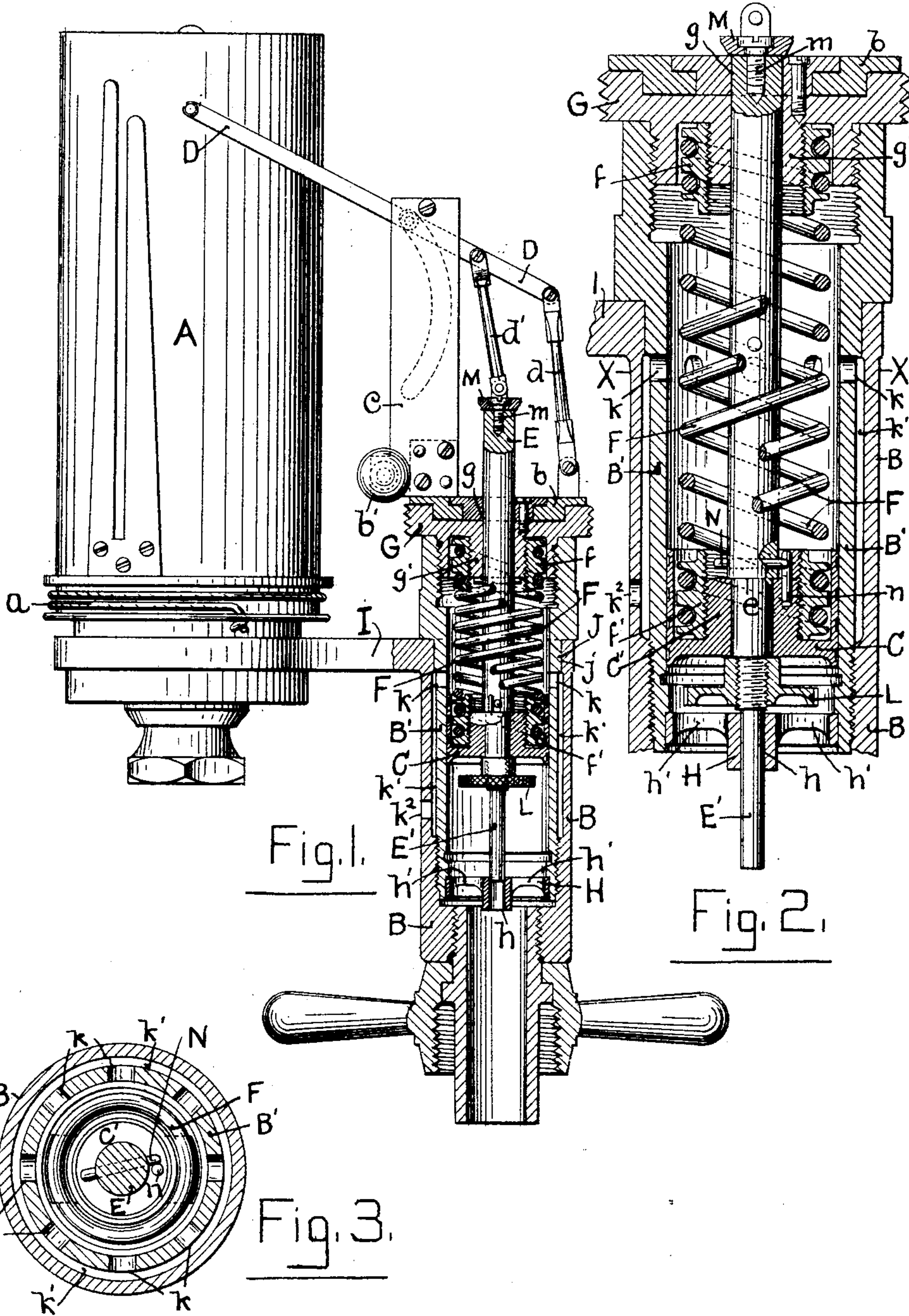


(No Model.)

W. HOUGHTALING.
STEAM ENGINE INDICATOR.

No. 538,044.

Patented Apr. 23, 1895.



Witnesses
Chas. Hanemann,
Edson Salisbury Jones.

Inventor
William Houghtaling
By L. Attorney
Chas M. Forbes

UNITED STATES PATENT OFFICE.

WILLIAM HOUGHTALING, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR TO
THE ASHCROFT MANUFACTURING COMPANY, OF SAME PLACE.

STEAM-ENGINE INDICATOR.

SPECIFICATION forming part of Letters Patent No. 533,044, dated April 23, 1895.

Application filed May 26, 1894. Serial No. 512,507. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HOUGHTALING, a citizen of the United States, residing in Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Steam-Engine Indicators, of which the following is a specification.

This invention relates to indicators for steam-engines, and the improvements consist in certain features of construction and arrangement hereinafter described and claimed, whereby better results are attained than have been secured heretofore.

Figure 1 represents the improved indicator partially in side view and partially in vertical section. Fig. 2 shows, on a larger scale, a vertical section of the steam cylinder and its casing, with the interior parts combined. Fig. 3 represents a horizontal section of the same, on line X—X of Fig. 2.

In the main, the instrument consists of a diagram-barrel, A, which is arranged to be rotated by a cord, *a*, that is intended to be secured at its outer end to the cross head of the piston-rod of the engine; a tubular casing, B, integral throughout its length within which a steam cylinder, B', is mounted; a piston, C, within said cylinder, and a pencil-arm, D, which is pivoted by a link, *d*, to a revoluble disk, *b*, and by a link *d'*, to the upper end of the piston-rod, E. The pencil-arm is adapted to be swung to and from the diagram-barrel, and in order that this may be conveniently done, a handle, *b'*, is attached to the guide, *c*, which projects upwardly from the disk, *b*. The pencil-arm is provided with a projecting pin, which enters a curved slot in the guide, *c*, (as shown by dotted lines in Fig. 1,) whereby the movements of the arm are directed in a well-understood way. Springs, F, surround the piston-rod, and bear at their lower ends upon the piston, and at their upper ends upon a screw-cap, G, which cap is provided with a central hole, *g*, through which the piston-rod passes, and by which the rod is guided, above the piston.

In the practical use of an indicator, constructed as thus far described, it has been found that the springs, when compressed by the action of steam on the piston, are liable

to buckle, or bend laterally, and that such buckling forces the piston out of axial alignment with the hole, *g*, thereby producing undue friction between the piston and cylinder, in which it reciprocates, and affecting the accuracy of the indicator, as well as causing excessive wear upon both piston and cylinder, to the detriment of the instrument.

To the avoidance of these undesirable results, the first feature of the invention is directed, and the desired end is secured by furnishing the piston with an extension, E', below the piston, and providing for such extension a guide, H, through a central hole, *h*, in which the said extension passes. This guide is removably fitted tightly within the cylinder at the lower end of the latter, and is provided with holes, *h'* through which the steam enters. It will be seen, therefore, that by extending the piston, or mounting the piston on the piston-rod intermediate of the length of the latter, and furnishing upper and lower guides for the same, any buckling of the springs will not press the piston to one side into closer engagement with the cylinder.

Steam-cylinders of indicators have been made, heretofore, in which what I have called the casing, B, projected above the arm, I, on which the diagram barrel, A, is mounted, and such casing has formed the steam cylinder of the instrument, the cap, G, having been screwed into the top of said casing. This form of construction has been objectionable because, when this casing became worn, the whole body of the instrument must be thrown away. To avoid this expense, some indicators have been constructed with a steam cylinder proper located within such a capped casing, the lower end of the cylinder alone having a bearing on the casing, and its upper portion standing free therefrom. The difficulty with this form of instrument has been that an absolute alignment of the axis of such cylinder with the axis of the hole in the cap, through which the piston-rod passed, has not been certain of attainment, so that there has been undue friction upon the piston to the detriment of the accuracy and lasting qualities of the device.

To attain this alignment, and yet have the cylinder removable, forms the second feature

of the invention, and this I accomplish as follows: The casing B is cut off at or about the height of the arm, I; the bottom of the steam cylinder, B', is threaded into the casing B; the cylinder is provided exteriorly with an annular enlargement or integral collar, J, which closely fits the opening, j, in the top of the casing; and the cap, G, is screwed into the top of the cylinder. An alignment of the axes of the cylinder and cap-hole, g, is thereby secured, and yet the cylinder can be easily removed from the casing, and can be replaced, when worn, by another at comparatively small expense. The cylinder is furnished with holes, k, to allow the escape of such steam as passes the piston, the said holes leading into an annular space, k', between the cylinder and the casing, which latter is provided with one or more holes, k², through which such steam passes out of the instrument. The springs, F, are secured at their upper ends to a ring, f, which is screwed upon a hub, g', on the cap, G; and at their lower ends the springs are secured to a ring, f', into which is screwed a hub, C', on the piston C. The piston, therefore, is removable from the piston-rod, but the former is clamped, when in working position, against a shoulder, e, on the latter by a nut, L, which is threaded upon the rod, as shown in Fig. 2. As the pencil-arm, D, is arranged to be swung to and from the barrel, A, and, as said arm is connected to the piston-rod by the link, d', provision is made for such a connection of the link to the rod as will enable the arm to be swung. This is secured by pivoting the link d' to a plate, M, which is swiveled, or revolvably secured to the rod E by a screw, m. As the nut, L, is threaded upon the rod, and the rod is swiveled to the plate, M, there is danger that the rod will be rotated with the nut when it is turned up to clamp the piston in place, or is oppositely turned so that the piston may be removed and a new spring be applied. In order to avoid this result, the rod is provided

with a transverse pin, N, which forms lateral projections thereon, and a pin, n, is set into the hub, C', of the piston, so that a partial rotation of the rod will bring said pins into contact and prevent any further turning of the same.

The improvements render the indicator more accurate and more lasting; and when the cylinder becomes worn it can be replaced at comparatively little expense.

What I claim, and desire to secure by Letters Patent, is—

1. In a steam-engine indicator, a steam-cylinder casing integral throughout its length, a steam-cylinder removably secured at its lower end within said casing and having an exterior bearing at the upper end of said casing, a piston fitted to reciprocate within said steam-cylinder, a pressure spring bearing upon the piston, a piston-rod secured to the piston and extending on both sides thereof, and guides for the piston-rod attached to the respective ends of the steam-cylinder, substantially as set forth.

2. The combination with the pencil-arm, of the piston-rod connected therewith by a link pivoted to the arm and swiveled to the rod, the piston mounted on the rod, a nut threaded on the rod for clamping the piston on the rod, lateral projections on the piston-rod, and a stop therefor on the piston, whereby the rotation of the rod is prevented when the nut is turned, substantially as set forth.

3. The combination with the steam-cylinder, of the piston mounted therein and provided with an extension on its steam side, and guides for the rod, the lower one of which is provided with steam inlets and secured tightly within the lower end of said cylinder, substantially as set forth.

WILLIAM HOUGHTALING.

Witnesses:

J. GRAY,

S. DE VORKIN.