

E. L. EDWARDS.
ADJUSTABLE X-RAY TUBE HOLDER.
APPLICATION FILED MAR. 20, 1920.

1,423,924.

Patented July 25, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

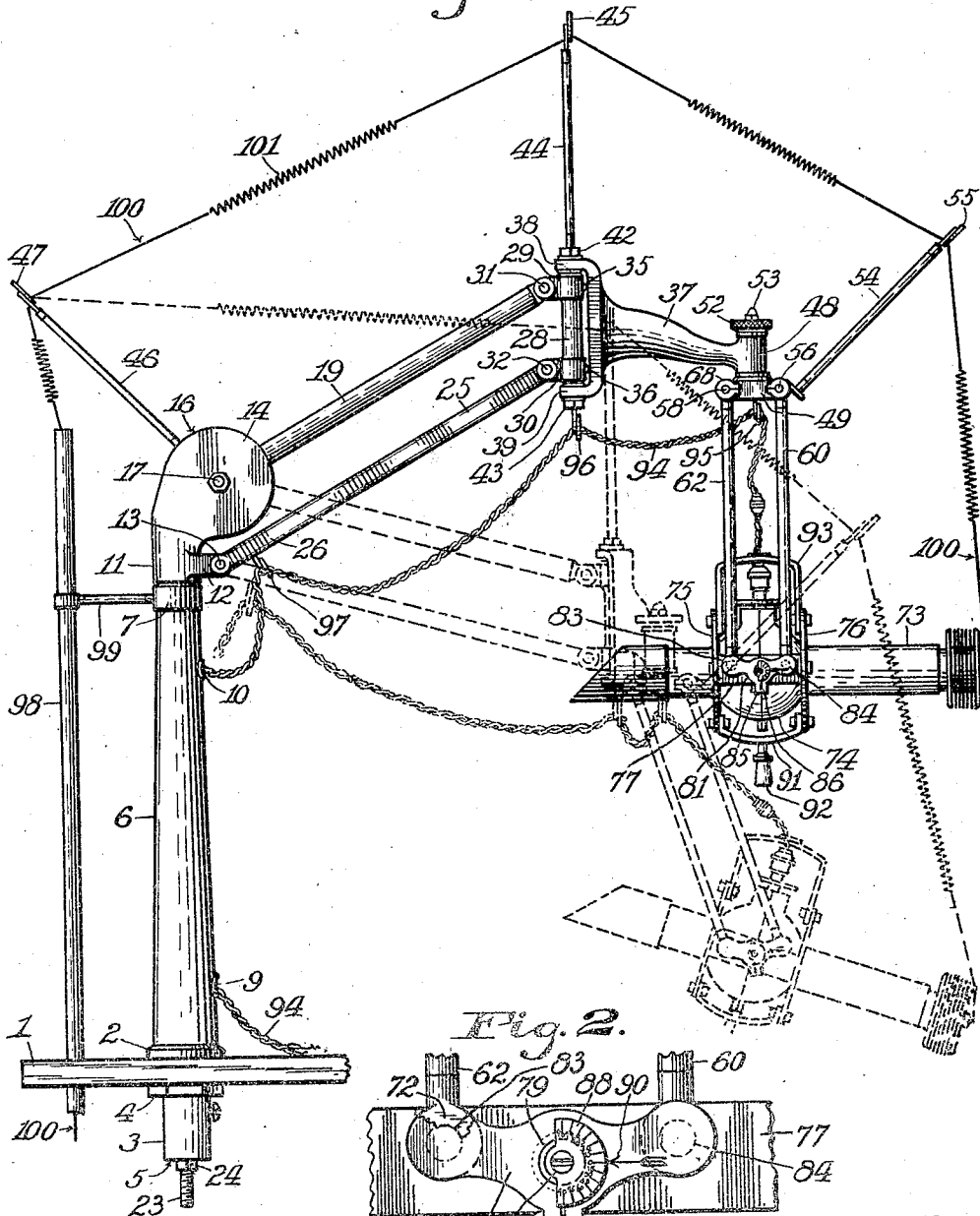
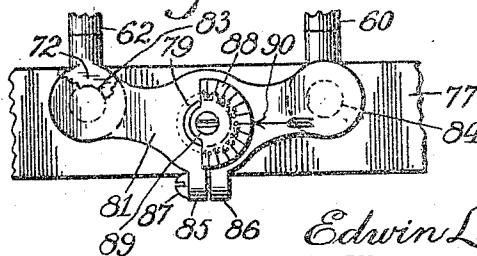


Fig. 2.



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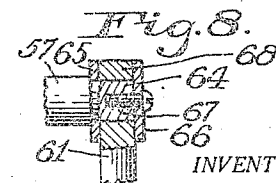
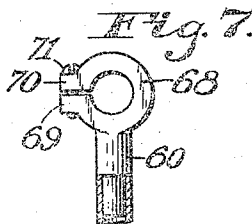
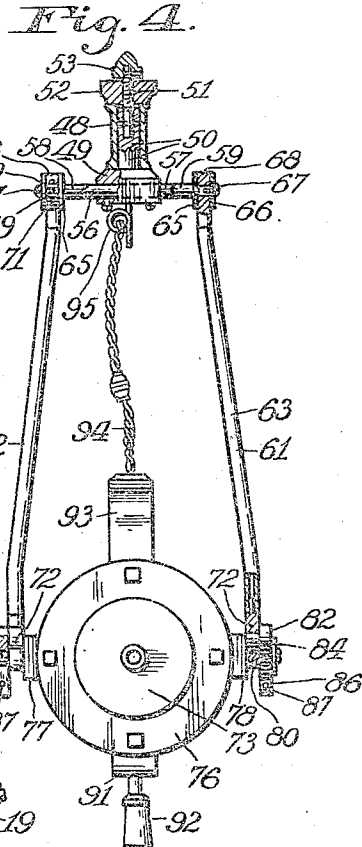
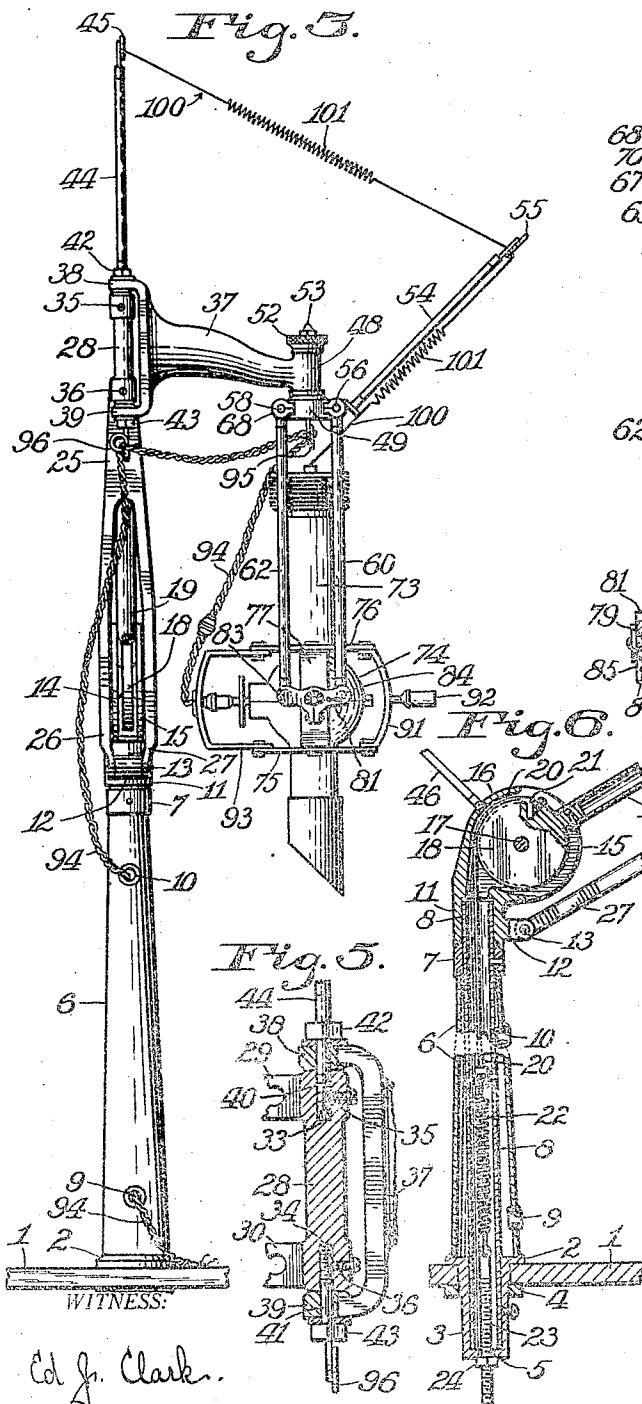
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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ADJUSTABLE X-RAY-TUBE HOLDER.

1,423,924.

Specification of Letters Patent. Patented July 25, 1922.

Application filed March 20, 1920. Serial No. 367,301.

To all whom it may concern:

Be it known that I, EDWIN L. EDWARDS, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Adjustable X-Ray-Tube Holder, of which the following is a specification, reference being had to the accompanying drawings and to the letters and figures of reference marked thereon.

This invention relates to an apparatus for holding an X-ray tube adjustably so that the tube may be held in different positions near to various portions of an object, the invention having reference more particularly to a tube holder that is designed to enable the X-ray tube to operate as on a crane and to be swung about by the operator, or to be firmly held in adjusted position.

An object of the invention is to provide an X-ray tube holder which shall be so constructed as to enable an operator to quickly adjust the X-ray tube in a simple manner, and in any position required for use; which tube holder shall be of light-weight but firm structure.

Another object is to provide an X-ray tube holder which shall be so constructed as to be adapted to be supported with its base at any desired angle necessary for convenient use, as upon a table or stand top, in inverted arrangement under a ceiling, or on the side of a wall, so as to be agreeable with conditions in any particular operation room.

A further object is to provide an adjustable X-ray tube holder which shall possess the maximum number of advantageous features with the minimum number of simple and reliable parts not liable to be injured in use, which holder shall be adapted to be folded when not in use so as to not occupy space which may be needed for other operations, and which shall be durable and economical in use.

With the above-mentioned and other objects in view, the invention consists in an X-ray tube holder having various novel features of construction enabling the holder to firmly support an X-ray tube in adjusted position and on any one of a great variety of relatively angular and other advantageous positions with respect to a stationary object or subject; and the invention consists also further in the novel parts, and in the different combinations and arrangements of

parts, as hereinafter particularly described and further defined in the accompanying claims.

Referring to the drawings, Figure 1 is a side view of the X-ray tube holder as preferably constructed and in one of its convenient arrangements; Fig. 2 is a fragmentary detail of the holder on an enlarged scale; Fig. 3 is an elevation of the holder in folded arrangement; Fig. 4 is a fragmentary sectional elevation showing details of the hanger portion of the tube holder on an enlarged scale; Fig. 5 is a fragmentary sectional detail of associated parts of the holder; Fig. 6 is a vertical section of the column or main member of the holder, partially broken away, in which balancing-appliances are illustrated; Fig. 7 is a fragmentary detail of a hanger rod for the X-ray tube; and, Fig. 8 is a fragmentary sectional detail of the hanger rod and its supporting pivot.

In the different figures of the drawings like characters of reference indicate like parts or features of construction herein referred to in detail.

For the purpose of illustrating the invention it is shown in one of the various different arrangements in which it is adapted to be used, being secured to the top 1 of a cabinet, table or stand which may be variously constructed. The improved holder comprises a column which has a base plate 2 seated upon the top 1 and having a downward extending socket portion 3 on which is a lock nut 4 engaging the under side of said top 1 to firmly secure the base thereto, the socket portion of the base having a bottom 5. A tapering shell 6 has its larger end seated upon the base plate 2 and supports an annular bearing member 7 on its top. A tubular column body part 8 extends into the socket portion 3 and is fixedly secured thereto, and it extends upward through the shell 6 and the bearing member 7, being secured to the bearing member, whereby to secure the shell in place, so as to constitute a substantial and stiff compound column or mast structure, the upper projecting portion of the tubular part 8 constituting a pivot upon the column. Preferably the lower portion of the shell or casing 6 has a guide opening 9 and the upper portion has a guide-opening 10 to receive an electrical circuit cable. An improved column head is provided which

comprises a base portion 11 having a jaw 12 supporting a pivot 13, and two side plates 14 and 15 having a top portion 16 connected thereto and to the base portion, the latter being supported upon the bearing member 7 to rotate on the pivot portion of the column, the side plates 14 and 15 supporting a pivot 17 above the pivot 13. An improved crane arm is provided which comprises a base portion 18 which is mounted on the pivot 17 between the side plates 14 and 15 and is cylindrical or has a cylindrical upper portion, and a main arm or rod portion 19 fixed to the base portion 18. The crane arm is provided with counter-balancing appliances which preferably comprise a ribbon or cable 20, which may be composed of metal or other suitable material, and having a lug 21 secured to the upper portion of the base member 18 and extending over the curved portion of the member and downward into the tubular part 8, in which it is connected to a long coil spring 22 which has an adjusting screw 23 connected thereto that extends through the bottom 5 of the base socket 3, an adjusting nut 24 being arranged on the adjusting screw against said bottom to adjust the tension of the spring. The crane arm has a parallel rod comprising a main member 25 and two shoulder members 26 and 27 that are connected to the pivot 13. An improved coupler head is provided which comprises a main portion 28 having pivot ears 29 and 30 provided respectively with pivots 31 and 32 which are spaced apart equal to the space between the horizontal pivots 13 and 17. The pivot 31 is connected with the main arm member 19 and the pivot 32 is connected to the arm member 25. The upper portion of the main portion 28 of the coupler head has a threaded socket 33 and the lower portion has a threaded socket 34, set-screws 35 and 36 being arranged in the walls of the sockets respectively. A crane arm member 37 of improved construction is provided which has pivot ears 38 and 39 that closely embrace the ends of the coupler head and are guided on pivot studs 40 and 41, which are screwed into the sockets 33 and 34 respectively to be engaged by the set-screws when properly adjusted, the pivot studs having heads 42 and 43 whereby to draw the pivot ears 38 and 39 more or less tightly to the pivot head to bind the ears to the head if desired or cause frictional resistance to pivotal movement. Preferably a guide post 44 is supported by the head 42 and has a guide eye or ring 45 on its top. The shoulder members 26 and 27 are properly spaced apart so as to receive the head plates 14 and 15 between them when the crane arm is swung upward. A guide post 46 is supported by the column head or cap head, being preferably secured to the top portion 16, and it is provided with a guide ring 47. The crane arm member 37 is provided with a vertical swivel head 48, and an improved hanger head 49 is provided which has a central journal or stem 50 rotatably arranged in the swivel head. The journal has a screw stud 51 which preferably is made separately and secured in the journal and is provided with an adjusting nut 52 arranged to seat upon the top of the swivel head and bind the hanger head securely to the swivel head, or so as to frictionally retard rotation of the hanger head. The screw stud 51 has a stop head 53 thereon slightly above the adjusting nut so as to permit the latter to be turned slightly and permit the hanger head to freely rotate, the stop head preventing the adjusting nut from accidentally working off of the screw. The hanger head supports a guide post 54 which has a guide ring 55 thereon. The hanger head is provided with two pivots 56 and 57 extending in alinement from opposite sides thereof and also two pivots 58 and 59 extending in alinement from opposite sides thereof, the pivots being horizontally arranged. Two hanger rods 60 and 61 are connected to the pivots 56 and 57 respectively and two similar hanger rods 62 and 63 are connected to the pivot rods 58 and 59 respectively. Preferably each pivot has a relatively small bearing portion 64 on which a collar 65 is arranged, and another collar 66 is arranged at the end of the bearing portion and secured in place by a screw 67 inserted into the bearing portion. The upper end of each hanger rod has a boss 68 which is arranged on the bearing portion of the pivot between the two collars which prevent lateral play of the boss on the bearing portion. The boss is slotted transversely and has lugs 69 and 70 thereon provided with a clamp screw 71 whereby the boss is drawn tightly on the bearing portion of the pivot, and there being four hanger rods the frictional resistance created by their bosses may be made sufficient to prevent swinging of the rods with the weight carried by them but permit the rods to be swung with slight manual effort. The lower end of each hanger rod has a suitable boss 72 thereon adapted to be connected to a pivot. The X-ray tube 73 includes a glass globe 74, and at opposite sides of the globe the tube is provided with frame plates 75 and 76 to which frame bars 77 and 78 are secured, the frame bars being provided with trunnions or pivots 79 and 80 respectively which are rotatively supported in the middle portions of balance bars 81 and 82. Each balance bar has pivots 83 and 84 adjacent to opposite ends thereof, the pivots on one of the balance bars supporting the bosses on the lower ends of the hanger rods 62 and 60 respectively, the pivots on the remaining one of the balance bars supporting the bosses on the ends of the remaining hanger rods. The balance

bars have each a pair of clamp ears 85 and 86 on the lower portion thereof, being slotted between the ears, and the ears are provided with a clamp screw 87 whereby the balance bar may be frictionally held to its trunnion with more or less force as may be desired. A graduated indicator plate 88 is secured by a screw 89 to one of the trunnions and extends at the outer side of the balance bar, the latter having an indicating mark 90 thereon which points to the zero mark when the X-ray tube is horizontal, said indicator plate having degrees marked thereon on each side of the zero mark so as to indicate the inclination of an X-ray tube when it is adjusted to various angles. The X-ray tube frame comprises also a cross bar 91 secured to the plates 75 and 76 and having a handle 92 thereon for controlling the position of the X-ray tube. Also an arch 93 is secured to the frame plates and guides an electrical circuit cable 94 which extends loosely through a guide ring 95 connected to the hanger head 49. The cable preferably extends through a guide ring 96 connected to the head 43 and through a guide ring 97 with which the crane arm is provided, and thence through the guide opening 10 into and through the space between the outer and inner parts 6 and 8 of the column and out through the guide opening 9 to a source of electricity.

Preferably a tubular guide 98 is arranged to extend through the supporting member 1 and has a brace 99 connected thereto that is secured to the bearing member 7 of the column, and a circuit wire 100 extends through the guide and also through the guide rings 47, 45 and 55, and thence into the X-ray tube, the circuit wire preferably having coiled portions 101 so as to be longitudinally elastic to permit swinging of the X-ray tube without fracturing the circuit wire.

In practical use the subject is conveniently placed and the X-ray tube will be put into action in the customary manner and with the improved holder may be shifted about and adjusted universally as may be required or desired for convenience, the tube being moved at will either towards or from the subject acted upon, in some cases the crane arm being swung upward or downward, the arm member 37 swung about on its pivot, or the hanger head 49 may be turned in the crane arm, or the hanger arms may be variously adjusted from the vertical, while the X-ray tube may be tilted on its trunnions, the circuit wires permitting all the various adjustments without being strained or broken. When the X-ray tube is not in use the holder may be folded up and the X-ray tube turned up vertically so as to be in compact arrangement, as shown in

Fig. 3. In Fig. 1 the holder is shown by

broken lines in an adjusted position to lower and tilt the X-ray tube.

Having thus described the invention, what is claimed as new is—

1. An X-ray tube holder including an arm, a hanger head connected to the arm and having four pivots on one and the same horizontal plane thereon, four hanger rods connected to and extending downward from the pivots respectively, and an X-ray tube frame provided with four pivots on one and the same horizontal plane and supported by the lower portion of the hanger rods respectively.

2. An X-ray tube holder including an arm, a hanger head swiveled to the arm and having four pivots on one and the same horizontal plane thereon, means for frictionally binding and preventing movement of the hanger head on the arm, four hanger rods connected to and extending downward from the pivots respectively, and an X-ray tube frame having four pivots on one and the same horizontal plane and supported by the lower portions of the hanger rods respectively.

3. An X-ray tube holder including an adjustable arm, a hanger head connected to the arm and having four pivots arranged on one and the same horizontal plane and rigid thereon, four hanger rods connected to and extending downward from the pivots respectively and provided each with a friction binder to retard pivotal movement of the rod on the pivot, and an X-ray tube frame provided with four pivots on one and the same horizontal plane and supported by the hanger rods respectively.

4. An X-ray tube holder including an adjustable arm, a hanger head connected to the arm and having four pivots arranged on one and the same horizontal plane thereon, four hanger rods connected to and extending downward from the pivots, means for binding and preventing free pivotal movement of the hanger rods on the pivots, a balance bar supported by the lower portions of two of the hanger rods, a companion balance bar supported by the lower portions of the remaining two hanger rods, and an X-ray tube frame arranged between and pivotally supported by the two balance bars.

5. An X-ray tube holder including a column, a column head pivoted to the column and having two horizontal pivots, two parallel rods connected to the pivots respectively, a coupler head having pivotal connection with the parallel rods, an arm having a jaw ear pivoted to the coupler head and provided with a swivel-head, a hanger head swiveled to the swivel-head and having four pivots thereon, four hanger rods connected to the four pivots respectively, and an X-ray tube frame having four pivots

supported by the hanger rods respectively.

6. An X-ray tube holder including an adjustable arm having a hanger head connected thereto, an X-ray tube frame provided with two pivots, two balance bars connected between their ends to the pivots respectively to pivotally support and balance the tube frame and provided with friction binders to retard pivotal movement of the frame, two hanger rods pivotally connected to the hanger head and also to the end portions respectively of one of the balance bars, and two hanger rods pivotally connected also to the hanger head and to the end portions respectively of the remaining one of the balance bars.

7. An X-ray tube holder including a hollow column having a column head pivoted thereon, the column head having two horizontal pivots, two parallel rods connected to the pivots respectively and having a coupler head pivotally connected thereto, an arm member having ears pivotally connected to the coupler head, the arm member being provided with a swivel-head, a hanger head swiveled to the swivel head, a plurality of hanger rods pivoted to the hanger head, an X-ray tube frame having pivots supported by the hanger rods, and counter-balancing appliances arranged in the hollow column and connected with one of the two parallel rods.

8. An X-ray tube holder including a pivoted arm having a swivel-head, a hanger head connected to the swivel-head and having four pivots thereon, four hanger rods connected to the pivots respectively, a balance bar having pivotal connection at its ends with two of the hanger rods, a balance bar having pivotal connection at its ends with the remaining hanger rods, an X-ray tube frame having two trunnions connected to the middle portion of the balance bars respectively, one of the trunnions extending through the balance bar, a graduated indicator plate secured to the end of the extended trunnion, an indicating mark arranged on the balance bar adjacent to said plate, and a handle on the X-ray tube frame.

9. In an X-ray tube holder, the combination with an X-ray tube, of a frame to support the X-ray tube and having two trunnions thereon, two balance bars connected at their middle portions to the trunnions respectively, two hanger rods pivotally connected to one of the balance bars adjacent to the opposite ends respectively thereof, two hanger rods pivotally connected to the remaining one of the balance bars adjacent to the opposite ends respectively thereof, and a hanger head having four pivots supporting the hanger rods respectively, with a column, and an arm adjustably mounted on the column and supporting the hanger head.

10. In an X-ray tube holder, a column

comprising a base plate having a socket wall extending downward therefrom, a tapered shell seated upon the base plate, an annular bearing member seated upon the shell, a tubular shaft secured to the socket wall and extending through and secured to the bearing member, and a column head rotatively connected to the projecting portion of the tubular shaft and supported upon the bearing member, said head having two horizontal pivots, in combination with two arm members connected to the pivots respectively, a coupler head pivotally connected to the arm members, and an arm member having pivotal connection with the coupler head.

11. In an X-ray tube holder, the combination with a crane arm, and an X-ray tube, of a hanger head supported on the crane arm and provided with four pivots, four hanger rods connected to the pivots respectively and having each a frictional grip on the pivot, a balance bar pivotally connected at opposite ends thereof respectively to two of the hanger rods, a balance bar pivotally connected at opposite ends thereof respectively to the remaining two hanger rods, and a frame supporting the X-ray tube and having two trunnions thereon pivotally supported in the middle portions of the balance bars respectively, the trunnions being frictionally gripped by the balance bars.

12. In an X-ray tube holder, the combination with a column, two parallel arm members pivotally supported one above the other on the column, and an X-ray tube, of a coupler head having pivotal connection with the two parallel arm members, a single arm member having two ears on one end and a swivel head on the opposite end thereof, the ears of the single arm member having contact with the top and the bottom respectively of the coupler head, two pivotal screws connected with the top and the bottom respectively of the coupler head and pivotally connecting the adjacent ears to the head, the pivotal screws having heads to bind the ears to the coupler head, a hanger head connected to the swivel head, hanger rods pivoted to the hanger head, and a frame supported by the hanger rods and supporting the X-ray tube.

13. In an X-ray tube holder, the combination with a column having a bearing member on the top thereof and also a pivot projecting above the bearing member, of a column head guided on the pivot and supported upon the bearing member, the lower portion of the column head having a pivot ear thereon, the upper portion of the column head having two upright head plates thereon and above the pivot ear, a pivot connected horizontally to the pivot ear, a pivot connected horizontally to the head plates, a parallel arm member connected to the

5 pivot on the pivot ear, a main arm member having a cylindrical base member arranged between the head plates and connected to the pivot thereon, a coupler head having horizontal pivots connected to the said arm members and having vertical pivots thereon, a single arm member having ears connected to the vertical pivots, to support the X-ray tube, and a counterbalance connected with the cylindrical base member of the main arm member.

10 14. In an X-ray tube holder, the combination of a base plate having a socket wall extending downward therefrom and a bottom fixed to the wall, a shell seated upon the base plate, a tubular shaft supported upon said bottom and secured to said socket wall, the shaft extending upward beyond said shell, an annular bearing member fixed on the shaft and in contact with the top of said shell, a column head rotatively connected with the upper portion of the shaft and supported upon the bearing member, said head having a pivot on one side thereof and also two head plates above the pivot, a pivot supported by said head plates, a parallel arm having two shoulder members connected with the first described pivot, a cylindrical arm base between said head plates and connected to the pivots supported thereby, a main arm fixed on said arm base, a cable secured to the periphery of said arm base and extending into said shaft, a coil spring connected to said cable, an adjusting screw connected to said spring and extending through said socket wall bottom, a nut on said screw beneath said bottom, a coupler head pivot-

ally connected to said arms, and a single arm member pivotally connected with the coupler head.

15 15. In an X-ray tube holder, the combination of a hollow column, a column head pivoted to the column, a post supported upon the column head and having a guide eye thereon, two parallel arm members pivoted to the column head, a coupler head pivotally connected to the arm members and having a post thereon provided with a guide eye, an arm member pivotally connected to the coupler head and having a swivel head thereon, a hanger head connected to the swivel head and having a post thereon provided with a guide eye, a guide ring supported on the lower portion of the hanger head, a guide ring supported on the lower portion of the coupler head, a guide ring supported on the under side of one of the parallel arm members, hanger rods supported by the hanger head, an X-ray tube frame supported by the hanger rods, an X-ray tube mounted in the X-ray tube frame, an electrical circuit wire extending through all the guide eyes to the X-ray tube, and an electrical circuit cable extending into the lower portion and out of the upper portion of the hollow column and thence through all the guide rings to the X-ray tube.

In testimony whereof, I affix my signature in presence of two witnesses.

EDWIN L. EDWARDS.

Witnesses:

E. T. SILVIUS,
F. M. ROEDER.