F. SIMPSON & A. R. T. WOODS.

ILLUMINATING DEVICE FOR PHOTOGRAPHIC RECORDING APPARATUS.

APPLICATION FILED DEC. 22, 1911.

1,068,370. Patented July 22, 1913.

2 SHEETS—SHEET 1.

FIG. 1.

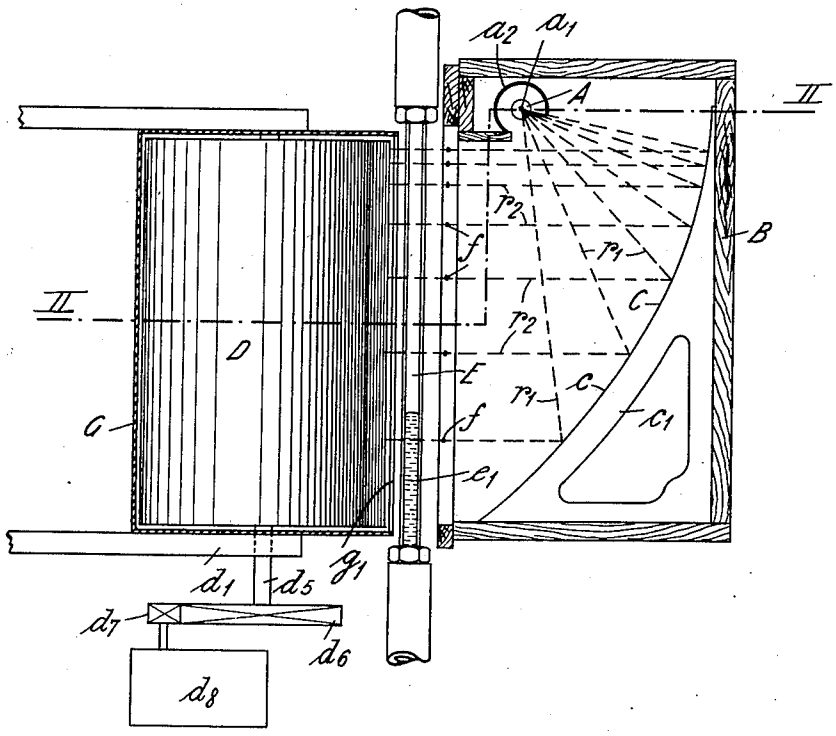
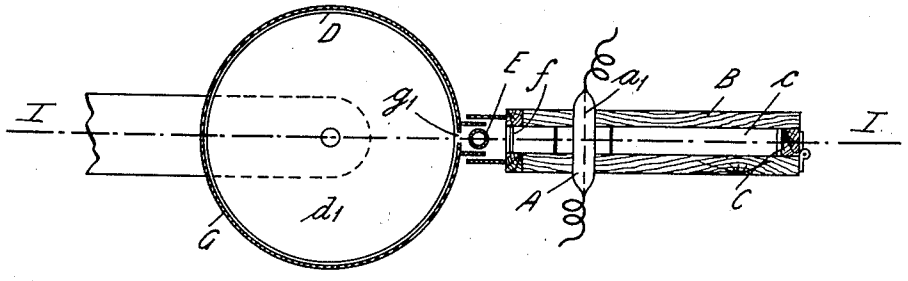


FIG. 2.



Attest
W. M. Barrett
H. L. Alden

Inventors
Fred Simpson
Arthur R. T. Woods
By Spear, Middleton, Donaldson & Spear
Atty's

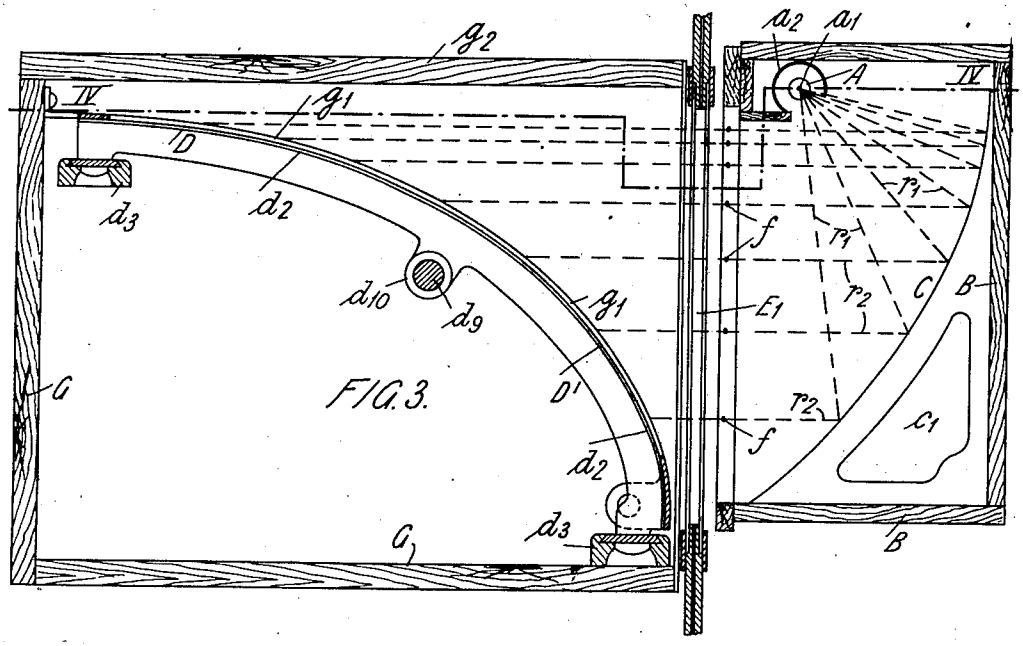
F. SIMPSON & A. R. T. WOODS.

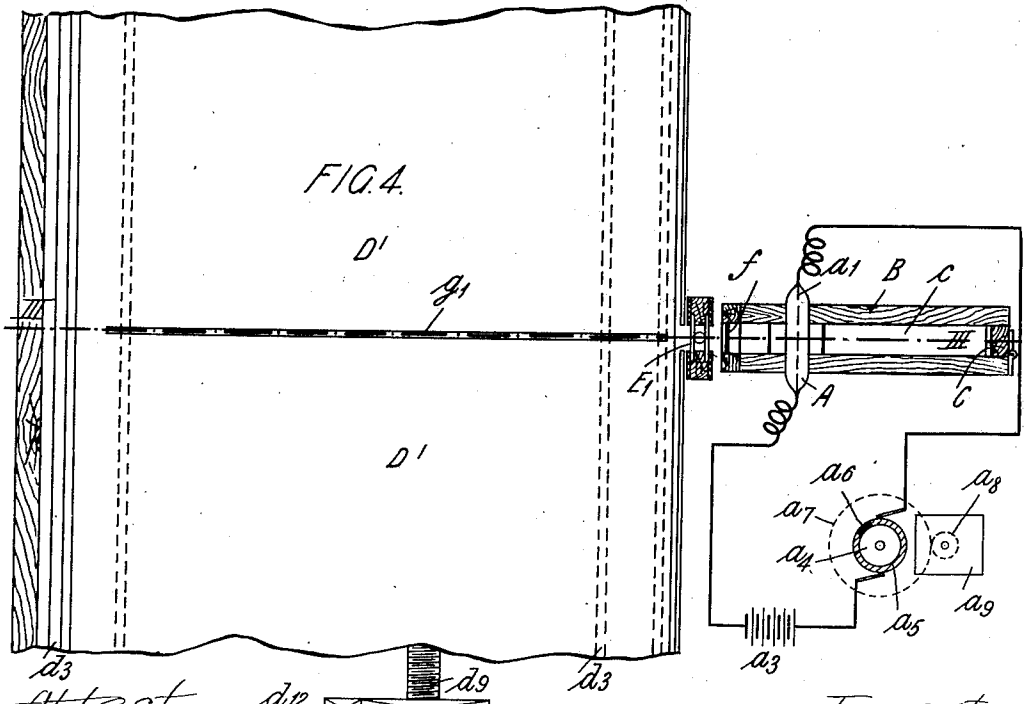
ILLUMINATING DEVICE FOR PHOTOGRAPHIC RECORDING APPARATUS.

APPLICATION FILED DEC. 22, 1911.

1,068,370. **Patented July 22, 1913.**

2 SHEETS—SHEET 2.





Attest
H. M. Barrett
H. L. Alden

Inventor
Fred Simpson
Arthur R. T. Woods
By Spear, Middleton, Donaldson & Spear
Attys

UNITED STATES PATENT OFFICE.

FRED SIMPSON, OF BLUNDELLSANDS, NEAR LIVERPOOL, AND ARTHUR ROBERT THOMAS WOODS, OF HARROW, NEAR LONDON, ENGLAND.

ILLUMINATING DEVICE FOR PHOTOGRAPHIC RECORDING APPARATUS.

1,068,370. Specification of Letters Patent. Patented July 22, 1913.

Application filed December 22, 1911. Serial No. 667,363.

To all whom it may concern:

Be it known that we, FRED SIMPSON, a subject of the King of Great Britain, and residing at Blundellsands, near Liverpool, England, and ARTHUR ROBERT THOMAS WOODS, a subject of the King of Great Britain, and residing in Harrow, near London, England, have invented certain new and useful Improvements in or Relating to Illuminating Devices for Photographic Recording Apparatus, of which the following is a specification.

In apparatus in which fluid pressure is measured and indicated by the height of a column of liquid in a glass gage tube, (as for example barometers, liquid flow meters of the Venturi type, or the like), it is a common practice to take a permanent record of the varying height of the column by photographic means, a band of sensitized paper, suitably masked, being traversed by clockwork behind the tube and a suitable illuminant being arranged in front of the tube. Where a lamp is used for this purpose, difficulty is experienced from parallax and from the penumbra effect, with the result that the record is not true to scale and has not a sharply defined edge.

According to the present invention the illuminant is arranged in respect to a parabolic reflector so as to give parallel reflected rays normal to the tube containing the liquid, and the invention also comprises improvements in respect to the shape of the sensitized surface.

The invention is illustrated in the accompanying drawings in which:—

Figure 1 is an elevation in section on the line I, I, of Fig. 2, which is a corresponding plan in section on the line II, II, of Fig. 1. Fig. 3 is an elevation in section on the line III, III, of Fig. 4, of a modification, and Fig. 4 is a corresponding plan in section on the line IV, IV, of Fig. 3.

Referring in the first instance to Figs. 1 and 2;—A is the lamp which is preferably an incandescent electric lamp the filament a^1 of which is straight and arranged horizontally in a narrow box B, at the back of which is located the reflector C arranged in the form of a narrow reflecting surface which in elevation is of parabolic contour so that rays of light r^1 falling on it from the filament a^1, which in elevation is a point located at the focus of the parabola C, are reflected in rays r^2 normal to the tube containing the liquid the movements of which have to be recorded. In Figs. 1 and 2 the said surface is sensitized paper mounted on a drum d^1 which is rotated by clock work or other suitable means and surrounded by a cylinder G having a vertical slot g^1 located just behind and parallel with the tube containing the liquid the movements of which have to be recorded; the slot g^1 is open or covered with a transparent material and the cylinder G is either opaque, or of a material transparent only to non-actinic rays, say of red or yellow celluloid. In the case illustrated, the part, the movements of which have to be recorded, is a liquid e^1, opaque to actinic light rays, and contained in the gage glass E located in front of the slot g^1.

If the drum d^1 be rotated by clock work then it is obvious that, since the paper behind the liquid will be screened from the rays r^2, a record will be made on the sensitized paper by the light passing above the liquid giving the height of the liquid e^1 in relation to time; and as the rays r^2 are parallel, the edge of the record will be clear and definite.

Wires f may be fixed across the path of the parallel rays so as to produce lines dividing the record according to the scale of the apparatus.

If the gage glass E be, say, a boiler or tank gage glass, the wires would be equally spaced, but if connected to a metering device for liquid flow, these divisions will be unequally spaced since the flow will be, in such apparatus, usually proportional to the square of the height of the column of liquid in the gage glass. If, however, the sensitized paper D be mounted on a surface d^2 (Figs. 3 and 4) suitably shaped, it will be seen that though the distances between the successive wires f may be unequal, it is easy to so shade d^2 that the images of these wires projected by the parallel rays on the surface D may be equally spaced.

In the modification illustrated in Figs. 3

and 4, the arrangement is similar to that already described, except that the drum d^1 is replaced by a curved surface d^2 mounted on cross slides d^3 and moved across the slot by a feed screw d^4 operated by a clock work mechanism. In order to increase the definiteness of the record the slot g^1 is carried around and close to the surface d^2 but is of course fixed, as before, in the line of the parallel rays r^2.

In Figs. 3 and 4 the tube E^1 is formed with parallel glass sides so as to give a clearer image.

The reflecting strip C need only be as wide as the gage tube or slightly wider, and the box or casing B has sides which reach to the gage tube so as to cut off extraneous light.

The illuminant may be extinguished periodically for definite intervals by means controlled by a time-piece, which may be the drum driving clock where this is sufficiently accurate; at such intervals blank lines are left on the record which give the time markings and obviate the use of marked paper and the need for accurately setting it. Where the illuminant is an electric light such controlling means comprise a switch in the lighting circuit, said switch being periodically opened by a cam or the like on one of the clock spindles.

Where gas is used as an illuminant an electromagnet would be fitted, controlled by the said switch and adapted, when actuated, to cut down the gas supply; or the said magnet may control a screen adapted to cut off the light during the said intervals.

The vertical sides of the box B may have plane mirrors fitted, so that rays of light falling on them are reflected finally on to the parabolic reflector, in which case both these rays and the rays falling directly on to the said reflector are reflected parallel with a horizontal plane.

The reflecting strip c may be cast or it may be of polished sheet metal or glass silvered at front or back and held in position and form by the accurately shaped back c^1 of the box against which it is clipped.

A cylindrical reflector a^2 may be arranged behind the lamp filament and concentric with it or very approximately so. The reflected light from the reflector will still in effect radiate from the focus of the parabolic reflector C.

Where an electric lamp is not available, any other suitable illuminant may be used, and a converging lens with cylindrical surfaces may be used therewith to focus the said illuminant on a horizontal line at the focus of the reflector, or a mask having a narrow slit may be used instead of or in addition to the converging lens.

The device is not restricted in its application to liquid gage columns, as it may obviously be used in analogous cases where a range of movement has to be recorded, for instance, an opaque screen connected to the moving part of any indicating instrument may be used with the apparatus described, said screen being located in front of the slot; and in some cases instead of using the edge of the screen in the manner described in connection with the liquid, the screen may be extended vertically across the rays and be provided with a horizontal slot through which the said rays will give a clearly defined line record.

In Figs. 1 and 2 the sensitized film is mounted on a drum D, the spindle of which, d^5, is provided with a gear wheel d^6 driven by a pinion d^7 actuated by any suitable clock work mechanism d^8.

In Figs. 3 and 4, the curved surface d^2 is driven by a screw d^9 gearing with a nut d^{10} and having a wheel d^{11} geared to a pinion d^{12} driven by any suitable clock work mechanism d^{13}.

The intermittent illumination of the lamp A is provided by connecting the lamp in series with a source of power a^3 in parallel with a commutating device a^4 having a conducting peripheral portion a^5 and an insulated peripheral portion a^6. The commutator is driven by a gear wheel a^7 which meshes with a pinion a^8 of any suitable clock work mechanism a^9.

Having now fully described our invention, we declare that what we claim, and desire to secure by Letters Patent is:—

1. In a photographic recording apparatus, in combination, a narrow cell provided at one end with a parabolic reflector and at the other end with a narrow slot, an illuminant in said cell at the focus of the parabolic reflector, a sensitized film carried on a curved surface generated by a straight line moving parallel to itself and at right angles to the plane of light emerging from said slot, the focus of the said line being a cycloidal curve, a clock mechanism for moving said surface and film back across the said slot, a fixed shield over said surface provided with narrow slit in direct alinement with the slot of said narrow cell, and a column of opaque liquid, the movement of which has to be recorded, located in a transparent container interposed between the said slot and slit, substantially as described.

2. In a photographic recording apparatus in combination, a narrow cell provided at one end with a parabolic reflector, at the other end with a narrow slot, and the side walls comprising parallel reflectors, an electric light within said cell, the filament of which is located at the focus of the parabolic reflector and at right angles to the

parallel reflecting sides, a sensitized film carried on a curved surface generated by a straight line moving parallel to itself and at right angles to the plane of light emerging from the said slot, a clock mechanism for moving the said surface and film, a fixed shield over said surface provided with a narrow slit in direct alinement with the narrow slot of said cell and a column of opaque liquid in a transparent container interposed between said slot and slit, substantially as described.

In testimony whereof we affix our signatures in the presence of witnesses.

FRED SIMPSON.

Witnesses to the signature of the above-named Fred Simpson:

J. E. LLOYD BARNES,
JOSEPH E. HIRST.

ARTHUR ROBERT THOMAS WOODS.

Witnesses to the signature of the above-named Arthur Robert Thomas Woods:

ARTHUR V. WHITTINGTON,
JOHN I. JOHNSTON.