United States Patent

[11] 3,600,576

[72] Inventors **Forrest L. Carter**
8000 MacArthur Blvd., Cabin John-Bethesda, Md. 20034;
Walter C. Sadler, 4903 Prince George Ave., Beltsville, Md. 20705

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[54] **GONIOMETER DEVICE**
4 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... **250/51.5 R,** 269/60
[51] **Int. Cl.** **G01n 23/20**
[50] **Field of Search** ..... 250/51.5, 49.5 R; 269/60, 71

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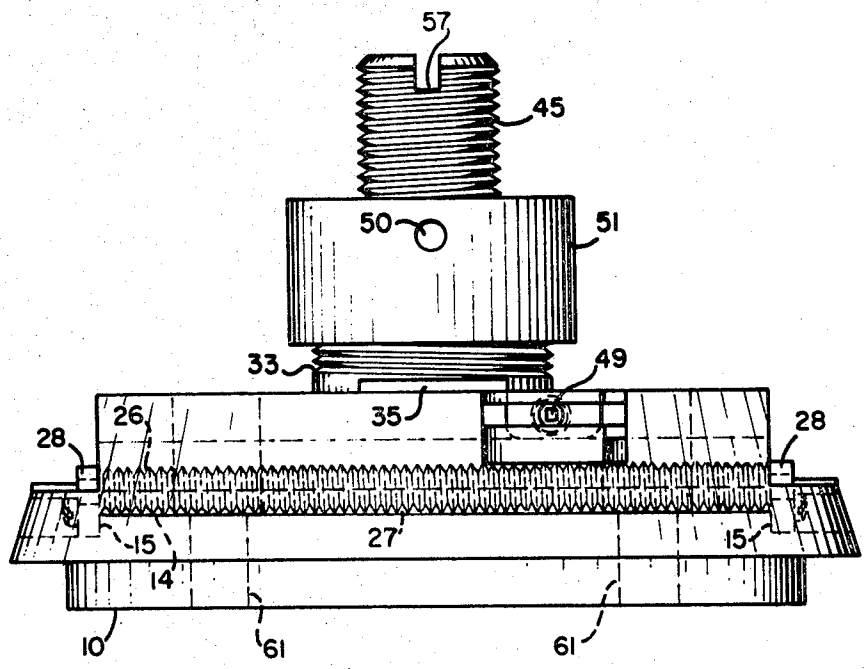
Primary Examiner—James W. Lawrence
Assistant Examiner—D. C. Nelms
Attorneys—R. I. Tompkins, Arthur L. Branning, R. J. Erickson and M. L. Crane

ABSTRACT: This disclosure is directed to an arcless goniometer head which supports a single crystal specimen for examination by the use of X-rays of neutrons. The device is made for X–Y adjustment of the crystal as well as for height adjustment and the crystal is so mounted that the mount may be removed with the crystal thereon for use of the device for other crystal studies through use of other mounts. The X–Y translation mechanisms are housed within a low flat housing which is removed from the crystal the maximum distance possible such that the crystal may be adjusted without exposure of ones hands during the adjustment. Thus, the crystal mounting rod extends considerable distance from the base such that high or low temperature may be used without the base affecting the temperature.



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SHEET 1 OF 2

FIG. 1

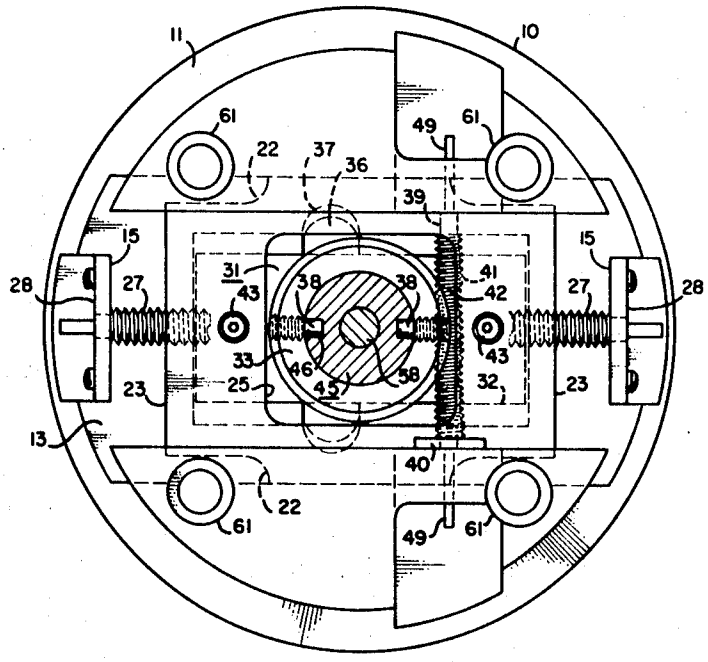
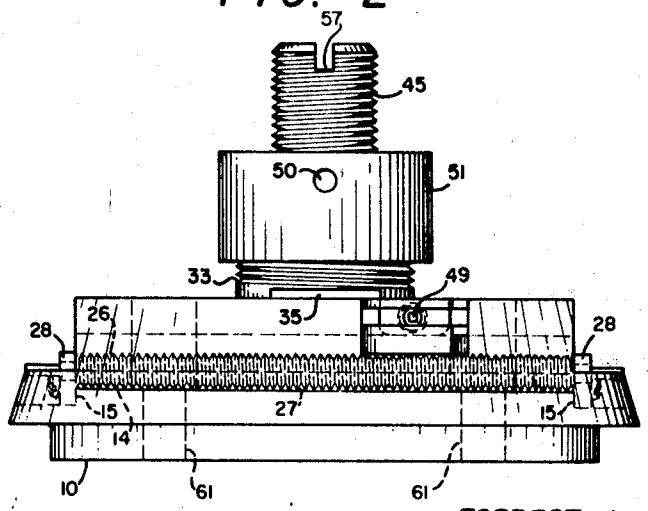


FIG. 2



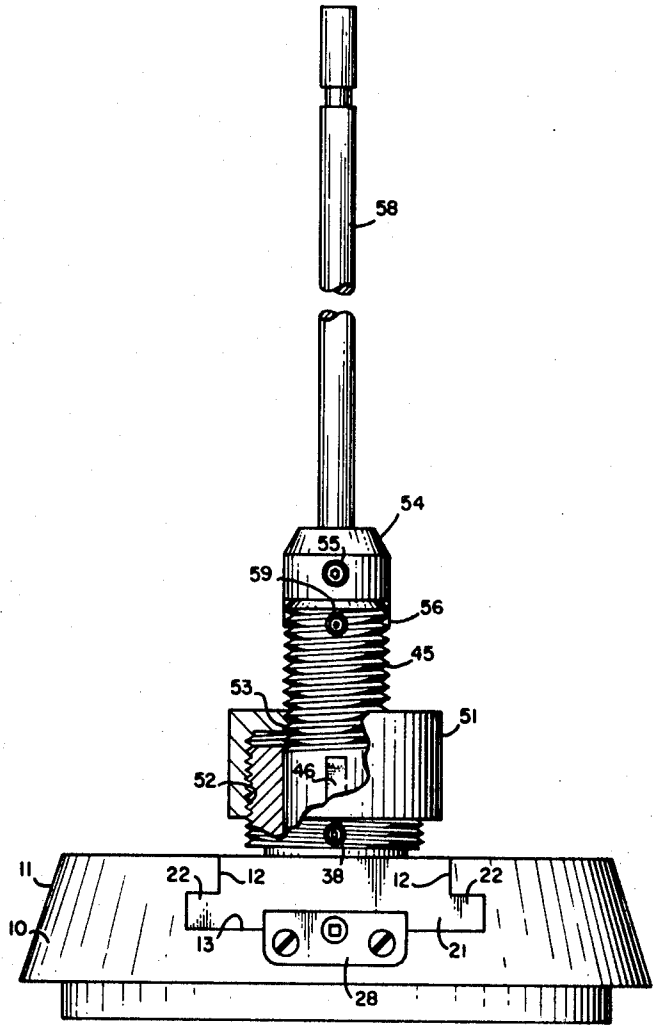
INVENTORS

FORREST L. CARTER
WALTER C. SADLER

BY Melvin L Crane AGENT

ATTORNEY

FIG. 3



INVENTORS
FORREST L. CARTER
WALTER C. SADLER
BY Melvin L Crane AGENT
ATTORNEY

GONIOMETER DEVICE

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

This invention is directed to an arcless goniometer head and more particularly to a low profile goniometer head suitable for diffraction studies at high and low temperatures without crystal movement during operation time.

Heretofore, goniometer heads used in diffraction studies have been made such that the adjusting means is close to the crystal holder wherein an operator's hand is near the X-ray beam during crystal adjustment. This endangers the operator. Further, the mechanical translations and the arc adjustments are unstable and move with time such that the crystal orientation is not the same. This requires periodic adjustment which becomes time consuming. The goniometer heads used are unavailable for other work when not collecting data, that is, unless one is willing to remove the crystal which requires remounting and reorientation of the crystal on the goniometer head for further study.

SUMMARY OF THE INVENTION

The device of this invention is made with a low base that includes both an X and Y mechanical translation mechanism. The crystal is mounted onto an elongated support rod, containing a key, which may be adjusted for height. The X-Y movable elements are mounted in the base and the movable elements are provided with locking screws that prevent the X-Y movable elements from movement once they have been positioned and the locking screws secured. Thus, the crystal may be removed with the keyed support rod and then replaced in the same angular position with only minor translation adjustments needed but not the time consuming arc adjustments.

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide a goniometer head which supports specimens for examination by suitable radiation within a high or low temperature environment.

Another object is to provide a goniometer head in which the mechanical translation means is of sufficient distance from the crystal to permit hand adjustment of the crystal without harm to the operator by radiation effects.

Stillanother object is to provide a goniometer head in which the crystal is supported a sufficient distance from the mechanical translation means that the temperature may be more easily controlled without affecting the mechanical translation means.

Yet another object is to provide a goniometer which may be locked after setting and which will not show any angular drift with time.

While still another object is to provide a goniometer head which permits removal of the crystal and crystal holder without interfering with the setting, thereby permitting use of the base for other uses with subsequent return of the crystal holder and crystal positioned in the correct orientation.

Another object is to provide a particularly low profile as well as stable translation mechanism.

Other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view partially in section to illustrate the relative parts.

FIGS. 2 and 3 are different side views illustrating the drive mechanisms and the relative parts.

DESCRIPTION OF THE DRAWINGS

Now referring to the drawings, there is illustrated a goniometer head made in accordance with the teaching of this invention wherein like reference characters refer to like parts throughout the specification. The goniometer head includes a base **10** within which two right angle mechanical translations operate to provide X-Y adjustment and an elevation adjustment is provided to adjust the elevation of a crystal held in place on a supporting rod. The base **10** is cylindrical with a conical outer surfaces **11** or any other desired shape. The top surface is cutaway in the shape of an inverted "T" to provide oppositely disposed horizontally extending lips **12** across the entire top portion. In the surface **13** of the base along the middle thereof a semicircular smooth nonthreaded groove **14** is formed parallel with the lip **12**. The surface of the base near the outer edges is cutaway at **15** perpendicular to the groove **14** to form a flat surface perpendicular with the ends of the groove **14**. A movable elongated flat surface member **21** of T-shape cross section is formed to fit into the cutout section of the base with a body portion between lips **12** and a winged portion **22** in the cutout below the lips such that the member **21** is movable along the lips in a direction along a line parallel with the lips **12**. The ends of the winged portions are cutaway over about one-quarter the length of the member **21** to permit movement between hold down screws which pass through the base to secure the goniometer head in place. A portion of the bottom surface of the member **21** is cutaway in the shape of a rectangle for a depth of about one-half the thickness of the member, thus the member is left with outer end edges **23** that extend along the cutout portion and ride along the surface of the base. The member **21** is also provided with a centrally located aperture **25** which may be square, circular or rectangular. The aperture passes through the entire member and is of the same width as the rectangular cutout that is cut from the bottom surface. The movable member **21** is provided with a threaded semicircular cutout **26** in the outer edges **23** at the midpoint which corresponds with the groove **14** in the base. A lead screw **27** is held in the groove **14** by end plates **28** that are secured to the base such that the threads on the lead screw matches the threaded cutout **26** in the edges **23** of member **21**. The relationship of the threaded cutout **26** in the edges **23** of member **21** and the lead screw is similar to that of a nut and bolt. With the bolt held against end wise movement but free to rotate, the nut will be threaded along the bolt as the bolt is rotated, the direction of movement along the bolt is dependent upon the rotational movement of the bolt, therefore, in the same manner as lead screw **27** is rotated, the member **21** will move along the lead screw due to the matched threads **26** on the edges **23**, and the threads on the lead screw. Therefore, the lead screw moves the member **21** relative to the base **10**.

A second movable member **31** is formed with a rectangular base **32** and a cylindrical portion **33** that extends from the rectangular base. The rectangular base is narrower in width than the rectangular cutout in the movable member **21** but of the same length so that the base of the movable member **31** will fit into the cutout in member **21** with the cylindrical portion **33** extending outwardly through the aperture **25**. The member **31** moves in a direction perpendicular to the movement of member **21**, however, the member **31** is moved along with member **21**. Therefore, the narrower rectangular base permits movement relative to the member **21**. The member **31** is provided with a cutout in the bottom surface of the base in the area of the lead screw **27** so that the member **31** may be moved relative to the member **21** without interference by the lead screw. The cylindrical member **33** is cutaway at **35** in the area along the aperture **25** in member **21** which permits movement of movable member **31** relative to member **21**. The base **32** is also provided with ears **36** that match with cutouts **37** in the member **21** so that ears **36** act as guides during movement of movable member **31**. Cylindrical member **33** is provided with diametrically opposite keys **38** that passes diametrically therethrough and ride in keyways. Movable member **31** is provided with a partial circular cutout **41** which is threaded. A

lead screw 42 secured in fixed end bearing 39 and removable plate bearing 40 in movable member 21 in alignment with threaded cutout 41 in the movable member 31 for adjusting movable member 31 relative to movable member 21 for movement perpendicular to the direction of movement of member 21. The ends of the lead screw are square for reception of extension 49 which fit into the square ends for the purpose of adjusting the lead screw. The movable member 21 is also provided with threaded apertures on opposite sides of cylindrical member 33 in which screws 43 are threaded. These screws 43 are threaded against the upper surface of movable member 31 firmly against the base thereby locking both movable members 21 and 31 against movement, once the proper setting has been accomplished. The upper end of cylindrical member 33 is threaded on the outside thereof, the purpose of which will be set forth later.

The members 21 and 31 cooperate to provide X-Y translation for adjustment in the horizontal plane. For vertical or height adjustment, an elevation mechanism is used. The elevation mechanism includes an elevation cylindrical member 45 which is threaded along the upper half whereas the lower half includes two diametrically opposite keyway slits 46 along a portion of the length thereof. The cylindrical member 45 fits with a sliding fit into the cylindrical part 33 of the movable member 31 such that the slits 46 ride along the keys 38. A cylindrical nut 51 having a threaded portion 52 on the inner surface thereof and a threaded coaxial aperture 53 of a smaller diameter is provided for adjusting the elevation cylinder. The nut is provided with suitable apertures 50 around the outer surface thereof for rotation by a spanner wrench. The large diameter portion of the nut fits over and is threaded onto the threaded end of cylindrical member 33 whereas the smaller diameter threaded aperture screw threads over the threaded end of the cylindrical elevation member 45. Thus, rotation of the nut moves the nut along the upper end of member 33 and simultaneously moves the threaded cylindrical elevation member 45 relative to the cylindrical member 33. The slits ride along the keys which prevents rotation of the elevation member 45 relative to cylinder 33.

A crystal is held in place by a supporting rod 58 that passes through a stop 54 and fits into the cylindrical elevation member 45. The stop 54 is provided with a set screw 55 that is screw-threaded into stop 54 to hold the supporting rod in place. The stop is provided with oppositely disposed teeth 56 on the lower surface thereof which fits into matting slots 57 in the upper end of the elevation cylinder which prevents the supporting rod from rotation relative thereto. Setscrew 59 is provided to secure the end of rod 58 against movement relative to cylindrical elevation member 45. The stop is provided for coarse adjustment of the crystal by use of the set screw setting against rod 58 whereas fine adjustment is brought about by use of the nut 51. The threads on the cylindrical member 33 of the movable member 31 and the elevation cylindrical member 45 may differ according to the desires of the manufacture and the degree of fine adjustment.

The base is cut away as necessary for assembly and operation of the lead screws and the movable members. For securing the base to a desired instrument or structure, the base is provided with four apertures 61 therein through which suitable screws pass. The apertures are positioned for best support, therefore, the apertures are located near the wings of the movable member 21. Therefore, in order to permit proper movement member 21, each of the ends of the end wings have been cutaway as shown. However, if the supporting means were located differently it would not be necessary to cut away the ends of the wings on the movable member 21.

In assembly of the device, the separate parts are made and prepared for assembly. The movable member 31 and adjusting screw 42 are assembled with movable member 21 such that the cylindrical part 33 extends through aperture 25 in member 21. With movable member 31 assembled with movable member 21, member 21 is slid into place in base 10. The lead screw 27 is then threaded into place along the threaded cutout 26. Once the lead screw is in place the lead screw holding plates are secured to the base to secure the lead screw in place such that the movable member 21 can now be moved by rotation of the lead screw. The lock screws may be screw threaded into place into the movable member 21.

The elevation cylinder may be placed into the cylindrical member 33 of the movable member 31 and then nut 51 is threaded onto the elevation cylinder and over the cylindrical member 33. The key may be placed into the cylindrical member either before or after placing the elevation cylinder therein. However, if it is desired to rotate the elevation cylinder with respect to the nut during assembly, it is best to insert the key and locking screw after assembly of the elevation cylinder and nut. The goniometer head is now ready for receipt of the crystal supporting rod and for securing the base in place for adjustment of the device by properly placing the crystal in place for test. The supporting rod and crystal may be removed without interfering with the setting of the goniometer head assembly.

The construction of the goniometer head may be made with any suitable material which is mechanically stable and not subject to failing. The removable support rod may be made of a variety of materials or composition including brass, ceramics, glass, quartz, $A1_2O_3$ rods, thin wall stainless tubes, etc. The primary object of the support rod is to maintain the crystal accurately centered in the test beam and to minimize the flow of heat to or from the crystal. In cases where gas flow heating or cooling is employed, small conical shields may be supported on the support rod to prevent gas flow from being directed onto the goniometer head.

In constructing the goniometer head of the present invention, it can be seen that the two translation mechanisms as well as the elevation or height adjusting mechanism is of a less overall height than the crystal support rod. Therefore, it is seen that the construction is such that the crystal is removed a substantial distance from the adjusting mechanisms. Such construction provides a safe device in which the crystal will be less affected by the goniometer head with respect to the temperature thereof.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. A goniometer head for positioning a specimen for nondestructive testing at high or low temperatures without harmful effects of an operator during adjusting of the specimen for test, which comprises:

a base,

a specimen support means secured relative to said base for movement relative thereto,

said support means including:

a first translation means for moving said specimen in a horizontal plane,

a second translation means for moving said specimen in a direction perpendicular to the direction of movement of said first means and in the same horizontal plane,

said first and second means mounted within said base and movable in the same plane relative to each other,

said second means including a cylindrical member extending upwardly through said first means:

said cylindrical member including screw threads along a portion thereof from the outer end thereof,

a second cylindrical element secured against rotation within said cylindrical member,

said second cylindrical element including screw threads on the outer surface thereof along a portion thereof,

a coupling nut,

said coupling nut adapted to be screw threaded over said second cylindrical element and said cylindrical member for translation of said second cylindrical ele-

ment relative to said cylindrical member in a direction toward or from said base,

a specimen support rod:

said support rod movable within said second cylindrical element and adjustable relative thereto, and

means for securing said support rod for movement relative to said second cylindrical element along a line perpendicular to said base.

2. A goniometer head as claimed in claim 1; which includes:

a translation locking means,

said translation locking means locking said first and second translation means against movement relative to said base.

3. A goniometer head as claimed in claim 2; in which:

said second translation means is carried by and movable with said first translation means.

4. A goniometer head as claimed in claim 3, in which:

said cylindrical member is provided with a key normal to the axis thereof, and

said second cylindrical element is provided with a key way to prevent rotation thereof relative to said cylindrical member.