

Jan. 9, 1940.

W. H. HAUPT

2,186,107

DIAPHRAGM OF THE BUCKY TYPE

Filed May 23, 1938

2 Sheets-Sheet 1

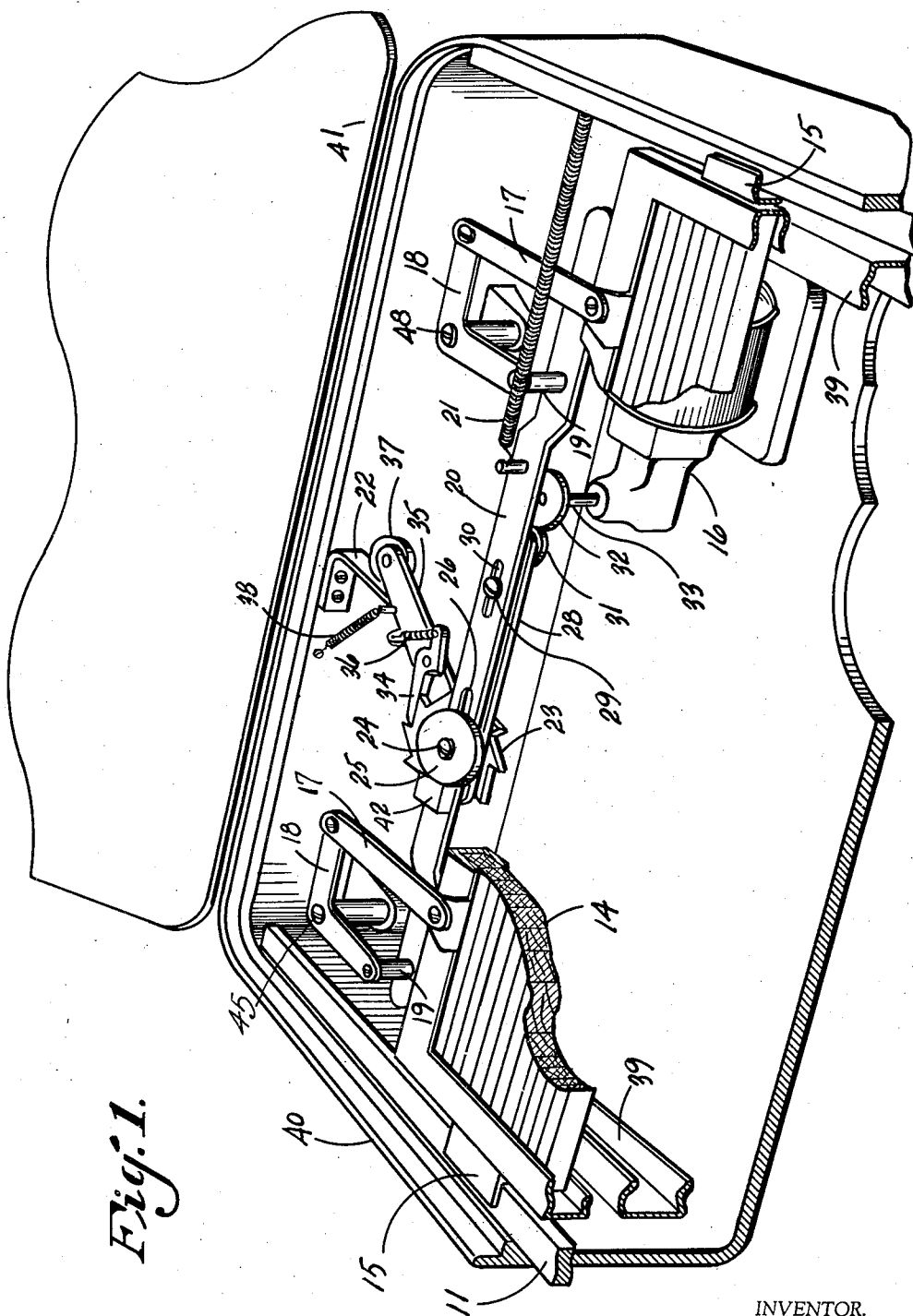


Fig. 1.

INVENTOR.
WALTER H. HAUPT
BY
Chester Tietig
ATTORNEY.

Jan. 9, 1940.

W. H. HAUPT

2,186,107

DIAPHRAGM OF THE BUCKY TYPE

Filed May 23, 1938

2 Sheets-Sheet 2

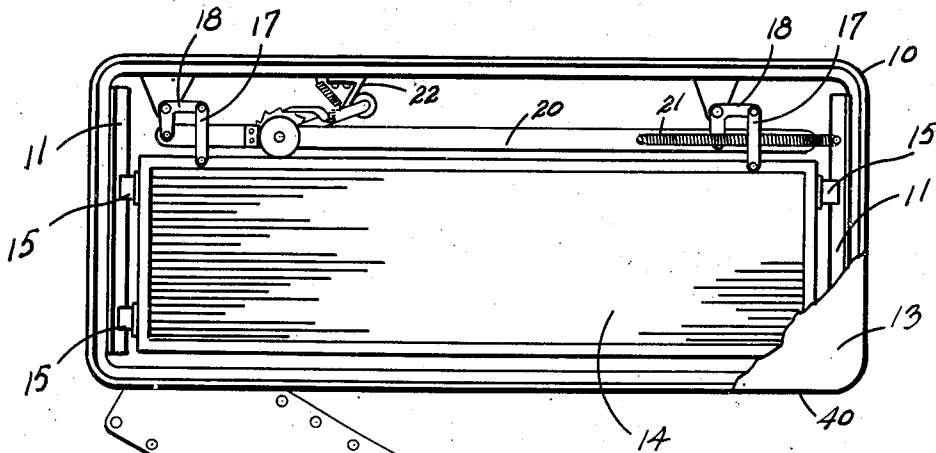


Fig. 2.

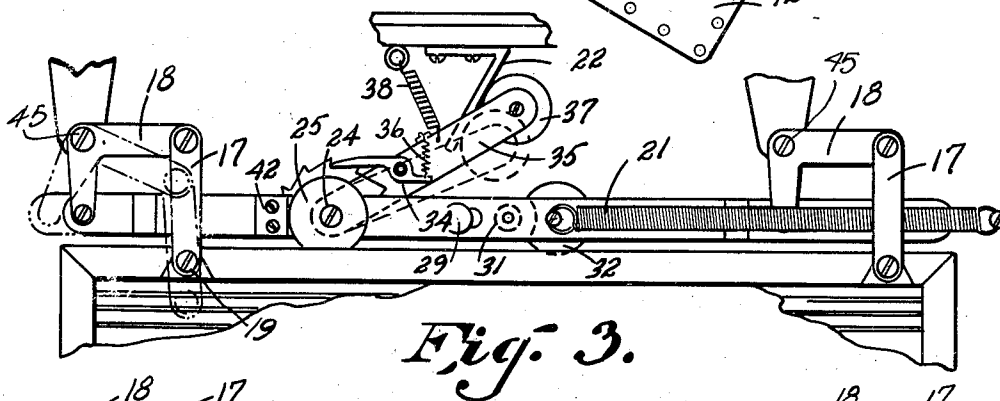


Fig. 3.

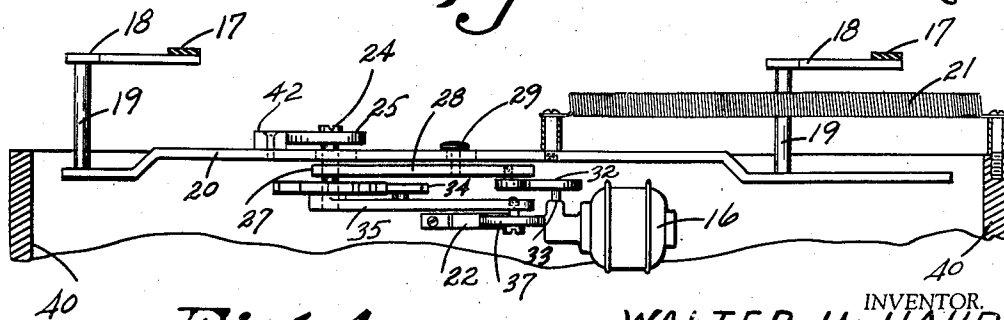


Fig. 4.

INVENTOR.
WALTER H. HAUPT
BY *Chester Lietz*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,186,107

DIAPHRAGM OF THE BUCKY TYPE

Walter H. Haupt, Ludlow, Ky., assignor to The Kelley-Koett Manufacturing Company, Incorporated, Covington, Ky., a corporation of Ohio

Application May 23, 1938, Serial No. 209,515

3 Claims. (Cl. 250-63)

In all radiographic work the secondary radiation from objects in the path of the rays have been a detriment to obtaining clear pictures. In order to overcome this difficulty diaphragms and grids of the bucky diaphragm type have been employed to cut radiation coming to the film in direction other than those of the primary rays. In ordinary practice the grid is arranged to move across the film at a certain speed so as to eliminate shadows of the grid line or the grating which is made of lead and is fairly impenetrable to the X-radiation. Speed of travel is varied as a rule in order to complete one movement in a space of time slightly longer than that required for the actual exposures. In medical work the exposure time will vary as a rule from $\frac{1}{10}$ or possibly $\frac{1}{20}$ of a second up to about 30 seconds. Oil pumps or other mechanisms are used to control the speed of travel of the grid.

In industrial work, however, the exposure times are much greater, sometimes being as high as 30 minutes in order to penetrate heavy layers of steel or the like. It is not practical to slow up the bucky diaphragm movement to a point where it would take 30 minutes to complete a single stroke. Hence, a reciprocating movement is generally used in order to move the grid across the screen or across the film.

Inherent in the nature of a reciprocating movement there is a stop, however short, at each end of each reciprocating stroke. This stop will cast a shadow of the grid upon the film and cannot be entirely eliminated regardless of how many reciprocations take place. I have designed a special type of mechanism operated from the reciprocating movement and linked with it so as to change the point of reciprocation or the turning point at the end of each stroke, until a cycle is completed. In other words if a certain point A is designated as the turning point at one end of the stroke the next time the bucky diaphragm comes to the position A it does not exactly turn at A but at a point A, plus .005" or .010", thereby making slight difference in that turning point. Each successive turning point changes in like manner until a given cycle is completed wherein the variation of turning point is sufficient to prevent superposition of shadows of grid line.

In the drawings, Fig. 1 is a perspective view of my device from the front, the cassette being absent.

Fig. 2 is a plan view of the diaphragm showing a cassette emerging from therebeneath.

Fig. 3 is a detail from Fig. 1 showing on a larger

scale, the means for altering the throw on each stroke.

Fig. 4 is a rear elevation of the driving mechanism.

In the drawings, 10 is a frame, to the inside shorter rails of which are attached angle irons. The frame is preferably provided with a lower pocket for the reception of a cassette 12. The frame may have a cover 13.

A lead grid 14 of the bucky type is adapted to reciprocate within the frame 10 and on angle irons 11 on gibs 15. Power for reciprocation is supplied from an electric motor 16 through a geared drive.

The direct pushing and pulling of the grid 14 is done by a pair of links 17, each of which is pivoted to a bell-crank 18 which in driving, assumes the position shown in dotted line in Fig. 3. Each bell-crank is pivoted to one end of a shaft 19 each of which in turn is tightly attached by its other end to a reciprocating bar 20 of the shape shown in Fig. 1. A spring 21 is arranged so as to be stretched by each positive reciprocation of of the bar 20, i. e., to the left as shown in the drawings. The spring tension then returns the bar to its original position.

So much of the structure as has been described in detail is conventional; what follows is novel:

Attached to the inner side of one of the longer rails of the frame, there is an angled dog 22. Upon the bar 20, there is mounted a ratchet wheel 23, the number of teeth of which is considerably greater than is shown. The ratchet wheel is supported upon a stud 24 which extends through its center and also through an eccentric 25 which is arranged to rotate in unison with the ratchet wheel. Stud 24 also extends through a slot 26 in bar 20 and also through a hole 27 in a driving bar 28 which extends below oscillating bar 20. A second stud 29 extends through both bars and is tight to driving bar 28, but permits bar 20 to slide under its head to allow the length of the stroke of the latter to vary.

The bar 28 is driven from the end opposite the ratchet by means of a roller 31 and a cam 32, which is eccentric and is mounted upon vertical motor shaft 33. The motor is of the special kind which has an inbuilt bevel worm gear drive.

Working upon the ratchet wheel 23 is a pawl 34 which is pivotably mounted upon a trigger 35 and is controlled by the tension of a spring 36. The trigger bears a roller 37 upon its outer end, which roller makes contact at each stroke of bar 20 with the dog 22. A spring 38 by its tension, keeps the trigger in a position where it may

engage and be depressed at each stroke by the dog.

As will be seen from Fig. 1 a pair of slides 39, are provided for the reception of a cassette. These are tightly attached to the inner wall surfaces of a case 40 which encloses the entire mechanism and also supports slides 11. Its top 41 is made of X-ray permeable material, preferably "Bakelite".

- 10 Operation of the device is as follows: The loaded cassette is inserted in slides 39. The specimen to be examined is placed over the entire device, but no weight is placed upon the device. Motor 16 is started and the X-ray beam is turned
- 15 on.

- Eccentric 32 then imparts an oscillatory motion to bar 28, carrying with it ratchet wheel 23 and eccentric 25. When the eccentric strikes a lug 42 on bar 20, the latter is set in motion toward the left but as soon as bar 20 ceases to drive it to the left, it is retracted by spring 21. The setting or length of the stroke can be changed by changing the position of tight stud 29 and substituting a differently shaped eccentric 32. Oscillatory motion of bar 20 rocks the bell-cranks 13 about pivot points 45, thereby oscillating links 17 and the grid 14 at 90° directional difference from the motion of bar 20. At each rightward stroke of bar 28 pawl 34 engages and drives forward one notch of ratchet wheel 23. At each leftward stroke, the pawl slips back one notch because the trigger 35 which carries the pawl, is depressed by striking dog 22 until the pawl slips back.

- At each partial rotation of ratchet wheel 23 under the driving force of pawl 34 the eccentric 25 is rotated an equal amount, thereby changing the distance that bar 20 will be pushed by bar 28. This change is reflected in the difference in stroke length imparted to grid 14 so that the amount of shadow thrown by a stoppage of the grid at any one place at all strokes will be reduced according to the number of different stopping places which are created by the ratchet teeth. If there are 30 teeth, there will be 30 different stopping places instead of one and the amount of shadow cast will be $\frac{1}{30}$ of what would ordinarily have been cast. The extent and clarity of the radiograph will thereby be much increased.

- 50 I claim as my invention:

1. In a radiographic diaphragm of the bucky type a grid, a conventional reciprocating bell crank drive for said grid including a pair of bell-cranks, a reciprocating bar driving said bell-cranks, a driving bar driving said reciprocating bar, an electric motor, an eccentric on said electric motor driving said driving bar, a case enclosing said grid and said drive, a dog mounted on the inner wall of said case, a ratchet, a lug on said reciprocating bar an eccentric adapted to be driven by said driving bar to communicate motion of the latter to the reciprocating

bar and ratchet rotating means carried upon said driving bar and making contact with said dog whereby to rotate partially at each stroke cycle of the driving bar, the eccentric, whereby to vary the length of throw imparted by reciprocating bar to said bell-cranks and so to said grid.

2. In an X-ray diaphragm of the bucky type a grid, a reciprocating bar attached to said grid, said bar having a plurality of slots therein, a spring attached to said bar, said spring being adapted to return said bar from one extreme of its position to the other, a driving bar adjacent said reciprocating bar, an eccentric driving said reciprocating bar, a lug on said reciprocating bar adjacent a slot thereof, an eccentric having a displacement parallel to said reciprocating bar and adapted to make contact with said lug and means for varying the stroke of said reciprocating bar and of the grid attached thereto, said means comprising a ratchet wheel, a stud tightly connecting said eccentric and said ratchet wheel, said stud being attached to the said driving bar and passing through a slot in said reciprocating bar, a trigger mounted on said stud, a pawl carried on said trigger and making contact with the periphery of said ratchet wheel, a dog mounted upon a fixed point and adapted to make contact with the outer end of said trigger and a plurality of springs, one of which is adapted to hold said trigger in contact with said dog and another which is adapted to hold said pawl in contact with the periphery of said ratchet wheel.

3. In a radiographic diaphragm of the bucky type, a case, slides therein for the reception of a cassette, other slides for the guidance of a grid, a grid and a drive for same, said drive comprising an electric motor of the inbuilt gear type mounted on the floor of said case, an eccentric on said motor, a horizontal driving bar pivoted within said case, a roller on said driving bar in contact with said eccentric, a reciprocating bar likewise pivoted in said case and adjustably attached to said driving bar, slots in said reciprocating bar, studs extending through said slots and through both of said bars, a ratchet wheel mounted below said driving bar on one of said studs, an eccentric mounted upon that stud which bears said ratchet wheel, said eccentric being mounted above said reciprocating bar, a lug on said reciprocating bar in contact with said last named eccentric, trigger-means actuable by the motion of said reciprocating bar whereby the position of said last named eccentric relative to said lug on said reciprocating bar may be changed through a partial revolution at each stroke of the driving bar and reciprocating bar to vary in length of horizontal stroke imparted at each alternate stroke of said driving bar to said reciprocating bar, the throw imparted to said grid by said reciprocating bar.

WALTER H. HAUPT.