

(No Model.)

F. M. CLARK.
STEAM ENGINE INDICATOR.

No. 535,485.

Patented Mar. 12, 1895.

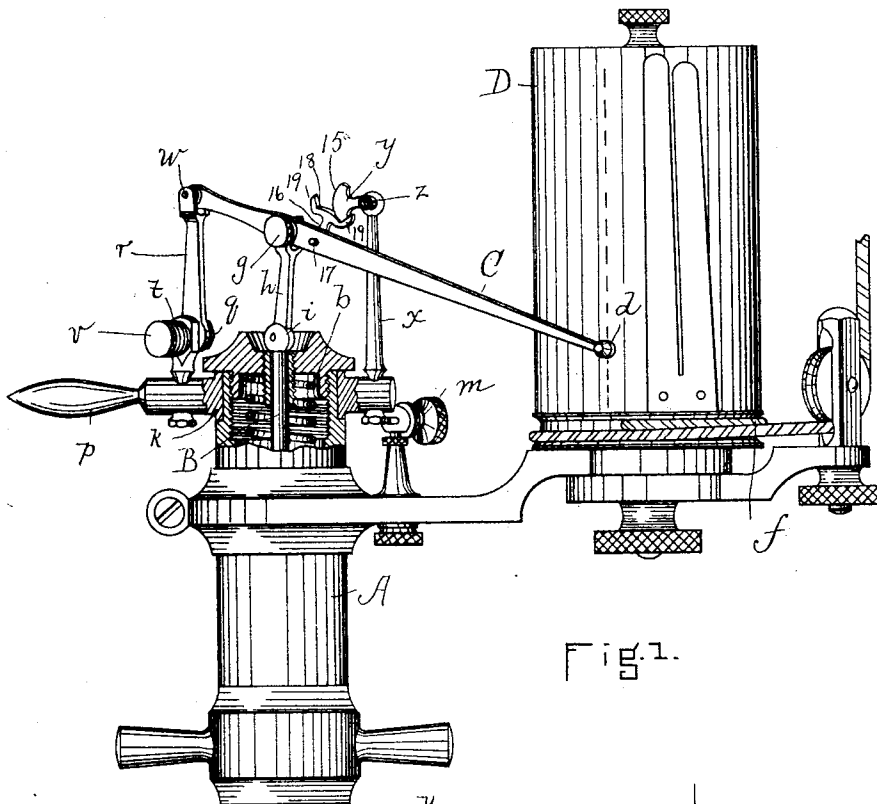


Fig. 1.

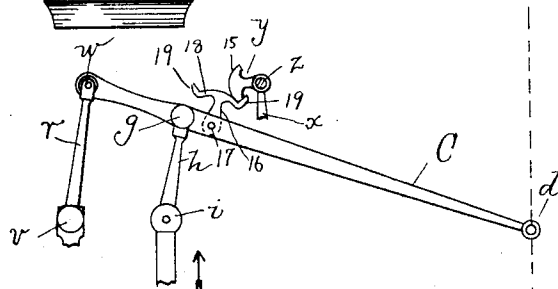


Fig. 2.

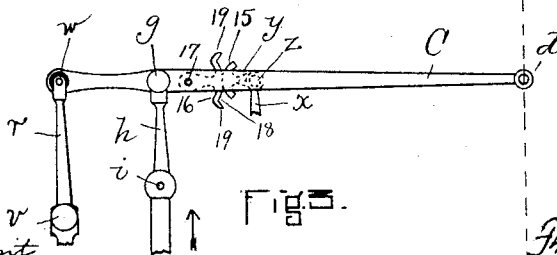


Fig. 3.

WITNESSES.

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STEAM-ENGINE INDICATOR.

SPECIFICATION forming part of Letters Patent No. 535,485, dated March 12, 1895.

Application filed January 2, 1895. Serial No. 533,512. (No model.)

To all whom it may concern:

Be it known that I, FRANK M. CLARK, of Tilton, in the county of Belknap, State of New Hampshire, have invented certain new and useful Improvements in Steam-Engine Indicators, of which the following is a description sufficiently full, clear, and exact to enable any person skilled in the art or science to which said invention appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is an elevation of my improved indicator a portion thereof being shown in section and the rocking indicator and its direct connections being shown in perspective; Fig. 2, an elevation of said lever and its guide cams, the marking point being shown as depressed, and Fig. 3 a like view showing the lever in horizontal position.

Like letters and figures of reference indicate corresponding parts in the different figures of the drawings.

My invention relates especially to an improvement in indicators for steam-engines, the object being particularly to overcome the difficulties incident to many of the forms of indicators now in common use which result from the fact that the marking point of the rocking or vibrating lever will not describe a straight line. Although in many of these devices the pencil describes an approximate straight line at the extreme points of its stroke the line in wavy and curved sufficiently to interfere with the reckoning of the card.

In carrying out my invention I make use of means which will be readily understood by all conversant with such matters from the following explanation:

In the drawings, A represents the cylinder of the indicator which is of the usual construction and is provided interiorly with a piston having a piston-rod, B, the piston being held against the steam-pressure by a spring, b, in the usual manner. The varying pressure of the steam on its piston and the reciprocation by the spring is indicated by a pencil, d, mounted on the rocking or vibrating lever, C, said pencil describing the line on the card on a cylinder, D. This cylinder, D, is actuated

by a cord, f, connecting with the engine in the usual manner. The lever, C, is pivoted at, g, to rock vertically in an arm, h, pivoted at, i, to the upper end of the piston, B. A sleeve, k, is fitted to rotate on the upper end of the cylinder, A, its movement in one direction being regulated by a stop-screw, m. This sleeve is provided with a handle, p. On the casting above said handle a short rock-shaft, q, is mounted and fast on said shaft there is a vertical arm, r. A coiled spring, t, acts torsionally to throw said arm toward the cylinder, A, the tension of said spring being regulated by a screw, v. The upper end of the arm is pivotally connected at, w, with the short arm of the vibrating lever, C. A standard, x, is fast on the sleeve casting and on the top of this standard a cam, y, is fast at, z. This cam has an arc-shaped face, 15. A companion cam, 16, is pivoted at, 17, to the vibrating arm, C, said cam having a working face, 18, on an arc from its pivot as a center, said face being in position to engage the face of the cam, y. The ends of the cam, 16, are turned up at, 19, so as to engage outside the ends of the companion cam and hold these parts in position during certain movements of the vibrating arm or lever.

The pivot, 17, and point, z, where the cam, y, is secured are in different planes as will be seen. As the piston, B, moves upward under the steam pressure the faces of the cams working together force the lever, h, pivoted to said piston into alignment with the piston, until the vibrating lever, C, is in horizontal position, as shown in Fig. 3, the arm or link, r, being thrown outward against the pressure of the spring, t, conjointly with this movement. Said spring as will be understood tends at all times to compel the indicator lever, C, to move endwise as it is vibrated up and down by the spring and steam. As soon as the piston is advanced far enough to drive the indicator lever beyond the horizontal plane shown in Fig. 3, the distance between the point, z, and pivot, 17, of the cams shorten causing the pencil end of the indicator lever to deviate from the arc of a circle and to maintain a straight line. The pressure of the spring, t, holds the cam working faces together and

said faces being cut on two arcs of which the radii vary as said cam, 16, moves by reciprocation of the piston, the pencil, *d*, is carried accurately in a straight line.

5 As in Figs. 1 and 2 the pencil is shown at the end of a stroke and the turned up point, 19, on the cam, 16, is engaged with one end of the cam, *y*. The piston returning, the cam surfaces work together to force the indicator
10 or vibrating lever against the pressure of the spring, *t*, and equalizing the tendency of said pencil to describe an arc from the pivot, *w*. These cam surfaces may be laid out geometrically and the position of the pivot, 17, and
15 point, *z*, in relation to each other and the pivot, *g*, accurately determined.

The connection of the vibrating or indicator lever, *C*, is direct with the piston, and the simplicity of the parts employed in obtaining
20 the movement described renders the apparatus exceedingly steady in its operation.

I do not confine myself to the particular construction of cams shown for regulating the movements of the vibrating lever, nor to locating them exactly in the position described,
25 a salient feature being the forming of a connection between the vibrating lever of an indicator and a fixed support consisting of two cams having working faces in engagement,
30 said faces being formed on determined arcs and one of said cams pivoted to the lever while the companion cam is fixed on a support in such manner that the distance between

said pivot and a point on the companion cam varies as the lever vibrates. 35

Having thus explained my invention, what I claim is—

1. The combination with the spring-pushed indicator lever of a cam pivoted thereon, and a cam mounted on a support in engagement
40 with said first cam, substantially as described.

2. The combination of the pivoted spring-pushed indicator lever of an arc-shaped cam pivoted thereon, an arc-shaped cam mounted on a support and engaging said first cam in
45 opposition to said spring, substantially as described.

3. The combination with the piston of the indicator lever pivotally connected therewith; the spring-tensioned link, *r*, pivoted to the
50 short arm of said lever; a cam pivoted to the long arm of said lever; a cam mounted on a fixed support, said cams having arc-shaped working faces in engagement in opposition to said spring. 55

4. The combination with the spring-pushed pivoted indicator lever, of the cam, 16, pivoted thereon; the cam, *y*, mounted on a support, said cams having arc-shaped working faces,
60 15, and, 18, and in engagement in opposition to said spring, substantially as described.

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Witnesses:

K. DUFFEE,
O. M. SHAW.