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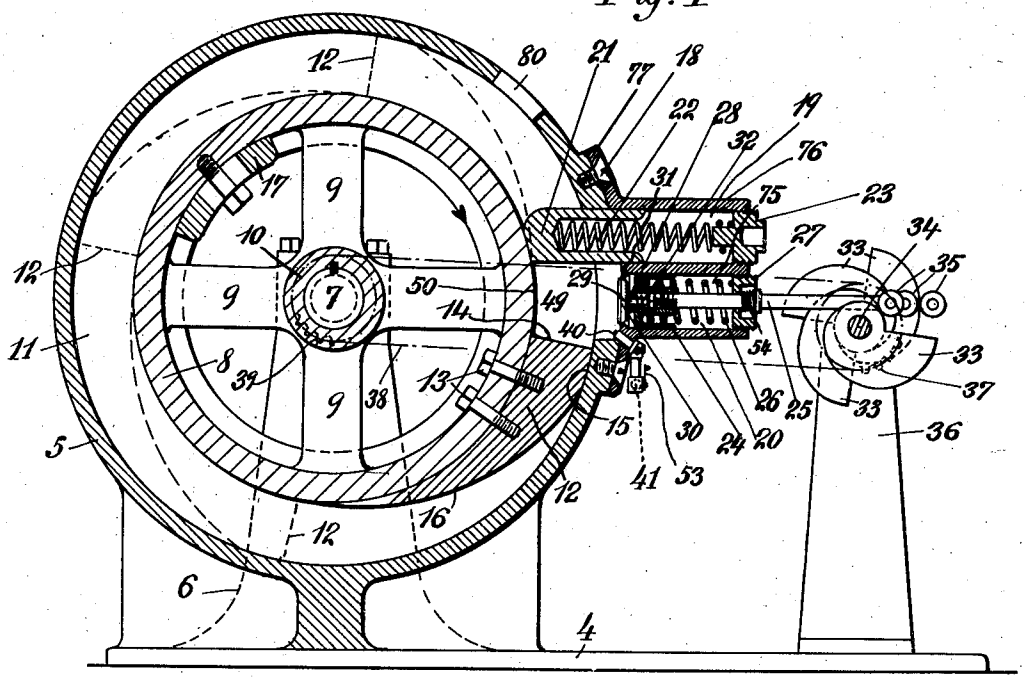
ROTARY INTERNAL EXPLOSION ENGINE.

APPLICATION FILED OCT. 31, 1910.

1,027,182. **Patented May 21, 1912.**

2 SHEETS—SHEET 1.

Fig. 1



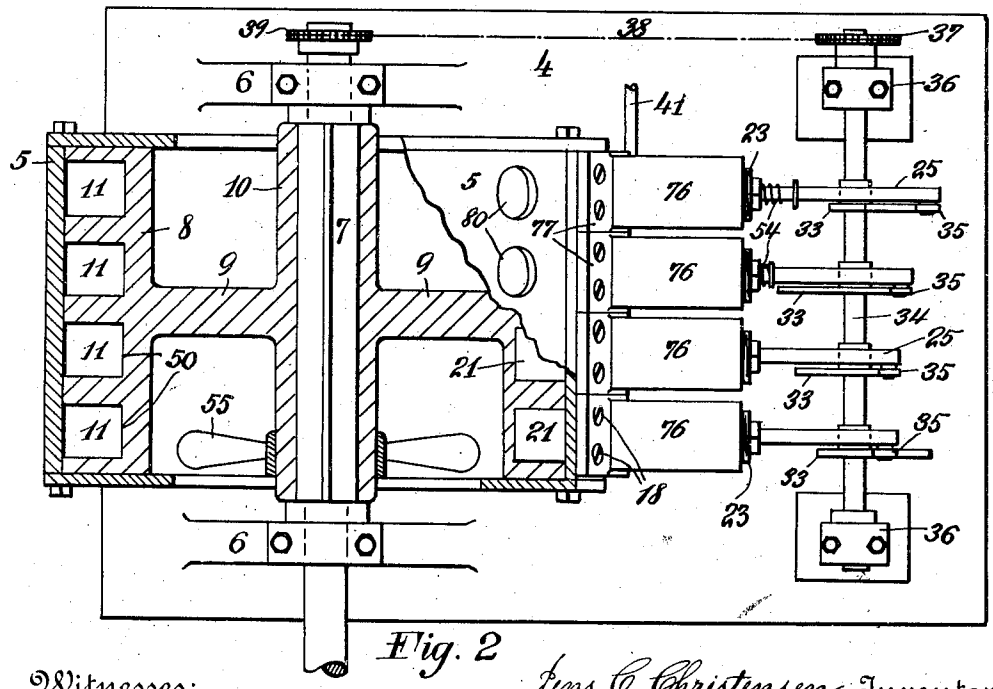


Fig. 2

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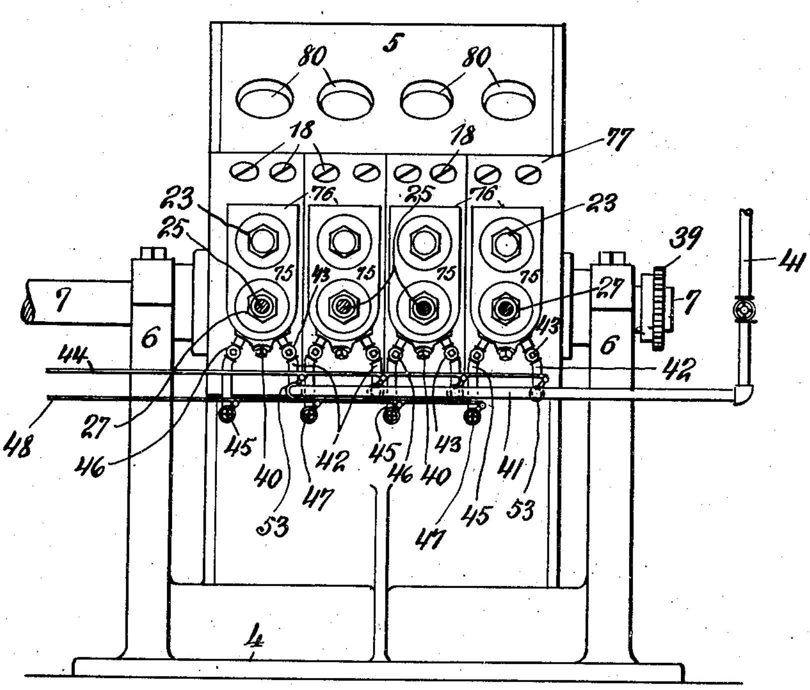

Fig. 3

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UNITED STATES PATENT OFFICE.

JENS C. CHRISTENSEN AND RUDOLF A. F. L. ANDERBERG, OF NEW YORK, N. Y.

ROTARY INTERNAL-EXPLOSION ENGINE.

1,027,182. Specification of Letters Patent. Patented May 21, 1912.

Application filed October 31, 1910. Serial No. 590,020.

To all whom it may concern:

Be it known that we, JENS C. CHRISTENSEN and RUDOLF A. F. L. ANDERBERG, citizens of the Danish Monarchy, and residents of the borough of Bronx, Westchester county, New York, have invented certain new and useful Improvements in Rotary Internal-Explosion Engines, of which the following is a specification.

This invention relates to internal explosion engines and has more particular reference to a rotary internal explosion engine. For the purpose of this disclosure the engine or motor is described as one using gasolene for fuel, but we do not wish to be understood as limiting our invention in this respect, nor with respect to the detailed construction set forth.

The objects of the invention are to provide a rotary engine of the internal explosion type of novel and useful construction with a view of obtaining great power and speed; and to accomplish these results by means of an engine of relatively small size and few parts.

With these and other objects in view the invention comprises such elements and combination of parts as is hereinafter set forth, while reference is had to the accompanying drawings in which—

Figure 1 is a vertical sectional view of a rotary internal explosion engine embodying the invention. Fig. 2 is a plan view partly in section, and Fig. 3 is a side elevation of the engine.

In the drawings the reference numeral 4 represents a suitable base supporting a cylinder or casing 5. The said base further supports two bearings 6, 6 in which is journaled a drive shaft 7 to which is keyed a wheel 8 having the spokes 9 and an elongated hub 10. The said wheel fits inside the cylinder 5 with a running fit and is provided with a plurality of grooves, the number of which depends upon the size and power of the unit. In this instance there are shown four annular grooves 11. In each of the latter and spaced 90° apart there is secured a piston 12 by suitable means as the bolts 13. Each piston is provided with a radial straight face 14, a concentric surface 15 and the cam or sloping surface 16 the base of which merges with the surface of the groove 11. Adjustable counterbalances 17 are provided to offset the weight of the pistons, the transverse area of which completely fills the groove 11 at the surface 14.

80 is the exhaust opening.

75 represents fuel supplying devices, one for each piston and as they are alike only one will be described. The said fuel supplier comprises a pump casing 76 provided with flanges 77 for securing the casing to the cylinder 5 by bolts or screws 18. The casing is provided with two chambers, an abutment chamber 19 and a pump chamber 20. In the former moves an abutment 21 normally projected into the groove 11 by a spring 22. The abutment is of the same width as the said groove. The tension of the spring may be regulated by the nut 23.

The pump chamber forms a pump in connection with the piston 24 carried by a piston rod 25. A spring 26 tends to force the piston toward the cylinder 5. The tension of said spring may be adjusted by the nut 27. In the bottom of the casing 16 there is formed a spider 28 in which is guided the stem 29 of the valve 30, which latter seats on the valve seat 31 in said pump casing and normally under the influence of a spring 32. It will be noted that the valve stem and spring lie within the pump piston 24 for purposes to be explained later.

The pump is operated by means of a cam 33 suitably secured to the cam shaft 34 and acting on the cam roll 35 carried by the piston rod 25. As the latter is reciprocated, it is guided in the nut 27 and on the hub of the cam 32. These latter are of course also spaced 90° apart. The cam shaft 34 is suitably journaled in two bearings 36, 36, carried by the base 4, and is provided with a gear 37 suitably driven by a chain 38 from a gear 39 on the main drive shaft 7. On the opposite end of this latter may be attached in any well known manner the element which is to be driven by the engine. In the bottom of the pump casing there is inserted a spark plug 40 or similar device for igniting the fuel.

The numeral 41 in Fig. 3 represents a pipe leading from a suitable source of fuel supply and through which the fuel, in this particular instance gasolene, is fed under pressure or otherwise to the pumps. For this purpose there are provided the branch pipes 42 leading from the pipe 41 to the

pumps 20. A check valve 43 which opens toward the pump is inserted in the branch pipes 42.

53 represents suitable throttling devices operated by a sliding rod 44 in any suitable manner.

45 are air pipes through which the air is sucked into the pump. Also in these pipes there are provided check valves 46, and 47 represent throttling devices operated by a sliding rod 48. The branch pipes or fuel and air inlets lead into the pump behind the valve 30 and in front of the pump piston 24 when the latter is drawn away from said valve.

The space marked 49 in Fig. 1 denotes the firing or explosion chamber which is formed periodically between the abutments 21 and the piston 14 inside the cylinder 5 four times during one revolution of the engine in this particular instance.

In Fig. 1 the engine is illustrated at the moment an explosion takes place and the wheel 8 is driven in the direction of the arrow due to the force of the explosion acting on the piston 12 as is obvious. The face 14 of the piston forms the one side of the explosion chamber, the other five faces are formed by the opposed inner sides of the groove or channel 11, the circular surface 50 of the wheel 8, the side of the abutment 21 and the face of the valve 30. It will be observed that the explosion chamber is tightly closed to avoid danger of back firing; and that the force of the explosion itself tends to seat the valve 30 firmly in its seat in addition to the force exerted for this purpose by the spring 32. Also that the pump piston 24 is fully to the bottom of the cylinder and cuts off fuel and air supply. When the cylinder piston 12 has traveled about a quarter of a revolution the pump piston will begin its outward travel as its cam 33 forces the cam roll 35 outward, thus gently compressing the pump piston spring 26. As the piston 24 moves outwardly it uncovers the inlet openings for the air and fuel as will be understood. A suitable amount of fuel is sucked into the pump and there mixed with the air. The check valves 43 and 46 and the throttles 53 and 47 will of course be suitably adjusted and operated so as to insure of the proper amounts of fuel and air being sucked in by the pump. The piston in the latter will finish its outward movement shortly before the cylinder piston reaches the abutment 21. While this latter is being lifted the cam roll 35 is on the highest concentric part of the cam 33 and as soon as the piston cylinder has partly or wholly formed the explosion chamber as shown in Fig. 1 the cam roll will pass off the cam, the spring 26 will force the pump piston inwardly with a sudden sharp blow. This causes compression of the fuel until the pressure is stronger than the force of the spring 32. At this moment the valve 30 is opened and the fuel injected into the explosion chamber. At the proper time it is then ignited, the explosion takes place and the wheel 8 receives another impulse.

It will be observed that the pump piston does not touch the spider 28 in Fig. 1. This is due to a cushion spring 54 on the piston rod 25. This spring is compressed just before the piston 24 completes its travel to the left and prevents the piston from striking the spider. It will also be noted that the piston 24 is hollow and passes over the valve stem 29, hence there is not enough compressed fuel between said valve and the said piston to prevent the valve from seating under the influence of the spring 32. Thus the valve 30 is seated immediately after the fuel has been injected into the explosion chamber. These precautions for obtaining a closed explosion chamber are necessary because of the nature of the fuel, but it will be seen that the pressure of both the compressed and later igniter fuel effectively prevents the valve from opening. The above described operation is of course the same for the four impulses received by the wheel 8 on the four pistons 12. It is to be noted that we obtain as many explosions or impulses per revolution as there are grooves in the wheel 8. Thus this engine is adapted to operate at great speed and yet there are comparatively few parts to accomplish the objects of the invention. As a cooling means we have shown a fan 55 carried by the hub 10 of the wheel 8. We may, also, if desired, cool the engine by any other well known means such as water circulated in a suitable water jacket.

While we have shown a mere illustration of an igniter, it is to be understood that we are not limited thereto, nor do we wish to be limited to the exact construction shown as the invention is susceptible of changes. Hence we claim all such changes as properly come within the legitimate and intended scope of the invention and the claims.

What is claimed is:—

1. In a rotary internal explosion engine the combination of a cylinder, a wheel within the same, a plurality of annular grooves formed in said wheel, a piston secured in each of the said grooves, movable abutments supported to coöperate with the said pistons to form explosion chambers, pumps supported on the said cylinder, one for each of the said pistons and comprising a casing, a pump piston movable within the same, a valve having a stem interposed between the cylinder and the pump, a recess formed in the pump piston for the reception of the valve stem when the pump piston is in position nearest the cylinder, means for oper-

ating said pump piston slowly away from the cylinder to suck in a charge of explosive fuel, means for forcing the pump piston suddenly toward the said valve to cause the same to be opened by the compressed charge of fuel and to inject the said charge into the said cylinder between the cylinder piston and the abutment, means for closing said valve as soon as the charge has entered the cylinder, means for preventing the pump piston from hitting the said valve when the said piston moves toward the cylinder and means for supplying fuel to the said pump.

2. In a rotary internal explosion engine the combination of a cylinder, a drive shaft in said cylinder, a wheel on the shaft, said wheel being provided with a plurality of annular grooves whereby a plurality of annular channels are formed between said wheel and the said cylinder, a piston secured in each of said channels in sliding contact with the cylinder wall, said pistons being spaced circumferentially in said channels, a plurality of sliding abutments, one for each channel and adapted to enter the latter and project into the path of the cylinder pistons, a mechanism for injecting a charge of explosive mixture into the channel between the piston and the abutment, means for operating said mechanism from the aforesaid drive shaft, a valve for cutting off said mechanism after the charge has entered the channel, said valve being adapted to form part of the explosion chamber of the engine and means for supplying fuel to the said charge injecting mechanism.

3. In a rotary internal explosion engine, the combination of a base, a cylinder mounted thereon, a drive shaft, bearings for the latter, a wheel on said shaft and within said cylinder, pistons on said wheel spaced circumferentially and longitudinally within said cylinder, counterweights adjustably secured to said wheel to counterbalance said pistons, a plurality of apertures formed in the wall of said cylinder in a line parallel to the axis of the said driveshaft, a plurality of separate casings secured to the outside of said cylinder to cover said apertures, one casing for each of the said pistons, separate chambers formed in the said casing, an abutment mounted in the one chamber and adapted to project through the said aperture and into the cylinder in the path of a piston, a spring for normally forcing said abutment inwardly, means for adjusting said spring, a pump mechanism supported in the other of the said chambers and comprising a piston movably supported in the chamber, a spring for normally forcing said piston toward the cylinder, a valve seated in the chamber and adapted to open toward the said wheel through the said aperture, a spring for closing said valve, a countershaft supported on said base, and operating connections between said countershaft and the said piston for moving the latter slowly away from the cylinder, and means for driving the said countershaft from the said driveshaft.

4. In a rotary internal explosion engine, the combination of a cylinder, a rotatable support within the same, a plurality of pistons secured to said support and spaced circumferentially and longitudinally in the same, a plurality of apertures formed in the wall of said cylinder, said apertures being formed in a line parallel to the axis of the said support, a plurality of casings secured to the cylinder to cover the said apertures, mechanism for injecting a charge of explosive fuel between all of said pistons during one revolution, said mechanism comprising a pump, a pump piston, means for operating the latter the full length of the said pump, a valve having a stem and seated in the said pump adjacent said cylinder and adapted to open into the latter to admit the said charge, a recess formed in the said pump piston for the reception of the said valve stem when the said piston has completed its stroke toward the cylinder and means for supplying fuel to the said pump.

5. In a rotary internal explosion engine, the combination of a cylinder, a wheel within the same, a plurality of pistons secured to said wheel, abutments supported adjacent said cylinder and adapted to coöperate with the said pistons to form explosion chambers, mechanism for injecting a charge of explosive fuel, into the said chambers, said mechanism comprising a pump for each cylinder, a piston in the same, a valve interposed between the cylinder and the said pump piston, means for operating the latter to draw in a charge of explosive fuel, means for operating the said pump piston to compress the said charge between itself and the said valve, a spring for keeping the latter closed until the charge has been compressed to maximum pressure, when the said valve is adapted to open by said pressure to admit the charge to the said explosion chamber, and means for supplying fuel to the said pump.

Signed at New York, N. Y. this 27 day of October 1910.

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