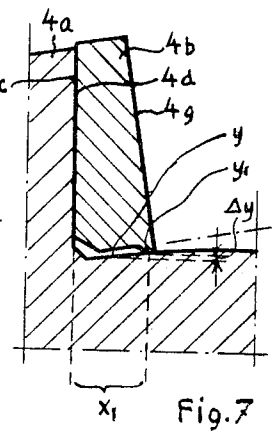

Fig.7

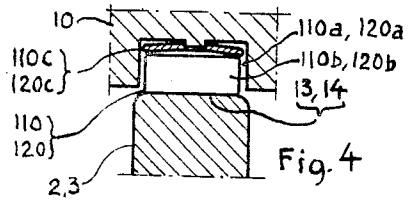

Fig.4

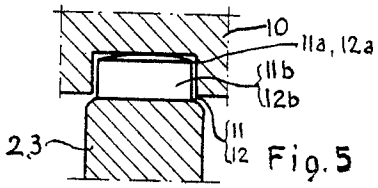

Fig.5

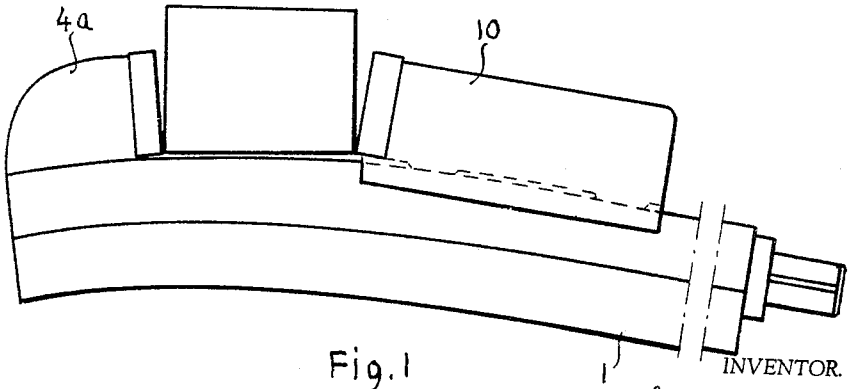

Fig.1

INVENTOR.

BY Johann Bernhard

Wenderoth, Lind and Ponack

attorneys

United States Patent Office 3,232,602 Patented Feb. 1, 1966

3,232,602

JAW VICES

Johann Bernhard, Finntorpsvagen 11, Nacka, Sweden

Filed Nov. 27, 1963, Ser. No. 326,443
Claims priority, application Germany, Dec. 1, 1962, B 69,830
13 Claims. (Cl. 269—134)

Jaw vices and similar clamping devices are generally provided with a supporting frame adapted to be secured to a vice bench or a machine table. Said supporting frame has a fixed clamping member projecting upwardly therefrom, and said clamping member is provided with a jaw plate. The supporting frame is also provided with guides, and these guides have guiding surfaces for a movable clamping member which is also provided with a suitable jaw plate. The movable clamping member is adapted to be moved against the fixed clamping member by means of a screw or some other actuating device so that the jaw plate of the movable clamping member can be pressed against the jaw plate of the fixed clamping member or against an object which is clamped between said jaw plates. When a clamping device of that kind is tightened, the clamping members will be subjected to a torque which causes a lifting of the movable clamping member which is permitted by the inevitable clearance in the guiding paths of said movable clamping member. This lifting leads to a number of disadvantages of which the following may be mentioned:

(1) When the clamping device is tightened, the clamping surfaces of the two jaw plates will be forced out of parallel and, therefore, if an object with parallel sides is being clamped between said jaw plates, said object will be clamped with a greater force at its lower part than at its upper part.

(2) An object which is clamped between the jaw plates and which has been inserted to a predetermined depth between said jaw plates against a stop bolt or other abutment will be lifted from said stop bolt at the tightening moment, said lifting being dependent upon a number of unknown factors, so that the clamping depth of said object will not be exactly determined after the tightening has been completed.

Jaw vices in which one or both of the jaw plates are adapted to be pulled down during the clamping process are already known. There are mainly two different principles which have been used for such pulling down of the jaw plates, viz.:

(1) The power transmission to the movable clamping member is adapted to be made via inclined sliding surfaces which are arranged to provide a clamping action at the same time as they bring about a downward pull of the movable clamping member.

(2) The power transmission to the movable clamping member is adapted to be made over link rods, said link rods being pivoted to the movable clamping member and adapted to press said clamping member against the fixed clamping member. Said link rods are inclined so that they also impart a downward pull to the movable clamping member.

Careful investigation has shown that these known arrangements are not sufficient for providing a complete downward pull of the clamped object against the supporting frame. It has also been impossible to maintain the clamping surfaces of the fixed and the movable clamping member completely parallel when the clamping pressure is high. The investigations have shown that said lack of parallelism as well as the slight rise of the clamped object, which has been observed, are caused by a bending of the supporting frame which occurs when the clamping pressure is high.

The present invention relates to a jaw vice in which the

bending of the supporting frame at high clamping pressure is compensated through a corresponding inclination of said movable clamping member, whereby an accurate parallelism between the clamping surfaces of the clamping members will be obtained and the exact position of the clamped object will be maintained. A jaw vice according to the invention has a fixed clamping member and a supporting frame, said supporting frame having a first set of guiding surfaces with which guiding surfaces provided on the movable clamping member cooperate, said movable clamping member being displaceable towards and from said fixed clamping member by means of an actuating member, for example a screw, with an auxiliary sliding member being connected between said actuating member and said movable clamping member, said auxiliary member having guiding surfaces which cooperate with a second set of guiding surfaces on said supporting frame, said first set and said second set of guiding surfaces being provided at opposite sides of said supporting frame. The auxiliary sliding member is connected to said movable clamping member by means of a number of connecting members with the connection between at least one end of said connection members and the part connected thereto being linked or bendable to a certain degree.

The invention is substantially characterized by the fact that the point of connection between said connection members and said auxiliary sliding member lies in a plane perpendicular to the direction of movement of said auxiliary sliding member and said movable clamping member, said plane being located nearer to said fixed clamping member than a plane which is parallel to the first mentioned plane and going through the clamping surface of said movable clamping member.

The invention will now be described with reference to the accompanying drawing, in which:

FIG. 1 illustrates a jaw vice of a conventional kind in which the bending of the supporting frame has been shown in an exaggerated way,

FIG. 2 is a longitudinal section through a jaw vice according to one embodiment of the present invention along the lines II—II and II*a*—II*a*, respectively, in FIG. 3,

FIG. 3 is a cross section of the same jaw vice along the line III—III in FIG. 2,

FIGS. 4 and 5 illustrate cross sections through different parts of the jaw vice, where carrier members for the movable clamping member are provided, and

FIGS. 6 and 7 are sections on a greater scale through the jaw plate of the fixed clamping member of two different embodiments of the jaw vice.

In the drawing, 1 designates a supporting frame for a jaw vice, said supporting frame having two guides 2 and 3. The guides 2 and 3 are connected together at both ends of the jaw vice by means of yokes 4 and 5 which may be secured to the guides by means of moulded connections or by screw connections or by any other suitable means. Between the guides, an actuating member in the form of a screw 6 is located, said screw 6 being rotatably mounted in the yokes 4 and 5 but prevented from being displaced in its longitudinal direction. At the rear part of the jaw vice, there is a fixed clamping member 4*a* which is provided with an inclined surface 4*c* for receiving a jaw plate 4*b*. The clamping member 4*a* is rigidly secured to the guides and preferably integral therewith. The jaw plate 4*b* has an inclined surface 4*d* which lies against the inclined surface 4*c* of the fixed clamping member 4*a*. The jaw plate 4*b* is fastened to the clamping member 4*a* by means of screws 4*e* and elastic washers 4*f* and is adapted to make a limited movement relative to the clamping member 4*a*.

The screw 6 cooperates with a nut 7*a* which belongs to an auxiliary sliding member 7 (FIG. 2) or which cooperates with such member.

The nut 7*a* may be a separate unit in the auxiliary sliding member 7, and may be kept in the auxiliary sliding member in such a way, that it is locked for movement in the direction of movement of said auxiliary sliding member but allowed to be slightly displaced in a direction perpendicular to movement of said auxiliary sliding member. By this means, there will be no mechanical stress transferred to the screw 6 from said auxiliary sliding member in a direction perpendicular to the longitudinal axis of said screw.

The auxiliary sliding member 7 is displaceably mounted between the guides 2 and 3 and has guiding surfaces 8 which cooperate with corresponding guiding surfaces 9 of said guides 2 and 3.

A movable clamping member 10 is provided with a surface 10*a* from which a number (preferably four) of carrier members 11*b*, 12*b*, 110*b*, 120*b* project. The carrier members are provided with guiding surfaces 11, 12, 110, 120 which cooperate with the upper guiding surfaces 13 and 14 of the guides 2 and 3.

Of the carrier members, there are two front carrier members 110*b*, 120*b* and two rear carrier members 11*b*, 12*b*. The carriers members 11*b*, 12*b*, 110*b*, 120*b* are located in holes 11*a*, 12*a*, 110*a*, 120*a* in the movable clamping member 10. On the upper side of the front carrier members 110*b*, 120*b* there are elastic washers, elastic bodies or rubber plates 110*c*, 120*c*. The upper surfaces of the rear carrier members 11*b*, 12*b* are dome-shaped in order to allow a slight tilting movement of the movable clamping member on said surface. The front part of the movable clamping member 10 rests on the resilient carrier members 110*b*, 120*b*, and the rear part rests on the dome-shaped carrier members 11*b*, 12*b*. Between the lower surface of the movable clamping member and the guides 2 and 3 there is a clearance.

In the embodiment shown there are two link rods 15 and 16 for transferring the movement from the auxiliary sliding member 7 to the movable clamping member 10. Each of said link rods 15 and 16 has a fulcrum pin or a threaded nut 17 and 18, respectively, at the lower end of said link rod, said fulcrum pin or nut being pivoted in recesses 19 and 20, respectively, which are provided in the sides of the auxiliary sliding member 7 at the front part thereof.

The fulcrum pins or nuts 17 and 18 may be adjustable on the link rods 15 and 16. The link rods may, for example, be threaded in said fulcrum pins or nuts or, still better, the link rods may run freely through said fulcrum pins or nuts and be provided with separate nuts 17*a*, 18*a* at their ends.

A rod 23 common to the link rods 15 and 16 is provided in the movable clamping member 10, said rod 23 going through the upper ends of said link rods.

Various types of link rods 15 and 16 may be used. Instead of the dome-shaped nuts 17 and 18, said nuts may have cylindrical surfaces which cooperate with corresponding pivoting recesses in the auxiliary sliding member 7. Instead of the common rod 23, the link rods may be provided at their upper ends with separate axle spindles or with dome-shaped pivoting means, which cooperate with corresponding recesses in the movable clamping member. The link rods may also be replaced by strong disc springs or the like, or by screws, or other connecting members, which may be rigidly secured to said auxiliary sliding member and/or to said movable clamping member but slightly bendable or tiltable relative to at least one of said members.

In case the link rods are replaced by other connection members, said front and said rear carrier members may be resilient or elastical to such an extent that the parallelism between the clamping surfaces of the fixed and the movable clamping members will be obtained or maintained during the clamping process.

Due to the fact, that the link rods are pivoted to said auxiliary sliding member at points which are located in front of the clamping surface of said movable clamping member, there will be very small losses of the clamping force and, at the same time, any tendency of self blocking of the movable clamping member due to wedge action, when the jaw vice is to be opened, is avoided.

The rear part of the movable clamping member 10 is secured to said auixliary sliding member 7 by means of screws 24 and 25. Said screws are threaded in the movable clamping member and run freely through holes in said auxiliary sliding member 7. As is clearly illustrated at 26 and 27 in FIG. 2, there must be a sufficient clearance round the screws 24 and 25 where they extend through the auxiliary sliding member. Under the heads of the screws 24 and 25 there are elastic washers 28 and 29; said washers being adapted to elastically press the guiding surfaces 8 of said auxiliary sliding member 7 against the guiding surfaces 9 of said guides 2 and 3, and at the same time press the movable clamping member 10 with its carrier members and their guiding surfaces against the guiding surfaces 12 and 13 of the guides 2 and 3.

Two helical springs 30 and 31 which are inserted in holes 32 and 33, respectively, in said auxiliary sliding member 7, tend to press said sliding member forwards against the screws 24 and 25. The springs 30 and 31 may preferably act with such a strength that the guiding surfaces 8 of the auxiliary sliding member 7, under the action of the link rods 15 and 16, will be pressed against the guiding surfaces 9 of the guides 2 and 3 also at the front part of said auxiliary sliding member. The arrangement of the spring 30, the screws 25, the auxiliary sliding member 7, the link rods 15, 16 and the movable clamping member 10 forces the guiding surfaces of the movable clamping member to be pressed tightly against the guiding surfaces of the guides 2 and 3 during the clamping process and also before the clamping process is started. This will be the case, also when said guiding surfaces are worn after long use.

When an object is clamped between the clamping member 4*a* and 10 the guiding surfaces 11 and 12 of the movable clamping member 10 will be pressed, due to the action of the link rods 15 and 16, against the guiding surfaces 13 and 14 of the guides 2 and 3 by a force which is dependent on the following factors: the length of the path along which the movable clamping member rests on the guides 2 and 3; the height of the clamping surface of the movable clamping member; the inclination of the link rods; the location of the points where the link rods are connected to the movable clamping member and to the auxiliary sliding member, and the clamping force.

It is evident from FIG. 2 that the length of the movable clamping member 10 is much greater than the height of the jaw plate 4*c*. Because of this arrangement, the force which tends to lift the movable clamping member 10 from the supporting frame will be rather small.

Because the connection between the link rods or other connection members, such as screws, disc springs or the like, and the auxiliary sliding member 7, is located in front of the clamping surface of the movable clamping member 10, it will be possible to match the force which is required to pull down the movable clamping member 10 to the lifting force which has been described in the foregoing.

The angle of inclination of the link rods, which means the enclosed angle between the link rods and the supporting frame, may be less than 60°, and also less than 45°. It may preferably be not greater than 37°, so that the losses of the clamping force due to the pulling down of the movable clamping member 10 will not decrease the clamping pressure between the clamping surfaces to any appreciable extent.

The guiding surfaces 11, 12, 110, 120 of the carrier members 11*b*, 12*b*, 110*b*, 120*b* as well as the guiding surfaces 6 of the auxiliary sliding member 7 are made of a material with a low friction coefficient. Therefore, no self-blocking of the movable clamping member will occur

during the clamping process and, therefore, about the same clamping force will be obtained as in a conventional jaw vice, which is not provided with any means for pulling down the jaw plates during the clamping process.

A jaw vice of the kind indicated as distinguished from already known jaw vices by the elastic washers **110***c*, **120***c* in the movable clamping member **10** which washers are adapted to compensate only that lifting of the clamping member **10** from the guides **2** and **3**, which is caused by the bending of the supporting frame during the clamping process. This arrangement leads to the effect, that the inclined jaw plate 4*c* will not press down the clamped object with too strong a force. There will be no sliding of the jaw plate 4*c* against the clamped object and, therefore, the position of the clamped object relative to the jaw plate will be maintained during the clamping process. This is made possible by the fact, that the spring arrangement in the auxiliary sliding member **7** will pull down the movable clamping member **10** against the guiding surfaces **13**, **14** of the guides **2** and **3** even before the clamping process has started. Therefore, there will be no appreciable displacement of the jaw plate (or in a double-sided jaw vice, in which the invention also may be applied, of the jaw plates) in the downward direction against the supporting frame. And, since the down-pulling force only to a small extent exceeds the lifting force, and the friction between the down-pulled jaw plates and the clamped object is very great, there will be no sliding of the jaw plate on the clamped object.

When the clamping force is very great, the supporting frame will be slightly bent as is illustrated in FIG. 1. This fact would lead to a lack of parallelism between the clamping members 4*a* and **10**, as the clamping member **10** is slightly lifted from the supporting frame, also if the clamping member **10** should be exactly parallel with the guides **2** and **3**. Therefore, a slight inclination of the movable clamping member must be brought about in order to compensate for said lack of parallelism. According to the invention, this will be obtained by means of the down-pulling link rods **15** and **16** in connection with the elastic washers or the elastic members **110***c*, **120***c* between the carrier members **110***b*, **120***b* and the movable clamping member **10**.

Because the down-pulling force in the described embodiment of a jaw vice according to the invention is active only at the front part of the movable clamping member, the elastic washers **110***c* and **120***c* will be compressed during the clamping process and, therefore, the movable clamping member will occupy a slightly inclined position. This results in the desired compensation for the lack of parallelism being obtained. It is important that the elastic force of the elastic washers has just that magntiude, that for all possible clamping forces, and for all possible distances between the clamping surfaces, the parallelism between the clamping surfaces of the clamping members 4*a* and **10** is maintained.

It is possible to obtain a complete compensation for all occurring clamping forces because the bending of the supporting frame as well as the down-pulling force increase with increasing clamping pressure.

But the bending of the supporting frame increases also with increasing clamping distances. For compensating any lack of parallelism also in consideration of this last mentioned fact, the pivots of the link rods in the auxiliary sliding member are positioned in a vertical plane which is displaced in a direction towards the fixed clamping member, from that vertical plane, which passes through the clamping surface of the movable clamping member. As will be apparent from FIG. 1, the bending of the supporting frame causes the auxiliary member **7** to be moved to a lower position, while the movable clamping member is lifted to a more elevated position. Therefore, the angle between the link rods to the direction of movement of the movable clamping member will be greater if the pivot of the link rods in the auxiliary sliding

member are displaced in the direction from the fixed clamping member towards the movable clamping member. It is also apparent, that if the distance between said pivots and the movable clamping member is considerable, said angle will alter with the bending of the supporting frame. A greater angle means, however, a more powerful pulling down of the front end of the movable clamping member. Thus, it is possible to obtain a substantially complete compensation of any lack of parallelism between the clamping surfaces which may be caused by the bending of the supporting frame. It will be evident therefore, that the carrier members in the movable clamping member enable the link rods to compensate the effect of the bending of the supporting frame because said bending leads to a greater down-pulling angle which, in turn, leads to a more powerful down-pull of the movable clamping member.

Because the carrier members are located in the front and rear ends of the movable clamping member at a rather great distance from each other, the bending of the supporting frame will bring about only a slight lifting of the movable clamping member, which lifting can be compensated as has been described in the foregoing.

As is illustrated in FIGS. 2, 6 and 7, the fixed clamping member 4*a* may have a jaw plate 4*b*, the rear surface 4*d* of which is inclined and cooperating with a corresponding inclined surface 4*c* of the fixed clamping member. The jaw plate 4*b* may be secured to the clamping member 4*a* by means of screws 4*e* which are going through the jaw plate in holes with some clearance, so that the jaw plate is slightly slidable on the clamping member. Elastic washers 4*f* may be placed under the heads of the screws 4*e* for keeping the jaw plate pressed against the clamping member.

The inclined surfaces 4*c*, 4*d* serve the purpose of pressing the jaw plate downward against the supporting frame **1**. In FIGS. 6 and 7 it is illustrated on an exaggerated scale, that the bending of the supporting frame brings about a slight inclination of the fixed clamping member 4*a*. The jaw plate 4*c* rests against the supporting frame **1** in a point lying at a distance x from the inclined surface of the fixed clamping member. Consequently, the surface 4*d* of the jaw plate will slide a little against the surface 4*d* of the clamping member during the clamping process. Because of that, the lifting of the jaw plate 4*d* and the clamping surface 4*g* will be less than if the jaw plate had been rigidly secured to the surface 4*c* of the clamping member 4*a*.

But, in spite of all, there will be a slight lifting of the clamping surface 4*g*. This lifting is dependent of the distance x and of the bending of the supporting frame **1**. The greater the distance x, the more the surface 4*d* will slide against the surface 4*c*. But, the greater the distance x, the more elevated will be the point where the jaw plate is resting on the bent supporting frame. This fact will be quite apparent from FIGS. 6 and 7.

In the arrangement according to FIG. 6 the point of support y is rather close to the surface 4*c* of the clamping member 4*a*. The lifting of the clamping surface 4*g* which occurs because of the swinging movement of the lever z will, therefore, be greater than in the arrangement according to FIG. 7 where the distance x_1 between the supporting point y_1 and the surface 4*c* is greater than in FIG. 6, and in which the length of the lever z is zero. But, in the arrangement according to FIG. 7, the supportting point y_1 is more elevated than in the arrangement according to FIG. 6, where the supporting point is y. The difference between y and y_1 is designated Δy and is dependent upon the bending of the supporting frame. The arrangement of the supporting point at some distance from the surface 4*c* leads, therefore, to two different effects. One of said effects tend to decrease the lifting of the clamping surface and the other effect tends to increase said lifting. For each jaw vice, there is an optimal value for the distance x, where the resulting lifting of the jaw plate is

minimum, said optimal value being dependent upon the bending of the supporting frame and upon the inclination of the clamping member *4a* during the clamping process. This optimal value of *x* can only be determined in an experimental way, and it is an object of the present invention to arrange the point of abutment *y* in such a way, that is, at such a distance *x* from the surface *4c*, that the lifting of the clamping surface *4g* relative to a fixed reference surface level will be minimum. (The reference level can be equal to the upper surface level of a jaw bench or machine table on which the jaw vice is mounted.)

The jaw plate *4b* can also be provided with a slot *4h* in the rear part thereof as is illustrated in FIG. 2. When the point of abutment *y*, as illustrated, is located beneath the slot *4h*, the jaw plate *4b* may be able to make a downward movement during the clamping process, so that the described lifting of the jaw plate can be completely compensated.

The spring action of the part *4e* which is located between the abutment point *y* and the slot *4h*, serves as a force of restoration for the said downward movement. For the sliding of the jaw plate already described, and which is caused by the inclination of the clamping member *4a* and from the bending of the supporting frame **1** during the clamping process, there will be no restoration force needed, because the clamping force always forces the support point of the jaw plate to rest against the supporting frame (or against some intermediate member resting on the supporting frame).

The supporting point (or supporting line) of the jaw plate is extended along the whole width of said jaw plate. Therefore, the location of the clamped object between the jaw plates has no influence of the accuracy of the clamping. In known vices with jaw plates subjected to down-pull, the jaw plates may be unsymmetrically pulled down when the clamped object is located unsymmetrically between said jaw plates. This leads to a less accurate clamping of the object and it may also cause damage of the clamped object. Because the clamping member *4a* during the clamping process will be slightly inclined, there will also by this reason, be a slight lack of parallelism between the clamping surfaces of the clamping members *4a* and and **10**, provided that said clamping surfaces were exactly parallel before the clamping process was started. In order to avoid that lack of parallelism, one of said clamping surfaces (preferably the clamping surface of the fixed clamping member) may be slightly inclined from the beginning so that parallelism will be exactly restored by the clamping pressure when the clamping process is completed.

I claim:

1. In a jaw vice, a supporting frame having guides thereon, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second set of guiding surfaces being located at opposite sides of said guides, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first-mentioned plane and passing through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated further connecting means between said auxiliary member and said movable clamping member, said further connecting means having a bias tending to eliminate any clearance in said first connecting means in the direction of movement of said auxiliary member towards said fixed clamping member.

2. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second set of guiding surfaces being located at opposite sides of guides upon said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connections means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first-mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said auxiliary member being connected to said movable clamping member in a direction perpendicular to the direction of movement of said members, said connection comprising connection means, a clearance in said connection means in the direction of movement of said members, said clearance allowing a limited displacement of one of said members in respect of the other, said connection means having a bias preventing said movable clamping member from being lifted from said supporting frame during the clamping process as well as during the return movement of said members when the jaw vice is opened.

3. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and second set of guiding surfaces, said first and second sets of guiding surfaces being located at opposite sides of guides upon said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first-mentioned plane and go-

ing through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said actuating means comprising a screw, said screw going freely through a part of said auxiliary member and cooperating with a threaded nut inserted in another part of said auxiliary member, said nut being locked for movement in the direction of movement of said auxiliary member, but allowed to be slightly displaced in a direction perpendicular to the direction of movement of said auxiliary member.

4. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second sets of guiding surfaces being located at opposite sides of guides belonging to said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first-mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said guiding surfaces of said movable clamping member being provided on separate carrier members, said carrier members being inserted in said movable clamping member and being slightly tiltable relative to said movable clamping member so as to allow the whole guiding surface of each of the carrier members to rest on the guiding surface of said supporting frame with which it is in contact, even if said movable clamping member should be slightly tilted relative to said supporting frame.

5. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second sets of guiding surfaces being located at opposite sides of guides belonging to said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first-mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said guiding surfaces of said movable clamping member being provided on separate carrier members, said carrier members being connected to said movable clamping member, said connection being elastically resilient in a direction perpendicular to the direction of movement of said clamping member, said resiliency being limited to a narrow range of movement and the force of restoration in said elasticity being sufficient to draw the guiding surfaces of said guides of said supporting frame.

6. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second sets of guiding surfaces being located at opposite sides of guides belonging to said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first-mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said guiding surfaces of said movable clamping member being provided on separate carrier members,, said carrier members being connected to said movable clamping member, said connection being elastically resilient in a direction perpendicular to the direction of movement of said clamping member, said resiliency in said connection being sufficient to eliminate the lifting of said movable clamping member from said supporting frame and to compensate the lack of parallelism between the clamping surfaces of said movable and said fixed clamping members, which may be caused by the bending of said supporting frame during the clamping process.

7. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and second set of guiding surfaces, said first and second sets of guiding surfaces being located at opposite sides of guides belonging to said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned

connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first-mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said guiding surfaces of said movable clamping member being provided on separate carrier members, said carrier members being connected to said movable clamping member, said connection being elastically resilient in a direction perpendicular to the direction of movement of said clamping member, said carrier members being provided in the front part as well as in the rear part of said movable clamping member, the resiliency of the connections of said rear carrier members and said front carrier members to said movable clamping member being so adjusted, that an increased clamping pressure, the parallelism between the clamping surfaces of said movable and said fixed clamping members will be retained or obtained.

8. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second sets of guiding surfaces being located at opposite sides of guides belonging to said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first-mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said guiding surfaces of said movable clamping member being divided in front and rear guiding surfaces, said front guiding surfaces being provided on separate carrier members, said carrier members being connected to said movable clamping member, said connection being elastically resilient in a direction perpendicular to the direction of movement of said movable clamping member, said rear guiding surfaces allowing a limited tilting of said movable clamping member along an axis which is perpendicular to the direction of movement of said movable clamping member.

9. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second sets of guiding surfaces being located at opposite sides of guides belonging to said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first-mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said elongated connection members comprising link rods, the angle between said link rods and said supporting frame being less than 60°, and preferably less than 37°.

10. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second sets of guiding surfaces being located at opposite sides of guides belonging to said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said fixed clamping member having a jaw plate, said jaw plate being provided with an inclined surface, said inclined surface cooperating with a corresponding inclined surface of said fixed clamping member, said jaw plate being secured to said clamping member by means of screws and elastic washers, said jaw plate being slidable to a limited extent on said fixed clamping member, said jaw plate being supported by said supporting frame, the distance between the supporting point and said inclined surface being such, that the increase in height which is caused by the bending of said supporting frame, and the inclination of said fixed clamping member during operation are compensated by the sliding of said jaw plate on said fixed clamping member.

11. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second sets of guiding surfaces being located at opposite sides of guides belonging to said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable

clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said fixed clamping member having a jaw plate, said jaw plate being provided with an inclined surface, said inclined surface cooperating with a corresponding inclined surface of said fixed clamping member, said jaw plate being secured to said clamping member by means of screws and elastic washers, said jaw plate being slidable to a limited extent on said fixed clamping member, a slot being provided in said jaw plate from the inclined surface thereof said slot being located over the point in which said jaw plate is supported by said supporting frame, the part between said slot and said supporting point being sufficiently resilient to allow said jaw plate to be drawn further downwards during the clamping process in order to further improve the compensation of the lifting of said jaw plate.

12. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second sets of guiding surfaces being located at opposite sides of guides belonging to said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said fixed clamping member having a jaw plate, said jaw plate being provided with an inclined surface, said inclined surface cooperating with a corresponding inclined surface of said fixed clamping members, said jaw plate being secured to said clamping member by means of screws and elastic washers, said jaw plate being slidable to a limited extent on said fixed clamping member, the clamping surface of said jaw plate being slightly unparallel to the clamping surface of said movable clamping member when the jaw vice is not used, in order to compensate for the inclination of said fixed clamping member during use of the jaw vice, so that an exact parallelism between said clamping surfaces is obtained during the clamping process by the action of the clamping pressure.

13. In a jaw vice, a supporting frame, a fixed clamping member secured to said supporting frame, a movable clamping member, an actuating member for moving said movable clamping member towards and from said fixed clamping member, said supporting frame having a first and a second set of guiding surfaces, said first and second set of guiding surfaces being located at opposite sides of guides belonging to said supporting frame, said movable clamping member having guiding surfaces cooperating with said first set of guiding surfaces of said guides, an auxiliary sliding member connected between said actuating member and said movable clamping member for transferring movement from the former to the latter, said auxiliary member having guiding surfaces cooperating with said second set of guiding surfaces of said guides, said auxiliary member being connected to said movable clamping member by a first connection means, said first connection means comprising a number of elongated connection members, one end of said connection members being connected to said movable clamping member and at the other end thereof to said auxiliary member, said last-mentioned connection lying in a plane perpendicular to the direction of movement of said movable clamping member and located nearer the fixed clamping member than a plane parallel to the first-mentioned plane and going through the clamping surface of said movable clamping member, the connection between at least one end of said elongated connection members and the part to which it is connected being bendable or articulated, said guiding surfaces of said movable clamping member being provided on separate carrier members, said carrier members being connected to said movable clamping member, said connection being elastically resilient in a direction perpendicular to the direction of movement of said clamping member, said resiliency being limited to a narrow range of movement and the force of restoration in said elasticity being sufficient to draw the guiding surfaces of said auxiliary member against said second set of guiding surfaces of said guides of said supporting frame, the force of restoration in said elasticity being also sufficient to prevent said movable clamping member to be drawn that far towards said first set of guiding surfaces of said supporting frame that the limit of said narrow range of movement is reached, also when the clamping pressure in the jaw vice has amounted to the highest value which the weakest part of the jaw vice will endure.

References Cited by the Examiner

UNITED STATES PATENTS

1,454,993 5/1923 Bothwell ..... 269—242 X

FOREIGN PATENTS

915,079 7/1964 Germany.

OTHER REFERENCES

Ser. No. 390,677, Hasse (A.P.C.), published May 4, 1943, now abandoned. Copy in 269–240.

WILLIAM W. DYER, JR., *Primary Examiner.*

ROBERT C. RIORDON, *Examiner.*