Sept. 5, 1961 C. L. CURRY 2,999,159

CASSETTE CHANGER FOR FEMORAL ARTERIOGRAPHY

Filed Feb. 24, 1959 2 Sheets-Sheet 1

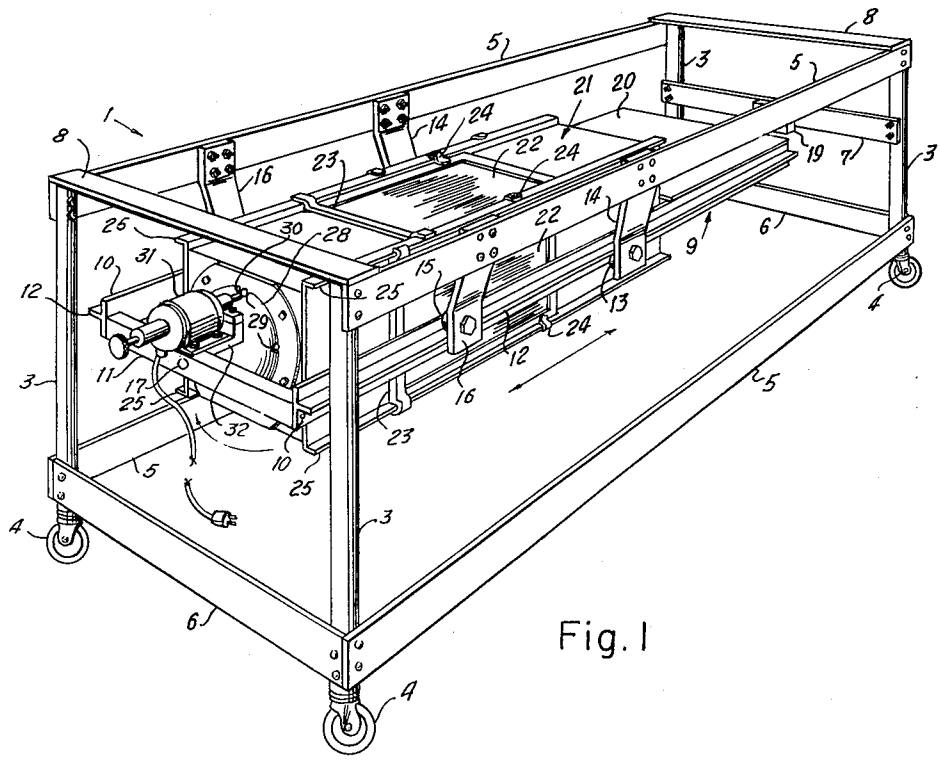


Fig. 1

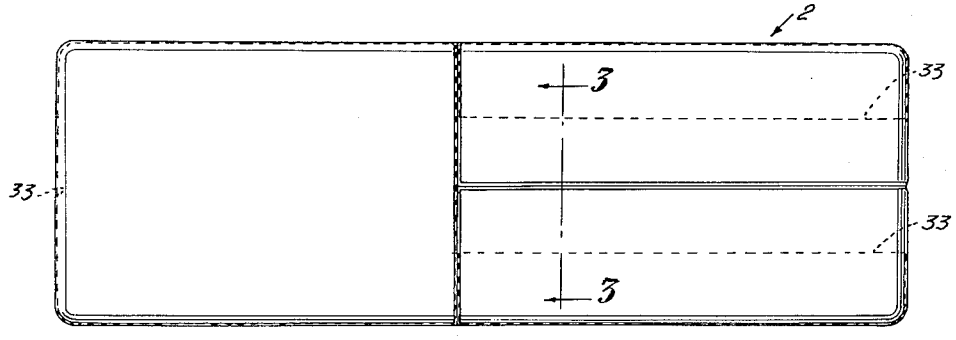


Fig. 2

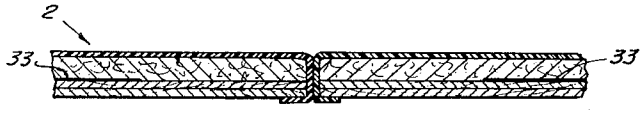


Fig. 3

INVENTOR

Charles L. Curry

BY Cecil L. Wood

ATTORNEY

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CASSETTE CHANGER FOR FEMORAL ARTERIOGRAPHY

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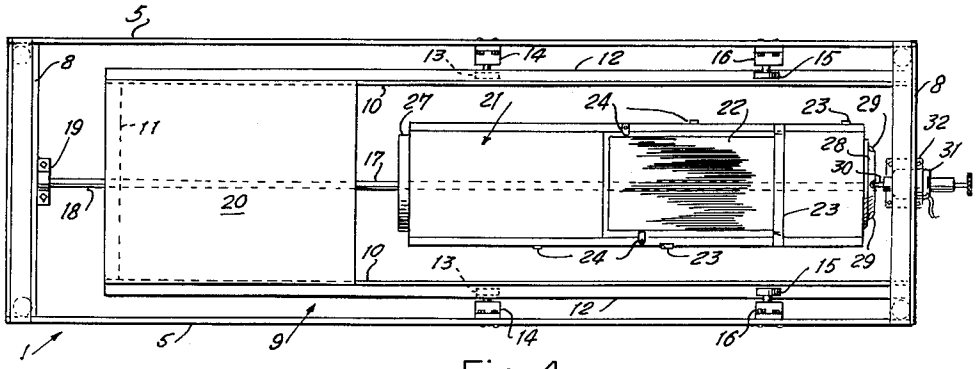


Fig. 4

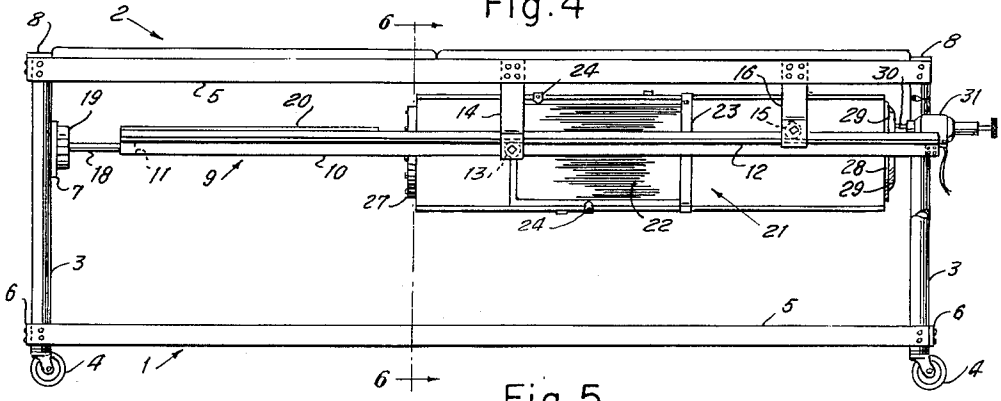


Fig. 5

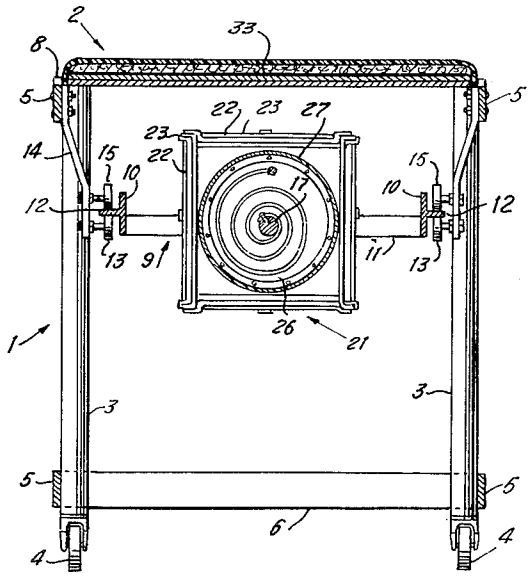


Fig. 6

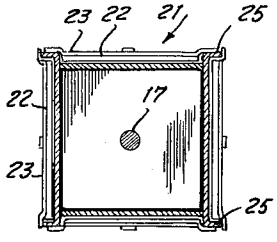


Fig. 7

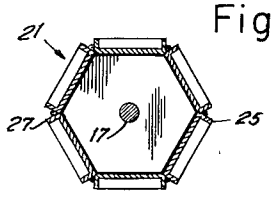


Fig. 8

INVENTOR
Charles L. Curry

BY Cecil L. Wood

ATTORNEY

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CASSETTE CHANGER FOR FEMORAL ARTERIOGRAPHY

Charles L. Curry, 1000 Montgomery, Fort Worth, Tex.

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5 Claims. (Cl. 250—58)

This invention relates to a cassette changer for femoral arteriography, and it concerns more particularly an X-ray table for use in femoral arteriography having incorporated therein an automatic cassette changer.

In femoral arteriography, which involves taking X-ray pictures of a patient's legs for the purpose of studying the condition of his arteries, it is common practice to inject a dye in a leg artery, for use as a tracer, and thereafter to take one or more X-ray pictures of the leg.

An object of this invention is to provide an improved apparatus whereby a series of X-ray pictures may be taken of a patient's leg, upon injection of such a tracer, showing progressively longitudinal sections of the leg as the tracer advances along the artery.

Another object of the invention is to provide apparatus for use in femoral arteriography comprising, in combination with an X-ray table adapted to support a patient in position for taking X-ray pictures of his legs, automatic means for presenting in rapid succession, for predetermined time intervals, a series of prepared X-ray film units, commonly referred to as cassettes, in operative position below the table top, and below one of the patient's legs supported on the table top, whereby the cassettes are adapted to be progressively exposed to the action of X-rays from a source positioned above the table.

Another object of the invention is to provide apparatus as described which includes a polygonal drum rotatably mounted on a fixed shaft arranged longitudinally of the table, below the top thereof, the drum being formed of lead sheeting and having means for attaching cassettes to the respective sides thereof, and arranged in advancing sequence, a coil spring surrounding the shaft and acting on the drum to rotate it relative to the shaft, mutually engaging means carried by the table and the drum adapted to releasably secure the drum in each of several rotative positions, whereby the cassettes are successively presented in operative position below the table top, and electrically operable means for releasing the mutually engaging means.

Another object of the invention is to provide apparatus as described in which the shaft carrying the cassettes supporting drum is rigidly secured to a sub-frame which is supported on the frame of the table, below its top, for longitudinal movement relative thereto, whereby the cassette supporting drum is conveniently accessible.

Another object of the invention is to provide apparatus as described which permits the use of cassettes of relatively small size, which are substantially less expensive than larger ones.

Another object of the invention is to provide apparatus as described whereby a series of X-ray pictures may be taken of a patient's leg, upon injection of a tracer, showing progressively longitudinal sections of the leg as the tracer advances along the artery, the section shown in at least one of the pictures being partially coextensive with the section shown in another picture of the series. The tracer dye usually advances relatively fast and it is desirable to expose the cassettes along the course of the tracer progressively in order to insure a clear and accurate picture which may not result by the use of a single cassette showing the entire arterial system along the leg in a single exposure.

Another object of the invention is to provide apparatus as described in which the width of each side of the cassette supporting drum corresponds substantially to

the width of a cassette, the drum being substantially longer than the cassettes and having means for securing the respective cassettes to adjoining sides thereof in progressively spaced relation to its ends.

Another object of the invention is to provide apparatus as described in which the table top has lead strips arranged along opposite sides thereof and extending a portion of its length corresponding substantially to the length of the cassette supporting drum, the lead strips being spaced apart from each other a distance corresponding substantially to the width of a cassette.

Another object of the invention is to provide apparatus as described which is of simple, rugged construction, is adapted to be manufactured inexpensively, and is efficient in operation and durable in use.

The invention will be readily understood by referring to the following description and the accompanying drawing, in which:

FIGURE 1 is a perspective view of an X-ray table embodying the invention, the top of the table being removed to show the cassette supporting drum.

FIGURE 2 is a top plan view of the table top.

FIGURE 3 is a fragmentary sectional elevational view, on an enlarged scale, taken on the line 3—3 of FIGURE 2.

FIGURE 4 is a top plan view of the table, showing the top removed.

FIGURE 5 is a side elevational view of the table, showing the top in place.

FIGURE 6 is a sectional elevational view taken on the line 6—6 of FIGURE 5.

FIGURE 7 is a cross sectional view of the cassette supporting drum and the fixed shaft on which the same is rotatably supported, and

FIGURE 8 is a view similar to FIGURE 7, showing a modified form of the cassette supporting drum.

Referring to the drawing, the numeral 1 designates generally the frame of an X-ray table adapted to support a patient in position for taking X-ray pictures of his legs, and the numeral 2 designates the top thereof.

As shown, the frame 1 is generally rectangular, and is supported at its corners on two pairs of legs 3, which have casters 4. Two pairs of side rails 5 are each connected at its ends to the legs 3 of one pair. The side rails 5 of each pair are spaced vertically relative to each other, and are connected to the corresponding legs 3 adjacent their upper and lower ends, respectively. A pair of end rails 6, which are positioned adjacent opposite ends of the frame 1, are each connected at its ends to a leg 3 of each pair, adjacent its lower end.

A cross bar 7, which is positioned adjacent one end of the frame 1, is connected at its ends to a leg 3 of each pair, intermediate its ends, in vertically spaced relation to the adjacent end rail 6, for use as hereinafter described.

A pair of cross bars 8 are positioned adjacent opposite ends of the frame 1, and are supported at their ends on the uppermost side rails 5.

A sub-frame, which is indicated generally by the numeral 9, is supported on the frame 1, below the top 2, for longitudinal movement relative to the frame 1, whereby the sub-frame 9 is movable from a retracted position, in which it is disposed below the top 2, to an extended position in which it extends longitudinally beyond the adjacent end of the top 2.

The sub-frame 9 is generally rectangular, and includes a pair of side bars 10 which are connected at their ends by a pair of end members 11. The side bars 10 are T-shaped in transverse section, and have longitudinal flanges 12 which extend laterally outwardly from opposite sides of the sub-frame 9, for use as hereinafter described. The end members 11 advantageously may be right angular in transverse section.

A pair of rollers 13, which are mounted on brackets 14 secured to the uppermost side rails 5, intermediate their ends, are engageable under the flanges 12 of the respective side bars 10, whereby the sub-frame 9 is adapted to be supported for longitudinal movement relative to the frame 1.

A pair of rollers 15, which are mounted on brackets 16 secured to the uppermost side rails 5 near one end of the frame 1, are engageable over the flanges 12 of the respective side bars 10 to thereby limit pivotal movement of the adjacent end of the sub-frame 9 about the rollers 13 in an upward direction while at the same time permitting downward pivotal movement thereof.

A fixed shaft 17 is arranged longitudinally of the sub-frame 9, along its longitudinal center line, and is rigidly connected to the end members 11. One end of the shaft 17 extends outwardly beyond the adjacent end member 11, as at 18, for engagement with a clamp 19 mounted on the cross bar 7, whereby the extended end 18 of the shaft 17 is adapted to be removably secured to the frame 1.

The ends of the side bars 10 adjacent the extended end 18 of the shaft 17 are additionally connected in parallel, spaced apart relation to each other by a flat plate 20, which is also connected to the shaft 17. The plate 20 serves as a spacer element, whereby the side bars 10 and the shaft 17 are rigidly connected in parallel, spaced apart relation to each other, and also serves as a counter weight, the weight thereof being balanced against the weight of the opposite end of the sub-frame 9.

A polygonal drum 21 is rotatably mounted on the shaft 17, adjacent the end thereof opposite the extended end 18. The drum 21 comprises a light metal frame which may be enclosed by lead sheeting and has means as hereinafter described for attaching cassettes, indicated by the numerals 22, to the respective sides thereof.

A plurality of strips 23, which extend across the several sides of the drum 21, are each engageable with an end portion of a cassette 22, and a plurality of pairs of clips 24, which are attached to the sides of the drum 21 in spaced apart relation to the respective strips 23, are engageable with the ends of the cassettes 22 opposite the strips 23, whereby the cassettes 22 are adapted to be removably secured to the sides of the drum 21. Each side of the drum 21 has a pair of longitudinal flanges 25 positioned adjacent the edges thereof. The flanges 25 are engageable with the longitudinal edges of the cassettes 22.

The sides of the drum 21 are substantially rectangular, and the width of each side corresponds substantially to the width of a cassette 22. The drum 21 is substantially longer than the cassettes 22, and the positions of the strips 23 and the clips 24 are such that the cassettes 22 are adapted to be secured, respectively, to adjoining sides of the drum 21 in progressively spaced relation to the ends of the drum 21.

As shown in FIGURES 1 to 7, the drum 21 has four sides, while FIGURE 8 shows a drum 21 having six sides.

A coil spring 26 surrounds the shaft 17 and is connected at its ends to the shaft 17 and the drum 21. The spring 26 acts on the drum 21 to rotate it relative to the shaft 17. The spring 26 is enclosed within a spring housing 27 which is attached to the end of the drum 21 nearest the extended end 18 of the shaft 17, in spaced apart relation to the plate 20.

A circular flange 28 surrounds the shaft 17 and is attached to the end of the drum 21 opposite the spring housing 27, in opposed relation to the adjacent end member 11 of the sub-frame 9. A plurality of circumferentially spaced indentations 29 are formed in the peripheral edge of the flange 28 for engagement by a pin 30, which is actuated by a solenoid 31 mounted on a bracket 32 attached to the adjacent end member 11. The pin 30 is adapted to releasably secure the drum 21 in each of several rotative positions, whereby the cassettes 22 are successively presented in operative position below the table top 2. The pin 30 is adapted to be disengaged from the respective indentations 29 upon energizing the solenoid 31.

The invention contemplates the use of suitable electrical circuits (not shown) whereby the drum 21 may be caused to move from one rotative position to another, according to a predetermined cycle, whereby the cassettes 22 are successively presented in operative position below the table top 2, for predetermined time intervals, automatically upon closing a single switch.

A pair of lead strips 33 are arranged along opposite sides of the table top 2, and extend a portion of its length corresponding substantially to the length of the drum 21. The lead strips 33 are spaced apart from each other a distance corresponding substantially to the width of a cassette 22.

The lead of the drum 21 prevents exposure of more than one of the cassettes 22 at a time, and the lead of the strips 33 prevents scattered radiation.

The apparatus shown is fully automatic, and is adapted to be operated by remote control, whereby only the patient needs to be exposed to radiation, the operator remaining in a safe place.

The invention may be modified in various ways without departing from the spirit and scope thereof.

What is claimed is:

1. Apparatus for use in femoral arteriography comprising, in combination with an X-ray table adapted to support a patient in position for taking X-ray pictures of his legs, automatic means for presenting in rapid succession, for predetermined time intervals, a series of cassettes in operative position below the table top, and below one of the patient's legs supported on the table top, the said automatic means comprising a rotatable polygonal drum carrying one of said cassettes on each planar side thereof and spaced longitudinally of said drum whereby the cassettes are adapted to be progressively exposed to the action of X-rays from a source positioned above the table and at different stations therealong.

2. Apparatus for use in femoral arteriography comprising, in combination with an X-ray table adapted to support a patient in position for taking X-ray pictures of his legs, a polygonal drum rotatably mounted on a fixed shaft arranged longitudinally of the table, below the top thereof, the drum being formed of lead and having means for attaching a cassette to each of the respective sides thereof, and spaced longitudinally of said drum, a coil spring surrounding the shaft and acting on the drum to rotate it relative to the shaft, mutually engaging means carried by the table and the drum adapted to releasably secure the drum in each of several rotative positions, whereby the cassettes are successively presented in operative position below the table top, and at different successive stations therealong and electrically operable means for releasing the mutually engaging means.

3. Apparatus for use in femoral arteriography comprising, in combination with an X-ray table having a frame and a top supported on the frame, a sub-frame having means supporting it on the frame of the table, below its top, for longitudinal movement relative to the table, whereby the sub-frame is movable from a retracted position, in which it is disposed below the table top to an extended position in which it extends longitudinally beyond the adjacent end of the table top, a fixed shaft arranged longitudinally of the sub-frame, a polygonal drum rotatably mounted on the shaft, the drum being formed of lead and having means for attaching a cassette to each of the respective sides thereof, the said cassettes arranged at different spacings along said drum, a coil spring surrounding the shaft and acting on the drum to rotate it relative to the shaft, mutually engag-

ing means carried by the sub-frame and the drum adapted to releasably secure the drum in each of several rotative positions, whereby the cassettes are successively presented in different operative positions below and along the length of the table top, and electrically operable means for releasing the mutually engaging means.

4. The structure of claim 2, the sides of the drum being substantially rectangular and the width of each side corresponding substantially to the width of a cassette, the drum being substantially longer than the cassettes and having means for securing the respective cassettes to adjoining sides thereof in progressively spaced relation to its ends.

5. The structure of claim 2, the table top having lead

strips arranged along opposite sides thereof and extending a portion of its length corresponding substantially to the length of the drum, the lead strips being spaced apart from each other a distance corresponding substantially to the width of a cassette.

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