

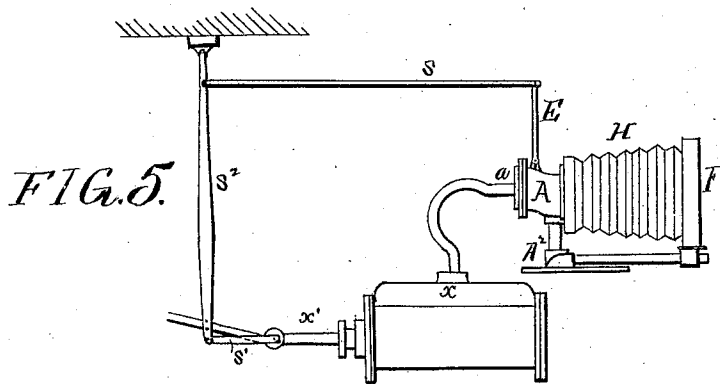
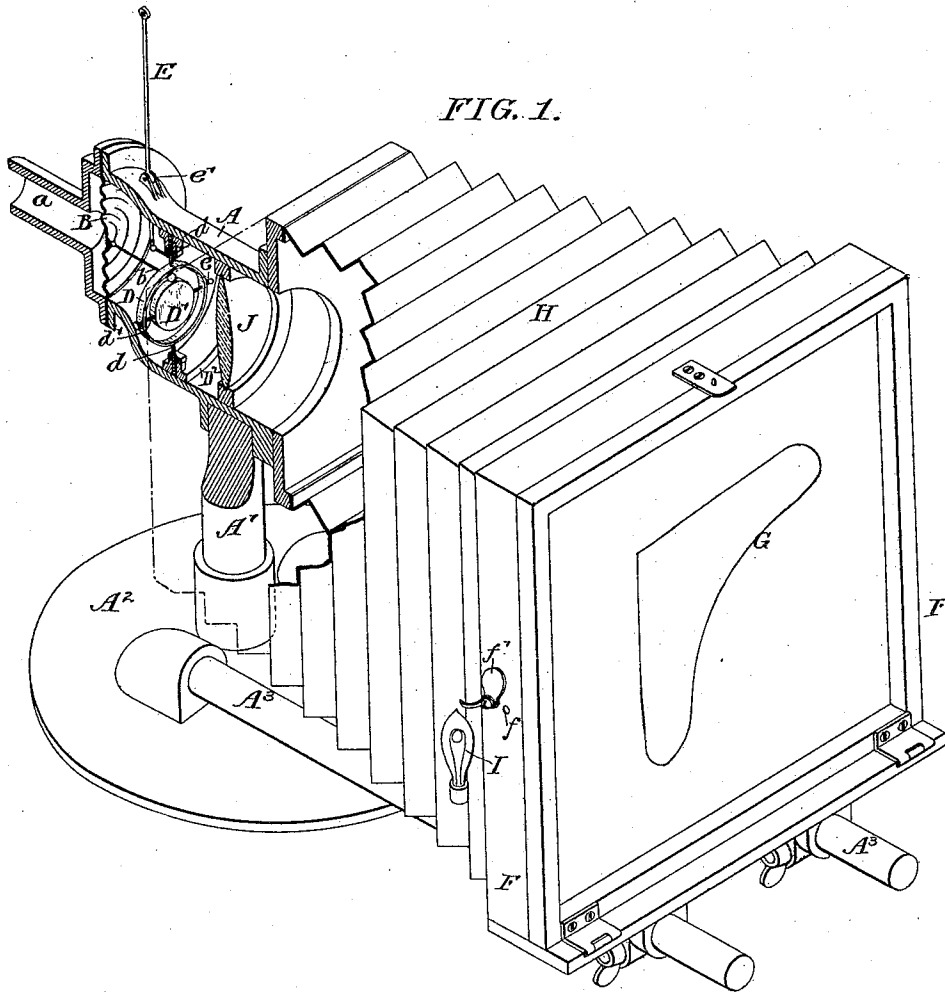
(No Model.)

2 Sheets—Sheet 1.

C. H. BEDELL.
STEAM ENGINE INDICATOR.

No. 575,202.

Patented Jan. 12, 1897.



Witnesses:
Hamilton D. Turner
Wm. A. Barr.

Inventor:
Charles H. Bedell
by his Attorneys
Horsman & Horsman

(No Model.)

2 Sheets—Sheet 2.

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FIG. 4.

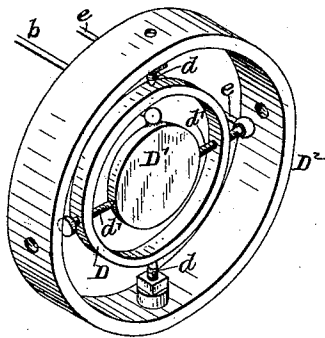


FIG. 2.

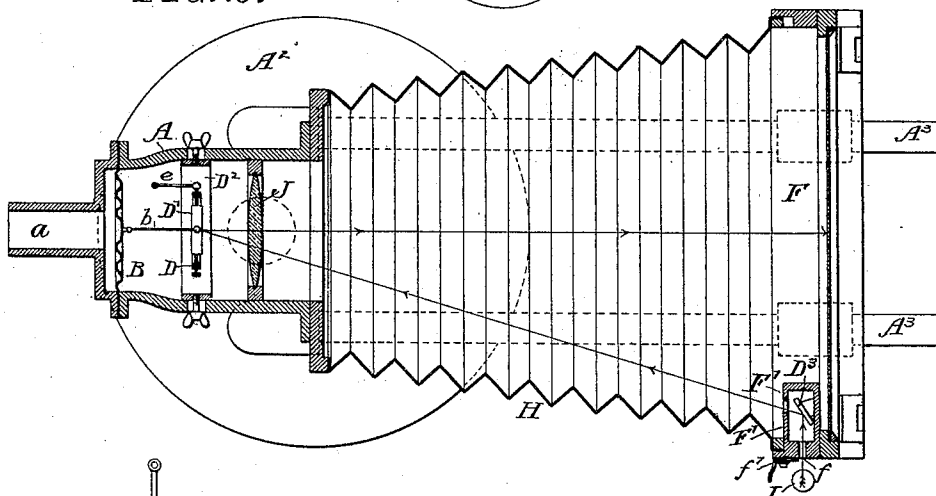
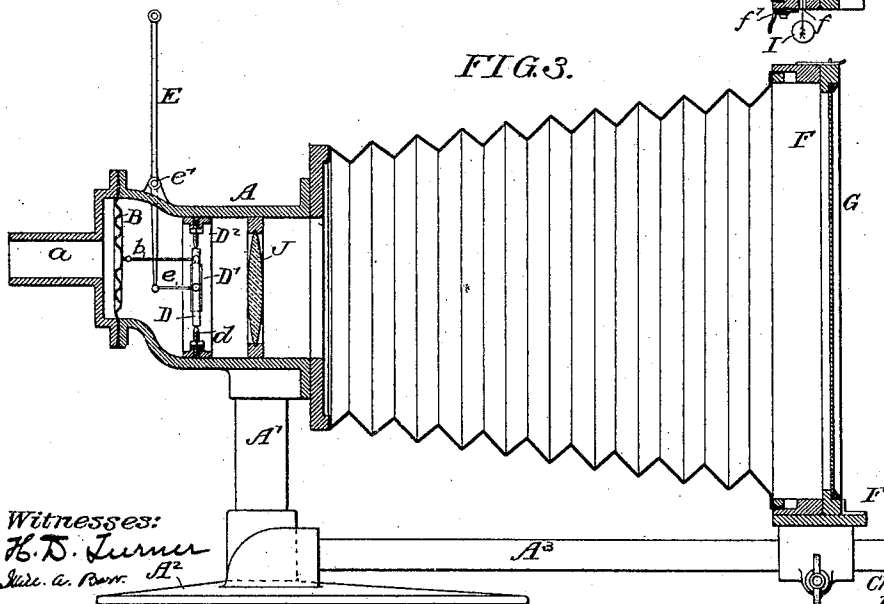


FIG. 3.



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UNITED STATES PATENT OFFICE.

CHARLES H. BEDELL, OF SWARTHMORE, PENNSYLVANIA.

STEAM-ENGINE INDICATOR.

SPECIFICATION forming part of Letters Patent No. 575,202, dated January 12, 1897.

Application filed June 8, 1896. Serial No. 594,785. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. BEDELL, a citizen of the United States, and a resident of Swarthmore, Delaware county, Pennsylvania, have invented certain Improvements in Steam-Engine Indicators, of which the following is a specification.

My invention relates to certain improvements in engine-indicators whereby the usual mechanical contrivance for marking by pencil upon paper is dispensed with and the rays from a suitable source of light are projected upon a plate to indicate the action of the engine. The plate can be either a ground-glass plate or, where it is desired to retain the image projected, a sensitized photographic plate can be used, and this plate can be developed in the ordinary manner and prints taken from it.

In the accompanying drawings, Figure 1 is a perspective view, partly in section, of my improved indicator. Fig. 2 is a sectional plan view. Fig. 3 is a longitudinal sectional view. Fig. 4 is a perspective view of the mirror, drawn to an enlarged scale; and Fig. 5 is a diagram view showing the indicator coupled to an engine.

A is a chambered casing having in it a diaphragm B of any suitable form, and *a* is a pipe communicating in the present instance with the steam-chest or steam-pipe of an engine. In the chamber A is a pivoted ring D, mounted on vertically-arranged pivots *d d*, so as to swing laterally, the pivots being very delicate, so that they will turn readily. Mounted on horizontal pivots *d'*, secured to the ring, is a mirror D'. Thus the mirror is so mounted that it will be capable of an angular movement. The ring in the present instance is carried by a frame D², which can be adjusted toward or from the diaphragm.

The mirror D' is connected by a rod *b* to the center of the diaphragm B. The rod and diaphragm are connected, preferably, by a ball-and-socket joint. The ring D is connected to a lever E by a rod *e*, the lever being pivoted at *e'*. This lever is connected in any suitable manner to the piston-rod, cross-head, or other moving part of the engine.

The casing A is mounted on a suitable bar A', projecting from the base-plate A². This plate has rear extensions A³, on which is

adapted to slide the frame F, carrying the ground-glass plate G and plate-holder when used. At one side of this frame F is a compartment F', in which is a mirror D³, arranged at such an angle in respect to the mirror D' that rays of light entering an opening *f* in the frame F will be reflected onto the mirror D' and projected onto the ground-glass plate G. The illuminator I can be of any available character, and is so situated in respect to the opening *f* that the rays of light from it will be projected onto the mirror D³. A shutter *f'* can be used to close the opening when necessary.

The chamber F is so arranged that the rays of light will not affect the plate directly, but only indirectly through the mirrors. The frame F is connected to the casing A by means of a bellows section H of the form common in ordinary photographic cameras, so that by adjusting the frame F on its support the proper focus can be obtained.

In order to have a sharp line indicated upon the ground glass, I use a condensing-lens J in the path of the rays of light from the mirror D³.

The operation of the indicator is as follows: The pipe *a* of the casing A is coupled to the steam-chest *x* of the engine preferably by a flexible connection, and the lever E is connected to the piston-rod *x'* through the links *s s'* and pivoted arm *s²*, so that as the rod reciprocates the motion will be imparted to the swinging mirror D' to cause the ray reflected therefrom to move back and forth transversely over the ground glass of the indicator, while the varying pressure in the cylinder will cause vibration of the diaphragm B, which will be imparted to the pivoted ring D, in which the mirror D' is mounted, thereby causing the ray to travel vertically over the ground glass, so that the sum of the two movements will produce on said ground glass a correct indicator-diagram.

It will be understood that in some instances the connections may be reversed. The mirror D' may be connected to the lever E and the ring D may be connected to the diaphragm B, and as a substitute for the diaphragm I may use a piston acting within the casing, and in place of the bellows section a telescopic section may be used as an equivalent.

lent, and a prism may be used in place of the mirror D'.

When I wish to make a photographic reproduction, I substitute for the ground glass the ordinary photographic-plate holder and mount a sensitized plate therein, taking care, however, that no light enters the dark chamber except what is reflected by the mirror D'.

Although I prefer in all cases to use the universally-pivoted mirror and to impart two movements to the same in a direction at right angles to each other, one movement due to the varying pressure in the cylinder and the other to the stroke of the piston, the essential principles of my invention may be embodied in an indicator in which the mirror has but one swinging movement, namely, that due to the varying pressure in the cylinder, the plate or plate-holder having connection with the cross-head or other reciprocating part of the engine, so as to be moved laterally thereby, and it will be further evident that instead of using a mirror as a means of projecting a beam of light direct onto the same the swinging projector may itself carry the illuminator. For instance, it may be in the form of a small lantern having a suitable condensing-lens whereby a ray of light may be thrown onto the object glass or plate.

I claim as my invention—

1. The combination in an engine-indicator, of means for projecting a beam of light, said projector being mounted so as to be capable of an angular movement, and provision whereby the varying pressure in the engine-cylinder is caused to effect such angular motion of the projector, substantially as described.

2. The combination in an engine-indicator, of a mirror, means whereby the varying pressure in the engine-cylinder is caused to give the mirror an angular movement, and provision for directing a beam of light onto said mirror so as to cause it to be projected thereby, substantially as described.

3. The combination in an engine-indicator, of a mirror, means whereby the varying pressure in the engine-cylinder is caused to give the mirror an angular movement, provision for directing a beam of light onto said mirror so as to cause it to be projected thereby and a focusing-lens situated in the path of the beam of light, substantially as described.

4. The combination in an engine-indicator, of means for projecting a beam of light, said projector being mounted so as to be capable of universal movement, means whereby the varying pressure in the engine-cylinder is caused to move the projector in one direction and a connection between said projector and some reciprocating portion of the engine whereby said projector is caused to produce a corresponding motion in a direction at right angles to the movement due to the pressure, substantially as described.

5. The combination in an engine-indicator, of a mirror universally mounted, a device connected to the pressure-chamber of the engine and connected to the mirror so that the movement of the mirror will be angular around one axis and a device connected to the reciprocating part of the engine for producing a corresponding movement of the mirror at right angles to the line indicated by the pulsations of the engine, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES H. BEDELL.

Witnesses:

WILL. A. BARR,
JOS. H. KLEIN.