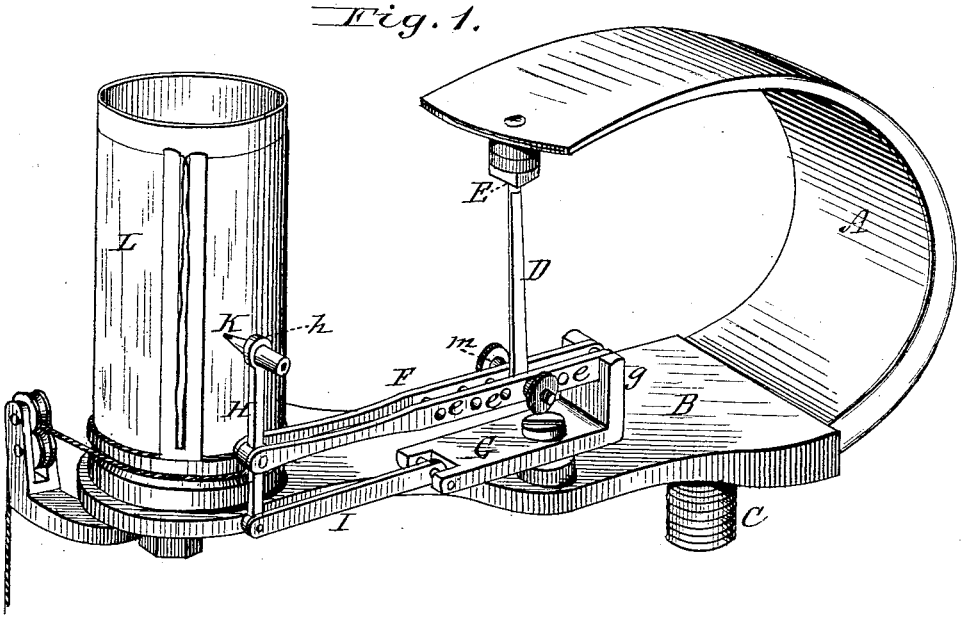
J. RAE.

Pressure-Indicator for Steam-Engines.

No. 204,086. Patented May 21, 1878.

Fig. 1.



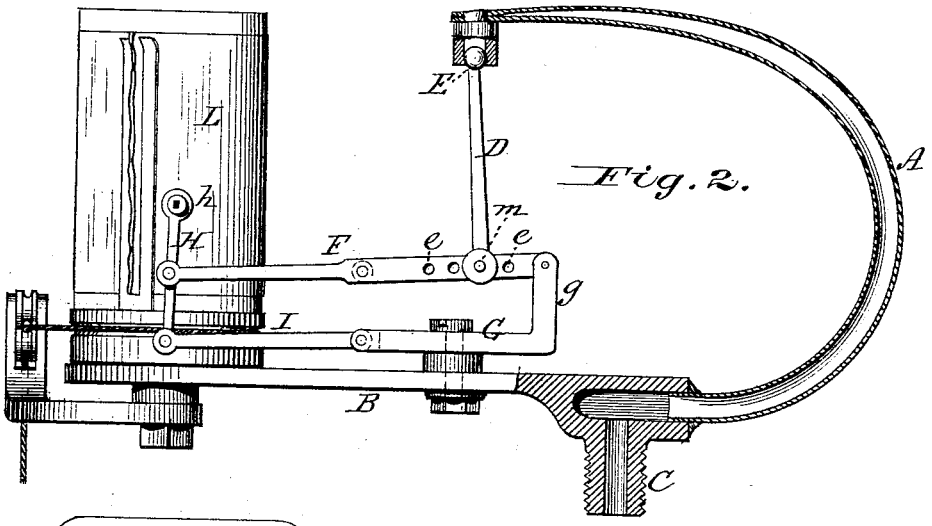
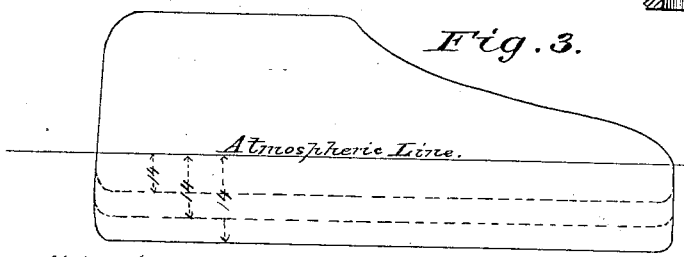


Fig. 2.

Fig. 3.



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IMPROVEMENT IN PRESSURE-INDICATORS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **204,086**, dated May 21, 1878; application filed December 20, 1877.

To all whom it may concern:

Be it known that I, JOHN RAE, of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Pressure-Indicators; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My invention relates to an improvement in the pencil-moving or registering devices of a registering pressure-gage; and its object is the production at will of pressure diagrams of different scales by means of the same gage—that is, to produce a diagram as large with twenty-five pounds of steam as with one hundred pounds, so as to multiply the defects that there may be in the engine, and this I effect with one spring and pencil attachment. To this end I so construct the pencil-moving lever that the motive-power may be applied thereto at variable points with relation to the fulcrum of said lever, and thereby vary the extent of movement of the pencil, when desired.

In the accompanying drawing, illustrating my invention, is shown its application to a steam-gage having a tubular or what is known as a "Bourdon" spring, but it may be as well applied to diaphragm or piston gages, as will be readily understood from the following description by persons familiar with the construction of such gages.

Figure 1 is a perpective view of a registering pressure-gage embracing my invention; Fig. 2, a view, partly in elevation and partly in vertical section, of the tubular spring and pencil-operating devices of a registering steam-gage. Fig. 3 shows a diagram such as would be taken at different pressures.

One end of the tubular spring A is attached to a base, B, and curves upward in approximately semicircular form. The lower end of this tubular spring is provided with a screw-nozzle, C, by means of which it may be connected to a steam boiler, cylinder, or other chamber within which steam or other vapor pressure is exerted.

A rod, D, is connected by a ball-and-socket joint, E, to the upper end of the spring, and the lower end of said rod is adjustably pivoted to a long lever, F, which is fulcrumed upon an arm, *g*, of a bracket, G, arranged upon the base B.

The outer end of the lever F is pivoted to the center of a vertical arm, H, the lower end of which is pivoted to one end of a short link, I, the other end of which is pivoted to the end of the bracket G, and occupies a position parallel with the spring-connecting lever.

The upper end of the vertical arm H is provided with a pencil-holder, *h*, in which is the pencil K, the point of which presses against the paper on the surface of the rotary drum L.

The object of the centrally-pivoted pencil-arm H, in connection with the parallel arrangement of the lever and link of unequal length, is to produce a direct vertical movement of the pencil, parallel with the axis of the drum, so that if the drum should remain stationary, and the lever F be moved, the pencil would produce a directly vertical line upon a sheet of paper placed in the usual manner upon said drum, for, as the upward movement of the lever F moves its pivot connection with the arm H upward and inward in a curved line, the simultaneous movement of the short link I moves the lower end of said arm inwardly, thus keeping its upper end outward sufficiently to compensate for the movement of the center, and thus maintain a movement of the pencil parallel with the axis of the cylinder.

The lever F is provided with a longitudinal series of holes, *e*, into either of which may be inserted the pin *m*, by which the rod D is pivoted to the lever.

Now, it is obvious that a given expansive movement of the tubular spring, caused by a certain degree of vapor or steam pressure therein, will, through the rod D, produce a movement of the pencil end of the lever F, varying in extent according to the relative proportions of the parts or arms of said lever on each side of the point of applied power. For instance, if the rod D be pivoted at the hole *e*, nearest the fulcrum of the lever F, a given extent of expansive movement in the spring will produce a greater movement of the lever than if said rod were pivoted at the hole farthest from the fulcrum.

Suppose the gage to be connected to one end of a steam-cylinder, it is obvious that the alternate supply and exhaust of pressure in said cylinder will cause a vibratory motion or alternate expansion and contraction of the spring, and a corresponding movement of the pencil.

Now, the drum L is connected with the cross-head or other part of the engine by a cord, so arranged as to give the desired length of diagram, and a spring in the drum to give a reciprocating motion, and when a sheet of blank paper is fixed upon the surface thereof this reciprocating motion, combined with the movement of the pencil, causes to be produced upon the paper a variable line, which will show the pressure at any given point of the stroke on a scale according to the point at which the rod D is pivoted to the lever F.

Referring to the diagram, the dotted lines show the pressures on the same card and with the same spring of twenty-five pounds of steam for the adjustment in the first hole *e* from the fulcrum, thirty-five pounds for the second, and fifty pound for the third.

The object is to multiply and show the defects that may be in the engine, and to produce different scales with the same spring, twenty pounds to one inch, forty pounds to one inch, sixty pounds to one inch, &c. The only difference there will be in the appearance of the diagram with twenty-five and fifty pounds will be in the case of condensing-engines, when the distance of the vacuum-line from the atmospheric would only be one-half at fifty of that at twenty-five.

Instead of the gage being connected to a cylinder to register the pressure at every stroke of the piston, it may be connected to a boiler or any other chamber in which vapor is exerted, and the drum-sheet may be so subdivided that the pencil will register the variations of pressure in the boiler.

To any one at all familiar with pressure-gages there will be no difficulty in connecting my registering devices with any of the known forms of diaphragm or piston-gages without special instructions, all that is necessary being to connect the usual index-operating lever or arm by a suitable link to the lever F, arranging the parts, of course, as required or suggested by circumstances, and to produce the required movement of the pencil-carrying arm.

The ball-and-socket joint E of the spring-connecting rod allows the latter to vibrate with the action of the spring without binding, and renders it easy to work with the different adjustments of the lever and rod connections.

I claim—

1. A registering pressure-gage, having a suitable motor, a lever adjustably connected therewith and connected with the pencil-carrying arm, in combination with a moving tablet, sheet, or drum, substantially as described.

2. The combination of the pencil-moving lever F, adjustably-pivoted rod D, and spring A, substantially as described.

3. The combination of the spring A, adjustably-pivoted rod D, lever F, centrally-pivoted pencil-arm H, and link I, substantially as described.

4. The combination, with the hollow spring A, the pencil-lever F, and the adjustable connecting-rod D, of the ball-and-socket joint E, for the purpose stated.

In testimony that I claim the foregoing I have affixed my signature in the presence of two witnesses.

JOHN RAE.

Witnesses:
C. A. FRASER,
G. FROTSCHER.