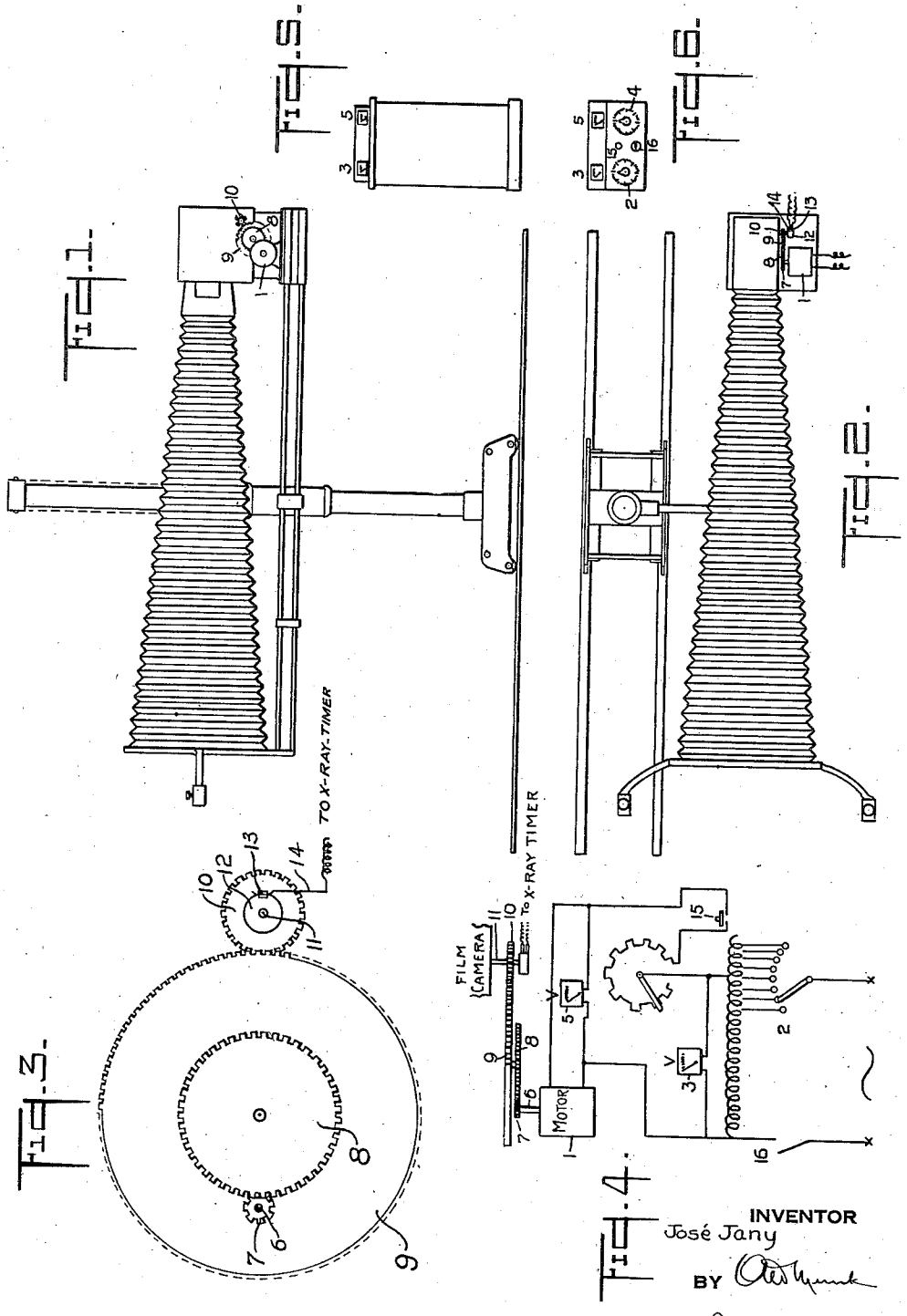
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APPARATUS FOR THE FILMING OF X-RAY IMAGES

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APPARATUS FOR THE FILMING OF X-RAY IMAGES

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2 Claims. (Cl. 250—66)

This invention refers to an apparatus driven by an electric motor to synchronize, on the one hand, the travel of a cinematographic film through a filming camera, and on the other hand, the sequence of discharges or X-ray exposures, which produce on a fluoroscopic screen, the X-ray image to be filmed.

The invention is illustratively exemplified in the accompanying drawing, in which

Figs. 1 and 2 are, respectively, a side elevation and a top plan view of an X-ray filming device provided with a synchronizing apparatus according to the invention;

Fig. 3 is a side elevation of the driving gear for the synchronizing mechanism on a larger scale;

Fig. 4 is a top plan view of said gear and of the driving motor on a slightly smaller scale including a diagram of the motor control circuit; and

Figs. 5 and 6 are, respectively, a side elevation and a top plan view of the motor control stand.

In the drawing, the non-synchronous motor 1 with adjustable auto-transformer 2 and voltmeter 3 to maintain uniform and to control the voltage of the feeding current, is fitted with adjustable resistance 4, with its respective voltmeter 5, which serves to control and reduce the speed of the motor. Motor 1 drives shaft 6 with respective small gear 7 and larger gear 8 with ratio 1:7.

The above-mentioned large gear 8 forms an integral part of a larger gear 9. This gear 9 is so constructed that 75% (say 270°) of its circumference is smooth, and the remaining 25% (say 90°) provided with teeth, corresponding in number and size to the teeth of smaller gear 10. The ratio between these two gears is 1:4.

The construction of the two gears 9 and 10 so permits that at each revolution of the larger gear 9 the smaller gear 10 turns one complete revolution, when in contact with the teeth of gear 9, i. e., during 25% of the revolution of the larger gear 9, remaining in stopped position during the remaining 75% of the revolution.

The gear 10 (the smaller one), is mounted on shaft 11, which may be linked up to, or disconnected from, the side shaft of the film transporting mechanism of the photographic or cinematographic camera. Operating with this synchronizing apparatus, the said photographic or cinematographic camera making the film can dispense with the shutter.

Mounted on the said shaft 11 is a cylinder of insulating material 12, containing, at one point, in a position parallel to shaft 11 a narrow contact bridge of metal, 13. Two electric contact brushes 14 are provided, with their respective springs to establish a contact and close a circuit around the said metallic contact bridge 13. This electric phase, controlled by the two brushes and respective contact bridge, on the insulated cylinder, closes or interrupts a circuit which operates the timer on the X-ray control stand, which, in its turn controls the emission of the X rays in the X-ray tube and the respective exposure on the fluorescent screen of the X-ray-image filming apparatus.

The said exposure takes place at the moment when gear 10 and its respective shaft 11 are in stopped position, which shaft is connected with the side shaft of the filming machine, and consequently the photographic or cinematographic film is in stopped position, and, likewise, the shutter of the photographic or cinematographic camera is in open and stopped position.

The X-ray exposure will be previously regulated in the X-ray timer and may be any fraction of time within the 75% of the time of the adjusted revolution of the motion of larger gear 9, or to put it more clearly, during the whole of the time of the stoppage of the smaller gear 10.

Operation of the apparatus

Switch 16 is thrown over connecting up the auto-transformer to the main electric supply.

By means of the auto-transformer's compensator and the respective voltmeter, the exact voltage of the main electric feed is regulated.

Then, adjustment is made at the X-ray timer of the X-ray unit control stand, of the desired period of emission of X rays in X-ray tube, for the exposure of the film.

Shaft 11 of gear 10 is then connected up to the side shaft of the film transport of the filming machine.

The apparatus is then ready to perform cineradiographic work, it being sufficient therefor, to press key or interrupter 15 to start up the cineradiographc filming or to terminate same by releasing the respective key.

Should it be desired to operate in Roentgenphotography, with single images, for mass survey work of tuberculosis, or in seriography, with single images in chronological sequence and at long intervals of time between one image and another, then it is sufficient to slow down the motor to minimum speed, press the button of the switch key and cut off the current from the motor,

immediately after the respective discharge of X-rays, place the next patient in position and repeat the same procedure.

For greater convenience of control, a pilot-lamp may be connected up with contact bridge 13.

The same procedure will be employed in the case of seriographs in chronological sequence at long intervals of time, when the transport and exposure of the image of each Roentgen-photograph will be started up or cut off, by hand, at the desired moment.

Purposes and application for which the apparatus is intended

The apparatus is so constructed as to be able to operate with film of any size, at any film velocity (number of images per second) and with any type of photographic or cinematographic filming camera, even without shutter, should the said filming camera operate permanently with this element.

It may be connected up to the filming camera or disconnected from same, in which case the filming camera will continue to operate in the usual manner as described in U. S. A. Patent 2,205,853.

In view of the foregoing, the apparatus is adaptable for operation with indirect cine-radiographic filming or for indirect Roentgen-photography work (mass survey work for tuberculosis) or for indirect seriography, by cine-radiography, by single images, in chronological sequence with long time intervals, with automatic or hand control over such time intervals.

By virtue of the said system and properties, the apparatus may be employed to make films of cine-radiographic nature of the stomach, duodenum, kidneys, etc., that is, of organs of involuntary and slow motion, in a pathologic cycle of long duration, where no interest attaches to the reproduction of the natural speed of working of the organ with any exactitude, but where the interest attaches to the registration, during the whole duration of the characteristic and pathological cycle, of same with all its phases, condensed into a film of shorter time, but, in compensation with sufficient X-ray energy in the tube so as to result in a clear image, even with the use of a Potter-Bucky anti-diffuser, which always consumes greater X-ray energy.

For example, it will be possible to condense the 1 to 2 minutes of the entire wave of peristaltism of the stomach or duodenum, making 1 image per second, thus reducing the 2 minutes of the filming, by means of the 120 images obtained, to a screening time of 10 seconds, at a projection speed of 12 images per second. This film so obtained will be closed up into one continuous band, which will permit the continuous projection of this pathological cycle which is the sole point of interest.

Within this filming time of 1 image per second, the X-ray timer may be regulated within 1/20 second limits up to 3/4 of a second.

This system permits the protection of the X-ray tube and of the patient, which renders possible filmings of longer duration.

Also, the sequence of the images may be controlled from 1 image each 2 seconds up to 8 images per second.

This system may also be employed, to advantage, for seriographed filming, by means of cine-radiography, the peristaltic movements of the duodenum, the movements of the kidneys, and those of the gall bladder and bladder, by means of the said principle of time condensation.

Having described the invention in detail and the method of realizing the same, what I claim is:

1. The combination with an apparatus for the cinematographic filming of X-ray images having an X-ray tube, an electrically controlled X-ray timer which, upon being switched on, causes operation of said tube for a selected time interval, a film camera arranged to record pictures produced by the rays emitted from said tube, and a film transport device associated with said camera, of a mechanism to synchronize the film transport and the operation of the X-ray tube, said mechanism comprising an electric motor, means to adjust and to control the speed of said motor, a control shaft operatively connected with said film transport device, a reducing gear between said motor and control shaft including a pinion fixed on said control shaft and a gear wheel continuously driven by said motor, said gear wheel carrying on only part of its periphery teeth adapted to mesh with the teeth of said pinion whereby said film transport device is operated intermittently in a predetermined rhythm, and means for switching on said X-ray timer including a control circuit for said X-ray timer, a pair of contact brushes in said control circuit, an insulating sleeve on said control shaft against which said contact brushes are pressed, and a strip of conducting material inserted in the surface of said insulating sleeve to bridge said pair of brush contacts and to close said timer control circuit whenever said control shaft reaches an angular position in which the teeth on said gear wheel become disengaged from said pinion.

2. A combination, as claimed in claim 1, in which said gear wheel carries on only one quarter sector of its periphery, gear teeth adapted to mesh with the teeth of said pinion, the total number of teeth on said pinion being equal to the number of teeth on said quarter sector of said gear wheel.

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