ILLUMINATING DEVICE FOR OPERATING ROOMS

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The present invention relates to operating room equipment, and more particularly to improvements in the manner of mounting operating room lamps, optical instruments, terminals for oxygen conduits, suction conduits, electric conduits and other accessories in such position that they are readily accessible to the physicians or to their assistants without in any way impeding the treatment of a patient.

It is already known to mount a lamp on the ceiling of an operating room in such a way that the reflector of the lamp is rotatable about a vertical axis. Certain other accessories, such as various optical instruments including photographic cameras, movie cameras, microscopes or television cameras are normally mounted on separate stands which may be moved into close proximity of the operating table. Additional stands or floor-mounted columns are provided to support terminals for suction tubes, tubes for laughing gas, oxygen and ether, electrical conductors and other types of conduits. Such stands and columns often limit the freedom of movement of the surgeon or of his assistants and may even interfere with movements of the lamp.

Accordingly, it is an important object of the present invention to provide an equipment which is especially suited for use in operating rooms and which, in addition to including an operating room lamp, also includes one or more additional accessories which are arranged in such a way that they cannot interfere with the movements of the lamp, that the lamp cannot interfere with movements or utilization of such additional accessories, and that each accessory is readily accessible to the surgeon or to his assistants without in any way hindering the treatment of patients.

Another object of the invention is to provide a very simple and space saving operating room equipment which is constructed and assembled in such a way that all of its parts may be supported by a single fixture so that stands, floor-mounted columns and similar accessories may be dispensed with.

A further object of the invention is to provide an improved ceiling fixture which may be utilized in operating rooms to support two or more similar or widely different accessories.

An additional object of the invention is to provide an equipment of the above outlined characteristics whose component parts may be moved to any desired position of adjustment with respect to the ceiling fixture and/or with respect to the operating table so as to be in requisite position for facilitating or recording the work of a surgeon, of an anesthetist, of a nurse or of other person or persons in charge of patients.

A concomitant object of the invention is to provide an arrangement for use in operating rooms which automatically prevents such movements of its accessories which could interfere with or cause damage to the other accessories.

The invention is based on the recognition that the ceiling fixture for the operating room lamp may serve as a direct or indirect support for one or more additional accessories, for example, one or more additional lamps, optical instrumentalities which are utilized for observation or recordal of an operation, various conduits which deliver oxygen, other fluids or electric current into close proximity of the operating table, and that such additional accessories are much more readily accessible and are much less likely to interfere with the work of the personnel if they are suspended from the ceiling.

In one of its simplest forms, the arrangement of our invention comprises a ceiling fixture which includes a substantially vertical pintle, a first operating room accessory including a lamp having an arm which is hinged to and is rotatable about the pintle, and at least one additional accessory which is also supported by the fixture. Such additional accessory or accessories may assume the form of a column which extends through and downwardly below a hollow pintle to support terminals for one or more fluid or current-conveying conduits, one or more additional lamps which are rotatable about the pintle, supporting means for a photographic camera, movie camera, microscope, television camera or a combination of such optical instrumentalities, and others.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following detailed description of certain specific embodiments with reference to the accompanying drawings, in which:

FIG. 1 is a side elevation view of an arrangement which is suspended from the ceiling of an operating room and which embodies one form of our invention;

FIG. 2 is a horizontal section as seen in the direction of arrows from the line II—II of FIG. 1;

FIG. 3 is a side elevation view of a modified arrangement;

FIG. 4 is a horizontal section as seen in the direction of arrows from the line IV—IV of FIG. 3;

FIG. 5 is a fragmentary large-scale axial section through a modified ceiling fixture;

FIG. 6 is a perspective view of an annular member which forms part of the fixture shown in FIG. 5; and

FIG. 7 is a perspective view of a complementary annular member which cooperates with the member of FIG. 6 to form a stop against excessive angular movements of accessories which are suspended on the ceiling fixture of FIG. 5.

Referring now in greater detail to the illustrated embodiments, and first to FIGS. 1 and 2, there is shown an arrangement which is intended for use in operating rooms and which may be mounted at a point above the head end of an operating room table 1. The legs 2 of this table are secured to or supported by the floor 3.

The arrangement comprises a fixture 4 which is anchored in the ceiling 5 and which comprises a downwardly extending hollow vertical pintle 6 serving as a means to turnably support the horizontal innermost arm 8 of a first operating room accessory here shown as a lamp 7. In the illustrated embodiment, the ceiling fixture 4 comprises a flange 9 which is rigid with or which forms the upper end portion of the pintle 6 and which is secured to the ceiling 5 by two-piece anchoring devices 10. A cap 11 may be screwed onto or otherwise secured to the flange 9 to conceal the bolts of the anchoring device 10. If desired, the bolts may be long enough to be driven into a roof beam (not shown) so as to make sure that the fixture 4 can support a substantial weight. As is known, such anchoring devices normally comprise an expandable sleeve which is inserted into a hole drilled in the ceiling and a bolt which is driven into and expands the sleeve into strong engagement with the material of the ceiling.
The innermost end portion of the arm 8 assumes the form of a bearing sleeve 12 which is hinged to and is turnable with the pintle 6 so that the reflector 13 of the lamp 7 may be moved to any desired angular position with respect to the pintle. The arrangement of FIG. 1 further comprises a second operating room accessory which constitutes a second lamp 7a and whose arm 8a comprises a bearing sleeve 12a which is hinged to and which is turnable with the pintle 6. It will be noted that the sleeves 12, 12a are staggered with respect to each other in the axial direction of the pintle 6 so that one thereof may turn without hindering similar angular movements of the other.

The outer end of the arm 8 carries a vertical pivot pin 14 for a second or intermediate arm 15 which in turn carries a horizontal pin 16 for a third or outermost arm 17, the latter having a bifurcated outer end portion which supports two coaxial pins 18 for the reflector 13. The parts 8 and 14-17 together constitute a supporting means for the reflector 13, and this supporting means is secured to the fixture 4. The just described construction of the lamp 7 enables the reflector 13 to be moved to several positions of adjustment with respect to the operating table 1. The other lamp 7a is of identical construction. It will be readily understood that each lamp 7a may be provided with additional articulated joints so that it may be more readily moved to a large number of different positions.

When the outermost arms 17, 17a of the two lamps are arranged in horizontal planes and when one of the sleeves 12, 12a is turned about the pintle 6, it is possible that the reflector 13 would come into actual abutment with the reflector 13a or vice versa. In order to avoid damage to the reflectors, we prefer to provide suitable stop means which insure that the inner arms 8, 8a cannot be moved toward each other once they assume a predetermined angular position. The stop means comprises a downwardly extending cushioning member or stop 20 which is fixed to the arm 8 and an upwardly extending cushioning member or stop 21 which is carried by the arm 8a and which abuts against the member 20 when the arm 8 is moved to the position 8' of FIG. 2, i.e., when the lamp 7 is swung in an arc 22 and assumes the position 7'. The members 20, 21 are mounted in such a way that the bifurcated sections 23, 23a cannot come into actual abutment with each other if the lamp 7 is swung in an anti-clockwise direction, as viewed in FIG. 2. Of course, one can provide additional stop means to prevent abutment of the section 23 with the section 23a when the lamp 7 is turned in a clockwise direction.

FIG. 1 shows in phantom lines (as at 7" and 7a") different positions of adjustment of the lamps 7 and 7a.

The arm 17 preferably consists of two telescoped sections 23, 24 which enable the operating room personnel to move the reflector 13 nearer to or further away from the ceiling fixture 4. In other words, the overall length of the composite arm 8, 15, 17 may exceed the overall length of the arm 8a, 15a, 17a, but, of course, it is equally possible to assemble the arm 17a of two telescoped sections 23a, 24a. The section 23 is rotatable with respect to the section 24 if desired, the supporting means of the lamps 7, 7a may be provided with twin joints or with universal joints so that even an inexperienced person may rapidly move the reflectors to any desired position of adjustment without detracting his attention from the patient on the operating table 1.

The internal space of the pintle 6 accommodates a column 25 which is secured to the fixture 4 (e.g., to the flanges 10, 12) and which comprises a lower end portion 26 constituting a head and located at a level below the pintle. The head 26 carries several terminals such as an electric outlet 27 for one or more plugs, not shown, one or more nipples 28 for connection of conduits which convey ether, laughing gas, oxygen, water or another fluid, a nipple (not shown) which connects to a suitable device for creating suction, and others.

A stirrup-shaped guide member 29 is secured to the head 26 and serves as a means for supporting cables, pipes and similar flexible conduits which are connected to the terminals so as to keep such conduits out of the way. For example, the guide member 29 may be mounted at a level above the head of the operating table 1 to support a supply conduit when the patient is to receive an anesthetic, such as ether or laughing gas. The guide member 29 is detachable from (as at 30) or adjustable with respect to the head 26.

If the area swept by the supporting means for the lamps 7, 7a need not be located entirely above the table 1, the pintle 6 may be placed above or even beyond the head of the table so that the head 26 will be positioned directly above the head of the person administering anesthetics. Of course, it is equally possible to place the fixture 4 directly above the central portion of the table 1.

The distance between the head 26 and the floor 3 is preferably such that the head may be reached by persons of average height but that this head does not interfere with the work of nurses, interns, surgeons and other persons in the operating room. For example, the head 26 may be located at a distance of between 1.9-2.2 m. from the floor. Consequently, and assuming that the distance between the floor 3 and the ceiling 5 exceeds substantially 2.2 m., the axial length of the pintle 6 and of the column 25 must be sufficient to insure that the arms or the reflectors of the lamps 7, 7a may be reached by a person standing beneath the fixture. As a rule, the sleeves 12, 12a will be located at a distance of between 2.1-2.5 m. above the floor, this being the average distance between the reflectors 13, 13a and the floor when the lamps 7, 7a assume the full-line positions of FIG. 1. Such mounting of the sleeves 12, 12a is much more convenient than in certain conventional arrangements wherein a single operating room lamp is pivotable about a vertical axis at a point immediately adjacent to the ceiling.

The column 25 is preferably mounted in such a way that its head 26 is rotatable and/or axially movable with respect to the pintle 6.

FIGS. 3 and 4 illustrate a modified arrangement wherein a slightly different column 125 comprises a head 126 which is mounted at the outer end of a laterally extending downwardly inclined arm 131. An important advantage of the arm 131 is that it enables an attendant to move the one or the other reflector 113, 113a directly above the head of the operating table 1 if the nature of operation or examination necessitates such direct illumination. The head 126 supports several terminals 127, 128, 132 for ether, laughing gas, suction conduits, water, electric conductors, and the like. As shown, the inner end portion of the arm 131 assumes the form of a bearing sleeve 133 which is turnable about the pintle 106 and which is located beneath the sleeve 112a of the arm 108a. As a rule, it is sufficient if the arm 131 may be moved through an angle of about 20° to both sides of a neutral position. Such limited angular displacements of the arm 131 are sufficient to permit movements of the one or the other reflector to the area occupied by the head 126 if the nature of an operation or examination should render such movement necessary. On the other hand, the head 131 is sufficiently close to the head of the table 1 so that the length of cables, conduits and similar flexible elements which are connected to the terminal 127, 128 and/or 132 need not be excessive.

In the embodiment of FIGS. 3 and 4, the fixture 104 comprises annular stop means 120 which are inserted be-
between the sleeves 112, 112a, 133 to prevent direct contact between the reflectors 113, 113a and/or between the re-actors and the head 126. It will be readily under-stood that the sleeve 133 of the arm 131 may be located above the sleeve 112 or between the sleeves 112, 112a.

At its lowermost end, the pintle 206 supports a universal joint 212, and is joined by a ring 213 with an arm 136 forming part of a supporting means for a further accessory, such as a microscope 137, a photo-graphic camera, a movie camera, a television camera or another optical instrument. The lower end of the arm 136 is articularly connected with a second arm 138 which is pivotable with respect to a third arm 139, the latter supporting the housing of the microscope 137. The joint 135 and the pivot pins 140, 141 between the ends of the arm 138 and the respective ends of the arms 136, 139 enable a nurse or another attendant to move the micro-scope 137 to any desired position of adjustment with re espect to the operating table 1. It will be noted that a third stop 129 is provided between the sleeve 133 and the joint 135 to prevent excessive angular displacements of the arm 136 with respect to the arm 131 or vice versa.

FIG. 5 is an axial section through a ceiling fixture 204 which supports the arms 208, 208a of two operating room accessories, such as a lamp and a microscope, a lamp and another optical instrument, etc. Such a fix-ture may be used with the arrangements illustrated in FIGS. 1-4. In addition, the fixture 204 supports a column 225 which is coaxial with and extends through a hollow vertical pintle 206. The upper end of the pintle 206 is welded to a washer 240 which is rigid with a ring 241, the latter being secured to the ceiling in the same way as or in a manner analogous to that shown in FIG. 1.

The arm 208 comprises a bearing sleeve 212 which is rotatable about axially spaced antifriction bearings 242, 243 mounted on the pintle 206. The inner race of the upper bearing 242 is in abutment with a rotary ring 244 whose flange abuts against the underside of the washer 240 to prevent frictional engagement of this washer with the sleeve 212. An annular spacer element 245 separates the inner races of the bearings 242, 243 from each other and is surrounded by a muf 246 of insulating material which carries three axially spaced slip rings 247, 248, 249 which respectively cooperate with sliding con-tacts 250, 251, 252 of conductors 253, 254, 255 which ex-tend into the hollow arm 208 and lead to the luminary or luminaries in the non-illuminated reflector carried by the arm 208.

The inner race of the bearing 243 is separated from the inner race of the third bearing 258 by a ring 257 which surrounds the pintle 206. The bearing 258 cooperates with a fourth bearing 259 to turnably support the sleeve 212a of the second arm 208a. The outer race of the bearing 243 is held between a split ring 260 and an annu-lus 261, both secured to the inner side of the sleeve 212. The spacer ring 245a, the insulating member 246a, the slip rings 247a, 248a, 249a, the contacts 250a, 251a, 252a and the conductors 253a, 254a, 255a of the second lamp 207a respectively correspond to similarly numbered parts of the lamp 207. The inner race of the bearing 259 is supported by a retaining nut 262 which is screwed onto the lower end of the pintle 206. The outer race of the bearing 258 is held between a split ring 260a and an annu-lus 261a both secured to the inner side of the sleeve 212a. The contacts 250, 251, 252 and 250a, 251a, 252a are biased by springs 263 which are accommodated in suitable caps 264, 264a respectively provided in the arms 208, 208a.

The slip rings 247, 248, 249 and 247a, 248a, 249a are connected to insulated conductors 265 which extend through the pintle 206 and lead to a suitable source of electric current, not shown.

The annuli 261, 261a together constitute a stop means for limiting angular displacements of the arms 208, 208a with respect to each other. These annuli are respectively shown in FIGS. 6 and 7. The annulus 261 is rigidly se-cured to and rotates with the sleeve 212, and the annulus 261a is mounted in the sleeve 212a so as to participate in angular displacements of the arm 208a. The under-side of the annulus 261 is provided with a downwardly extending radial projection 270 which may come into abutment with a similar projection 270a provided at the upper side of the annulus 261a when the arm 208a is turned through an angle of about 270 degrees with re spect to the arm 208 or vice versa. The projections 270, 270a are respectively located diametrically opposite the arms 208, 208a. Consequently, when the projections 270, 270a are moved into actual abutment with each other, the arms 208, 208a are angularly spaced through an angle a which corresponds to the angle between the radial center lines of the two projections when the pro-jections are in actual abutment with each other. This angle is selected with a view to prevent direct contact be-tween the reflectors which form part of the accessories 207, 207a. An important advantage of the stop means shown in FIGS. 6 and 7 is that they limit angular move-ments of arms 208, 208a in a clockwise or in an anti-clockwise direction. When the projection 270 is moved into abutment with the projection 270a, the lamp 207 may be rotated by rotating the arm 208a, i.e., both lamps may be rotated as a unit.

If the fixture 204 is utilized as a substitute for the fix-ture 104 of FIG. 3, the nut 262 serves as a support for the universal joint 135 so that all accessories may be sus-pended on the pintle by means of a single retaining element.

As a rule, the stop means 270, 270a is preferred over the stop means 20, 21 of FIGS. 1 and 2 because it is fully concealed and cannot accumulate dust or other impurities, and also because it limits movements of the arms in two directions.

The column 225 is hollow and accommodates two or more conduits 275, 276 which are assumed to convey an anesthetic, water, steam, oxygen, another fluid or electric current to the non-illuminated head which is located beneath the pintle 206. If desired, and in order to elimi-nate the possibility of explosion, the column 225 may accommodate protective tubes to seal the conduits 275, 276 from each other and/or from the atmosphere.

In all embodiments of our invention, we take full ad-vantage of the ceiling fixture by utilizing this fixture as a holder for two, three or more accessories. If the ceiling of an operating room is located at a certain distance above the floor, the length of the pintle which forms part of the ceiling fixture is sufficient to support a series of bearing sleeves and to provide room for a comparatively large head of a column so that such head may carry several terminals for various conduits. Since it is rather simple to provide strong anchoring means for the ceiling fixture, the latter is capable of carrying con-siderable loads including the combined weight of two, three, four or more accessories.

An important advantage of an arrangement which comprises at least two operating room lamps is that such arrangement may be used with considerable advantage in connection with operations involving transplantation of skin, in operations involving treatment of patients involved in traffic or other accidents, in operations which involve comparatively large parts of a patient's body, in operations for treatment of narrow or small wounds which cannot be properly illuminated from above, in gynecological operations, and others. In such instances, it is of utmost importance to have several luminaries mounted in a way to insure that they may be moved, either together or individually, to any desired position of adjustment.

In accordance with another feature of our invention, a microscope or another optical instrument may be mounted on the arm of a lamp or another accessory,
for example, on the arm 208a of the lamp 207a shown in FIG. 5. The supporting means 236 of the microscope may be rigid with or it may be articulately connected to the arm 208a. Thus, one or more accessories need not be directly supported by the ceiling fixture but may be carried by the remaining accessory or accessories.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations are not intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed is new and desired to be secured by Letters Patent is:

1. An arrangement for use in operating rooms, comprising a ceiling fixture including a substantially vertical hollow tubular pintle; a first operating room accessory including a lamp having an arm hinged to and turnable about said pintle; and a second operating room accessory comprising a column supported by said fixture, said column being received in and having a lower portion extending downwardly and beyond said pintle, and fluid conveying conduit means extending through said column and having terminal means provided at said head.

2. An arrangement as set forth in claim 1, wherein said arm comprises a series of articulately connected links one of which is hinged to said pintle, whereby the overall length of said arm as well as the inclination of said links may be varied.

3. An arrangement for use in operating rooms, comprising a ceiling fixture including a substantially vertical hollow tubular pintle; a first operating room accessory including a lamp having an arm hinged to and rotatable through an angle greater than 360° about said pintle; and a second operating room accessory including a column supported by said fixture, said column being received in and having a lower portion extending beyond said pintle, said lower portion including an arm extending laterally of and having a head distant from said pintle, and fluid conveying conduit means extending through said column and having terminal means provided at said head.

4. An arrangement for use in operating rooms, comprising a ceiling fixture including a substantially vertical hollow tubular pintle; a first operating room accessory including a lamp having an arm hinged to and rotatable through an angle greater than 360° about said pintle; and a second operating room accessory including a column supported by said fixture, said column being received in and having a lower portion extending beyond said pintle, said lower portion including an arm extending laterally of and having a head distant from said pintle, said arm including a lock and a lock releasing mechanism for preventing the arm from being turned beyond said limits.

5. An arrangement for use in operating rooms, comprising a ceiling fixture including a substantially vertical hollow tubular pintle; a first operating room accessory including a lamp having an arm hinged to and turnable through an angle greater than 360° about said pintle; and a second operating room accessory comprising a column supported by said fixture, said column being received in and having a lower portion extending beyond said pintle, said lower portion including an arm hinged to and rotatable through an angle greater than 360° about said pintle, independent of the rotary movement of said first accessory; and at least one additional accessory including an optical instrument having supporting means secured to said fixture, said supporting means comprising an arm which is hinged to and is turnable about said pintle at a point axially spaced from the point at which said first mentioned arm is hinged to said pintle, and further comprising stop means for limiting turning of one of said arms with respect to the other of said arms, said pintle further comprising vertically spaced slip rings, and each of said arms further comprising vertically spaced sliding contacts which cooperate with said slip rings to maintain a continuity of electric power at said lamps and said optical instrument regardless of the angular position of said arms.

6. An arrangement as set forth in claim 5, wherein said stop means comprises resilient cushioning members fixed to said arms and engaging each other in a predetermined angular position of said arms.

7. An arrangement as set forth in claim 5, wherein said stop means comprises a first projection fixed to and turnable with one of said arms and a second projection fixed to and turnable with another of said arms, one of said projections engaging the other projection in a predetermined angular position of said arms with respect to the other.

8. An arrangement for use in operating rooms, comprising a ceiling fixture including a substantially vertical hollow tubular pintle; a first operating room accessory including a lamp having an arm hinged to and turnable about said pintle through an angle greater than 360°; a second operating room accessory including a lamp having an arm hinged to and independently turnable about said pintle through an angle limited only by the position of said first operating room accessory; and a third operating room accessory comprising a column supported by said fixture, said column being received in and having a lower portion extending downwardly and beyond said pintle, and fluid conveying conduit means extending through said column.

9. An arrangement as set forth in claim 8, wherein said pintle comprises a lower end portion, wherein each of said arms has a bearing sleeve rotatably surrounding said pintle, and further comprising a single retaining member secured to the lower end portion for retaining said sleeves on said pintle.

10. An arrangement as set forth in claim 8, wherein each of said accessories has an arm provided with a bearing sleeve hinged to and turnable about said pintle, and stop means disposed in said sleeves for limiting angular movements of the respective arms with respect to each other, said stop means comprising horizontally disposed annuli including cooperating projections.

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