



SPECIFICATION

TITLE OF THE INVENTION

STAND APPARATUS FOR MEDICAL OPTICAL EQUIPMENT

WHAT IS CLAIMED IS

[Claim 1] A stand apparatus for a medical optical equipment characterized in that:

a pair of parallel vertical links and a pair of parallel horizontal links are combined to form a parallel linkage, and an intermediate portion of one of said vertical links is pivotally supported through a fulcrum to a stand disposed on a floor;

an upper one of said horizontal links of said parallel linkage is extended to form a supporting link, and a substantially vertical front link is pivotally supported to said supporting link at a front end thereof, said medical optical equipment being supported to a lower end of said front link;

a joint shaft of said parallel linkage is set at a rear end of said supporting link, and a crank member having a horizontal fulcrum lying on a horizontal line on which said joint shaft lies and a vertical fulcrum lying on a vertical line on which said joint shaft lies is supported to said joint shaft, said horizontal fulcrum of said crank member and a portion of said stand being connected together by a vertical sublink parallel to said one vertical link of said parallel linkage and having a length equal to the linear distance between said joint shaft of said one vertical link and said fulcrum of said parallel linkage, said vertical fulcrum of said crank member and a portion of said front link being connected together by a horizontal sublink parallel to said supporting link and having a length equal to that of said supporting link; and

a counterweight is provided below said parallel linkage to

REPLACED SHEETS SG

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counterbalance a weight applied in a lowering direction of said parallel linkage about said fulcrum and thereby keep said medical optical equipment still in a floating condition.

[Claim 2] A stand apparatus for a medical optical equipment according to Claim 1, wherein a supporting parallel linkage unit having vertical links is provided at a lower end of said front link, and said medical optical equipment is supported to a lowermost horizontal link of said supporting parallel linkage unit.

[Claim 3] A stand apparatus for a medical optical equipment according to Claim 1 or 2, wherein said stand is rotatably mounted on a base disposed on said floor so as to be rotatable about a substantially vertical axis of rotation, and a weight of said stand and a structure thereabove is balanced with respect to said substantially vertical axis in each of at least two perpendicular directions.

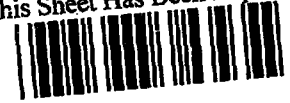
[Claim 4] A stand apparatus for a medical optical equipment according to Claim 1 or 2, wherein said intermediate portion of said one vertical link of said parallel linkage is pivotally supported through said fulcrum to said stand disposed on a wall of a room.

[Claim 5] A stand apparatus for a medical optical equipment according to Claim 1 or 2, wherein said intermediate portion of said one vertical link of said parallel linkage is pivotally supported through said fulcrum to said stand disposed on a ceiling; a lower end of said horizontal links of said parallel linkage is extended to form said supporting link; and said counterweight is provided above said parallel linkage.



DETAILED DESCRIPTION OF THE INVENTION

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[0001]

[Industrial Field of Utilization]

This invention relates to a stand apparatus for a medical optical equipment.

[0002]

[Prior Art]

A surgical operation such as a brain surgical operation and heart surgical operation is performed with an affected part being observed by an operator through an operating microscope. Accordingly, the operator strains his/her nerve because of very minute operation, and in many cases much time is spent for the operation. Such a long operating time will undesirably cause an increase in physical and mental fatigues of both the subject and the operator.

[0003]

A medical optical equipment such as an operating microscope plays a very important role in such a high-level operation, and easiness of use of the medical optical equipment directly follows a reduction in the operating time. A conventional stand apparatus for permitting the medical optical equipment to be easily used is shown in Figs. 10 and 11, for example (see Japanese Patent Laid-open No. Sho 56-32110).

[0004]

Referring to Fig. 10, reference numerals 1 and 2 denote a base and a stand, respectively. The stand 2 is rotatable about a vertical axis α of rotation relative to the base 1. An electromagnetic clutch C is provided between the stand 2 and the base 1 to lock a rotational position of the stand 2 relative to the base 1. The base 1 is provided on its lower surface with casters 3 each having a locking mechanism and a vertically

moving mechanism, thereby permitting the base 1 to be moved on an upper surface of a floor F and further permitting the base 1 to be locked at a desired position and to be adjusted in levelness.

[0005]

A first parallel linkage 4 is pivotally mounted through a fulcrum 5 to an upper end portion of the stand 2. The first parallel linkage 4 is rotatable about the fulcrum 5 in a frontward direction (a direction shown by an arrow A) or in a rearward direction (a direction shown by an arrow B), and can be locked by an electromagnetic clutch (not shown) provided at the fulcrum 5. An upper end of the first parallel linkage 4 is formed by a horizontal shaft 6, and a second parallel linkage 7 and a third parallel linkage 8 are interlockingly mounted to the horizontal shaft 6. A front end of the third parallel linkage 8 is formed by a front link 9 extended downwardly, and an operating microscope 10 is mounted to a lower end of the front link 9.

[0006]

The operating microscope 10 is located below an extension L of the horizontal shaft 6. Accordingly, the operating microscope 10 itself functions as a kind of weight to form a balancing structure like a so-called "yajirobei (balancing toy)", and the operating microscope 10 is swingable about an intersection 11 between the extension L and the front link 9, so that an operator can arbitrarily change an observation angle of the operating microscope 10 to observe an opened portion of the head of a subject 12. Further, electromagnetic clutches (not shown) provided at joint shafts 13 for joining the parallel linkage 7 to the horizontal shaft 6, thereby locking the swing position of the operating microscope 10 after changing the observation angle.

[0007]

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**[Problems to be Solved by the Invention]**

In such a conventional stand apparatus for a medical optical equipment, however, the front link 9 is swung about the intersection 11 in concert with the change in the observation angle of the operating microscope 10 by the operator 14 as shown in Fig. 11. Accordingly, there is a possibility that the front link 9 may strike against an assistant 15 present near the operator 14. Further, depending upon the observation angle, the front link 9 may strike against the operator 14 himself/herself. Thus, the operability of the stand apparatus is bad. Further, as the front link 9 itself has not been perfectly sterilized, the touch of the front link 9 with the operator 14 or the like is undesirable from a sanitary view.

[0008]

Further, the location of the stand apparatus of this kind is selected to an optimum position according to the content of the operation to be performed. That is, while a specific position in the periphery of the subject 12 is selected by indication from the operator 14, the work of moving the stand apparatus to the specific position and setting it at this position is carried out by a person not taking part in the operation because of sanitary demand. After moving the stand apparatus to the indicated position and then locking it, this person must carry out horizontal adjustment of the stand apparatus to make it perfectly horizontal. That is, since the floor F of an operating room is not perfectly horizontal, such horizontal adjustment is required. If the horizontal adjustment is not carried out, the vertical axis α becomes inclined. As a result, at the instance the electromagnetic clutch C is disengaged, the stand 2 and the structure thereabove possibly start largely rotating about the vertical axis α . In this manner, every time the position of the stand

apparatus in the prior art is changed, the horizontal adjustment must be carried out at the position after changed. Thus, the stand apparatus in the prior art is very troublesome to handle.

[0009]

This invention has been achieved in view of the problems mentioned above, and it is an object of the present invention to provide a stand apparatus for a medical optical equipment which can prevent a link member supporting the medical optical equipment from largely swinging during operation of the equipment and eliminate the need of the horizontal adjustment.

[0010]

[Means for Solving the Problems]

According to the stand apparatus for a medical optical equipment described in Claim 1 of the present invention, said stand apparatus is characterized in that:

a pair of parallel vertical links and a pair of parallel horizontal links are combined to form a parallel linkage, and an intermediate portion of one of the vertical links is pivotally supported through a fulcrum to a stand disposed on a floor;

an upper one of the horizontal links of the parallel linkage is extended to form a supporting link, and a substantially vertical front link is pivotally supported to the supporting link at a front end thereof, the medical optical equipment being supported to a lower end of the front link;

a joint shaft of the parallel linkage is set at a rear end of the supporting link, and a crank member having a horizontal fulcrum lying on a horizontal line on which the joint shaft lies and a vertical fulcrum lying on a vertical line on which the joint shaft lies is supported to the joint

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shaft, the horizontal fulcrum of the crank member and a portion of the stand being connected together by a vertical sublink parallel to the one vertical link of the parallel linkage and having a length equal to that between the joint shaft of the one vertical link and the fulcrum of the parallel linkage, the vertical fulcrum of the crank member and a portion of the front link being connected together by a horizontal sublink parallel to the parallel linkage supporting link and having a length equal to that of the supporting link; and

a counterweight is provided below the parallel linkage to counterbalance a weight applied in a lowering direction of the parallel linkage about the fulcrum and thereby keep the medical optical equipment still in a floating in the air.

[0011]

According to the stand apparatus for a medical optical equipment described in Claim 2 of the present invention, a supporting parallel linkage unit having vertical links is provided at a lower end of the front link, and the medical optical equipment is supported to a lowermost horizontal link of the supporting parallel linkage unit.

[0012]

According to the stand apparatus for a medical optical equipment described in Claim 3 of the present invention, the stand is rotatably mounted on a base disposed on the floor so as to be rotatable about a substantially vertical axis of rotation, and a weight of the stand and a structure thereabove is balanced with respect to the substantially vertical axis in each of at least two perpendicular directions.

[0013]

According to the stand apparatus for a medical optical equipment described in Claim 4 of the present invention, the intermediate portion of

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the one vertical link of the parallel linkage is pivotally supported through the fulcrum to the stand disposed on a wall of a room.

[0014]

According to the stand apparatus for a medical optical equipment described in Claim 5 of the present invention, the intermediate portion of the one vertical link of the parallel linkage is pivotally supported through the fulcrum to the stand disposed on a ceiling; a lower end of the horizontal links of the parallel linkage is extended to form the supporting link; and the counterweight is provided above the parallel linkage.

[0015]

[Functions]

Accordingly, even when the parallel linkage is deformed to move the medical optical equipment in the vertical direction and/or the horizontal direction, the front link supporting the medical optical equipment is always kept in a substantially vertical condition. Thus, there is no possibility that the front link may largely swing to strike against any persons in the periphery thereof, so that the stand apparatus is desirable from the viewpoints of operability and sanitariness.

[0016]

With this structure that the medical optical equipment is mounted through the supporting parallel linkage unit to the lower end of the front link, the direction of the medical optical equipment can be changed even in the substantially vertical condition of the front link by deforming the supporting parallel linkage unit.

[0017]

With this structure that the weight of the stand and the structure

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thereabove is balanced with respect to the vertical axis in each of at least two perpendicular directions, there is no possibility that the stand and the structure thereabove may spontaneously rotate even when the stand is disposed on an inclined floor. Accordingly, it is unnecessary to carry out horizontal adjustment of the stand apparatus after moving it from one place to another, thereby greatly simplifying the handling of the stand apparatus.

[0018]

As the stand according to Claim 4 is disposed on the wall of the room, a floor space can be widely utilized.

[0019]

As the stand according to Claim 5 is disposed on the ceiling of the room, a floor space can be widely utilized.

[0020]

It is to be noted that the parallelism to the vertical link or the horizontal link in the description mentioned above and below means the parallelism to a phantom straight line of the vertical link or the horizontal link. For example, when the vertical link or the horizontal link is partially curved, the parallelism to the vertical link or the horizontal link means the parallelism to a straight line connecting opposite ends of each link (or a straight line connecting one end of each link to the fulcrum). Accordingly, the length of the vertical link or the horizontal link means the length of such a straight line.

[0021]

[Preferred Embodiments]

There will now be described some preferred embodiments of the present invention with reference to the drawings.

[0022]

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Figs. 1 to 8 show a first preferred embodiment of the present invention. Reference numeral 16 denotes a base. The base 16 is provided on its lower surface with casters 17 each having a locking mechanism. The casters 17 allow the base 16 to be moved on a floor F. A stand 18 substantially U-shaped in side elevation is mounted on the base 16. The stand 18 is rotatable about a vertical axis α , of rotation. An electromagnetic clutch C_1 is provided on the vertical axis α , to stop rotation of the stand 18 and lock a rotational position of the stand 18.

[0023]

A fulcrum 19 is set at a front end of an upper portion of the stand 18, and a parallel linkage 20 is supported to the fulcrum 19. The parallel linkage 20 is composed of a pair of or two parallel vertical links 21 and 22 and a pair of or two parallel horizontal links 23 and 24. These links 21 to 24 are pivotally joined together at their opposite ends by four joint shafts β_1 to β_4 . A lower intermediate portion of the front vertical link 21 of the parallel linkage 20 is pivotally supported to the fulcrum 19. An electromagnetic clutch C_2 is provided on the fulcrum 19 to lock a pivotal position of the vertical link 21 (i.e., a deformed condition of the parallel linkage 20). The front vertical link 21 supported to the rotational axis 19 is curved rearward to have such a structure as not to interfere with an operator. A lever 25 is fixed to a lower end of the rear vertical link 22 so as to interlock integrally therewith, and a first counterweight W_1 is mounted on a lower end of the lever 25. Further, a second counterweight W_2 is mounted on a rear end of the lower horizontal link 24.

[0024]

A supporting link 26 extends frontward from a front end of the upper horizontal link 23 of the parallel linkage 20 in an integral manner, and a

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vertical front link 27 is pivotally mounted through a joint shaft β , to a front end of the supporting link 26. The supporting link 26 is curved upward to have such a structure as not to interfere with the head of the operator.

[0025]

As also shown in Figs. 5 and 6, a supporting parallel linkage unit 30 consisting of two parallel linkages 28 and 29 interlocking each other is provided below the front link 27 so as to be rotatable about a vertical axis α_1 of rotation. An electromagnetic clutch C_1 is provided on the vertical axis α_1 at an upper or base end of the supporting parallel linkage unit 30 to lock rotation of the supporting parallel linkage unit 30 about the vertical axis α_1 . An operating microscope (medical optical equipment) 33 is mounted through an electromagnetic clutch C_2 to a lowermost horizontal link 30a of the supporting parallel linkage unit 30 so as to be rotatable about an axis α_2 of rotation. One of two vertical links 32 of the supporting parallel linkage unit 30 on the near side of the operating microscope 33 is so curved as to retract from the operating microscope 33, thereby preventing interference with the operator. In this manner, the supporting parallel linkage unit 30 is cranked in shape as a whole, so that a center 33a of the operating microscope 33 supported by the supporting parallel linkage unit 30 is positioned just under the front link 27 (i.e., on the vertical axis α_1). The operating microscope 33 is adapted to be moved for adjustment along the axes α_1 and α_2 , and along an axis containing the center 33a and extending in a direction perpendicular to the plane of the sheet of Figs. 5 and 6 by means of a sliding mechanism not shown. Accordingly, the center 33a can be set on the axes α_1 and α_2 by using this adjusting mechanism. The vertical links 32 of the supporting parallel linkage unit 30 are kept always parallel to the front link 27, and

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the horizontal link 31 only is changed in angle to thereby change an observation angle of the operating microscope 33. A vertically deformed condition of the supporting parallel linkage unit 30 can be locked by an electromagnetic clutch C₃.

[0026]

An L-shaped crank member 34 is supported to the joint shaft β_1 at a rear or base end of the supporting link 26. On the crank member 34 are set a horizontal fulcrum β_2 lying on a horizontal line L₁ on which the joint shaft β_1 lies and a vertical fulcrum β_3 lying on a vertical line L₂ on which the joint shaft β_1 lies. Further, a joint shaft β_4 is provided on the stand 18 at a position lying on a vertical line L₃ on which the fulcrum 19 lies. The horizontal fulcrum β_2 and the joint shaft β_4 are connected together by a vertical sublink 37 parallel to the vertical link 21 and having the same length as that of a straight line extending between the fulcrum 19 and the joint shaft β_1 . On the other hand, the vertical fulcrum β_3 on the crank member 34 and a joint shaft β_5 provided on the front link 27 at an upper end portion thereof are connected together by a horizontal sublink 38 parallel to the supporting link 26 and having the same length as that of the supporting link 26 (i.e., the length of a straight line extending between the joint shaft β_1 and the joint shaft β_5). Accordingly, in view of a mechanism, the fulcrum 19, the joint shaft β_1 , the joint shaft β_4 , and the joint shaft β_5 form a "parallel linkage", whereas the joint shaft β_1 , the joint shaft β_3 , the joint shaft β_4 , and the joint shaft β_5 form another "parallel linkage".

[0027]

The stand apparatus according to this preferred embodiment has not only the above-mentioned mechanical feature but also the following feature in view of weight balance. That is, as shown in Figs. 7 and 8, the stand

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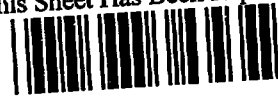
apparatus as a whole is designed and adjusted so that a left-hand weight X and a left-hand weight Y with respect to the vertical axis α , are equalized as viewed both in a side elevation (Fig. 7) and in a front elevation (Fig. 8). Thus, the weight balance of the stand apparatus as a whole is ensured with respect to the vertical axis α , in each of two perpendicular directions. Accordingly, even when the electromagnetic clutch C_1 is disengaged in a condition where the stand apparatus is set on the floor F that is inclined, there is no possibility that the stand 18 and the structure thereabove may spontaneously rotate about the vertical axis α_1 . This is due to the same mechanical function as that in assuming a "cylinder" freely rotatable about the vertical axis α , wherein even when the "cylinder" is set on an inclined surface, the "cylinder" does not spontaneously rotate. Accordingly, after moving the stand apparatus from one place to another, it is unnecessary to carry out any troublesome horizontal adjustment of the stand apparatus at the new place.

[0028]

The mechanical operation of the stand apparatus mentioned above will now be described.

The most characteristic point in the mechanical operation of the stand apparatus is that the crank member 34 does not rotate. That is, the horizontal fulcrum β , always lies on the horizontal line L_1 passing the joint shaft β_1 , and the vertical fulcrum β , always lies on the vertical line L_2 passing the joint shaft β_1 . Accordingly, when the supporting link 26 is raised or lowered to thereby raise or lower the operating microscope 33 as shown in Fig. 2 or 3, the joint shaft β_1 and the vertical fulcrum β , remains still, so that the front link 27 as the link opposite to a parallel linkage 40 formed between the joint shaft β_1 and the vertical fulcrum β , in the parallel linkage is always kept in the vertical





condition.

Further, when the main parallel linkage 20 is rotated about the fulcrum 19 to thereby move the operating microscope 33 in a frontward direction (Fig. 4) or in a rearward direction, the crank member 34 remains still, so that the front link 27 is kept always in the vertical direction.

In this manner, the front link 27 is kept always in the vertical condition regardless of vertical and horizontal movements of the operating microscope 33. Therefore, there is no possibility that the front link 27 may interfere with the operator or the like during operation of the stand apparatus.

[0029]

In changing the observation angle of the operating microscope 33, the supporting parallel linkage unit 30 supported under the front link 27 is rotated about the vertical axis α , or is deformed to thereby set a desired angle. Also in this case, the vertical links 32 of the supporting parallel linkage unit 30 are kept always in the vertical condition, thereby preventing interference with the operator or the like.

[0030]

Additionally, in raising or lowering the supporting link 26 (Fig. 2 or 3) or in horizontally moving the supporting link 26 away from the stand 18 (Fig. 4), the total weight of the parts supported at the fulcrum 19 inclusive of the parallel linkage 20, the supporting link 26, the supporting parallel linkage unit 30, and the operating microscope 33, are counterbalanced by the first counterweight W_1 and the second counterweight W_2 . Accordingly, even when the electromagnetic clutch C_1 is disengaged to permit the operating microscope 33 to be moved by the hand of the operator or the like, and the operating microscope 33 is freed from the hand at any position after moved, the operating microscope 33 is kept stopped at this

position. Particularly in horizontally moving the operating microscope 33 away from the stand 18 (Fig. 4), the first counterweight W_1 is moved opposite to the operating microscope 33 by the lever 25 pivoted integrally with the vertical link 22, thereby effecting reliable weight balance.

[0031]

Fig. 9 shows a second preferred embodiment of the present invention. While the first preferred embodiment mentioned above is a floor disposition type of stand apparatus, the second preferred embodiment is a ceiling disposition type of stand apparatus. That is, the parallel linkage 20 and the structure therebelow in the second preferred embodiment are vertically inverted from the structure of the first preferred embodiment. A base 42 is fixed to a ceiling 41, and the stand 18 is mounted on a lower surface of the base 42 so as to be rotatable about the vertical axis α_1 . The other structure is similar to that of the first preferred embodiment, so that the same parts as those of the first preferred embodiment are denoted by the same reference numerals and the double explanation thereof will be omitted. Also in this type where the stand apparatus is set on the ceiling 41, the weight balance in each of at least two perpendicular directions with respect to the vertical axis α_1 is provided. Accordingly, even when the vertical axis α_1 is slightly inclined during long-term use of the stand apparatus, there is no inconvenience that the stand 18 and the structure therebelow may spontaneously rotate at the instance the electromagnetic clutch C_1 is disengaged.

[0032]

Having thus described the floor disposition type of stand apparatus and the ceiling disposition type of stand apparatus, the present invention may be applied to a wall disposition type of stand apparatus in which the stand 18 is disposed on a wall of an operating room.

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[0033]

[Effects of the Invention]

As described above, in the stand apparatus for the medical optical equipment according to the present invention, even when the main parallel linkage is deformed to move the medical optical equipment in the vertical direction and/or the horizontal direction, the front link supporting the medical optical equipment is kept always in the substantially vertical condition. Accordingly, there is no danger that the front link may largely swing to strike against any persons near the stand apparatus. Thus, the stand apparatus of the present invention is desirable from the viewpoints of operability and sanitariness.

[0034]

Furthermore, the weight balance of the stand and the structure thereabove in each of at least two perpendicular directions with respect to a vertical axis of rotation of the stand is provided. Accordingly, even when the stand is disposed on an inclined floor, the stand and the structure thereabove do not spontaneously rotate. As a result, it is unnecessary to carry out horizontal adjustment of the stand apparatus after moving the stand apparatus from one place to another, thereby greatly simplifying the handling of the stand apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view of a stand apparatus for a medical optical equipment according to a first preferred embodiment of the present invention;

Fig. 2 is a side view similar to Fig. 1, showing a condition where the medical optical equipment is raised;..

Fig. 3 is a side view similar to Fig. 1, showing a condition where the

medical optical equipment is lowered;

Fig. 4 is a side view similar to Fig. 1, showing a condition where the medical optical equipment is horizontally moved away from a stand;

Fig. 5 is an enlarged side view of a supporting parallel linkage unit;

Fig. 6 is an enlarged side view similar to Fig. 5, showing a condition where the supporting parallel linkage unit is deformed;

Fig. 7 is a schematic view illustrating a balancing structure with respect to a vertical axis of rotation as viewed in side elevation of the stand apparatus;

Fig. 8 is a schematic view illustrating a balancing structure with respect to the vertical axis of rotation as viewed in front elevation of the stand apparatus;

Fig. 9 is a side view of a stand apparatus for a medical optical equipment according to a second preferred embodiment of the present invention;

Fig. 10 is a side view of a stand apparatus for a medical optical equipment in the prior art; and

Fig. 11 is a schematic view illustrating a deformed condition of a parallel linkage of the stand apparatus shown in Fig. 10.

DESCRIPTION OF THE NUMERALS

18: STAND

19: FULCRUM

20: PARALLEL LINKAGE

21, 22: VERTICAL LINK

23, 24: HORIZONTAL LINK

26: SUPPORTING LINK

27: FRONT LINK

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30: SUPPORTING PARALLEL LINK UNIT

33: OPERATING MICROSCOPE (MEDICAL OPTICAL EQUIPMENT)

34: CRANK MEMBER

37: VERTICAL SUBLINK

38: HORIZONTAL SUBLINK

41: CEILING

α_1 : VERTICAL AXIS OF ROTATION

β_1 through β_4 : JOINT SHAFT

β_6 : HORIZONTAL FULCRUM

β_7 : VERTICAL FULCRUM

F: FLOOR

W_1 : FIRST COUNTERWEIGHT

W_2 : SECOND COUNTERWEIGHT

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