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ARTICULATE SUPPORT ARM ASSEMBLY FOR OPTICAL DEVICES

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2 Sheets-Sheet 1

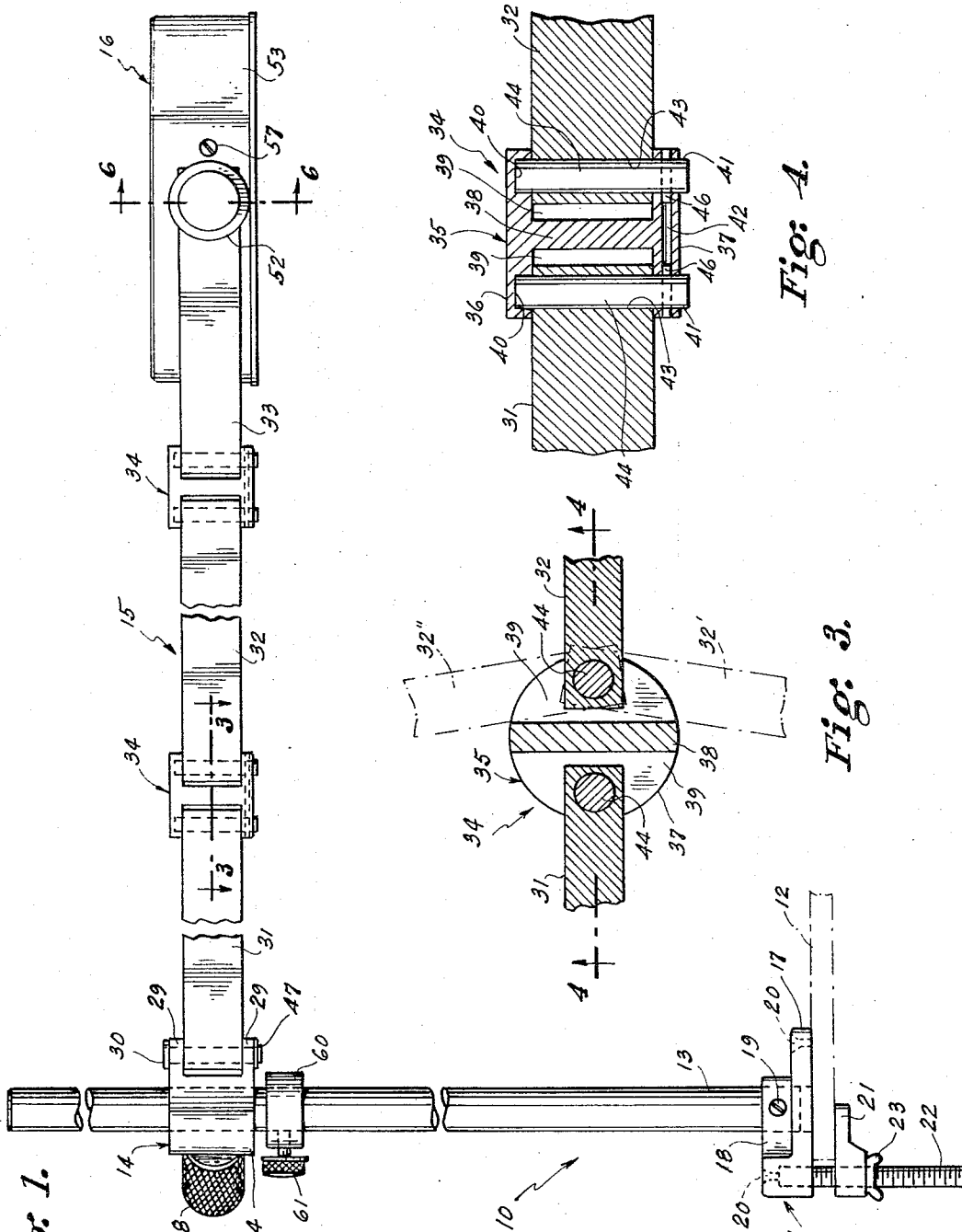


Fig. 1.

Fig. 2.

Fig. 3.

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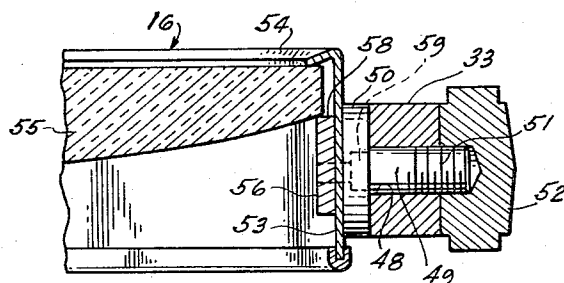
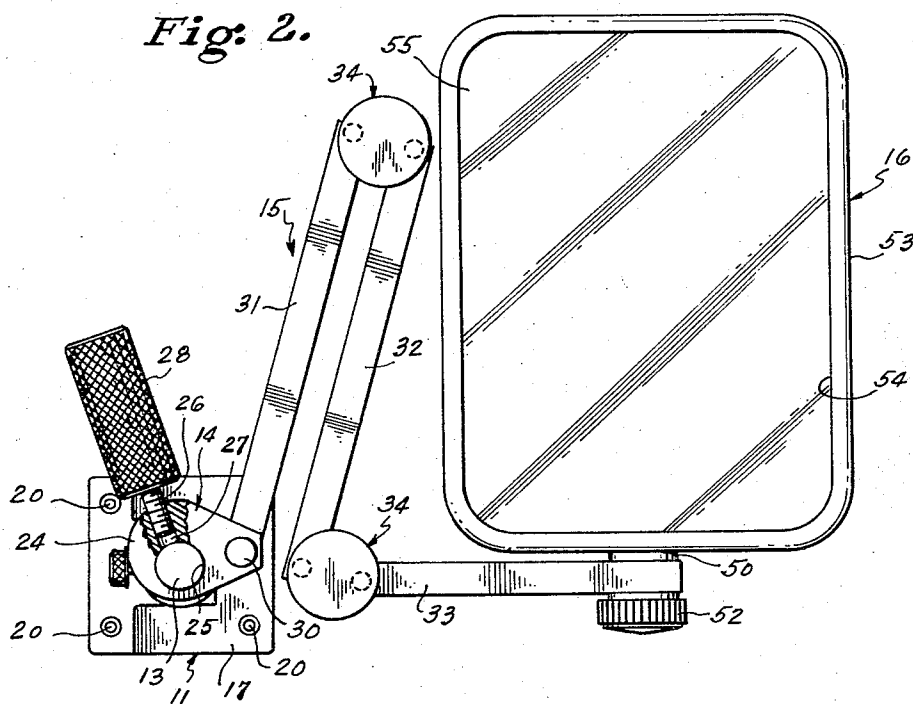
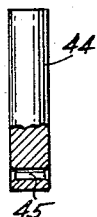


Fig. 6.

Fig. 5.



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1

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ARTICULATE SUPPORT ARM ASSEMBLY FOR OPTICAL DEVICES

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This invention relates to an adjustable support structure for optical or other devices arranged so that the supported device may be adjustably raised or lowered, tilted or moved horizontally in relation to an underlying work surface.

It is an object of this invention to provide an articulate arm assembly particularly intended to form part of an adjustable support structure for an optical device, such as, a large magnifying lens suitable for binocular viewing of minute objects being assembled or inspected, and wherein the articulate arm assembly is formed of a plurality of elongated arm elements arranged in successive end-to-end relation and having their adjacent ends joined to each other in a manner to permit relative horizontal swinging of the adjacent arm elements through approximately 360°.

Another object is to provide an articulate arm assembly of the described character in which the joints connecting the adjacent ends of the successive arm elements are constructed to permit free relative swinging movements thereof and to avoid binding of the arm elements in all relative positions thereof.

A further object is to provide an adjustable support structure including an articulate arm assembly which is designed so as to be relatively inexpensive to produce and attractive in appearance.

In accordance with an aspect of this invention, the elongated arm elements arranged in successive end-to-end relation have bores extending through their adjacent end portions perpendicular to the longitudinal axes of the arm elements, and are pivotally connected at their adjacent ends by joint means each including a joint element having parallel walls spaced apart by a web extending centrally between the walls, and parallel pivot pins extending between, and mounted in the spaced walls of the joint element at opposite sides of the web, such pivot pins being received in the bores at the adjacent ends of the arm elements, so that, upon swinging of one arm element relative to the next arm element substantially beyond an angle of 180°, the angularly displaced arm element acts against the web of the joint element to turn the latter relative to the next arm element about the pivot pin forming the connection therewith.

The above, and other objects, features and advantages of this invention, will be apparent in the following detailed description of an illustrative embodiment thereof which is to be read in connection with the accompanying drawings forming a part hereof, and wherein:

FIG. 1 is a side elevational view of an adjustable support structure shown carrying an optical device and which includes an articulate arm assembly embodying this invention, with arm elements of that assembly and a vertical post also included in the adjustable support structure being shown broken or reduced in length;

FIG. 2 is a top plan view of the arrangement shown on FIG. 1, but with the articulate arm assembly in another possible position thereof;

FIG. 3 is an enlarged, sectional view taken along the line 3—3 on FIG. 1 and showing details of a joint assembly connecting adjacent arm elements;

FIG. 4 is a sectional view taken along the line 4—4 on FIG. 3;

2

FIG. 5 is a detail view, partly broken away and in section, of a pivot pin included in the joint assembly of FIGS. 3 and 4; and

FIG. 6 is an enlarged detail sectional view taken along the line 6—6 on FIG. 1, and showing the means by which the optical device is suspended from the articulate arm assembly.

Referring to the drawings in detail, and initially to FIGS. 1 and 2 thereof, it will be seen that the adjustable support structure there illustrated and generally identified by the reference numeral 10 includes a base 11 adapted to be mounted on a table or other work surface indicated by broken lines at 12 on FIG. 1; a vertical post 13 extending upwardly from base 11; a mounting bracket assembly 14 adjustable vertically along post 13; and an articulate arm assembly 15 supported, at one end, by bracket 14 and having an optical or other device 16 suspended from its other end.

In the support structure shown, base 11 includes a generally rectangular plate 17 having a raised portion 18 formed with an upwardly opening socket receiving the lower end of post 13 which is secured in the socket, as by set screw 19. The base plate 17 may be secured to the table or other work surface 12 by means of screws passing through countersunk holes 20 formed in plate 17 adjacent the four corners thereof. Alternatively, and as shown on the drawings, plate 17 may be secured to table 12 adjacent an edge of the latter by means of a clamp jaw 21 slidable vertically on two threaded rods 22 depending from one side portion of base plate 17 and having wing nuts 23 screwed thereon below clamping jaw 21 for holding the latter tightly against the underside of the edge portion of table 12.

The mounting bracket assembly 14 includes a body 24 formed with a vertical bore 25 extending therethrough and slidably receiving post 13. As shown particularly on FIG. 2, body 24 further has a tapped bore extending radially outward from bore 25 and receiving a locking screw 26. The inner end of locking screw 26 carries a bearing pad 27 of nylon or other suitable material that can be urged into clamping or locking engagement with post 13 without scoring or marring the surface of the latter. Secured to the outer end of locking screw 26 is a cylindrical handle 28 having a knurled surface and being of sufficiently large size to permit its use in turning locking screw 26 for either locking or releasing body 24 relative to post 13 and in raising and lowering bracket assembly 14 and the arm assembly 15 and optical device 16 suspended therefrom. Body 24 of bracket assembly 14 further has a pair of vertically spaced ears 29 extending therefrom and formed with vertically aligned openings which receive a vertical pivot pin 30.

In accordance with this invention, articulate arm assembly 15 includes a plurality of elongated arm elements, for example, three arm elements 31, 32 and 33, as shown. In order to minimize the weight of arm assembly 15, elements 31, 32 and 33 are preferably of aluminum or other light metal. The arm elements are preferably formed of bar stock of rectangular cross-section simply cut into suitable lengths for easy fabrication. The arm elements 31, 32 and 33 are arranged in successive, end-to-end relation and have the major dimensions of their rectangular cross-sections extending vertically. Arm assembly 15 further includes joint assemblies 34 which pivotally connect the adjacent ends of arm elements 31 and 32 and of arm elements 32 and 33, respectively.

As shown particularly on FIGS. 3 and 4, each of the joint assemblies 34 includes a joint element 35 having spaced top and bottom walls 36 and 37 which are preferably circular and joined by a central or diametrically extending vertical web 38 so that recesses 39 are defined between the top and bottom walls 36 and 37 at the opposite

sides of web 38 for receiving the adjacent ends of arm elements 31 and 32 or of arm elements 32 and 33. Sockets 40 (FIG. 4) are formed in the underside of top wall 36 at opposite sides of, and spaced from web 38, and holes 41 extend through bottom wall 37 in vertical alignment with both sockets 40. The bottom wall 37 is further formed with a bore 42 extending diametrically there-through at right angles to the plane of web 38 so as to intercept holes 41.

The opposite end portions of arm elements 31 and 32 and the end portion of arm element 33 that is to be pivotally connected to arm element 32 are formed with bores 43 extending vertically therethrough, that is, in the direction of the major axis of the rectangular cross-section of the arm elements. Each of the joint assemblies 34 further includes two pivot pins 44 extended upwardly through holes 41 of the related joint element 35 and through the bores 43 in the end portions of the arm elements to be pivotally connected by the joint assembly. The upper ends of pivot pins 44 project above the arm elements and are received in sockets 40, as shown particularly on FIG. 4. The lower end portion of each pivot pin 44 has a diametrically extending bore 45 (FIG. 5) located to register with the diametrical bore 42 in the lower wall 37 of the joint element when the upper end of the pivot pin 44 is fully seated in the related socket 40, and the ends of bore 45 are preferably beveled or countersunk, as shown, so as to facilitate the entry of a locking pin 46 driven into bore 42 through the adjacent end of the latter.

The end portion of arm element 31 which is to be suspended from bracket assembly 14 is inserted between ears 29, and the vertical bore 43 in such end portion of arm element 31 receives pivot pin 30 which is inserted downwardly therein. The pin 30 is secured against inadvertent removal, as by a split resilient metal ring 47 (FIG. 1) which engages in an annular groove formed in the surface of pin 30 so as to be located below the lower ear 29.

The end portion of arm element 33 from which optical device 16 is to be suspended is formed with a bore 48 (FIG. 6) extending laterally therethrough, that is, in the direction of the minor axis of the rectangular cross-section of element 33. Bore 48 receives a trunnion 49 extending from a mounting pad 50 which is suitably secured to the suspended device 16, as hereinafter described. Trunnion 49 has a length greater than the width of arm element 33 and its projecting end portion is threaded, as at 51, to receive an internally threaded knob 52.

In the illustrated embodiment of the invention, the suspended optical device 16 is of a type intended for the magnified binocular viewing of objects, for example, during the assembly or inspection of minute parts. The device 16 is shown to include a generally rectangular frame 53 preferably formed with rounded corners, as shown on FIG. 2, and having an inwardly directed flange 54 extending along one entire edge of the frame. A lens 55 is received in frame 53 and, where such lens is plano-convex, as shown, the lens is arranged with its planar surface facing toward and seating, at its edge portion, against flange 54. The lens 55 may be held within frame 53 by means of retainers 56 secured against the inner surfaces of the short sides or ends of rectangular frame 53, as by screws 57 (FIG. 1). Retainers 56 have suitably contoured longitudinal edges 58 (FIG. 6) to seat against the convex surface of lens 55 at the opposite ends of the latter. The frame 53 is secured, at one of its short sides or ends, to mounting pad 50, as by screws 59 (shown in broken lines on FIG. 6) which extend through aligned holes in pad 50 and frame 53 and into tapped holes in the adjacent retainer 56.

In order to prevent dropping of optical device 16 onto the table or other work surface 12 during adjustment of bracket assembly 14 along post 13, a stop is preferably provided on post 13 below the bracket assembly. Such stop may be in the form of a collar 60 slidable along post 13 under the bracket assembly and being adjustably se-

cured in position by a set screw with an actuating knob 61.

It will be apparent that adjustment of the vertical position of optical device 16 above table 12 may be achieved by moving bracket assembly 14 along post 13, as previously described. Tilting of optical device 16 or turning thereof about a horizontal axis coinciding with the axis of trunnion 49, so that either the planar or the convex surface of lens 55 may face downwardly, is made possible merely by loosening knob 52 and manually tilting or turning the optical device, whereupon knob 52 is retightened to secure the optical device in its adjusted position relative to arm element 33.

When it is desired to change the horizontal position of optical device 16 over the table or work surface, it is only necessary to grasp the knob 52 or the frame 53 of the optical device and to manually displace the latter to the desired position. Such horizontal displacement of the optical device, causes the elements 31, 32 and 33 of the articulate arm assembly 15 to be suitably angularly displaced with respect to each other and relative to the body 24 of bracket assembly 14. During horizontal displacement of the optical device, for example, from the position of FIG. 1 where arm elements 31, 32 and 33 are fully extended or in-line, to the position of FIG. 2 where the arm elements are relatively folded, the joint assemblies 34 ensure that the necessary relative angular displacements of the arm elements will be freely accomplished without binding.

As shown particularly on FIG. 3, the effectiveness of each joint assembly 34 in permitting relative angular displacement of the arm elements connected thereby through at least 360° without binding results from the fact that each connected arm element, for example, the element 32 on FIG. 3, can swing relative to joint element 35 through an angle of at least 180° from one extreme position, indicated in broken lines at 32', to the opposite extreme position, indicated in broken lines at 32''. At each of these extreme positions, the arm element engages the central web 38 of the joint element so that further swinging of the arm element beyond one or the other of the extreme positions 32' and 32'' causes turning of joint element 35 about the pivot pin 44 which connects the joint element to the next adjacent arm element 31. Such turning of the joint element 35 results in a laterally directed force acting on the adjacent end of the next arm 31 and tending to swing the latter in the direction for completing the folding or relative angular displacement of the pivotally connected arm elements. Thus, the horizontal displacement of the optical device is achieved smoothly and without undue resistance from the articulate support arm assembly.

It will also be apparent that the components of articulate arm assembly 15 present a smooth and attractive appearance and require a minimum of machining operations so as to be capable of relatively inexpensive production.

Although an illustrative embodiment of this invention has been described in detail herein with reference to the accompanying drawing as supporting a particular type of optical device, it will be apparent that other devices can be supported from the arm assembly 15, and further that various changes and modifications may be made in the described and illustrated embodiment by one skilled in the art without departing from the scope or spirit of the invention, except as defined in the appended claims.

What is claimed is:

1. An articulate support arm assembly comprising a plurality of elongated arm elements arranged in successive end-to-end relation; and joint means pivotally connecting adjacent ends of said arm elements, each of said joint means including a joint element carrying two spaced apart, parallel pivot pins and having a web extending between said pivot pins perpendicular to the plane passing through the axes of said pins, said adjacent ends of the arm elements having bores receiving said pivot pins of the joint means.

2. An articulate support arm assembly comprising
 a plurality of elongated arm elements arranged in successive end-to-end relation and having bores extending through their adjacent end portions perpendicular to the longitudinal axes of the arm elements; and
 joint means pivotally connecting the adjacent ends of said arm elements, each of said joint means including a joint element having parallel walls spaced by a central web extending therebetween to define oppositely opening recesses receiving said adjacent ends to the arm elements, and parallel pivot pins mounted in said walls at opposite sides of said web and extending through said bores of the end portions of the arm elements disposed in said recesses.
3. In an adjustable support for an optical device, an articulate arm assembly comprising
 a plurality of elongated, horizontally directed arm elements arranged in successive end-to-end relation and having vertical bores in their adjacent end portions; and
 joint means pivotally connecting said adjacent ends of the arm elements, each of said joint means including a joint element having top and bottom walls and a vertical web extending centrally between said walls, and vertical pivot pins extending between, said mounted in said walls at opposite sides of said web, said pivot pins being received in said bores at the adjacent ends of the arm elements so that each joint element and the arm elements connected thereby are relatively swingable through approximately 180 degrees and the arm elements connected by each joint means are relatively swingable through approximately 360 degrees.
4. An adjustable support for an optical device comprising
 a vertical post;
 a mounting bracket slidable on said post and carrying locking means for securing said bracket in adjusted position along said post; and
 an articulate arm assembly mounted at one end on said bracket for horizontal swinging with respect to the bracket and having means at its other end for carrying an optical device, said arm assembly including a plurality of elongated, horizontally directed arm elements arranged in successive end-to-end relation and having vertical bores in their adjacent end portions, joint elements between said adjacent ends of the arm elements and each having top and bottom walls and a vertical central web spacing said walls to permit said adjacent end portions of the arm elements to extend between said walls at opposite sides of said web, and vertical pivot pins mounted in said walls at said opposite sides of the web and being received in said bores of the adjacent end portions of the arm elements so that each joint element and the arm elements connected thereby are relatively swingable through approximately 180 degrees and the arm elements connected by each joint element are swingable relative to each other through approximately 360 degrees.
5. An adjustable support for an optical device as in claim 4;
 wherein said bracket has vertically spaced ears extending therefrom and carrying a vertical pivot pin, and

- the arm element at said one end of the arm assembly has a vertical bore receiving said pivot pin of the bracket for effecting the mounting of the arm assembly on the bracket.
6. An adjustable support for an optical device as in claim 4;
 wherein said arm elements are straight and have rectangular cross-sections with larger vertical than horizontal dimensions.
7. An adjustable support for an optical device as in claim 4;
 wherein the arm element at said other end of the arm assembly has a horizontal bore extending there-through and receiving said means for carrying an optical device so that the latter can be adjusted about the axis of said horizontal bore.
8. In a viewing apparatus, the combination of
 a vertical post;
 a mounting bracket slidable on said post and carrying locking means for securing said bracket in adjusted position along said post;
 an articulate arm assembly mounted at one end on said bracket for horizontal swinging with respect to the bracket, said arm assembly including a plurality of elongated, horizontally directed arm elements arranged in successive end-to-end relation and having vertical bores in their adjacent end portions, joint elements between said adjacent ends of the arm elements and each having top and bottom walls and a vertical central web spacing said walls to permit said adjacent end portions of the arm elements to extend between said walls at opposite sides of said web, and vertical pivot pins mounted in said walls at said opposite sides of the web and being received in said bores of the adjacent end portions of the arm elements so that each joint element and the arm elements connected thereby are relatively swingable through approximately 180 degrees and the arm elements connected by each joint element are swingable relative to each other through approximately 360 degrees, the arm element at the end of said assembly remote from said bracket having a horizontal bore extending there-through;
 a lens element;
 a frame carrying said lens element and having a threaded trunnion projecting from one side of the frame through said horizontal bore; and
 a knob screwed on said trunnion to clamp said frame relative to the arm element having said horizontal bore.

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