

April 7, 1959

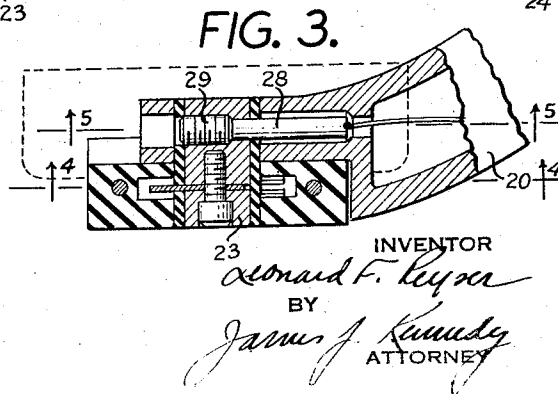
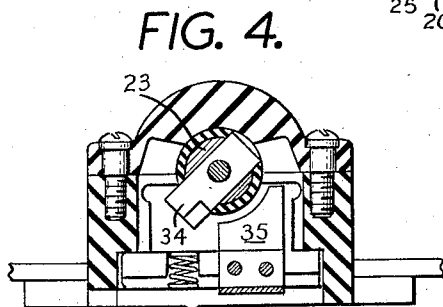
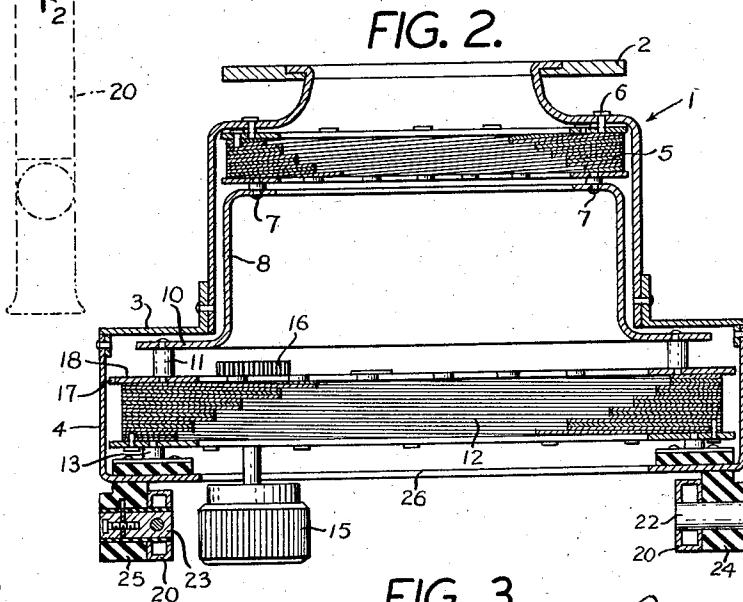
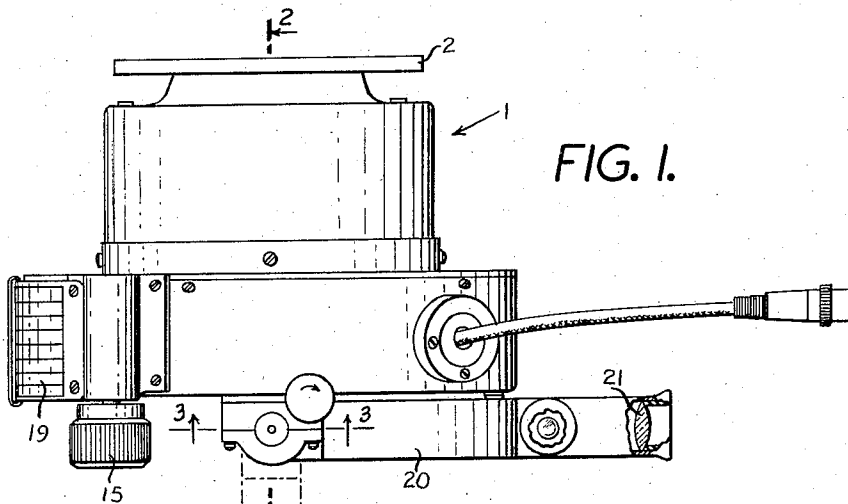
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2,881,329

X-RAY CONE

Filed Jan. 26, 1956

2 Sheets-Sheet 1



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FIG. 6.

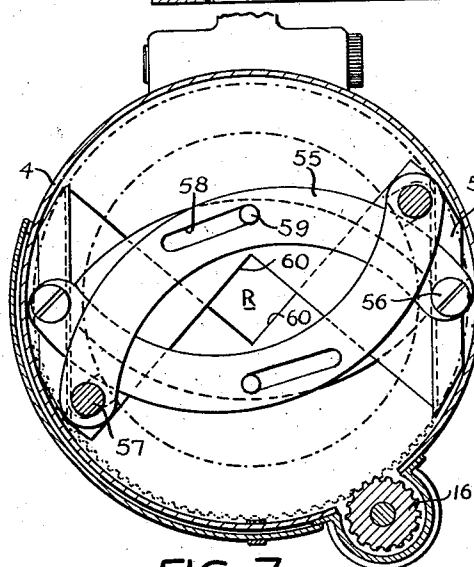
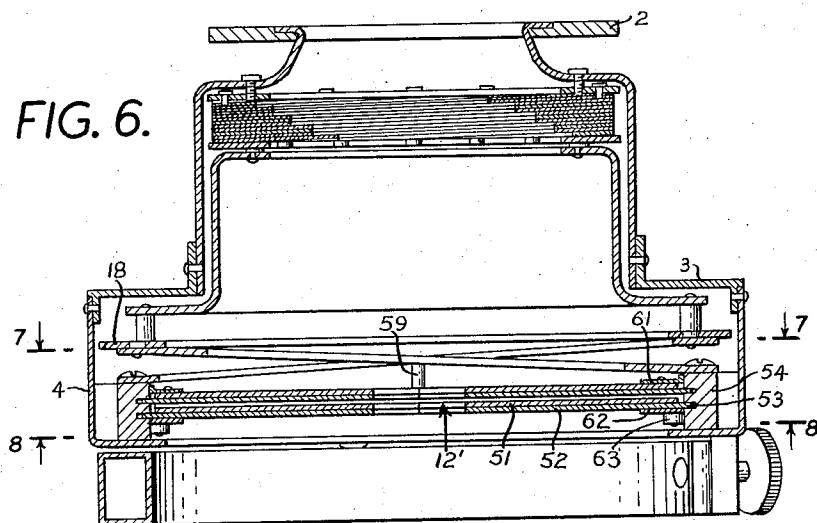


FIG. 7.

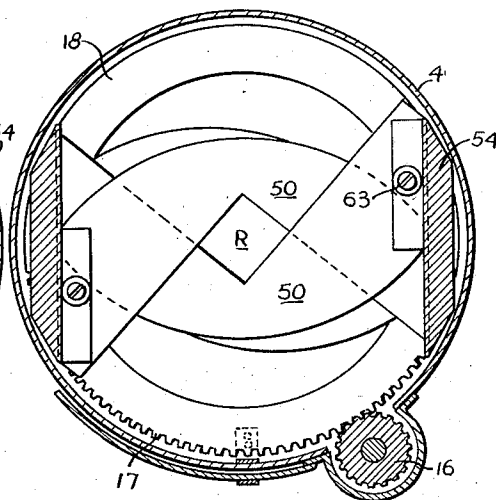


FIG. 8.

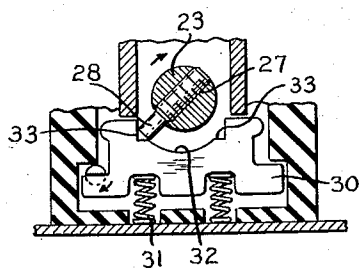


FIG. 5.

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2,881,329

X-RAY CONE

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5 Claims. (Cl. 250—105)

This invention relates to improvements in X-ray cones, or devices for more sharply limiting the area exposed to radiation whether for diagnostic or therapeutic purposes.

Wright Patent No. 2,614,224 discloses an adjustable iris X-ray cone equipped with focusing attachment, and the present invention in one aspect thereof is an improvement on the device of this patent, one object being to synchronize the adjustment of upper and lower apertures in a simple and reliable manner.

A further object is to improve the mounting of the automatic switch mechanism associated with the pivoted bail which carries the focusing or centering light.

A further object is to provide an improved cone having a rectangular adjustable aperture as distinguished from a substantially circular aperture.

Still another object is to provide a cone in which circular aperture means and rectangular aperture means may be readily interchanged.

A cone embodying the invention in a preferred form will now be described with reference to the accompanying drawing, and the features forming the invention will then be pointed out in the appended claims.

In the drawing:

Fig. 1 is a side elevation of the cone of the present invention;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged section on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged section on the line 4—4 of Fig. 3;

Fig. 5 is an enlarged section on the line 5—5 of Fig. 3;

Fig. 6 is a section similar to Fig. 2, but showing the unit adapted to rectangular aperture; and

Figs. 7 and 8 are sections on the respective lines 7—7 and 8—8 of Fig. 6.

Referring now first to Figs. 1—5, the cone comprises an upper casing structure 1 including a flange 2 for attachment to the X-ray machine and a lower flange 3 to which the lower housing section 4 is secured. An upper iris diaphragm assembly 5 is secured to the casing 1 by means of screws 6, and the operating studs 7 for the leaves, typically six in this assembly, are received in slots formed in the upper part of a rotatable air shell 8, so that the turning of this shell 8 with relation to the casing 1 will contract and expand the aperture as desired. The structure of the leaves and the operation of this diaphragm may be substantially the same as that disclosed in the prior Wright patent above referred to, or of any other convenient form, and will not be further described herein.

As is well known, the beam projected by an X-ray tube is not a simple conical beam emanating from a determined point but comprises substantial quantities of scattered radiation and particularly scattered and relatively soft radiation so that a single diaphragm or aperture can define the area of exposure only in a rather approximate way. Two or more diaphragms properly synchronized as to the adjustment of their apertures and

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spaced apart in the direction of the beam causes improvement of the beam definition, but such devices have heretofore taken the form of relatively complicated and bulky collimators using swinging diaphragm supports, and multiple diaphragm devices built on the principle of the Wright patent referred to above have required multiple gearing and have been relatively complex in construction. In no case has it been found possible to operate upper and lower iris diaphragms in a synchronous manner with a single gear mechanism and to permit use of the same synchronizing and upper diaphragm operating mechanism with either iris diaphragms or rectangular diaphragms as before. The present invention makes provision for this type of operation.

A lower flange 10 in the element 8 supports by means of bolts and studs 11, a lower iris diaphragm unit 12, which is also attached by connections 13 to the stationary casing 4, so that turning of the shell 8 operates this lower diaphragm element synchronously with the upper diaphragm element 5. The turning movement is accomplished by means of a knob 15 carried in a pinion 16 in mesh with gear teeth 17 formed on the upper plate 18 of the lower iris diaphragm unit, which is secured to the shell 8. A suitable scale 19 may be provided for reading the diaphragm settings.

A bail 20 carrying a focusing light 21 is mounted for movement between the solid line (out of operation) and broken line (operative position) positions of Fig. 1 by means of trunnions 22 and 23 which are rotatively journaled in insulating blocks 24, 25 secured to inwardly facing flange or clip 26 on the lower casing or housing member. There is associated with the trunnion 23 a spring detent or catch means for yieldably holding the bail 20 in either of the two positions of Fig. 1 and also connection and switch means for the light 21.

As best shown in Fig. 5, the trunnion 23 has a cross bore 27 in which a detent arm 28 is mounted, the bore and section 29 of the arm being correspondingly threaded so that the protrusion of the bar 28 from the axis of the trunnion 23 may be regulated as desired. Member 28 cooperates with a spring pressed detent plate 30 which is urged toward the trunnion 23 by springs 31 and contains a concentric surface 32 for engagement by the projection 28 with notches 33 to each side thereof. These notches are arranged 90° apart for holding the bail 20 in either of the positions shown in Fig. 1 which are also 90° apart. Trunnion 23, as best shown in Fig. 4, also carries a knife switch blade 34 which cooperates with co-operating switch element 35 and establishes an electrical connection when the bail 20 is in the lowered or broken line position of Fig. 1. This permits automatically switching on and off the focusing light.

The same general housing and operating elements as just described with relation to the iris diaphragm unit 12 may be used with a rectangular adjustable aperture as shown in Figs. 7 and 8. In this case, there is substituted for the assembly 12, an assembly indicated generally by the reference character 12'. This assembly includes a pair of cooperating diaphragm elements 50. Each of these elements may comprise an upper layer of lead 51 for opacity to the X-rays and a lower supporting layer 52 of a different metal for mechanical strength. An edge 53 of the lower layer is received in a groove formed in a guide member 54, secured to the depending housing element 4. There is associated with each aperture plate 50 an operating arm 55 of arcuate form, one end of which is pivotally attached to member 54 by a stud 56 and the other end of which is pivotally attached by stud or pin 57 to the upper plate 18 previously referred to and which element of the iris diaphragm assembly as well as all other upper elements may be retained. Intermediate its

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ends, the arm 55 has a slot 58 receiving a post 59 which is fixed to the aperture plate 50. In consequence, as the gear wheel plate 18 is rotated, the arms 55 are also rotated about their pivotal attachments 56, but in opposite directions, and move the aperture plates 50 toward and away from each other so as to regulate the size of the rectangular aperture R, which is formed between the angular cut outs 60 of the plates 50. A true rectangular opening is thus provided, and one edge remains in fixed orientation and with its center fixed in any position of adjustment. Plates 50 may also be provided with upper guide members 61 and lower guide members 62 for abutting against the adjacent faces of member 54 and maintaining the plates in constant alignment during their adjusting movements. Rollers 63 may be provided to eliminate undue friction in this movement. It will be observed that the major part of the assembly for iris lower diaphragm and for rectangular aperture lower diaphragm may be identical and unchanged, which feature is of considerable advantage in economy of manufacture and in permitting the alteration of the equipment to suit changing requirements by the user.

What is claimed is:

1. An attachment for X-ray machines comprising a casing having means for attachment to an X-ray machine in the path of the X-ray beam, upper and lower adjustable diaphragm assemblies in the said casing, operating mechanism for the said diaphragm assemblies comprising a rotatable shell carried within the casing, means connecting the said shell to both the upper and lower diaphragm assemblies, and externally operable means for rotatively adjusting the said shell.

2. An attachment for X-ray machines comprising a casing having means for attachment to an X-ray machine in the path of the X-ray beam, upper and lower adjustable diaphragm assemblies in the said casing, operating mechanism for the said diaphragm assemblies com-

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prising a rotatable shell carried within the casing, means connecting the said shell to both the upper and lower diaphragm assemblies, and comprising for the lower diaphragm assembly an annular plate having peripheral gear teeth, and an externally operable pinion meshing with the said annular plate for rotatively adjusting the said shell.

3. An attachment according to claim 2, in which the said casing has an inwardly facing lower flange, and comprising removable diaphragm assembly supports therein carrying the lower diaphragm assembly, whereby the said attachment is capacitated for use with different lower diaphragm assemblies.

4. An attachment according to claim 3, in which the diaphragm assembly comprises a pair of rectangular-aperture plates relatively movable for forming an aperture of adjustable size, means formed in the said supports for guiding the said aperture plates for rectilinear movement, and means for moving the said plates comprising a pair of curved arms, each pivotally attached at one end to a said support and at the other to the said annular plate and having respectively pin and slot connections to the said aperture plates.

5. An attachment according to claim 4, in which the said curved arms extend in slanted position upwardly from their attachments to the said supports to their attachments to the said plates, are positioned for overlapping each other at both ends and are curved concavely toward each other so as not to obstruct the rectangular aperture when in overlapped position.

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