

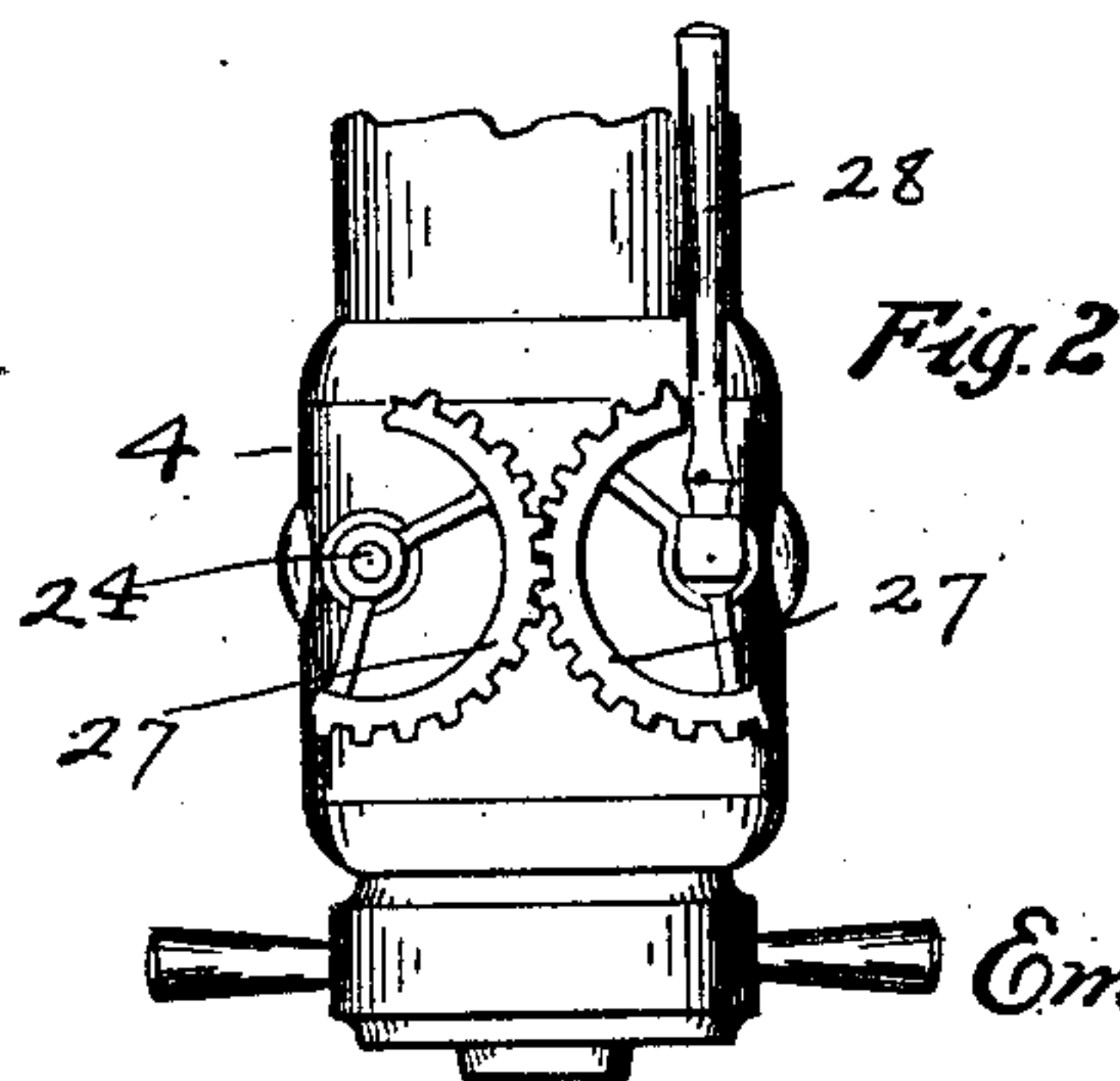
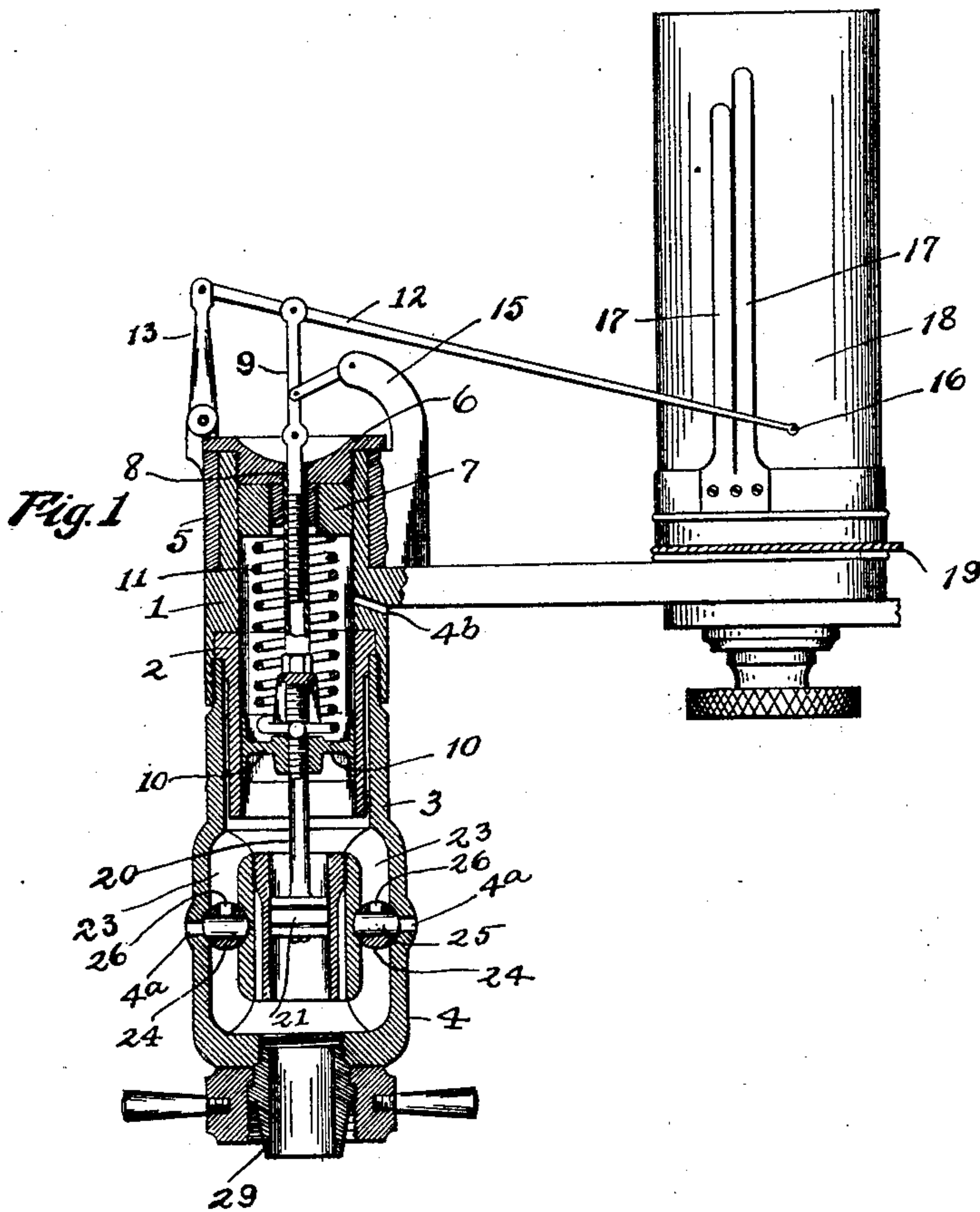
No. 715,382.

Patented Dec. 9, 1902.

E. A. HITCHCOCK.  
STEAM PRESSURE INDICATOR.

(Application filed May 26, 1902.)

(No Model.)



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# UNITED STATES PATENT OFFICE.

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## STEAM-PRESSURE INDICATOR.

SPECIFICATION forming part of Letters Patent No. 715,382, dated December 9, 1902.

Application filed May 26, 1902. Serial No. 108,954. (No model.)

*To all whom it may concern:*

Be it known that I, EMBURY A. HITCHCOCK, a citizen of the United States, residing at Columbus, in the county of Franklin and State

5 of Ohio, have invented a certain new and useful Improvement in Steam-Pressure Indicators, of which the following is a specification.

My invention relates to steam-engine indicators of that class which are adapted to produce a penciled design on an indicator-card indicating steam-pressure; and the objects of my invention are to provide an indicating device of this class with improvements whereby the same pencil-lever-operating mechanism may be employed for producing indications from both low and high pressure cylinders and to produce when either of said pressures are being indicated substantially the same-sized diagram and to produce certain improvements in details of construction, which will be more fully pointed out hereinafter. These objects I accomplish in the manner illustrated in the accompanying drawings, in which—

25 Figure 1 is a central vertical section of an indicator, showing my improvement in connection therewith and showing the card-carrying drum in elevation; and Fig. 2 is an outer side view of the lower portion of the indicator-body.

Similar numerals refer to similar parts throughout the several views.

In carrying out my invention I employ a suitable casing or cylinder, the body of which may consist in the usual or well-known form of upper and lower united cylindrical sections 1 and 2, said lower section having leading downward therefrom a terminal casing-section 3, which in the present case is enlarged in its lower portion to form a terminal chamber 4, the upper section of which is preferably constructed with an external sleeve 5 and is provided with an upper end cap 6, beneath which, within the upper section 1, is provided a spring bearing-head 7.

8 represents a vertical piston-rod which extends centrally through the cap 6 and which being formed tubular is internally threaded to receive the threaded portion of an upward extension 9 of said piston-rod. On the lower end portion of said piston-rod and within the

cylinder is carried a piston 10, which is adapted to fit and slide within said cylinder.

11 represents the usual spring, which is arranged between the bearing-head 7 and the piston 10.

The upper end of the piston-rod extension 9 has pivoted thereto in its outer end portion a laterally-extending pencil-carrying lever 12, the adjacent end of which is pivotally connected with a standard 13, rising from the indicator casing or body. The piston-rod extension 9 is also pivotally connected with one end of a guide-link 14, the remaining end of which is connected with a bracket-arm 15, rising from the sleeve 5.

The outer end of the lever 12 is adapted to carry in the usual manner at a point 16 a pencil the point of which is adapted in the manner hereinafter described to be moved over the surface of a paper held by spring-strips 17 on a vertical oscillating drum 18, which receives its movement in the usual manner from the reducing mechanism of the engine through a cord 19.

In carrying out my improvements I provide the piston 10 with a central downwardly-extending rod 20, which carries on its lower end a second piston 21, the latter being of less circumference and area than the piston 10 and fitting and adapted to slide within an open-end cylinder 22, which is arranged centrally within the casing terminal chamber 4. Connecting the space below the open-end cylinder 22 with a space above the same and beneath the piston 10 are side steam-passages 23, and within each of the latter is rotatably mounted a valve 24. Each of these valves 24 has formed therethrough, at right angles with the direction of its length, an opening 25, and leading from this opening 25 through one side of each of said valves is a port 26, this latter port being adapted to register, when the valve is in a closed position, with a port 4<sup>a</sup> through the wall of the chamber. As indicated in Fig. 2 of the drawings, the corresponding outer ends of the valves 24 on the outer side of the enlargement 4 are provided with meshing gear-segments 27, one of the latter having connected therewith an operating-lever 28.

With the lower end outlet-coupling exten-



sion 29 is adapted to be connected a steam-inlet pipe which may be provided with the usual five-way-valve mechanism, thus providing for the connection of four pipes there-  
 5 with, one from each end of a low-pressure cylinder and one from each end of a high-pressure cylinder. This construction, however, is well known and is not herein shown.

In order to illustrate the operation of my  
 10 device, we will assume that the lower end portion of the chamber 4 is properly connected with the ends of a high-pressure cylinder and that the valves 24 are in the closed positions indicated in Fig. 1. The parts being in this  
 15 position it is obvious that the steam-pressure will be against the comparatively small piston 21 and that the operation of raising the piston 10 within its cylinder and against the spring 11 will result in the usual operation of  
 20 the pencil-carrying lever 12 and in the production of a pressure-diagram upon the card carried in the usual manner by the oscillating cylinder 18. Assuming, however, that the connection with the lower end of the ter-  
 25 minal chamber 4 has been made with the ends of the low-pressure cylinder, the valves 24 are turned so that the upper and lower portions of the passages 23 communicate through the central openings of the valves, with the re-  
 30 sult that the under side of the piston 10, which is of greater area than the piston 21, is subjected to the pressure of steam from the low-pressure cylinder. By thus subjecting the  
 35 the larger piston 10 to the pressure of steam from the low-pressure cylinder a sufficient movement of said piston 10 and rod 8 is imparted to produce a movement of the pencil-holding lever which will result in the production of  
 40 substantially as large a diagram upon the card as that produced by the pressure of the steam from the high-pressure cylinder against the piston 21. When the valves 24 are in the closed position, it is obvious that any steam  
 45 which may have accumulated between said valves and the under side of the piston 10 will be permitted to exhaust through the valve-openings 26 and 25 and the casing-openings 4<sup>a</sup>. I also provide in the usual manner in  
 50 the upper portion of the cylinder 1 a steam-outlet port 4<sup>b</sup> to permit the escape of steam which may accumulate in said cylinder above the piston 10.

It is well known that in obtaining accurate results in determining horse-power through  
 55 steam-engine indicators it is desirable that the diagram be drawn as large as possible, and in compound engines, where steam is

working at different pressures in different cylinders, it has been common to employ at least two indicators containing springs offer- 60  
 ing different degrees of resistance in order to produce the desired sized card. By my construction and operation it will be seen that a construction is produced which may result in the production of substantially as large a dia- 65  
 gram from the low-pressure cylinder as from the high-pressure cylinder and that this is accomplished by the employment of one indicator and but one spring. It will be un-  
 70 derstood that in accomplishing the objects of my invention the upper and lower pistons bear approximately or exactly the same relation to each other with reference to area as the two pistons of the engine.

In using my improved indicator in conjunc- 75  
 tion with a compound single-acting engine, where the cylinders are in close proximity to each other, the connection with the indicator could be made with the two cylinders and ac-  
 80 complish thereby the same result as two indicators. It is also obvious that in the employment of long-stroke multiple-extension engines, where the cylinders are in close prox-  
 85 imity to each other, my improved indicator would be of great advantage and is particularly adapted for use in connection with com-  
 90 pound locomotives. It will also be observed that the construction of the improved parts of the indicator herein shown and described is without undesirable complication and that  
 the same may be produced at a comparatively low cost.

Having now fully described my invention, what I claim, and desire to secure by Letters Patent, is— 95

In a steam-pressure indicator, the combination with a cylinder having a terminal extension 4, the latter having an inlet in its lower portion, and an open-end cylinder with-  
 100 in said extension and valve-controlled passages 23 connecting the spaces above and below the inner cylinder, of a piston in said upper cylinder, a piston in said lower internal cylinder connected with said upper pis-  
 105 ton, a rod rising from the upper piston, a pencil-carrying lever connected with said rod and a spring interposed between the upper portion of the cylinder and the upper piston, substantially as specified.

EMBURY A. HITCHCOCK.

In presence of—

C. C. SHEPHERD,  
 A. L. PHELPS.