

G. H. CROSBY.
Steam-Engine Recorder.

No. 219,149.

Patented Sept. 2, 1879

Fig. 1.

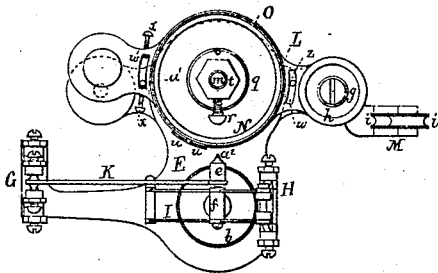


Fig. 2.

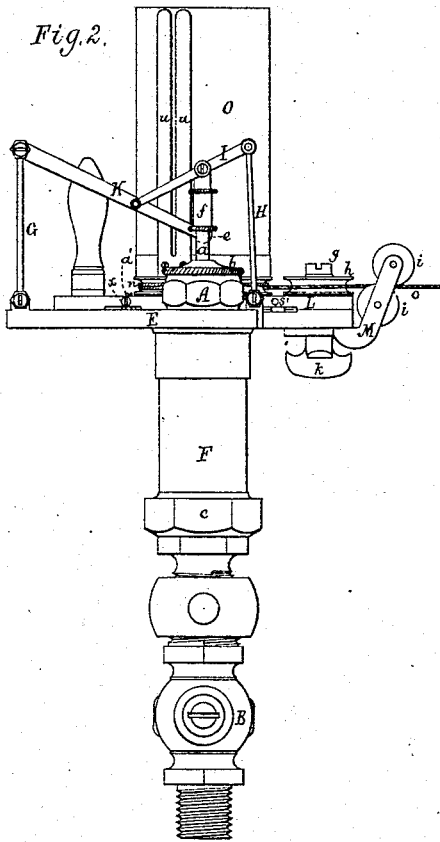
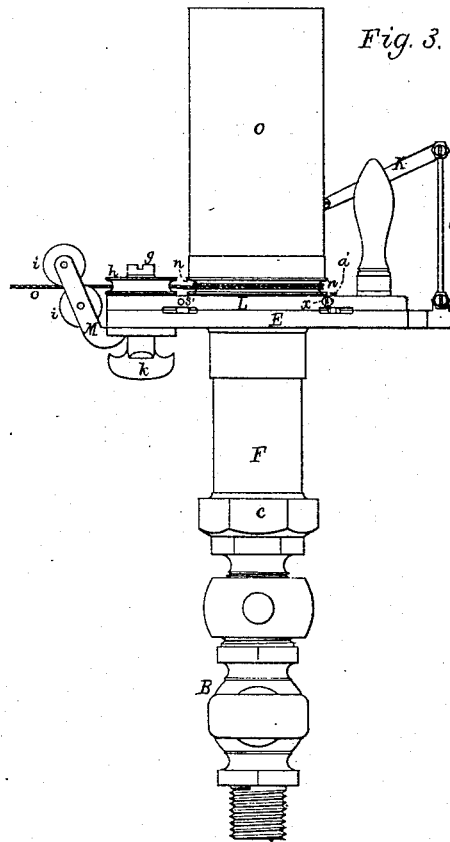


Fig. 3.



Witnesses:

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Fig. 6.

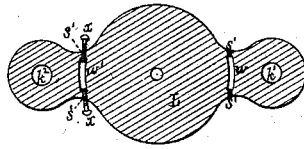


Fig. 4.

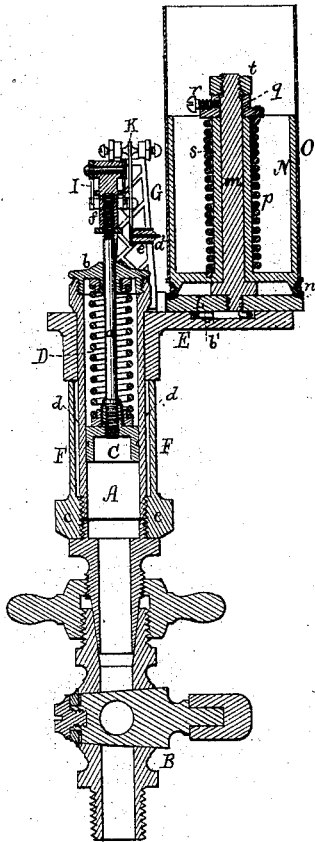
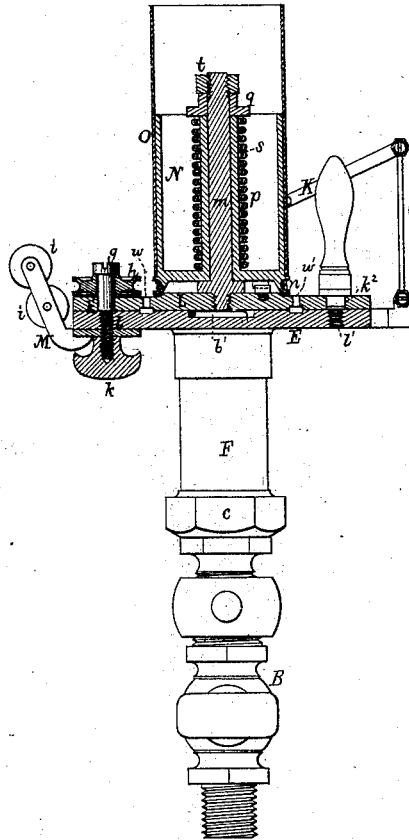


Fig. 5.



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UNITED STATES PATENT OFFICE.

GEORGE H. CROSBY, OF EAST SOMERVILLE, MASSACHUSETTS.

IMPROVEMENT IN STEAM-ENGINE RECORDERS.

Specification forming part of Letters Patent No. **219,149**, dated September 2, 1879; application filed December 24, 1878.

To all whom it may concern:

Be it known that I, GEORGE H. CROSBY, of East Somerville, of the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Steam-Engine Indicators; and do hereby declare the same to be described in the following specification and represented in the accompanying drawings, of which—

Figure 1 is a top view, Fig. 2 a front elevation, Fig. 3 a rear elevation, and Figs. 4 and 5 transverse and vertical sections, of an indicator containing my invention.

The indicator is to register the degrees of steam-pressure exerted on the piston of an engine during its stroke, my invention consisting in improvements on indicators of the kind provided with rotary drums or cylinders for supporting and revolving the sheet of paper while it may be in the act of being marked by the marker when moved vertically by the piston of the indicator or by mechanism operated thereby.

As indicators of the class mentioned are well known and in common use, and as their mode of operation and the results attainable by such are well understood by engineers or persons skilled in steam-engines, it will not be necessary for me to describe such.

My invention consists, first, in the combination of two vibratory standards and two levers arranged and combined with each other and with the indicator piston-rod and supporting-arm, essentially in manner and to operate as set forth; second, in the piston-cylinder applied to move lengthwise in its sustaining arm or plate, in combination with an encompassing chambered jacket fastened to such cylinder at its lower part only, and having no connection or communication with the bore of the cylinder, whereby steam can flow from such bore into the jacket or chamber; third, in the combination of a movable lever for supporting the drum with such drum and the arm by which the cylinder and the marker parallel motion are sustained; fourth, in the combination of an actuating-spring and stationary and adjustable stops with the lever sustaining the rotary drum, and with the arm furnished with the cylinder and piston and the marking mechanism or parallel motion, as

set forth; fifth, in the combination of an intermediate or auxiliary guide-wheel with the drum, and with an adjustable arm provided with other guide-wheels and pivoted or applied so as to revolve about the first-named or intermediate guide-wheel; sixth, in a helical spring, an adjusting-column, and a clamp screw or nut, or both, arranged and combined with the reciprocating drum and its spindle, substantially in manner as set forth; seventh, in the arm or support-plate provided with opposite pivotal holes, in combination with the drum-supporting lever, arranged upon such arm or support-plate, and having opposite pivotal holes, all being substantially as and for the purpose described; eighth, in the arm provided with the opposite pivotal holes and a stop-screw and screw-holes therefor, in combination with the drum-carrying lever furnished with opposite pivotal holes, arcal slots, stop-screws, and screw-holes, all being substantially as set forth; ninth, in the steam-pressure indicator, the drum thereof provided with mechanism for moving it up to and away from the marker, in combination with the said marker, adapted to move only in a straight or vertical line or arc.

In the drawings, A denotes the steam-cylinder, coupled in the usual way with a stop-cock, B, and provided with a piston, C, whose rod *a* projects through the head *b* of the said cylinder.

Encircling the piston-rod is a helical spring, D, for depressing the piston within the cylinder, such spring being extended from the piston to the head of cylinder.

The cylinder goes up through a flat arm, E, without being directly attached thereto. At its lower part, however, the cylinder is screwed into the lower part, *c c*, of a cylindrical jacket, F, between which and the cylinder and surrounding the latter is a narrow space, *d*, which, with the jacket, serves to prevent radiation or loss of heat from the cylinder.

The jacket at its upper part abuts against and is projected down from the support-plate or arm E.

From the above it will be seen that both the jacket and the cylinder can be expanded lengthwise by the heat of the steam without one in so doing being interrupted by the other.

There are extended up from the arm E two standards, G H, which, arranged with the piston-rod as represented, are so pivoted at their lower ends to the arm as to enable each of them to move or vibrate toward and away from the other.

To the standard H and to the head of the piston-rod a lever, I, is pivoted and arranged, as shown.

Furthermore, there is jointed to the standard G a lever, K, the connection of the two being at or near the outer end of the lever. The said lever K is also pivoted to the lever I.

The distance between the axes of the outermost pivots of the lever I is equal to that between the axes of the pivots connecting the lever K with the standard G and lever I. At its inner end the lever K is provided with a marker socket or carrier, *e*, the distance of whose center or axis from the axis of the pivotal connection of the levers I K is equal to the distance of the latter axis from the axis of the pivotal connection of the lever I and the piston-rod head *f*.

When the piston-rod may be in vertical movement a marker or pencil, *a*², in the holder *e* will have imparted to it a corresponding but faster or greater motion.

The peculiar parallel motion for effecting the said movement of the marker has been found to operate to excellent advantage, the lever I of it being directly connected with the piston-rod head by a joint, and not indirectly by a link, as in some other parallel motions, wherein the piston-rod moves rectilinearly, particularly in that of the well-known Richards steam-engine indicator.

Furthermore, there is arranged on and pivoted to the arm E a flat lever, L, whose fulcrum is a headed screw, *g*, which passes down through a grooved guide-wheel, *h*, screws into and through the arm E, and serves as a pivot for a rotary furcated arm, M, furnished with two grooved guide-wheels, *i i*.

A clamp-nut, *k*, screwed upon the lower part of the screw *g*, serves to fix the arm M in any desirable position within the range of its motion around the wheel *h*.

Besides having the holes *k*¹ *l* made in them for reception of the pivot *g*, the lever L and arm E have two other like holes, *k*² *l'*, made in them at like distances from the axis of the reciprocating drum N. This drum turns freely on a spindle, *m*, extending up from the lever L, and near its lower end is provided with a groove, *n*, made entirely around it. To this groove there is fixed a cord, *o*, which, after having been wound in such groove one or more times around the drum, is led partially about the wheel *h*, and thence between the guide-wheels *i i*, such cord, when the indicator is in use, being attached to the piston cross-head or some other proper movable part of the steam-engine.

A helical spring, *p*, encompassing the spindle *m*, is attached at its lower end to the bot-

tom of the drum, and at its upper end to a rotary collar, *q*, arranged to revolve on the spindle, and provided with a clamp-screw, *r*, screwed into such collar and against the spindle. Besides such clamp-screw the collar rests on a sleeve, *s*, surrounding the spindle, and may be furnished with a set-nut, *t*, screwed on the upper part of the spindle and against the collar.

By means of the collar and either or both of its clamps the spring may be taken up or wound up, as occasion may require, for it to operate with the requisite pressure on the drum to cause such drum to revolve backward to its normal position after it may have been revolved the opposite way by the cord. Like other drums of the kind, it and its supporting device should be provided with stops to insure such position of the drum. There is applied to the drum in the usual way a tube, *O*, for carrying on its outer surface a sheet of paper spread thereon, it being held in place by springs *u u*.

Furthermore, there are in the lever L (a horizontal section of which is shown in Fig. 6) two arcual slots, *w w'*, which are arranged transversely in it and at equal distances from the axis of the drum. Each slot is provided with two screw-holes, *s' s'*, at its opposite ends, to receive a pair of stop-screws, *x x*. There is also in the arm E a screw-hole, *z*, immediately under each arcual slot, such being to receive another stop-screw, *a*¹. These stop-screws are to gage and limit the movements of the drum relatively to the marker.

A spring, *b'*, suitably applied to the arm E and the lever L, serves to retract the lever or move it and the drum away from the marker, such lever being moved the opposite way by an attendant with his hand applied to the lever or to a handle inserted in the hole near the free end of the said lever.

By having the arm and lever provided with the two sets of holes *k*¹ *l* *k*² *l'* and the slots, stop-screws, and screw-holes, arranged as explained, the lever at either end may be pivoted to the arm, and may also have the intermediate guide-wheel and the arm carrying the pair of guide-wheels applied to the pivot when arranged in either pair of the pivot-holes. By such means the indicator can be adapted for being applied to either head of a steam-engine cylinder, and thus often save the necessity of using a pair of indicators, or one to each cylinder-head, as is the case with indicators as usually made.

With the parallel motion hereinbefore described the marker will be moved at a much more rapid rate than the piston C.

I am aware that in the United States Patent No. 167,364 the reciprocating drum has within it, and fastened to and concentric with its supporting or pivotal sleeve, a case for holding a volute spring, and that such case is provided with a cap or cover held in position by a screw and nut on the pivotal shaft of the drum, the spring at one of its ends being at-

tached to the case, and at the other to a hub extending down from the cover, all of which differs very materially from my adaptation of a spring and its adjusting devices in the indicator hereinbefore described, as I use no volute spring, and have no box and cover thereto, but employ a helical spring, and arrange it about the pivotal sleeve and to extend up from the bottom of the part N, and fix it at its lower end to the said bottom, and at its upper end to an adjustable collar arranged on the spindle *m* and provided with a clamp screw or nut, or both, thereby dispensing with any box or case to hold the spring, besides accomplishing other new and useful results.

I am also aware that in the said Patent No. 167,364 the spindle on which the drum revolves is shown as having pivoted on it an arm carrying two guide-wheels, such being to enable the said arm and guide-wheels to be turned around in a path concentric with the drum or its groove for receiving the cord that passes between the two guide-rollers. The indicator shown in such patent has its drum pivoted on a spindle projecting up from the stationary arm; but in my improved indicator the drum-spindle extends upward from a lever pivoted to the stationary arm, such lever being to enable the drum to be moved up to and away from the marker. This necessitates the employment of the wheel *h*, arranged between the drum and the arm and its guide-wheels and on the fulcrum-pin of such lever, for were the arm pivoted underneath the drum, as it is shown to be in the said patent, without having an intermediate guide-wheel, the movement of the drum by the lever up to the marker would so increase the strain on the cord as to cause the drum to be revolved a little too much or too soon before its paper might come in contact with the marker, thereby producing erroneous registration. One or more other advantages result from the combination of the wheel N with devices described with which it is used.

Having thus explained my improved steam-pressure indicator, what I claim therein as of my invention is as follows, viz:

1. The indicator parallel motion, substantially as described, consisting of the two vibratory standards G H and the levers I K, arranged and combined with each other and with the arm E and the piston-head *f*, essentially in manner and to operate as set forth.

2. The piston expansive cylinder A, applied to move lengthwise in the arm E, in combination with the encompassing chambered jacket F, fastened to such cylinder at its lower part only, and having no connection with the bore of the cylinder, whereby steam can flow from such bore into the jacket or its chamber *d*.

3. The combination of the movable lever L with the arm E and the drum pivoted to the said lever, and provided with marking mechanism, arranged with it, and to operate the marker, substantially as described.

4. The combination of the actuating-spring *b'* and the stationary stop *a'* and adjustable stops *xx* with the lever L, sustaining the drum, and with the arm E, furnished with the cylinder and piston and marking mechanism, substantially as described.

5. The combination of the intermediate guide-wheel *h* with the drum N and its carrying-lever L, and with the adjustable arm M, provided with the guide-wheels *i i*, and pivoted so as to turn about the said intermediate guide-wheel *h*, as set forth.

6. The helical spring *p*, the adjusting-collar *q*, and the clamp-screw *r* or nut *t*, or both, arranged and combined with the reciprocating drum N and its spindle *m*, substantially in manner and to operate as described.

7. The arm E, provided with the opposite pivotal holes *l l'*, in combination with the lever L, arranged therewith and with the drum N, and provided with opposite pivotal holes *k¹ k²*, all being substantially as and for the purpose described.

8. The arm E, provided with the opposite pivotal holes *l l'*, and the stop-screw *a'* and screw-holes therefor, in combination with the drum-carrying lever L, provided with the opposite pivotal holes *k¹ k²*, the arcal slots *w w'*, and the stop-screws *xx* and their two sets of receiving-holes *s'*, all being arranged substantially as set forth.

9. In the steam-pressure indicator, the drum thereof provided with mechanism, substantially as described, for moving it up to and away from the marker, in combination with the marker having mechanism to move it only in a straight line or path, as set forth.

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Witnesses:

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