

Feb. 14, 1933.

E. POHL

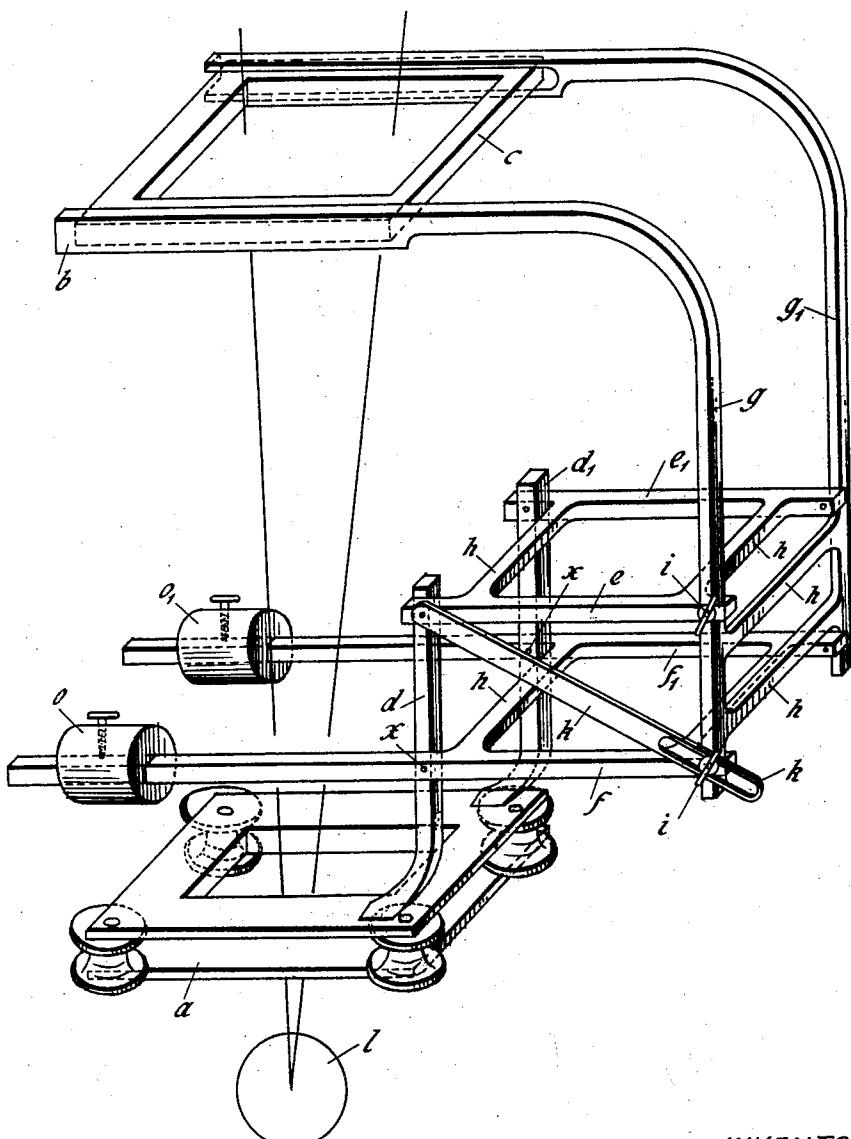
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SUPPORTING FRAME FOR RONTGEN RAY APPARATUS

Filed July 9, 1928

2 Sheets-Sheet 1

Fig. 1.



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2 Sheets-Sheet 2

Fig. 2.

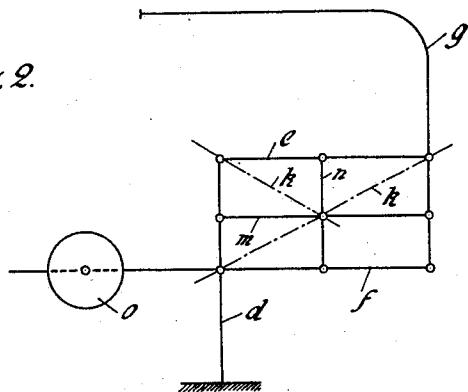


Fig. 3.

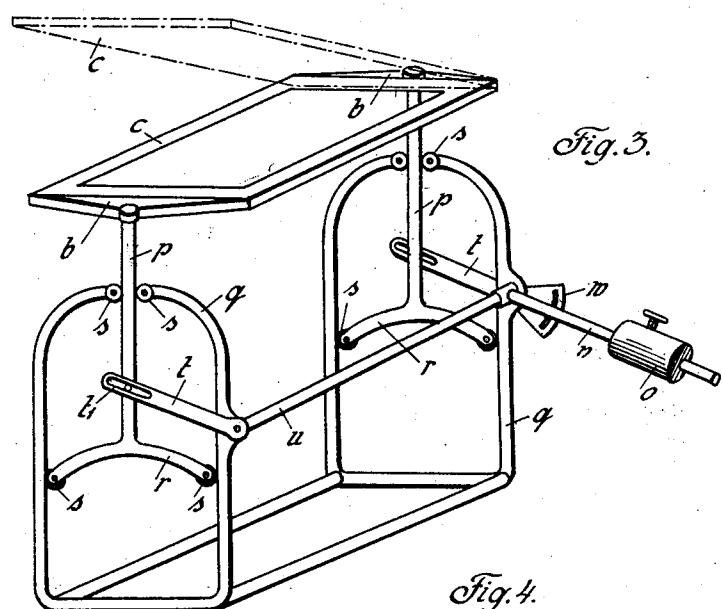
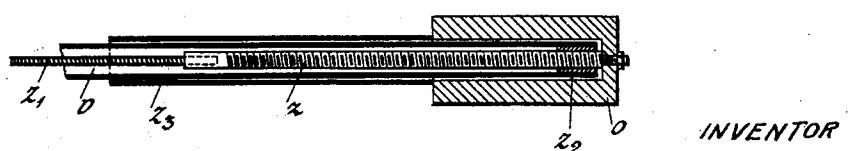


Fig. 4.



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## UNITED STATES PATENT OFFICE

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## SUPPORTING FRAME FOR RÖNTGEN RAY APPARATUS

Application filed July 9, 1928, Serial No. 291,384, and in Germany July 12, 1927.

The invention relates to supporting frames for Röntgen ray apparatus and has for its object to provide means for adjusting the height of the translucent screen holder relative to the carriage which carries the Röntgen ray tube, and which is slidably adjustable horizontally relative to the table or couch on which the patient is supported. According to the invention the connecting member between the aforesaid holder and the Röntgen stand is formed by a lever device carrying a counterpoise for balancing the mass of the holder and members supported thereon. In this manner it is made possible to adjust the screen or the box or both parts at the same time without much effort in the vertical direction to and from a patient.

The lever device may, according to the invention, be a lever parallelogram consisting of two or more parallel levers, or the lever device may be formed of one or more double-armed levers, one arm of which carries the counterpoise, whilst the other arm engages on a rod movable in the direction of its axis which serves as holder for the screen and the box. The movable rod as a screen and box holder for Röntgen stands is of itself known.

The counterpoise may be adjustably arranged. It may also be replaced by a Röntgen tube with protecting casing arranged on the lever device; furthermore the Röntgen tube and a special counterpoise may cooperate together as compensating mass.

Further details of the invention will appear from the following specification and the drawings and are set forth particularly in the appended claims.

In the drawings:

Fig. 1 is a perspective view of a structure embodying the lever parallelogram.

Fig. 2 is a diagrammatic representation of a modification.

Fig. 3 shows a constructional example with

the double-armed lever which engages on the longitudinal movable rod.

Fig. 4 shows the adjustable arrangement of the counterpoise.

The supporting frame for the auxiliary apparatus (illuminating screen and box) is composed of a carriage *a* guided, for example, on the Röntgen stand, a frame *b* for taking a translucent screen *c* or a Röntgen box (not shown) as well as a connecting frame arranged between the carriage *a* and the frame *b*.

The connecting frame consists, according to Fig. 1, of a lever parallelogram which is formed by the levers *d*, *e*, *f* and *g*. In order to secure sufficient strength, all the levers are mounted in duplicate, as can be seen in the drawings from the reference letters *d*<sub>1</sub>, *e*<sub>1</sub>, *f*<sub>1</sub> and *g*<sub>1</sub>. Equivalent lever bars are connected with one another by transverse bars *h* and are thus combined into a single lever whereby the strength of the whole arrangement is increased. In Fig. 1, one lever parallelogram is represented which has two parallel levers in each plane. On the other hand, Fig. 2 shows a lever parallelogram with, for example, three parallel levers in each plane that is, in addition to the levers *d*, *e*, *f*, *g*, the levers *m* and *n* are provided.

Alternatively two levers may be mounted parallel to one another in one plane, and more than two levers in another plane. The lever parallelograms are, for example, secured after each adjustment by clamping screws *i* if this should be desired for any reason. In general, a special fixing of the lever parallelogram is not required since the system once adjusted retains its position without trouble. In addition to the clamping screws *i*, it is possible also, as can be seen from both Figs. 1 and 2, for a connecting bar, for example, a slide *k*, to be mounted, which, according to the example shown, is guided diagonally in a rectangle of the lever system and thus connects with one another.

two pivots of the lever system located diagonally opposite one another. It is possible in the case of Fig. 2, to bridge over diagonally two rectangles by one and the same slide. However, in the construction of the lever parallelogram according to Fig. 2, it is sufficient if only one corresponding short slide *k* is mounted diagonally in one of the rectangles as shown in the left upper rectangle of Fig. 2. By means of the slide *k*, the strength of the device is further increased.

The levers *f* and *f*<sub>1</sub> are prolonged beyond the pivot *w* and each carry on their prolongations in a weight *o* and *o*<sub>1</sub> to balance the mass of the carrier.

According to Fig. 3, the connecting frame consists of the longitudinally movable rods *p* which have on their top ends the frame parts *b* to take the screen *c* or the box and are each guided on a frame *q*. For this purpose the rods *p* are provided on their lower ends with a cross-piece *r* whereby the rods *p* obtain a well supported guidance on the frame *q* so that they cannot rotate about their axes. At the guiding points of the rods *p* are arranged slide rollers *s* or ball bearings which provide an easy axial movement of the rods. At an intermediate point on each rod *p* are pivoted on the frame *q* levers *t* which are connected firmly with one another by a shaft *u*. A pin and slot connection *t*<sub>1</sub>, is provided between lever *t* and rod *p*. A lever *v*, on which the counterpoise *o* is mounted, is freely pivoted to the levers *t* about the shaft *u*. Firmly connected with one of the levers *t* is a segment *w* with slot guide for a set screw, which is adapted to be screwed in the lever *v*, which makes it possible to set the lever *t* in a definite position in relation to the lever *v*, so that the length of the lever *t* may be altered and thus the height of the plate holder may be adjusted. Owing to the fact that the moments of the weight of the plate holder and the weight of the counterpoise about the pivot are always equal, the lever *v* will always come to rest in the position of balance making a definite angle with the horizontal. Thus the plate holder will always come to rest at a certain height which may be determined by adjusting the lever *t* with reference to the lever *v*. This regulation may be also effected by oblique position of the slot *t*<sub>1</sub> with reference to the lever *t*, whereby the slotted members can then be adjustably secured on the lever. In both cases the slot can be constructed curved instead of straight. For the purpose of the invention, it will also be satisfactory if only one rod *p* and accordingly only one lever *t*, *v* is provided. However, the arrangement shown is to be preferred since the screen and the box are always held straight and in the correct position when raised and lowered. In order with

this construction of the connecting frame, to permit a ready adjustment of the patient to the stand, the screen *c* is pivotally secured on one of the frame parts *b*, so that the screen can be turned up as indicated in Fig. 3. This mounting of the screen so that it can be turned up is of itself known and is also applicable in the case of one-sided arrangement of the rod *p* as well as with the constructional example according to Fig. 1.

The counterpoise and the fixing device may be operated from the place of observation in the vicinity of the translucent screen *c* or the box, for example, by means of a flexible shaft or the like. Fig. 4 shows a corresponding arrangement of the counterpoise. The weight *o* is provided with a recess with a recess with which it is mounted on the free end of the levers *f*, *f*<sub>1</sub> (Fig. 1) or the lever arrangement *v*, (Fig. 3). The recess is not bored right through so that the one end wall of the weight remains complete. Secured on this end wall and located in the interior of the weight is a threaded spindle *z* with which the flexible shaft *z*<sub>1</sub> leading towards the point of observation in the vicinity of the illuminating screen is connected. The levers *f*, *f*<sub>1</sub> and *v* are made of steel tube and in fact all levers and struts of the frame may be made of tubes, even those of Fig. 1. Thus the flexible shaft *z*<sub>1</sub> may be placed in the interior of the tubes so that it can be mounted in a protected condition. On the end of the lever on which the weight *o* is mounted, there is a threaded guide *z*<sub>2</sub> for the spindle *z*, so that by rotation of the spindle by means of the flexible shaft, the position of the weight and thus its action can be varied. It is appropriate to mount on the weight a tubular sleeve *z*<sub>3</sub> so that on lengthening the weight lever, the spindle *z* is always covered and protected.

The mounting of the flexible shaft in combination with the fixing device is effected accordingly in similar manner. By this means, omitting the threaded spindle *z*, the flexible shaft *z*<sub>1</sub> can be connected directly with the fixing screw *i* (Fig. 1) and at *w* (Fig. 3).

The lever devices described are, of course, also applicable with the well-known connecting members with Röntgen stands with swinging arrangement of the screen and box holder.

It will be noted that the support *b* is intended to carry either the translucent screen or the Röntgen plate holder, interchangeably, whichever is required, and the phrase "support for Röntgen ray apparatus" in the claims, is intended to describe the support for carrying the screen or the plate holder, as above.

I claim:

1. In Röntgen ray apparatus adapted for Röntgen observation and photography of a patient in various positions, the combination

of a stand, a support for Röntgen ray apparatus adapted to be moved towards and away from a patient, and means for adjustably supporting said support at various desired heights, comprising a member carrying said support, and arranged for movement in its axial direction only lever means pivoted to said stand and connected to said member to cause movement thereof in said axial direction, and an adjustable counterpoise connected to an arm of said lever means and arranged to balance said support and carried and connected parts, at a desired height of said support, varying in accordance with the position of said counterpoise, each different position of said counterpoise corresponding to a different height of said support.

2. In Röntgen ray apparatus adapted for Röntgen observation and photography of a patient in various positions, the combination of a stand, a support for Röntgen ray apparatus adapted to be moved towards and away from a patient, and means for adjustably supporting said support at a desired height, comprising means carrying said support, guiding means on said stand constraining said carrying means to move in its axial direction only, a multiple-armed lever pivoted to said stand and having one arm connected to said carrying means by a pin and slot connection, and an adjustable counterpoise connected to another arm of said lever, arranged to balance said support and carried and connected parts at a desired height of said support, varying in accordance with the position of said counterpoise, each different position of said counterpoise corresponding to a different height of said support.

3. In Röntgen ray apparatus, the combination of a stand, a support for Röntgen ray apparatus, and means for adjustably supporting said support at different desired heights, comprising means carrying said support, a multiple-armed lever pivoted to said stand, one arm of said lever having a non-rigid pivotal connection with said carrying means causing vertical movement of the latter, a counterpoise on another arm of said lever, and means for adjusting the arms of said lever with respect to one another to equalize the moments of said support and counterpoise for a desired adjusted height of said support.

4. In Röntgen ray apparatus, the combination of a stand, a support for Röntgen ray apparatus, and means for adjustably supporting said support at different desired heights, comprising means carrying said support, a multiple-armed lever pivoted to said stand, one arm of said lever having a non-rigid pivotal connection with said carrying means causing vertical movement of the latter, and a counterpoise on another arm of said lever, said arms being separate from one another and carrying cooperating means ad-

jacent to the pivots thereof whereby the angular relation between the arms may be adjusted.

5. In Röntgen ray apparatus, the combination of a stand, a support for Röntgen ray apparatus, and means for adjustably supporting said support at a desired height, comprising a pair of rods carrying said support and having transverse extensions, said stand serving as a guiding means for the ends of the transverse portions of each rod and comprising guiding means for the vertical portion thereof, constraining the same to move vertically, a multiple-armed lever pivoted to said stand, and so connected at one end to said rods as to cause vertical movement thereof and a counterpoise on another arm of said lever.

6. In Röntgen ray apparatus, the combination of a stand, a support for Röntgen ray apparatus, means for adjustably supporting said support at a desired height, comprising a member carrying said support, a lever pivoted intermediately to said stand, one arm of said lever being connected to said member, an adjustable counterpoise carried by a second arm of said lever, a threaded guide carried by said second arm, a threaded spindle rotatably mounted in said guide and connected to said counterpoise, and a flexible shaft connected to said spindle and extending to the position of an operator for the apparatus.

7. In Röntgen ray apparatus, adapted for Röntgen observation and photography of a patient in various positions, the combination of a stand, a support for Röntgen ray apparatus adapted to be moved towards and away from a patient, and means for adjustably supporting said support at various desired heights, comprising a member carrying said support, guiding means for causing said member, when moved, to travel in a desired path, a lever arm pivoted to said stand and connected to said member, a second lever arm pivoted to said stand and connected to move with said first arm, counterpoise means carried by said second arm arranged to balance said support and parts carried by and connected therewith, at a desired height of said support, with said second lever arm making a definite angle with the horizontal at which the moments of said counterpoise and parts balanced thereby are equal, and adjustment means for varying the angle of said second arm with the horizontal at which the said moments are equal, and thereby altering the height of said support for which the system is balanced at rest.

8. In Röntgen ray apparatus, the combination of a stand, a support for Röntgen ray apparatus adapted to be moved towards and away from a patient, and means for adjustably supporting said support at different desired heights, comprising a member carrying

said support and arranged for movement in its axial direction only, lever means pivoted to said stand and connected to said member to cause movement thereof in said axial direction, an adjustable counterpoise connected to an arm of said lever means and arranged to balance said support and carried and connected parts at a desired height of said support, varying in accordance with the position of said counterpoise, and means operable at a distance from said counterpoise for varying its position on its said lever arm.

In testimony whereof I have hereunto affixed my signature.

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ERNST POHL.

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