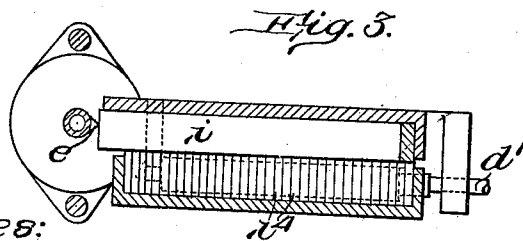
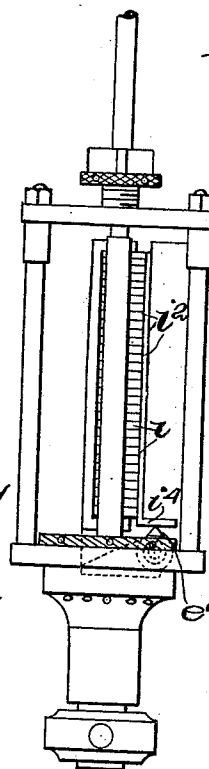
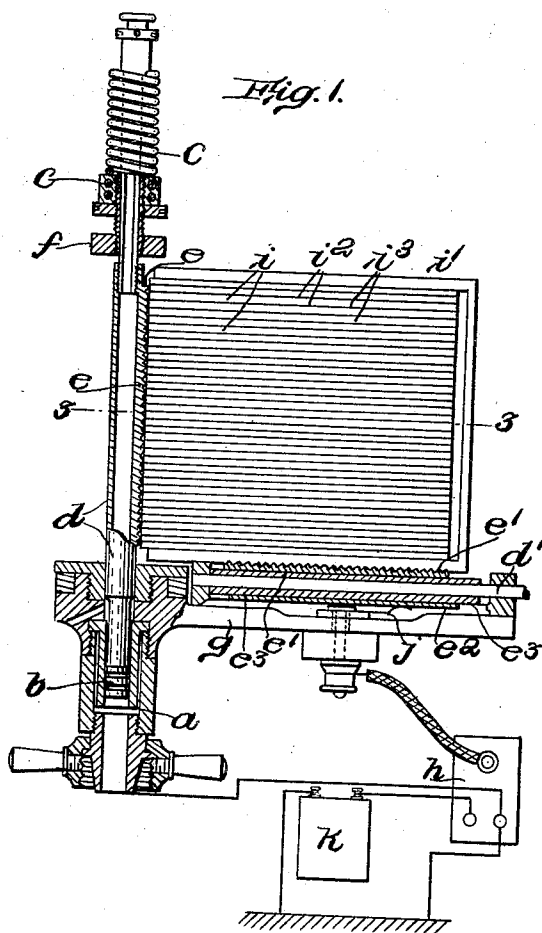


991,843.

J. F. GILL.
ENGINE INDICATOR.
APPLICATION FILED MAR. 11, 1909.

Patented May 9, 1911.
2 SHEETS—SHEET 1.



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Fig. 4.

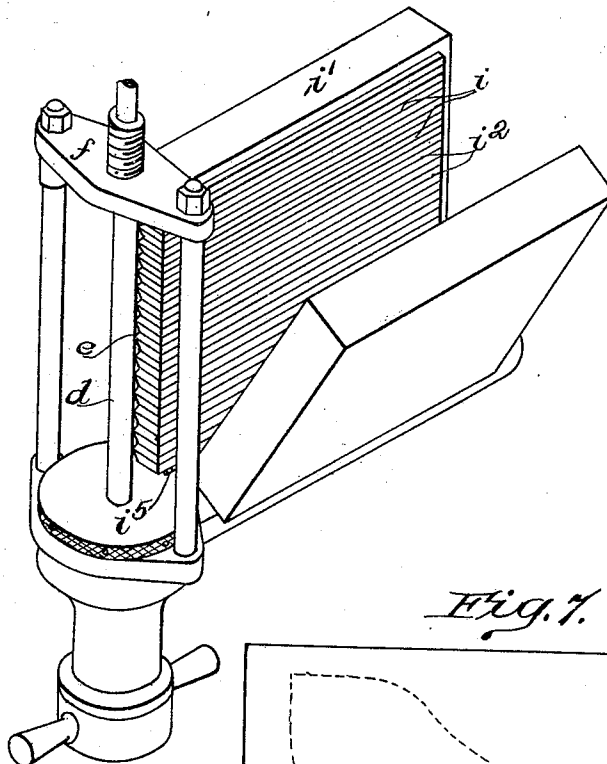


Fig. 7.

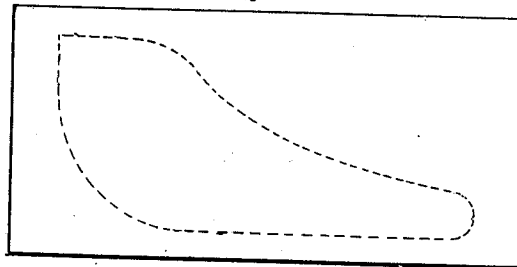


Fig. 6.

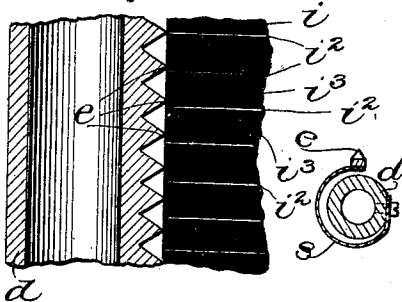
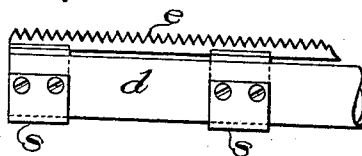


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ENGINE-INDICATOR.

991,843.

Specification of Letters Patent.

Patented May 9, 1911.

Application filed March 11, 1909. Serial No. 432,784.

To all whom it may concern:

Be it known that I, JAMES FRANCIS GILL, a British subject, formerly residing at Clapham, in the county of Surrey, England, but now residing at Bootle, near Liverpool, in the county of Lancaster, England, have invented certain new and useful Improvements in Engine-Indicators, of which the following is a specification.

This invention relates to a new or improved form of steam and other engine indicator whereby perforated indicator diagrams are obtained, the perforations being produced by the passage through the paper of an electrical current. By this construction the art of indicating an engine is simplified, errors due to lost motion, inertia, friction, etc. are almost entirely eliminated, and the perforated diagrams can be subsequently used for the purpose of taking multiple copies thereof as often as and when required.

The new or improved indicator is illustrated in the accompanying drawings:

Figure 1 is a partly sectional side elevation of the apparatus showing the electrical connections; Fig. 2 is a front elevation of the apparatus; Fig. 3 is a section taken on the line 3—3 in Fig. 1; Fig. 4 is an isometrical projection showing the apparatus opened in order that a sheet of paper may be inserted; Fig. 5 is an enlarged view showing a modification of a detail of construction; Fig. 6 is a view showing in detail on an enlarged scale projections *e*; Fig. 7 is a view showing the record sheet and the record obtained in the use of the device.

The same letters of reference where they occur are used to denote the same or corresponding parts in all the figures of the drawings.

The improved indicator apparatus comprises a cylinder *a*, piston *b* and calibrated springs *c*, as in the ordinary type, but, as it is only necessary that the piston shall move to a very small extent, the cylinder *a* is made correspondingly short. If desired a diaphragm may be used in place of the piston and spring. Fixed rigidly to the piston *b* is a light metallic rod or tube *d* with a series of short teeth *e* forming electrical contact points at equal intervals along its length. This rod may be guided in a cross bar *f* at its upper end for steadiness. The teeth *e* may be formed integrally with, or be secured to, the piston rod *d*, or, as shown

in Fig. 5, they may be formed in a strip of metal which is separate from the piston rod *d* and be secured thereto by means of two or more circularly shaped springs *s* so that the teeth will exert very slight positive pressure on the edge of the laminated plate *i* with which they make contact.

The laminated plate *i* is mounted on the frame of the indicator in an electrically insulated case *i*¹ and is composed of a series of alternate strips of metal foil *i*² and insulating material *i*³. This laminated plate *i* is so disposed that the contact points *e* on the piston rod *d* just barely touch the edge of the laminated plate *i*. The series of metal foil strips *i*² is approximately the same in number as the contact points *e* on the piston rod *d* but they are slightly differently pitched so that (as in a vernier scale) a limited movement of the piston will cause the metal strips *i*² to be electrified in succession; one of the series of contact points *e* making electrical contact with one of the series of metal foil strips *i*²; so that, as the piston moves up through its limited amount of travel, the point of electrical contact will move through a large range on the plate *i*.

A similar laminated plate *i*⁴ of approximately the same size as the plate *i*, is secured thereto by means of a hinge *i*⁵ and spring, or by any other suitable device, so that it lies flat on the plate *i* with its conductors all at right angles to those on the said plate *i*. A second metallic rod *d*¹, arranged at right angles to and with contact points *e*¹ similar to those on the piston rod *d*, but insulated from the frame *g* of the apparatus, is arranged to move through a limited distance and to make electrical contact with the metal foil strips on the second plate. The contact points *e*¹ are on a tube *e*² insulated from the rod *d*¹ by the ebonite or other non-conducting sleeve *e*³. The points *e*¹ may be secured to the rod *d*¹ by means of springs such as shown at *s* in Fig. 5, but in this case the springs must be insulated from the rod *d*¹. This second rod *d*¹ is connected through suitable reducing gear to the piston of the engine to be indicated. An electric sparking coil *h* with a safety spark gap is connected so that the current therefrom passes through the spring *j* first to the tube *e*² and contact points *e*¹ on the second rod *d*¹, thence to one of the metal foil strips in the second laminated plate *i*⁴, according to the position of the engine piston, thence to a metal foil

strip i^2 in the first laminated plate i and out through the contact e on the piston rod d and casing of the indicator apparatus to earth and back to the coil through the accumulator or other battery k .

To take a diagram: Open the apparatus as shown in Fig. 4; place a flat piece of any suitable paper between the two laminated plates i and i^4 , secure them by the spring clip, attach the reducing gear to the piston of the engine, and turn on the indicator cock, switch on the electricity and the current will flow and by disruptive sparking action will pierce holes in the paper which is the only impediment in the path of the current. The position of these very small holes will correspond to the intersection of the two conductors at right angles which are electrified at the same instant; thus producing a diagram from which may be obtained a true record of the variations of pressure in the engine cylinder. If this perforated diagram is placed on a page of a book and an inked roller passed over it, the diagram will appear, its boundaries being defined by small dots.

Having described my invention what I claim and desire to secure by Letters Patent is:

1. An engine indicator, comprising normally broken electric circuits and means operated by the fluid under pressure for closing said circuits and thereby producing a diagram of the pressure during the operation of the engine; substantially as described.

2. An engine indicator, comprising normally broken electric circuits and means operated by the fluid under pressure for closing said circuits and producing, by per-

foration made by the closing of said circuits, a diagram of the pressure during the operation of the engine; substantially as described.

3. An engine indicator comprising two similar laminated plates composed of a series of alternate strips of metal and insulating material, the said laminated plates being arranged at right angles to each other and adapted to receive and hold a diagram paper between them; series of contact points adapted to be mechanically connected, respectively, with an engine piston and the indicator piston and arranged in an electrical circuit, said contact points being adapted to move over the edges of said laminated plates and having a different pitch to that of the metal strips in said plates; substantially as described.

4. An engine indicator comprising two similar laminated plates composed of a series of alternate strips of metal and insulating material, the said laminated plates being arranged at right angles to each other and adapted to receive and hold a diagram paper between them; series of contact points mounted on circularly shaped springs adapted to be mechanically connected with an engine piston and the indicator piston and arranged in an electrical circuit, said contact points being adapted to move over the edges of said laminated plates and having a different pitch to that of the metal strips in said plates; substantially as described.

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

JAMES F. GILL.

Witnesses:

W. LLOYD BARNES,
JOSEPH E. HIRSH.