June 5, 1956 O. A. COSTELLO 2,748,624

ROTARY TABLE

Filed May 29, 1951 4 Sheets-Sheet 1

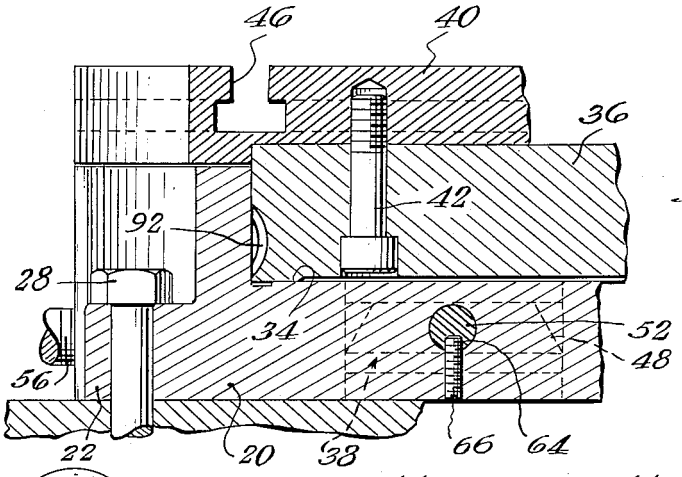


Fig. 7.

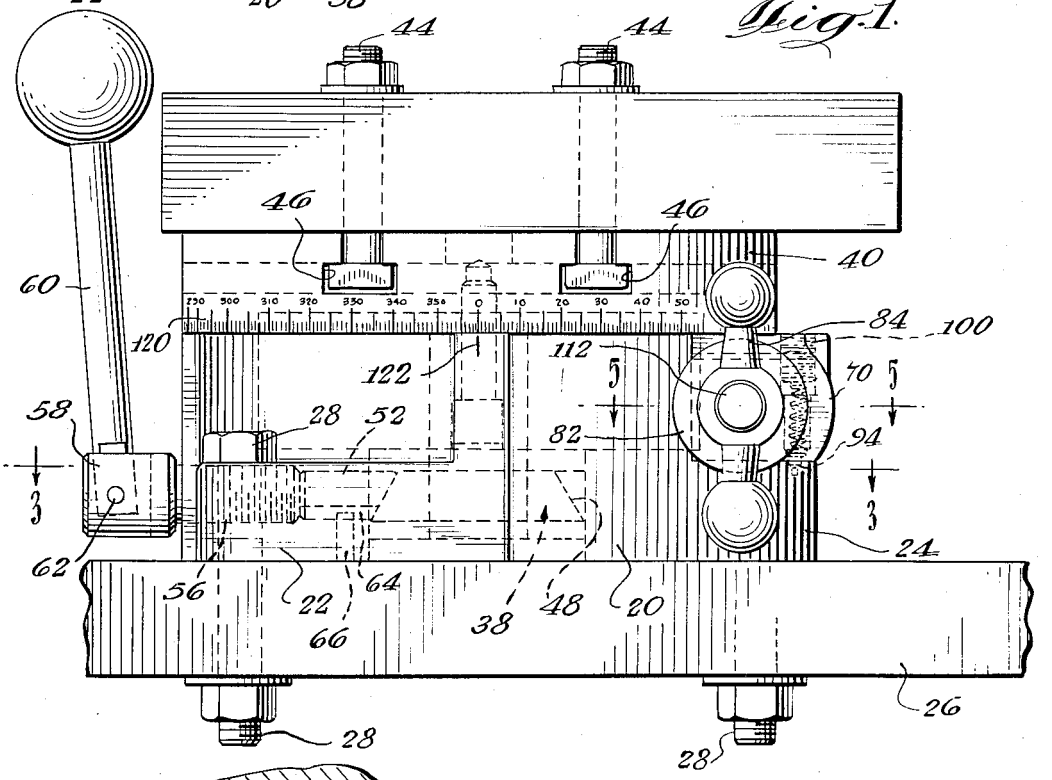


Fig. 1.

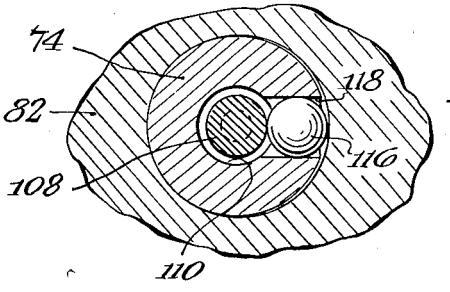


Fig. 8.

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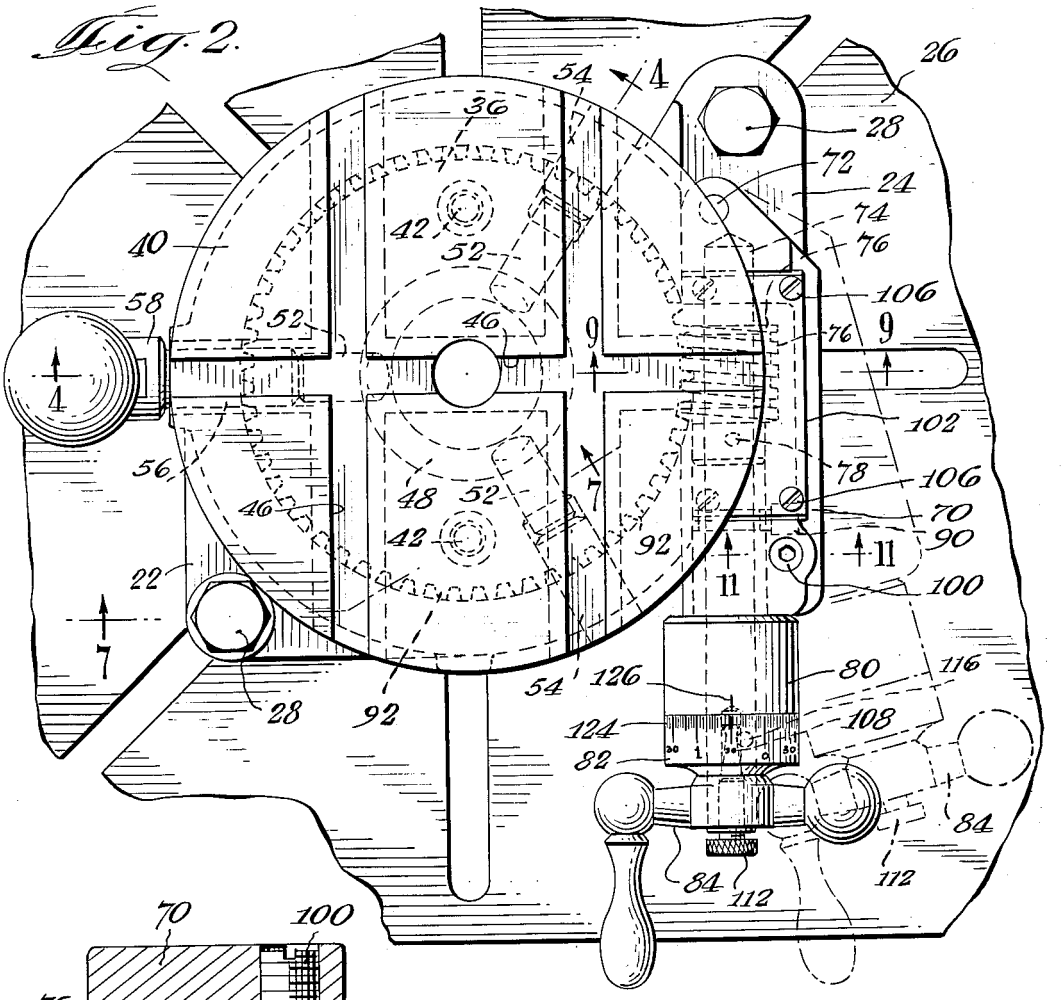
Fig. 2.



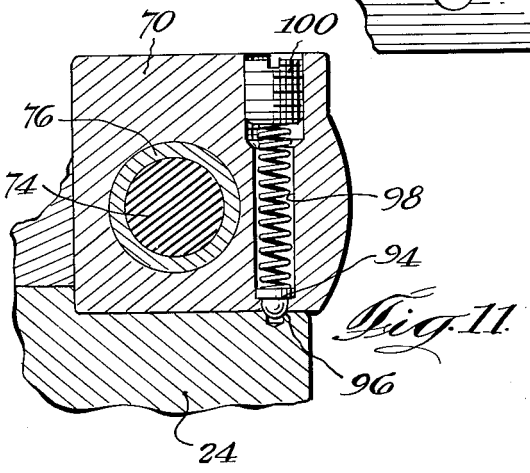




Fig. 11.

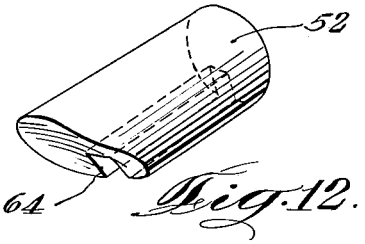



Fig. 12.

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Fig. 3.

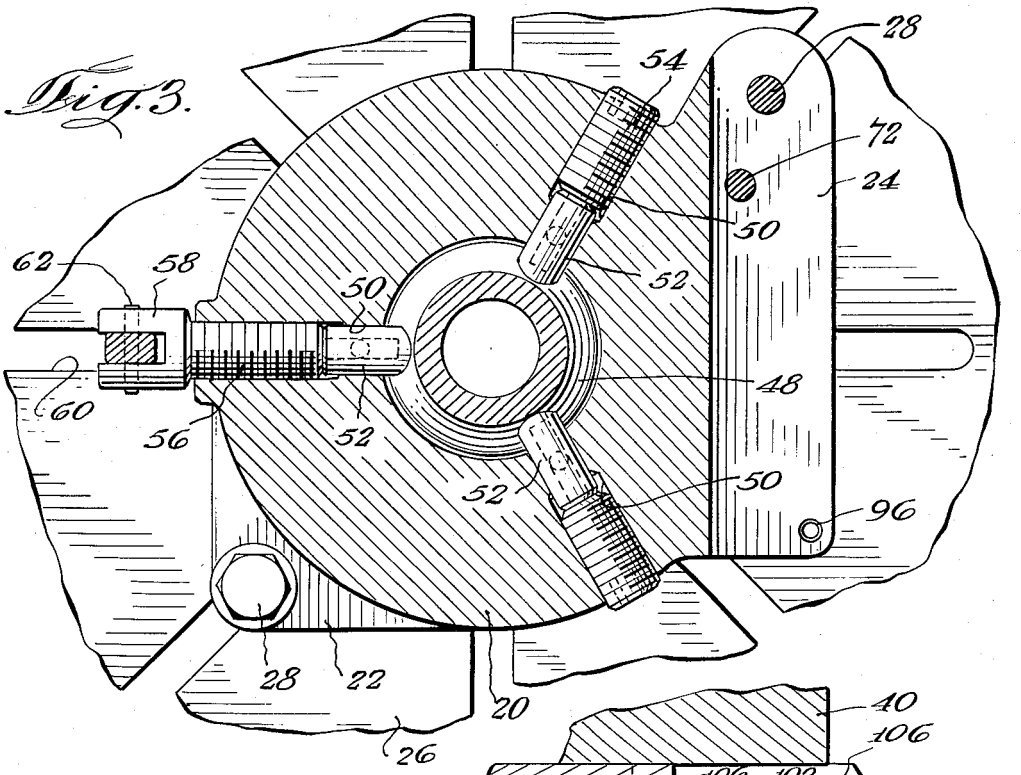


Fig. 9.

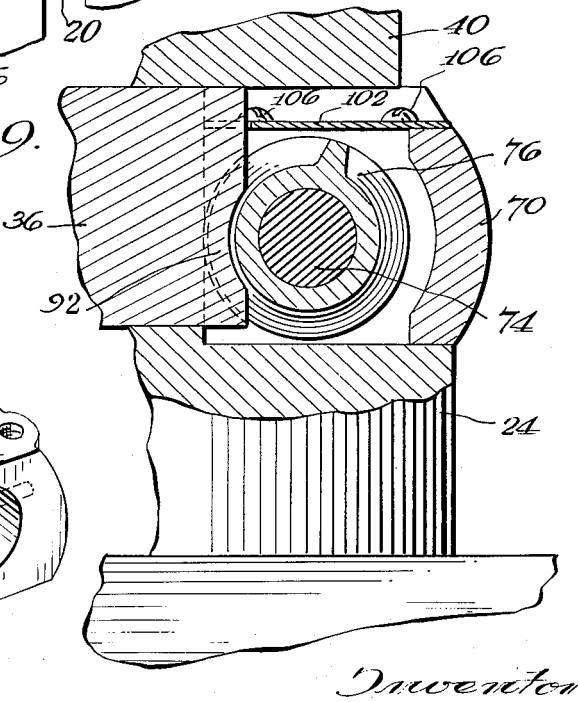


Fig. 10.

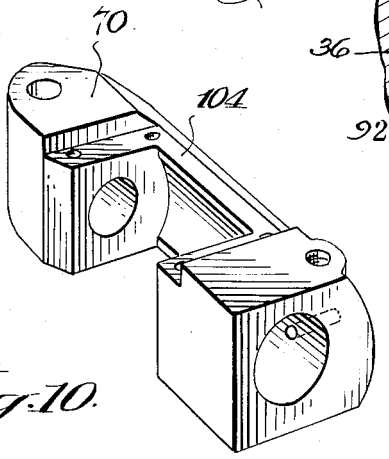


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Fig. 4.

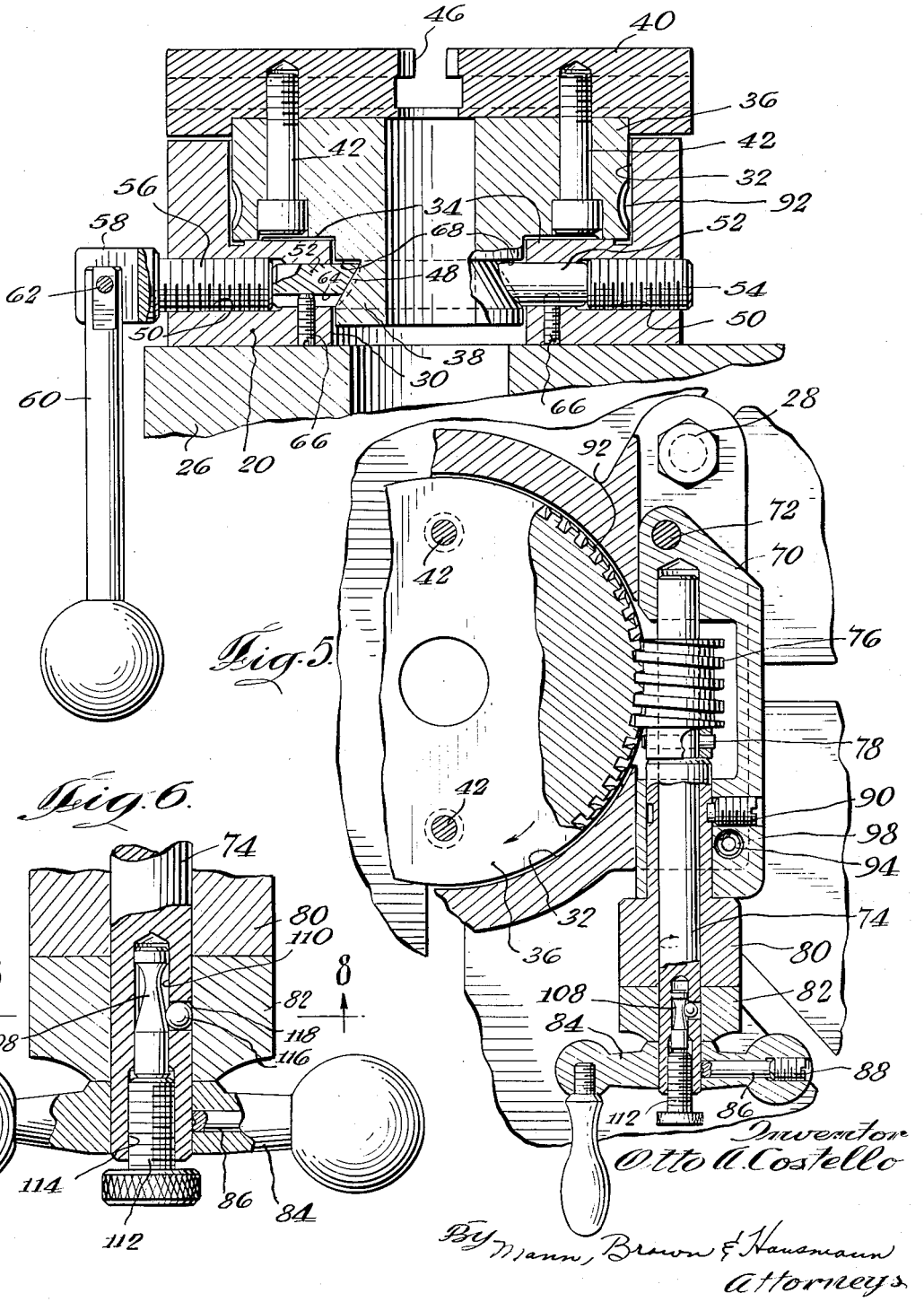


Fig. 5.

Fig. 6.

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2,748,624

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2,748,624

# ROTARY TABLE

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Application May 29, 1951, Serial No. 228,859

10 Claims. (Cl. 74—813)

My invention relates to rotary tables having a wide variety of uses and applications in machine tools such as shapers, drill presses, lathes, milling machines and the like, as well as being adapted for bench layout work.

An object of my invention is to provide a new and improved table that may be more quickly and conveniently rotated from one exact position to another.

Another object is to provide a new and improved pivotal support which more accurately and securely holds the table in exact positions and which may be readily adjusted to compensate for wear.

Another object of my invention is to provide a new and improved arrangement of scales.

Another object is to provide a new and improved means for locking an adjustable scale in various positions.

Another object is to provide a new and improved arrangement of gearing for accurately positioning the rotary table.

These and other objects will become apparent as the disclosure proceeds and the description is read in conjunction with the accompanying drawings, in which:

Fig. 1 is an elevational view of the rotary table of my invention showing a work piece on the table;

Fig. 2 is a plan view of the rotary table;

Fig. 3 is a plan view partly in section taken on the line 3—3 of Fig. 1;

Fig. 4 is an irregular sectional view taken on line 4—4 of Fig. 2;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 1;

Fig. 6 is a partial detail view showing the assembly for locking the fine adjustment scale on the shaft;

Fig. 7 is a detail sectional view taken on line 7—7 of Fig. 2;

Fig. 8 is a detail view taken on line 8—8 of Fig. 6;

Fig. 9 is a detail sectional view taken on line 9—9 of Fig. 2;

Fig. 10 is a perspective view of the table rotating mechanism housing;

Fig. 11 is a detail sectional view taken on line 11—11 of Fig. 2; and

Fig. 12 is a perspective view of the clamping shoe.

My novel rotary table has a cylindrical, hollow base 20 with lateral flanges 22 and 24 (Figs. 2 and 3) attached to a work bench 26 by bolts 28 passing through the flanges and slots in the work bench. The base has a lower bore 30 (Fig. 4) and a larger upper bore 32, which form therebetween an internal seat 34. A worm wheel 36 is inserted in the upper bore 32 to rest upon the seat 34, and has a cylindrical depending portion 38 adapted to fit snugly in the lower bore 30. A work holding member 40 is secured to worm wheel 36 by machine screws 42 and the work piece is secured to member 40 by bolts 44 (Fig. 1), whose heads are disposed within T-slots 46 in the work holding member. When the work piece is to be rotated, the worm wheel 36, member 40 and the work piece will be rotated relative to the base, as will be hereinafter explained. The worm wheel 36 and holding member 40 may be called the table.



A novel feature of my invention is the means I have provided to lock the worm wheel in the base. As seen in Fig. 4, the depending portion 38 has been cut away to form an inclined circumferential bearing surface 48. Referring to Figs. 3 and 4, it will be noted that the lower part of base 20 has three partially threaded radial bores 50 in which clamping shoes 52 are carried in alignment with bearing surface 48. Socket headed lock screws 54 are threaded into two of the bores 50 and a lock screw 56 having a bifurcated head 58 is threaded into the other bore 50. A handle 60 is connected to lock screw 56 by a pin 62. The lock screws 54 are threaded into the bores 50 until the clamping shoes 52 associated therewith engage the bearing surface 48. The handle 60 may then be operated to either force the clamping shoe 52 associated therewith into engagement with bearing surface 48 and lock the worm wheel 36 to the base or to release the clamping shoe to permit rotation of the worm wheel. Thus, with this three point clamping it is only necessary to operate one of the lock screws and this is easily and quickly performed by handle 60.

As seen in Fig. 12, the clamping shoe 52 has an arcuate face that corresponds with the curvature of the bearing surface 48. A longitudinal channel 64 is formed along the lower margin of the clamping shoe 52. In Fig. 4 it will be noted that pins or screws 66 are threaded through the bottom of base 20 and into the channels 64. These screws 66 prevent the clamping shoes 52 from turning in bores 50 and thus prevent the shoes from jamming which would result in gouging of bearing surface 48. It should be understood that the screws 66 do not, however, hinder the movement of the shoes 52 axially of the bores 50.

Besides providing positive locking of the worm wheel 36, my novel locking means prevents any movement of the worm wheel 36 axially of itself whether the wheel is free to rotate, or locked in place. This feature is effected by inclining the bearing surface 48 relative to the axis of wheel 36 and by providing the shoes 52 with complementary inclined faces. Thus, as seen in Fig. 4, the wheel 36 cannot be moved upwardly due to shoes 52 engaging the bearing surface 48, whether they are in the locking position or not, and locking action of the shoes draws the wheel 36 into firmer engagement with the seat 34 which supports the worm wheel at all times. However, the wheel 36 can be conveniently removed from base 20 by simply removing the lock screws 54 and 56 and shoes 52.

Another aspect of my locking means is that any wear on the bearing surface 48 will not affect the alignment of the wheel 36 within the base 20, since the wear can be compensated for by adjusting the shoes 52 so that the depending portion 38 is centrally located in bore 30. Therefore, the surfaces of depending portion 38 and bore 36 is not subjected to any wear and true alignment is assured.

A gear housing 70 (best seen in Fig. 10) is pivotally secured to the lateral flange 24 of base 20 by a hinge pin 72 (Fig. 5). This housing 70 has a shaft 74 journaled therein. A worm gear 76 is secured to the shaft by a pin 78. Also mounted on this shaft are a sleeve 80, a graduated collar 82, and a ball crank 84, secured to the shaft by pin 86 and lock screw 88. The worm 76 is disposed within the housing 70 and the sleeve 80 is held fast to housing 70 by a screw 90. The collar 82 is rotatably mounted on shaft 74 and may be locked thereto in a manner subsequently described.

The worm 76 is so disposed within housing 70 that it will engage teeth 92 on worm wheel 36 when the housing is in the position shown in Fig. 5. It should be noted that the base 20 has been cut away to expose the teeth 92 adjacent the lateral flange 24. When the

housing **70** is swung to the position shown in phantom in Fig. 2 the worm **76** will be out of engagement with teeth **92**.

This novel concept gives my rotary table a versatility heretofore unknown. In the position of the worm **76** shown in Fig. 5, the work piece may be rotated through the gearing (by turning ball crank **84**) to any position, and when the worm is swung about pin **72** to the position shown in phantom in Fig. 2, the work piece may be turned by hand without using the gearing. As will be hereinafter explained, the concept of having the worm **76** adapted to engage or disengage the worm wheel **36** will enable the operator to approximately adjust the work piece to the desired position by hand rotation, and then exactly position it by using the gearing.

In order to hold the worm **76** in engagement with wheel **36** I have provided a plunger **94** (Fig. 11) urged into an identation **96** in the lateral flange **24** by a spring **98**. A threaded plug **100** controls the amount of force holding the plunger **94** in the indentation **96**. The worm **76** is disengaged from teeth **92** by simply applying enough lateral force on ball crank **84** or sleeve **80** to swing the housing **70** about pivot pin **72** and urge the plunger **94** out of identation **96**. In order to keep dirt, metal shavings and the like away from the gearing I have provided a cover **102** held on a seat **104** (Fig. 10) of the housing **70** by screws **106**, as seen in Figs. 2 and 9.

As previously mentioned the graduated collar may be rotated with the shaft **74** or about the shaft, and herein lies another novel feature of my invention. Referring to Figs. 5, 6, and 8, it will be noted that an hour-glass shaped pin **108** is inserted in an axial bore **110** in shaft **74** and a thumb screw **112** is threaded into a tapped enlargement **114** of bore **110**. When the screw **112** is threaded into tapped hole **114** a sufficient distance, the arcuate sides of the pin **108** will jam the ball **116** in cross bore **118** against the collar **82** to secure the collar to the shaft **74**, but, as seen in Fig. 5, when the screw is threaded outwardly a sufficient distance, the ball will be released from engagement with the collar and permit the collar to rotate relative to the shaft.

Fig. 1 shows that work holder **40** has a circumferential scale **120** formed thereon adjacent an index mark **122** formed on base **20** and Fig. 2 shows a scale **124** formed on the collar **82** adjacent an index mark **126** on the sleeve **80**. These scales are utilized to facilitate positioning of the work piece. The scale **120** is usually laid out in degrees, while the scale **124** is usually laid out in minutes which, of course, refer to the angular movement of the worm wheel **36**. Assuming, for the sake of illustration, that the gear ratio between worm **76** and wheel **36** is 72:1, one revolution of the shaft **74** will move the wheel through 5° so the scale **124** may have five equally spaced marks, and these may be indicated as 0, 1°, 2°, 3°, and 4° marks. I have shown, in Fig. 2, the space between these degree marks as being divided into twenty equal spaces and, thus, each space represents three minutes of movement of the wheel. Hence, the scales **120** and **124** may be utilized to give an accurate setting to the work piece by reading degrees on scale **120** and degrees or minutes on scale **124**.

Since I have incorporated in my rotary table the novel concept of having the table rotated either by hand or by gearing, the scales **120** and **124** may be used in still other ways. If, for example, the operator wishes to move the table to a setting of 58°36′, he swings the worm **76** out of engagement with wheel **36**, releases the wheel by turning handle **60**, rotates the wheel until 58° registers with index mark **122**, swings the worm into engagement with the wheel, sets the 0 on scale **124** opposite index mark **126**, tightens screw **112** to lock the collar to the shaft **74**, rotates the shaft until the index mark reads 36′ on scale **124**, and relocks the table with handle **60**. It should be noted from the preceding description that these steps are easily and quickly performed and the necessity of laboriously turning the shaft **74** through a great number of revolutions is completely eliminated. The brief description of how the scales **120** and **124** may be used is by no means to be considered the only ways in which the scales may be coordinated, since my structure lends itself to a great number of particular modes of operation.

Having described my invention it should be apparent that I have provided an extremely versatile rotary table that may be more quickly and conveniently rotated to locate a work piece in any exact position. The work piece is accurately and securely supported and locked in position at any division of a revolution by a three-point locking means which insures accurate location of the table at all times and hold the table firmly against its supporting base. Provision has been made to compensate for any wear in the locking means whereby the initial accuracy in the positioning and locking of the rotary table may be maintained throughout the life of the mechanism. It should also be noted that I have provided a novel and particularly simple and convenient arrangement for releasing or securing in any desired position an adjustable scale whereby such scale can be readily shifted relative to a second scale to effect any desired relationship therebetween.

While I have illustrated and described only a single form of my invention it is to be understood that my invention is not limited to the details shown and described but includes all modifications, variations, and equivalents coming within the scope of the following claims.

I claim:

1. In a rotary table for supporting a work piece, a hollow cylindrical base, an annular, upwardly facing, internal flange formed on the base, said flange being bounded by an upper wall and a thicker lower wall, said lower wall having radial bores, a table nested within said hollow cylindrical base between said walls, clamping shoes inserted in said radial bores in said lower wall, means to force said clamping shoes into frictional engagement with said table, and means to rotate said table.

2. In a rotary table for supporting a work piece, a hollow cylindrical base having radial bores spaced 120° apart, a table nested in said hollow base, an upwardly facing annular bearing surface formed on said table, said bearing surface being disposed at an oblique angle relative to the axis of said cylindrical base, clamping shoes inserted in said radial bores in alignment with said bearing surface, said clamping shoes having downwardly facing bearing surfaces adjacent said upwardly facing bearing surface of substantially the same configuration as said upwardly facing bearing surface, lock screws bearing against said shoes to force said shoes against said upwardly facing bearing surface, a handle attached to one of said lock screws and operable to lock or release said base and table, said shoes having elongated channels extending axially of said bores, and pins engaging said base and disposed within said channels to prevent rotation of said shoes within said bores.

3. In a rotary table for supporting a work piece, a base, a table supported by said base, means to lock said table to said base, a gear on said table, a table rotating mechanism, said table rotating mechanism comprising a housing hingedly connected to said base, a shaft journaled in said housing, a worm secured to said shaft, and a yielding catch on said housing adapted to engage said base, said worm being meshed with said gear when said catch engages said base.

4. In a rotary table for supporting a work piece, a base, a table supported by said base, a circumferential scale on said table, means to lock said table to said base, a gear on said table, a housing hingedly connected to said base, a shaft journaled in said housing, a worm secured to said shaft, a collar surrounding said shaft, a second circumferential scale on said collar, means to releasably secure said collar to said shaft, said collar being capable of rotation relative to said shaft as well as rotation with

said shaft, and said worm engaging said gear when said housing is pivoted on said base to a position such that said worm is substantially tangent to said gear, and a yielding plunger on said housing adapted to latch with said base when said worm engages said gear.

5. In a rotary table for supporting a work piece, a hollow cylindrical base having radial bores, a table nested within said hollow cylindrical base, clamping shoes inserted in said radial bores, lock screws in said radial bores adapted to force said clamping shoes into frictional engagement with said table to lock said table relative to said base, said shoes having elongated channels extending axially of said bores, pins engaging said base and disposed within said channels to prevent rotation of said shoes within said bores, gear teeth formed on said table, a housing pivotally connected to said base, a shaft journaled in said housing, a worm secured on said shaft, said worm engaging said gear teeth when said housing is pivoted about said base to a position where said worm is substantially tangent to said table, and a handle secured to said shaft to rotate said shaft and worm.

6. In a rotary table for supporting a work piece, a hollow cylindrical base, an annular, upwardly facing, internal flange formed on the base, said flange being bounded by an upper wall and a thicker lower wall, said lower wall having radial bores, a table nested within said hollow cylindrical base between said walls, an annular bearing surface formed on said table, said bearing surface being disposed at an oblique angle relative to the axis of said cylindrical base, clamping shoes inserted in said radial bores in alignment with said bearing surface, said clamping shoes having faces adjacent the bearing surface of substantially the same configuration as said bearing surface, lock screws bearing against said shoes to force said shoes against said bearing surface to lock said table to said base, and means to rotate said table.

7. In a rotary table for supporting a work piece, a hollow cylindrical base, an annular, upwardly facing, internal flange formed on the base, said flange being bounded by an upper wall and a thicker lower wall, said lower wall having radial bores, a table nested within said hollow cylindrical base between said walls, an annular bearing surface formed on said table, said bearing surface being disposed at an oblique angle relative to the axis of said cylindrical base, clamping shoes inserted in said radial bores in alignment with said bearing surface, said clamping shoes having faces adjacent the bearing surface of substantially the same configuration as said bearing surface, lock screws bearing against said shoes to force said shoes against said bearing surface to lock said table to said base, said shoes having elongated channels extended axially of said bores, pins engaging said base and disposed within said channels to prevent rotation of said shoes within said bores, and means to rotate said table relative to said base.

8. In a rotary table for supporting a work piece, a



hollow cylindrical base having radial bores, a table nested in said hollow base, an annular bearing surface formed on said table, said bearing surface being disposed at an oblique angle relative to the axis of said cylindrical base, clamping shoes inserted in said radial bores in alignment with said bearing surface, said clamping shoes having faces adjacent the bearing surface of substantially the same configuration as said bearing surface, lock screws bearing against said shoes to force said shoes against said bearing surface to lock said table to said base, said shoes having elongated channels extending axially of said bores, pins engaging said base and disposed within said channels to prevent rotation of said shoes in said bores, and means to rotate said table relative to said base.

9. In a rotary table for supporting a work piece, a hollow cylindrical base having radial bores, a table nested in said hollow base, clamping means comprising clamping shoes inserted in said radial bores and means to force said clamping shoes into frictional engagement with said table whereby said clamping means is continuously operable to lock said table to said base in any relative position, a gear on said table, and a table rotating mechanism pivotally attached to said base, said table rotating mechnism being adapted to engage or disengage said gear by pivoting said table rotating mechanism about said base.

10. In a rotary table for supporting a work piece, a base, a table supported by said base, a circumferential scale on said table, means to lock said table to said base, a table rotating mechanism, said table rotating mechanism comprising a shaft rotatable to turn said table and a collar rotatably mounted on said shaft adjacent one end thereof, said shaft having an axial bore adjacent said end and a transverse bore connecting said axial bore and said collar, a ball in said transverse bore, shiftable means in said axial bore, said shiftable means having a reduced portion and another portion of greater size and adapted upon movement within said axial bore to force said ball into engagement with said collar to lock said collar relative to said shaft, whereby said collar and shaft may be secured in various adjusted positions, and a second scale formed on said collar, said second scale being graduated in divisions relating to angular movement of said table.

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