

(No Model.)

W. F. BROWN.
STEAM ENGINE INDICATOR.

No. 347,088.

Patented Aug. 10, 1886.

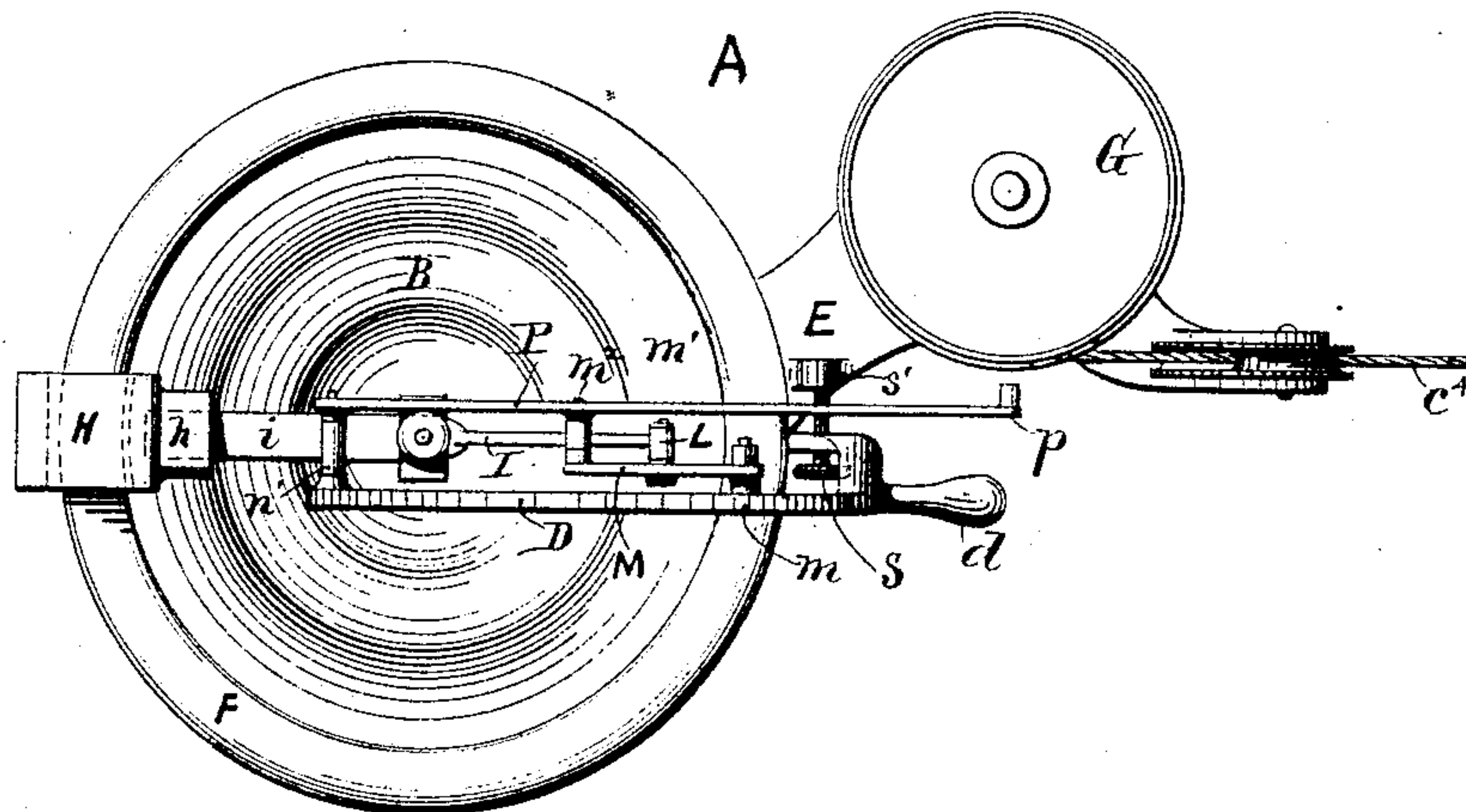


FIG. 2.

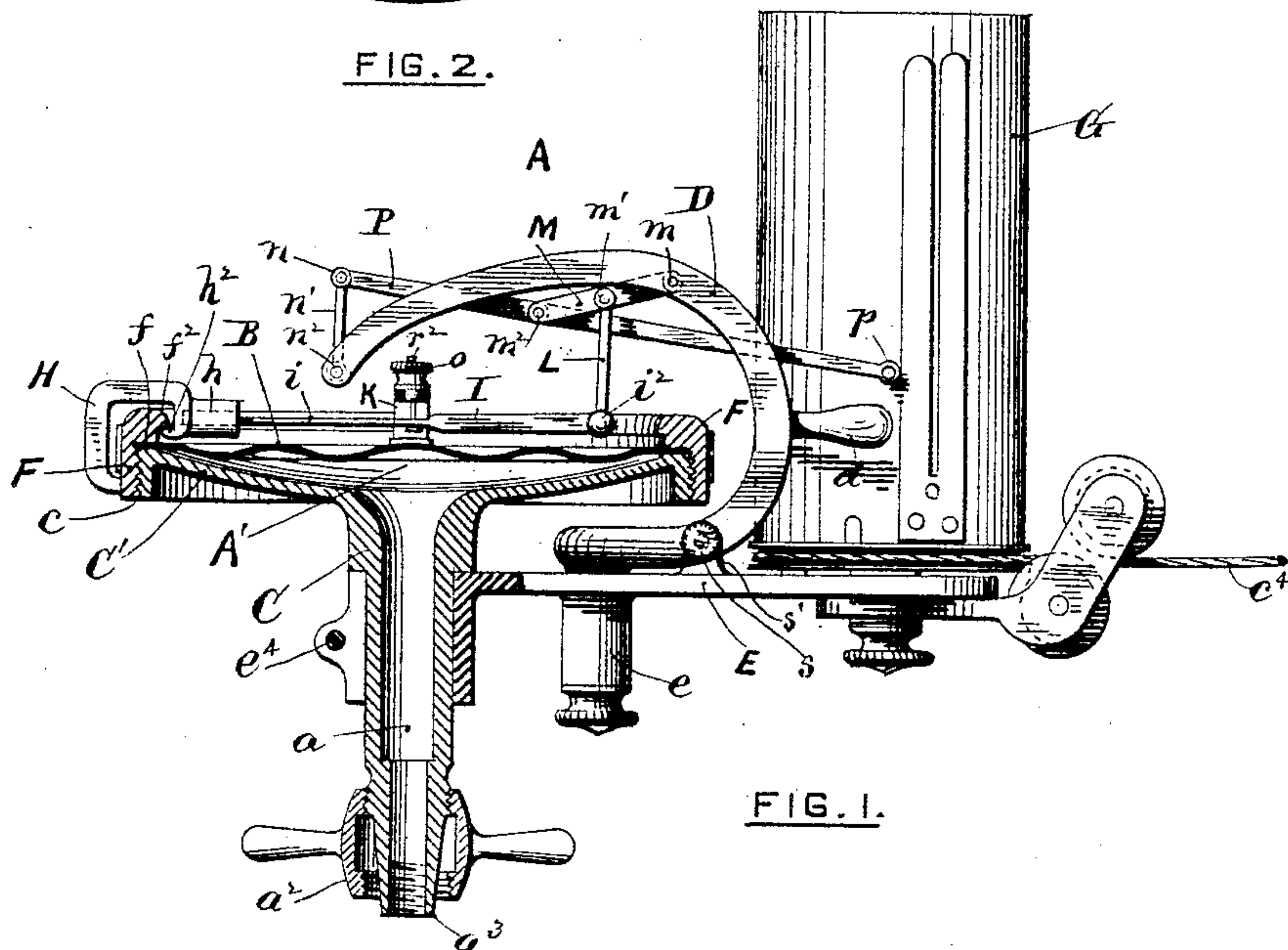


FIG. 1.

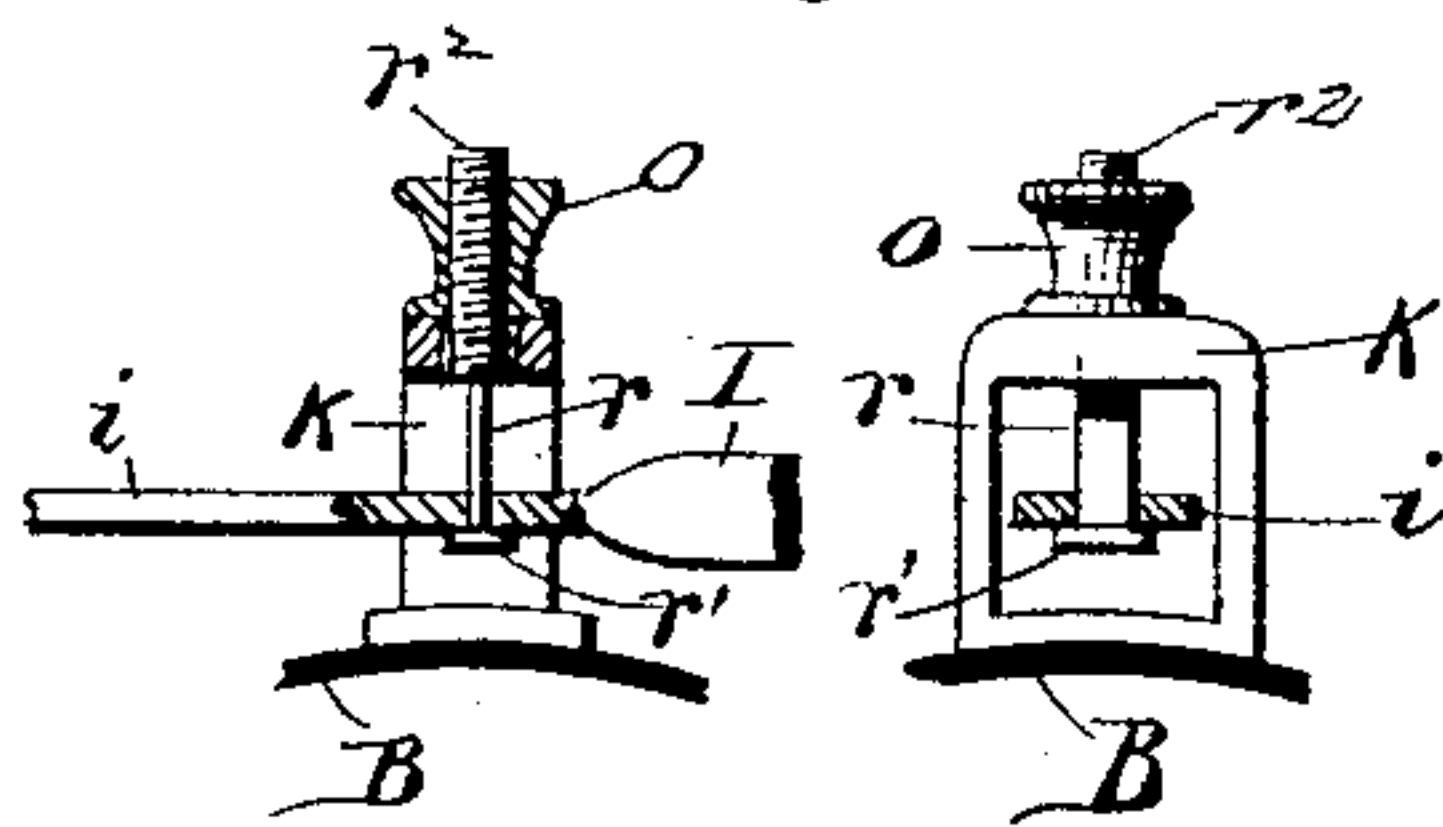


FIG. 3.

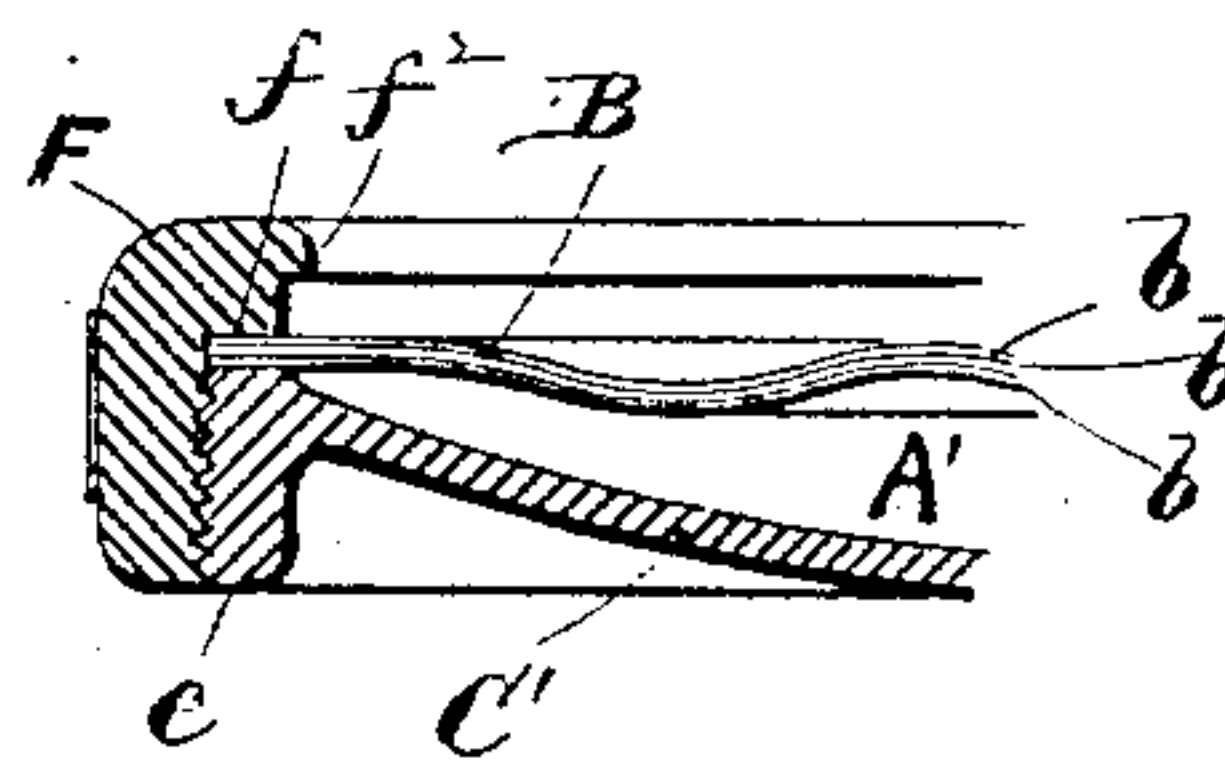


FIG. 4.

WITNESSES:

Joseph P. Manton, Jr.
Charles Harrigan.

INVENTOR:

Walter F. Brown.
By Geo. H. Remington
Attorney.

UNITED STATES PATENT OFFICE.

WALTER F. BROWN, OF PROVIDENCE, RHODE ISLAND.

STEAM-ENGINE INDICATOR.

SPECIFICATION forming part of Letters Patent No. 347,088, dated August 10, 1886.

Application filed December 12, 1885. Serial No. 185,431. (No model.)

To all whom it may concern:

Be it known that I, WALTER F. BROWN, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Steam-Engine Indicators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as 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 or figures of reference marked thereon, which form a part of this specification.

My invention relates more particularly to mechanism for recording the pressure or force exerted against the moving piston of a steam-engine cylinder; and it consists, essentially, of a metallic diaphragm removably secured to the enlarged head of a tube adapted to connect directly with the engine-cylinder, in combination with a spring-lever connected with the diaphragm, mechanism forming a parallel movement for the pencil or tracer, and a paper-carrying barrel or cylinder, the whole arranged so that any pressure or pressures in the steam-cylinder are correspondingly communicated to the said head and against the under side of the diaphragm, the latter thereby causing the spring-lever to vibrate, and by means of the pencil carried by the free end of an arm of the parallel mechanism producing a "card" or diagram upon the paper mounted on the barrel, which in turn receives a reciprocating movement from suitable moving parts of the engine, all as will be more fully hereinafter set forth and claimed.

Heretofore, so far as I am aware, this class of recording-indicators has been provided with moving pistons and trunks or rods which require packing to prevent the escape of steam, such construction necessarily producing an excessive amount of friction as compared with the work required to operate the tracer, the cards or diagrams thus produced being proportionately distorted or inaccurate.

The object of my present invention is to reduce the working friction to a minimum, by means of which the pencil is made to trace a smoother and more accurate line than heretofore, owing to the reduced weight of the reciprocating parts and the lessened number of the

joints, thereby overcoming the objections and disadvantages inherent in piston-indicators.

In order to illustrate my invention I have prepared the accompanying sheet of drawings, in which—

Figure 1 represents a side elevation of the instrument complete, the diaphragm, and its tube or steam-cylinder connection being shown in central section. Fig. 2 is a top view of the same. Fig. 3 represents, enlarged, both front and side views of the parts which connect directly with the diaphragm; and Fig. 4 is a partial central sectional view, enlarged, showing the diaphragm composed of several layers or plates of thin metal.

The following is a more detailed description of the invention, including the manner of its operation.

A, again referring to the drawings, designates the device as a whole.

C is a tube having its lower or free end, a^3 , taper turned, and provided with a coupling, a^2 , by means of which the indicator is adapted to be connected with the steam-engine cylinder, as usual. The upper portion or head of the tube is enlarged at C' to form the chamber A', having a comparatively large area, said head being provided at its periphery with a screw-threaded flange or rim, c , adapted to receive the annular nut F.

B indicates the metallic diaphragm, secured to the head C' by means of the nut F, just described, the latter having an inwardly-projecting circular flange, f , which bears against the outer portion of the diaphragm, as fully shown in Figs. 1 and 4. The diaphragm B is made of sheet-steel, or other metal which is susceptible of being vibrated under pressure without impairing its efficiency.

In Fig. 4 I have represented a modified form of the diaphragm, wherein a series of thin metallic disks or layers b are employed.

E designates an arm or plate adjustably secured to the tube C by means of a clamping-screw, e^1 , said arm having the paper-carrying barrel G mounted at its outer end, the barrel being provided with means for holding the paper thereon, and means for revolving the barrel substantially as in the well-known "Richards Indicator." Intermediate of said barrel and tube is pivoted or journaled to the plate E at e an arm, D, which supports the

recording mechanism about to be described. To the outer or free end of said arm or standard, at n^2 , is pivoted a short link, n' , which is connected with and forms the fulcrum for the

5 pencil-carrying or working lever P, the latter in turn having a horizontal link, M, pivoted thereto at m^2 , this link being fulcrumed to the bent arm D at a point, m , intermediate of the end p of the lever and the said pivot m^2 .
 10 I is a spring lever or arm, having the end of its flexible portion i freely mounted in a socket, h , of the dog or clamp H, the latter having a lip, h^2 , which engages the circular flange f^2 of the annular nut F, as fully shown
 15 in Fig. 1. The outer or free end of the spring-lever connects with the lower end of a vertical link, L, by means of a universal or ball joint, i^2 , the upper end of said link being pivoted to the link M at a point intermediate of the
 20 joints m m^2 , before described.

K, Fig. 3, indicates a light metallic frame, which rests upon the diaphragm B at its center, the frame having an opening in its top through which the threaded portion r^2 of the
 25 flexible or flattened stem r loosely passes, the lower portion of said stem passing through a central opening formed in the spring-lever i , the latter being supported by means of the enlarged head r' , formed on the lower end of
 30 the stem, all as clearly shown. A nut, o , at the top of the frame K serves to accurately adjust the relative position of the several parts just described.

s' is a lug formed on the plate E, the same
 35 serving, in connection with the screw s of the standard D, as a stop, by means of which the point of the pencil or tracer is nicely adjusted with relation to the paper mounted on the barrel G.

40 The operation is substantially as follows when employed for indicating-engines: The end a^2 of the tube C is first connected with the cylinder-cock and secured in place by means of the coupling a^2 . The paper-carrying barrel
 45 G, by means of the cord c^2 , is then connected with a "lazy-tongs" or other equivalent device, which in turn connects with suitable parts of the engine having reciprocating movements, for the purpose of imparting a reduced travel
 50 to the said barrel, the latter being provided with a retraction-spring, all as usual, or substantially as would be the case with a Richards indicator. Now, the cylinder-cock being opened steam under pressure is thereby
 55 admitted into the chamber A' of the enlarged head C' and against the under side of the confined diaphragm B, by means of which the latter is forced outwardly or vertically, thus slightly lifting the frame K and the unconfined
 60 portion of the spring-lever I, which, in connection with the pivoted links L M n' , lever P, and pivoted standard D, produces a practically parallel vertical movement of the free end p of the lever P, the said movement being
 65 much greater than that of the diaphragm, owing to the relative arrangement of the levers, &c.

It is obvious that a pencil mounted in the socket p of the lever would trace a diagram upon the surface of the paper of the revolving
 70 barrel G by means of the vibratory movement of said lever, such movement being produced or caused by the pulsations of the diaphragm, due to the action of the steam in the engine-cylinder. The diaphragm moves up or down
 75 from its normal position, according as the pressure in the engine-cylinder is above or below atmospheric pressure.

By means of the handle d the standard D, with its connections, is adapted to be swung
 80 partly around on its axis e , thereby removing the pencil from the paper, the link L, which is directly in line with said axis, at the same time turning on the universal joint i^2 , formed at the free end of the spring-lever I. 85

My improved indicator possesses advantages over other instruments of this class in that all the working parts are lighter, and at the same time more readily accessible. The lever I can be quickly removed from the socket
 90 of the dog H, and the latter detached from the nut F, after which the nut may be unscrewed from the head C' and the diaphragm removed, and another replaced corresponding to a different pressure, if desired, substantially as in
 95 substituting one spring for another in a piston-indicator.

As indicated in Fig. 4, one or more layers or thin disks b may be added to the diaphragm for the purpose of recording higher pressures,
 100 the converse being equally true for recording lower pressures.

It is to be understood that the diaphragms have been previously subjected to tests and suitably adjusted and numbered, so that a
 105 person can readily select the diaphragm required, corresponding within its limits to the pressure on the engine-piston.

My improved indicator will produce a truer record of the action of the steam within the
 110 engine-cylinder than one having a piston with its necessary connections and packings, as in the latter case the percentage of working friction in the indicator itself is much greater than is required to operate the pencil-lever by
 115 means of steam acting upon the diaphragm B.

The indicator A is readily adapted to be tested at any time by simply screwing a test-gage into the threaded end a^2 of the tube.

I make no claim, broadly, to a steam-engine
 120 indicator having the pencil or tracer thereof adapted to move in a straight line by means of rods and levers arranged to produce parallel movement, such construction not being new with me; but
 125

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

1. In a steam-engine indicator or recorder, the combination, with the parallel mechanism, substantially as shown and described, and piv-
 130 oted standard carrying said mechanism, of an elastic diaphragm removably secured to the enlarged head of a tube adapted to communicate with the interior of the engine-cylinder,

a spring-lever mounted above and extending across the center of said diaphragm, its free end having a universal or ball joint connected with said parallel mechanism, and a frame 5 resting upon the center of the diaphragm, said frame having a rod or stem adjustably mounted therein which connects with and partly supports the spring-lever, the whole constructed and arranged substantially as shown, and for the purpose hereinbefore set forth.

2. In an engine-indicator provided with a paper-carrying barrel, and the pivoted standard D, carrying the parallel mechanism and 15 tracer, the combination, with the adjustably-mounted spring-lever I, connected with the parallel mechanism, substantially as shown and described, of the elastic diaphragm B, annular nut F, and tube C, the latter being adapted to 20 connect with the interior of the engine-cylinder, whereby the pressures of steam, air, vapor, or other gases within the cylinder are communicated to the diaphragm, thereby vibrating the said spring-lever and causing the tracer 25 to move vertically, substantially as shown, and for the purpose set forth.

3. In a steam-engine indicator or recorder, the combination, with the attaching-tube C, having an enlarged chambered head, C', mechanism for producing a parallel movement of 30 the pencil, and the suitably-mounted spring-lever I, of the metallic multiple diaphragms b, removably secured to the said chambered head C', substantially as shown, and for the 35 purpose set forth.

4. The combination, with the tube C, diaphragm B, nut F, and dog H, adapted to engage said nut, of the spring-lever I, removably secured to said dog, mechanism for carrying 40 a pencil or tracer, a link, L, connecting said mechanism, a universal or ball joint, i^2 , connecting the link L to the free end of the said spring-lever, the center frame, K, resting upon

the diaphragm, a rod, r , connecting the frame K and lever I, and means for vertically adjusting said rod, as set forth. 45

5. The combination, with the suitably-mounted elastic diaphragm B and frame K, resting upon the center portion thereof, of the spring-lever I and rod or stem r , adjustably 50 mounted in the frame K, said rod passing through the flattened or spring portion i of the lever, and being provided with an enlargement or head, r' , upon which the center portion of said lever rests, substantially as shown 55 and set forth.

6. As an improved article of manufacture, the steam-engine indicator A, hereinbefore described, the same consisting of the tube C, having an enlarged head, C', provided with an 60 elastic disk or diaphragm, B, which is secured in place by means of the annular nut F, and forming the chamber A', a spring-lever, I, mounted in a dog, H, attached to said nut, a frame, K, resting upon the center of the dia- 65 phragm, having a rod, r , passing through and supporting the lever I, said rod being adjustably mounted in the frame K, an arm, E, adjustably secured to the tube C, having a paper-carrying barrel, G, mounted at its outer end, 70 and further provided with a socket, e , intermediate of the barrel and tube, a bent support or standard, D, mounted in said socket e , the working-lever P, adapted to move the pencil or tracer in a vertical direction by 75 means of links M n' , pivoted to said standard, and the link L, connecting the link M and the free end of the spring-lever I, the whole arranged and adapted for use substantially as shown and set forth. 80

In testimony whereof I have affixed my signature in presence of two witnesses.

WALTER F. BROWN.

Witnesses:

WM. R. DUTEMPLE,
GEO. H. REMINGTON.