

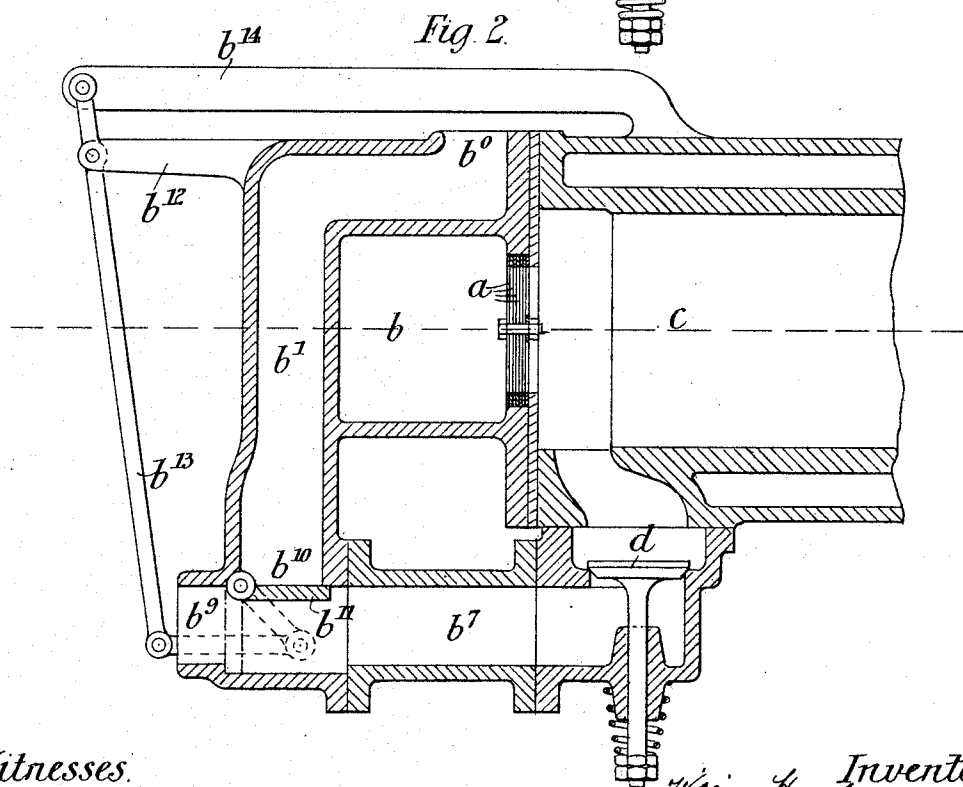
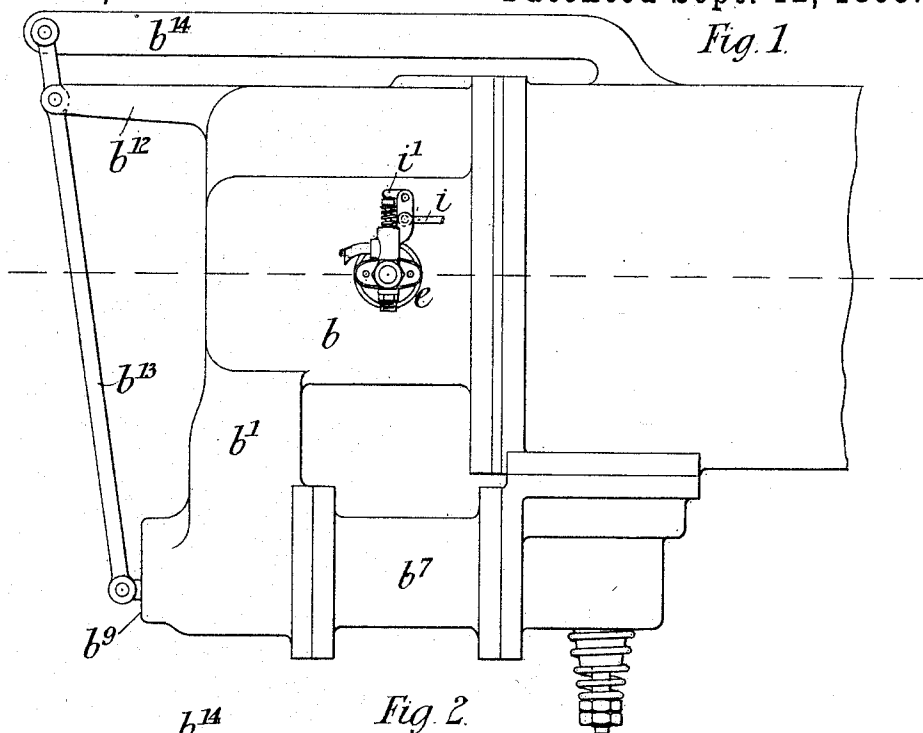
(No Model.)

2 Sheets—Sheet 1.

W. HORNSBY, R. EDWARDS & W. E. GIBBON.
ENGINE OPERATED BY THE EXPLOSION OF COMBUSTIBLE MIXTURES.

No. 504,807.

Patented Sept. 12, 1893.



Witnesses.

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Fig. 4

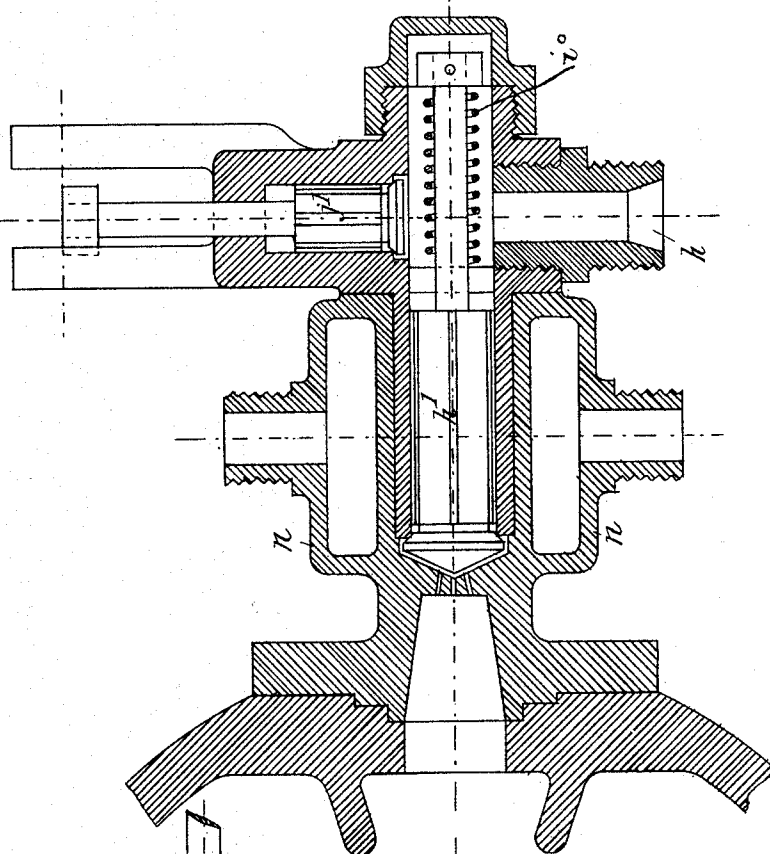
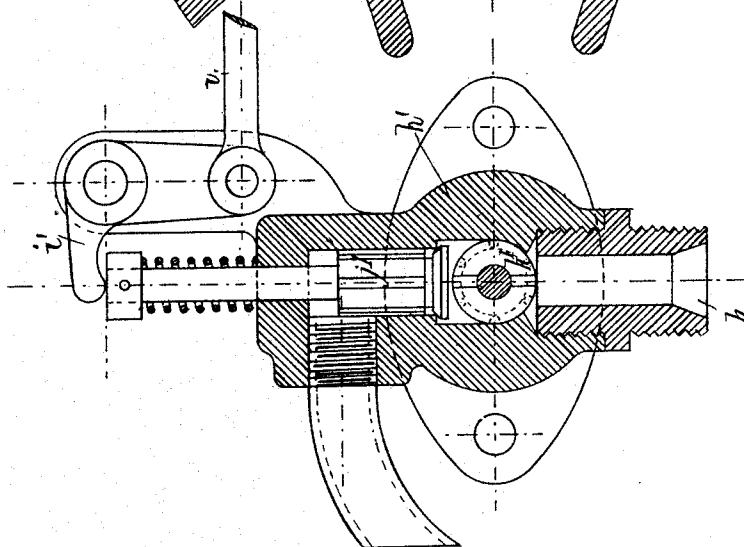


Fig. 3



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UNITED STATES PATENT OFFICE.

WILLIAM HORNSBY, ROBERT EDWARDS, AND WILLIAM EDWARD GIBBON,
OF GRANTHAM, ENGLAND, ASSIGNORS TO RICHARD HORNSBY & SONS,
LIMITED, OF SAME PLACE.

ENGINE OPERATED BY THE EXPLOSION OF COMBUSTIBLE MIXTURES.

SPECIFICATION forming part of Letters Patent No. 504,807, dated September 12, 1893.

Application filed September 27, 1892. Serial No. 447,085. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM HORNSBY, ROBERT EDWARDS, and WILLIAM EDWARD GIBBON, subjects of the Queen of Great Britain, residing at Grantham, England, have invented new and useful Improvements in Engines Operated by the Explosion of Combustible Mixtures, of which the following is a specification.

This invention relates to engines operated by the explosion of mixtures of combustible vapor or gas and air and chiefly to that class of such engines operated by the explosion of mixtures of hydrocarbon vapor and air and in which the hydrocarbon vapor is produced in a heated chamber attached to the cylinder, and it comprises the improvements hereinafter described.

In the accompanying drawings,—Figure 1 is an elevation of part of an engine cylinder having our improvements applied thereto; and Fig. 2 is a longitudinal section of the same. Figs. 3 and 4 are views drawn to an enlarged scale of part of the apparatus shown in Fig. 1.

According to our invention we heat the air for the formation of the explosive mixture by placing a partition formed of a series of perforated plates *a, a* of wire gauze or the like (or, in some cases, only a portion of the partition is made of wire gauze or the like) between the explosion chamber *b* and the working part *c* of the cylinder, which partition readily takes up the heat of the explosions so that when the air which is drawn into the cylinder through the valve *d* is pressed from the cylinder into the vaporizer *b* at the back of the partition it is more or less heated by passing through these plates or the like.

The oil is pumped into the vaporizer through a valve-box *e* attached thereto and containing two valves *h, j'*, the former of which when opened allows the oil to pass it and go into the vaporizer, while the other valve *j'* is arranged to be opened by the engine governor to allow the oil to return or flow back again into the reservoir and thus prevent it going past the first named valve into the vaporizer when the engine does not require an explosive charge. The valve *h* is kept closed

by a spring *i* or by other suitable means and opens when the pump forces oil against it always providing that the valve *j'* is not open. The valve *j'* is closed by its own weight or a spring or by the pressure of the oil and is opened by the action of the governor as hereinbefore stated, so that, when the engine is running too fast, the governor opens this valve and lets out the oil, thus preventing it from passing the valve *h* and going into the vaporizer.

Figs. 3 and 4 show this valve-box and the two valves *j', h'* drawn to an enlarged scale. The oil from the pump enters through the opening *h* and passes the valve *h'* if it is to enter the vaporizer or combustion chamber, or the valve *j'* if it is to overflow or pass back into the oil reservoir, the said valve being operated by the governor through the medium of the rod *i* and the lever *i'*.

In order to keep the valve *h'* cool, the valve-box may be jacketed as shown at *n*, Fig. 4, and provided with an inlet and outlet connected to the water-jacket or water pipes of the cylinder, or water can be run through it from any external source. In some cases the jacket may be filled with oil from the oil-pump that supplies the vaporizer or combustion chamber, the oil circulating round the jacket and then entering the valve-box.

In order to maintain the vaporizer at as nearly as possible a uniform temperature whether the engine is running with a heavy or light load we provide the said vaporizer with a jacket through which, when the vaporizer becomes too hot, more or less of the air drawn in by the engine piston or the air-pump as is usual in such engines shall pass, a separate passage being provided through which the air is drawn direct from the atmosphere when the vaporizer is at the required temperature.

To regulate the quantity of air drawn through the jacket or through the passage, a regulating damper or valve is employed, the opening or closing of which causes the amount of air that is drawn in around the vaporizer to be increased or decreased, and, at the same time, the air that is drawn direct from the atmosphere to be decreased or increased in a

proportionate manner. The opening and closing of this damper are effected by utilizing the expansion of a rod or a column of mercury in contact with the vaporizer, or this valve can
5 be regulated by hand.

In the drawings b' is the jacket around the vaporizer or chamber b and b^7 is the passage leading to the air suction valve d . b^9 is an opening to the air in this passage, b^0 is an
10 opening in the jacket and b^{10} is another opening to the jacket b' .

b^{11} is the valve which, as shown, closes the opening b^{10} to the jacket b' but which can close the opening b^9 as indicated by dotted
15 lines. This valve b^{11} is actuated by the expansion of the arm or extension b^{12} and the vaporizer, which expansion causes the said valve to be opened when the arm b^{12} and the vaporizer get hot, as the lever b^{13} , which is
20 connected to the valve, is held at its upper end by the arm b^{14} . With this arrangement when the vaporizer becomes too hot, the valve b^{11} opens to admit cool air through the jacket and thus cool the vaporizer, and when
25 sufficiently cool the contraction causes the closing of the valve. Any other suitable arrangement of rods, valves, or levers may be used, and a column of mercury may be used in place of the rod b^{12} .

30 Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

35 1. In an explosion engine, the combination with the combustion chamber and the cylinder, of a partition of wire gauze or like material placed between such chamber and cylinder, a fuel inlet to the combustion chamber, and air inlet to the cylinder.

2. In an explosion engine, in combination 40 with one and the same valve-box, two valves, one being held closed by a spring, and another adapted to be opened by a governor actuating it, so that the oil will pass the first named valve when the pump forces it past 45 it, but that oil can pass the second valve only when the governor actuates and opens it, substantially as described.

3. In an explosion engine, the combination 50 with the vaporizer or combustion chamber, of a jacket open to the atmosphere, a valve located in the jacket to allow more or less of the air that is required in the cylinder to be drawn through it, and a rod or column of 55 mercury, whose expansion or contraction under variations of the temperature of the vaporizer or combustion chamber serves to open or close this valve to allow air to be drawn around the vaporizer or combustion chamber or to shut off the supply of air through the 60 jacket substantially as described.

4. The combination of a cylinder and a combustion chamber, an air jacket surrounding the combustion chamber, open to the atmosphere and also to an air-inlet passage to 65 the cylinder, a valve controlling the opening between the jacket and the air inlet passage, and a thermostatic device governing said valve.

Dated September 8, 1892.

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