

Sept. 5, 1961

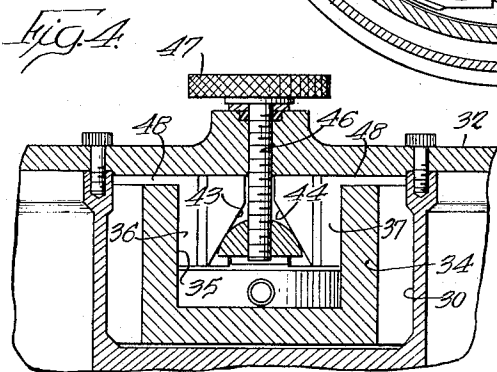
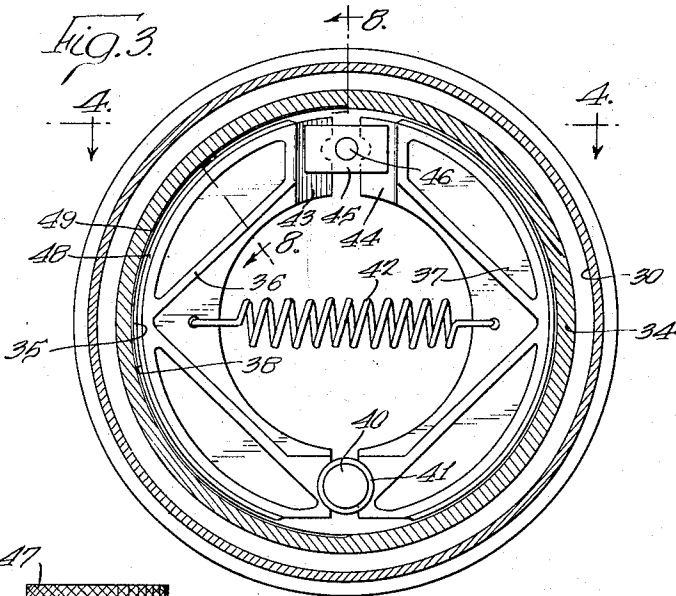
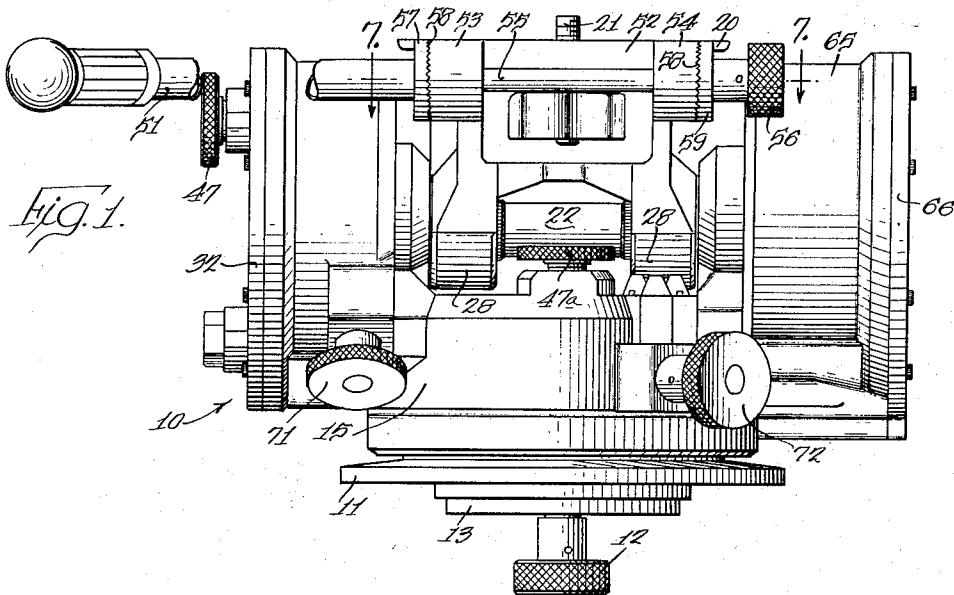
C. O'CONNOR

2,998,953

PANHEAD

Filed June 21, 1957

3 Sheets-Sheet 1



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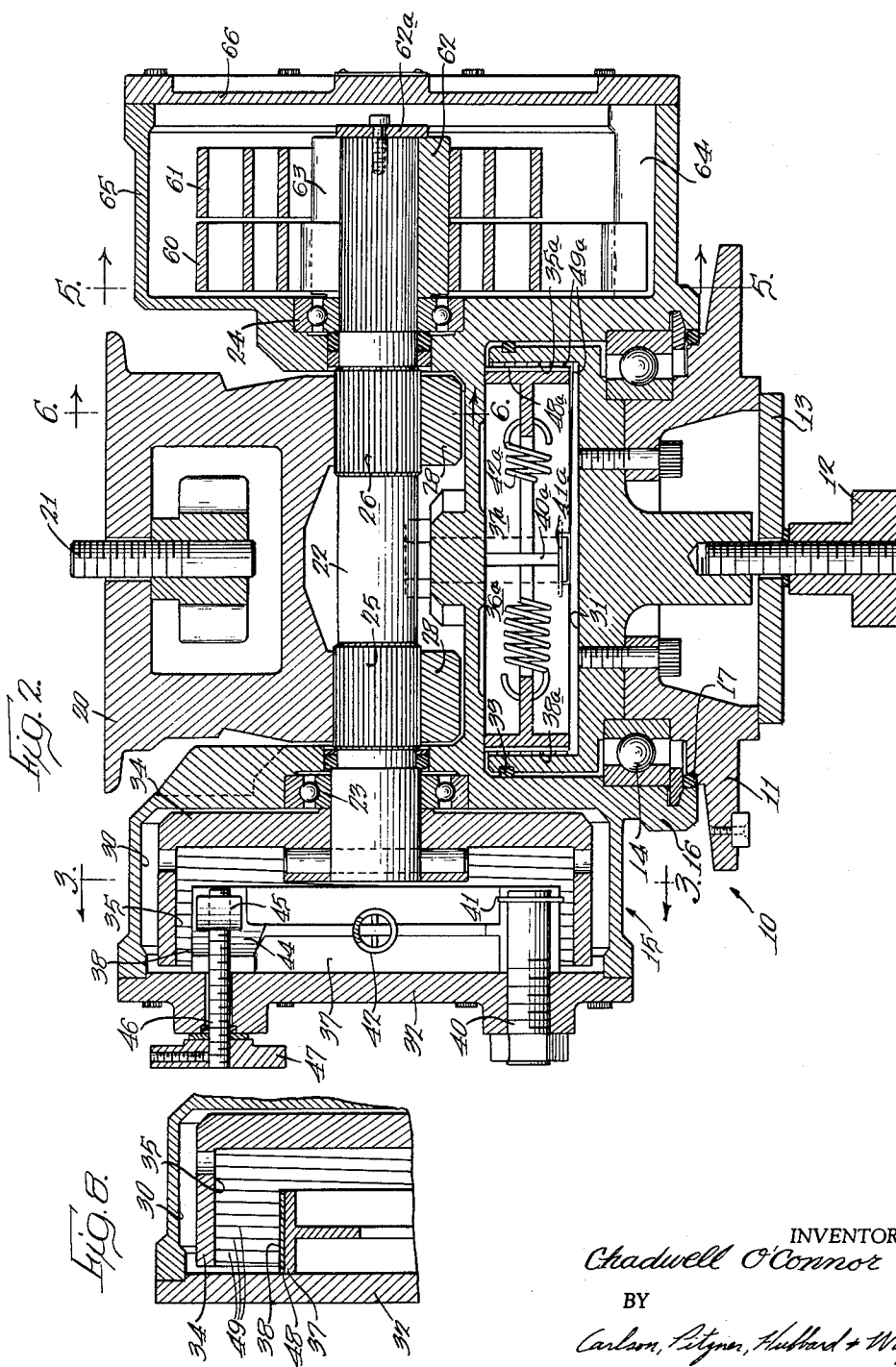
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3 Sheets-Sheet 2



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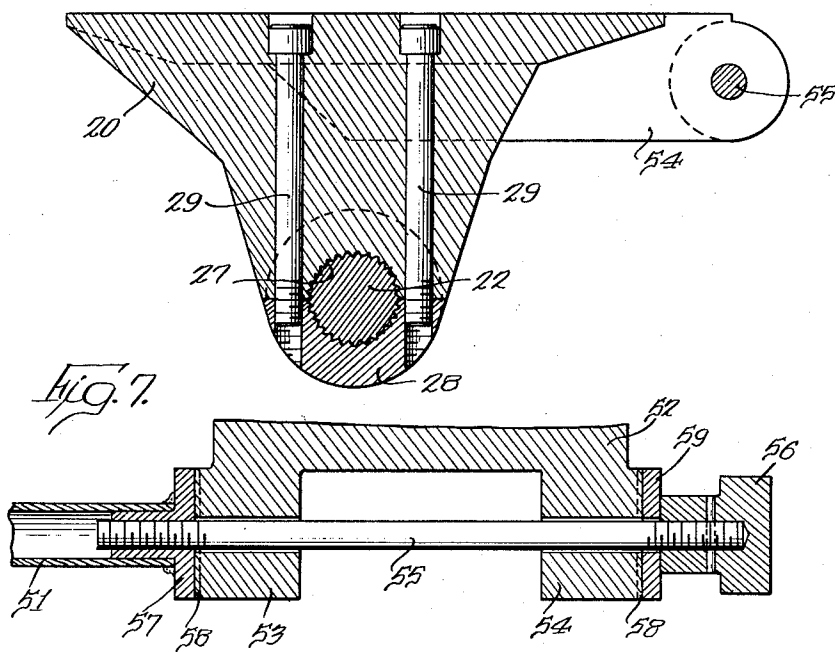
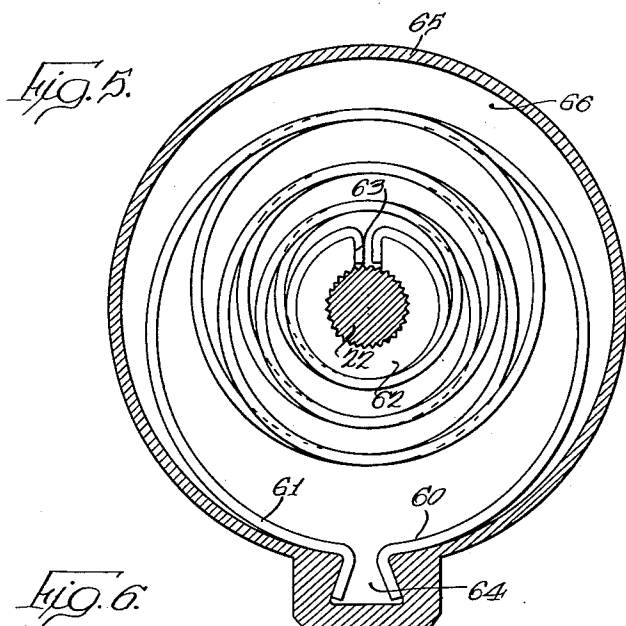
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PANHEAD

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3 Sheets-Sheet 3



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2,998,953

PANHEAD

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Alta Loma, Calif.Filed June 21, 1957, Ser. No. 667,192
5 Claims. (Cl. 248—183)

The present invention relates to panheads for supporting and mounting heavy cameras, surveying instruments and similar equipment, and more particularly to a panhead that permits uniformly smooth panning and tilting movements under widely diverse operating conditions.

One of the most difficult functions which must be performed by a panhead is permitting the mounted camera or other instrument to be smoothly scanned back and forth and up and down. The movement must be smooth and uniform, free from jerking or chattering when starting or stopping and during both fast and slow movement.

The problems of designing such a panhead are further complicated by requiring the panhead to perform uniformly through extreme temperature ranges, and by mounting large cameras having substantial inertia and weight on the head.

It is the general aim of the invention to fully meet the above requirements and provide a panhead that smoothly and uniformly pans and tilts through wide extremes in temperature ranges.

It is a further object to provide a panhead having the above characteristics that will support and smoothly operate with heavy, massive cameras without being itself bulky and cumbersome.

In more detail, it is an object to provide a panhead having an improved arrangement of controls which permits an operator to have direct and convenient control of the head in all of its possible positions. It is a collateral object to provide such a panhead with an improved reversible, and angularly adjustable, handle as an aid to convenient operation.

With more particularity, it is an object to provide a panhead having an improved counterbalancing spring arrangement that smoothly compensates for the overbalancing weight of a tilted heavy camera.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIGURE 1 is a rear elevation view of a panhead constructed according to the present invention.

FIG. 2 is a central vertical section of the panhead shown in FIG. 1.

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2.

FIG. 4 is a sectional view taken along line 4—4 of FIG. 3.

FIG. 5 is a sectional view taken along line 5—5 of FIG. 2.

FIG. 6 is a sectional view taken along line 6—6 of FIG. 2.

FIG. 7 is a sectional view taken along line 7—7 of FIG. 1.

FIG. 8 is a sectional view taken along line 8—8 of FIG. 3.

While the invention will be described in connection with a preferred embodiment, it will be understood that I do not intend to limit the invention to that embodiment, but, on the contrary, intend to cover all alterations, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning first to FIG. 1, there is shown a panhead 10 constructed according to the present invention as seen from the rear or operator's side of the head. To mount the panhead, a suitably formed tripod base 11 is carried

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at the bottom of the device to which is threadably attached a tripod locking screw 12, and a clamping washer 13 (see FIG. 2). Rotatably supported on the base 11 by means of a ball bearing assembly 14 is a tripod housing 15. A depending flange or skirt 16 is formed integrally with the housing and extends downwardly to surround and protect the ball bearing assembly 14. In order to seal lubricant within the ball bearing assembly 14 and prevent the entry of dirt or other foreign material, an O ring 17 is disposed between the lip of the skirt 16 and a suitably formed shoulder on the base 11.

For mounting a camera or other instrument, the panhead 10 is provided with a mounting plate 20 through which extends a conventional instrument mounting screw 21. As will be apparent to those versed in the art, a camera or other instrument to be mounted on the panhead is placed flatly on the plate 20 and the screw 21 is threaded upwardly into a conventionally provided threaded hole to draw the instrument tightly and securely against the plate 20.

To permit the plate 20 to be tilted about a horizontal axis, it is carried by a tilting shaft 22 which is journaled in the housing 15 by means of two aligned ball bearing assemblies 23 and 24. In order to securely clamp the plate 20 to the tilting shaft 22, the shaft is provided with two serrated portions 25 and 26 which are surrounded and snugly engaged by mating serrated areas 27 on the plate 20 and similar areas on a pair of clamps 28 (see FIG. 6). The serrated portions 25, 26 on the shaft 22 are tightly gripped between the portion 27 of the plate 20 and the clamps 28 by tightening the bolts 29, of which two are provided for each of the clamps 28, and thus the plate is firmly secured to the shaft 22 and rotates therewith.

To manually control the position of the mounting plate 20, the plate is provided with a rearwardly extending and rigidly mounted handle 51 (see FIG. 1). The mounting of the handle 51 will be discussed more fully below. It will be appreciated that by grasping the handle 51 an operator can tilt the camera plate 20 in a vertical plane about the axis of the shaft 22, and can simultaneously rotate the plate 20, together with the entire panhead housing 15, in a horizontal plane about the tripod base 11. This affords complete flexibility and enables a camera or other instrument mounted on the plate 20 to be aimed by the operator in any desired direction.

For insuring uniform, smooth and steady tilting and panning movements of the plate 20, both about the axis of shaft 22 and about the axis of bearing 14, fluid frictional resistance is imposed against both rotating movements by two braking chambers, one for each axis of rotation, with each braking chamber having closely spaced, cooperating, cylindrical braking surfaces rotating in a fluid medium. In the present embodiment, the braking chambers comprise a first cylindrical chamber 30 formed integrally in one side of the housing 15 and concentric with the tilting shaft 22, and a second cylindrical chamber 31 formed in the top of the base 11 and concentric with the supporting bearing 14.

Turning first to the chamber 30, it is closed and sealed by means of a cover plate 32 suitably secured to the housing 15. Disposed within the chamber 30 is an annular braking member 34 having an inner cylindrical braking surface 35. The member 34 is pinned to the tilting shaft 22 and thus rotates in unison with the shaft 22 within the chamber 30. Disposed within the braking surface 35 is an annular unit including two arcuate brake shoes 36 and 37 (see FIG. 3) which are adjustably secured to the chamber cover plate 32. The annular unit is completed by elements 40 and 45 (see FIG. 3) which are described in detail below. The shoes 36, 37 combine to form a substantially cylindrical outer braking surface 38

which is closely disposed to, and concentric with, the braking surface 35 on the member 34.

Turning next to the braking chamber 31 which provides a cylindrical recess, it will be seen that elements and surfaces within the chamber 31 which are identical to corresponding elements and surfaces within the chamber 30 have been given the same numerical designation with the distinguishing suffix "a" added. The chamber 31 is sealed to the closely encircling housing 15 by means of an O ring 33, and its inner wall forms a cylindrical braking surface 35a. Disposed within this braking surface 35a are two brake shoes 36a and 37a which are adjustably supported by the housing 15. The shoes 36a and 37a combine to form a substantially cylindrical braking surface 38a which is closely disposed to, and concentric with, the braking surface 35a.

In accordance with the present invention, an extremely viscous, temperature stable fluid is disposed between each pair of closely spaced, adjacent, cylindrical braking surfaces, and said surfaces are constructed to permit selective relative spacing with one surface of each pair being formed of a material having the properties of sheet cork so as to induce a smooth, fluid-like frictional resistance to relative rotation between the adjacent braking surfaces which can be selectively adjusted and which will remain uniform throughout a wide temperature range. In the present instance, a thick silicone fluid is placed within both of the braking chambers 30, 31 so as to fill them one third to one half full, and each of the shoes 36, 37, 36a, 37a have bonded thereto thin layers of cork 48 which form the braking surfaces 38, 38a. It has been found that capillary attraction and the manual movement of the shoes within the chambers 30, 31 keeps the silicone fluid disposed between the entire adjacent areas of the braking surfaces at all times, and this in turn imposes a smooth, fluid-like frictional resistance against rotation of the mounting plate 20 around either of its two possible axes of movement.

The function of the cork is to prevent galling of the adjacent braking surfaces when they are relatively moved, which results in "chattering" and a "sticky" rotational movement. It was found that using two metallic braking surfaces with a thick, viscous silicone fluid between, caused each of the surfaces to gall, particularly when aluminum was utilized in order to keep the panhead 10 light and easy to handle. However, when one of each pair of braking surfaces is formed of cork, a particularly smooth, fluid-like frictional resistance is obtained. It will be understood that the invention is not limited solely to the use of sheet cork, and that any material exhibiting a similar characteristic can be substituted for cork without departing from the invention.

As is well known, silicone compounds retain their physical characteristics through very wide temperature ranges and therefore the fluid between the braking surfaces imposes substantially the same frictional resistance throughout temperature ranges of -20°F. to 120°F. While silicones have been recognized as temperature stable compositions, their metal lubricating properties are very poor. However, by disposing a cork surface adjacent the silicone fluid, a particularly smooth and jerk-free action is achieved.

In carrying out the invention, a particularly effective silicone fluid has been compounded for use in the braking cylinders 30, 31 which is quite viscous so as to produce the desired frictional resistance without being rubbery or tacky which would cause grabbing or jerking when the adjacent braking surfaces are rotated. In the present instance, a substantially pure silicone rubber gum, which may be, for example, the General Electric product SE-76, is mixed with a pure silicone oil, which, for example, may be the General Electric product trade named "Viscasil," to produce a fluid having a viscosity of approximately 100,000 centipoises. In order to increase the viscosity of this solution without making it rubbery or tacky, 15% by

weight of a silica aerogel is added to the solution to produce a liquid having a viscosity within the range of 1 to 2 million centipoises. An example of a particular silica aerogel which has been found to be extremely effective is the product trade marked "Santocel C" which is supplied by the Monsanto Chemical Company.

It has been found that a solution formulated in the above manner produces reliably uniform frictional resistance from -20°F. to 120°F. This is to be contrasted with conventional lubricants and greases which have a similar range only from approximately 40°F. to 100°F.

Also in accordance with the invention, the cooperating braking surfaces 35, 35a and 38, 38a respectively, are adjustable so that the degree of frictional resistance desired can be selectively obtained. This is accomplished in the present instance by adjusting the positions of shoes 36, 37, 36a, 37a. Since the construction and adjustable support of the shoes 36a, 37a is identical to the construction and support of shoes 36, 37 only the latter will be described in detail.

Giving our attention now to the adjustable mounting of the brake shoes 36, 37, it can be seen that means have been provided to adjustably spread the shoes so that the spacing between braking surfaces 35 and 38 can be selectively varied. In the present instance, the shoes 36, 37 are pivotally supported on a pin 40 by forming each shoe with a short arcuate portion near one end which conforms to the circumference of the pin, and drawing the arcuate portions into snug engagement with the pin by means of a tensioned spiral spring 42. Carried at the end of the pin 40 is a washer 41 which overlies the end portions of the shoes and thus prevents their moving laterally off of the pin 40.

To cause the shoes 36, 37 to be adjustably spread, each shoe is formed with a tapered cam surface 43, 44, respectively, at the ends opposite the pin 40. Riding between, and in engagement with, the tapered surfaces 43, 44 is a wedge 45 that is threadably mounted on an adjusting screw 46 which passes through the cover plate 32. The screw 46 has fixed thereto a knob 47 which is readily accessible at the exterior of the housing 15.

Thus, to adjust the positioning of the braking surface 38 with respect to the braking surface 35, it can be seen that it is merely necessary to turn the knob 47, which rotates the adjusting screw 46 and moves the wedge 45 between the tapered surfaces 43, 44. By moving the wedge 45 to the left in FIG. 2, the shoes 36, 37 are wedged apart against the resistance of the spring 42, which brings the braking surfaces 35, 38 closer together. On the other hand, when the wedge 45 moves to the right in FIG. 2, the force of the spring 42 causes the shoes 36, 37 to swing toward each other around the pin 40 and further separates the braking surfaces.

It will be understood that the shoes 36a, 37a are similarly constructed and arranged so that the positioning of knob 47a (see FIG. 1) permits the adjustment of the spacing between braking surfaces 35a and 38a.

It can be readily seen that by adjusting the knobs 47, 47a the braking surfaces may be brought closer together which increases the shearing action in the lubricant when the surfaces move relatively and thus increases or stiffens the frictional resistance against rotation. By manipulating the knobs 47, 47a, to separate the braking surfaces, a looser and freer rotation of the parts may be obtained. For any particular setting of the braking surfaces, the resulting frictional resistance to rotation will remain substantially constant through wide ranges of varying temperatures due to the temperature stability of the silicone fluid.

In order to further increase the fluid frictional resistance to relative rotation between the adjacent braking surfaces and to permit the spacing of these surfaces to be relatively adjusted, helical grooves 49 and 49a are cut into the braking surfaces 35 and 35a respectively. As

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stated, these helical grooves serve a dual purpose. First, they cause the fluid disposed between the braking surfaces to move laterally which adds a lateral shearing force to the peripheral shearing force induced when the braking surfaces are relatively rotated and thus substantially increases the frictional resistance imposed by the fluid. Second, the helical grooves 49, 49a permit the brake shoes 36, 37 and 36a, 37a to be readily withdrawn so as to separate the surfaces 38, 38a from the surfaces 35, 35a. It will be appreciated that if two smooth surfaces were closely disposed with the intervening gap filled with a viscous fluid there would be a substantial suction-like resistance to separating the surfaces, but by providing the helical grooves 49, 49a it has been found that the brake shoes may be readily withdrawn and adjustably positioned with respect to their cooperating braking surfaces.

Also in accordance with the invention is the provision of flat oppositely coiled springs arranged to counterbalance a heavy camera or other instrument when it is tilted far beyond the axis of the shaft 22. In the present embodiment, two flat coiled springs 60 and 61 are oppositely wound and tensioned between the tilting shaft 22 and the housing 15. To secure the springs 60, 61 to the shaft 22, the latter is extended past the supporting bearing 24 and is serrated to receive a complementarily formed sleeve 62, and the inner ends of the springs 60, 61 are bent into a recess 63 formed in the outer periphery of the sleeve. The sleeve 62 is held against sliding from the end of the shaft 22 by means of a washer 62a suitably secured to the end of the shaft 22. To secure the outer ends of the springs 60, 61 to the housing 15, the housing is provided with an inversely tapered recess 64 into which are bent the outer ends of the springs.

The operation of springs 60, 61 can be readily understood. When the mounting plate 20 is tilted so as to rotate the tilting shaft 22, one of the springs 60, 61 is wound more tightly about the shaft 22 while the remaining spring is unwound or loosened about the shaft. As each of the springs 60, 61 is initially tensioned in opposed and exactly balanced relation, the additional winding of one of the pair produces a counter-twisting force on the shaft 22 which is calculated to substantially balance the weight of a camera or other heavy instrument when it is tilted to either side of the axis of the shaft 22.

So that the springs 60, 61 may be retained in lubricant and protected against dirt or other foreign material, the housing 15 is formed to provide a cylindrical case 65 which surrounds the springs 60, 61 and to which may be secured and sealed a cover plate 66. In this manner the springs are completely enclosed and protected and may be charged with a lubricant for insuring smooth winding and unwinding action without danger of the lubricant escaping from the case 65.

In accordance with a further aspect of the invention and for controlling the movement of the mounting plate 20, the panhead 10 is provided with an operating handle 51 which is mounted in a novel manner permitting the handle to be angularly adjusted for convenient grasping, or reversed for proper left or right hand operation. In the present embodiment, the handle 51 is secured to a rearwardly extending flange 52 formed integrally with the plate 20 (see FIGS. 1 and 7), and which has two aligned bosses 53, 54 that are suitably apertured to receive a locking shaft 55 which threadably engages and securely locks the handle 51 in position. In order to operate the shaft 55, a knurled thumb knob 56 is non-rotatively secured to one end of the shaft. The opposite end of the locking shaft 55 is threaded so as to engage a threaded locking nut 57 rigidly fixed to handle 51. It can thus be seen that the locking shaft 55 can be extended through the bosses 53, 54 to threadably engage the nut 57 and draw the latter firmly against one of the bosses so as to lock the handle 51 to the mounting plate 20.

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In order to lock the handle 51 at any desired angle with respect to the mounting plate 20, the lateral face of nut 57 and the outer surfaces of each of the bosses 53, 54 are provided with complementary radial serrations 58. Thus, when the locking shaft 55 draws the nut 57 tightly against either of the bosses 53, 54, the complementary serrations will engage and lock the handle 51 at any angle desired for convenience of the operator. It will be appreciated that since the outer surfaces of each of the bosses 53, 54 is serrated the handle 51 may be locked to either side of the ledge 52, in accordance with the wishes of the operator, by merely releasing the locking shaft 55 and reversing the parts.

To avoid damage to the serrations on the bosses 53, 54 when the knob 56 is tightened, a washer 59 is provided which may be interposed between the knob 56 and whichever one of the bosses 53, 54 the knob is to be tightened against.

It has also been found desirable to provide simple mechanisms which are effective to selectively lock the mounting plate 20 against rotation around both its tilting and panning axes. In the present embodiment, the locking control takes the form of two knurled control knobs 71 and 72 (see FIG. 1). In the manner well known to those skilled in this art, the control knobs 71, 72 are non-rotatively fixed to locking screws (not shown) which are threaded into suitable apertures formed in the housing 15. When either of the knobs 71 or 72 is rotated its respective locking screw is carried inwardly to grippingly engage the rotative members located just within the housing wall. In the case of knob 71, its associated locking screw engages the outer cylindrical periphery of the braking element 34 so as to prevent the rotation of shaft 22 and thus lock the mounting plate 20 against tilting movement. The locking screw associated with knob 72 extends through the outer wall of housing 15 to bear against the outer cylindrical surface of that portion of base 11 forming the chamber 31. It will be seen that this latter locking engagement prevents turning or panning movement of the mounting plate 20.

It is one of the features of the invention that all of the controls for adjusting and operating the panhead 10 are within the convenient reach of an operator standing behind the panhead and grasping the handle 51, and these controls remain within convenient reach in all angular positions of the mounting plate 20. To accomplish this objective, it can be seen that all of the control knobs 47, 47a, 71, 71a, are mounted in, and thus rotate with, the panhead housing 15. These controls are conveniently grouped at one side of the housing so as to be accessible from a single operating position. As the panhead is swung in a horizontal plane, i.e., panned, the swinging housing carries the control knobs in their same relative positions to the new angle at which the panhead is aimed, and thus all of the control knobs remain within the convenient reach of the operator.

It can also be seen that the panhead 10 is particularly effective for use with heavy cameras or other similar instruments. The counterwound springs 60, 61 apply smooth, steadily increasing counterbalancing forces to the mounting plate 20 as the plate is gradually tilted and thus prevents a heavy instrument, when overcentered, from exerting so much force on the handle 51 as to make smooth movements of the plate 20 impossible. Further, the smooth fluid frictional resistances to both panning and tilting movements make it virtually impossible to move the mounting plate 20 in sudden fits and starts even when the plate is carrying a heavy load. "Jerking" becomes virtually impossible both in initiating movement of the mounting plate 20 and in bringing that movement to a stop. Still further, the fluid resistance to movement of the instrument can be adjusted by the operator so that he can select the proper "feel" which permits him to most effectively operate the instrument. Once the degree of fluid resistance is selected, it will be appreciated that this value will remain constant through extremely

wide ranges of temperature variation due to the temperature stability of the silicone fluid producing the fluid frictional resistance.

I claim as my invention:

1. A panhead for supporting an instrument and permitting it to smoothly scan comprising in combination, a base provided with means for securement to a suitable support, an instrument mounting plate pivotally supported on said base and having means permitting an instrument to be fixed to said plate, two substantially annular units having surfaces closely adjacent to one another and having aligned central axes, one of said units being fixed to said base and the other being fixed for oscillation with said plate, a chamber enclosing said units, and a viscous silicone fluid within said chamber and between said surfaces to impose a frictional drag thereon, one of said units having a layer of cork covering its said surface to prevent binding or galling between the surfaces.

2. A panhead for supporting an instrument permitting smooth scanning movements comprising, in combination, a base provided with means for securement to a suitable support and having a cylindrical recess, a housing pivoted on said base for rotation about a vertical axis, an annular unit mounted within said recess for rotation with said housing with its outer cylindrical surface in close proximity to the cylindrical wall of said recess, at least one of said surfaces having a helical groove therein, an instrument mounting plate journaled to said housing for rocking movement about a horizontal axis, a chamber formed in said housing enclosing a second annular unit having a cylindrical surface and being supported by said housing concentric to said horizontal axis, a member having a cylindrical surface in close proximity to said last mentioned cylindrical surface and mounted for rocking movement with said plate, at least one of said latter surfaces having a helical groove formed therein, both said recess and said chamber containing a viscous fluid for imposing a frictional drag on said units and means for expanding and contracting said annular units so as to adjustably vary said frictional drag, said helical grooves readily permitting adjustment of said units toward and away from their respective opposed cylindrical wall and cylindrical surface

3. In a panhead for supporting an instrument and having an axis about which the instrument can be swung, a frictional drag device for insuring smooth scanning movement of the instrument comprising, in combination, a chamber defining a cylindrical surface concentric with said axis, an annular unit having an arcuate surface in close proximity to said cylindrical surface, said chamber and unit being mounted for relative rotation when the instrument is swung about said axis, a viscous fluid disposed in said chamber between said surfaces to impose a smooth frictional drag against said rotation, and means for adjustably positioning said unit to vary the spacing

of said surfaces so that the amount of said drag can be selected.

4. A panhead for supporting an instrument permitting smooth scanning movements comprising, in combination, a base provided with means for securement to a suitable support and having a cylindrical recess, a housing pivoted on said base for rotation about a vertical axis, an annular unit carried for rotation by said housing and mounted within said recess with its outer cylindrical surface in close proximity to the cylindrical wall of said recess, an instrument mounting plate journaled to said housing for rocking movement about a horizontal axis, a chamber formed in said housing enclosing a second annular unit having a cylindrical surface and being supported by said housing concentric with said horizontal axis, a member having a cylindrical surface in close proximity to said last mentioned cylindrical surface and mounted for rocking movement with said plate, both said recess and said chamber containing a viscous fluid for imposing a frictional drag on said units and means for expanding and contracting said annular units so as to adjustably vary said frictional drag.

5. In a panhead for supporting an instrument and having an axis about which the instrument can be swung, a frictional drag device for insuring smooth swinging movement of the instrument comprising, in combination, a chamber defining a cylindrical surface concentric with said axis, an annular unit having an arcuate surface in close proximity to said cylindrical surface, one of said surfaces being formed of cork, said chamber and unit being mounted for relative rotation when the instrument is swung about said axis, a viscous silicone fluid disposed in said chamber and between said surfaces to impose a smooth frictional drag against said rotation, and means for adjustably positioning said unit to vary the spacing of said surfaces so that the amount of said drag can be selected.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,998,953

September 5, 1961

Chadwell O'Connor

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 8, list of references cited, under the heading UNITED STATES PATENTS, add the following:

2,775,317 Sinisterra ----- Dec. 25, 1956

Signed and sealed this 27th day of March 1962.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents