(No Model.) 2 Sheets—Sheet 1.

J. W. HARTLEY & J. KERR.

GAS ENGINE.

No. 515,770. Patented Mar. 6, 1894.

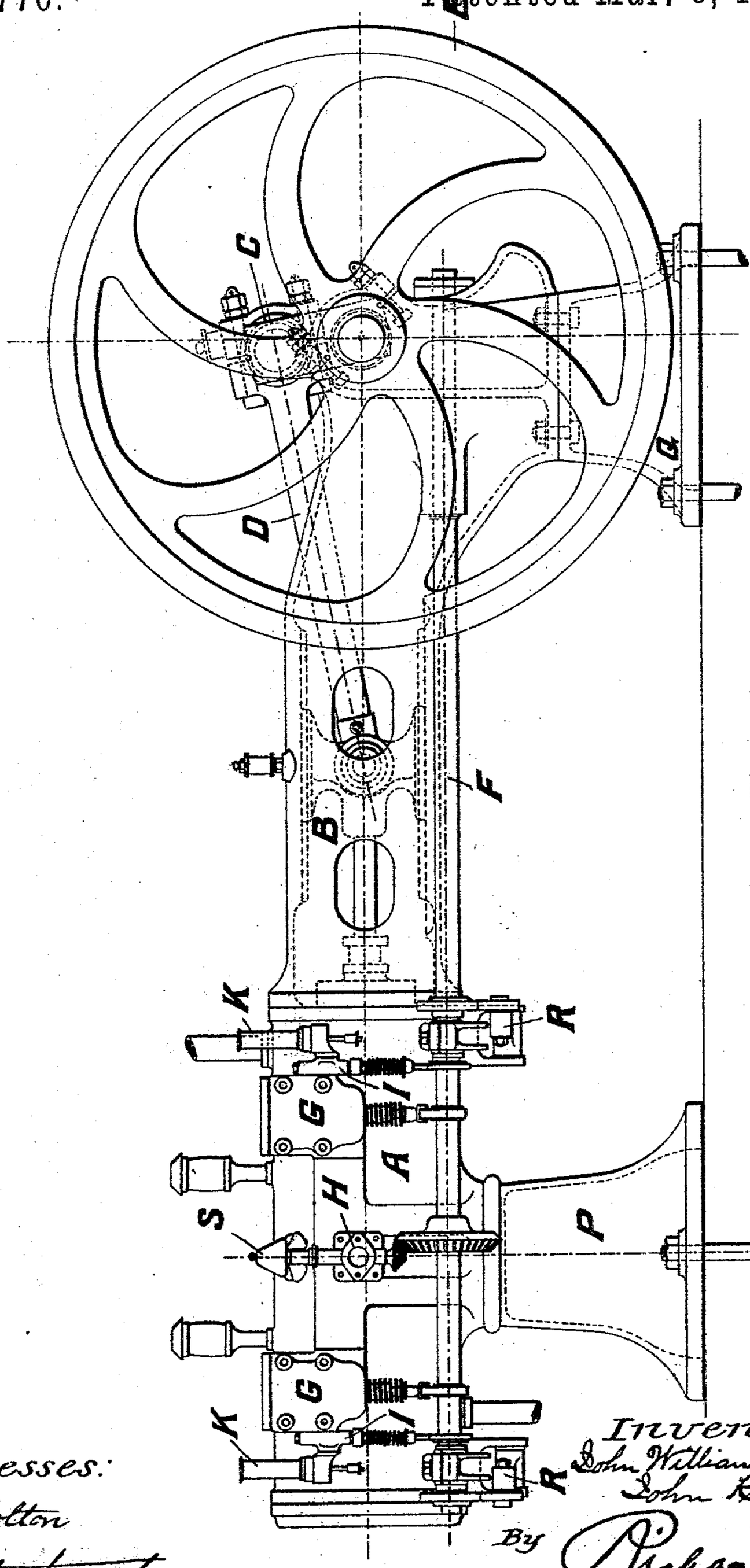

FIG. 1.

Witnesses:
E. B. Bolton
E. K. Stutesman

Inventors:
John William Hartley
John Kerr
By Richards & Co
their Attorneys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

J. W. HARTLEY & J. KERR.

GAS ENGINE.

No. 515,770. Patented Mar. 6, 1894.

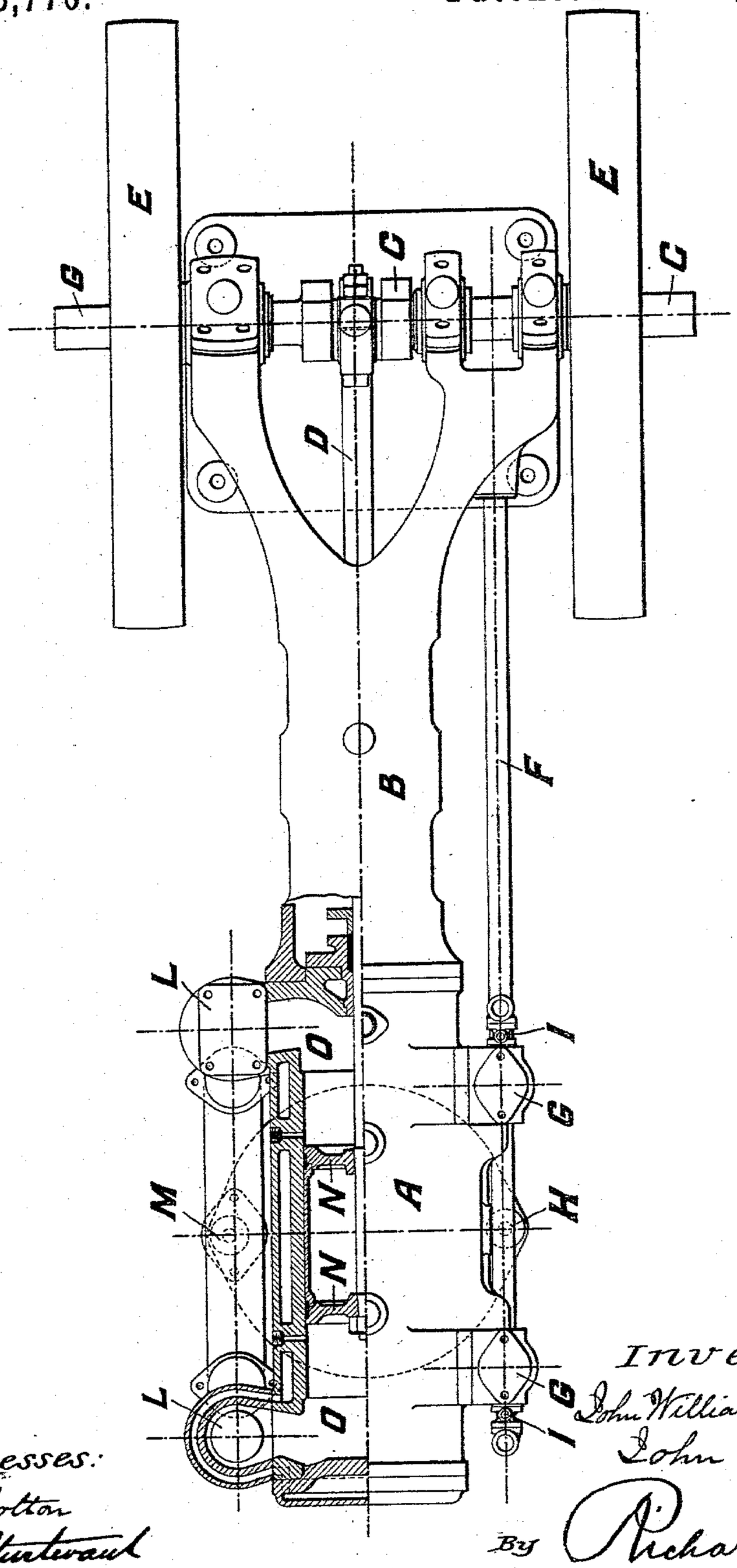

FIG. 2.

Witnesses:
E. B. Bolton
E. K. Stuntevant

Inventors:
John William Hartley
John Kerr
By Richards & R
their Attorneys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN WILLIAM HARTLEY AND JOHN KERR, OF KILMARNOCK, SCOTLAND.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 515,770, dated March 6, 1894.

Application filed March 9, 1893. Serial No. 465,233. (No model.)

To all whom it may concern:

Be it known that we, JOHN WILLIAM HARTLEY and JOHN KERR, subjects of the Queen of Great Britain, residing at Kilmarnock, in the county of Ayr, Scotland, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

Our invention relates to double acting gas engines using the well known "Otto" or "Beau de Rochas" cycle on both sides of the piston and our object is to so arrange the construction and valve gear as to produce an effective, steady, and highly economical engine.

Referring to the two accompanying sheets of drawings:—Figure 1 is an elevation showing the arrangement of engine, of gas and air valves, timing valves and other valve gear of a double acting "Otto" cycle gas engine constructed in accordance with our invention. Fig. 2 is a plan part in section corresponding to Fig. 1.

A cylinder A is mounted upon a stool P and connected by a bored out guide B to a front stool Q, the said guide B forms the frame of the engine and carries the crank shaft C in suitable bearings; the construction being as shown in the drawings somewhat after the style of the well known Corliss steam engine bed. The back end of the cylinder A is closed by a back cover which is preferably water jacketed, and the front end is closed by a cylinder cover also water jacketed, which cover contains a stuffing gland for the piston rod. The front cover as shown in the drawings is cast in one with the cylinder and the stuffing gland is pushed in as indicated in section (Fig. 2) and suitably bolted in position. The piston N is connected to a crosshead working in the bored out guide and the crosshead in turn connects by connecting rod D to the crank shaft C. The stroke of the piston N is so arranged in the cylinder A, that spaces O O are left at each end of the stroke into which the said piston does not enter. A valve shaft F is driven by skew gear from the crank shaft C at one half the rate of rotation of the said crank shaft. The valve shaft F is arranged to pass directly under two air and gas valves G G, a gas valve N and two timing valves I I.

The gas and air valves, gas supply valve and timing valves are all arranged on one side of the engine, while the two exhaust valves L L are arranged on the opposing side of the engine; the said exhaust valves L L are also actuated from the valve shaft F by means of levers R R together with suitable cams and rollers.

The governor S of any well known centrifugal type is actuated from the valve shaft F by suitable gearing and it controls the gas valve H; the said gas valve H supplies alternately the air valves G G, so that a mixture of gas and air is admitted by either of these valves to one of the compression spaces O O.

Suitable cams are mounted on the valve shaft F and actuate the air valves G G by convenient rollers preferably attached to levers acting under the ends of their spindles. The timing valves I I are similarly actuated. The air supply for both valves G G is preferably taken from the stool P by cored out passages within the cylinder opening into a cavity within the said stool.

K K are the funnels surrounding the incandescent ignition tubes.

The exhaust valves L L connect to a common discharge pipe M (Fig. 2).

By the arrangements we have described we produce an engine in which at full power two impulses are given to the crank shaft in every two revolutions of the engine. Gas and air are admitted on one out stroke behind the piston N to the back compression space O by way of the gas and air valve G and the gas valve H; the valves G and H then close, and on the return stroke mixture is compressed into the said back space O, and is ignited after the crank crosses the "in" center by the action of the timing valve I which admits explosive mixture to the back ignition tube; an impulse is thus given at the back end of the piston. On the return stroke, the piston discharges the burned gases by way of the back exhaust valve L. Meantime, the same cycle of operations is proceeding on the front side of the piston N and the forward impulse is succeeded by a backward impulse or vice versa, so that during one revolution of the engine two impulses are given to the crank shaft, the energy of which is stored up in the fly

wheels E E. During the succeeding revolution of the engine following the power or impulse revolution, the discharging and charging processes then proceed, so that every second revolution two impulses are given to be followed by one revolution of two idle strokes, that is, idle strokes so far as the evolution of power is concerned.

By this our new arrangement of engine and valve gear great steadiness and great increase of power are given for a given weight of engine.

It will be observed that both exhaust and inlet valves are arranged symmetrically. The engine is governed by the centrifugal gov ernor S which controls the gas supply valve H and determines the number of explosions to be given in accordance with the variable amounts of power required from the engine.

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—

In combination, the cylinder and piston, the two charge inlet valves, the single gas valve with branch pipes leading to both the charge inlet valves, the valve stems depending through their casings, the cam shaft extending under the valve stems to operate the same directly, the governor for the single gas valve located between the two charge inlet valves the gearing for operating said governor directly said gearing extending from the cam shaft, the ignition valves arranged on same side of the engine with the cam shaft and over the same and having their stems actuated directly by cams on the cam shaft, the exhaust valves arranged on the opposite side of the engine from the cam shaft and inlet valves and the levers extending from the cam shaft to the stems of the exhaust valves, substantially as described.

In witness whereof we have hereunto set our hands in presence of two witnesses.

JOHN WILLIAM HARTLEY.
JOHN KERR.

Witneses to signature of John William Hartley:
JAS. CONNER,
CHAS. H. WEBB.
Witnesses to signature of John Kerr:
S. W. CARR,
J. HILL.