Feb. 13, 1968 R. E. BOICE 3,368,284

LEVELING TABLES

Filed Sept. 22, 1965

FIG. 1

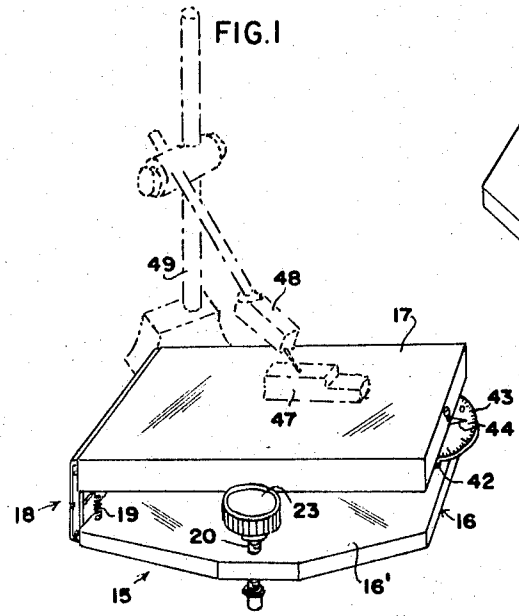
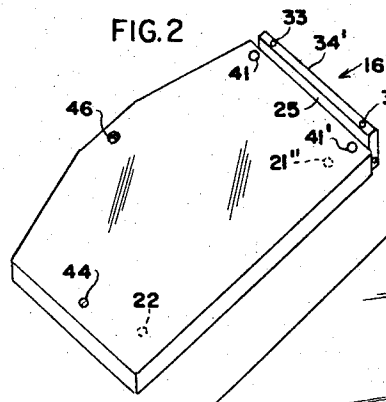


FIG. 2



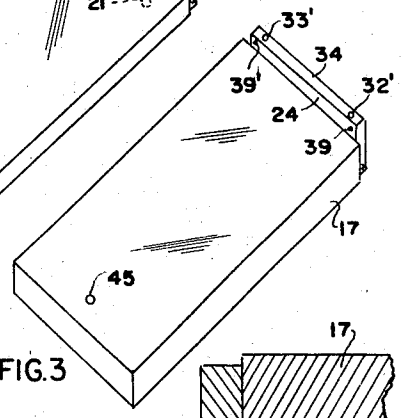


FIG. 3

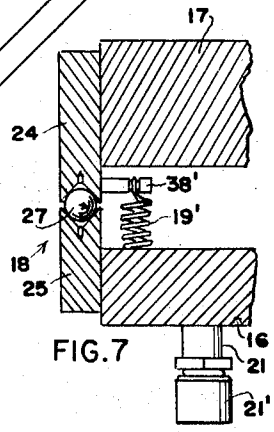
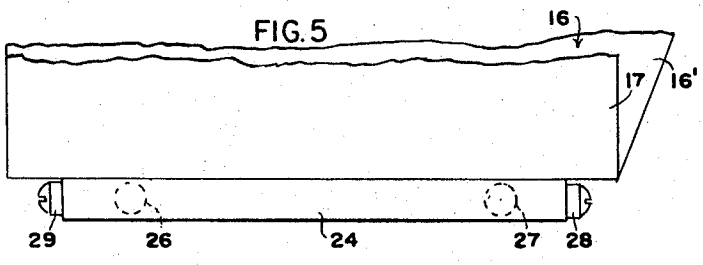


FIG. 7

FIG. 5



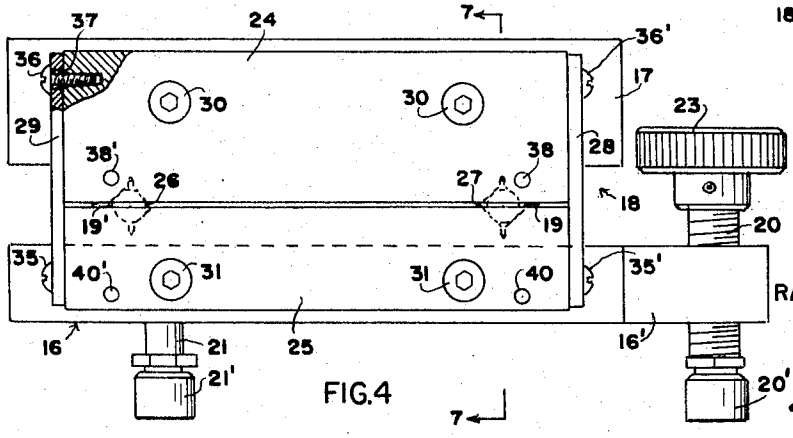


FIG. 4

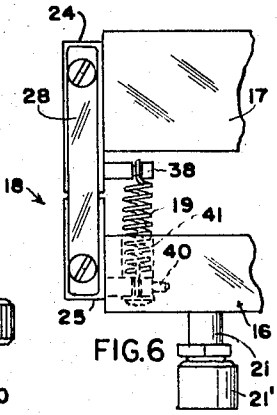


FIG. 6

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LEVELING TABLES

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6 Claims. (Cl. 33—174)

ABSTRACT OF THE DISCLOSURE

A leveling table including a base member hingedly connected to an overlying surface plate by leaves connected to the base member and surface plate. The leaves have facing sockets which receive rotatably fitted balls and the surface plate is tiltable about the line of centers of the balls. The base plate is tiltable about an axis orthogonal to the line of centers of the balls and in the plane of the base member.

The present invention relates to adjustable work supports used in precision measurement procedures and more particularly to a leveling table comprising a surface plate member above a base member to which it is hingedly connected along one end and means for independently tilting said members to desired positions; the axes of swing of said members being in perpendicular relation.

In preferred engineering practice, each of said members is supported at three points. The base member may be a plate having three legs like a tripod, each leg terminating in a ball-jointed foot; one of said legs being a screw which when turned, will cause the base resting on a surface, to swing on an axis determined by the line of centers of the ball elements of the joints of the other two legs. One of the points at which the surface plate member is supported, is also a screw to be turned so said surface plate will swing on the axis of said hinge connection.

Optimum precision is attained by this invention by having said hinge connection comprised of two spaced identical ball elements, each rotatably fitted in opposite sockets in said members. This materially simplifies the hinge construction by using a minimum of parts, maintains a true axis line, avoids hinge looseness and increases the sensitiveness of movement of the surface plate in relation to the base member. However, all the parts of this leveling apparatus must be assembled as a unitary structure to be practical.

It is therefore the principal object of this invention to provide a novel and improved leveling table comprised on the components set forth, assembled as a unitary structure.

Another object thereof is to provide a leveling table of the character described, of novel and improved construction, made of simple parts, and which is easy to use and efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

For one practice of this invention, the hinge structure comprises two relatively thick leaves, one secured along a straight edge of the base member, and extending upwardly therefrom, and the other secured along the corresponding end of the surface plate, and extending downwardly therefrom; the facing surfaces of said leaves, each having two spaced conical sockets; all of said sockets being identical, and the sockets of one being directly opposite the sockets of the other. Rotatably fitted in each pair of opposite sockets, is a steel ball. These ball elements are of identical diameter which is of a size

so that when facing surfaces of the hinge leaves are parallel, the leaves are spaced to permit the required maximum angular relation between the base and surface plate members. Spring means near the hinge leaves, bias said plate members towards each other and there is a link along each side edge of the hinge structure, loosely connecting the hinge leaves.

In the accompanying drawing forming part of this specification, similar characters of reference indicate corresponding parts in all the views.

FIG. 1 is a perspective view of a leveling table embodying this invention, shown in use. The work piece being gaged and the gage means are shown by dash-dot lines.

FIG. 2 is a perspective view of the base plate.

FIG. 3 is a perspective view of the surface plate, shown inverted.

FIG. 4 is an enlarged end view of the leveling table.

FIG. 5 is a fragmentary top plan view of FIG. 4.

FIG. 6 is a fragmentary front view of said leveling table.

FIG. 7 is a fragmentary section taken at line 7—7 in FIG. 4.

In the drawing, the leveling table designated generally by the numeral **15**, comprises a base which may be a plate **16** which is under a surface plate **17**; said plates being associated at one end by a hinge structure indicated generally by the numeral **18**, and biased towards each other, near the hinge structure, by the springs **19, 19'**. The surface plate is rectangular and the base plate conforms thereto, but has a forward extension **16'** through which a knobbed upright screw **20** is in threaded engagement therewith, serving as one of the legs of said base member; said screw **20** being equidistant from spaced identical rear legs, only one of which is shown at **21**; the holes in the base plate in which said rear legs are respectively mounted being indicated at **21''** and **22**. Each of the said three legs terminates in a ball-jointed foot, as indicated at **20'** and **21'**. The knob for turning the screw **20** is denoted by the numeral **23**.

The hinge structure **18** consists of the hinge leaves **24, 25**, the identical steel balls **26, 27** and the links **28, 29**. The leaf **24** is secured by the bolts **30**, to a side edge of the surface plate **17**, and extends downwardly therefrom. The leaf **25** is secured by the bolts **31**, to the corresponding side edge of the base plate **16**, and extends upwardly therefrom; the facing surfaces of said hinge leaves, each having two spaced conical sockets. The sockets **32, 33** in the surface **34** are directly opposite respectively to the sockets **32', 33'** in the surface **34'**; all sockets being identical. The steel ball **26** fits rotatably in the opposite sockets **32, 32'** and the ball **27** fits rotatably in the opposite sockets **33, 33'**. These ball elements are of identical diameter which is of a size so that when said facing surfaces **34, 34'** are parallel, they are spaced sufficiently to permit the prescribed maximum angular relation between the base and surface plate members. Along one side edge of the hinge structure, there is a link **29**, pivotally connected at its ends to the hinge leaves respectively, by the screw **35** on which said link fits for rotation, and by the screw **36** on which said link fits loosely in the hole **37**. Along the other edge of the hinge structure, there is a similar link **28**, similarly associated with said hinge leaves. The pins **38, 38'** extend from the respective holes **39, 39'** in the leaf **24**, into the space between the plates **16, 17**, and anchor one end of each of the tensioned coil springs **19, 19'** respectively, the other ends of which are anchored on the pins **40, 40'** respectively, which end into the sockets **41, 41'** respectively which are in the base plate **16**. These springs are near the hinge structure **18**, and serve to maintain the leveling table **15**, assembled as a unitary structure, besides their function

of biasing the plate members towards each other which is incidental. The links **28, 29** serve to hold the plates from separation along the vertical, in which they are aided by the action of the springs **19, 19'**. The balls **26, 27**, seated in their sockets, serve to hold said plates from relative movement along the horizontal, in which they are aided by said links **28, 29**.

The other side end of the plate **17**, is supported on the upper end of a screw **42** which is threadedly engaged in the base plate **16** and carries the optional graduated disc **43** which cooperates with a zero-settable pointer **44** mounted on the surface plate **17**, to serve for micrometer measurements. The scale on the disc **43** may be for measuring the angular relation of the plates **16, 17**. The screw **42**, the disc **43** and the pointer may constitute a micrometer reading in the decimal system, and if the distance between the axis of the screw **42** and the line of centers of the spherical elements, the balls **26, 27**, is ten inches, the angular relation of the plates **16, 17** can be easily ascertained from its sine after taking the reading on the scale **43** which may be in thousandths of an inch, with the reading at zero when the plates **16** and **17** are parallel.

The upper end of the screw **42** which latter is engaged through the threaded hole **44**, is rounded and sets rotatably in the conical socket **45**. The threaded hole for the screw **20** in the extension **16'**, is indicated by the numeral **46**. The screws **35, 35'** are in alignment and so are the screws **36, 36'** in the embodiment illustrated. Of importance is that the centers of the spherical elements **26, 27** are equi-distant from the plane of the upper surface of the surface plate **17**.

The numeral **47** denotes a piece of work to be tested, resting on the surface plate, and the numeral **48** designates an indicator device on a stand **49**, whose structure and manipulation is well known in the gaging art. The screw **20** is turned to get the base **16** level, which may be ascertained with the indicator device, and the wheel **43** is turned to get the surface plate **17** level, also to be ascertained with said device, whereupon, if any tilt is desired for the surface plate, the pointer **44** is brought to zero reading on said wheel, which zero graduation is preferably exposed when said plates are parallel, and then said wheel is turned to such reading which determines the sine of the required angle of tilt of the surface plate in relation to the base plate.

This invention is capable of numerous forms and various applications without departing from the essential features herein disclosed. It is therefore intended and desired that the embodiment shown herein shall be deemed merely illustrative and not restrictive and that the patent shall cover all patentable novelty hereinafter claimed; reference being had to the following claims rather than to the specific description herein to indicate the scope of this invention.

I claim:

1. In a leveling table of the character described, the combination of a base member to be rested on a surface, said base member having a front edge and a side edge, means to tilt said base member about an axis that is parallel to said surface and rearward of said front edge, a surface plate positioned above and facing said base member, said plate having a side edge and an upper surface, two hinge leaves having side edges, one leaf secured to and along said side edge of said base member and extending upwardly therefrom, the other secured to and along said side edge of said surface plate and extending downwardly therefrom, said leaves positioned to present facing surfaces directly opposite one another, spaced sockets in each of said leaves and opening in said facing surfaces; the sockets in one leaf being directly opposite the sockets in the other leaf respectively, a spherical element positioned rotatably in each pair of said opposite sockets; less than a half of each spherical element being in each socket; the centers of said spherical elements being equidistant from the plane of the upper surface of said surface plate, spring means adjacent said leaves biasing said surface plate towards said base member and said leaves towards each other, two links along the side edges of said leaves, one at the front and the other at the rear of the leveling table; each link being mounted at one of its ends in good pivotal fit to one of said leaves and connected in loose pivotal fit at its other end to the other of said leaves, and means to tilt the surface plate with respect to said base member about the axis constituting the line of centers of said spherical elements.

2. A leveling table as defined in claim **1**, wherein the base member has two spaced legs, each having a ball joint interposed therein; the line of centers of said ball joints constituting the axis about which the base member can be moved to be tilted.

3. A leveling table as defined in claim **1**, wherein all spherical elements are identical and all sockets are identical.

4. A leveling table as defined in claim **1**, wherein the pivotal axes where the link ends are in good pivotal fit, are in alignment, and wherein the pivotal axes where the link ends are in loose pivotal fit, are in alignment.

5. A leveling table as defined in claim **1**, wherein the spring means are positioned between the base member and the surface plate.

6. A leveling table as defined in claim **1**, wherein the means to tilt the base member comprises a substantially upright screw forward of the surface plate; the base member having an extension forward of said surface plate; said screw being positioned through a threaded hole in said extension and threadedly engaged therein and said screw having a ball joint interposed in the lower portion thereof which is below the base member.

No references cited.

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