G. R. HARVEY.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED FEB. 6, 1911.

997,190. Patented July 4, 1911.

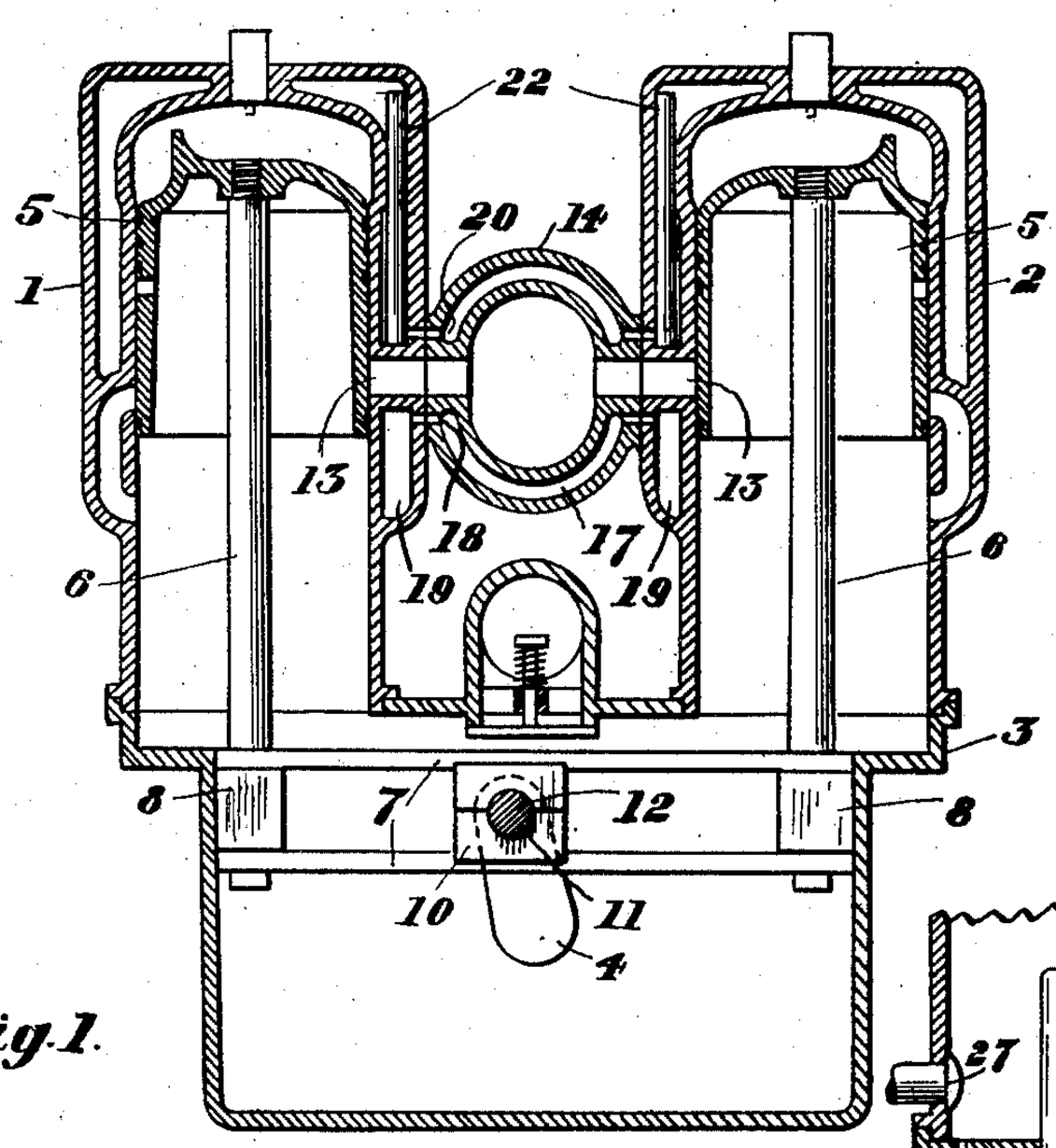

Fig. 1.

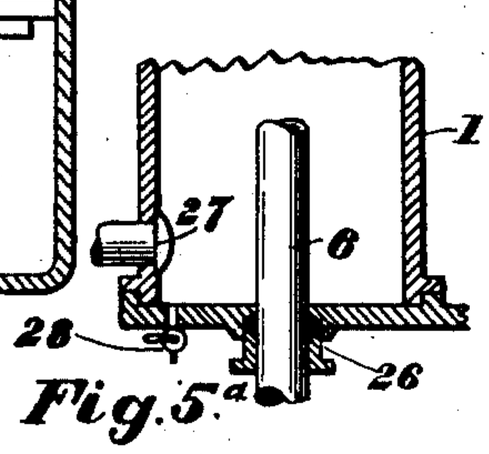

Fig. 5.

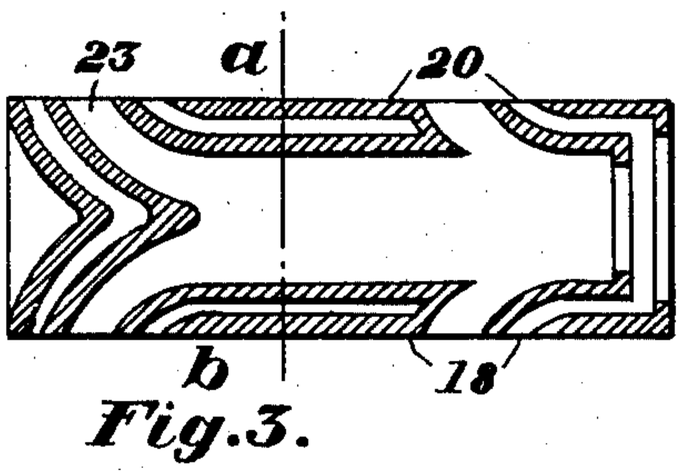

Fig. 3.

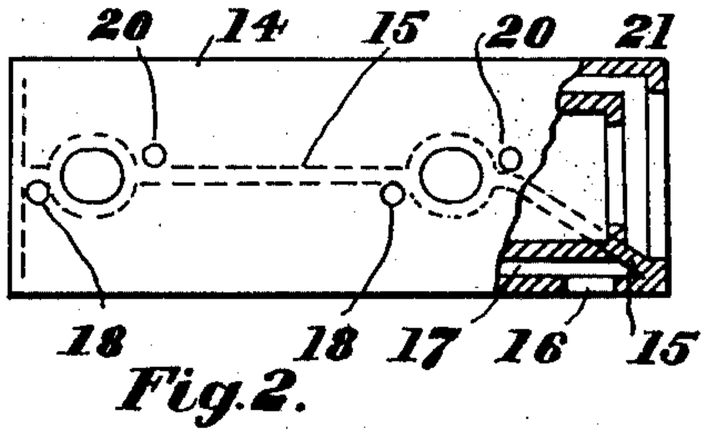

Fig. 2.

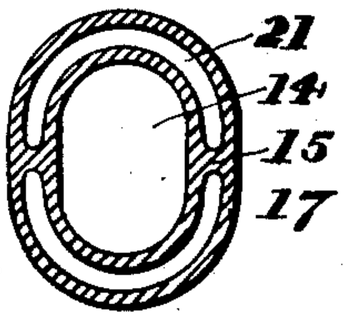

Fig. 4.

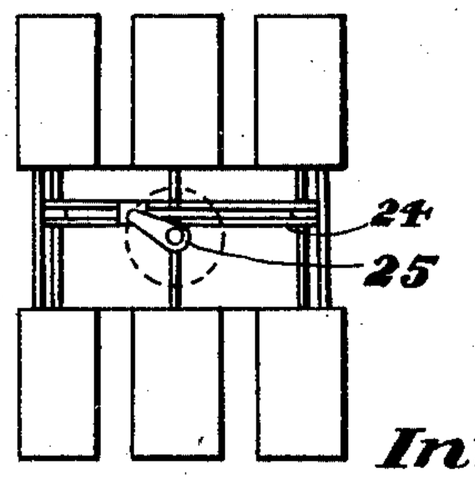

Fig. 5.

Witnesses

A Duck

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UNITED STATES PATENT OFFICE.

GEORGE ROY HARVEY, OF HAMILTON, ONTARIO, CANADA.

INTERNAL-COMBUSTION ENGINE.

997,190. Specification of Letters Patent. **Patented July 4, 1911.**

Application filed February 6, 1911. Serial No. 606,944.

To all whom it may concern:

Be it known that I, GEORGE ROY HARVEY, a subject of the King of Great Britain, and resident of the city of Hamilton, county of Wentworth, Province of Ontario, in the Dominion of Canada, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

The invention relates to improvements in internal combustion engines, as described in the following specification and illustrated in the accompanying drawings that form part of the same.

The invention consists essentially in the novel construction and arrangement of parts, whereby a plurality of pistons operating in parallelly arranged cylinders are connected together to operate upon a single crank of a crank shaft.

The objects of the invention are, to simplify the construction of high power engines of the internal combustion type, to reduce the average weight per horse power in high power engines, and to lessen the friction and vibration in such engines.

In the drawings, Figure 1 is a vertical cross sectional view of a pair of cylinders taken at right angles to the crank shaft. Fig. 2 is a side elevational view of the exhaust manifold shown partly in section. Fig. 3 is a horizontal longitudinal sectional view through the exhaust manifold. Fig. 4 is a vertical cross sectional view through the line *a*—*b* Fig. 3. Fig. 5 is a diagrammatic view showing an arrangement of opposed cylinders. Fig. 5ª is a broken view of a modified form of cylinder.

Like numerals of reference indicate corresponding parts in each figure.

Referring to the drawings, 1 and 2 are a pair of engine cylinders secured to the engine frame 3 and arranged equidistant at each side of the crank shaft 4 journaled in said frame.

5 are the pistons operating in the cylinders 1 and 2 having rigidly connected thereto the rods 6.

7 are a pair of bars spaced apart at the ends by the blocks 8 and rigidly connected to the lower ends of the rods 6 and forming the slide bars of what is commonly known as a "Scotch yoke".

10 is the slide block slidably secured between the bars 7 and having a journal bearing 11 in which is journaled the crank pin 12 of the crank shaft 4. The block 10 is free to slide longitudinally between the bars 7 so that on the outward or downward movement of the pistons, the pressure applied to the yoke members will be transmitted to the crank pin and the crank rotated.

The cylinders are herein shown and described as the two cycle type but it must be understood that four cycle cylinders may be coupled to the crank shaft in the same manner if so desired. Further, while two cylinders are shown in Fig. 1 it will be readily understood that three or more cylinders may be connected to the yoke if desired in a manner similar to that shown in the diagrammatic view in Fig. 5, the main feature being in connecting a plurality of working pistons to one crank. With this arrangement a multiple crank engine may be so constructed that the number of cylinders may be doubled or trebled or even quadrupled if desired so that the cylinders will be operating uniformly on one crank at the same time. Such a construction adds very few parts and consequently an engine of high power may be built with a very low comparative weight per horse power.

It will be readily understood that two or more cylinders may thus be placed together to operate in conjunction with one crank and in a high power engine quite a large number of cylinders may be used instead of increasing the bore and stroke. The additional weight will be merely that of the few cylinders and pistons of a light construction instead of the heavy structure necessary when the bore and stroke is increased.

In the two cycle form of engine as herein shown, the exhaust ports 13 of each cylinder are arranged on the inner side and a common manifold 14 secured between the said cylinders. The manifold 14 is water jacketed and the water jacket is divided longitudinally by the division wall 15, one end of which is sloped downwardly to clear the entrance to the exhaust chamber.

16 is the water inlet passage to the lower compartment 17 of the manifold 14 leading from a suitable pump.

18 are openings leading from the lower compartment 17 and communicating with the water jackets 19 of the cylinders 1 and 2.

20 are openings leading to the upper compartment 21 and communicating with the vertical tubes 22 arranged within the water jacket of the cylinder, said vertical tubes

forming the outlet duct for the water in the water jackets. The exhaust passages 23 are preferably arranged to slope at an angle toward the main exhaust. It will be seen from this description that the inflowing water is separated from the outflowing and the clear circulation is thus established.

In the diagrammatic view in Fig. 5, six cylinders are shown arranged in sets of three directly opposed to each other, each having their rigid piston rods connected to the common yoke 24 which is operatively connected with the single crank 25. It will be readily understood from this description that a very great multiplicity of cylinders may be connected to the one crank shaft. A special feature in the construction described is that in the manufacture the necessity of carrying a great many expensive parts is avoided. The expense of special tools for machining the various parts will be obviated and otherwise the cost of construction will be reduced to a minimum.

In Fig. 5[a] I show a slight modification on the form of cylinder to be used where an open crank case is desired, the piston rod 6 operating through a stuffing box 26.

27 is the gas intake and 28 is a pet cock opening from the bottom of the cylinder to allow the straining of any condensed oil or gasolene that may lodge in the bottom of the cylinder.

What I claim as my invention is:—

1. In an internal combustion engine, a frame, a crank shaft journaled in said frame, a plurality of cylinders rigidly supported from said frame and arranged parallelly in a common plane transversely of and in right angular relation to said crank shaft, said cylinders being placed in balanced arrangement laterally to each side of said crank shaft, pistons operating in unison within said cylinders, piston rods rigid with said pistons, a pair of parallelly arranged distance bars rigidly connected to the outer ends of said piston rods, and a block slidably arranged between said pair of distance bars and rotatably connected to the crank pin of said crank shaft.

2. In an engine, a plurality of cylinders parallelly arranged in a common plane and a similar plurality of cylinders opposing the aforesaid cylinders in the same plane, pistons working in unison in all of said cylinders, a Scotch yoke rigidly coupling the outer ends of the piston rods of all of said pistons, a crank shaft intersecting the plane of said cylinders and having a single crank therein, and a journal block sliding in said yoke with the crank pin of said crank journaled therein.

Signed at city of Hamilton, Canada, this eleventh day of January 1911.

GEORGE ROY HARVEY.

Witnesses:

H. E. SHERK,

M. A. BREHENY.