

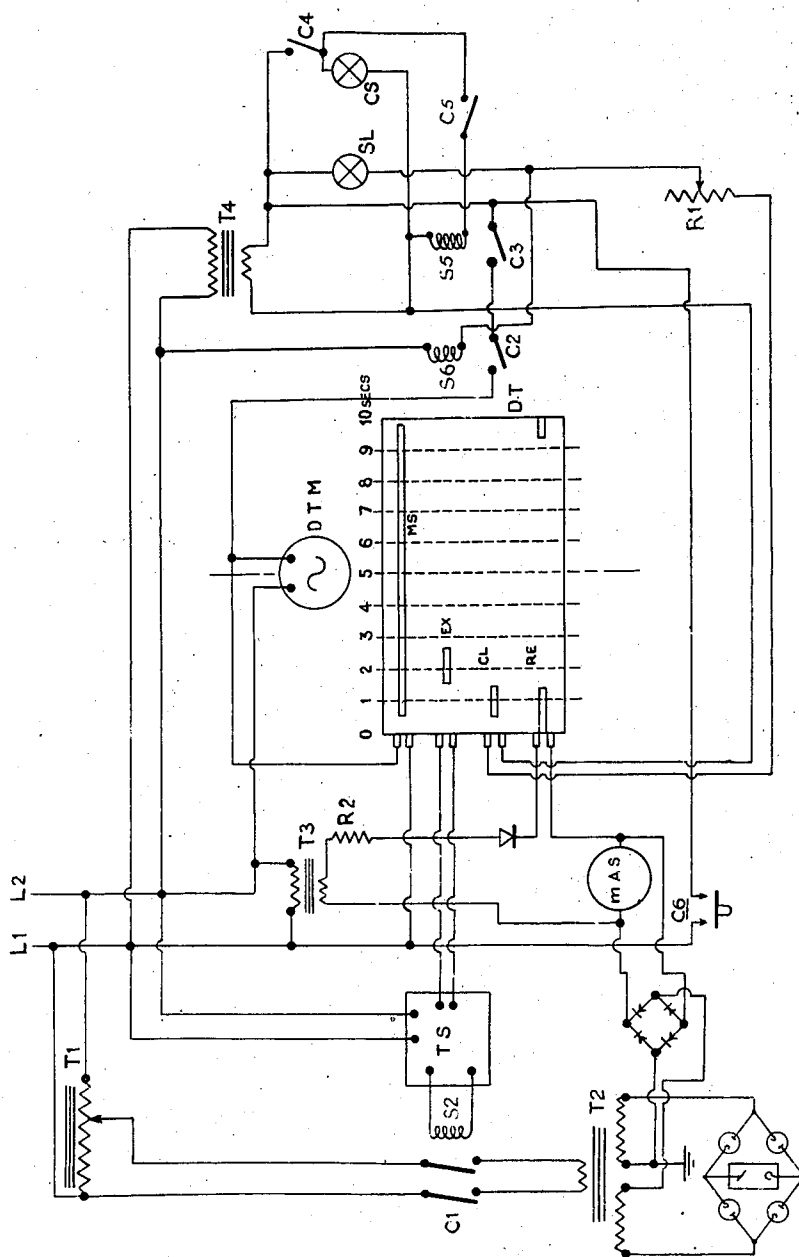
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X-RAY MASS CHEST APPARATUS CONTROL GEAR

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X-RAY MASS CHEST APPARATUS CONTROL GEAR

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1

This invention relates to X-ray apparatus and has more particular reference to apparatus for indirect or screen radiography in which the images produced on a fluorescent screen are photographed. In such apparatus, and particularly in the case of apparatus designed for miniature film radiography where a number of separate photographs of different patients are obtained side by side on a length of film, it is desirable that each photograph should bear an identification. Usually each patient is given an identification card bearing identification data, and these data should be reproduced on the photograph. A simple and convenient method employed for the purpose is to introduce the card into a card receiver near the X-ray screen, to illuminate it and photograph it on the same length of film as the radiograph. As will be apparent, it is necessary to provide safeguards to ensure not only that the conditions requisite for obtaining the radiograph are satisfied, but also that a card is properly positioned to be photographed to identify the radiograph, so that otherwise actuation of the exposure switch is ineffective.

In the arrangement of such apparatus for indirect radiography according to the present invention, on closing the exposure switch a circuit for a motor is set up by way of relays the operation of which is dependent upon the presence of a correctly positioned identification card in the card receiver and of an operative lamp in the socket for the card illuminating lamp, and the motor is coupled with a drum carrying contacts one set of which maintains the motor circuit until the drum has completed a cycle, another set of which completes a circuit for the card illuminating lamp and a further set of which completes a circuit initiating the X-ray exposure.

Generically, however, the present invention provides X-ray apparatus in which when the apparatus is properly set, the closing of the X-ray exposure switch completes the circuit for a motor coupled with a drum carrying a number of sets of contacts one set serving to maintain the motor circuit until the drum has completed a cycle, and the remainder controlling the operation or operations to be performed during the cycle.

In a preferred form of the invention, provision is made for automatically re-setting the milliamperes second meter.

A diagrammatic circuit representation of a preferred form of the present invention is shown in the drawing accompanying the provisional

2

specification, and reference will now be had to that drawing.

The supply leads from the mains are indicated at L1, L2. These supply an auto-transformer T1 which when a high-tension contactor C1 is closed under the action of a coil S2 controlled by a time switch TS, supplies the primary of a high-tension transformer T2, the centre earthed split secondary winding of which feeds the X-ray tube. The current through the tube is measured by a milliamperes-seconds meter MAS which is assumed to be of the type which maintains its reading until reset.

When an identification card is correctly positioned, it closes the contact C4. As a result, a signal lamp CS, the lighting of which indicates that a card is in position, is lit by current from a transformer T4 which supplies low-voltage current. The contact C5 in series with the contact C4 and a relay S5 represents the interlocks usually provided in such apparatus, such as safeguards, to ensure that the camera is ready for operation, the patient is correctly positioned etc. Provided that a card is in position and the other interlocks are closed, the relay S5 is energised from the transformer T4 and closes the contact C3.

Then to initiate the exposure, the exposure switch C6 which is shown as of the press-button type, is closed. Consequently a circuit for relay S6 is completed via L1, C6, the card illumination lamp SL and the coil of S6 back to L2. The relay S6 is thereby operated by the mains voltage (e. g. 230 volts) and closes the contact C2. The lamp SL, however, is designed for a low voltage (e. g. 6 volts) as compared with the mains, so that its resistance is low compared with relay S6 and the relay current is too small to light the lamp. At the same time, this arrangement makes the operation of the relay S6 dependent upon the lamp SL being in position and having its filament intact.

Due to C2 and C3 being closed, a circuit is completed for the motor DTM through L1, C6, C3, C2, DTM back to L2. The motor DTM is coupled with and drives a control drum DT which is shown in developed form in the drawing. It is assumed that the motor is so chosen and coupled to the drum DT that the latter completes one revolution in 10 seconds, this representing the time for the complete cycle of operations associated with each exposure. Shortly after the drum DT has started to rotate contacts MS thereon complete a further circuit for the motor DTM, the contact MS being so arranged that the motor

3

circuit is maintained until the drum DT has completed a revolution. Consequently, the exposure switch C6 has to be depressed only long enough to initiate the rotation of the drum DT, whereafter the release of the switch C6 with the resultant breaking of C2 does not interfere with the continuation and completion of the cycle of operations. In the drawing, the drum DT is shown with three further sets of contacts EX, CL and RE, which serve to control the X-ray exposure, the card light and the automatic resetting of the milliamperere seconds meter AS. It will also carry other sets of contacts (not shown in the drawing) for controlling the usual circuits for valve and tube boosting, energisation of rotor (in rotary-anode tubes), etc. In the example shown, when the drum DT has been rotating between 1 and 2 seconds, the contacts EX complete a circuit for the time switch TS which is energised to start the exposure. The duration of the exposure is controlled in the usual way by the time switch TS and not by the contacts EX. Earlier in the rotation of the drum DT (after approximately 1/2 sec.) the drum contacts CL have completed a circuit for the card illumination lamp SL which is consequently supplied with low tension current from the secondary winding of the transformer T4. The current is adjusted by a variable resistance R1 which serves to control the intensity of the card illumination lamp. The duration of the illumination is determined by the contacts C1. As shown, the card illumination immediately precedes the X-ray exposure, but the relative timing is not critical.

During the X-ray exposure the milliamperere seconds meter *mAS* is operated and it maintains its reading until the end of the cycle (after 9 1/2 seconds in the example shown) when it is reset due to the resetting contacts RE on the drum DT completing a resetting circuit comprising the secondary winding of a transformer T3, a resistance R2 and a rectifier. The time interval between the conclusion of the exposure and the commencement of resetting (about 7 seconds for the drum assembly as shown) is sufficient to enable the meter *mAS* to be read conveniently. If desired, provision may be made for cutting out the automatic reset provided by the drum DT and substituting therefor a manually controlled switch for the resetting circuit.

To ensure that the card is correctly positioned it may be provided with a notch on its leading edge to one side of the centre line, so that the card cannot be fully inserted unless the notch matches with a corresponding projection in the card guide. The controls, e. g. a Burgess type micro-switch, for the contact C4 are so arranged as to be operated only when the card is fully inserted. Any other data to be recorded on the radiograph, e. g. the date, can be photographed either in conjunction with the identification card or the X-ray exposure. In the latter case, lead letters may be mounted between the X-ray tube and the screen, or optically opaque letters may be mounted between the screen and the film.

We claim:

1. In an X-ray apparatus for screen radiography, the combination with an X-ray tube and means for photographing on a film of a device for identifying the photograph, means for accommodating the identification device, means for indicating the presence and proper disposition of the identification device, a guard relay circuit controlled by said identification means, said indicating means including a low voltage card

4

illumination lamp connected in series with said guard relay and a source of power for illuminating the indicating device whereby the corresponding film being exposed is identified, means for effecting the several operations necessary in the use of the X-ray tube for the film exposure, a motor-operated drum provided with contact segments for automatically controlling the operation effecting means in correctly timed sequence, circuit means operable by said guard relay circuit for controlling the motor circuit to initiate operation of said drum, a manually controlled switch for initially closing the motor circuit, and means controlled by the drum upon initiation thereof by the manual switch, for holding the drum-motor circuit closed for the duration of one predetermined cycle of operations by the effecting means.

2. In an X-ray apparatus for screen radiography, the combination with an X-ray tube and means for photographing on a film of a device for identifying the photograph, means for accommodating the identification device, means for indicating the presence and proper disposition of the identification device, a guard relay circuit controlled by said identification means, said indicating means including a low voltage lamp connected in series with the coil of the guard relay, and the guard relay contact actuated by the relay coil being in series with a further relay contact actuated by a separate relay coil energized through a circuit including a switch controlled by the correct positioning of the identification device, means for effecting the several operations necessary in the use of the X-ray tube for the film exposure, a motor-operated drum provided with contact segments for automatically controlling the operation-effecting means in correctly timed sequence, circuit means operable by said guard relay circuit for controlling the motor circuit to initiate operation of said drum, a manually controlled switch for initially closing the motor circuit, and means controlled by the drum upon initiation thereof by the manual switch, for holding the drum-motor circuit closed for the duration of one predetermined cycle of operations by the effecting means.

3. In an X-ray apparatus for screen radiography, the combination with an X-ray tube and means for photographing on a film of a device for identifying the photograph, means for accommodating the identification device, means for indicating the presence and proper disposition of the identification device, a guard relay circuit controlled by said identification means, said indicating means including a low voltage lamp connected in series with the coil of the guard relay and the guard relay contact actuated by the relay coil being in series with a further relay coil actuated by a separate relay coil energized through a circuit including a switch controlled by the correct positioning of the identification device, said further relay coil having a contact the closure of which is dependent upon additional interlocks provided for insuring proper positioning of the patient and the photographing means, means for effecting the several operations necessary in the use of the X-ray tube for the film exposure, a motor-operated drum provided with contact segments for automatically controlling the operation effecting means in correctly timed sequence, circuit means operable by said guard relay circuit for controlling the motor circuit to initiate operation of said drum, a manually controlled switch for initially closing the motor cir-

5

cuit, and means controlled by the drum upon initiation thereof by the manual switch, for holding the drum-motor circuit closed for the duration of one predetermined cycle of operations by the effecting means.

4. In an X-ray apparatus for screen radiography, the combination with an X-ray tube and means for photographing on a film of a device for identifying the photograph, means for accommodating the identification device, means for indicating the presence and proper disposition of the identification device, a guard relay circuit controlled by said identification means, said indicating means including a low voltage lamp connected in series with the coil of the guard relay and the guard relay contact actuated by the relay coil being in series with a further relay coil actuated by a separate relay coil energized through a circuit including a switch controlled by the correct positioning of the identification device, said further relay coil having a contact the closure of which is dependent upon additional interlocks provided for insuring proper positioning of the patient and the photographing means, means for effecting the several operations necessary in the use of the X-ray tube for the film exposure, a motor-operated drum provided with contact segments for automatically controlling the operation effecting means in correctly timed

6

sequence, said drum including a set of contacts for enabling the operation effecting means to complete a circuit for a separate timing device whereby the actual exposure is controlled, circuit means operable by said guard relay circuit for controlling the motor circuit to initiate operation of said drum, a manually controlled switch for initially closing the motor circuit, and means controlled by the drum upon initiation thereof by the manual switch, for holding the drum-motor circuit closed for the duration of one predetermined cycle of operations by the effecting means.

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