Oct. 6, 1925. 1,556,217

W. E. HAMILTON

MOVABLE SECONDARY RAY DIAPHRAGM

Filed Dec. 12, 1921 2 Sheets-Sheet 1

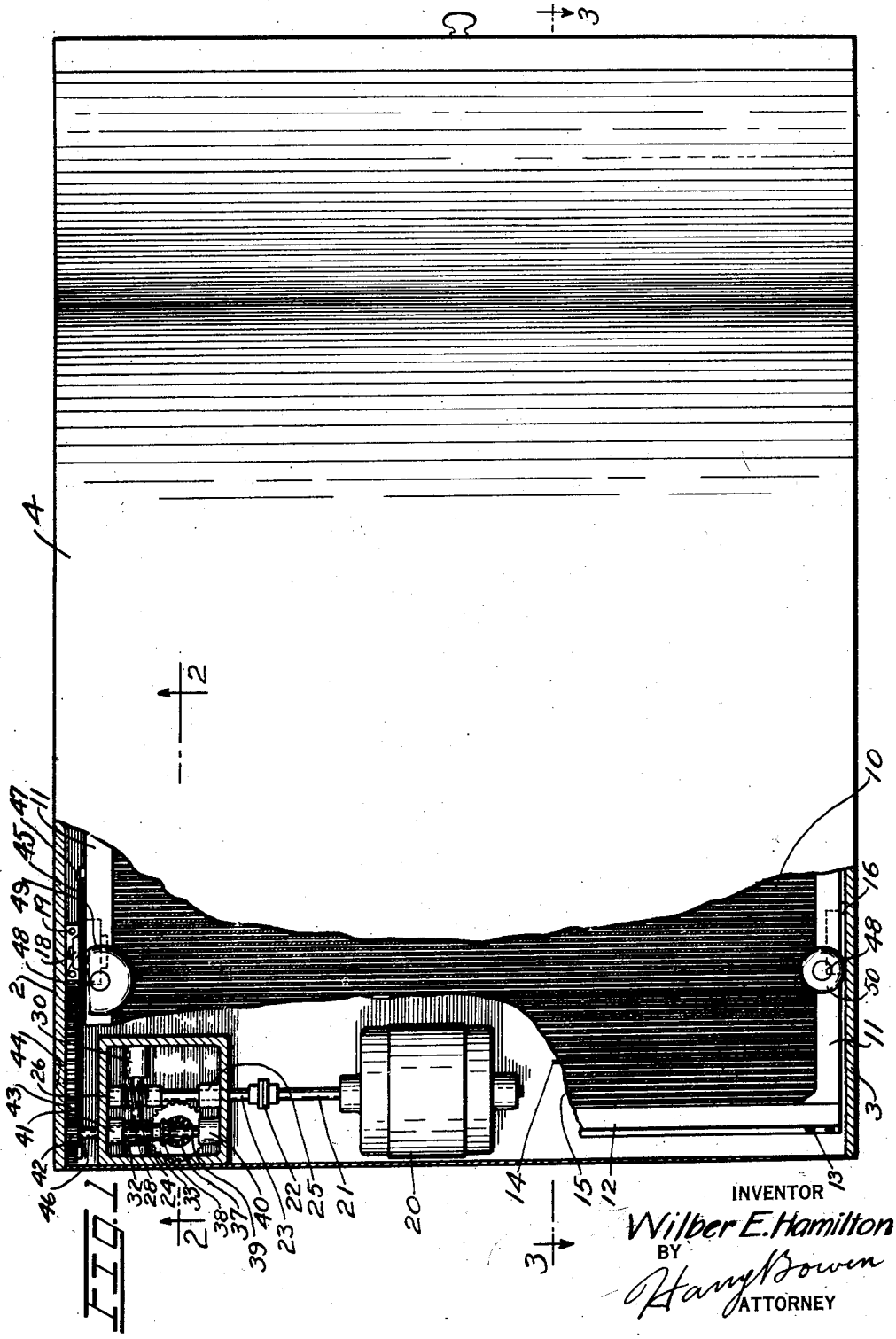


FIG. 1

INVENTOR
Wilber E. Hamilton
BY
Harry Bowen
ATTORNEY

Oct. 6, 1925. 1,556,217

W. E. HAMILTON

MOVABLE SECONDARY RAY DIAPHRAGM

Filed Dec. 12, 1921 2 Sheets-Sheet 2

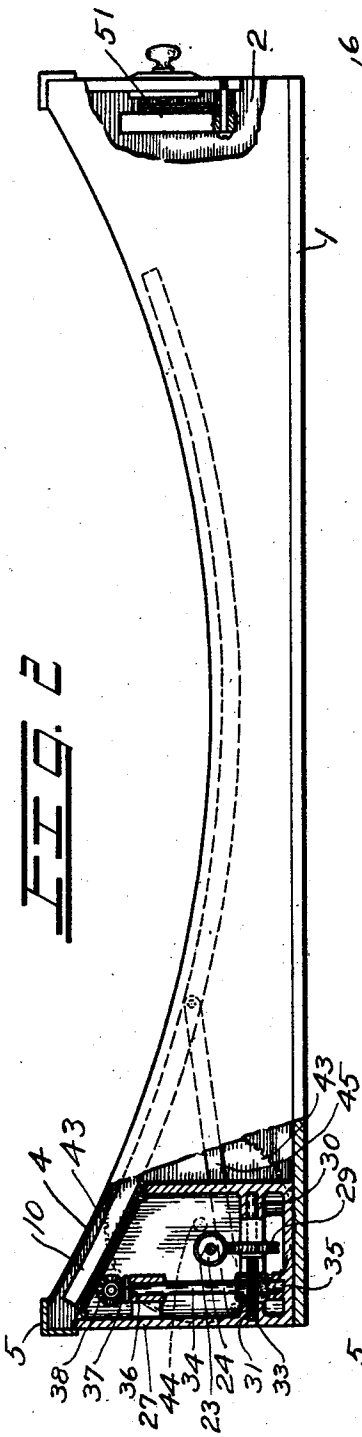


FIG. 2

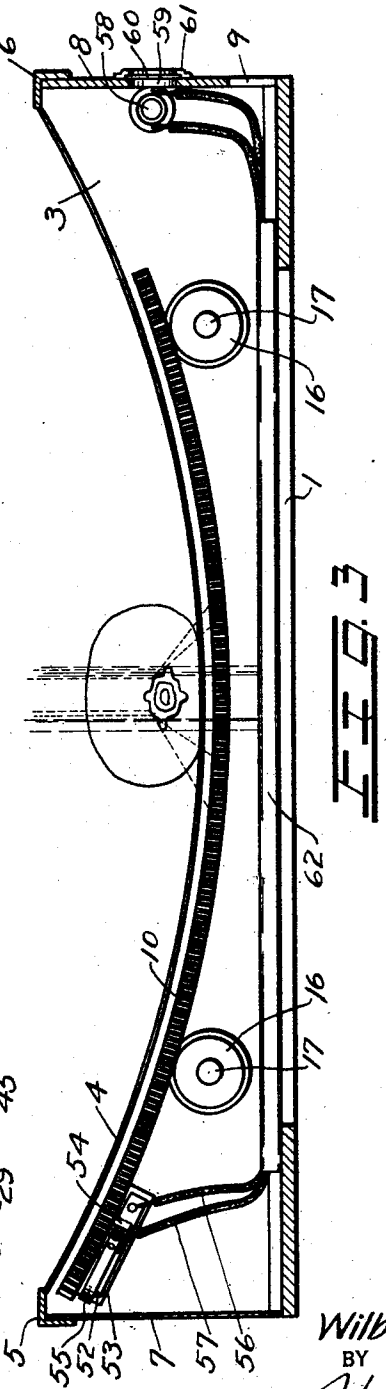


FIG. 3

INVENTOR
Wilber E. Hamilton
BY
Harry Bowien
ATTORNEY

Patented Oct. 6, 1925. 1,556,217

UNITED STATES PATENT OFFICE.

WILBER E. HAMILTON, OF SEATTLE, WASHINGTON.

MOVABLE SECONDARY RAY DIAPHRAGM.

Application filed December 12, 1921. Serial No. 521,754.

To all whom it may concern:

Be it known that I, WILBER E. HAMILTON, a citizen of the United States, residing at Seattle, county of King, and State of Washington, have invented a new and useful Movable Secondary Ray Diaphragm; and I do hereby declare that the following is a full, clear, and exact specification, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention is a device for eliminating the blur around the outline of the bones and tissues in an X-ray picture providing a movable diaphragm between the object and the plate which is constructed so that it will kill the secondary or oblique rays.

The object of the invention is to construct a diaphragm of thin parallel strips of lead, or any other material having the power to resist X-rays, and wood which will move on a radius from the center line of the rays with which an X-ray picture is being taken between the object which is being photographed and the plate or negative on which the picture is being exposed.

Another object of the invention is to provide a movable diaphragm which may be placed between an object of which an X-ray is being taken and the plate or negative which will eliminate the secondary or oblique rays.

Another object is to provide a movable diaphragm which may be placed between the object of which an X-ray picture is being taken and the plate or negative, which will make it possible to secure a sharp outline of not only the bone but also of the tissues.

And still another object of the invention is to provide a diaphragm constructed of thin parallel strips of lead, or any other metal which will resist X-rays, and wood which will move continuously while the picture is being taken so that the strips of lead will not be printed on the plate or negative.

With these ends in view, the invention embodies an aluminium frame whose upper side is constructed on a radius with a diaphragm, constructed of thin parallel strips of lead, or any other material having the power to resist X-rays, and wood, which moves on rollers in the frame on a radius similar to the radius on the top of the frame. A motor is also embodied in one end of the frame which is connected by suitable gears to a lever which is also connected to the diaphragm and which moves the diaphragm backward and forward as the device is being used. On each of the upper corners of the diaphragm are small rollers placed in a horizontal plane so that they will keep the diaphragm away from the sides of the frame and cause it to travel parallel to the sides of the frame. At one end of the frame is an electrical contact over which a brush on the end of the diaphragm may pass as the diaphragm approaches this end and this is connected thru wires to a light at the opposite end of the frame so that it will automatically light the light.

A rheostat may be placed at one end of the frame for controlling the speed of the motor as it is necessary to move the diaphragm at different speeds depending upon the length of the exposure, thickness of the object and the penetration of the rays.

Other features and advantages of the invention will appear from the following description taken in connection with the drawings, wherein—

Figure 1 is a top plan view with a part broken away.

Figure 2 is a side elevation with a part broken away on line 2—2 of Figure 1.

Figure 3 is a cross section on line 3—3 of Figure 1.

In the drawings I have shown my device assembled as it would be constructed wherein numeral 1 indicates the base on which are the two side plates 2 and 3 and on top of these is a thin cover plate 4 which is reinforced at the ends by the cross members 5 and 6. One end of the frame is completely covered by a thin metal plate 7 and the other is partly covered by a metal plate 8 leaving a slot 9 at the bottom.

Inside of the frame is a diaphragm 10 which is constructed of thin strips of lead and wood arranged alternately, held together by bars 11 on the sides and 12 on the ends and these are held together by screws 13 at the corners. The thin strips of lead 14 between which are the thin strips of wood 15 extend longitudinally across the diaphragm so that as the diaphragm moves along the frame the strips of lead thru which the rays cannot pass are continuously moving and therefore are not printed upon the plate or negative as would be the case if they were arranged lengthwise in the diaphragm. The diaphragm rests upon the rollers 16 which are mounted upon

the pins 17 in the sides of the frame with the exception of the roller at the corner of the frame adjacent to the means for moving the diaphragm and this roller is mounted upon a stand 18 held by the screws 19 to the base of the frame.

In one end of the frame a small motor 20 may be installed which is connected to suitable gears and levers to move the diaphragm backwards and forwards The motor shaft 21 is connected thru a coupling 22 to a shaft 23 on which is a worm gear 24. The shaft 23 is held in the bearings 25 and 26 in a suitable housing 27 and in the same housing below the shaft 23 and at right angles to it is another shaft 28 on which is a worm gear 29 shown in Figure 2 which causes the shaft 28 to rotate as it is rotated by the worm 24. The shaft 28 is held in bearings 30 and 31 in the frame 27. On this shaft is also a worm 32 which meshes with the worm gear 33 which is fixedly mounted on the vertical shaft 34 and this is held in the bearings 35 and 36. On the upper end of the shaft 34 is a bevel gear 37 which meshes with another bevel gear 38 on another horizontal shaft 39 and this is held in bearings 40 and 41 in the top of the housing 27. The shaft 39 extends thru the housing and has a small spur pinion 42 mounted on its outer end. The pinion 42 meshes with a large spur gear 43 which is rotably mounted on the pin 44 in the side 2 of the frame. The lever 45 is pivotally connected to the spur gear 43 near its outer edge by a bolt 46 and its opposite end is connected to the diaphragm by a bolt 47.

On this side of the device a space is left between the edge of the diaphragm at the side of the frame which allows room for the gear 43 and the lever 45. On the upper side of the diaphragm and at each of the four corners are small rollers placed in a horizontal plane and pivotally mounted on pins 48. As one side of the diaphragm is further away from the side of the frame than the other, the rollers on that side which are indicated by the numeral 49 are of a larger diameter than those on the other side which are indicated by the numeral 50. These rollers bear against the sides of the frame and hold the diaphragm in a position so that its sides will always be parallel to the sides of the frame.

In the center of one end of the frame a rheostat 51 may be placed for operating and controlling the speed of the motor. This rheostat may be constructed as shown in Figure 2 with suitable wires connecting it to the motor or it may be of any desired design.

On one side of the frame a copper plate 52 may be placed on a piece of insulation 53 just under the lower edge of the diaphragm and on the under side of the diaphragm is a lug 54 on which is a copper brush 55 which bears against the plate 52 when the diaphragm approaches this end of the frame as shown in Figure 3. This forms an automatic electric switch which is connected by the wires 56 and 57 to a light 58 at the opposite end of the frame and as the switch is closed the light will inform the operator that the diaphragm has reached the opposite end as it will shine through the hole 59 in the end 8 of the frame. The hole 59 may be covered by a piece of glass 60 which may be red or any desired color and this is held in place by a flange 61.

Any suitable means may be used for connecting the rheostat 51 and the light 58 to a battery or an electric current.

It will be understood that changes may be made in the construction without departing from the spirit of the invention. One of which changes may be in the use of any other metal having the power to resist X-rays instead of the lead strips as described or in a different arrangement of the gears for operating the diaphragm or in the means for holding the rollers upon which the diaphragm rests or in the use of the light for informing the operator when the diaphragm reaches the opposite end.

The construction will be readily understood from the foregoing description. To use the device it is placed upon a table about 25 to 30″ under the X-ray target or tube and the object to be X-rayed placed across it. As the picture is taken the motor is set in motion which thru the gears and the lever 45 moves the diaphragm backward and forward very slowly. It will be seen that should the diaphragm remain stationary thin lines would appear across the picture directly under each of the thin strips of lead, therefore, my invention particularly covers the moving of the diaphragm which permits the direct rays to pass between the thin strips of lead without registering them on the plate.

From the diagram shown in Figure 3 which indicates an object with a bone in its center it will be seen that the direct or primary rays which pass straight downward will go thru the diaphragm and register a sharp outline of the bone or any tissue. At the same time the secondary rays which strike the sides of the bone glance off at various angles and therefore endeavor to pass thru the diaphragm at an angle. As the diaphragm is constructed of thin strips of material which have the power to resist these rays they will not be allowed to pass thru it therefore a picture which will be registered on a plate or a negative in a plate holder 62 in the bottom of the frame under the diaphragm will show a clear outline around the bones and tissues instead of the blurred outline which ordinarly appears on X-ray pictures.

Having thus fully described the invention

what I claim as new and desire to secure by Letters Patent is—

In a tray for taking X-ray pictures or the like having a movable screen with a plurality of parallel impenetrable strips extending transversally and arranged alternately with penetrable, a curved aluminum plate which follows the curvature of the screen, a short distance above the screen, rollers at the edges of the screen upon which it is supported, other rollers attached to the edges of the screen and bearing against the inner sides of the frame, an arm attached to the edge of the screen and to an eccentric, means for rotating the eccentric, and a pilot light for notifying the operator as the screen reaches the opposite side.

WILBER E. HAMILTON.