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FLUOROSCOPIC SHUTTER CONTROL MECHANISM

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Fig. 1

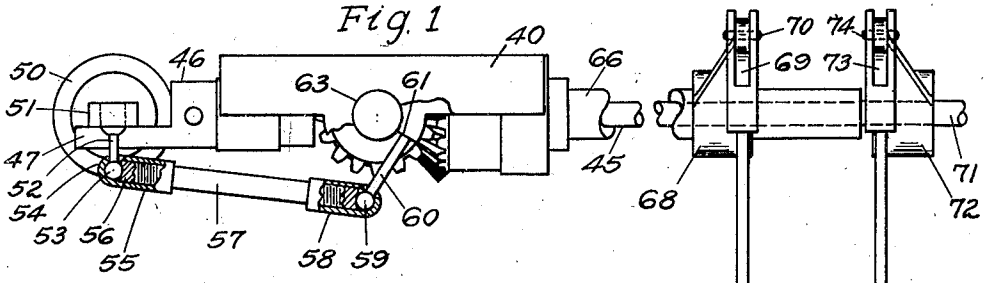


Fig. 2

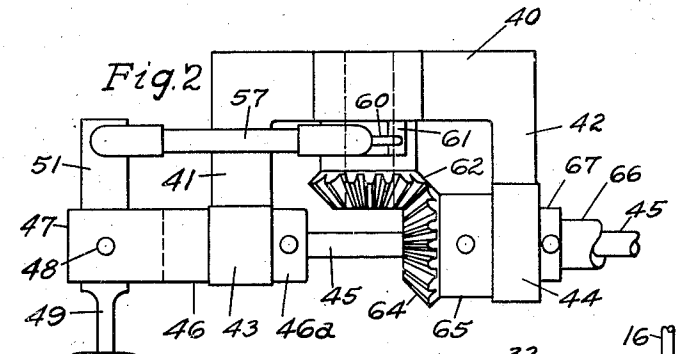
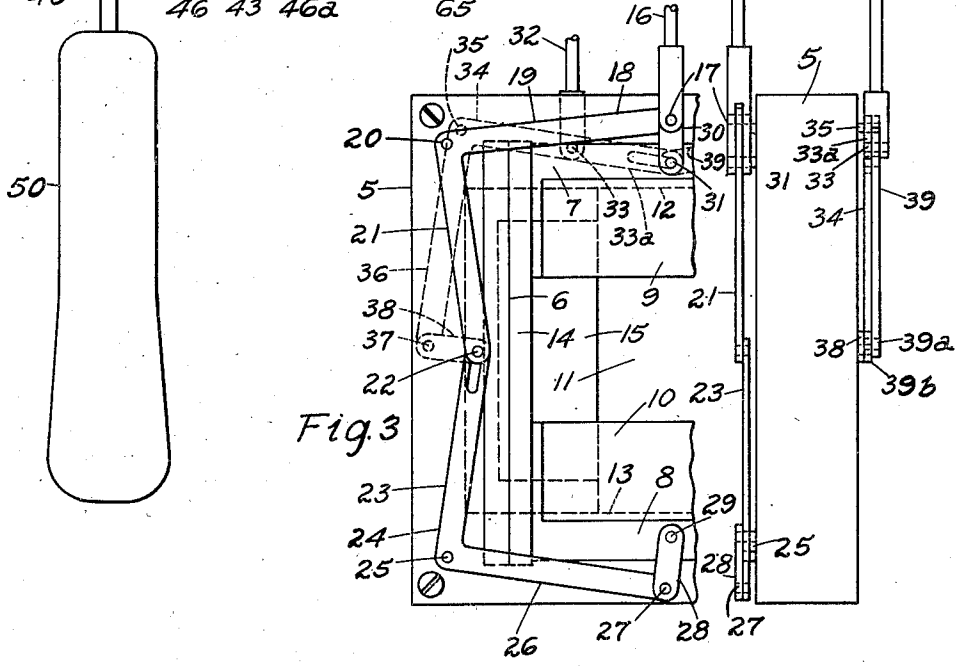


Fig. 3



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FLUOROSCOPIC SHUTTER CONTROL MECHANISM

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6 Claims. (Cl. 250—105)

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This invention relates to X-ray apparatus and, more particularly, to mechanism for variably opening the transversely arranged pairs of blades of the fluoroscopic shutters commonly employed with such apparatus, one object of the invention being to provide an improved mechanism of the above character having a more simple, practical and convenient construction.

Another object is to provide such a control mechanism having a single, or common, operating member adapted to be moved in different directions for more quickly and conveniently adjusting both pairs of shutter blades.

A further object is to supply a more simple and practical mechanism of the nature indicated, comprising relatively few parts, of simple construction, adapted to be manufactured and applied to known X-ray apparatus at a relatively low cost.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a top plan view of a mechanism embodying the present invention, partly in section and partly broken away;

Fig. 2 is a side elevation of the handle and associated parts shown in Fig. 1, and

Fig. 3 is a side elevation of the shutter mechanism, as viewed from the left in Fig. 1.

In the embodiment herein disclosed by way of illustration, the invention is applied to the operation of a known type of fluoroscopic shutter for X-ray apparatus, comprising a substantially rectangular hollow frame 5 formed with horizontally extending, upper and lower guideways, the lower of which is shown at 6. The upper of these guideways and the upper half of frame 5 are omitted from Fig. 3 to simplify the drawing. A pair of supporting frames 7 and 8 are horizontally slidable on these guideways, toward and from each other, and support a pair of cooperating shutter blades 9 and 10, respectively, made of sheets of material, such as lead, opaque to X-rays, for adjusting the horizontal width of the shutter opening 11.

Frame 5 is formed also with a pair of spaced vertical guideways, as 12 and 13, on which a similar pair of supporting frames are slidably mounted, one of which is shown at 14, provided with a similar opaque shutter blade 15. The opposite and cooperating frame and blade (not shown) have the same construction and sliding

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movement on the guideways 12 and 13 and these frames and blades are reciprocable vertically toward and from each other, to control the vertical width of the shutter opening 11. These horizontally and vertically moving pairs of blades are movable independently of each other, or simultaneously, as desired, to control the shape and the size of the shutter opening or aperture 11, as well understood in the art.

The means for moving the blades 9 and 10 horizontally comprise, preferably, a reach rod 16 having one end pivotally connected at 17 with one arm 18 of a bellcrank lever, indicated generally at 19, pivoted at 20 on the frame 5. The other arm 21 of the lever is connected at 22, by a pin and slot connection, with one arm 23 of a bellcrank lever indicated generally at 24 and pivoted at 25 on the frame 5. The other arm 26 of this lever is pivoted at 27 to a link 28 pivoted at 29 to the frame 8 of the shutter blade 10. Rod 16 is also pivotally connected, behind the pivot 17, with a link 30 which is pivotally connected at 31 with the frame 7 of the blade 9. It will be evident from this construction that as reach rod 16 is reciprocated, it oscillates the bellcranks 19 and 24 and reciprocates the blades 9 and 10 simultaneously toward and from each other to control the horizontal width of the shutter aperture.

The means for operating the vertically movable blades comprises, preferably, a reach rod 32 which is pivotally connected at 33 with one arm 33a of a bellcrank lever indicated generally at 34. This lever is pivoted at 35 on the frame 5 and its other arm 36 is pivoted at 37 to a link 38 having its other end pivoted to frame 14 of the lower shutter blade 15, behind the pivot 22. The outer end of the arm 33a of the lever 34 is pivotally connected, behind the pivot 31, with one arm of a bellcrank lever 39 which is pivoted at its center on the frame 5 with its other arm pivotally connected at 39a to a link, 39b, similar to the link 38 and pivotally connected to the upper shutter blade frame, these parts for actuating the upper blade being similar in construction to the parts described in connection with the lower blade frame and similarly connected. It is evident from this arrangement that reciprocation of reach rod 32 serves to oscillate both bellcranks 34 and 39 and simultaneously reciprocate the lower blade 15 and its corresponding upper blade toward and from each other, to control the height of the shutter aperture.

The mechanism for reciprocating the reach rod 16 comprises, preferably, a stationary sup-

port or bracket, 40, having spaced arms 41 and 42 formed with alined shaft bearings 43 and 44, respectively. Bearing 43 forms one support for a rock shaft 45 of relatively small diameter which extends to the left in Fig. 2 beyond the bearing and has pinned thereto a collar 46 having an integral arm 47 which has pivoted thereto at 48 a lever 49 provided on one side of the pivot with an operating handle 50. A collar 46a, pinned to shaft 45 on the opposite side of the bearing, holds the shaft against endwise movement. The other end 51 of the lever has fixed thereto a short stud 52, Fig. 1, formed at its end with a ball 53 received in a socket formed between the rounded end 54 of a tubular casing 55 and the end 56 of a connecting rod 57 which is threaded into the casing, as shown, thus providing a ball and socket or universal joint between the lever 49 and the connecting rod 57.

The other end of rod 57 is similarly threaded into a casing 58 to form with the end of the latter a socket for the reception of a ball 59 on the end of a stud 60 having its other end fixed to a shoulder 61 on the hub of a bevel gear 62 journaled as at 63 for oscillating movement in the bracket support 40. Gear 62 meshes with a bevel gear 64 having a hub 65 pinned on one end of a tubular shaft 66 surrounding shaft 45 and mounted for rocking movement thereon and in the support bearing 44, tubular shaft 66 thus providing a second bearing for the shaft 45. The gear hub 65 on one side of the bearing and a collar 67 pinned to shaft 66 on the other side of the bearing, serve to hold the shaft 66 against endwise movement.

It will be evident from the above construction that by pivotally oscillating lever 49 about its pivotal connection with arm 47, by oscillating handle 50 in one plane, rod 57 is reciprocated longitudinally to rock gear 62 on the support and thereby rock gear 64 of the tubular shaft 66. Shaft 66 has fixed thereon at its other end a hub 68 carrying an arm 69 pivoted at 70 between the branches of the bifurcated other end of the reach rod 16, so that oscillation of the shaft by handle 50 serves to reciprocate the reach rod to operate the horizontally moving pair of shutter blades.

It is evident also that handle 50 may be oscillated in a transverse plane to rock the inner shaft 45 to which it is pinned at 48. Shaft 45 is extended beyond the end of the tubular shaft 66, as at 71, for the reception of a hub 72 fixed thereon and carrying an arm 73 pivoted at 74 between the branches of the bifurcated other end of the reach rod 32, so that the oscillation of the inner shaft 45 by handle 50 serves to reciprocate the rod 32 and operate the pair of vertically moving shutter blades.

Handle 50 may thus be oscillated in either one of relatively transverse planes to control either of the pairs of shutters independently of the other pair. Or, the handle may be oscillated simultaneously in both planes to simultaneously control both pairs of blades, either uniformly or differentially, to adjust the shutter aperture to any desired size or shape within the limits of the shutter mechanism. A single handle 50 is thus provided capable of universal movement to adjust either pair of blades independently, or both together simultaneously.

Such X-ray apparatus is frequently operated under conditions of poor illumination and with the chief attention of the operator directed to other parts of the mechanism and the object to be viewed or photographed, and the single control handle of the present invention eliminates the confusion and inconvenience under such unfavorable conditions of shifting the hand from one to another of several handles in trying to find and operate the proper handle for effecting a desired shutter adjustment.

It will thus be seen that the invention accomplishes its objects and while it has been herein disclosed by reference to the details of a preferred embodiment, it is to be understood that such disclosure is intended in an illustrative, rather than a limiting sense, as it is contemplated that various modifications in the construction and arrangement of the parts will readily occur to those skilled in the art, within the spirit of the invention and the scope of the appended claims.

We claim:

1. In X-ray apparatus, a control mechanism for a set of adjustable fluoroscopic shutter blades having one pair of blades movable relatively to one another in one direction but restrained against relative movement in a transverse direction and another pair of blades movable relatively to one another in a different direction but restrained against movement transversely to said different direction, said mechanism comprising a pair of shafts mounted for rotary movement and connected with said pairs of blades, respectively, and a single control member common to said shafts and rotatable in one direction to rotate one of said shafts for moving said one pair of blades only and in a different direction for rotating the other of said shafts for moving said other pair of blades alone and independently of the first mentioned pair of blades.

2. In X-ray apparatus, a control mechanism for a set of adjustable fluoroscopic shutter blades having one pair of blades movable relatively to one another in opposite directions parallel with one straight line and another pair of blades movable relatively to one another in opposite directions parallel with another straight line, said mechanism comprising a pair of concentric shafts mounted for relative rotary movement and connected with said pairs of blades, respectively, of said set, a single control member common to said shafts, and means by which said member is mounted for universal pivotal rocking movement for operating said pairs of blades either independently or simultaneously with each other.

3. In X-ray apparatus, a control mechanism for a set of adjustable fluoroscopic shutter blades having one pair of blades movable toward and from each other in one direction along a straight line and another pair of blades movable toward and from each other in a different direction along a different straight line, said mechanism comprising a pair of shafts mounted for rotary movement and connected with said pairs of blades, respectively, an arm on each shaft, a link pivotally connected with each arm for movement longitudinally thereby and adapted for connection with one of said pairs of blades, a single control member common to said shafts and movable in different directions, for operating either of said pairs of blades independently of the other thereof when said member is moved in one direction and for operating both of said pairs simultaneously when said member is moved in different directions simultaneously.

4. In X-ray apparatus, a control mechanism for a set of adjustable fluoroscopic shutter blades having one pair of blades movable toward and from each other in one direction along one

straight line and another pair of blades movable toward and from each other in a different direction along a different straight line, said mechanism comprising a pair of concentric shafts each having a rotary rocking movement and each connected to the blades of one of said pairs, and a single control member connected with both of said shafts and movable about intersecting axes for rotating both of said shafts and operating all of said blades simultaneously.

5. In X-ray apparatus, a control mechanism for a set of adjustable fluoroscopic shutter blades having one pair of blades movable toward and from each other in one direction along one straight line and another pair of blades movable toward and from each other in a different single direction along a different single straight line, said mechanism comprising a pair of shafts each having a rotary rocking movement and each connected to the blades of one of said pairs, a unitary handle mounted for pivotal movement in each of intersecting planes, said handle being directly connected with one of said shafts, and having link means connected with the other shaft, to effect rotary movements of both of said shafts by movement of said handle in each of said planes.

6. In X-ray apparatus, a control mechanism for a set of adjustable fluoroscopic shutter blades having one pair of blades movable toward and

from each other in one direction along one straight line and another pair of blades movable toward and from each other in a different direction along a different straight line, said mechanism comprising a pair of concentric shafts each having a rotary movement and each connected to the blades of one of said pairs, a common handle pivotally mounted on one shaft, gearing for rotating said other shaft, and link means connecting said handle and gearing for rotating both of said shafts by different pivotal movements of said common handle.

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