May 24, 1949. O. F. TREFZ 2,471,361

MACHINIST'S UNIVERSAL VISE

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Fig. 1.

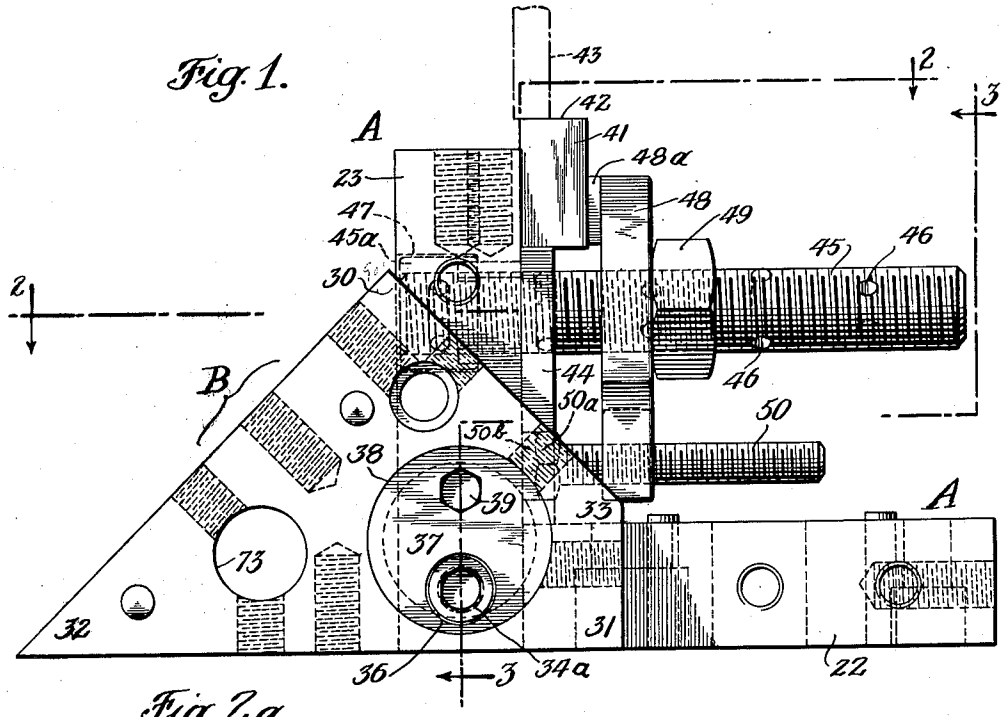


Fig. 2a.

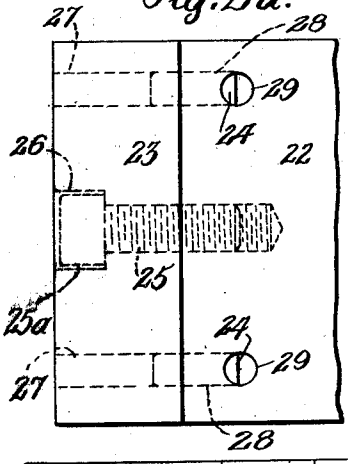
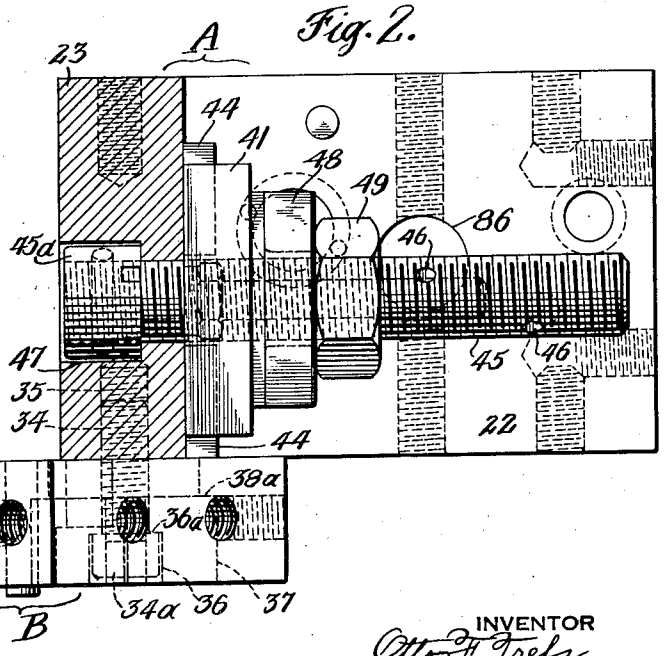


Fig. 2.



INVENTOR
Otto F. Trefz
BY
Symmestvedt & Lechner
ATTORNEYS

May 24, 1949. O. F. TREFZ 2,471,361

MACHINIST'S UNIVERSAL VISE

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Fig. 3.

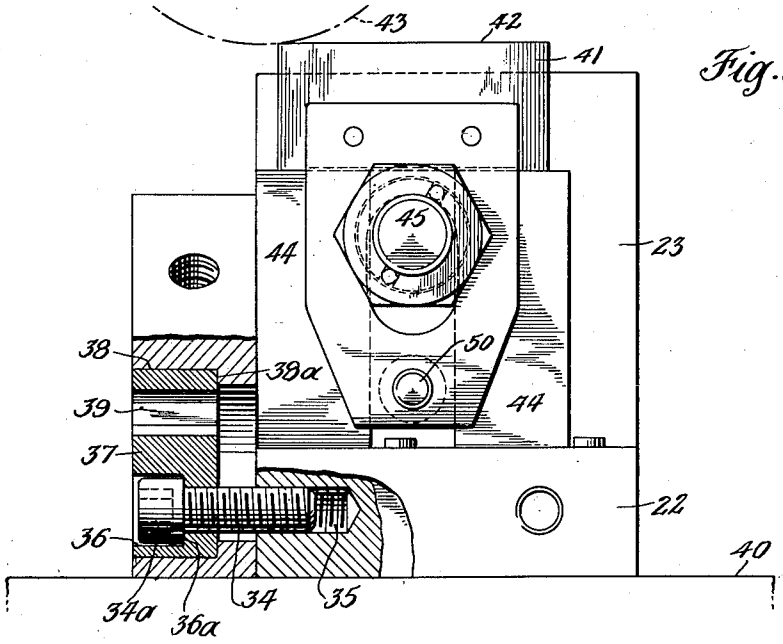


Fig. 4.

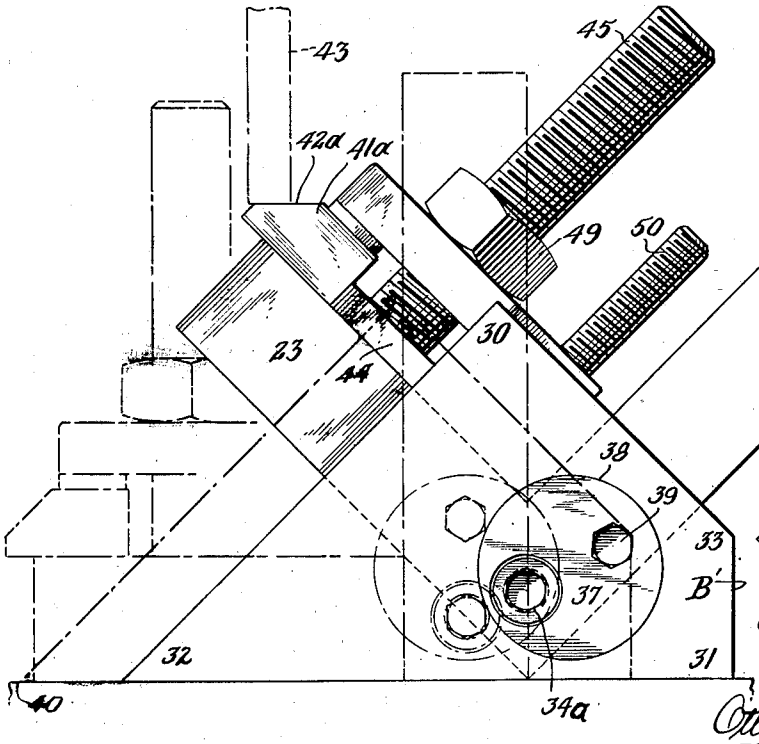
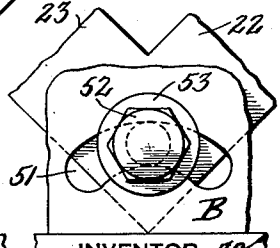


Fig. 5.



INVENTOR
Otto F. Trefz
BY
Symmestvedt & Lechner
ATTORNEYS

May 24, 1949. O. F. TREFZ 2,471,361

MACHINIST'S UNIVERSAL VISE

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Fig. 6.

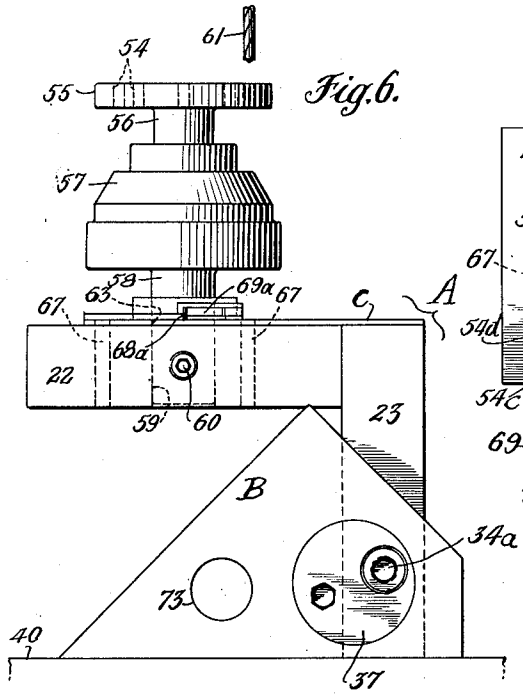


Fig. 7.

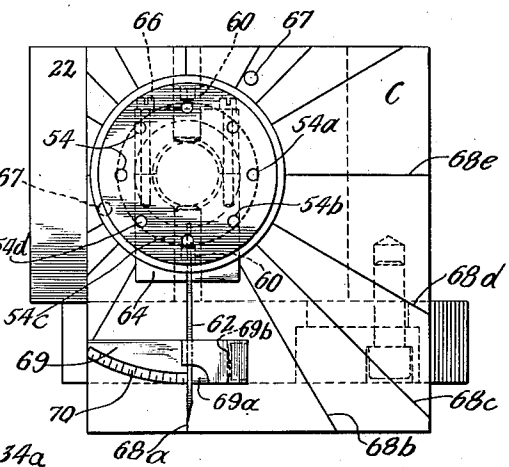


Fig. 8.

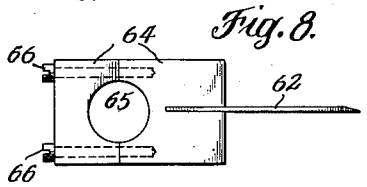


Fig. 9.

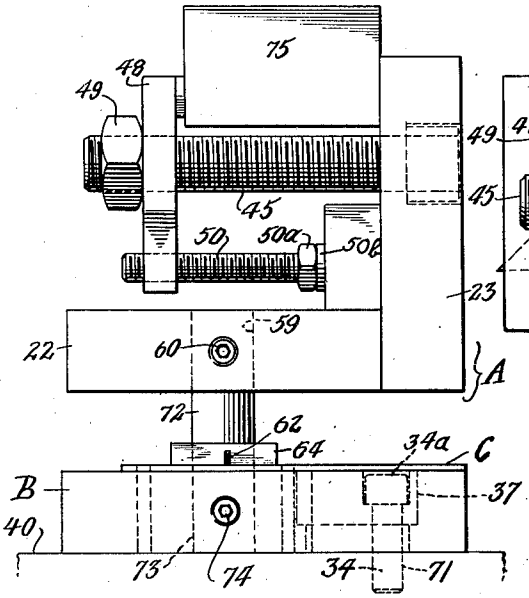
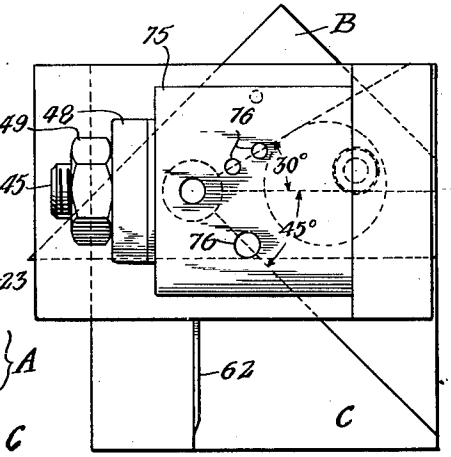


Fig. 10.



INVENTOR
Otto F. Trefz
BY
Dynnestvedt & Lechner
ATTORNEYS

May 24, 1949. O. F. TREFZ 2,471,361

MACHINIST'S UNIVERSAL VISE

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Fig. 11.

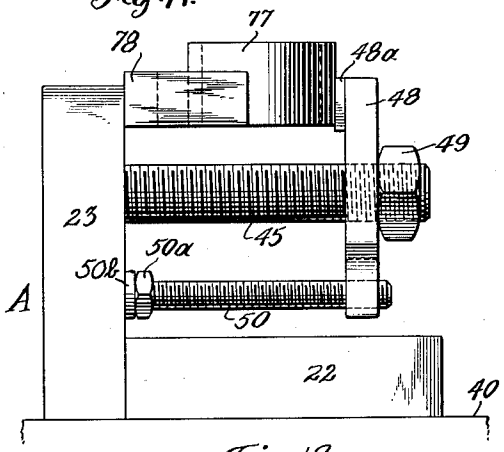


Fig. 12.

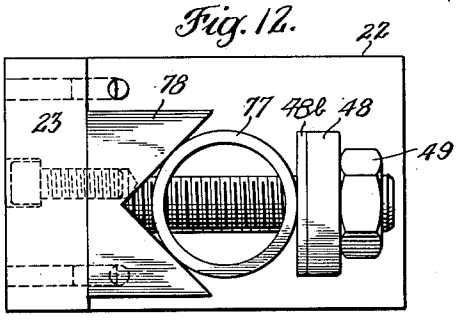


Fig. 13.

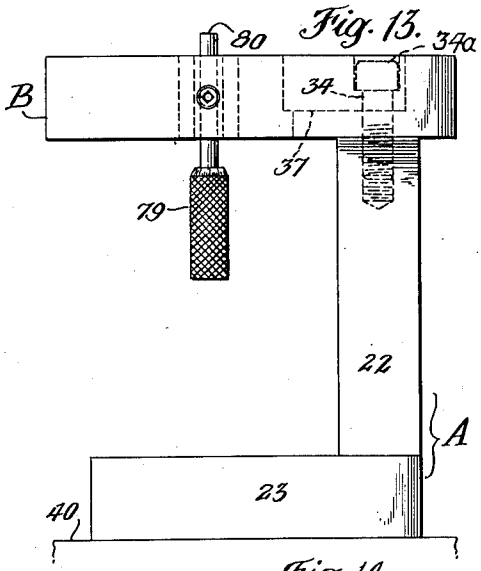


Fig. 14.

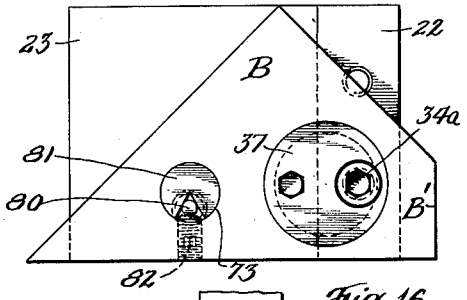


Fig. 15.

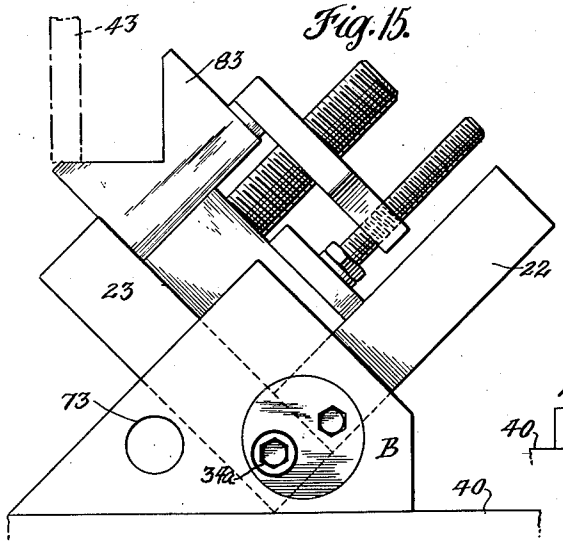


Fig. 16.

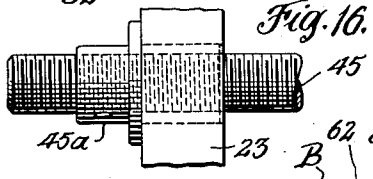
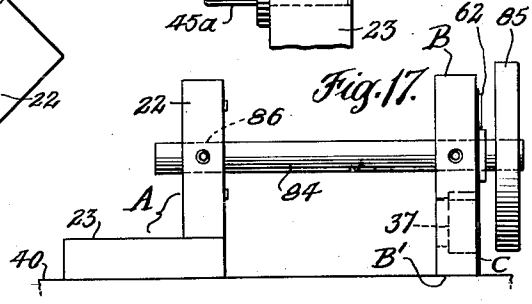


Fig. 17.



INVENTOR
Otto F. Trefz
BY
Synnestvedt & Lechner
ATTORNEYS

Patented May 24, 1949 2,471,361

UNITED STATES PATENT OFFICE

2,471,361

MACHINIST'S UNIVERSAL VISE

Otto F. Trefz, Philadelphia, Pa.

Application July 18, 1945, Serial No. 605,805

9 Claims. (Cl. 90—59)

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This invention relates to a machinist's holding tool or vise and is particularly concerned with the provision of a device of this character which has such greatly increased adaptability over structures heretofore known to those skilled in the art as to render it of almost universal usefulness within, of course, the size limits to which it has been built.

More specifically, the invention relates to the so-called knee or angle plate commonly used by machinists and is concerned with the provision of a novel device of this nature, together with means for simply and easily adjusting its angular position and thereafter holding it firmly in such position without the use of any of the common and more or less clumsy and space-consuming clamping devices which, heretofore, have limited the adaptability and usefulness of angle plates.

Among the objects of the invention are—(1) the provision of a device of this kind in which the knee or angle plate can be mounted on any one of its edge faces and adjusted to any angular position on said edge and thereafter clamped firmly in its position of adjustment; (2) the provision of a device of this character which affords far greater clearances and freedom for manipulating the tools with which the work is to be done; (3) the provision of a device of this nature which is so flexible in its application as to render the same adaptable for a far wider variety of operations than has heretofore been possible and thereby enable the machinist to expeditiously and accurately perform almost any required operation; (4) the provision of a device of this nature with which it is possible to hold a wide variety of regularly or irregularly shaped pieces of work; (5) the provision of improved setting and indexing means for a device of this nature; (6) the provision of an indexing device together with a cooperating sine bar by means of which an almost indefinite variety of operations requiring different angular settings or relationships may be performed; and, in general, to provide a machinist's knee and means for adjusting and holding the same which render the device especially valuable for the making of instruments, parts, or machines or precision.

How the foregoing objects, together with such other objects as may appear hereinafter or are incident to my invention, are attained is illustrated in preferred embodiments in the accompanying drawings wherein—

Figure 1 is a side elevation of the principal

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parts of my device showing the same in one assembled relationship;

Figure 2 is a sectional plan view taken as indicated by the line 2—2 on Figure 1;

Figure 2a is a partial plan view illustrating a detail of construction;

Figure 3 is a sectional end view taken as indicated by the line 3—3 on Figure 1;

Figure 4 is an elevational view similar to Figure 1 but showing the parts in a different assembled relationship;

Figure 5 is a partial side elevation illustrating a modification of a detail;

Figure 6 is a side elevation illustrating the principle parts of my device in an assembled relationship somewhat different than that which is illustrated in Figure 1 and incorporating also an indexing feature;

Figure 7 is a plan view of Figure 6;

Figure 8 is a plan view of a part of the indexing mechanism employed in Figures 6 and 7;

Figure 9 is an elevational view illustrating still another manner of employing my device for indexing purposes;

Figure 10 is a plan view of Figure 9;

Figure 11 is an elevational view showing how the knee or angle plate member of my invention can be employed in the ordinary manner;

Figure 12 is a plan view of Figure 11;

Figure 13 is an elevational view illustrating still another way in which the principal parts of my device can be cooperatively arranged;

Figure 14 is a plan view of Figure 13;

Figure 15 is an elevational view showing how my device can be used in the grinding of a V-block;

Figure 16 is a partial view illustrating certain details of a spindle employed with my device; and

Figure 17 is an elevational view illustrating still another way in which the principal parts of my invention may be arranged for an indexing or graduating operation.

Referring to the drawings and, in the first instance, particularly to Figures 1 to 4 inclusive, it will be seen that the principal parts of my invention comprise a knee or angle plate A and what I have termed a foot plate B adapted to operatively cooperate with the angle plate in a multitude of different ways as will further appear. The knee or angle plate is preferably constructed of two individual plates 22 and 23 each of which is carefully and accurately machined so that all opposite faces and edges are absolutely parallel and all angles are right angles whereby it will always be "in square" on the face plate of the

machine with which it is being used, regardless of the surface or edge upon which the knee is placed.

The plates 22 and 23 may be secured together by means of a pair of positioning dowels 24 (see Figure 2a) and a bolt 25 the head 25a of which fits into a suitable recess 26 near the bottom of the plate 23 so as not to project beyond the outer face of the plate. The dowels are slipped into position through suitable apertures 27 in the plate 23 and aligned apertures 28 in the plate 22. The plate 22 is also provided with similar apertures 29 at right angles to the apertures 28. When the two plates 22 and 23 are placed together, as illustrated, and clamped in position by bolt 25 they form a true right angle.

The foot plate B is preferably formed in the shape of a trapezium the opposite angles 30 and 31 of which are true right angles and the opposite angles 32 and 33 of which are, respectively, an angle of 45° and an angle of 135°. All edges and faces of the foot plate are also accurately machined so that the member is always "in square" with the face plate of the machine on which it rests regardless of which face, side or edge happens to be supporting it at the moment.

The foot plate B is primarily a supporting plate for the angle plate A although, as will further appear, it, in turn, may be supported by the angle plate for the performance of any operation where such an arrangement would be more convenient. The foot plate is secured to the knee or angle plate by means of a bolt the shank 34 of which is threaded to cooperate with a correspondingly threaded opening 35 near the bottom of an edge face of the plate 23. The head 34a of this bolt fits into a hole 36 in a disk crank member 37, the under side of the head 34a being adapted to abut against the shoulder 36a of the hole 36.

The disk crank member fits a cylindrical bore 38 in the foot plate B and is adapted to abut against a shoulder 38a. Here again the parts are carefully and accurately machined so that the disk crank member has a smooth running fit in the bore 38 and so that both its inner and outer faces are absolutely square and in alignment respectively with the shoulder 38a and the outer face of the foot plate. As best seen in Figure 3, the hole 36 is located somewhat off center in the disk crank member 37 so that when said member is rotated the position of the bolt 34 can be adjusted in a vertical direction so as to accommodate it to varying elevations of the opening 35, as will further appear. The disk crank member 37 is also provided with another hole 39 in which a suitable tool can be inserted, if necessary, for the purpose of rotating the disk crank member 37 as occasion may demand during the adjustment of the position of the angle plate A.

The head 34a of the bolt is formed with an hexagonal opening 34b into which a suitable wrench may be fitted for the purpose of tightening or loosening the bolt. It will now be apparent that when the bolt is screwed up tightly the knee or angle plate A is firmly and rigidly secured against the adjacent face of the supporting or foot plate B.

Assuming now that the angle plate is to be positioned as shown in Figures 1 to 3 inclusive, I will now describe the procedure to be followed. The foot plate and the angle plate are placed upon the machine base 40 (see Figure 3) of the machine with which the device is to be used and the bolt 34 is started into the hole 35. A tool or wrench is then applied to the head of the bolt 34a and while carefully holding the foot plate and the angle plate in absolutely square position on the machine base 40 the wrench is then used to tighten the bolt 34 until the parts are rigidly connected together, the foot plate then acting to prevent displacement or tipping of the angle plate during the operation to be performed. If, when the angle plate and the foot plate are placed together, the bolt 34 does not quite register with the opening 35, the disk crank member 37 is rotated slightly so as to bring the bolt and hole into perfect alignment, after which the tightening operation can be effected as already described.

The device is then "in square," as it is termed, and may be used, for example, for the purpose of holding a member 41 upon which a flat face 42 is to be ground by means of the grinding wheel 43.

The piece 41 may be held on the angle plate in any desired manner although I prefer to employ the so-called face plate clamping instead of what is known as parallel side clamping for the reason that it interferes to a lesser extent with adjustment of the angular position of the knee A. In Figures 1 to 3 the work piece 41 rests upon a pair of parallel bars 44, one on each side of the clamping spindle or bolt 45, the bars 44 in turn resting at their lower ends on the flat upper face of the plate 22 of the knee.

The spindle 45 projects through from the outer face of the plate 23. The spindle is threaded throughout as shown and carries an adjustable head in the form of a nut 45a which can be screwed to any desired position along the spindle and held in place by a suitable set screw adapted to extend through any one of a series of holes 46 in the spindle. In Figures 1 to 4 inclusive, for example, the head 45a is positioned near one end of the spindle and fits into a recess 47 in the plate 23 so that the head does not project beyond the outer face of the plate. In this way the spindle and its head will in no way interfere with an adjustment of the knee A involving a 90° turn to the left, as viewed in Figure 1, so that the plate 23 rests upon the face plate of the machine and the plate 22 is vertical. (Figure 4, dot and dash lines.)

It will thus be seen that the spindle 45 provides a means whereby the vise jaw 48 can be clamped against the face of the member 41 by means of the clamping nut 49 and a cooperating set screw 50, which latter projects through a suitably threaded opening in the bottom portion of the vise jaw 48. In doing this the jaw 48 is first brought lightly against the block 41 and then the set screw 50 is adjusted so that its head 50a just touches the adjacent side face of the plate 23 of the knee or angle plate A. After this adjustment has been made the clamping nut 49 is tightened up with a wrench in order to firmly grip the work piece 41. In this way the set screw prevents cocking of the jaw 48 and insures firm holding of the work.

Since my improved device is intended to be particularly applicable for use in the machining of precision parts, the face of the jaw 48 and the head of the set screw 50a are provided with pads of fiber or similar material, as indicated at 48a and 50b.

Reference will now be made specifically to Figure 4 in which figure I have shown my improved device as it would be employed to machine or grind an angular face 42a on a block 41a. It will be understood, of course, that for purposes of illustration the work pieces 41 and 41a and also the several work pieces appearing in the later

figures to be considered hereinafter are indicated as being very simple machine parts. Other and more complex parts can also be worked upon but for the sake of illustrating the invention it is unnecessary to go into more complicated shapes.

In Figure 4 the work piece 41*a* is clamped against the face of the plate 23 in exactly the same way that was employed for the clamping of piece 41 in Figures 1 to 3, so no further description of this will be made. However, in order to produce the angular face 42*a*, the angle plate or knee A is swung around to the position indicated where each plate 22 and 23 makes a 45° angle with the face plate 40 on the machine. Since all parts are "in square" this naturally will enable the grinding wheel 43 to the cut the face 42*a* at an angle of 45° with respect to the parallel sides of the work piece 41*a*.

In order to bring the angle plate or knee into the position shown in Figure 4 the bolt 34 is loosened slightly and a tool is inserted in the hole 39 of the disk crank member 37 which can then be used as a handle to effect rotation of the member 37. As the angle plate or knee swings counterclockwise it is obvious that the hole 35 into which the bolt 34 is screwed will be raised slightly in a vertical direction and this lifting of the hole 35 and bolt 34 is permitted by suitable rotation of the disk crank member 37, as will be clearly understood from an inspection of Figure 4. This can be accomplished by a slight jiggling action as the movement of the angle plate is continued and when it reaches its desired position the lower corner of the angle plate must rest squarely on the face plate and the lower edge of the foot plate must also rest squarely on the face plate, after which the bolt 34 can be tightened up as before in order to lock the angle plate and the foot plate. The foot plate will then hold the angle plate or knee rigidly in the desired position for the machining operation necessary to cut the face 42*a*.

In Figure 4 I have also shown in dot and dash lines a position in which the angle plate is swung all the way around 90° from the position shown in Figure 1 to a position where the plate 23 rests upon the face plate 40.

While I prefer to employ the disk crank member 37 for adjusting the angle plate, as illustrated in Figures 1 to 4, because it is stronger and affords greater accuracy and rigidity due to its large cylindrical bearing in the foot plate B, yet it is possible to employ other types of clamping such, for example, as that which is illustrated as a modification in Figure 5. In this figure the foot plate B is provided with an arcuate slot 51 through which a headed securing bolt 52 is adapted to pass. The bolt 52, of course, is designed to cooperate with a hole such as the hole 35 shown in Figures 1 to 4 and clamping is effected by tightening up the bolt so that the foot plate B is clamped between the washer 53 and the adjacent face of the angle plate.

From all of the foregoing it will be clear that with my improvements it is possible to adjust a machinist's knee or angle plate to any desired position within a 90° arc and then to firmly and rigidly clamp it in absolutely true position for performance of the desired work. Furthermore, machine parts of almost any type (within the size capacity of the knee, of course) can be clamped in desired position on the angle plate. It is also feasible to clamp the work to either side of the angle plate by providing the proper openings in plate 22 as well as in plate 23 and, finally, by providing a series of openings corresponding to the opening 35, it is quite possible to clamp the angle plate and the foot plate in various different relationships, some of which are illustrated in succeeding figures of the drawings now to be discussed. It is also possible to use either one or the other of the two plates 22 and 23 in association with the foot plate B, although for most purposes it is more convenient to use the two plates together in the form of the customary angle plate or knee. However, such independent use of the plates 22 and 23 is contemplated by my invention and is intended to be included within the scope of the appended claims.

Referring now to Figures 6, 7 and 8, I have shown how my device may be employed for indexing purposes, the particular illustration being for the drilling of a plurality of evenly spaced holes 54 in a circular arrangement on a work piece having a disk portion 55 and a shaft portion 56 by means of which latter it is secured in a chuck 57 of any well known construction. The chuck 57 has a spindle or shaft 58 which fits a hole 59 in the plate 22 of the knee or angle plate A and is secured in place by means of set screws 60 which project inwardly through suitable openings in opposite edge faces of the plate 22.

It will be noted, however, that the angle plate is shown in an entirely different relationship with respect to the foot plate B, namely with the plate 23 clamped against the side of the foot plate and the plate 22 extending horizontally therefrom somewhat in the nature of a shelf or table. The edge of the plate 23 is provided with a suitably threaded hole corresponding to the threaded aperture 35 already described in connection with Figures 1 to 5, and clamping is again effected by means of the disk crank member 37 and the bolt 34. The plate 22, therefore, is held in perfect parallelism with the face plate 40 of the machine on which the tool is being used so that the holes 54 may be drilled in perfect vertical relationship thereto by means of the drill 61.

In order to accomplish the required indexing or spacing of the holes 54, I associate with the chuck 54 an indexing plate C and an indexing finger 62. The plate C is provided with an aperture 63 which is placed in registry with the opening 59 in the plate 22 before the chuck spindle 58 is inserted. In this position the square edges of the plate can be positioned so that they exactly parallel the edge faces of the angle plate.

The index finger 62 is associated with a split collar device 64 having a central aperture 65 adapted to fit snugly around the spindle 58 of the chuck. The two parts of the collar 64 can be clamped together or loosened slightly by means of the set screws 66.

In assembling the parts illustrated in Figures 6 to 8 inclusive, the plate C, as already stated, is placed on the top surface of the plate 22 with its aperture in alignment with the aperture 59 and its edges parallel to the edges of the angle plate. For the sake of absolute accuracy this is accomplished by means of positioning pins or studs 67 secured in suitable apertures and projecting upwardly beyond the upper face of the plate 22. These pins fit correspondingly located holes in the plate C. The collar 64 of the index finger 62 is placed on the plate C with the screws 66 loosened slightly so as to effect a small degree of separation between the collar

members 64 and then the spindle 58 of the chuck is passed through the assembly, whereupon the spindle 58 is secured by means of the set screw 60.

The plate C is provided with radial graduations struck from the center of the aperture 63. Certain of these graduations have been referred to by the reference characters 68*a* to 68*e* inclusive. To begin with the finger 62 can be swung into alignment with the graduation 68*a* and when placed in this position the collar members 64 are tightly clamped against the spindle 58 by tightening up on the screws 66. In this position the first hole 54*a* may be drilled. In order to drill the hole 54*b* the set screws 60 are loosened and the chuck is rotated counter-clockwise until the index finger registers with the graduation 68*c* and then the set screws 60 are again tightened while the hole is being drilled. Following this, in order to drill the hole 54*c*, the set screws 60 are again loosened, the chuck again rotated, this time until the finger registers with the graduation 68*e*, following which the set screws 60 are once more tightened and the hole drilled. This procedure may be repeated with any desired spacing for the holes 54. It is obvious, however, that in order to drill the hole 54*d* the index finger will have to be loosened on the spindle 58 by slightly unscrewing the set screws 66, after which it can be swung in a clockwise direction from the position of registry with the graduation for hole 68*e* into a position of registry with the graduation 68*a*, whereupon the set screws 66 are again tightened. Following this the set screws 60 are once more loosened and the chuck is rotated in a counter-clockwise direction carrying with it the index finger until it registers once more with the graduation 64*c*, whereupon the hole 54*d* can be drilled. These operations are repeated whatever number of times are necessary to complete the desired series of holes.

In instances where finer adjustments are required than are given by the graduation marks on the plate C I employ a vernier member 69, having an arcuate scale 70, which member can be mounted upon the index finger 62, the mounting being accomplished in any suitable manner as, for example, by a friction fit, so that the member 69 may be slipped over the free end of the finger 62, there being a small filler block 69*a* between the finger 68*a* and the U-shaped spring 69*b*. The vernier scale, of course, must be related to the graduations on the plate C in the desired manner but for the sake of illustration it will be assumed that the graduations on the vernier are of 5 minute spacing so that if the finger is rotated until the first graduation marked on the vernier registers with the line 68*a* the member to be graduated will have been moved five minutes.

In Figure 6 it will be seen that the angle plate A has been set in a position where the holes will be drilled normally to the disk 55 but if it should be desired to drill the holes at an angle this can be accomplished by swinging the angle plate into the desired position by means of the disk crank clamping device already described.

In Figures 9 and 10 I have shown another way of cooperatively arranging or associating the angle plate A with the foot plate B in which the foot plate, instead of being in an upright position as shown in Figures 1 to 6, is laid flat on the face plate 40 of the machine to which it may be secured by means of the disk crank member 37 and the bolt 34 in the same manner as it was previously secured to the angle plate, there being, of course, a suitable screw threaded aperture 71 in the face plate 40 with which the bolt 34 cooperates. In this instance the angle plate is mounted on a spindle 72 which fits the opening 59 in the plate 22, the set screws 60 again being employed for holding the spindle tight in the hole. The other end of the spindle is projected downwardly into the hole 73 in the angle plate B, the spindle being held in the angle plate hole by means of set screws 74. In this arrangement a work piece 75 can be clamped in position to receive the necessary machining or other treatment in a manner exactly the same as already described in connection with Figures 1 to 4. For the sake of illustration it is assumed that the operation to be performed in Figures 9 and 10 is the drilling of a plurality of holes 76 which may be located in any required relationship by means of the indexing plate C and finger 62, as already described, although in this instance it will be understood, of course, that the indexing members C and 62 are mounted around the spindle 72.

In Figures 11 and 12 I have illustrated plate A as used in the customary manner directly on the face plate 40 without employing my improved clamping or foot plate B, although it will be understood that the foot plate can be associated with the angle plate in these figures where the work to be performed demands an angular position other than the square position shown. In these figures any necessary machining operations, such as grinding, drilling, milling or laying out can be performed on a tubular member or sleeve-like work piece 77 which is clamped in place by interposing a V-block 78 between the sleeve 77 and the plate 23 of the knee A. In this setup the vise jaw 48, the clamping spindle 45, the set screw 50 and the locking nut 49 are employed in exactly the same manner in which they were employed in the setup of Figures 1 to 4.

In Figures 13 and 14 still another possible setup of my device is illustrated in which I have shown a micrometer screw 79 secured in place for grinding the face 80 thereof. In this instance, the angle plate A rests on the face plate 40 of the machine with which it is to be used and the foot plate B is secured against the outer edge face of the plate 22, the disk crank clamping member 37 and the bolt 34 again being employed to rigidly secure the foot plate B against the end of the plate 22 as shown. The micrometer screw 79 is secured to the foot plate by means of a small V-block 81 which fits the aperture 73 in the foot plate. A set screw 82 locks the micrometer screw in place.

At this point I should like to point out that the face plate 40 of the machine with which my device is employed may, of course, be of the magnetic clutch type and would preferably be of this type in setups such as shown in Figures 11 to 14 inclusive.

Figure 15 illustrates a setup for grinding a V-block 83, the clamping of the block on the plate 23 and the adjustment of and the support for the angle plate being provided for by means of the foot plate B in the manner already described in connection with previous figures.

Figure 16 merely illustrates an arrangement in which the spindle 45 extends entirely through the plate 23 and projects outwardly toward the left instead of being flush within the confines of the plate 23 as it is in Figures 1 to 4. Some situations require a longer spindle 45 which can be accommodated to the device in this way although it

will be understood, of course, that in such situations it would not be possible to employ as great a variation in the angular adjustments of the angle plate.

Figure 17 illustrates still another possible use of my improved device in which a shaft **84**, carrying at one end a member **85** to be graduated, is supported between the angle plate A and the foot plate B, the shaft **84** having a bearing adjacent one end in the angle plate and at the other end in the foot plate, the opening **73** in the foot plate being employed for the purpose and another corresponding opening **86** being provided in the plate **22** for instances of this kind, the indexing plate C and the finger **62** being associated with the foot plate B and the shaft **84** in a manner exactly similar to the way in which these members have been previously employed. In this instance the foot plate has been mounted so that it rests upon its shortest side, B'.

I claim:

1. For use on a machine tool face plate, a machinist's universal vise, comprising a work-holding plate, a cooperating foot plate, a threaded hole in an edge of the holding plate, a headed clamping bolt the shank of which is threaded to screw into said hole, and an opening in the foot plate through which the shank of said clamping bolt is adapted to pass, said opening being constructed and arranged so as to provide for an arcuate path of travel for the bolt upon relative angular movement between the holding plate and the foot plate, whereby the holding plate may be clamped in desired angular relationship to the foot plate and both plates held "in square" on the supporting face plate.

2. A machinist's universal vice, comprising a work-holding plate, a cooperating foot plate, a circular opening in the foot plate having an internal shoulder, a disk crank rotatable in said opening and adapted to seat on said shoulder, a shouldered aperture in said disk crank, a threaded hole in an edge of the holding plate, and a headed clamping bolt having its shank threaded to fit the threads in said holding plate hole, whereby the holding plate and the foot plate may be adjusted as to their relative angularity in the plane of the foot plate and then clamped together.

3. A machinist's universal vice, comprising a 90° angle plate with a plurality of similarly threaded holes in edge faces thereof, a cooperating foot plate, a circular opening in the foot plate having an internal shoulder, a disk crank rotatable in said opening and adapted to seat on said shoulder, a shouldered aperture in said disk crank, and a headed clamping bolt having its shank threaded to fit the threads of said angle plate holes, said disk crank and bolt being adapted to cooperate with any one of said holes whereby the foot plate may be angularly adjusted with respect to and clamped against the corresponding edge of the angle plate.

4. The device of claim 2 in which the foot plate is a trapezium having one pair of opposite angles right angles.

5. The device of claim 1 in which the foot plate is a trapezium having one pair of opposite angles right angles.

6. The device of claim 3 in which the foot plate is a trapezium having one pair of opposite angles right angles.

7. The device of claim 2 in which the foot plate is a trapezium having one pair of opposite angles right angles and the other pair a 45° angle and a 135° angle.

8. The device of claim 1 in which the foot plate is a trapezium having one pair of opposite angles right angles and the other pair a 45° angle and a 135° angle.

9. The device of claim 3 in which the foot plate is a trapezium having one pair of opposite angles right angles and the other pair a 45° angle and a 135° angle.

OTTO F. TREFZ.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
963,559	Hines	July 5, 1910
1,015,497	Kaster	Jan. 23, 1912
1,169,900	Winter	Feb. 1, 1916
1,169,928	Commons	Feb. 1, 1916
1,323,901	Nelson	Dec. 2, 1919
1,374,759	Noddings	Apr. 12, 1921
2,315,433	Kulla	Mar. 30, 1943
2,347,111	Jesionowski	Apr. 18, 1944
2,365,436	Saucier	Dec. 19, 1944
2,366,385	Comfort	Jan. 2, 1945