ADJUSTABLE SUPPORT ARM

BACKGROUND OF THE INVENTION

Adjustable support arms allow mounted objects such as electronic displays, keyboards, or other items to be moved to the appropriate ergonomic position relative to the user. By enabling users to align the monitor at the correct height for them, adjustable support arms encourage a healthier, more ergonomic working posture which helps prevent eye and neck strain. Additionally, they preserve precious workspace by floating the monitor above the user's work surface.

In today's modern workplace, adjustable support arms must provide users with a wide range of height, depth, and angle adjustments. For example, when changing from a seated position to a standing position at height-adjustable desks, users oftentimes will desire that the monitor, keyboard and other equipment be at adjusted to different positions. Similarly, where the concept of hot-desking is employed in the workplace, a given workstation must be capable of accommodating different users of different sizes throughout the workday. Accordingly, an adjustable support arm offering improved adjustability over a wide range of travel would be beneficial.

SUMMARY OF THE INVENTION

The invention disclosed herein is generally directed to an adjustable support arm capable of providing users with a wide range of height, depth, tilt, and swivel options for the side-to-side, front-to-back, and up-to-down movements that the modern workspace requires. An adjustable support arm exemplifying the principles of the present invention can comprise one or more of the following features: a quick-release joint for enabling easy removal and attachment of the arm assembly to the base assembly; a friction cartridge assembly for connecting the arm assembly to the base assembly in a manner which reduces slack in the joint; an adjustable panning insert for adjusting the side-to-side range of motion of the support arm; a bearing positioned in the hub of the base assembly for reducing the amount of force required to adjust the side-to-side motion of the support arm as well as the amount of force required to detach the arm assembly from the base assembly; a quick-release accessory fastening mechanism for easy removal and attachment of a mounted accessory (e.g., an electronic display, keyboard, or other object) to the support arm; and an accessory bracket assembly for mounting both primary and secondary accessories to the adjustable support arm.

In an embodiment exemplifying the principles of the invention, the adjustable support arm can comprise an arm assembly releasably mounted to a base assembly. The adjustable support arm optionally may also comprise an articulating joint connected to the arm assembly, and an accessory bracket assembly connected to the articulating joint.

In a further embodiment exemplifying the principles of the invention, the adjustable support arm may also comprise a quick-release joint for releasably connect the arm assembly to the base assembly. The quick-release joint may comprise a spring-loaded latch coupled to the base assembly which releasably engages an indentation in a connector shaft secured to the arm assembly, thus locking the arm assembly into connection with the base assembly. In

embodiments whereby the arm assembly comprises a first arm mounted to a second arm, a quick-release joint may also be utilized to releasably connect the arms.

In another embodiment exemplifying the principles of the invention, the adjustable support arm may also include a friction cartridge assembly for dampening side-to-side movement of the arm assembly and reducing slack in the joints. The friction cartridge assembly may comprise a taper-lock bushing surrounding a portion of the connector shaft. Set screws positioned adjacent to the taper-lock bushing can be utilized to cause the taper-lock bushing to deflect inward towards the connector shaft as the set screws are driven inward, thus increasing the friction between the connector shaft and the taper-lock bushing and, in turn, dampening the side-to-side movement of the arm assembly.

In yet another embodiment exemplifying the principles of the invention, the adjustable support arm may also include a ring-shaped, adjustable panning insert coupled to the arm assembly for restricting the range of side-to-side motion of the support arm. The adjustable panning insert can comprise first and second male splines positioned in a stacked orientation around the inner wall of the adjustable panning insert. The adjustable panning insert also includes first and second projections positioned in a spaced relation around the circumference of the adjustable panning insert and extending in the vertical plane. In operation, a user can elect the preferred range of side-to-side motion of the support arm by adjusting the orientation of the adjustable panning insert relative to its housing formed in the base assembly and/or the first arm. By having the first projection spaced apart from the second projection along the circumference of the adjustable panning insert, a user will have three swivel settings (e.g., 90°, 180°, and 360° rotation) based upon the adjustable panning insert's orientation in the housing.

In yet another embodiment exemplifying the principles of the invention, the adjustable support arm may also include a quick-release accessory fastening mechanism for easy removal and attachment of an accessory (e.g., an electronic display, keyboard, or other object) to the adjustable support arm. The accessory fastening mechanism can comprise spring-loaded latch and a hook. An accessory can be secured to the support arm by first coupling the hook to the upper portion of the accessory's mounting bracket and then coupling the spring-loaded latch to the lower portion of the accessory's mounting bracket.

In yet another embodiment exemplifying the principles of the invention, the adjustable support arm may also include an accessory bracket assembly having tubular mounts for attaching secondary accessories to the adjustable support arm. One or more accessory brackets can be coupled to the tubular mount(s) to provide a frame for mounting secondary accessories such as paper holders, lights, and the like.

The above summary is not intended to describe each embodiment or every possible implementation. These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying figures, where like reference numerals refer to identical or functionally similar elements throughout the separate views, which are not true to scale, and

which, together with the detailed description below, are incorporated in and form part of the specification, serve to illustrate further various exemplary embodiments and to explain various principles and advantages in accordance with the present invention:

Figure 1 is a front perspective view of an exemplary embodiment of an adjustable support arm of the present invention;

Figure 2 is a front, partially exploded perspective view of the adjustable support arm shown in Figure 1;

Figure 3 is a rear, partially exploded perspective view of the support arm shown in Figure 1;

Figure 4A is a rear perspective view of an exemplary embodiment of a quick release joint useful for releasably connecting the second arm to the first arm of the adjustable support arm shown in Figure 1;

Figure 4B is a cross-sectional view of the quick release joint shown in Figure 4A;

Figure 4C is a cross-sectional view of the quick release joint shown in Figure 4A;

Figure 5A is a rear perspective view of an exemplary embodiment of a quick release joint useful for releasably connecting the arm assembly to a base assembly of the adjustable support arm shown in Figure 1;

Figure 5B is a side, partially transparent view of the quick release joint shown in Figure 5A;

Figure 6A is a perspective view of an exemplary embodiment of a friction cartridge assembly useful for connecting the arm assembly to the base assembly in a manner which reduces slack in the joint;

Figure 6B is cross-sectional view of the friction cartridge assembly shown in Figure 6A;

Figure 7 is a cross-sectional view of an alternative embodiment of a quick release joint useful for releasably connecting the sections of the adjustable support arm shown in Figure 1;

Figure 8A is a partially exploded, perspective view of an exemplary embodiment of an adjustable panning insert useful for adjusting the side-to-side range of motion of the arm assembly of the adjustable support arm shown in Figure 1;

Figure 8B is a partially exploded, perspective view of the adjustable panning insert shown in Figure 8A;

Figure 8C is a perspective view of an exemplary embodiment of the housing formed in the upper end of the first arm adapted for receiving the adjustable panning insert;

Figure 8D is a perspective view of an exemplary embodiment of the housing formed in the lower bracket of the second arm adapted for receiving the adjustable panning insert;

Figure 8E is a partially exploded, perspective view of the adjustable panning insert shown in Figure 8A in reverse orientation;

Figure 8F is a partially exploded, perspective view of the adjustable panning insert shown in Figure 8A in reverse orientation;

Figure 8G is a top view of the adjustable panning insert shown in Figure 8A;

Figure 9A is a perspective view of an exemplary embodiment of the accessory bracket assembly connected to an exemplary embodiment of the articulating joint of an adjustable support arm of the present invention;

Figure 9B is a partially exploded, perspective view of an exemplary embodiment of the accessory bracket assembly and the articulating joint;

Figure 9C is a perspective view of an exemplary embodiment of the quick-release accessory fastening mechanism useful for releasably connecting the accessory bracket assembly to the articulating joint;

Figure 9D is a perspective view of an alternative embodiment of the accessory bracket assembly;

Figure 9E is a front perspective view of an alternative embodiment of the accessory bracket assembly utilizing an adaptor bracket;

Figure 9F is a rear perspective view of the alternative embodiment of the accessory bracket assembly depicted in Figure 9E;

Figure 9G is a rear perspective view of an alternative embodiment of the accessory bracket assembly utilizing an offset VESA bracket;

Figure 10A is a perspective view of an exemplary embodiment of the accessory bracket assembly;

Figure 10B is a perspective view of an exemplary embodiment of the accessory bracket assembly;

Figure 10C is a perspective view of an alternative embodiment of the accessory bracket assembly;

Figure 10D is a perspective view of an alternative embodiment of the accessory bracket assembly;

Figure 10E is a perspective view of an alternative embodiment of the accessory bracket assembly;

Figure 11A is a perspective view of the exemplary adjustable support arm shown in Figure 1 but with an alternative embodiment of the accessory bracket assembly comprising a horizontal crossbar;

Figure 11B is a perspective view of the exemplary adjustable support arm shown in Figure 1 but with an alternative embodiment of the accessory bracket assembly comprising a vertical crossbar;

Figure 11C is a perspective view of the exemplary adjustable support arm shown in Figure 1 but with an alternative embodiment of the accessory bracket assembly comprising a vertical crossbar and a second accessory support mounted thereto;

Figure 12 is a perspective view of an alternative embodiment of the base assembly suitable for use with the adjustable support arm of the present invention;

Figure 13A is a perspective view of an alternative embodiment of the articulating joint suitable for use with the adjustable support arm of the present invention;

Figure 13B is an exploded view of an alternative embodiment of the articulating joint suitable depicted in Figure 13A;

Figure 14A is a front perspective view of an alternative embodiment of the base assembly suitable for use with the adjustable support arm of the present invention;

Figure 14B is a rear perspective view of the alternative embodiment of the articulating joint suitable for use with the adjustable support arm of the present invention;

Figure 15 is a rear perspective view of another alternative embodiment of the base assembly suitable for use with the adjustable support arm of the present invention; and

Figure 16 is a perspective view of an alternative embodiment of a static arm suitable for use with the adjustable support arm of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Detailed embodiments of the present invention are disclosed herein. However, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which can be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure. Alternate embodiments may be devised without departing from the spirit or the scope of the invention. Further, the terms and phrases used herein are not intended to be limiting, but rather, to provide an understandable description of the invention. While the specification concludes with claims defining the features of the invention that are regarded as novel, it is believed that the invention will be better understood from a consideration of the following description in conjunction with the drawing figures, in which like reference numerals are carried forward.

As used herein, the terms “a” or “an” are defined as one or more. The term “plurality,” as used herein, is defined as two or more. The term “another,” as used herein, is defined as at least a second or more. The terms “comprises,” “comprising,” or any other variation thereof are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements, but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. An element proceeded by “comprises … a” does not, without more constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises the element. The terms “including,” “having,” or “featuring,” as used herein, are defined as comprising (i.e., open language). The term “coupled,” as used herein, is defined as connected, although not necessarily directly, and not necessarily mechanically. As used herein, the term "about" or “approximately” applies to all numeric values, whether or not explicitly indicated. These terms generally refer to a range of numbers that one of skill in the art would consider equivalent to the recited values (i.e., having the same function or result). In many instances these terms may include numbers that are rounded to the nearest significant figure. Relational terms such as first and second, upper and lower, top and bottom, right and left, and the like may be used solely to distinguish one entity or action from another entity or action without necessarily requiring or implying any actual such relationship or order between such entities or actions.

Referring now to Figures 1-3, an exemplary embodiment of an adjustable support arm **1** of the present invention is shown. In the exemplary embodiment depicted in Figures 1-3, the adjustable support arm **1** may comprise a base assembly **10**, an arm assembly (**20, 30**) releasably mounted to the base assembly **10**, an articulating joint **40** connected to the arm assembly (**20, 30**), and an accessory bracket assembly **50** connected to the articulating joint **40**. In the exemplary embodiment depicted in Figures 1-3, the arm assembly may comprise a second

arm **30** releasably mounted to a first arm **20**. In the depicted exemplary embodiment, the second arm **30** is a dynamic arm while the first arm **20** is a static arm. The dynamic arm allows a user to optimize both the vertical and horizontal positioning of the accessory bracket assembly **50** relative to the user, thus providing the adjustable support arm **1** a wide range of height adjustability. In certain embodiments, the dynamic arm can be a counter-balanced, parallelogram support arm, such as U.S. Pat. No. 9,657,889 to Chumakov, the disclosure and all of the contents of which are incorporated herein by reference. In other embodiments, the dynamic arm **30** can be a single bar, pivot arm or any other known dynamic arm capable of providing height adjustability. The static arm can be a riser arm (e.g., Figures 1-3) designed to further optimize the vertical and horizontal positioning of the accessory bracket assembly **50**, or the static arm can be a horizontal extension arm (e.g., Figure 16) adapted for adjusting the horizontal positioning of the accessory bracket assembly **50** and any attached accessory relative to the base assembly **10**. In alternative embodiments, the arm assembly can comprise a first arm only, with the first arm being either a dynamic arm or a static arm releasably mounted directly to the base assembly **10**. In further alternative embodiments, the adjustable support arm **1** can optionally exclude both the second arm **30** and the articulating joint **40**, with the first arm **20** having one end connected to the base assembly **10** and the other end connected to the accessory bracket assembly **50**. The base assembly **10** functions to mount the adjustable support arm **1** to a work surface or other fixture, such as a slat wall. Referring to the exemplary embodiment depicted in Figures 1-3, the base assembly **10** may comprise a base plate **13** adapted to be positioned on the top of a work surface **3**, a post **14** extending upward from the base plate **13**, a clamp bracket **11** attached to the base plate **13** and extending below the work surface, and a screw **12** threadingly engaged with the clamp bracket **11**. In order to secure the base assembly **10** to a work surface, the user can rotate the screw **12** until the screw's distal end comes into contact with the underside of the work surface. The exemplary embodiment of the base assembly **10** depicted in Figures 1-3 is configured to be mounted to the work surface **3** of an office desk. However, a skilled artisan will recognize that the base assembly **10** can be alternatively configured to be mounted to a wall or other fixture. For example, Figures 14A and 14B depict a base assembly **1000** configured for attachment to a slatwall. The base assembly **1000** can comprise first and second protrusions **1005**,**1007** adapted to engage grooves in a slatwall. The base assembly **1000** can further comprise a post **1014** housing a first release joint **100 and a panning insert as shown**. Figure 15 depicts an exemplary base assembly **1100** comprising a mounting plate **1105** and a plurality of screws **1106** for mounting the adjustable support arm **1** directly to a wall. Additionally, as shown in Figure 12, each of the various embodiments of the base assembly may be configured to comprise two or more posts **14a**,**14b** for attaching multiple arm assemblies to the base assembly, and the posts may contain the panning inserts.

Still referring to the exemplary embodiment depicted Figures 1-3, a first end **21** of the first arm **20** can be releasably attached to the post **14** utilizing a first connector shaft **80** coupled to a first release joint **100**. As described in greater detail herein, the first release joint **100** may engage the first connector shaft **80** to secure the first arm **20** to the post **14** of the base assembly **10**. To disengage the first release joint **100** from the first connector shaft **80** and remove the first arm **20**, a user can access the first release joint **100** through a slot **17** positioned on the posterior

side **14*p*** of the post **14**. In alternative embodiments, the slot **17** through which the first release joint **100** is accessed can be positioned on the anterior side **14*a*** of the post **14**, or on any other side of the post. In certain embodiments, the first arm **20** may be attached to the base assembly **10** in a manner allowing a user the ability to adjust the front-to-back positioning (i.e., depth) of the support arm **1** by rotating the first arm **20** about its connection to the base assembly **10**. In other embodiments, the first arm **20** may be attached to the base assembly **10** in a manner preventing rotation of the first arm **20** relative to the base assembly **10**. Still referring to the exemplary embodiment depicted in Figures 1-3, the second arm **30** can comprise a parallelogram linkage **31** having a first end **32** pivotally attached to a lower bracket **34** and a second end **33** pivotally attached to an upper bracket **35**. The lower bracket **34** of the second arm **30** can be releasably attached to the second end **22** of the first arm **20** utilizing a second connector shaft **81** coupled to a second release joint **200**. To disengage the second release joint **200** from the second connector shaft **81** and remove the second arm **30**, a user can access the second release joint **200** through a slot **25** formed on the posterior side **22*p*** of the second end **22** of the first arm **20**. In alternative embodiments, the user can access the second release joint **200** through a slot **25** formed on the anterior side **22*a*** of the second end **22** of the first arm **20,** or on any other side of the second end **22** of the first arm **20**.

The articulating joint **40** functions to provide the attached accessory bracket assembly **50** a wide range of adjustability, such as panning/swiveling (i.e., a left or right angled movement), tilting (i.e., an upward or downward angled movement), and/or rotation (i.e., turning from landscape to portrait view). Referring to the exemplary embodiment depicted in Figures 1-3, the articulating joint **40** can comprise a swivel ring **41**, a tilt ring **42** attached to the swivel ring **41**, and a mounting plate **44** attached to the tilt ring **42**. The swivel ring **41** can be attached to the upper bracket **35** via a swivel pin **36** so as to allow side-to-side panning movement. The mounting plate **44** can be attached to the tilt ring **42** via a tilt pin **43** so as to allow up-to-down tilting movement. In alternative embodiments, the articulating joint **40** can take on a variety of forms. For example, a turret-style articulating joint **40** is depicted in Figure 13A. The turret-style articulating joint **40** can comprise a turret **48** capable of being secured to the second arm **30**, a tilt hub **49** pivotally attached to the turret **48**, and a mounting plate **44** attached to the tilt hub **49**.

The accessory bracket assembly **50** can be releasably attached to the mounting plate **44.** An embodiment of the accessory bracket assembly **50** is depicted in Figures 10A and 10B. The accessory bracket assembly **50** can comprise a central bracket **51** positioned within a frame **56**. The frame **56** may comprise a VESA plate adhering to the standards created by the Video Electronics Standards Association, but can comprise other plates or mounts suitable for mounting various electronic equipment, including Apple® products. The frame **56** has an inner cavity for housing the central bracket **51**. The frame **56** can be secured to the central bracket **51** with one or more fasteners. In the embodiment depicted in Figures 9B and 10A-10B, the frame **56** comprises a 100x100 VESA plate. Select alternative embodiments of the accessory bracket assembly **50** are depicted in Figures 9D-9G. Figure 9D shows an alternative embodiment of the accessory bracket assembly whereby a 100x200 frame **58** is attached to the central bracket **51**. As shown in the alternative embodiment depicted in Figures 9E and 9F, an adaptor bracket may be attached to the

central bracket **51** to allow for non-VESA compliant accessories to be mounted to the support arm **1**. Figure 9G depicts an alternative embodiment of the accessory bracket assembly **50** whereby an offset central bracket **51** comprising a horizontal beam **55** is pivotally attached to a VESA bracket **59**, thereby allowing the accessory mounted to the VESA bracket **59** to be positioned in an offset orientation relative to the offset central bracket **51**. As shown, any suitable frame or bracket can be utilized to attach the desired accessories to the monitor arm of the invention.

The adjustable support arm **1** may comprise one or more quick-release joints for releasably connecting the components of the adjustable support arm **1**. For example, a first quick-release joint **100** may be utilized to releasably connect the arm assembly **20**,**30** to the base assembly **10**, while a second quick-release joint **200** may be utilized to releasably connect the second arm **30** to the first arm **20** in embodiments where a second arm **30** is utilized.

Referring to Figures 4A-4C, an exemplary embodiment of the second release joint **200** useful for releasably connecting the second arm **30** to the first arm **20** of the adjustable support arm **1** is shown. The second release joint **200** can comprise a latch **210**, an axle **215**, and a spring **217**. The latch **210** can comprise an upper portion **211**, a lower portion **212** having a protrusion **218**, and an aperture **213** positioned between the upper and lower portions **211**, **212**. The latch **210** can be pivotally connected to the second end **22** of the first arm **20** via an axle **215** extending through the aperture **213**, with the axle **215** functioning as a fulcrum about which the latch **210** pivots. Meanwhile, the connector shaft **81** can be secured within the central chamber **37** of the lower bracket **34** by any means known in the art, such as via a bolt or by way of a pressure fitting.

In operation, a user can attach the second arm **30** to the first arm **20** by sliding the connector shaft **81** into the central bore **23** formed in the second end **22** of the static arm **20**. A spring **217** can be positioned between the static arm **20** and the upper portion **211** of the latch **210** to bias the latch's protrusion **218** into engagement with the indentation **84**, thus locking the second arm **30** into connection with the first arm **20**. When the support arm **1** is swiveled from side-to-side, the connector shaft **81** will move relative to the central bore **23** formed in the second end **22** of the first arm **20**, with the connector shaft **81** and the central bore **23** preferably being in frictional engagement to minimize slack in the joint and provide damping. To detach the second arm **30**, a user can access the second release joint **200** through the slot **25** formed in the second end of the first arm **20**. By pressing the upper portion **211** inward relative to the first arm **20**, the latch **210** will rotate about the axis and thus cause the protrusion **218** to disengage from the indentation **84** in the connector shaft **81**, thus allowing the user to lift the second arm **30** from the central bore **23** formed in the second end **22** of the first arm **20**. In alternative embodiments, the protrusion **218** can be formed in the upper portion **211** instead of the lower portion **212** as depicted in Figures 4A-4C. In alternative embodiments, the spring **217** can comprise a leaf spring, a Belleville spring, or any other spring known in the art. Further, the latch **210** can be any suitable shape known in the art to achieve the functions described above.

Referring to Figures 5A-5B, an exemplary embodiment of the first release joint **100** useful for releasably connecting the arm assembly **20, 30** to the base assembly **10** of the adjustable support arm **1** is shown. The first release joint **100** shown in Figures 5A-5B is

substantially similar to the exemplary embodiment of the second release joint **200** shown in Figures 4A-4C, with reference numerals for like components differing by **100**. In operation, a user can attach the first arm **20** to the post **14** by sliding the connector shaft **80** into the central bore **17** formed in the post **14** of the base assembly **10**.

Referring now to Figure 7, an alternative embodiment of a release joint suitable for releasably connecting the components of the adjustable support arm **1** is shown. The release joint **250** depicted in Figure 7 is shown releasably connecting the second arm **30** to the first arm **20**, although a skilled artisan will readily recognize that the release joint **250** could be utilized to releasably connect the first arm **20** to the base assembly **10** as well. Referring to Figure 7, the release joint **250** can comprise a latch **260** and roller balls **271**, **272** positioned in a passage **28** that extends into the central bore **23** of the first arm **20**, with an identical latch and roller balls optionally positioned on an opposing second side of the first arm **20**. The latch **260** can comprise an upper portion **261** and a lower portion **262**, with the upper portion **261** having a protrusion **268** defining a linear cam surface adapted for selectively engaging the roller ball **271**. The latch **260** can be slidingly attached to the second end **22** of the first arm **20** by, for example, having a longitudinal flange on the latch **260** engaging a slot integrated into the second end **22** of the first arm **20**. In operation, a user can attach the second arm **30** to the first arm **20** by sliding the connector shaft **81** into the central bore **23** formed in the second end **22** of the first arm **20**. To secure the second arm **30** in place, the user can slide the latch **260** upwards relative to the base assembly **10**, thereby causing the linear cam surface of the protrusion **268** to engage the roller ball **271** and cause the roller ball **271** to move inward within the passage **28** towards the central bore **23**. This in turn will force the roller ball **272** to also move inward within the passage **28** and into engagement with the indentation **84** in the connector shaft **81**, thus securing the second arm **30** in place. In certain embodiments, a spring can be utilized to bias the latch **260** upwards relative to the base assembly **10**, thereby dispensing with the necessity for the user to slide the latch **260** to secure the second arm **30**. To detach the second arm **30**, the user can slide the latch **260** downwards relative to the base assembly **10**, thereby causing the linear cam surface of the protrusion **268** to disengage from the roller ball **271**. This will allow the roller balls **271, 272** to move outward within the passage **28** and have the roller ball **272** disengage from the indentation **84** in the connector shaft **81**. In further alternative embodiments of the release joint **250**, the protrusion **268** can be formed in the lower portion **262** of the latch **260** instead of the upper portion **261** as depicted in Figure **7**. Moreover, in further alternative embodiments, the biasing spring can bias the latch **260** downwards relative to the base assembly **10** as opposed to upwards.

Referring to Figures 6A-6B, an exemplary embodiment of a friction cartridge assembly **300** is shown. The friction cartridge assembly may be utilized as an alternative means for coupling the joints of the adjustable support arm **1**. The friction cartridge assembly **300** functions to dampen side-to-side movement of the arm assembly **20**, **30** using friction, while also reducing slack in the joint(s) of the adjustable support arm **1**. In Figures 6A-6B, the friction cartridge assembly **300** is depicted as being utilized in the joint formed by the second arm **30** and the first arm **20** of the arm assembly. However, an identical friction cartridge assembly **300** can be utilized in the joint formed by the first arm **20** and the base assembly **10**. Similarly, in

embodiments whereby the arm assembly consists of a second arm **30** only, a friction cartridge assembly **300** can be utilized in the joint formed by the second arm **30** and the base assembly **10**.

Referring to Figures 6A-6B, the friction cartridge assembly **300** can comprise a taper-lock bushing **310** and set screws **335**,**337**. The taper-lock bushing **310** may feature an outer profile adapted to frictionally engage a tapered, internal central chamber **37** formed in the lower bracket **34** of the second arm **30,** and the taper-lock bushing **310** may feature an inner profile adapted to frictionally engage the connector shaft **81**. Meanwhile, the set screws **335**,**337** function to secure the taper-lock bushing **310** into place within the central chamber **37** of the lower bracket **34**, while also functioning to adjust the friction applied by the taper-lock bushing **310** to the connector shaft **81.** In operation, a shaped end (e.g., polygon-shaped) of the connector shaft **81** will mate with a congruent seat in the central bore **23** to fix the connector shaft **81** in place such that the connector shaft **81** does not rotate relative to the first arm **20** when the support arm **1** is swiveled from side-to-side. As the support arm **1** is swiveled from side-to-side, the connector shaft **81** will remain stationary due to the shaped end of the connector shaft **81** being mated with a congruent seat in the central bore **23** of the first arm **20**. However, the taper-lock bushing **310** will rotate with the lower bracket **34** of the second arm **30** as it is swiveled from side-to-side, with the friction between the connector shaft **81** and the taper-lock bushing **310** functioning to dampen this side-to-side movement.

A user can secure the taper-lock bushing **310** within the central chamber **37** of the lower bracket **34** by driving the set screws **335**,**336** into threaded apertures **36*a***,**36*b*** formed in the lower bracket **34**. In this exemplary embodiment, the distal ends of the set screws **335**,**336** will abut the shoulders **313** of the taper-lock bushing **310** and force the tapered, upper portion **315** of the taper-lock bushing **310** into wedging engagement with the tapered, central chamber **37** of the lower bracket **34**. A user can also optimize the friction applied by the taper-lock bushing **310** to the connector shaft **81** by driving the set screws **335**,**336** into threaded apertures **36*a***,**36*b*** formed in the lower bracket **34**. As the set screws **335**,**336** are driven into the threaded apertures **366*a***,**366*b***, the lower portion **311** of the taper-lock bushing **310** will deflect inward towards the connector shaft **81**, thus increasing the friction between the connector shaft **81** and the taper-lock bushing **310**.

Referring now to Figures 8A-8G, an exemplary embodiment of an adjustable panning insert **700** suitable for adjusting the range of side-to-side (i.e., panning or swiveling) motion of the support arm **1** is depicted. The adjustable panning insert **700** may be a ring-shaped, hollow cylinder having an outer wall **701**, an inner wall **702**, a first end **704**, and a second end **705**. The adjustable panning insert can be other shapes, including but not limited to a sphere, prism, or cube. In one embodiment, the adjustable panning insert **700** further defines a radial plane and a longitudinal plane. The inner wall **702** can comprise a first spline **710** and a second spline **712** positioned adjacent to one another along the surface of the inner wall **702** and each comprising teeth **714** extending inward from the inner wall **702**. The first spline **710** is positioned proximate to the first end **704**, and the second spline **712** is positioned proximate to the second end **705**. The adjustable panning insert **700** may further comprise first and second projections **715**,**716** spaced apart along the circumference of the second end **705** and extending vertically therefrom; i.e., the first and second projections **715**,**716** extend in a direction that is perpendicular to the radial plane

of the adjustable panning insert **700**. In the embodiment depicted in Figures 8A-8B and 8E-8G, the first projection **715** is spaced apart from the second projection **716** along the circumference of the second end **705** of the adjustable panning insert **700** by approximately 90 degrees relative to the center of the adjustable panning insert **700** (See Fig. 8G). In an alternative embodiment, the first projection **715** can be spaced apart from the second projection **716** along the circumference of the second end **705** by 60 degrees. In further embodiments, the first and second projections **715**,**716** can be spaced apart at a multitude of distances. Moreover, in further alternative embodiments, the adjustable panning insert **700** may also comprise third and fourth projections spaced apart along the circumference of the first end **704**. Instead of splines, pins and holes may be used, or any other suitable mating means or mechanisms may be used, for achieving the functions described with respect to the adjustable panning insert **700**.

The adjustable panning insert **700** restricts the range of side-to-side motion of the support arm **1** through its interaction with the lower bracket **34** of the second arm **30**. In the exemplary embodiment depicted in Figures 8A-8G, the adjustable panning insert **700** is shown being retained within the second end **22** of the first arm **20**. In embodiments whereby the arm assembly does not include a first arm **20**, the adjustable panning insert **700** can be retained in a housing formed in the post **14** of the base assembly **10**. Referring to Figure 8C, the housing formed in the second end **22** of the first arm **20** may comprise a channel **24** formed in the upper end of the first arm **20**. The channel **24** can define an outer wall **26** and an inner wall **27**. A spline **29** having a plurality of teeth **29a** can be positioned along the outer periphery of the inner wall **27** such that the teeth **29a** extend radially from the inner wall **27** and partially into the channel **24** for mating with either the first or second splines **710**,**712** of the adjustable panning insert **700**, depending on which side of the panning insert **700** is facing up. The spline **29** can further comprise one or more pockets **29b** adapted to receive and mate with the first and second projections **715**,**716** of the adjustable panning insert **700** when the adjustable panning insert **700** is oriented such that the second spline **712** engages with the spline **29** formed in the channel **24** of the first arm **20.** Referring now to Figure 8D, the lower bracket **34** of the second arm **30** can comprise a groove **38** adjacent to the central chamber **37**. The central chamber **37** is adapted to house the upper portion of the connector shaft **81**. In embodiments where the friction cartridge assembly **300** is utilized, the central chamber **37** will also house the friction cartridge assembly **300**. The groove **38** is adapted to receive the first and second projections **715**,**716** of the adjustable panning insert **700**. A stop **39** can be positioned along the groove path of the groove **38**. In the embodiment depicted in Figure 8D, the stop **39** is positioned within the anterior portion **38*a*** of the groove **38** proximate to the anterior side **34*a*** of the lower bracket **34**, although in alternative embodiments the stop **39** can be positioned at other locations along the groove path, such as within the posterior portion **38*p*** of the groove **38** proximate to the posterior side **34*p*** of the lower bracket **34**. The channel **24** and the groove **38** each may be annular, ring-shaped, oval-shaped, or any other suitable shape to achieve the functions described herein.

In operation, a user can elect the preferred range of side-to-side motion of the support arm **1** by adjusting the orientation of the adjustable panning insert **700** relative to its housing formed in the upper end of the first arm **20**. In the embodiment depicted in Figures 8A-8B and 8E-8G, the first projection **715** is spaced apart from the second projection **716** along the circumference of

the second end **705** by approximately 90° (as measured relative to the center of the adjustable panning insert **700**) along the circumference of the adjustable panning insert **700**, thereby providing a user three swivel settings: 90°, 180°, and 360° rotation. Figure 8G is a top view of the adjustable panning insert **700** depicting the first and second projections **715**,**716** spaced apart by approximately 90°, with the stop **39** being transposed in various positions along the circumference of the adjustable panning insert to show the possible positioning of the adjustable panning insert's projections relative to the stop **39** depending on the orientation of the adjustable panning insert **700** and the horizontal positioning of the arm assembly **20**,**30**.

Referring to Figures 8A-8B, the adjustable panning insert **700** is positioned in a first orientation which will allow the second arm **30** to rotate 360° relative to the first arm **20**. In this first orientation, the second male spline **712** will engage with the female spline **29** formed in the channel **24** of the first arm **20**, with the one or more pockets **29b** receiving and housing the first and second projections **715**,**716** of the adjustable panning insert **700**. In this arrangement, the first end **704** of the adjustable panning insert **700—**which lacks a projection—will not engage the stop **39** in the groove **38 of** the second arm's lower bracket **34**, thereby allowing 360° rotation. Referring now to Figures 8E-8F, the adjustable panning insert **700** is positioned in a second orientation which will only allow the second arm **30** to rotate 90° relative to the first arm **20**. In this second orientation, the first male spline **710** will engage with the female spline **29** formed in the channel **24** of the first arm **20**, while the first and second projections **715**,**716** of the adjustable panning insert **700** will protrude into the groove **38** of the second arm's lower bracket **34**. In this second orientation, the adjustable panning insert is seated in the housing such that the protrusions are proximate to the anterior side of the base assembly. As the second arm **30** is rotated in a first direction relative to the first arm **20**, the stop **39** will engage the first projection **715** after approximately 45° of travel (as measured from a starting position directly facing the user) and prohibit further panning in the first direction. Similarly, as the second arm **30** is rotated in a second direction relative to the first arm **20**, the stop **39** will engage the second projection **716** after approximately 45° of travel (as measured from a starting position directly facing the user) and prohibit further panning in the second direction. In a further embodiment, a user may position the adjustable panning insert **700** in a third orientation to allow the second arm **30** to rotate 180° relative to the first arm **20**. Starting from the orientation depicted in Figures 8E-8F, this third orientation may be achieved by rotating the adjustable panning insert **700** about its central axis 180° in the horizontal (i.e., radial) plane and then re-seating the first male spline **710** into engagement with the female spline **29** of the first arm **20**. As the second arm **30** is rotated in a first direction relative to the first arm **20**, the stop **39** will engage the first projection **715** after approximately 90° of travel (as measured from a starting position directly facing the user) and prohibit further panning in the first direction. Similarly, as the second arm **30** is rotated in a second direction relative to the first arm **20**, the stop **39** will engage the second projection **716** after approximately 90° of travel (as measured from a starting position directly facing the user) and prohibit further panning in the second direction.

The adjustable panning insert **700** may be a ring-shaped, hollow cylinder having an outer wall **701**, an inner wall **702**, a first end **704**, and a second end **705**. The adjustable panning insert **700** further defines a radial plane and a longitudinal plane, The inner wall **702** can comprise a

first male spline **710** and a second male spline **712** positioned adjacent to one another along the surface of the inner wall **702** and each comprising teeth **714** extending inward from the inner wall **702**.

Whereas, in the embodiments depicted in Figures 8A-8G, the adjustable panning insert **700** is shown having first and second male splines **710,712** positioned along the inner wall **702**, in alternative embodiments the first and second male splines **710,712** may be positioned along the outer wall of the adjustable panning insert **700**. In such alternative embodiments, the female spline **29** would be positioned along the inner periphery of the outer wall **26** such that the teeth **29a** extend laterally from the outer wall **26** and partially into the channel **24** for mating with either the first or second male splines **710**,**712** of the adjustable panning insert **700**. In further alternative embodiments, the first and second male splines **710,712** may be replaced with one or more projections, while the female spline **29** may be replaced with one or more slots adapted to mate with the one or more projections. While the foregoing description illustrates the adjustable panning insert functionality using splines, projections, and pockets, any other acceptable means or mechanism for temporarily mating the panning insert **700** with the groove **38** can be used, including but not limited to the following: a ratchet and pawl; a rack and pinion or other mating gears; one or more pins mated to one or more holes, etc.

Referring still to Figures 8A-8F, certain embodiments of the adjustable support arm may utilize a bearing **720** positioned adjacent to the inner wall **27** of the channel **24** formed in the second end **22** of the first arm **20**. The bearing **720** functions to operatively engage the connector shaft **81** to reduce the amount of force required to adjust the horizontal (i.e., side-to-side) positioning of the second arm **30**. In one exemplary embodiment, the bearing **720** is an angular contact bearing having inner and outer ring raceways that are displaced relative to each other in the direction of the bearing axis, thereby simultaneously accommodating radial and axial loads. However, other bearing types may be utilized.

Referring now to Figures 9A-9C and 13B, the mounting plate **44** of articulating joint **40** can comprise a fastening mechanism for easy removal and attachment of a mounted accessory or accessory adapter (e.g., an electronic display, keyboard, paper holder, laptop holder, tablet holder, phone holder, light, or other object) to the support arm **1.** In Figures 9A-9C and 13B, an exemplary embodiment of the accessory fastening mechanism **400** is depicted. The accessory fastening mechanism **400** can comprise spring-loaded latch **410** and a hook **420**. In one exemplary embodiment, the spring-loaded latch **410** can comprise a clasp **412** and a button **414**, with the clasp **412** protruding from the front side of the mounting plate **44** and the button **414** protruding from the rear side of the mounting plate **44.** A spring **411** (see Figure 13B) may be positioned within the a cavity formed in the mounting plate **44** and may operatively engage the spring-loaded latch **410** to bias it downward relative to the center of the mounting plate **44**. In the exemplary embodiment depicted in Figures 9A-9C and 13B, the spring-loaded latch **410** is positioned within a cut-out **46** formed in the lower portion **45** of the mounting plate **44**, and the hook **420** protrudes from the front side of the upper portion **47** of the mounting plate **44**. In alternative embodiments, the spring-loaded latch **410** can be attached at various portions of the mounting plate **44**, including but not limited to the upper portion **47** of the mounting plate **44**, while the hook **420** can be attached at various positions of the mounting plate **44**, including but

not limited to the lower portion **45** of the mounting plate **44**. A person of ordinary skill in the art would appreciate that the locations of the latch and hook can vary, and multiple latches and hooks can be used, to allow for the quick release function described herein. Further, the hook(s) and latch(es) can be of any suitable shape to achieve the intended function described herein.

In operation, a user can utilize the accessory fastening mechanism **400** to selectively remove and re-attach the accessory bracket assembly **50** to the mounting plate **44** of the articulating joint **40.** To attach the accessory bracket assembly **50**, a user may first couple the hook **420** to the upper portion of the central bracket **51** by tilting the bracket's upper portion towards the bracket assembly **50** and extending the hook **420** into the upper opening **53** of the central bracket **51**. Next, the user may bring the lower portion of the central bracket **51** into a position adjacent the spring-loaded latch **410** and may or may not lift the spring loaded latch **410** by lifting up on the button **414**. Then, the user can bring the lower portion of the central bracket **51** into a position adjacent the lower portion of the mounting plate **44**, which will cause the clasp **412** to extend into the lower opening **52** of the central bracket **51**. If the user lifted the spring loaded latch **410,** upon releasing the button **414**, the clasp **412** can engage the lower portion of the central bracket **51** to secure the accessory bracket assembly **50** to the mounting plate **44**. If the user did not lift the spring loaded latch **410**, the clasp **412** will be forced to accommodate the lower opening **52** of the central bracket **51** through compression of the spring **411**. To remove the accessory bracket assembly **50**, the user can reverse the foregoing process. Specifically, the user can lift up on the button **414** and disengage the clasp **412** from the lower portion of the central bracket **51**. The user can then detach the hook **420** to the upper portion of the central bracket **51**.

Referring now to Figures 10A-10B, an exemplary embodiment of an accessory bracket assembly **50** having mounts or mounting pieces for attaching secondary accessories to the adjustable support arm **1** is shown. The accessory bracket assembly **50** can comprise any combination of a top mount **510**, a right mount **520**, a bottom mount **530**, and a left mount **540** each attached to the frame **57** of the accessory bracket assembly **50**. The mounts or mounting pieces may be tubular in shape or of any other suitable shape to achieve the functions described herein. The accessories that couple with the mounts or mounting pieces can either couple directly or indirectly to the mounts via temporary fasteners. A first accessory support **575** can be coupled to the top and bottom mounts **510**,**530**, while a second accessory support **576** can be coupled to the right and left mounts **520**,**540**. The first and second accessory supports **575**,**576** may comprise U-shaped tubing with diameters slightly smaller than the inner diameter of the tubular mounts, thus allowing the first and second accessory supports **575**,**576** to be coupled to the mounts **510,520,530,540** by sliding the ends of the first and second accessory supports **575**,**576** into the hollow openings of the mounts. In alternative embodiments, the accessory supports **575**,**576** can be linear tubing (e.g., see Figures 10C-10E) or any other shaped body capable of coupling to the mounts **510,520,530,540**. Secondary accessories, such as paper holders, lights, electronic displays, keyboards, laptop holders, tablet holders, phone holders, and other accessories can then be attached to the accessory supports **575**,**576** using fasteners or brackets known in the art.

Alternative embodiments showing a variety of exemplary accessory support configurations are depicted in Figures 10C-10E such as a handle, an earphone or headset holder or mount, and a side panel, tablet holder, or paper tray holder.

Referring now to Figures 11A-11C, alternative embodiments of the accessory bracket assembly are depicted. As shown in Figure 11A, the accessory bracket assembly **50** may comprise a horizontal crossbar assembly **591** attached to the joint **40**. As shown in Figure 11B, the accessory bracket assembly **50** may comprise a vertical crossbar assembly **592** attached to the joint **40**. As shown in Figure 11C, one or more accessory supports **575**,**576** may be attached to either the horizontal or vertical crossbar assemblies **591**, **592** at the sides, top, or bottom, as applicable given the crossbar configuration.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teaching presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

CLAIMS

1. An adjustable support arm comprising an arm assembly, the arm assembly comprising:

a) a base mounted to a work surface;

b) a first arm comprising a first end and a second end, wherein the first end is coupled to the base;

c) a second arm comprising a first end, a second end, and a parallelogram linkage and being mated to the second end of the first arm,

d) a mounting plate mated to the second end of the second arm;

e) an accessory bracket assembly attached to the mounting plate;

f) a removable, adjustable panning insert positioned between the first arm and the second arm, wherein the panning insert limits the rotation of the second arm about an axis formed between the first and second arms.

2. An adjustable support arm comprising:

a) a base assembly;

b) an arm assembly, the arm assembly comprising:

i) a first arm comprising a first end and a second end, wherein the first end of the first arm is releasably coupled to the base assembly;

ii) a second arm releasably coupled to the second end of the first arm, the second arm comprising a parallelogram linkage having a first end pivotally attached to a lower bracket and a second end pivotally attached to an upper bracket; and

c) a first adjustable panning insert positioned between the first arm and the base assembly to limit rotation of the first arm about the base; and

d) a second adjustable panning insert positioned between the second arm and the first arm to limit rotation of the second arm about the first arm.