

No. 780,722.

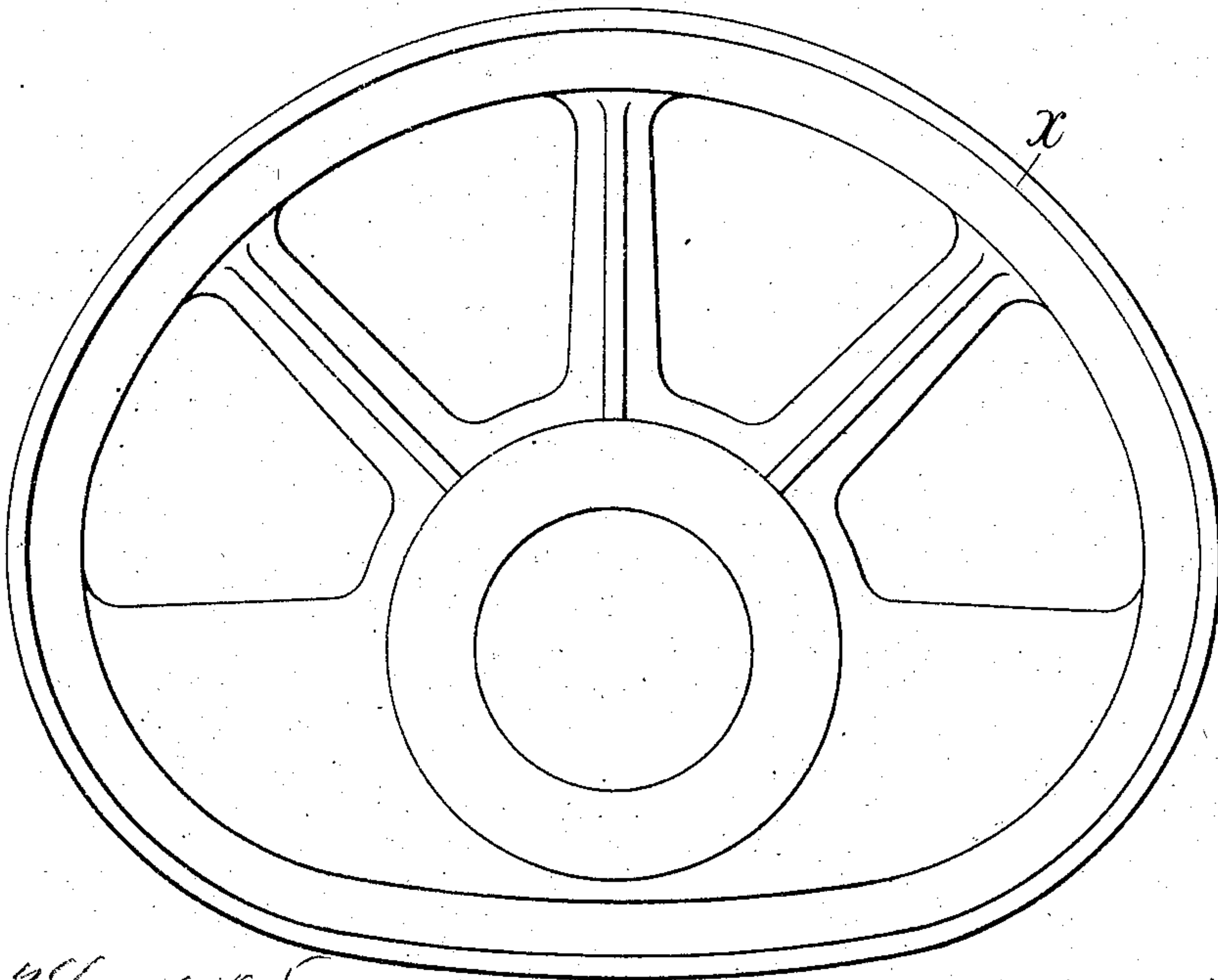
PATENTED JAN. 24, 1905.

P. F. MACCALLUM.
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAY 7, 1901.

2 SHEETS—SHEET 2.

Fig. 5.



Jan 24 1905
M. Callum
Fig. 4

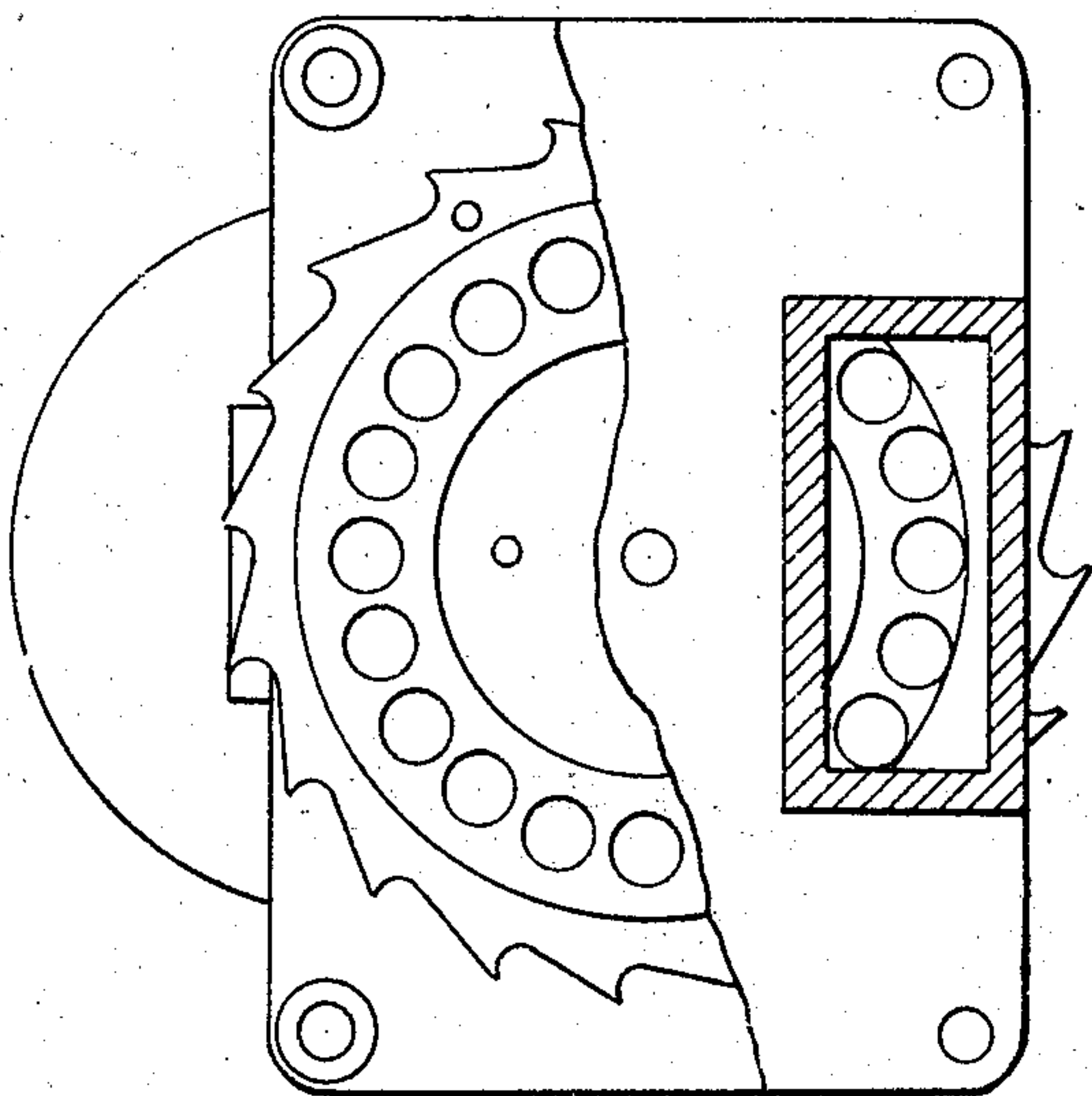


Fig. 3.

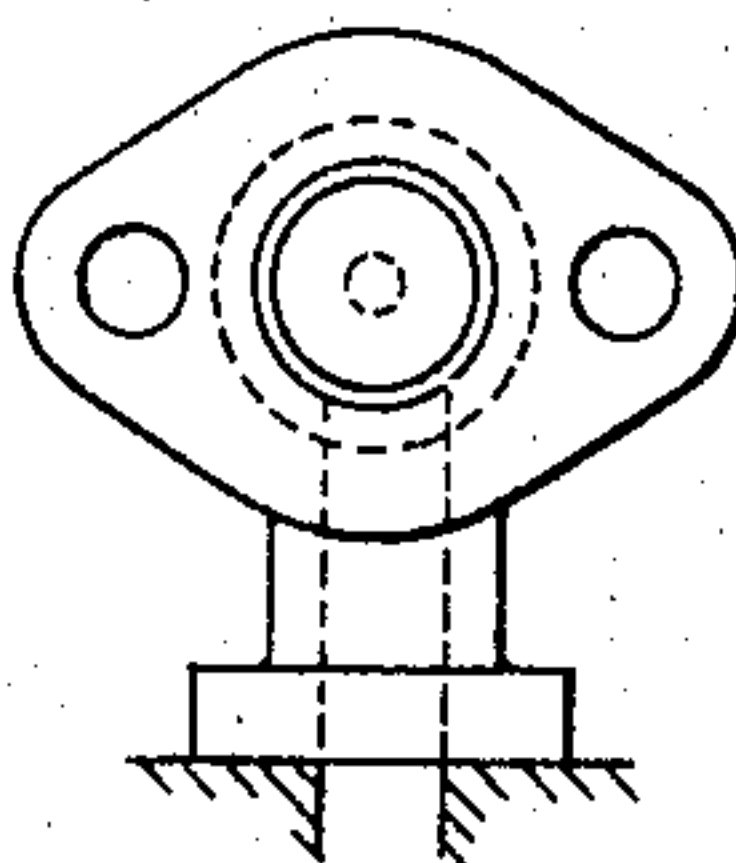
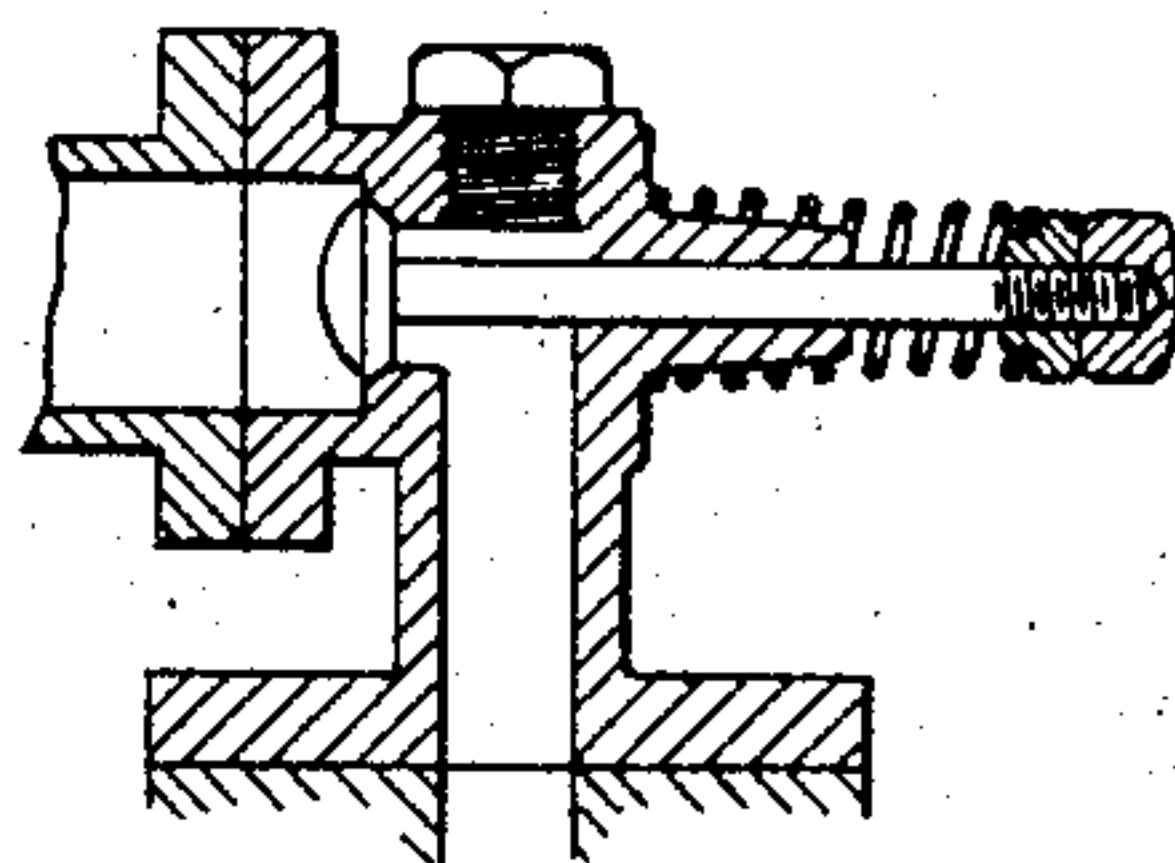


Fig. 2.



Inventor

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Witnesses

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UNITED STATES PATENT OFFICE.

PATRICK FRASER MACCALLUM, OF HELENSBURGH, SCOTLAND.

INTERNAL-COMBUSTION ENGINE.

SPECIFICATION forming part of Letters Patent No. 780,722, dated January 24, 1905.

Application filed May 7, 1901. Serial No. 59,128.

To all whom it may concern:

Be it known that I, PATRICK FRASER MACCALLUM, a subject of the King of Great Britain and Ireland, residing at Fairbank, Helensburgh, in the county of Dumbarton, Scotland, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to an internal-combustion engine burning powdered fuel and having a separate combustion or ignition chamber arranged alongside the working cylinder or expansion-cylinder to which it is connected by a passage, while a grate on which the fuel is consumed is reciprocated in a vertical direction within the combustion-chamber, so as to make a down and up stroke while the engine-piston is making a downstroke and to remain in the upper position while the engine-piston is making an upstroke—that is, while air is being compressed into the combustion-chamber. The said grate is carried by a rod passing through an extension of said combustion-chamber, which extension is partly filled with water for the purpose of cooling the rod and of regulating the volume of air-space within said combustion-chamber.

The invention consists in the features of construction and combinations hereinafter described with reference to the annexed drawings, in which—

Figure 1 is a vertical section of the improved internal-combustion engine embodying my invention. Figs. 2 and 3 are sectional and end detail views, respectively, to a larger scale, showing the valve for timing the air-injection. Fig. 4 is a sectional plan view of the fuel-feeding apparatus. Fig. 5 is a detail showing the contour of the cam for reciprocating the rod carrying the movable grate.

As shown in the drawings, a separate combustion-chamber *a* is connected with the expansion-chamber *m* by means of a passage *b*. The combustion-chamber *a* is formed with an extension *d*, which serves for the reception of water which prevents overheating of the rod *f*, hereinafter referred to, and serves as a re-

ceptacle for ash or grit deposited from the fuel. By varying the level of the water in the extension *d* the volume of the air-space within the combustion-chamber is correspondingly varied.

The grate *e*, which reciprocates in the combustion-chamber, is carried by the rod *f*, passing through a stuffing-gland in the base of the extension *d*, as shown. The said rod receives an up-and-down movement from the cam *x* on the engine-shaft for the purpose of placing the grate *e* in the best position for firing the fuel and for removing and retaining the heated grate out of the way of incoming air during the period of air-compression. A pulley *x'* is keyed on the rod *f* for the purpose of rotating said rod during its reciprocating movement, if desired.

The working cylinder or expansion-cylinder *m* is provided with grooves for lubrication purposes and with grooves for the circulation of water surrounding the path of the piston *l*, as fully described in the specification of Letters Patent No. 710,483.

The working cylinder is provided with an exhaust-valve *n*, through which the waste products of combustion are expelled on the upstroke of the piston *l*, which valve *n* is held open as long as necessary for this purpose by the action of devices operated from the upper shaft *n'*. The shaft *n'* is driven by a belt *n²* from the engine-shaft *w'* and operates the fuel-feeding mechanism shown in Fig. 4. The said fuel-feeding mechanism is in its essentials the same as that described in the specification of Letters Patent No. 626,840 and forms no part of the present invention. On the upstroke of the piston *l* air is drawn into the crank-chamber *v* through valves *v'*, placed in the sides of said chamber, and is slightly compressed by its downstroke—say to about five to eight pounds per square inch, at which pressure the valves *l'* on the upper surface of the piston are opened and the air passes upward into the expansion-chamber to be again compressed by the upstroke of the piston *l* into the combustion-chamber *a*. Instead of passing all the air for combustion

from the crank-chamber through the valves l' a portion of the air may be passed directly from the said crank-chamber by means of a pipe w^2 through a non-return valve w into the combustion-chamber.

The engine is actuated as follows: After the surface of the grate e has been sufficiently heated the combustion-chamber is closed, with the piston l of the engine near the top of its stroke. Compressed air from a reservoir may then be led in to start the engine. The engine being in motion, the piston l on its upward movement draws a volume of air into the inclosed air-tight crank-chamber. During the upward stroke of the piston or during a large portion thereof the grate e is retained at the upper end of the combustion-chamber a in order that the fresh air forced by the upward stroke of the piston l through the passage b may not be heated by passing over the intensely-heated grate e . Then as the compression-stroke of the piston is nearly completed the grate e is quickly lowered to a position below the passage b , at which time a charge of fuel is injected into the combustion-chamber by the fuel-feeding and air-injecting devices, as shown in Figs. 2 to 4, and such fuel is ignited on contact with the heated surfaces of the grate e , whereby the resultant combustion furnishes the energy to force the piston l to make a working stroke. Before or when the piston l has completed its downward movement the grate e is again raised to its upper position. When the piston l is about the bottom of its stroke, the exhaust-valve n opens and allows the waste products

of combustion to escape from the expansion and combustion chambers.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. The improved internal-combustion engine, comprising, in combination, an expansion-cylinder, a piston reciprocating in said expansion-cylinder, a combustion-chamber located alongside said expansion-cylinder, a passage connecting said combustion-chamber with said expansion-cylinder and a grate adapted to move vertically in front of said passage, substantially as described.

2. In an internal-combustion engine, the combination of an expansion-cylinder, a piston reciprocating in said expansion-cylinder, a combustion-chamber located alongside said expansion-cylinder, and having a water-holding extension, a passage connecting said combustion-chamber and said expansion-cylinder, a grate, and means for reciprocating said grate vertically in front of said passage, substantially as described.

3. In an internal-combustion engine, in combination the expansion-cylinder m , the piston l , the combustion-chamber a having the water-holding extension d , the passage b , the grate e , the rod f , cam x and shaft w' , as shown and described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

PATRICK FRASER MACCALLUM.

Witnesses:

WALLACE FAIRWEATHER,
JNO. ARMSTRONG, Junr.