March 18, 1969 H. SCHMIDT 3,432,934

SINE PLATE ASSEMBLY

Filed Aug. 30, 1966

Fig. 1

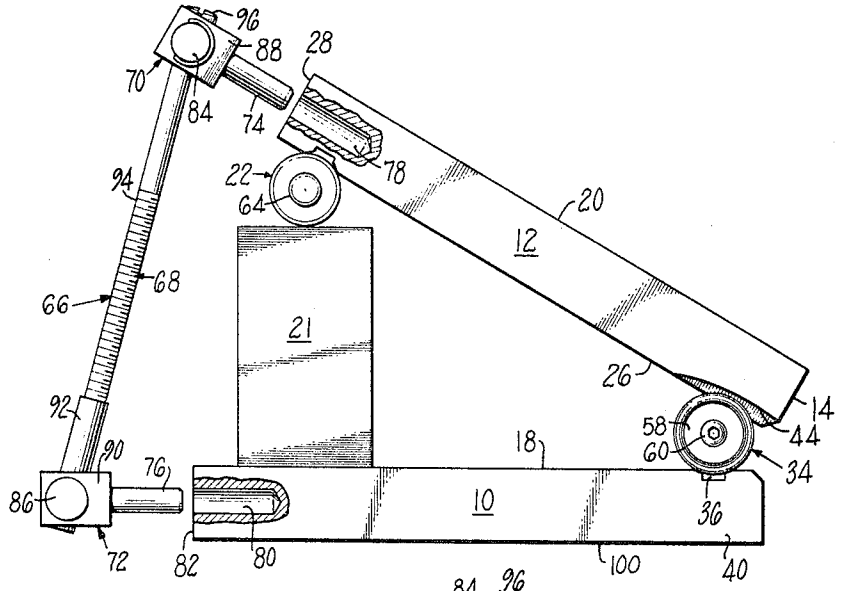
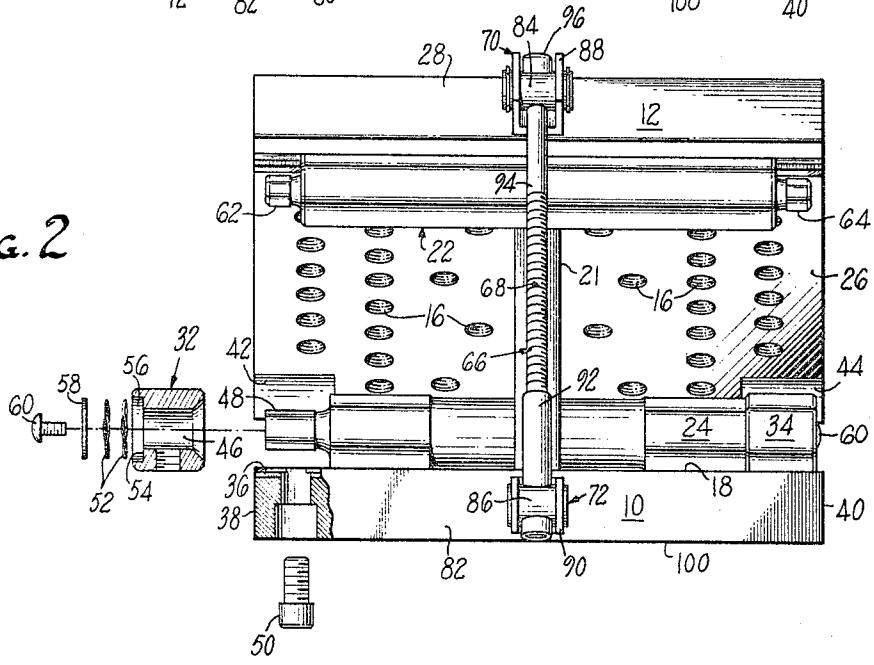


Fig. 2



INVENTOR.
HERMANN SCHMIDT

BY
Lindsey, Prutzman and Hayes
ATTORNEYS

United States Patent Office 3,432,934
Patented Mar. 18, 1969

3,432,934

SINE PLATE ASSEMBLY

Hermann Schmidt, 237 Burnham St.,
East Hartford, Conn. 06108

Filed Aug. 30, 1966, Ser. No. 576,092
U.S. Cl. 33—174 5 Claims
Int. Cl. G01b 5/20

ABSTRACT OF THE DISCLOSURE

A sine plate assembly having a clamp for precluding movement of a top plate of the assembly from an angularly adjusted position relative to a base plate and including a rigid adjustable length fastener having upper and lower pivotally attached toggle yokes respectively having shank portions removably insertable into sockets formed in front end edges of the plates.

This invention generally relates to precision tools and particularly concerns sine plates and the like usable, for example, in accurately holding a workpiece at a selected angle.

A primary object of the invention is to provide an improved sine plate particularly suited for quick and easy manufacture and assembly and which will provide long, reliable service.

Another object of the invention is to provide an improved sine plate capable of accurately setting sines of small angles at minute increments.

A further object of the invention is to provide a sine plate of the above described type having an improved clamp for retaining the plates of the assembly in a desired angular relation and which is of durable, compact and economical construction particularly suited for quick attachment and release.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth, and the scope of the application of which will be indicated in the appended claims.

In the drawing:

FIG. 1 is a side elevational view, partly broken away and partly exploded, showing a sine plate assembly constructed in accordance with the present invention; and

FIG. 2 is a front elevational view of the assembly of FIG. 1, exploded in part, partly broken away and partly in section.

Referring now to the drawing in detail, a preferred embodiment of a sine plate assembly of this invention is shown generally comprising a base member or plate **10** upon which a top member or plate **12** is pivotally connected adjacent its rear end **14**, the top plate **12** being shown as having a plurality of openings **16**. Plates **10** and **12** are preferably formed of hardened ground steel each having an upper face **18** and **20** with fine precision finished surfaces. The base plate **10** thus provides a flat master surface from which vertical measurements are taken in

accordance with conventional techniques by means of a precision gage block **21**, or combination of gage blocks, and the top plate **12** provides an accurately flat work support surface.

As best seen in FIG. 2, a front roll **22** and a pivot shaft **24** are spaced apart a preselected standard distance and secured in position, e.g., by screws, not shown, across a lower face **26** of the top plate **12** adjacent its front end **28** and rear end **14** respectively.

In accordance with one feature of the present invention, the longitudinal axes or center lines of the pivot shaft **24** and the front roll **22** are readily and precisely positioned parallel to one another in a common plane parallel to the finished upper faces **18** and **20** of plates **10** and **12** when the front roll **22** is in engagement with the base plate **10**. This is accomplished by means of a pair of end bushings **32, 34** precisely located in a lateral recess **36** extending inwardly from opposite sides **38, 40** of the base plate **10**. Bushings **32, 34** are accurately formed cylinders having equal outside diameters greater than that of the pivot shaft **24**, and the rear corners of the lower face **26** of the top plate **12** are shown cut away at **42** and **44** to provide sufficient clearance for the enlarged end bushings **32, 34**. An axial hole **46** (FIG. 2) is formed in each bushing for receiving a reduced end portion **48** at each end of the pivot shaft **24** whereby the same is supported for rotation within the bushings **32, 34** which are removably secured to the base plate **10** by suitable fasteners such as the machine screw shown at **50**. By virtue of the above described structure, manufacture and assembly is significantly facilitated since close tolerances are readily held on bushings **32, 34** to ensure dimensional integrity and their enlarged size effects greater purchase for the screws **50** and increased strength of assembly.

In addition, the disclosed pivot arrangement is particularly suited to maintain the top plate **12** essentially free of lateral displacement during a work forming operation. Each end bushing **32, 34** preferably includes a pair of annular flat springs or wave washers **52** seated against a shoulder **54** formed by an enlarged recess **56** at the outer end of each bushing **32, 34**. The springs **52** are bottomed against the shoulder **54** and compressed by means of a retaining ring **58** firmly seated by a screw **60** threadably secured to the reduced end portion **48** of the pivot shaft **24**. Upon adjustment of the screws **60** at opposite ends of the pivot shaft **24**, oppositely directed axial spring forces are applied to the pivot shaft **24** whereby it is continuously balanced under spring tension and maintained against axial displacement while yet allowing for the necessary movement between plates **10** and **12**.

In this regard, it will be noted that if the plates **10** and **12** are disassembled for any reason, the top plate **12** may be readily reassembled in proper working condition in a minimum period of time requiring only a minimal degree of skill.

The pivot shaft **24** is thus quickly and accurately located and assembled for swinging movement of the top plate **12** toward and away from the base plate **10**, and the top plate **12** may be angularly adjusted relative to the base plate **10** by positive contact between the front roll **22** and a gage block such as that illustrated at **21** posi-

tioned on the base plate **10**. The size of the gage block is selected for whatever dimension is required to locate a workpiece at a desired angle on the top plate **12** as, e.g., in drilling, milling, surface grinding and similar work forming operations.

To set sines of small angles, the front roll **22** is shown as having opposite end portions **62**, **64** of reduced diameter. The reduction in diameter of the front roll **22** is preferably exactly 0.400 inch to provide a 0.200 inch step on the front roll **22**. The sine plate assembly of the invention is thus adapted for use with standard sets of gage blocks conventionally available in heights above 0.100 inch, typically at successive increments of 0.0001 inch in gage block height.

In the course of various machining operations, my tendency of the top plate **12** to be lifted from the gage block assembly is minimized by means of an improved clamp **66** provided in accordance with still another feature of the invention. Clamp **66** generally comprises a rigid, adjustable length fastener **68** having opposite end portions connected to upper and lower toggle yokes **70**, **72** respectively having rearwardly projecting shank portions **74**, **76** removably insertable into sockets **78**, **80** formed in front ends **28**, **82** of plates **12** and **10**. The upper and lower toggle yokes **70**, **72** respectively include a pivot pin **84**, **86** rotatably supported between opposite legs of a generally U-shaped bracket portion **88**, **90** attached at forward ends of their respective shank portions **74**, **76**.

In the preferred embodiment, fastener **68** is comprised of two separable parts including an internally threaded sleeve **92** fixed to pivot pin **86** of the lower toggle yoke **72**, and a bolt **94** slidably received in an aperture of pivot pin **84** of the upper toggle yoke **70** for pivotal movement relative to the top plate **12**.

In operation, shank portions **74**, **76** of the clamp **66** are simply inserted into the sockets **78**, **80**, and the lower threaded end of the bolt **94** is secured in the sleeve **92** after the angular setting of plate **12** is properly adjusted relative to base plate **10**. Bolt **94** is provided with an enlarged head **96**, preferably slotted for receiving a setting instrument such as a screwdriver, not shown, whereupon the clamp **66** is readily tightened to draw the head **96** of the bolt **94** into engagement with pivot pin **84** of the upper toggle yoke, thereby to lock top plate **12** in position to provide the desired pressure on the gage block **21**.

It is to be noted that a considerable mechanical advantage is provided by the described clamping arrangement wherein the holding force is applied on the front ends of the plates **10**, **12** to more effectively resist any tendency of the front plate **12** being lifted away from the base plate **10**. In addition, a set of bolts of varying length is provided to accommodate a full range of angular settings of the top plate **12**, and the overall length of the fastener **68** may be preselected accordingly such that it is continuously positioned within an included angle formed by a lower face **100** of the base member **10** and the upper face **20** of the top plate **12**, thereby eliminating any possibility of the clamp **66** interfering with a supporting surface for the assembly or with a workpiece being supported on the top plate **12**.

The sine plate assembly of the present invention is of durable compact construction providing ease and economy in its manufacture and assembly while yet maintaining the required dimensional integrity. The disclosed structure also provides improved bearing support for the removable end bushings which as noted above are readily disassembled and reassembled by relatively unskilled labor to provide a proper pivotal connection between the movable plates. In addition, the above described structure is particularly suited to be quickly and easily set to securely hold a workpiece at a desired angle, even at small angles, without danger of the adjusted position of the assembly being disturbed during a machining operation. As will be apparent to those skilled in the art, the features disclosed in the preferred embodiment could be readily incorporated in similar tools for obtaining compound angles.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above described will become readily apparent without departure from the spirit and scope of the invention.

I claim:

1. A sine plate assembly comprising a base member and a top member each having a socket formed in a front end thereof, said top member being pivotally connected adjacent its rear end to said base member, and an adjustable removable clamp including upper and lower toggle yokes each having a shank portion removably inserted into said sockets of said base member and said top member respectively, and a rigid adjustable length fastener having opposite end portions pivotally connected to said toggle yokes for precluding movement of said top member from a preselected angularly adjusted position with respect to said base member, said fastener being extensible to permit quick release of said clamp from said members.

2. The assembly of claim **1** wherein said clamp is continuously positioned within an included angle formed between a lower face of said base member and an upper face of said top member irrespective of said angularly adjusted position of said top member relative to said base member.

3. The assembly of claim **1** wherein said upper toggle yoke includes an apertured pivot pin, and wherein said adjustable length fastener comprises an internally threaded sleeve pivotally connected to said lower toggle yoke, and a bolt slidably received in said apertured pivot pin of said upper toggle yoke and threadably secured in said sleeve for selectively adjusting the length of said fastener, said bolt having a head at one end thereof engageable with said apertured pivot pin for precluding swinging movement of said top member away from said base member.

4. A sine plate assembly comprisng a base plate and a top plate each having an upper face including a flat finished surface and a lower face, said upper face of said base plate having a lateral recess extending inwardly from opposite side edges thereof adjacent its rear end, a front roll and a pivot shaft spaced apart in parallel relation and secured to said lower face of said top plate adjacent front and rear ends thereof respectively, a pair of bushings coaxially mounted on said base plate and rotatably supporting said pivot shaft for swinging movement of said top plate toward and away from said base plate, said bushings each having an outside diameter of enlarged size relative to that of said pivot shaft and being positioned in said lateral recess of said base plate whereby center lines of said front roll and said pivot shaft are readily and precisely located in a common plane parallel to said flat finished surfaces of said plates when said front roll is in engagement with said base plate, said base plate and said top plate each having a socket formed in said front ends thereof, and an adjustable removable clamp comprising a rigid adjustable length fastener having opposite end portions and a pair of toggle yokes pivotally connected thereto, said toggle yokes each having a shank portion removably inserted into said front end sockets of said base plate and said top plate for precluding movement of said top plate from a preselected angularly adjusted position with respect to said base plate, said fastener being extensible to permit quick release of said clamp from said plates.

5. A sine plate assembly comprising a base member and a top member each having a socket formed in a front end thereof, said top member being pivotally connected adjacent its rear end to said base member, and an adjustable removable clamp including upper and lower toggle yokes each having a shank portion removably inserted into said socket of said base member and said top

member, respectively, each also having a generally U-shaped bracket portion connected to each said shank portion, a rigid adjustable length fastener having opposite end portions, respectively, pivotally connected to said U-shaped bracket portions for precluding movement of said top member from a preselected angularly adjusted position with respect to said base member, said fastener being extensible to permit quick release of said clamp from said members, and a pivot pin mounted between opposite legs of each said U-shaped bracket portion providing the pivot connection between said opposite end portions of said fastener and said toggle yokes.

References Cited

UNITED STATES PATENTS

2,733,702	2/1956	Barrett.	
2,442,136	5/1948	Luther.	
2,190,455	2/1940	McCollum et al.	210—63
2,351,773	1/1944	Lóvenston.	
646,499	4/1900	Lodge.	

LEONARD FORMAN, *Primary Examiner.*

S. STEPHAN, *Assistant Examiner.*