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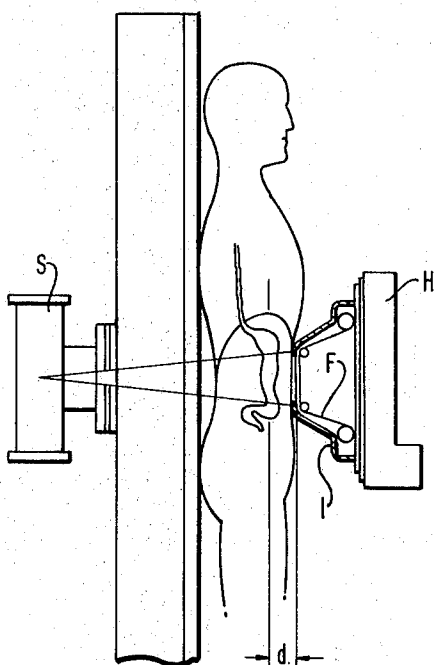
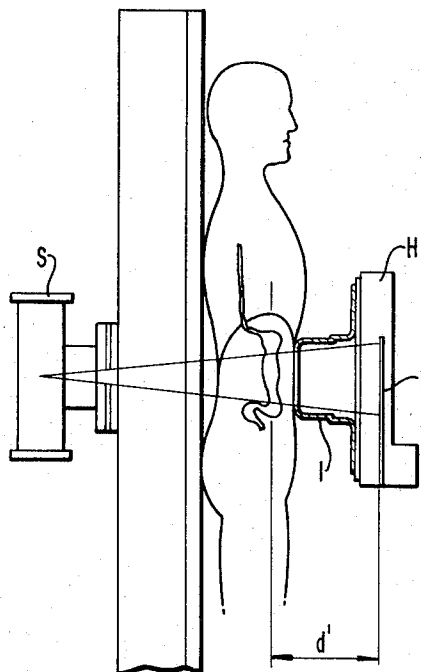
F. FISCHER  
FILM POSITIONING ARRANGEMENT WITHIN A BODY PRESSURE MEMBER  
FOR X-RAY MACHINES

3,535,518

Filed May 9, 1969

3 Sheets-Sheet 1

PRIOR ART **FIG. 1**



**FIG. 2**

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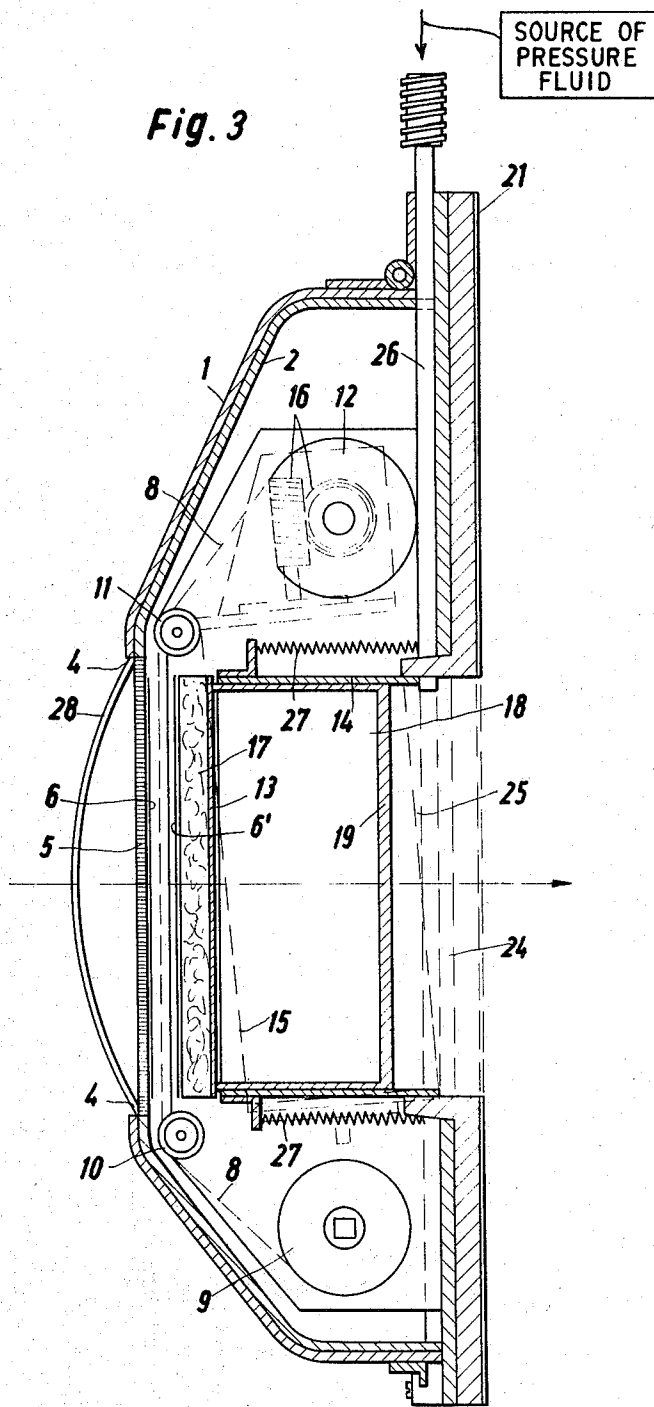
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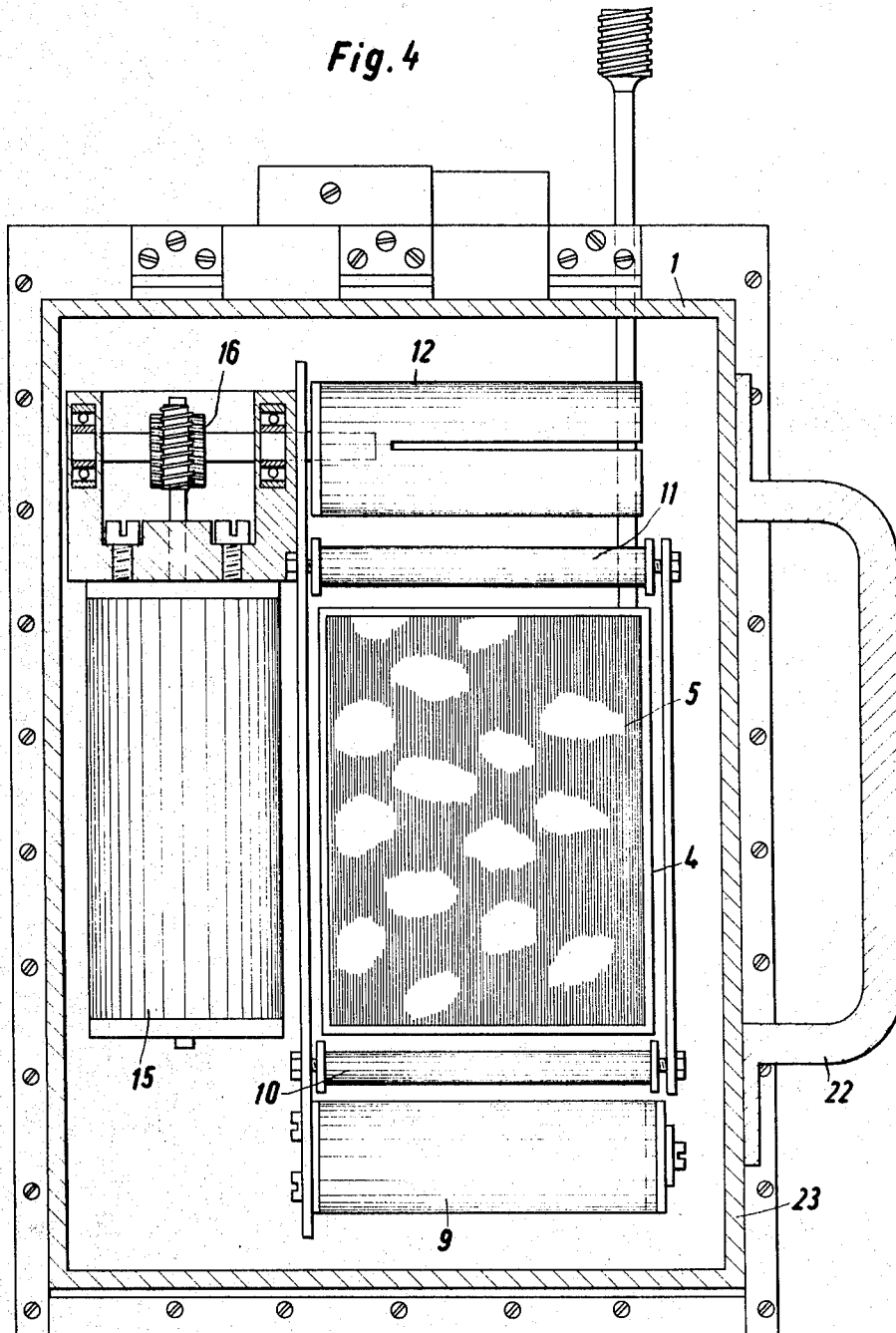
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Fig. 4



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## FILM POSITIONING ARRANGEMENT WITHIN A BODY PRESSURE MEMBER FOR X-RAY MACHINES

Fredi Fischer, 32 Mullerstr., 1 Berlin 65, Germany  
Continuation-in-part of application Ser. No. 586,310,  
Oct. 12, 1966. This application May 9, 1969, Ser.  
No. 823,349

Claims priority, application Germany, Oct. 15, 1965,  
F 47,453

Int. Cl. G03b 17/26

U.S. Cl. 250—66

6 Claims

### ABSTRACT OF THE DISCLOSURE

A film positioning mechanism for use in X-ray machines wherein an X-ray impermeable housing is provided with a wall portion forming a pressure member to be pressed against the body of the patient and having an X-ray transparent window therein, and film supply means for guiding an X-ray sensitive film strip into the pressure member for contact with the inner surface of the window.

This application is a continuation-in-part application of co-pending application Ser. No. 586,310 filed Oct. 12, 1966, now abandoned.

The present invention relates in general to X-ray machines, and more particularly to X-ray machines especially designed for gastrointestinal series exposures.

In X-ray machines designed for stomach and intestine diagnosis, a box or housing was provided within which the film transporting mechanism and the window for the X-rays were accommodated. However, in order to photograph particular body elements which may be normally blocked from direct exposure, it is generally necessary to manipulate the fat pads and organs of the patient by application of pressure during the exposure. This has been accomplished by providing on the housing of the radioscapy apparatus a projecting member which is placed against the body of the patient whose X-ray picture is to be taken. The front wall of this projection, that is the wall portion which presses against the body of the patient, is provided with a window in which a transparent glass or quartz member is located. Thus, exposures are taken through the window which is in direct contact with the body of the patient.

In the known arrangement of the type described, due to the presence of the projecting pressure member, the magazine containing the film strip for making a series of photographs is arranged so as to be rearwardly spaced from the window through which the exposure is taken with the result that the film is spaced relatively far from the body of the patient, and accordingly, the resulting photographs are rather unsharp. On the other hand, if the projecting pressure member is eliminated, not only will it be extremely difficult to obtain photographs of inaccessible body elements, but also, the focus of apparatus, while improved, will still not be entirely satisfactory due to difficulty in getting the radioscapy housing close to the body. Obviously, the fact that the film is located within the housing means that the film is also spaced inwardly away from the window at least by the thickness of the housing wall and is therefore further spaced from the body of the patient, additionally contributing to the unsharp exposures.

It is therefore a general object of the present invention to overcome the disadvantages of the prior art as mentioned above.

A more specific object of the invention is to provide a film positioning mechanism for X-ray machines which

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places the film as closely as possible to the body of the patient whose X-ray photograph is to be taken.

Another object of the invention is to provide such a mechanism for use in X-ray machines, which permits the taking of a series of photographs in quick succession.

In accordance with one feature of my invention, I provide a film positioning mechanism for use in X-ray machines, which comprises a housing having a projecting pressure member of a material which is impermeable to X-rays, which projecting member is provided with a wall portion adapted to be placed against the body of a patient, such wall portion having a cut-out therein and a transparent window member located in the cut-out. I further provide film supply means arranged in the projecting member itself to one side of the window so as to be shielded by the material of the member and the housing and including a supply of strip-shaped film, and furthermore I provide intermittently operable film take-up means which is located to another side of the window opposite the one side, the strip-shaped film extending from the film supply means to the film take-up means and having a major surface facing the window parallel thereto. Finally, I also provide biasing means for biasing successive increments of the strip-shaped film into engagement with the window provided in the outside wall of the projecting member, and for doing so in the intervals between intermittent operation of the film take-up means.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a schematic diagram illustrating the manner in which gastrointestinal series exposures have been obtained with a conventional X-ray apparatus;

FIG. 2 is a schematic diagram similar to FIG. 1 wherein an X-ray apparatus in accordance with the present invention is utilized;

FIG. 3 is a vertical section through a mechanism in accordance with the present invention; and

FIG. 4 is a rear-view, partly sectioned, of the device shown in FIG. 3.

Referring first to FIG. 1 of the drawings, an X-ray apparatus of conventional configuration provides a housing H of a radioscapy mechanism, which includes a film transporting mechanism and possible also a fluorescent screen for direct viewing in addition to other control elements (not shown). The housing H has a projecting member 1' which is designed to press against the body of the patient, as shown, while X-rays from source S pass through the stomach and intestine area of the body and projecting member 1' to the film F within the housing H. As seen in the figure, the object-film distance  $d'$  is extremely long, thereby preventing proper focusing.

In FIG. 2 an X-ray apparatus including a film positioning mechanism in accordance with the present invention, the film F is provided within the projecting member 1 in direct contact with the inside of the wall portion of the projecting member 1 pressing against the body of the patient. Thus, the object-film distance in this case becomes absolutely minimum, thereby remarkably improving the focus of the X-ray photograph so that a very clear image is obtained.

Discussing now the invention projecting member in detail in connection with FIGS. 3 and 4 thereof, it will be seen that the projecting member is indicated with reference numeral 1 and has a substantially frustoconical configuration. It is provided with a rail or similar fastening

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device 21 which is engaged in complementary rails or devices provided on the housing of a movable radioscopia apparatus. The coupling of the rails 21 with their counterparts on the movable radioscopia apparatus establishes the necessary contacts with the electrical switching devices for the X-ray machine, not shown since it forms no part of the present invention.

The housing of the X-ray apparatus along with the projecting member 1 consists largely of organic plastic material and is provided with a handle or grip 22 on one wall 23 thereof, this wall 23, for example, being removable so as to make the interior of the projecting member 1 accessible for the insertion and removal of the film. The exterior of the housing is covered with a layer of lead sheet material of approximately 1 mm. thickness, although this thickness can vary and is mentioned here only for purposes of information. The front wall of the projecting member 1, that is that part which is placed into engagement with the body of a patient whose X-ray photograph is to be taken, is provided with a cut-out 4 which may in accordance with conventional practice be approximately 90-by-120 mm. A flat window member, with a screening plate is indicated with reference numeral 5 and it will be seen that it is provided with a fine grid. A foil 6 can be provided rearwardly of the window member 5 to reinforce the same.

A film strip 8, which is coated on both sides thereof, is provided within the projecting member 1 and conventionally has a width of 89 mm., although again this figure is mentioned only for purposes of information. The supply of the film strip 8 is provided on a supply spool 9 and the strip is guided by guide rollers 10 and 11 past the window 5 to a take-up spool 12 which is rotatable by a motor 15 and a conventional gear arrangement 16. During exposure, the film strip 8 is pressed against the inner side of the window member 5, that is in the illustrated embodiment directly against the reinforcing foil 6. For this purpose there is provided a pressure plate, for instance of foam rubber, which is indicated with reference number 14 and whose front face which engages the film strip 8 is covered with a reinforcing foil 6'. The rear of the pressure plate 17 is backed by a support plate 13 which constitutes an end wall of a hollow piston 18 whose opposite end wall is indicated with reference number 19. The piston 18 is guided in a cylinder 14 whose rear wall 24 preferably consists of organic plastic material. The pressure space in the interior of cylinder 14 is indicated with reference numeral 25 and by a suitable arrangement, which is not illustrated because it is entirely conventional and well known to those active in the art, a pressure fluid can be introduced into the interior of the cylinder 14. A conduit 26 may be provided for introducing the pressure fluid into the cylinder 14 and it will be obvious that when the piston 18 moves to the left in FIG. 3 under the influence of such pressure fluid, the film strip 8 is pressed against the reinforcing foil 6 which in turn is in direct engagement with window member 5. Return springs 27 are provided which move the piston 18 to the right, that is out of engagement with the film strip 8, when the pressure of fluid in the interior of cylinder 14 ceases.

Obviously, the provision of the film strip 8 on the two spools 9 and 12 makes possible the use of a long strip so that, if the strip is moved in a stepwise manner past the window member 5, as is provided for in accordance with the present invention, the invention makes it possible to take a relatively long series of X-ray photographs without having to exchange the film magazine. At the same time, there is only a minimum space now between the film and the body of the patient, since the film strip 8 of course engages directly the window member 5 through the intermediary of the reinforcing foil 6 which is very thin, so that distortion and lack of sharpness is substantially eliminated by this arrangement.

In accordance with the invention it is also possible to

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provide a rubber or plastic bulb or bladder 28 which can be arranged exteriorly of the window member 5 covering the same, and which can be inflated by any suitable device, for instance by hand via an air bulb, and this bladder 28 can be provided for use in such cases when it is necessary to press against certain portions of the body of the patient, for instance if fatty tissue is to be compressed or moved out of the way.

In an entirely conventional manner the device can be actuated by a remotely located switching control and it will be understood that the taking of the X-ray photographs takes place in the following sequence: firstly, it is determined that X-ray beam is extinguished; secondly, the film strip 8 is advanced from spool 9 to spool 12 by a distance corresponding to the height of the window member 5; thirdly, the piston 18 presses the film strip 8 against the reinforcing foil 6 of window member 5; simultaneously the exposure is taken by generating that X-ray beam for a given period of time; and finally the exposed film portion or increment of the strip 8 is moved upwardly beyond the window member 5 so that it is now protected by the material of housing and projecting member 1 against the adverse influence of X-rays during subsequent exposures.

It will be understood that the take-up spool 12 is rotated in a take-up sense by the motor 15 via the gear 16, which can advantageously be a worm gear arrangement, and that such advancing of the spool 12 is accomplished intermittently. The entire process, from advance of the film through taking of the exposure and to the extinguishing of the X-ray beam takes approximately 4 seconds with the device illustrated in FIG. 1.

Of course it should be understood that the piston and cylinder arrangement and its actuation by means of a pressure fluid can be replaced by another suitable mechanism, for instance by springs, electromagnetic devices, or the like. This does not form an essential limitation and has been mentioned here only for purposes of example.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of film-positioning mechanisms for X-ray machines differing from the types described above.

While the invention has been illustrated and described as embodied in film-positioning mechanism for an X-ray machine, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence apparent to one of ordinary skill in the art.

What is claimed as new and desired to be secured by Letters Patent is:

1. Film positioning arrangement for X-ray machines, comprising radioscopic housing means opaque to X-rays and a relatively substantially smaller projecting member opaque to X-rays mounted on said housing means for pressing against and manipulating body parts of a patient, said projecting member being provided with an X-ray permeable window having an inner surface; film means located entirely within said projecting member on one side of said window including film supply means for carrying a strip-shaped film; film take-up means for receiving film from said film supply means located at the opposite side of said window so that a film extending from said supply means to said take-up means extends parallel to said inner surface spaced from and facing the

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same; and pressure means for selectively pressing increments of the film into engagement with said inner surface of said window.

2. An arrangement as defined in claim 1, wherein said pressure means comprises pressure fluid-operable means.

3. An arrangement as defined in claim 1, wherein said pressure means comprises a cylinder located in said projecting member on a side of the film remote from said window, and a piston slidably movable in said cylinder toward and into contact with said film for pressing the same against said surface in response to the introduction of a pressure-fluid into said cylinder, and return-spring means permanently urging said piston in a direction away from the film.

4. An arrangement as defined in claim 1, and further comprising X-ray permeable bladder means located exteriorly of said projecting member and covering said window, said bladder means being selectively inflatable for contacting the skin of a patient.

5. An arrangement as defined in claim 1 wherein said

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film supply means and said film take-up means each include at least one guide member located within said projecting member adjacent said window at respective sides thereof for guiding said film past said window closely adjacent thereto.

6. An arrangement as defined in claim 5 wherein said pressure means extends at least in part into said projecting member to a point closely adjacent said film so as to press said film against said window upon actuation.

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