Jan. 17, 1961 A. J. FODERARO 2,968,732

TUBE STAND HEAD COUNTERBALANCE

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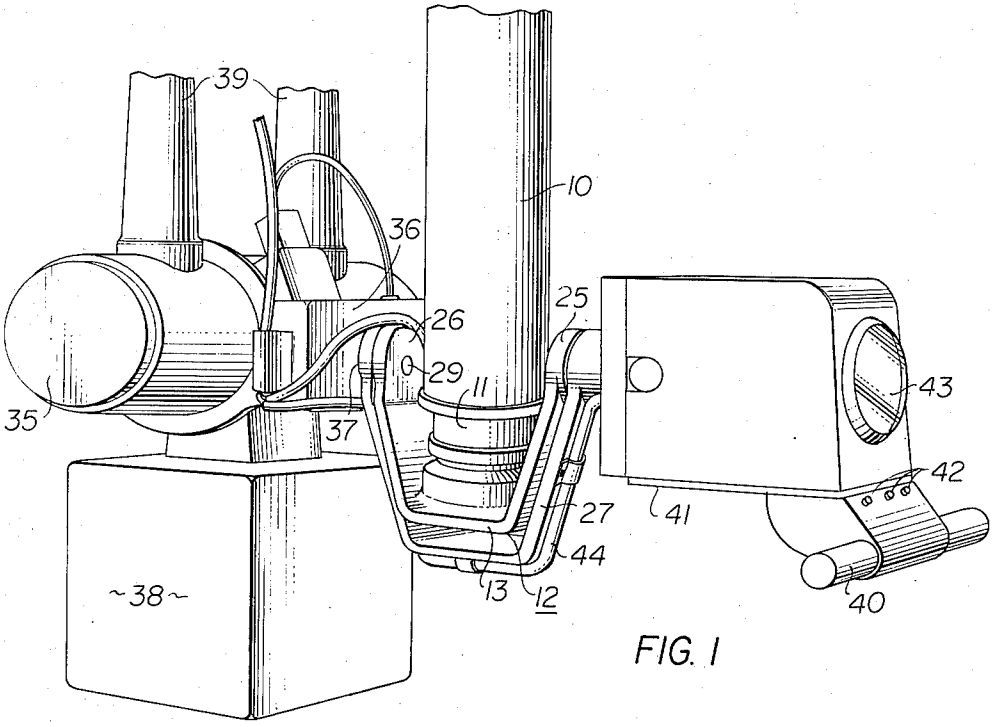


FIG. 1

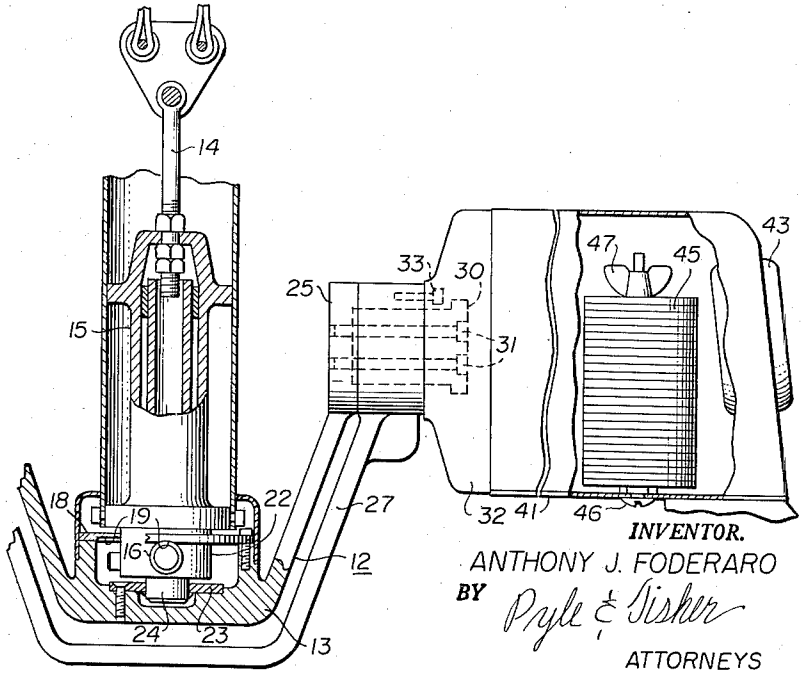


FIG. 2

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TUBE STAND HEAD COUNTERBALANCE

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9 Claims. (Cl. 250—91)

This invention relates to X-ray devices and more particularly to a novel and improved ceiling mounted X-ray tube.

This application is a continuation-in-part of copending application Serial No. 791,480, filed February 5, 1959, under the title "Compensating Cam and Spring Balance," which application is a division of Serial No. 608,948, filed September 10, 1956, under the title "Compensating Cam and Spring Balance for X-Ray Devices," now United States Patent No. 2,876,362 of March 3, 1959.

In recent years tube stands for suspending X-ray tubes and the like from ceilings or other overhead supports have come into relatively wide use. A full and complete disclosure of one such tube stand for ceiling mounting may be found in the above referenced patent and copending application and in United States Patent Number 2,835,520, issued May 20, 1958. As taught in that patent, longitudinal and transverse tracks support the tube and permit the ceiling support X ray tube to be positioned in any desired location over an X ray table. The tube stand is vertically adjustable to permit the X-ray tube to be moved up and down. The present invention is directed to the apparatus mounted at the base of such a tube stand.

In previous mechanisms the X-ray tube, the elements for controlling the tube, and a handle for positioning the tube have all been mounted more or less cantilever fashion predominately to one side of the tube stand. Such a construction places a severe strain on both the tube stand and the bearings between the tube stand and the X-ray tube support.

In addition to subjecting the bearings to excessive strain, these prior proposals also create problems in maintaining alignment of the beam emitted by the X-ray tube and the well known Bucky diaphragm which is normally positioned over the X-ray film to be exposed. The problems associated with misalignment of an X-ray tube and a Bucky diaphragm are discussed in U.S. Patent No. 2,823,316, entitled "Centering Device for X-Ray Apparatus," issued February 11, 1958, to J. A. Reynolds, for a solution to the problem of aligning a tube stand and a Bucky diaphragm. However, for best results this solution depends on a tube stand which remains in alignment as it is extended and contracted. The present invention contributes to the maintenance of that alignment.

This invention overcomes the disadvantages of the prior art by providing a support mechanism which is disposed on both sides of the tube stand axis and which is counterbalanced so that the stresses applied to the tube stand are substantially exclusively vertical. A tube control handle and tube actuation members are all mounted on the tube stand opposite from the X-ray head to provide symmetrical disposition of the objects being supported and to minimize the amount of counterweighting needed.

Accordingly, one of the principal objects of this invention is to provide a novel and improved overhead supported tube stand device in which the objects supported are balanced on either side of the tube stand.

A related object of the invention is to provide a novel and improved tube stand support X-ray device in which the X-ray head is supported on one side of the tube stand and in which counterweights are supported on the opposite side of the tube stand to counterbalance the X-ray head.

A more specialized object of the invention is to provide a novel and improved X-ray head tube stand support wherein a pair of U-shaped brackets are journaled on the base of a tube stand and wherein the X-ray tube and supported counterweights are supported on opposite arms of the brackets to rotate about a horizontal axis above the base of the tube stand so as to provide balance about such horizontal axis.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a perspective view of a foreshortened tube stand, an X-ray tube mounted on the tube stand, and counterbalancing weight on the opposite side of the tube; and

Figure 2 is a foreshortened plan view with parts broken away and removed and on an enlarged scale with respect to Figure 1 showing the counterweight portion of the mechanism and a portion of the support mechanism.

Referring to the drawings and to Figure 1 in particular, relatively movable telescoped tube stand elements are shown at **10** and **11**. These elements may be made in accordance with the teaching of the referenced U.S. Patent Number 2,835,520. These telescoping tubes provide lateral support for the mechanism.

A generally U-shaped inner bracket **12** is provided. The inner bracket **12** has a central portion **13** which is connected to a supporting cable **14** through a suitable centering and supporting mechanism **15**. The centering and supporting mechanism **15** carries a plurality of bearings **16** which are rotatable about horizontal axes. The central portion **13** includes an annular supporting disk **18** which rides on the bearings **16** for vertical support of the inner bracket **12**. A plurality of notches **19** may be formed at suitable spaced intervals about the disk. For example, with two support bearings **16**, four notches **19** may be provided. With every 90° of rotation the bearings **16** will index into a pair of the notches **19** to locate the tube in the selected position.

The central portion **13** includes an annular disk **18**. The disk **18** is in close peripheral association with a cylindrical projection **22** on the centering and supporting structure **15**. An annular guide disk **22** also forms a part of the central portion **13**. The guide disk **23** coacts with a second and smaller cylindrical projection **24** on the centering and supporting structure **15**.

The inner bracket **12** has upstanding arms terminating at upper support ends **25**, **26**. A second and outer bracket **27** is symmetrically disposed about the inner bracket **12**. One arm of the outer bracket **27** is connected to the inner bracket by a suitable shouldered screw **29** threaded into the upper support end **26**, Figure 1. An equivalent structure is shown in detail in cross section in Figure 2 for connection of the other arm of the outer bracket **27** to the upper support end **25**. There, a headed journal bearing guide **30** is fixed to the support end **25** as by lag bolts **31**. The outer bracket **27** and a housing **32** which is connected to it as by screws **33** are rotatable about the headed journal bearing **30** and the shouldered screw **29**. The headed journal bearing **30** and the shouldered screw **29** are along a common axis

to journal the outer bracket 27 for rotation about that axis.

An X-ray head 35 is mounted on a head bracket 36. The head bracket 36 is suitably fixed at 37 to the outer bracket 27. The X-ray head 35 and the housing 32 are rotatable with the outer bracket 27 about the horizontal axis of the headed journal bearing 30 and shouldered screw 29.

A collimator 38 may be fixed to the X-ray head 35. Suitable shielding members 39 which serve as receptacles for the ends of the X-ray head cables are fixed to the X-ray head. The receptacles or cable shields 39' project from the X-ray head in a direction opposite from the collimator to facilitate balancing the collimator when the outer bracket 27 and the connected parts are rotated about the horizontal axis.

A handle 40 is fixed to a control member 41 which also serves, in the preferred and disclosed embodiment, as a housing base. The housing base 41 and the handle 40 together serve as a control member to transmit operator supplied controlling forces to the tube stand.

Suitable X-ray head control members such as switches 42 may be mounted on the handle 40. A level gauge 43 may be provided in the housing. With this construction all X-ray head control members such as the handle 40, the level gauge 43, the switches 42 and cables 44 leading to the switches are positioned opposite from the X-ray head to provide symmetry, balance, and ease of operation and to partially counterbalance the head.

One of the outstanding advantages of the invention is achieved by balancing the X-ray tube with the control member mechanism previously described as being disposed on the side of the tube stand opposite the X-ray head and by supporting a plurality of counterweights 45 as part of such mechanism. The weights 45 are carried in the housing 32. The counterweights 45 may be a series of annular lead washers suitably fixed to the housing base 41 by a positioning bolt 46 and a wing nut 47. The counterweights 45 add weight to the control member side of the device to counterbalance the X-ray tube 35 and those elements associated with the tube such as the collimator 38 and cable housings 39 which must be on the X-ray head side of the tube stand.

The weights 45 serve a dual function in that they are also used to trim an overhead counterbalance system for vertical movement. The trim may be very precise because the counterbalancing of the X-ray head need only be approximate, not exact.

While the invention has been described with a great deal of detail it is believed that it essentially comprises a tube stand supported mechanism having a first weight including an X-ray tube supported on one side of the tube stand and a second weight supported on the opposite side of the tube stand to counterbalance the X-ray head.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

I claim:

1. An X-ray mechanism for mounting on a ceiling tube stand or the like comprising, an inner bracket having a central portion and first and second upstanding arms, the central portion including means for rotational mounting of the bracket on a tube stand, the arms each having a first end connected to the central portion and a second end, journal means carried by each of the arms at the second ends, an outer bracket having a central portion and first and second upstanding arms, the outer bracket being symmetrically disposed about said inner bracket, said outer bracket arms having upper ends, means connecting said second ends to said upper ends and permitting relative rotation of the brackets about an axis transverse to the arms, an X-ray head mounted on said outer bracket first arm, a control member mounted on the outer bracket second arm, a housing mounted on the control member, and a counterweight carried by said member and disposed within said housing.

2. An X-ray mechanism for mounting on a ceiling tube stand or the like comprising, an inner bracket having a central portion and first and second upstanding arms, the central portion including means for rotational mounting of the bracket on a tube stand, the arms each having a first end connected to the central portion and a second end, journal means carried by each of the arms at the second ends, an outer bracket having a central portion and first and second upstanding arms, said outer bracket arms having upper ends, means connecting said second ends to said upper ends and permitting relative rotation of the brackets about an axis transverse to the arms, a first weight including an X ray head and associated mechanism carried by the brackets, a second weight carried by the brackets, the first and second weights being disposed on opposite sides of said rotational mounting means, and said second weight being a counterbalance for said first weight.

3. An X-ray mechanism for mounting on a ceiling tube stand or the like comprising, an inner bracket having a central portion and first and second upstanding arms, the central portion including means for rotational mounting of the bracket on a tube stand, the arms each having a first end connected to the central portion and a second end, journal means carried by each of the arms at the second ends, an outer bracket having a central portion and first and second upstanding arms, said outer bracket arms having upper ends, means connecting said second ends to said upper ends and permitting relative rotation of the brackets about an axis transverse to the arms, a first weight including an X-ray head and associated mechanism carried by the brackets, a second weight carried by the brackets, said second weight including a plurality of annular counterweights and means to hold said counterweights in stacked relationship, the first and second weights being disposed on opposite sides of said rotational mounting means, and said second weight being a counterbalance for said first weight.

4. The device of claim 2 wherein the second weight includes a handle.

5. The device of claim 2 wherein the second weight includes means to control the X-ray head.

6. In combination with an overhead tube stand having a vertical axis, a first generally U-shaped bracket journaled on the base of the tube stand for rotation about the axis of the tube stand, a second U-shaped bracket mounted on the first bracket for rotation about an axis normal to the tube stand axis, an X ray head carried by one arm of the second bracket, a control arm mounted on the other arm of the second bracket, said control arm including a control handle, and counterweights housed within the control arm.

7. In combination with an overhead tube stand, a first generally U-shaped bracket journaled on the base of the tube stand for rotation about the axis of the tube stand, a second U-shaped bracket mounted on the first bracket for rotation about an axis normal to the tube stand axis, an X-ray head carried by one arm of the second bracket, a collimator mounted on the head, cable reception means mounted on the head and projecting therefrom in a direction away from said collimator, a control arm mounted on the other arm of the second bracket, said control arm including a control handle, and counterweights housed within the control arm.

8. In combination with an overhead tube stand, a first generally U-shaped bracket journaled on the base of the tube stand for rotation in a horizontal plane about the axis of the tube stand, a second U-shaped bracket mounted on the first bracket for rotation about an axis

normal to the tube stand axis, an X-ray head carried by one arm of the second bracket, a control arm mounted on the other arm of the second bracket, said control arm including a control handle, counterweights housed within the control arm, and X-ray tube control means mounted adjacent said control handle.

9. In combination with an overhead supported tube stand having a plurality of relatively movable members, the improvement which comprises, a bracket journaled on the tube stand for rotation in a longitudinal plane about the axis of the tube stand movement, said bracket including first and second support portions projecting transversely in opposite directions from said tube stand movement axis, an X-ray tube carried by said first support portion, tube balancing and control means carried by said second portion, said tube balancing and control means including a handle and housing means for the retention of X-ray tube control mechanism, said X-ray tube and said tube balancing and control means being rotatable together about a horizontal axis.

References Cited in the file of this patent

UNITED STATES PATENTS

1,622,320	Kelley	Mar. 29, 1927
1,630,181	Isherwood	May 24, 1927
2,659,827	Scag et al.	Nov. 27, 1953
2,835,520	Schiring et al.	May 20, 1958
2,876,362	Foderaro	Mar. 3, 1959