ARM AND INSTRUMENT HOLDING APPARATUS
12 Claims, 14 Drawing Figs.

ABSTRACT: An adjustable forearm rest apparatus of articulated type with hand holding means which is extensible or retractable and angularly positionable on a support bracket. The bracket may be mounted selectively on a stand of adjustable type or attached to a hospital bed and the apparatus includes an upper arm support and means for holding instruments and devices used in cardiovascular studies, etc.
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BACKGROUND AND PRIOR ART

Recent medical techniques in the study of heart ailments involve cardiovascular studies wherein needles and catheters are inserted into major veins and arteries of a patient's arm to obtain more accurate readings on the actual heart condition than can be obtained from conventional electrocardiographic apparatus. For efficient use of these new techniques, the patient's arm should be held firmly but comfortably and should be positionable at suitable and various angles to facilitate insertion of the catheters for study, during exercise, etc. This requires that the apparatus be adjustable in several respects. Part of it must be extensible or retractable to fit patient's arms of different lengths. The various articulated parts must be adjustable in angle for some uses.

Numerous arm rests have been devised in the prior art, including arm boards for supporting a patient's arm for various treatments such as blood transfusions, etc. Other devices have been designed merely for supporting a patient's arms for reading or for feeding himself while in a hospital bed, chair or the like. None of these devices, so far as applicants are aware, is suitable for the specific requirements of the particular cardiovascular studies for which the present invention is especially designed, although it has other uses, obviously.

It is one important object of the present invention to design an articulated arm support that will meet all the requirements for accurate positioning of and holding of the arm, and its parts, without causing the patient undue discomfort. Another object is to provide such a device that it can be affixed to and easily detached from a portable stand. The stand holds it securely during a test and also makes it easier to move the arm support system from room to room, as in a hospital. The system includes supporting devices which are adjustable and/or detachable, for auxiliary equipment such as supplies of intravenous liquids, catheters, needles, recording devices, and the like. It is also desirable to be able to mount at least the basic apparatus directly on a standard hospital bed without substantial modification of the bed. Hence, another object is to make the apparatus interchangeable for stand mounting or bed mounting.

When the stand is used, as is usually preferable, it is desirable that it be adjustable in height, that it be of lightweight material, readily portable and, at the same time, that it be sturdy, rugged and that it sit firmly in place during a study without any chance of accidental shifting or rolling on the floor. Therefore, another object is to design the stand that when tilted purposely it can be readily moved or rolled on attached rollers, but as long as it sets upright it will remain firmly in place, the rollers then being inactivated.

SUMMARY

In summary, the apparatus or system is mounted preferably on a mobile tripod stand, which tripod is provided with a pair of normally inoperative rollers for easy movement from place to place when the stand is tilted. The rollers are so located that they raise off the floor to permit contact by nonrotary elements when the stand is set upright. Friction pads on each of the three legs support the device against accidental displacement. The stand comprises an adjustable vertical column with rigid support elements for the operating parts of the apparatus. Thus a rigid bracket at the top of the column supports the articulated arm board, as well as its adjustment mechanism and the essential auxiliary supports for medical instruments, recorders, and related equipment. The articulated arm board may be to this bracket or to a universal mounting bracket which can be attached simply and readily to the frame of a standard hospital bed. Thus the apparatus can be readily transferred from the normal tripod stand to the patient's bed if desired. The tripod stand may carry various supplemental supports, posts or brackets for the examining physician's convenience, including containers of liquid to be injected into veins, and supplemental devices or equipment not shown.

The articulated arm board itself is mounted to the support bracket for pivotal adjustment about a horizontal axis. An adjusting screw provides for rotation, i.e., raising or lowering the major arm support part around this axis to adjust the angle in a vertical plane in which the patient's forearm is to be positioned. This major part or forearm support portion of the arm rest is per se adjustable in length so as to accommodate and hold the patient's arm from elbow to wrist for patients of different arm length. Means may be provided for holding the forearm accurately in place. Self-locking means are provided for fixing both the angular and longitudinal adjustments instantly with positive locking but quick and easy release for adjustment. The hand supporting portion of the board is articulated to the forearm support. This adjustment also is about a horizontal axis, permitting adjustment of the hand to various positions in a vertical plane about said axis. A hand grip and other securing means are provided on the hand support. The parts are so arranged that the patient's forearm rests comfortably but firmly on the forearm support and the hand is placed palm up on the hand support, usually with the fingers comfortably but positively restrained under a transverse gripping bar. In this position the patient cannot remove his arm from the device but the parts can all be adjusted to make him comfortable while still placing hand, forearm and upper arm in proper positions and holding them there while the tests are conducted properly. At the inner end of the forearm support another articulated plate is provided for supporting the lower or outer part of the arm. The arrangement of all the parts preferably is such that all necessary adjustments can be made very quickly and then held properly with self-locking devices.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical perspective view of a complete device embodying a stand with auxiliary supporting elements on which the articulated adjustable arm support is mounted.

FIG. 2 is a plan view of the articulated arm board per se shown in a larger scale.

FIG. 3 is a vertical longitudinal section through the articulated arm board taken substantially along line 3-3 of FIG. 2.

FIG. 4 is a transverse view, partly in section, showing locking means for the longitudinally adjustable extension forearm support, taken substantially along the line 4-4 of FIG. 2.

FIG. 5 is a bottom plan view of the forearm and hand support structure on somewhat larger scale than FIGS. 2 and 3.

FIG. 6 is an enlarged detail view of the adjusting and locking means for the hand support.

FIG. 7 is an enlarged sectional view of the post adjusting mechanism, taken substantially along line 7-7 of FIG. 1.

FIG. 8 is a transverse sectional view of the support column and utility mounting elements, taken substantially along the line 8-8 of FIG. 1.

FIG. 9 is a fragmentary side view of a modification of FIG. 3, showing mounting of the arm support unit on a bed frame instead of a stand.

FIG. 10 is an enlarged sectional view of the longitudinal extension adjusting and locking means for the forearm support.

FIG. 11 is a perspective view of a typical pad used on the arm support.

FIG. 12 is a detail view on a larger scale of a utility support lock on the column support post.

FIG. 13 is a detail view of an adjustable instrument support, showing clamping means partly in section.

FIG. 14 is a sectional detail view taken substantially along the line 14-14 of FIG. 13.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to FIG. 1, a preferred embodiment is shown which includes a supporting tripod stand 11 including a main hollow vertical column 13, square in cross section, to which is secured three angularly disposed legs 15, 17 and 19. Each of these legs has a frictional support pad 21 affixed thereto at its
3,540,719

outer extremity. In addition, two of the legs 15 and 19 are provided with brackets 23, 25, respectively, in which are mounted freely rotatable rollers 27 and 28 respectively. The arrangement is such that when the stand is upright with all three legs resting on the floor the rollers 27 and 28 are raised slightly off the floor. However, by tilting the stand to the right, as seen in Fig. 1, the rollers will contact the floor, raising the pads 21 slightly above the floor, and the device which is fairly sturdy and heavy can then be rolled about very easily.

Inside the vertical column 13 is mounted a hollow, round slidable post 29 which can be raised to any desired level by rotating a screw 30, mounted in ball bearings 31, 32. A transverse support 33 is fixed to or integral with post 13. Screw 30 is driven through bevel gear mechanism 34, 35 driven by a hand wheel 36, as shown in detail in Fig. 7. The screw raises and lowers a nut 37 of size and shape to slide freely up and down inside post 13, while being restrained against rotation therein. This nut is secured to the lower end of post 29. The screw is self-locking so that the adjustable post 29 stays firmly in any adjusted position. Pairs of studs 38 and 39 are mounted on two or more faces of the fixed vertical post 11 and each pair is adapted to hold a mounting bar 40 or 41, attached thereto by screws. The latter bar 41 is shown on the back side of the post 11. Fig. 1. A curved auxiliary support arm 42, made of suitable tubular stock, is secured by welding or otherwise to a bracket 43, slidable vertically onto either bar 40 or 41. Screws 44 locks the bracket 45 to the bracket 39. A bracing member 45 stiffens the assembly.

The post 42 may have various brackets and other holding means attached thereto, as for example the self-clamping bracket 50 shown at the top which is slidable mounted on the post and can be locked in any adjusted position by the hinged plates 52, 53 which have a compression spring 55 between them. Screws 56 couple them normally in an extended position. By gripping the plates and squeezing them together the bracket can be raised or lowered freely on the post but when released the plate 52 springs away to lock the bracket firmly in place. A container, for blood or other liquid for intravenous injection for example, can be attached, retaining means being provided on plate 53, such as a hook 56, retained in an annular groove 59 in plate 53 by means of a compression spring 57 which is releasable by means of a button 58.

Referring now to Fig. 3, the arm support per se comprises a bracket 60 which is attached to the top of adjustable post 29. The post 29 is secured to nut 37 which is not rotatable in the support column 11; hence bracket 60 likewise is not rotatable. A block 62 attached rigidly to bracket 60 (or integral therewith, if preferred) has an upstanding locking stud 64 projecting from the upper surface. This block also is bored vertically to receive bearings 66 for a pivotal support pin 68. The latter is freely slidable and rotatable in its bearings 66 and its ends are secured in upper and lower arms of a bifurcate bracket 70. This bracket 70 comprises a horizontal bored portion 72, Fig. 2, which is adapted to receive a transverse hinge pin 74. The pin 74 passes through ears 75 and 76 of a forearm support bracket 77. The latter can be rotated in a vertical plane about a horizontal axis on pin 74. Bracket 70 has on its lower surface, to the right of vertical pin 68 a series of conical recesses 80, 81, 82, 83, 84 so that by lifting the arm support slightly, sliding pin 68 upwardly a little in its bearing 66, bracket 70 can be rotated in a horizontal plane and released to drop into a conical recess, e.g. 82, over stud 64. This locks the bracket 70 in any desired rotational position against accidental displacement. Thus the whole arm support can be rotated around the axis of the support column 29 and locked in any desired position. The unit is merely lifted slightly to clear the stud 64 and then rotated to the desired position. Note the dotted line position, Fig. 2.

An upper arm supporting plate 90 is fastened to the bracket 70 by suitable screws or the like 91.

The bracket 77, previously mentioned as being hinged to bracket 70 through its ears 75, 76, supports a pair of main forearm support rods 97, 98, and a pair of utility support rods 99, 100. The utility support rods 99, 100, are adapted to hold various instruments and devices which are used in connection with the cardiovascular studies. Instruments such as a pressure transducer, for example, may be mounted on a universally adjustable bracket 102 mounted on the rear arm 99 as seen in Figs. 1 and 2. Other instruments such as an oximeter cuvette can be mounted on another bracket 101, which is adjustable, i.e. universally mounted for positioning as desired on the front bar or rod 100. The rods 97, 98 form the principal support for a forearm supporting plate 104 which is adjustable in rectilinear translation thereon and is mounted on a pair of transverse bars 103, each having slidingly supporting ears 105 lined with friction reducing bearings 135 for mounting on bars 97, 98. The plate 104, at its outer or left end, Figs. 2 and 3, has pivot supporting ears 107. A hand supporting plate 108 is hinged to the forearm support plate 104 by means of a pin 109 which passes through the ears 107 and through corresponding flange elements 110 on the hand support plate. A hand grip includes an upstanding bracket 111 screwed or otherwise suitably fastened to the hand supporting plate 108. This bracket has a transverse rod of convenient size to be gripped by the fingers as shown at 112, Figs. 1 and 2. The means by which the articulated parts may be adjusted and locked in any desired position will be described presently.

The arrangement is such that a patient rests part of his upper arm above the elbow on the plate 90, his forearm on the plate 104 and his hand, palm up, on the hinged plate 108, with his fingers under the handholding device 111, 112. As previously noted, the device can be adjusted first in a horizontal plane by pivoting about the nonrotatable post 29 and locking it into place by dropping one of the recesses 81, 82, etc. over the stud 64.

As best seen in Fig. 3, the bracket 70 has dependent portions 119 to receive a cross pin 120 below hinge pin 74. Forearm support bracket 77 has a pair of depending ears 121, each bored to receive a transverse pin 122 which is thus mounted parallel with pin 120. The pin 122 is bored, in its middle and transversely to its length, and also is threaded to receive an adjusting screw 124 which passes therethrough. The forward or right end of screw 124, as seen in Figs. 1, 2 and 3, is reduced to pass rotatably through the pin 120, transversely to its axis. As indicated at 126, this reduced portion fits for free rotation in the pin 120. Both pins 120 and 122 are rotatable in their supports. The reduced end 126 of the adjusting screw 124 is grooved to receive a locking ring or horseshoe 128 which retains it in place and prevents sliding in either direction through pin 120. A head or knob 129, Fig. 1, is threaded to screw 124; hence by turning the screw 124 one way or the other the distance between transverse pins 120 and 122 is increased or reduced, thus changing the angle at which the forearm support plate rests with respect to the upper arm plate 90 and the mounting bracket 70. In this way the forearm support can be adjusted in a vertical plane about its horizontal axis on pin 74, as shown in detail in dotted lines, Fig. 3. The forearm support plate 104 is mounted on the two transverse bars 103 which are bored and preferably bushed with antifriction material at their respective ends as indicated at 135, Fig. 5, to slide freely but snugly along the support rods 97.

On the under side of plate 104 a bar 138 is fastened by screws 139 to the transverse bars 103. See Fig. 10. Bar 138 is slotted at 140 in its middle portion (see Fig. 5) to receive a movable bar 141 which is pivoted at its forward or right end at 142 for limited pivotal movements. An adjusting lever or trigger 145 is pivoted at 146 in the slot 140 of bar 138 and has a flat surface 147 which engages a flat lower part 148 of the hinged member 141, shown best in profile in Figs. 3 and 10. When the trigger or lever 145 is moved either to the right or left about its pivot 146, it raises the left end of the bar 141 slightly. Bar 141 carries a rigidly mounted transverse bar 150 which has beveled ends 151, best shown in Fig. 4. A coiled compression spring 152, opposed by forearm support plate 104, Fig. 10, normally urges the plate 141 into its lowestmost position in near contact with the trigger 145. The movement...
of the trigger compresses the spring and the bevel-ended bar 150 is raised out of its frictional locking relation with respect to the support bars 97 and 98. Otherwise spring 152 holds bar 141 down and keeps the bevel ends 151 in wedged position between bars 97 and 98 so as to lock the forearm support plate by friction against longitudinal shifting. This provides a quick, reliable and very convenient self-locking and infinitesimal adjust-ment, positionable at any point by means of which the arm support can be slid in-out along the support bars 97, 98 to adjust its length. Slots 153 are provided in the side flanges 154 of forearm support plate 104 so that snaps can be put through them to fasten the arm in place when needed.

The hand support 108 previously described as being pivoted at 109 to the left of the forearm support plate, is provided also with means for adjusting its angular position. A link 160, FIGS. 3, 5 and 6, is pivoted at 161 to the left end of bar 138. Its other end is fastened pivotally to a block 162 mounted slidably on a grooved or spooled rod 164 supported in a fixed bracket 165 at its outer end and with its right end secured to the pivot pin 109. Spring pressed plungers means 170, operated by slideable button means 171, normally biased to locking position by a coiled compression spring 172, are adapted to engage and disengage any groove 173 in the rod 164 by releasing the plunger 170, swinging the hand support plate 108 to the desired position, and then allowing the plunger to reengage in a groove 173, FIG. 6, by reason of spring 172, the hand support plate can be adjusted and locked in any desired position. See dotted line adjustment positions, FIG. 3. Slots 174, 175 are provided for strapping the hand in position on plate 108 when needed.

Thrm support thus has four self-locking adjustments. The whole unit can be adjusted angularly in a horizontal plane, when it is locked in position by engagement between stud 64 and a conical recess 80 to 84. The forearm support is adjusta-ble up and down by a self-locking screw 124, 130. It is longitudi-nally adjustable and self-locking by wedge ended bar or rod 150 under control of spring 152 and trigger 145. The hand support plate is adjustable and self-locking by block 162 slid-ing and selectively locking on spool rod 164.

In addition to the adjustments just mentioned, the overall adjustment in height provided in the support column 13, 29, through screw 30 and nonrotatable nut 37 is desirable and important that the arm support is mounted on the tripod stand, as is being preferred. Other types of adjustments obviously could be provided for any or all of these parts, but those described are positive and trouble free. They are generally preferred over conventional set screws and the like.

As mentioned above, the arm support per se can be mounted on a hospital bed in lieu of the stand. It can be mounted similarly, if desired, on an operating or examination table, etc., by simply using a modified bracket or support block 180, FIG. 9, which is designed for quick engagement and disengagement with respect to a mount element 181 on a side frame element 182 of a hospital bed, table, etc. 183. The bracket or block 180 is secured by any suitable means such as screws 185 to an upstanding flange or web element 186 of a bracket 187. The latter corresponds to block 62, FIG. 3, previ-ously described, and transfer from one support to the other is obvious.

The stand 11, however, has special merit and normally will be preferred for cardiovascular studies because of its conven-ient auxiliary support and instrument holding features. These too are made adjustable and self-locking, a simple and convenient arrangement for one of them being shown in FIGS. 13 and 14. Here the instrument support rod 101 of FIG. 1 is shown pivoted on a transverse pin 190 mounted with its en-closed head portion 191 seated in a bore 192 of a slidable block member 193. The head portion 191 is bored transversely to slide on a support bar 99 or 100, FIGS. 1 and 2. A tightening nut 194 is adapted to hold the head 191 strongly in fric-tional engagement with rod 99 or 100 while also clamping sup-port rod 101 in the desired position, all at a single clamping operation.

3,540,719

The device, in use, is usually covered with an absorbent blotter pad or cover to keep it clean and to absorb blood or other liquid. Such a cover, made of absorbent paper or other fibrous or spongy material, is shown at 197, FIG. 11. It is flexi-ble to fit over the arm rest in any adjusted position and preferably is provided with a slot 198 to fit around the hand hold bracket 111, being slotted to the end at 199 to facilitate putting it in place. Such a pad is shown also in dotted lines in FIG. 11.

In use, the patient is normally put in bed or in a reclining position. The stand, FIG. 1, is moved up to a convenient posi-tion; the post 29 is raised or lowered by adjusting device 36. A cover pad 197 will be put on before the patient’s arm is laid on the support with the elbow approximately above the support bracket. The device may be rotated about the support post by lifting it enough to clear the stud 64 and moving it to a new self-locking position. Auxiliary equipment of various types may be mounted on elements 59, 102, 101, etc., and one or both bars 99, 100 may be omitted in some cases.

A preliminary adjustment may be made of the screw 130 and the sliding or longitudinal adjustment of elements 145, 151 along support bars 97, 98. After the patient’s arm is in place on the pad 197, with fingers under bar 112 and bracket 111 between two fingers, further adjustment may be made if needed. Straps may be put through slots 153, 174, 175 to hold the arm or hand in proper position, which may be required in some cases. It will be understood that, if desired, only a single friction element 151 may be used to lock in lon-gitudinal adjustment. However, the arrangement shown is preferred.

Cardiovascular studies can be carried out rapidly. The procedures involved include X-rays, blood studies, insertion of a plastic catheter in an artery, e.g. inserted at the wrist and extending up to the shoulder, releasing dye into a vein and making a colorimetric test to determine rate of pumping by the heart, etc. A patient may stand up and take exercise with the equipment still attached to forearm and wrist. The trigger 145 is operated and the forearm support slides off the bars 97, 98, for example, while instrumentation is still connected to ob-serve effects of exercise, etc. The whole series of tests can be completed within a few minutes. A dozen tests often can be made, by the use of recently developed techniques and the equipment of this invention, within the time formerly required for a single test. Convenient and more positive detection of unsuspected ailments is facilitated, making earlier and more successful treatment of heart and circulatory diseases possible in many cases. The present invention provides in effect a system of equipment for such treatments and adjustments.

It will be understood that the invention is susceptible of other uses than those specifically mentioned above, such as for use in surgical and transfusional or intravenous treatments and operations, bone settings, etc., on the arm and hand. The multiple adjustment features plus the inherent design make it possible to hold the arm and hand in proper positions for the treatments without causing unnecessary discomfort or pain. Various modifications may be made in the equipment or in particular components thereof, as will be obvious to those skilled in the art. It is intended to cover such by the claims below, insofar as and as broadly as the state of the prior art properly permits.

We claim:

1. Apparatus for supporting the arm of a person for medical treatment, study and the like, which comprises the combina-tion of a stand, bracket and upper arm support means secured to said stand for angular adjustment in a substantially horizon-tal plane, extensible means adjustably attached to said bracket and comprising a main support for the forearm, means for ad-justing the main support in a vertical plane to vary its angle of inclination with respect to the body of said person, a hand support articulated to said forearm support and angularly adjusta-ble with respect thereto, and means for securing the hand to said hand support.
2. Apparatus according to claim 1 which includes locking adjustments for said articulated hand support and said upper arm support.

3. Apparatus according to claim 1 in which the extensible means comprises sliding elements mounted on parallel bars and which includes a spring actuated frictional locking means for engaging at least one of said bars.

4. Apparatus according to claim 1 which includes a normally upstanding supporting stand for said main support, said stand having at least three legs of which two are provided with rollers, said rollers being mounted so as to clear a floor when the stand is upright but to contact and roll freely on said floor when the stand is tilted out of its normal upstanding position.

5. Apparatus according to claim 4 wherein the stand comprises an upstanding post and an adjustable member slidably on and frictionally lockable on said post for supporting supplementary equipment.

6. Apparatus according to claim 1 wherein the main support is mounted on a quick attachment bracket selectively attachable to the supporting stand or a hospital bed.

7. Apparatus according to claim 1 wherein the main support is equipped with at least one supporting rod alongside said main support and adjustable bracket means mounted on said rod for supporting auxiliary equipment.

8. Apparatus according to claim 1 wherein there are provided an inner pair of parallel bars for slidably and removably mounting said main support, and an outer pair of parallel bars for supporting auxiliary equipment.

9. Apparatus according to claim 1 which comprises a retaining device for a container or the like attached to a stand element independent of said main support.

10. In combination, a portable stand, a longitudinally adjustable arm support secured to said stand by pivot means permitting adjustment of said arm support in a vertical plane with respect to said stand, means adjustable in a horizontal plane for mounting said arm support on said stand in various positions, means for securing said mounting means in a selected adjusted position, a hand support, and means mounted on the arm support for adjustably positioning said hand support with respect to said arm support.

11. Combination according to claim 10 which comprises a forearm support interposed between said arm support and said hand support, said forearm support being mounted for rectilinear translational adjustment with respect to said arm support, and infinitesimally adjustable locking means to secure the forearm support accurately in any desired position of said translational adjustment.

12. Combination according to claim 11 wherein the hand support is mounted for rectilinear translational adjustment with respect to said forearm support.