Dec. 24, 1968 C. R. HUDGENS 3,418,475

LEAF SPRING-MOUNTED SHUTTER DEVICE ACTIVATED BY THE INTERRUPTION OF ELECTRICAL POWER

Filed Aug. 19, 1965

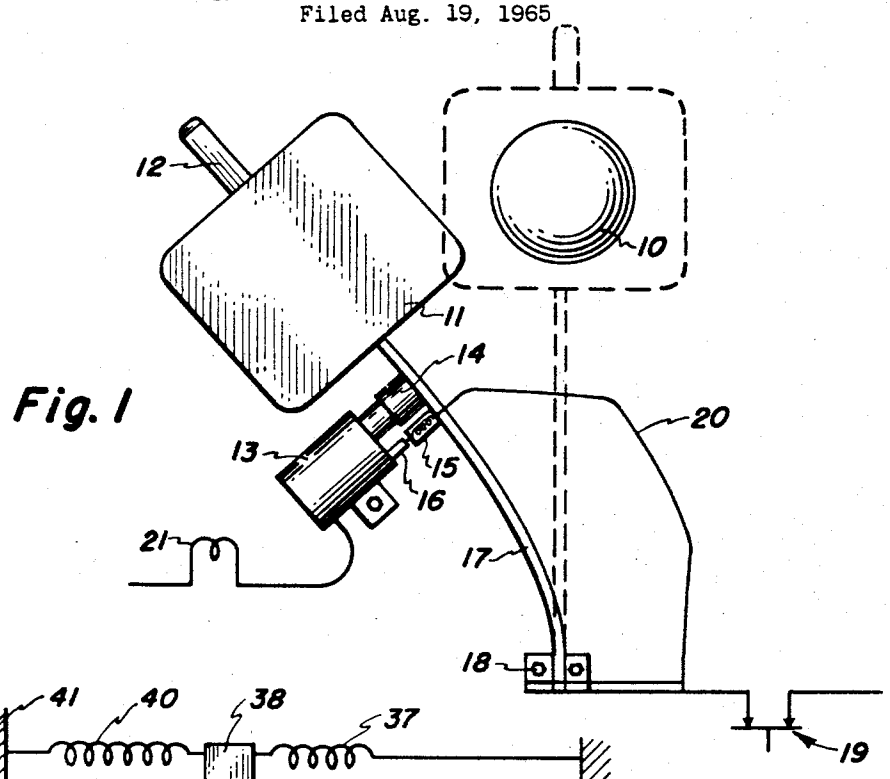


Fig. 1

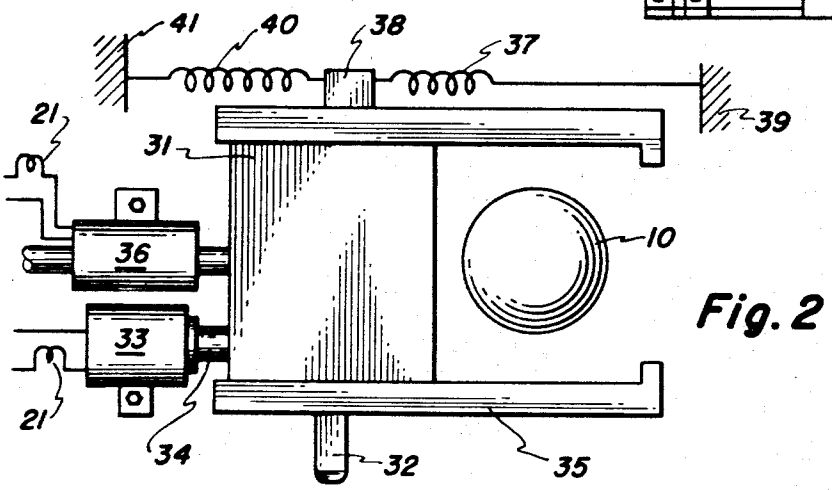


Fig. 2

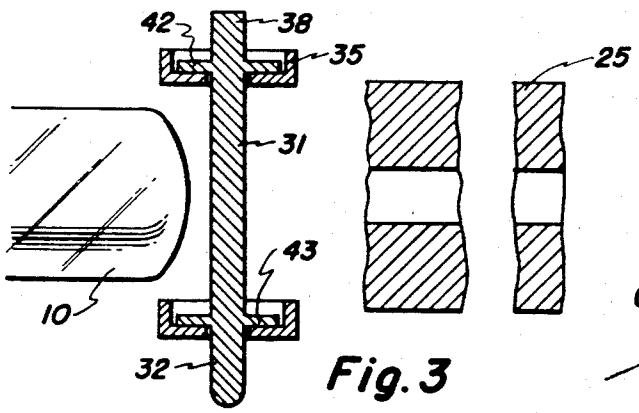


Fig. 3

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LEAF SPRING-MOUNTED SHUTTER DEVICE ACTIVATED BY THE INTERRUPTION OF ELECTRICAL POWER

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Filed Aug. 19, 1965, Ser. No. 481,147
1 Claim. (Cl. 250—105)

ABSTRACT OF THE DISCLOSURE

A safety device for shielding against radiation emitting sources comprising a spring loaded and normally closed shutter, means for opening said shutter, and electrical means for securing said shutter in the open position as long as electrical power is maintained thereto.

This invention relates to safety shutter devices and more particularly to a safety shutter device for X-ray or other radiation emitting machines or devices.

As X-ray or other radiation emitting machines increase in size and output, the danger of exposure to the radiation from the tube or source increases correspondingly. Without a safety shutter effectively blocking the source of the radiation, the technician adjusting the machine, or the sample or specimen being examined, is constantly in danger from exposure to the residual or other radiation emissions which may emanate from the source, even in instances where the power is off. Such radiation on a cumulative or other basis may be extremely dangerous to the technician.

Hence there is a need for a safety device to prevent accidental exposure to radiation from X-ray tubes or other sources. Such a device should preferably require manual retraction from the closed or safety position, but should have an automatic feature which returns it to the closed or safety position.

The present invention satisfies the need for a safety device as discussed above by providing a safety shutter which prevents the passage of radiation from the source through the collimator.

An object of the present invention is to provide a new and improved safety shutter for an X-ray or other radiation emitting machine.

Another object of the invention is to provide a safety shutter which is characterized by few moving parts and is thus highly reliable.

Another object of the invention is to provide a safety shutter which has both manual and automatic operation capabilities or features.

This specification, including the description, drawing, and claim, has been prepared in accordance with the requirements or provisions of the patent laws and the rules promulgated under the authority thereof.

In the accompanying drawing:

FIG. 1 is an end view of one embodiment of the present invention;

FIG. 2 is an end view showing another embodiment of the present invention with alternative features; and

FIG. 3 is a sectional view showing the relationship of the shutter to the source and the collimator.

The embodiment illustrated in FIG. 1 discloses an X-ray tube or other radiation source **10**, which is normally covered by a shutter **11** to prevent the emission of radiation through the collimator **25** (see FIG. 3). The shutter may be of lead or other radiation absorbing material, if alpha, beta, or gamma rays are to be absorbed, or in the case of neutron absorption, a hydrogenous material may be laminated with lead or some other type shielding. The shutter **11** is urged to the covered or closed position as shown

in phantom by a leaf spring **17**, enlarged for illustrative purposes, secured to the machine as at **18** and may be manually removed from and returned to such position by a handle **12** and is held in the open or uncovered position as illustrated by an electromagnet **13** which abuts a shoe or plate **14** comprised of a magnetic material, such as iron, secured to the spring **17**. The electrical circuit to the electromagnet **13** is completed when the shutter **11** has been manually moved to the open position which allows electrical contact **15** secured to the spring **17** to touch contact **16** secured to the electromagnet. Slight variations in wear, axial alignment, etc., between the electrical contacts **15** and **16** and the electromagnet **13** and shoe **14** may be compensated for in many ways, such as, for example, providing a slight spring bias for the contact **15**. The electrical circuit may be completed through the electrically isolated and conductive spring **17** or through a separate wire **20**, either of which may be connected to manual and automatic timing switches **19**. A leaf spring may, for example, be coated with a suitable plastic, or, on the other hand, may comprise a plastic spring having embedded therein a conductor. An indicator light **21** may be placed in the circuit to show when the shutter is in the open position. An added safety feature may comprise placing the light in series so that a burned out bulb will automatically open the circuit and cause the shutter to close.

While the embodiment of FIG. 1 is preferred due to its few moving parts, and hence freedom from inadvertent jamming during operation, there is shown in FIG. 2 an embodiment wherein the shutter **31**, rather than moving arcuately as in FIG. 1, moves in a straight line manner in guide means **35** to cover or uncover the tube or source **10**. The shutter **31** is urged to the closed position either by a tension spring **37** secured to a post **38** on the shutter and to the machine as at **39** or by a compression spring **40** secured to the post **38** and to the machine as at **41**, or by both springs, if desired. Handle **32** is provided to move the shutter manually, and electromagnetic means **33** are provided to hold the shutter in the open position. Since the shutter is made of lead or some other radiation absorbing material, presumably non-magnetic, a shoe **34** of magnetic material secured to the shutter is provided to abut against the electromagnet **33**. An indicator light **21** is placed in series with the electromagnet as in the previous embodiment.

In some cases it may be desirable to provide automatic means for moving the shutter to the open position. For such a purpose a solenoid **36** may be used. The solenoid serves to both move the shutter and to hold it in the open position.

FIG. 3 shows the shutter **31** disposed axially aligned with and intermediate the X-ray tube or source **10** and the collimator **25**, in close proximity to the tube. Flanges **42** and **43** of the shutter **31** may overlap the leading (or head) portion of the tube **10**.

The size and thickness of the shutter vary, of course, according to the size and output of the radiation source. It has been found, however, that a ⅛ inch thick lead shutter is satisfactory for most applications.

Any suitable mountings, guide and stop means, switches, etc., may be used and therefore have not been shown in detail. Furthermore, the configuration of the shutter, while disclosed as substantially square, may be round, oval, or otherwise.

It will be seen that the described device provides a new and improved shutter combination for preventing emission of radiation from X-ray, cobalt or other emitting machines or devices at other than desired periods. The device is of simple and inexpensive construction, for relatively foolproof operation.

I claim:

1. A safety device for shielding against X-rays after interruption of electrical power in combination with a support, an X-ray source and an apertured collimator comprising a lead shutter normally disposed in a normal first position overlying said source intermediate said source and said collimator and in alignment with said source and the aperture of said collimator, manually operable means for moving said shutter to a second position out of alignment with said source and collimator aperture, an elongated electrically conductive leaf spring member having one end portion fixedly attached to said support at a location spaced from said source and secured adjacent an opposite end portion to said shutter and in unflexed condition normally maintaining said shutter in said first position overlying said source, said member being rotatable about its fixedly attached end portion to a flexed condition with said shutter in said second position out of alignment with the source, electromagnetic holding means adjacent said second position for holding said leaf spring member in flexed condition and shutter in said second position when supplied with electric current, magnetic material means carried by said leaf spring member for magnetically engaging said electromagnetic holding means, an electrical contact carried by said leaf spring member for closing a circuit through said electromagnetic holding means when said shutter is in said second position,

and an indicator light and controlling switch connected in series circuit with each other, said electrical contact member, and said electromagnetic holding means, whereby said electromagnetic holding means is energized only upon circuit continuity through said switch, contact, electromagnetic holding means, and indicator light.

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WILLIAM F. LINDQUIST, *Primary Examiner.*

U.S. Cl. X.R.

250—108

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,418,475 December 24, 1

Claude R. Hudgens

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading to the printed specification, lines 5 and 6, "Claude R. Hudgens, 610 Skyview Drive, West Carrollton, Ohio 45449" should read -- Claude R. Hudgens, West Carrollton, Ohio, assignor to the United States of America as represented by the United States Atomic Energy Commission --.

Signed and sealed this 10th day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR
Commissioner of Patents