D. G. ROOS.

ENGINE INDICATOR.

APPLICATION FILED JULY 17, 1916.

**1,349,346.** Patented Aug. 10, 1920.

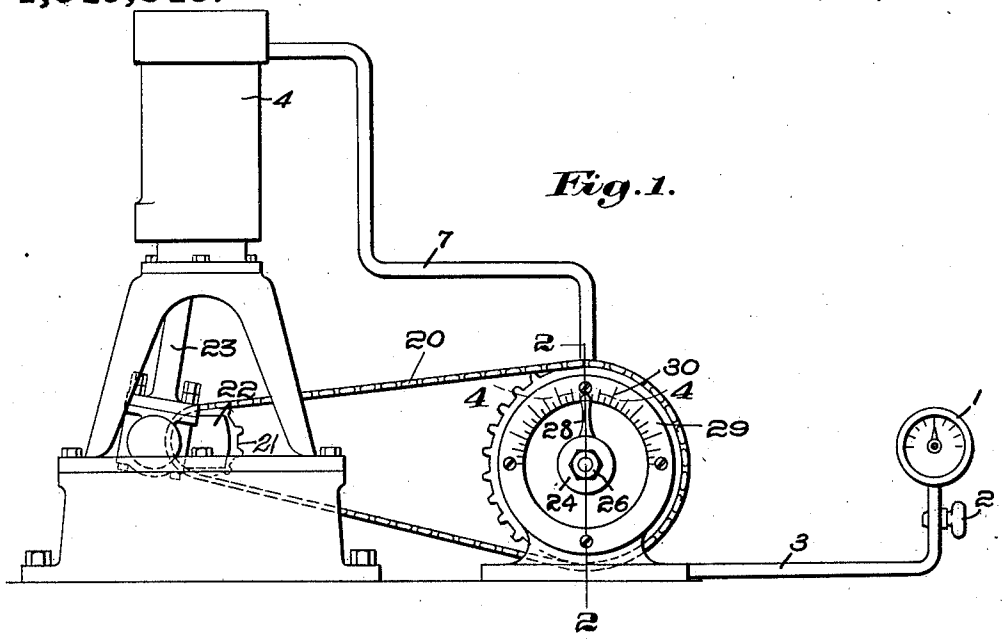



*Fig. 1.*

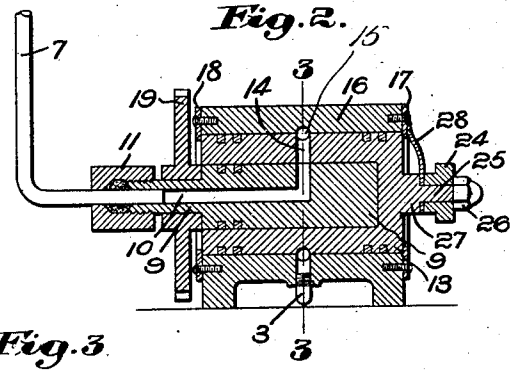



*Fig. 2.*




*Fig. 3.*




*Fig. 4.*

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# UNITED STATES PATENT OFFICE.

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## ENGINE-INDICATOR.

1,349,346. Specification of Letters Patent. **Patented Aug. 10, 1920.**

Application filed July 17, 1916. Serial No. 109,625.

*To all whom it may concern:*

Be it known that I, DELMAR G. ROOS, a citizen of the United States, and a resident of Bridgeport, county of Fairfield, and State of Connecticut, have invented an Improvement in Engine-Indicators, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to engine indicators, and is more particularly concerned with means for indicating a cylinder pressure at a predetermined point in the piston stroke, which point may be varied at will, so that a study may be made of the pressure conditions at any given portion of the piston stroke, and from such observations a diagram plotted from the data thus obtained, as distinguished from instruments in the use of which an instantaneous diagram of the whole stroke is made.

My invention will be best understood by reference to the following description, when taken in connection with the accompanying illustration of one specific embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings:

Figure 1 is a front elevation of an engine indicating apparatus embodying my invention;

Fig. 2 is a sectional view on line 2—2 of Fig. 1;

Fig. 3 is a sectional view on line 3—3 of Fig. 2; and

Fig. 4 is a detail sectional view on line 4—4 of Fig. 1.

Referring to the drawings, and to the embodiment of my invention which I have selected for illustration, I have there shown, largely in diagrammatic and conventional fashion, an engine indicating apparatus comprising suitable pressure-responsive means, herein a pressure gage 1, which may be of any usual well known type adapted for the purpose, and preferably equipped with a suitable shut-off valve 2, by means of which it may be shut off from the source of pressure. A conduit 3 leads from the pressure gage to a point where it may be placed in communication with a cylinder 4 of an engine 5 during a predetermined portion of the stroke of an engine piston 6.

In the specific embodiment, a conduit 7 leads from a piston chamber 8, and communicates with a suitable engine-driven element 9, herein in the form of a species of rotating valve. In the present example, this rotating valve is provided with an axial passage 10, at all times in communication with the conduit 7 which enters such passage at the outer end of the latter, and is provided with a suitable stuffing box 11 to prevent leakage. The rotary valve 9 is further provided with a radial passage 12, communicating with the axial passage 10, and terminating at the circumferential surface of the valve.

Encircling the valve 9 is a valve casing 13, the latter being provided with a port 14 disposed in the same plane as the passage 12, whereby the latter is caused to communicate with such port intermittently during the rotation of the valve. The port 14 at all times communicates with the conduit 3, by way of a suitable passage 15, the latter herein being annular, and formed either in the valve casing 13 or in the surrounding housing 16, or partly in each. The valve casing 13 may be held against axial movement in the housing 16 by suitable means, herein rings 17 and 18, secured to the ends of the housing and overlapping the ends of the valve casing as clearly shown in Fig. 2.

The valve 9 may be operated in definitely timed relation with the engine piston 6 by suitable gearing, herein comprising a sprocket wheel 19 connected by a chain 20 to a sprocket wheel 21, the latter being secured to a usual crank-shaft 22 connected by a usual connecting rod 23 to the piston 6 of the engine. The ratio of the gearing will naturally be such that the cycle of the valve 9 will correspond with the power stroke of the engine's cycle, and the ratio can be changed from time to time by substituting different sprocket wheels. By mounting the valve casing 13 to turn in the housing 16, the point in the stroke at which pressure is utilized for operating the pressure-responsive means may be varied at will, this being evident from the fact that as the port 14 is shifted circumferentially, the point in the turning movement of the valve 9 at

which communication is established between the piston chamber 8 and the pressure gage 1 is varied.

As a means for turning the valve casing 13 to vary the instant of communication, the said casing is herein provided with a suitable handle 24 secured to a stem 25 projecting axially from the casing. The handle may be secured to the stem by appropriate means, such as a nut 26 threaded onto the latter, and forcing the handle against a shoulder 27.

Suitable means may be provided for indicating the particular point in the piston's stroke at which the reading is taken, such means herein comprising an index 28 cooperating with a graduated scale 29, the length of such scale corresponding to the length of the piston stroke, and the scale being appropriately graduated in inches or other units of measure. If, for example, it is desired to have a 6-inch stroke, and if suitable gearing be employed, the scale may be 6 inches long and graduated into inches and fractions thereof, thus enabling the engineer to observe the pressure conditions obtaining in the cylinder at any given point in the piston stroke, by simply turning the index 28 to the selected point indicated by the scale. It is also evident that, instead of changing the ratio of the gearing or in addition to such change of ratio, the graduated scale may be removed and a different one substituted.

Any suitable means may be provided to prevent accidental turning movement of the valve casing 13, but one suitable and very simple expedient is to provide the scale 29 with graduations 30 in the form of shallow radial grooves (see Fig. 4), to receive the index finger 28, the latter for this purpose being resilient, so as to snap into the groove and hold the valve casing definitely in the selected position of adjustment.

By means of the described apparatus, the engineer is enabled to study the pressure conditions at a predetermined point in the piston stroke, to the exclusion of the remainder of the stroke, and take readings at any point at will, after which a diagram may be plotted from the readings thus secured, this method having marked advantages over that heretofore employed in the taking of an instantaneous record of the entire stroke in a single operation.

While I have herein shown and described one specific form or embodiment of my invention for illustrative purposes, and have disclosed and discussed in detail the construction and arrangement incidental to one specific application thereof, it is to be understood that the invention is limited neither to the mere details or relative arrangement of parts, nor to its specific embodiment herein shown, but that extensive deviations from the illustrated form or embodiment of the invention may be made, without departing from the principles thereof.

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

1. In an indicator for pressure fluid engines, the combination of pressure-responsive means, and engine-driven means including a valve having a cycle of movement corresponding in duration to the piston's power stroke and means through which said valve establishes communication between the engine's cylinder and said pressure-responsive means during a predetermined portion only of the piston's power stroke and during a predetermined portion only of said cycle of movement of said valve.

2. In an indicator for pressure fluid engines, the combination of pressure-responsive means, engine-driven means including a valve having a cycle of movement corresponding in duration to the piston's power stroke, means to cause said valve to establish communication between the engine's cylinder and said pressure-responsive means during a predetermined portion only of the piston's power stroke, and during a predetermined portion only of said cycle of movement of said valve, and means at will to determine the particular point in said valve's cycle and in such power stroke at which such communication will be established.

3. In an indicator for pressure fluid engines, the combination of pressure-responsive means, and valve means including two coöperating valve elements one of which is driven continuously during the power stroke in definitely timed relation with the engine and the other of which is adjustable with reference to the travel of the first, said valve means having provision to establish communication between the engine's cylinder and said pressure-responsive means at a period in the piston's stroke, which period is determined by such adjustment.

4. An instrument of the class described comprising, in combination, a pressure-fluid supply conduit, pressure-responsive means, and means to place said pressure-responsive means in communication with said supply conduit, the second mentioned means comprising a valve and a valve casing, valve operating means for relatively moving said valve and valve casing, and means for varying the timing of said valve by moving said valve casing.

5. An instrument of the class described comprising, in combination, a pressure fluid supply conduit, pressure-responsive means, and means to place said pressure-responsive means in communication with said supply conduit, the second-mentioned means comprising a rotatable valve, valve operating

means, and rotatable means directly coöperating with said valve for varying the timing of said valve.

6. An instrument of the class described comprising, in combination, a pressure fluid supply conduit, pressure-responsive means, and means to place said pressure-responsive means in communication with said supply conduit, the second-mentioned means comprising a rotatable valve having a peripheral port, valve operating means to drive said valve continuously during the power stroke, and rotatably adjustable means provided with a port with which said peripheral port registers during a portion of the rotation of said valve.

7. An instrument of the class described comprising, in combination, a pressure fluid supply conduit, pressure-responsive means, and means to place said pressure-responsive means in communication with said supply conduit, the second-mentioned means comprising a rotatable valve having a peripheral port, valve operating means to drive said valve continuously during the power stroke, rotatably adjustable means provided with a port with which said peripheral port registers during a portion of the rotation of said valve, and a housing inclosing said rotatable means and having a passage communicating at all times with the second-mentioned port and with said pressure-responsive means.

8. An instrument of the class described comprising, in combination, a pressure-fluid supply conduit, pressure-responsive means, and means to place said pressure-responsive means in communication with said supply conduit, the second-mentioned means comprising a rotatable valve having a peripheral port, valve operating means to drive said valve continuously during the power stroke, rotatable means provided with a port with which said peripheral port registers during a portion of the rotation of said valve, and means for indicating the position of said rotatable means with respect to its rotative movement.

9. An instrument of the class described comprising, in combination, a pressure fluid supply conduit 7, pressure responsive means 1, and means to place said pressure responsive means in communication with said supply conduit, the second-mentioned means comprising a rotatable valve 9, having a peripheral port 12, valve operating means 19, 20, rotatable means 16 provided with a port 14 with which said peripheral port registers during a portion of the rotation of said valve, and means 28, 29 for indicating the position of said rotatable means with respect to its rotative movement.

In testimony whereof, I have signed my name to this specification.

DELMAR G. ROOS.