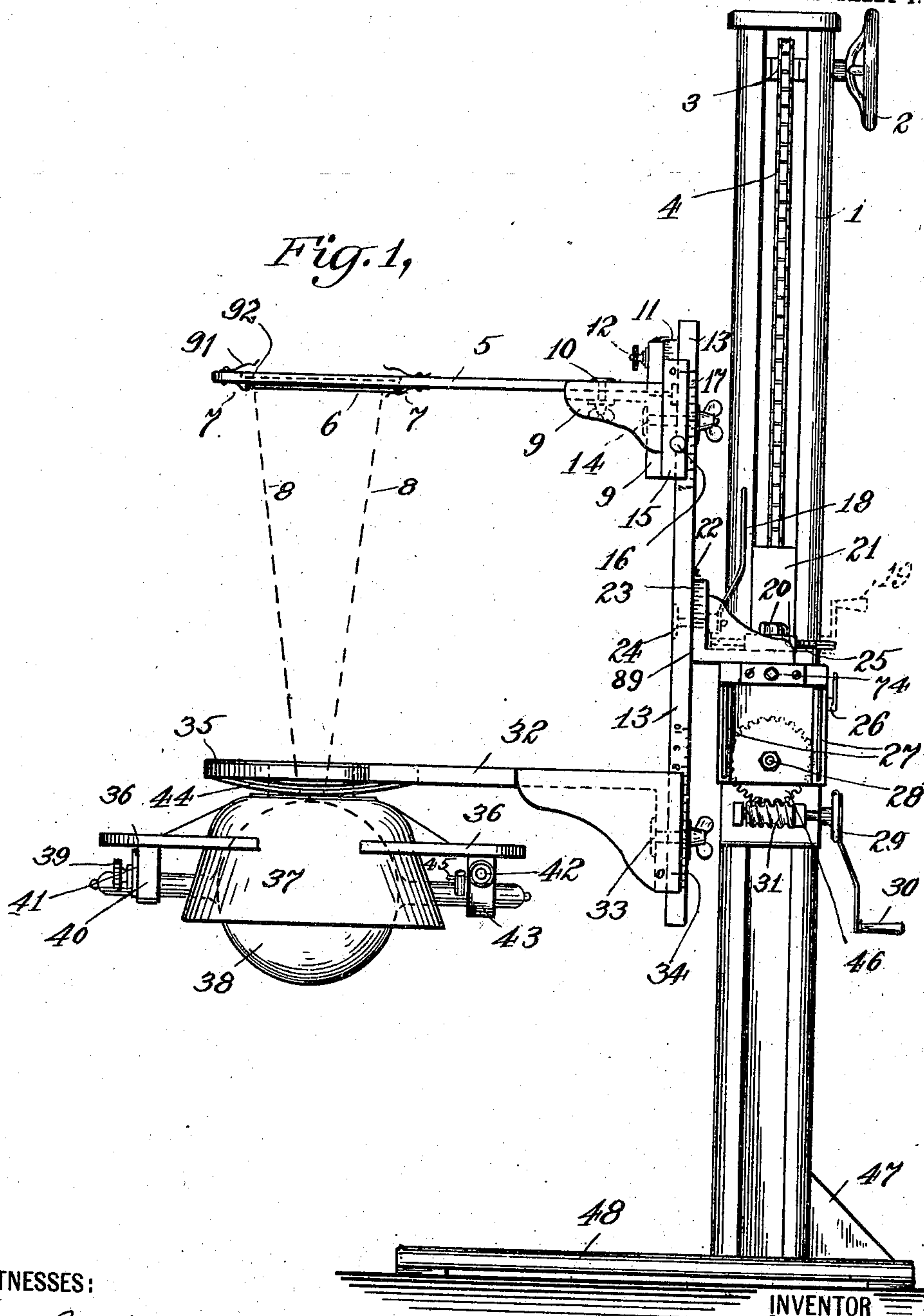


No. 847,728.

PATENTED MAR. 19, 1907.

E. W. CALDWELL.
X-RAY APPARATUS.
APPLICATION FILED APR. 11, 1906.

2 SHEETS—SHEET 1.



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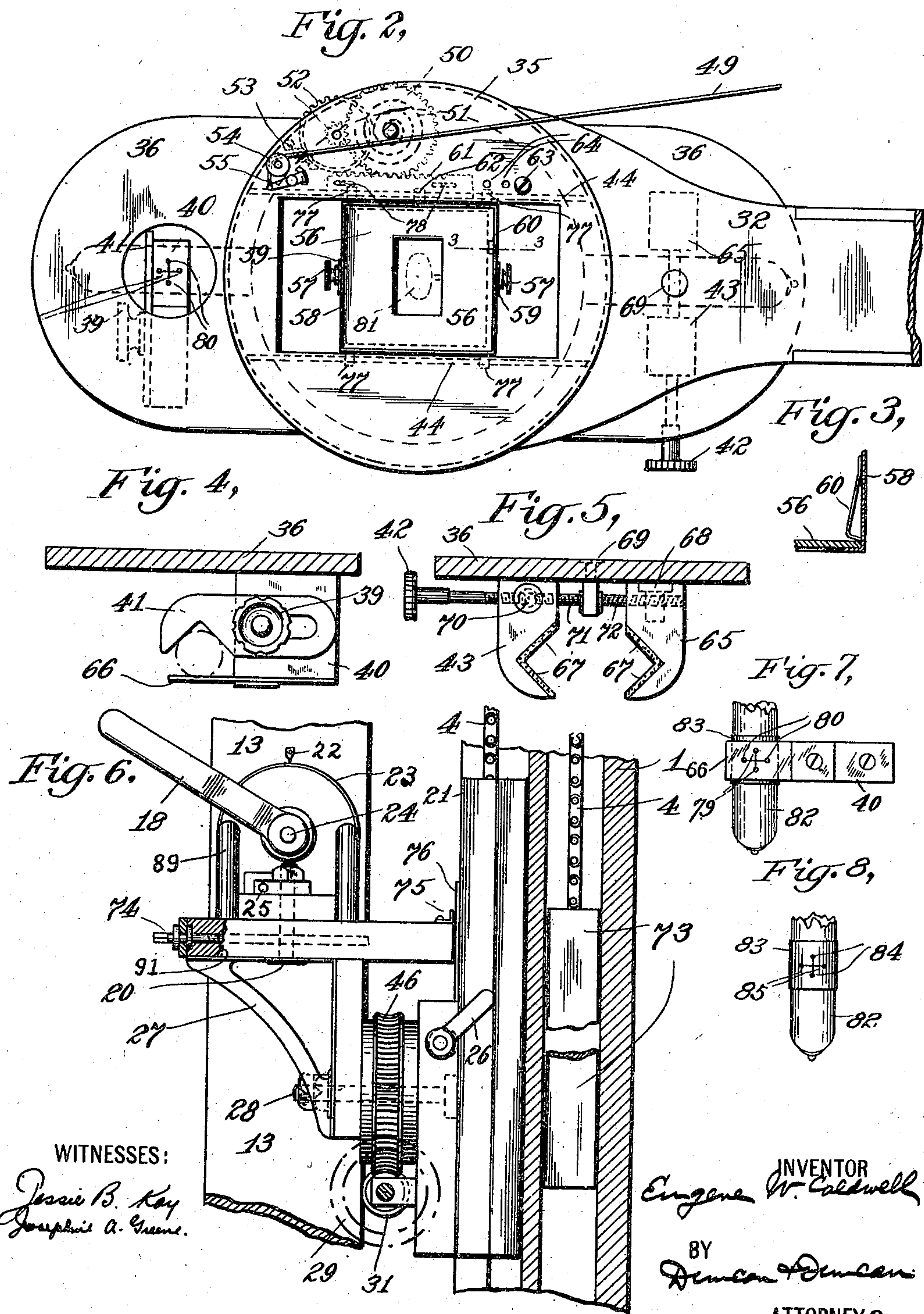
ATTORNEYS

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2 SHEETS—SHEET 2.



UNITED STATES PATENT OFFICE.

EUGENE W. CALDWELL, OF NEW YORK, N. Y.

X-RAY APPARATUS.

No. 847,728.

Specification of Letters Patent.

Patented March 19, 1907.

Application filed April 11, 1906. Serial No. 311,017.

To all whom it may concern:

Be it known that I, EUGENE W. CALDWELL, a citizen of the United States, and a resident of New York city, in the county and State of New York, have invented certain new and useful Improvements in X-Ray Apparatus, of which the following is a specification, taken in connection with the accompanying drawings, which form a part of the same.

This invention relates to X-ray apparatus, and relates especially to apparatus for adjustably supporting an X-ray tube and a photographic plate in proper relation thereto.

In the accompanying drawings, showing an illustrative embodiment of this invention, Figure 1 is a side elevation. Fig. 2 is a partial plan view. Fig. 3 is a sectional detail on the line 3 3 of Fig. 2. Figs. 4 and 5 are other sectional details of the same. Fig. 6 is a detail shown in vertical section. Figs. 7 and 8 show details of the tube-aligning devices.

In the illustrative embodiment of this invention shown in the drawings a suitable heavy post 1 is indicated, which may be mounted on any suitable base 48, provided with the brace 47, if desired, so that the whole is bodily movable and may be adjusted upon the floor supporting it. The block 21 is preferably slidingly mounted in suitable dovetail grooves in the post and may be adjusted at the proper height by a sprocket-chain 4, connected to the block, passing over a suitable sprocket 3, mounted in the post and provided with an operating-wheel 2, a counterpoise being also preferably arranged in a cavity in the post and connected to the other end of the sprocket-chain 4. The cam 26 is secured to the block 21, and when moved into the position indicated in Fig. 6 its eccentric working face is forced into engagement with the post, locking the block in adjusted position thereon.

The slide 27 is revolubly mounted on the block 21 by the bolt 28, and the worm-wheel 46 is rigidly secured to this slide. A cooperating worm 31, mounted on the block, engages this worm-wheel, as indicated, and serves to angularly adjust the position of the slide and connected parts about this bolt 28 when the operating-lever 29 30 is rotated. The relative position of these parts may be indicated by a suitable pointer 75 on the slide, which coöperates with a graduated arc or other scale 76 on the block. The head 89 is detachably secured to the slide by a bolt 20, passing through suitable slots in both the

head and slide. The traverse-screw 25 is rotatably mounted in the head and passes through a collar 90 upon the bolt 20, so that when this screw is turned by a suitable handle, such as 19, (shown in dotted lines in Fig. 1,) these parts traverse the head with respect to the block with a powerful screw action. A similar screw-feed at right angles to this movement is effected by the screw 74, which also engages a similar collar around the bolt 20, so as to move this bolt along the slot parallel to the screw 74, in which the bolt 20 operates. These screw adjustments between the head and slide may be used for initially setting the apparatus, and thereafter the parts may be securely locked in the desired position by tightening the bolt 20. It will be noted that these two angularly-arranged screw adjustments effect, in connection with the vertical movement of the block on the post, an adjustment of the head and carrier 13, supported thereby, in any direction in space, and also these parts may be rotated about the adjustably-mounted bolt 28 by the worm-wheel adjustment described.

The carrier 13, as indicated in Figs. 1 and 6, is mounted upon the head 89 by the bolt 24, and the lock 18, having a threaded nut or other similar connection with the bolt, serves to securely fasten these parts in position or instantly release them when moved into the position indicated in Fig. 6. In that position the carrier may rotate about the bolt 24 with respect to the head, and this movement may be indicated by the scale or graduated arm 23 on the head and the coöperating pointer 22. Upon the carrier is mounted the arm 32, provided with the support 35, and these parts may be slidingly mounted on the carrier and rigidly clamped thereto at any time by the bolt 33, operating in a suitable slot in the carrier. The position of these parts may be indicated by a coöperating scale and index 34 upon them. At the other end of the carrier is mounted the slide 15, and upon the outer face of the slide is the head 9, all these parts being preferably secured together by the bolt 14 passing through them and through a suitable slot in the carrier. The slide may be prevented from moving along the carrier by the screw 16, and the rotation of the head with respect to the slide can be prevented at any time by tightening the screw 12, which operates in a suitable circumferential slot in the head. This angular movement

of the head 9 with respect to the slide 15 is indicated by a suitable cooperating scale and index 11 on the parts, and the position of the slide upon the carrier is similarly indicated by a scale and index 17, as shown in Fig. 1. The head 9 carries the plate-holder or support 5, which is connected thereto by the bolt 9 passing through a suitable slot in this holder so as to allow for a limited sliding movement of these parts, which may be suitably indicated. The holder, which is preferably interchangeable, is formed with clips 7, which serve to support a marker or plate comprising suitable lines or indications and serve as guides when imprinted on the negative. Suitable clips 91 may also be formed on the upper side of the holder to maintain in proper position the photographic plate, which, together with its envelop or holder, may be fitted into the depression 92.

The support 35, upon which the X-ray tube is preferably movably mounted, may be formed, as indicated in Fig. 2, with a suitable aperture 93, on either side of which suitable tracks 44 may be formed. The carriage 58 is mounted in this aperture and may have the guides or rolls 77 engaging the tracks on either side, so as to smoothly guide it as it moves along these tracks, which are preferably arranged substantially concentric with respect to the photographic plate when in normal position, as is indicated in Fig. 1. The rack 61 is mounted on the pin 62 of this carriage and is engaged by the geared drum 50, which also engages the gear 52. This gear, as is indicated in Fig. 2, operates the fly 53, of ordinary construction, when the pivoted spring-pressed catch 55 is withdrawn from its path. This catch, as indicated, is controlled by the cord 49, passing over the guide-pulley 54 and adapted to swing the catch against the action of its spring, so that the fly is released and the gearing operates under the influence of the spring 51, thus gradually feeding the rack and connected carriage along the tracks. The extent of the movement of the carriage is limited by a suitable stop 63, which may engage in one of a series of holes 64, and this stop projects into the path of the rack 61 or other member attached to the carriage, so as to positively limit its movement and bring it accurately into alinement. A suitable hood 37, preferably formed of material impervious to the X-rays and of proper shape to accommodate an X-ray tube, is indicated as provided with upwardly-projecting lips 59, which may be rigidly but detachably secured to the carriage by the nuts 57, so that different hoods may be readily used and quickly attached to the carriage and operating mechanism, which is arranged and adjusted to give the desired angular movement of the X-ray tube for proper stereoscopic effects.

Upon the hood suitable brackets 36 are formed provided with clamps of any desired construction, preferably adapted to properly secure and simultaneously align the X-ray tube with respect to the carriage. As indicated in Fig. 4, the block 40 may be secured to the bracket 36, and the alining-plate 66, preferably of transparent material, such as celluloid or the like, may be secured to the block in any manner. This plate, as is indicated in Fig. 7, is formed with alining means or markings to cooperate with the aliner 83, which may be provided with corresponding markings and secured to the end 82 of the X-ray tube. As indicated, the plate is formed with a series of holes 79 80, which may be joined by cross-lines or other devices to be more readily aligned with the markings on the tube-aliner. The aliner may consist of a strip or band of paper or other similar material properly fastened upon the X-ray tube, and after the tube has once been properly adjusted in the clamps so as to bring the radiating spot of its target 81 into exactly the desired position with respect to the carriage and the rest of the apparatus marks are made on the aliner by inserting a pencil or other marking device through the holes 79 80 in the alining-plate, and thereafter cross-lines or other indications are made upon the aliner, so that subsequently the tube may be readily readjusted to exactly the same position with respect to the alining-plate through which the indications on the aliner 83, secured to the tube end 82, may be readily observed. Any desired form of clamp may be used in connection with these alining devices, and a simple construction is indicated in Fig. 4, the clamp-jaw 41 being provided with a suitably-inclined recess and held in position by the clamping-bolt 39. Upon the other bracket 36 the loosely-pivoted stud 69 is indicated in Fig. 5 carrying at its outer end the clamp-screw 42, having a suitable collar or other arrangement to rotatably connect it with the stud and prevent longitudinal movement with respect thereto and being provided with the oppositely-threaded portions 71 72 on each side of the stud. The screw 72 engages the headed nut 68, mounted so as to have a slight pivotal movement in the jaw 65, and, if desired, the similar headed nut 70, with which the screw 71 cooperates, may be similarly mounted, so as to have a slight freedom of movement in the jaw 43, the holes through which the screws pass being slightly enlarged for this purpose. The jaws may of course in all cases be provided with any desired form of yielding grips 67, of rubber, felt, or other material. This clamp has a self-centering action, because of the simultaneous inward movement of both parts of the clamp, so as to properly center this end of the X-ray tube regardless of slight differences in diameter. The swiveling jaws also contribute to

firmly engage and hold the X-ray tube and accommodate for irregular contour.

To more effectually minimize any possible harmful effect of the X-rays upon the subject and to cut off secondary rays from the photographic plate, suitable impervious diaphragms are provided, which cut off the rays except just what are necessary for making the photographic exposures. The diaphragms are made of various sizes and shapes to correspond with the size and location of photographic plate to be acted upon, and the diaphragms may be conveniently held in position in the carriage 58 by a suitable latch 60 in the form of a light spring, which, as indicated in Figs. 2 and 3, is arranged at the side of the carriage and engages the diaphragm 56, of lead or other impervious material. In this way, in connection with the impervious hood 37, all the X-rays from the tube are cut off except those within the cone of radiation 88, (indicated in Fig. 1,) which by selecting the proper diaphragm can be arranged to just cover properly the photographic plate employed. Also by having a pin-hole diaphragm or one provided with cross-wires or other indications the centering of the tube-targets can be effected photographically, if desired.

In using this apparatus for X-ray exposures it is usually desirable to adjust the tube-support 35 and plate-holder 5 to a standard relative position as far as the conformation of the subject will allow, although, of course, it is desirable to bring these parts as close together as possible in many cases. When in this relative position, these parts, firmly secured to the carrier 13, may be moved together in any direction whatever by this apparatus, as well as instantly rotated about the bolt 24 after releasing the lock 18. Also in taking a stereoscopic exposure the first exposure is taken with the carriage at one end of its travel, and then the carriage and attached parts, including the tube, are automatically and rapidly moved in the proper direction and to the desired extent by the escapement described as soon as the catch is released. Furthermore, this is effected in a positive manner and without either loss of time or jarring of the parts, which is very desirable in such cases. It is also desirable in many instances in using such apparatus to be able to accurately reproduce the various adjustments at any time, and this can be readily done by reading the indications of the various scales after the apparatus has been adjusted for any particular purpose.

This invention having been described in connection with an illustrative embodiment thereof, to the details of which it is not limited, what is claimed as new, and what it is desired to secure by Letters Patent, is set forth in the appended claims:

1. In X-ray apparatus, a movable post and base, a block slidingly mounted in said

post, a counterweight operating within said post, a sprocket-wheel, a sprocket-chain connecting said block and counterweight and operated by said wheel, a head revolubly connected with said block, a worm-wheel adjustment between said head and block, a carrier revolubly mounted on said head, means to lock said carrier in adjusted position, a holder mounted on said carrier, an arm and support mounted on said carrier and adjustable with respect to said holder, curved tracks in said support substantially concentric with said holder, a carriage mounted on said tracks and operating in an aperture in said support, a removable impervious diaphragm in said carriage and an impervious hood to receive an X-ray tube secured to said carriage.

2. In X-ray apparatus, a carrier, a plate-holder mounted on said carrier, a support mounted on said carrier and adjustable with respect to said holder, adjustable means to support said carrier, tracks in said support, a carriage mounted on said tracks to operate in an aperture in said support, a spring-operated escapement to move said carriage along said tracks, means to limit the movement of said carriage and means to support an X-ray tube from said carriage.

3. In X-ray apparatus, a carrier, a holder mounted on said carrier, a support mounted on said carrier, and adjustable with respect to said holder, a carriage movably mounted on said support, means on said support to automatically move said carriage with respect thereto and means to mount an X-ray tube on said carriage.

4. In X-ray apparatus, a support having an aperture, a carriage movably mounted on said support to operate in said aperture, an escapement to move said carriage with respect to said support and means to mount an X-ray tube on said carriage.

5. In X-ray apparatus, a support provided with an aperture, a carriage movably mounted on said support to operate within said aperture, a spring escapement to move said carriage with respect to said support, and a hood detachably connected to said carriage to support an X-ray tube.

6. In X-ray apparatus, a carrier, a holder mounted on said carrier, a support mounted on said carrier and adjustable with respect to said holder, a diaphragm detachably mounted on said support, means to clamp an X-ray tube to said support, an alining-plate on said support provided with markings and a cooperating aliner on said X-ray tube.

7. In X-ray apparatus, a support, means to clamp an X-ray tube to said support, an alining-plate on said support having markings and an aliner on said tube to cooperate with said alining-plate and to receive alining markings therefrom.

8. In X-ray apparatus, a support, means

to clamp an X-ray tube to said support, a transparent alining-plate provided with apertures and markings and an aliner on said tube to receive alining-markings from said holes.

9. In X-ray apparatus, a carrier, a holder mounted on said carrier, a support mounted on said carrier, means to mount an X-ray tube on said support, alining means to aline said tube with respect to said support and detachable impervious diaphragms mounted on said support in line with said holder.

10. In X-ray apparatus, a movable post and base, a block movably mounted on said post, a carrier revolvably mounted on said block, means to lock said carrier in adjusted position, a holder mounted on said carrier, a support mounted on said carrier, and adjust-

able with respect to said holder, an impervious hood mounted on said support, means to clamp an X-ray tube to said hood, alining means to aline said tube with respect to said hood and removable impervious diaphragms to be mounted on said support to limit the radiation issuing from said tube.

11. In X-ray apparatus, a support, an alining-plate on said support, clamps to secure an X-ray tube to said support comprising a self-centering clamp having jaws and a double-threaded screw to simultaneously move said jaws together and an aliner on said tube to cooperate with said alining-plate.

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Witnesses:

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