

March 20, 1951

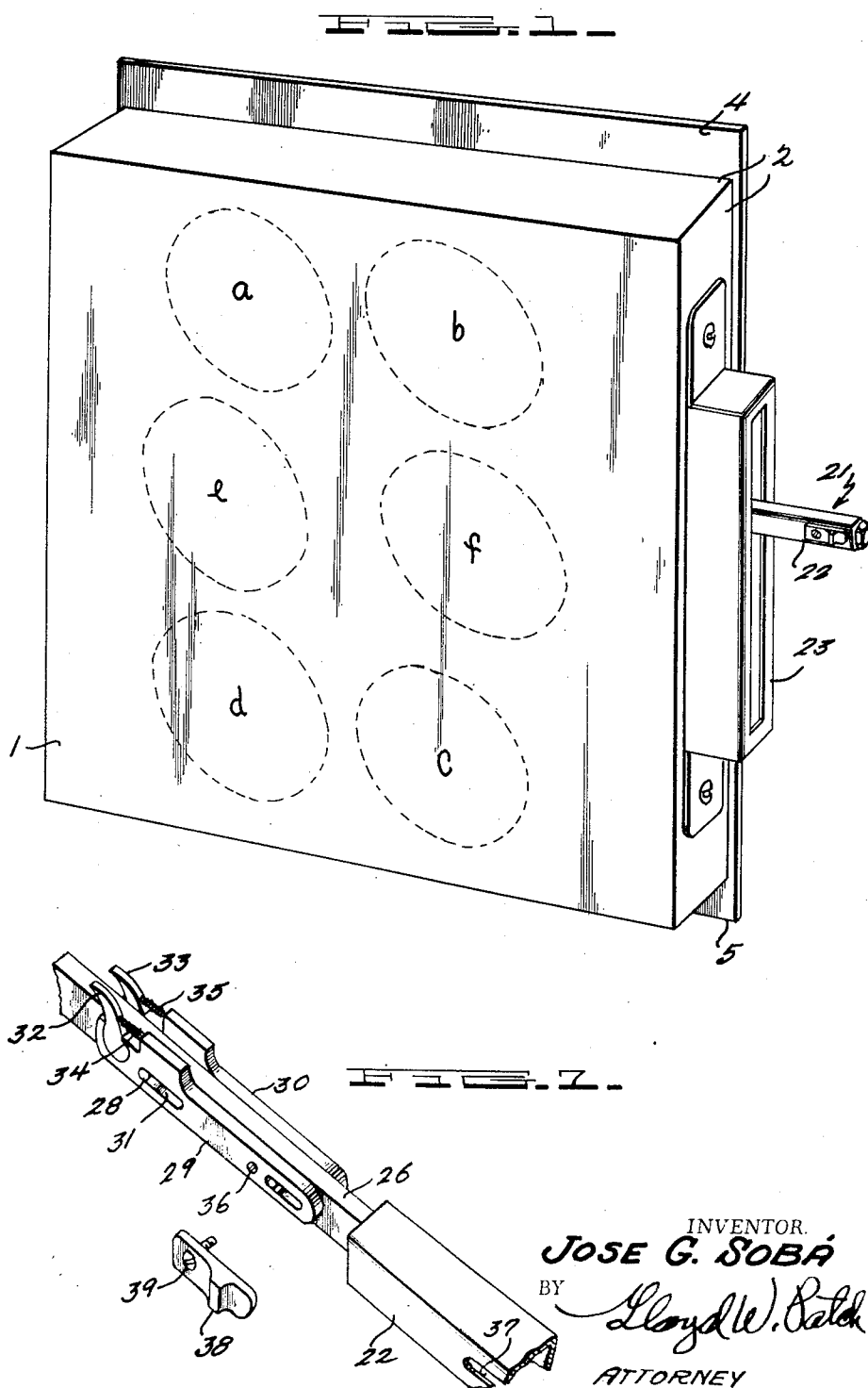
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2,545,899

MULTIPLE X-RAY PICTURE SERIATING DEVICE

Filed Jan. 26, 1949

3 Sheets-Sheet 1



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March 20, 1951

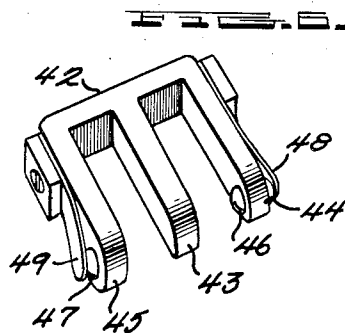
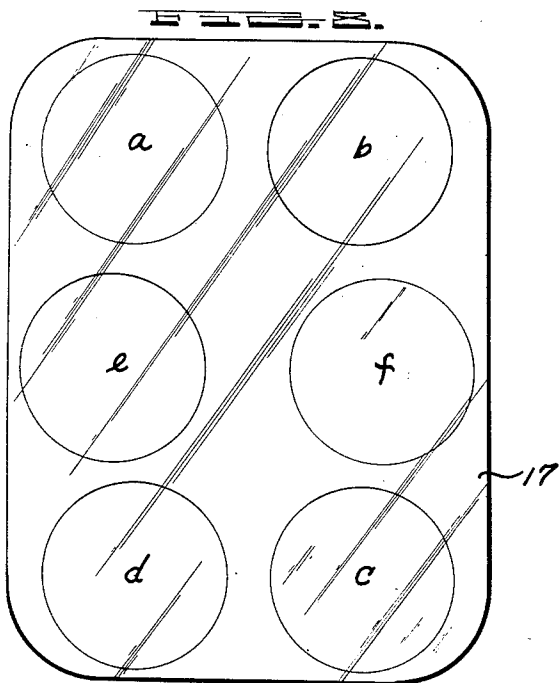
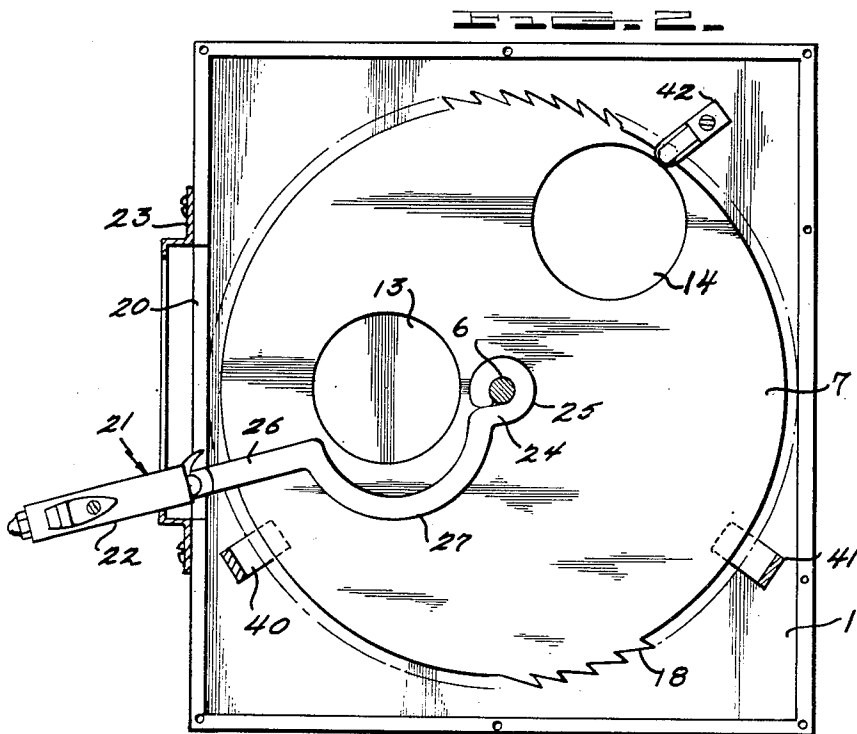
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MULTIPLE X-RAY PICTURE SERIATING DEVICE

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3 Sheets-Sheet 2



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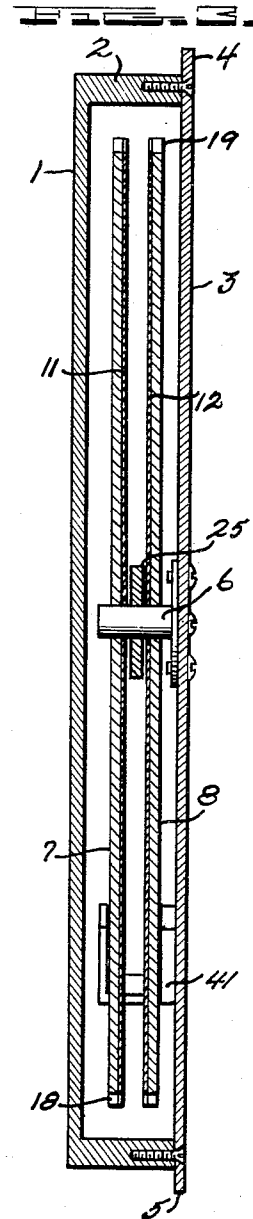
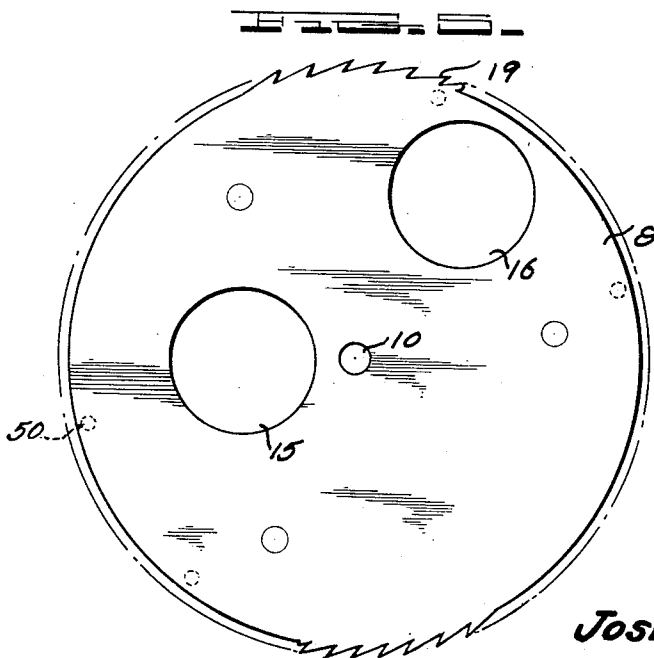
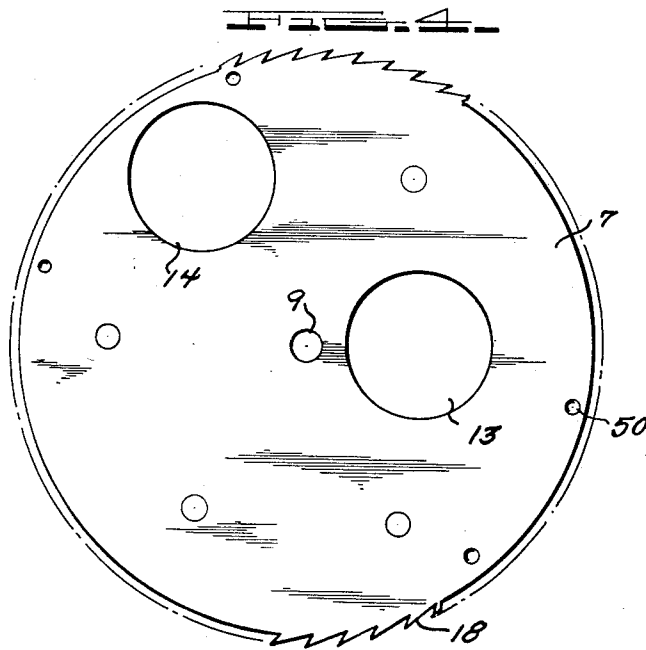
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MULTIPLE X-RAY PICTURE SERIATING DEVICE

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3 Sheets-Sheet 3



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6 Claims. (Cl. 250—66)

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My invention relates to multiple X-ray picture seriating devices, and particularly to means whereby a series of exposures can be made in predetermined arrangement and location on a single sensitized film, plate or the like, of standard dimension as now ordinarily used.

The object of this invention is to provide a device that can be employed with radiographic apparatus as now used, and which will permit the production of four or six exposures or pictures on the usual eight by ten inch or other standard sized film as now supplied commercially in cassette form for X-ray use.

Another object is to provide a multiple X-ray picture seriating device with which six exposures or pictures can be located or seriated upon a single elongated rectangular film with three exposures along each side following the longer dimension.

A further object is to provide multiple X-ray picture seriating device structure that can be readily employed with X-ray and radiosopic apparatus as now in use.

Still another purpose is to provide structure of this character including a pair of rotatable masking disks having exposure openings therethrough at different locations with respect to the center of rotation, together with means to rotate said disks to bring selected openings of the two disks into registry and to revolve the location of the registering openings and expose these openings at desired seriated locations whereby a plurality and series of exposures and pictures can be produced in desired serial location on a single sensitized film.

Another object is to provide two rotatable masking disks having picture or exposure openings therethrough at different locations with respect to the center of rotation, with the two disks being capable of rotatable movement to revolve those portions through which the exposure openings are provided and thus dispose the two disks in such relative position that the opening adjacent to the center and the opening further from the center can be cleared, with the other opening masked off, together with means manually actuatable to move one or either or both of the disks to accomplish the desired registration of either set of openings, and the desired revolution of the disks to present the registering openings in adjusted and predetermined positions required for seriated projections of the series or multiplicity of pictures upon the sensitized film.

Still another purpose is to provide means im-

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penetrable by X-rays to mask out all other portions so that the usual cassette can be subjected to six exposure intervals for taking the six desired separate exposures at the different locations, without danger or possibility of accidental light penetration or exposure.

Still another purpose is to provide a multiple X-ray picture seriating device which can be used with X-ray equipment as already installed, and which will make it possible to give a complete showing and history on say three films, a single film or exposure being made in the usual manner to show the entire area, and then one or two or more films each showing a seriated plurality of smaller related pictures, as for example of a suspected area or a single area in different conditions of functioning, or a member such as a finger in different positions, thus making it possible to greatly reduce the usual X-ray cost and expenses by showing on two or three or more films a multiplicity of different positions or phases that would ordinarily require an expensive series of separate pictures and a separate film for each picture.

Still another purpose of my invention is to permit location of exposures on a single film in such serial arrangement and placement that they can be readily viewed and the several exposures can be compared without recourse to and handling of a number of separate films.

With the above and other objects in view, some of which will be apparent to those skilled in the art, and others of which are inherent in the construction and use of the device, my invention includes such novel features of construction and assemblies of parts which will be hereinafter set forth in connection with the drawings.

In the drawings:

Figure 1 is a view in perspective showing an embodiment of my invention.

Fig. 2 is a view in elevation looking from the opposite side from the showing in Figure 1, and with the cover plate removed and parts in section to better illustrate the construction and assembly of the device.

Fig. 3 is a vertical sectional view taken substantially at right angles to the device.

Fig. 4 is a view in elevation showing one of the exposure seriating and cassette shielding disks.

Fig. 5 is a view similar to the showing in Fig. 4 disclosing the second disk.

Fig. 6 is an enlarged perspective view to better disclose the retaining means employed to hold the disk in adjusted position.

Fig. 7 is an enlarged fragmentary perspective

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view to better illustrate the disk manipulating and revolving means.

The supporting structure is made up as a substantially rectangular case having surrounding edge walls 2, so that this supporting structure becomes in fact a containing case for the other portions of the device. The open side of the case structure as thus provided is adapted to be closed by a cover plate or wall 3, held in place by screws or other suitable fastenings. The cover plate 3 is extended on opposite edges beyond the edge walls 2, to thus provide projecting slide flanges 4 and 5. These projecting slide flanges 4 and 5 can be made to fit standard parts of an X-ray machine or apparatus, to thus permit ready placement and removal of the case with respect to the X-ray equipment.

Since my invention is adaptable to be fitted and used with various types of fluoroscopic and radiographic apparatus, and those skilled in the art will readily understand and appreciate the manner of fitting my device in place for use, no attempt is here made to illustrate or particularly describe any type or construction of X-ray apparatus. Furthermore, the device of my present invention relates to serializing parts and features, rather than to the electrical parts or X-ray portions of the apparatus with which my device is used.

The housing structure, including sidewall 1, edge walls 2, cover plate 3, and other portions of the supporting structure, can be made of aluminum or other suitable metal, of sheet or molded plastics of transparent or translucent properties, and in fact of any other suitable material that will give support to the parts and will allow penetration of X-rays.

A bearing shaft 6 is carried substantially centrally within the casing or housing space as defined by the edge walls 2, and in the present instance I have disclosed this bearing shaft as being carried by the cover plate 3 and extending inwardly substantially toward the sidewall 1. Serializing and masking disks 7 and 8 are made to be of generally circular outline, and are provided in their middle portions with bearing openings 9 and 10. These bearing openings 9 and 10 accommodate bearing shafts so that the two disks are rotatably mounted within the casing structure to be revolved on the same general axis, either independently or together.

These serializing and masking disks 7 and 8 are of sufficient size to have an area greater than and to cover a sensitized film or sheet of usual commercial size, as for example on 8 x 10 inch X-ray film, and the disks 7 and 8 have a lead shielding or masking covering thereon as indicated at 11 and 12, respectively.

The disk 7 has a picture exposure opening 13 therethrough and through the lead shielding 11, offset from the central bearing opening 9 and yet inwardly from the peripheral edge of the disk, and a similar opening 14 is provided through the disk 7 and its shielding 11, at a location spaced outwardly from the central bearing opening 9. Disk 8, and its shielding 12, have an exposure opening 15 therethrough spaced from the center of rotation a distance to substantially register with the opening 13, and disk 8 and its shielding have a second opening 16 therethrough positioned to register with opening 14 when the disks are rotated to bring these openings 14 and 15 into alignment. The openings 13 and 14 of disk 7, and the openings 15 and 16 of disk 8 are so located that when one set of openings is in alignment,

the other set is closed. By this arrangement, the disks 7 and 8 can be moved independently or relatively to close all openings, to bring openings 13 and 15 into aligned registration, or to bring the openings 14 and 16 into aligned registration and to close or block out all other openings.

As is set forth above, the device of my invention is intended and is adapted to permit exposure of six independent pictures or areas of a single elongated sensitized sheet, such as the usual X-ray film as now supplied in commercial form in cassettes. In Fig. 8 of the drawings, I have illustrated diagrammatically such a film, at 17, and have indicated the seriated positioning and the area of six exposures or pictures within the film area. As here shown, the four corner exposures or picture areas are indicated at *a*, *b*, *c*, and *d*, and these areas can be exposed through the exposure openings 14 and 16 of masking disks 7 and 8, when these openings are brought into registry and the disks 7 and 8 are then rotated together. Heretofore four pictures have been taken on a single X-ray film of the usual elongated rectangular form, but this has meant that only four exposures could be made, and the remaining area of the sensitized sheet is worthless and is lost. By bringing the openings 13 and 15 of the disks 7 and 8 into registry, and then rotating the disks together to accomplish disposition of the registering openings substantially laterally with respect to the bearing openings 9 and 10 it is possible to open an exposure or picture area at the lefthand side, as at *e*, between the areas *a* and *d*, and to open for exposure a similar area at the righthand side between the areas *b* and *c*. In this manner, it is possible to provide for exposure and showing of six pictures on the usual X-ray film, and to substantially use the greater area of the film, without resulting waste or unused large areas.

As has been explained, the film or other sensitized sheets, in cassette or other form, will be placed and will be held for exposure in the usual manner and with usual X-ray apparatus, and no attempt is here being made to particularly illustrate or to describe film holding means.

In Figure 1 of the drawings I have attempted to illustrate by dotted lines something of the general location of areas of exposure that can be accomplished with my improved structure.

It will of course be appreciated that the relative areas of exposure for accomplishing the radiographic pictures will result from independent movement of either or both of the disks 7 and 8, and by simultaneous movement of these disks when the desired exposure openings are in registry, and to this end I provide means to rotate the disks independently or together, as may be desired, and means to retain desired settings of the disks.

With the above adjustment and manipulation of the disks in mind, disk 7 is provided with peripheral ratchet teeth 18, and disk 8 has peripheral ratchet teeth 19. These ratchet teeth are preferably of equal size or length on the two disks, and are faced in the same direction, on both disks. Thus, by providing movable means to engage in the teeth of the two disks, it is possible to move or rotate each disk separately, and to revolve the two disks together.

The casing or housing structure has an elongated opening 20 through one side edge thereof, and disk revolving means, generally indicated at 21 is provided with an operating handle 22 extending through this elongated opening to be

manually grasped and manipulated to accomplish desired revolution of the disks. A shield 23 is provided around the elongated opening 20.

The disk revolving means includes an elongated member 24 having a bearing 25 at one end pivotally fitted on bearing shaft 6, and having a straight handle receiving portion 26 at the other end by which handle structure 22 is carried. In the intermediate portion, this elongated member 24 is bowed or formed to follow a substantially semicircular arc, as at 27, to thus offset the intermediate portion of the elongated member so that it will clear and will leave unobstructed the registering openings 14 and 15, when an exposure or picture is to be made through these registering openings to give exposure and picture at one side of the film or sensitized sheet. The bearing portion 25 is fitted on bearing shaft 6 intermediate disks 7 and 8, and the straight extending portion 26 thus projects substantially radially from between the disks 7 and 8 and through the elongated opening or slot 20. The operating handle 22 is a preferably substantially rectangular tubular construction which fits over the extending end of the handle or elongated operating portion 24 and serves as a housing for ratchet means engageable with and released from the ratchet teeth 18 and 19.

The straight handle carrying portion 26 has a pin 28 extending therethrough and projecting on each side; and, ratchet carrying bars 29 and 30 are disposed on opposite sides of the straight handle carrying portion 26 with the ends of the pin 28 slidably received in slots 30. In this way, the ratchet carrying bars 29 and 30 are slidably mounted on the straight portion 26 with their inner ends presented adjacent to the ratchet teeth 18 and 19 of the disks 7 and 8. Ratchet pawls or dogs 32 and 33 are swingably or rackably mounted at the inner ends of the ratchet carrying bars 29 and 30, and springs 34 and 35 are provided to resiliently hold the pawls or dogs 32 and 33 in ratcheting relation.

The ratchet carrying bars 29 and 30 are provided with screwthreaded openings 36, and operating handle portion 22 has slots 37 therethrough registering with these openings 36. Thumb pieces 38 are provided on each side of the tubular operating handle portion 22, and have screws 39 received in the openings 36 and slidable through the slots 37. With this arrangement, pulling or pushing force can be exerted on either or both thumb pieces 38, and in consequence the ratchet carrying bars 29 and 30, separately or together, can be moved into position so that the ratchet pawls or dogs 32 and 33 will engage with and will be disengaged from contact with the ratchet teeth 18 and 19.

Substantially U-shaped bracket members 40 and 41 are carried within the casing structure and embrace the ratchet teeth edges of the disks 7 and 8 to prevent displacement of these disks. As has been stated, it is desirable that means be provided to resiliently retain the disks 7 and 8 in such positions to which they may be adjusted. With this in mind, I provide a substantially E-shaped bracket member 42 within the casing or housing, this E-shaped bracket member being perhaps best shown in Fig. 6. The central branch 43 of this bracket 42 is disposed in the space between the disks 7 and 8, and the outside branches 44 and 45 are disposed adjacent to the outer sides of the disks. The arm portions 44 and 45 have bearing openings therethrough, and detent balls 46 and 47 are fitted loosely in these openings,

springs 48 and 49 being secured on the outer sides of the arms 44 and 45 to exert yielding pressure upon the detent balls 46 and 47 to urge these detent members into contact with the outer sides of the disks 7 and 8. The disks 7 and 8 have a plurality of detent recesses 50 formed in the outer faces thereof at predetermined and desired locations, and aligned to receive the detent balls 46 and 47 to thus resiliently retain the disks 7 and 8 in desired set positions. As stated, it is desirable that detent recesses 50 be so located that the disks with the exposure openings in aligned relation will be positioned to permit seriated exposures to accomplish a picture substantially in the composite and serial sequence and arrangement and placement as indicated in Fig. 8.

In the use of my multiple X-ray seriating device, where the casing is made of transparent or translucent material, the operator can view the parts to accomplish desired registration of exposure openings of the two disks, and to adjust the parts in the serial arrangement or desired settings for the seriated sequence. As the disks are revolved, the registering exposure openings will be revolved in their relative disposition and six exposures can be made to accomplish the showing of six pictures on a single elongated rectangular film of commercial size as now supplied in cassette form for X-ray use. With the projecting slide flanges 4 and 5 serving to support my device in place, the device can be readily fitted into position for use, and can be quickly and readily removed for fluoroscopic examinations or other use.

Also, when the device is in place fluoroscopic examination of affected or suspected areas or parts can be made by adjusting the disks 7 and 8 to bring the desired openings thereof into registration, and by fluoroscopic observation the disposition and the setting of the disks 7 and 8 can be observed and can be determined. Through the medium of the disk revolving means 21, one or both of the disks 7 and 8 can be revolved, and thus desired openings can be brought into registration, and the two disks can then be moved together to revolve the position of the registering openings and accomplish settings for the serial or seriated sequences of exposures. Either the pawl 32 or 33 can be engaged with the ratchet teeth of the corresponding disk by inward pressure exerted upon the thumbpiece 38 to shove the desired ratcheting bar inwardly, and the ratchet pawls can either or both be moved to inoperative positions by exerting outward pulling force upon one or both thumbpieces 38.

From the foregoing it will be seen that I have provided a multiple X-ray picture seriating device of simple or inexpensive construction that can be used with X-ray equipment of standard type as now installed, and which will permit the production of six exposures upon a single film or sensitized sheet of standard and usual sizes of X-ray film as now commercially supplied for X-ray use, and that the exposures can be serially arranged or located in desired sequence and in position to substantially fit upon and fill the X-ray film in convenient and economical manner.

While I have herein shown and described only certain specific embodiments of my invention and have suggested only certain possible modifications, it will be appreciated that many changes can be made in the form, construction, and arrangement of the parts, and in the materials where specified, without departing from the spirit and scope of my invention.

I claim:

1. A multiple X-ray picture seriating device comprising a supporting structure, and a pair of rotatable masking disks having two exposure openings therethrough with one opening nearer the center of rotation than the other, said masking disks being rotatable separately and together to bring the openings into registry and to vary the position of the registering openings.

2. A multiple position picture exposing and seriating device for making a plurality of exposures on a single sensitized sheet of material comprising a supporting structure, a pair of masking disks rotatably mounted on a common center on the supporting structure, each of said disks having two picture exposure openings therethrough with one opening nearer the center of rotation than the other, and rotating means to move said disks to bring the openings into registry and to dispose the registering openings in desired relative location with respect to the area of the sensitized sheet.

3. A multiple position exposing and seriating device for making a plurality of exposures on a sheet of sensitized material comprising a supporting structure, a pair of masking disks rotatably mounted on a common center on the supporting structure, each of said disks having at least two exposure openings therethrough with one opening located nearer the center of rotation than the other, the disks being independently and relatively rotatable to bring each set of openings into registry as desired and to mask out the other set of openings, and the disks being rotatable together to dispose the registering openings over a desired portion of the sensitized sheet.

4. A multiple X-ray picture seriating device for use in locating and masking a plurality of exposure openings and areas on a sensitized sheet comprising a housing structure, a pair of masking disks rotatably mounted in said housing structure and capable of revolution on a common center, manually actuatable means operable from the outside of the housing to revolve said disks singly and together, said disks having two exposure openings therethrough with one opening spaced nearer the center of rotation than the other whereby the openings can be brought into registry and registering openings adjusted to different locations by revolving the disks, and means within the housing to hold said disks in desired adjusted positions.

5. A multiple X-ray picture seriating device for use between an X-ray machine and a sensitized sheet comprising an enclosing casing, a bearing shaft within the casing, a pair of masking disks of greater diameter than the size of the sensitized sheet mounted on said bearing shaft

for rotation, each of said disks having at least two exposure openings therethrough with one opening located near the center of rotation, the disk being relatively rotatable to selectively bring each set of openings into registry as desired and to mask out the other set of openings and said disks being rotatable together to dispose the registering openings over a desired portion of the sensitized sheet, said disks being provided with peripheral ratchet teeth, a disk revolving means including an elongated member swingably mounted on bearing shaft intermediate the two disks, an operating handle on said elongated member available for manually swinging the elongated member from the outside for the housing casing, and manually controllable ratchet means on said elongated member engageable with the ratchet teeth of the disk.

6. A multiple X-ray picture seriating device for use between an X-ray machine and a sensitized sheet comprising a housing casing, a bearing shaft within the housing casing, a pair of masking disks of greater size than the sensitized sheet rotatably mounted on said bearing shaft, each of said disks having at least two exposure openings therethrough with one opening located nearer the center of rotation, the disks being relatively rotatable to bring each set of openings into registry as desired and to mask out the other set of openings, the disks being rotatable together to dispose the registering openings over a desired portion of the sensitized sheet, said disks having peripheral ratchet teeth, disk revolving means including an elongated member swingably mounted on one of its ends on the bearing shaft intermediate the two disks and having its other end extending outside the housing casing for manual manipulation to swing the elongated member, ratchet carrying slide members slidably mounted on each side of the elongated member, spring held ratchets carried at the inner ends of said slide members in position to engage with the ratchet teeth of the disk, manually actuatable means to move such slide members to adjust said ratchet members into and out of ratchet tooth engaging positions, and latch detent means to hold the two disks in desired adjusted positions.

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