C. R. ORD.

ROTARY EXPLOSIVE ENGINE.

APPLICATION FILED MAY 24, 1915.

1,209,995.

Patented Dec. 26, 1916.

2 SHEETS—SHEET 1.

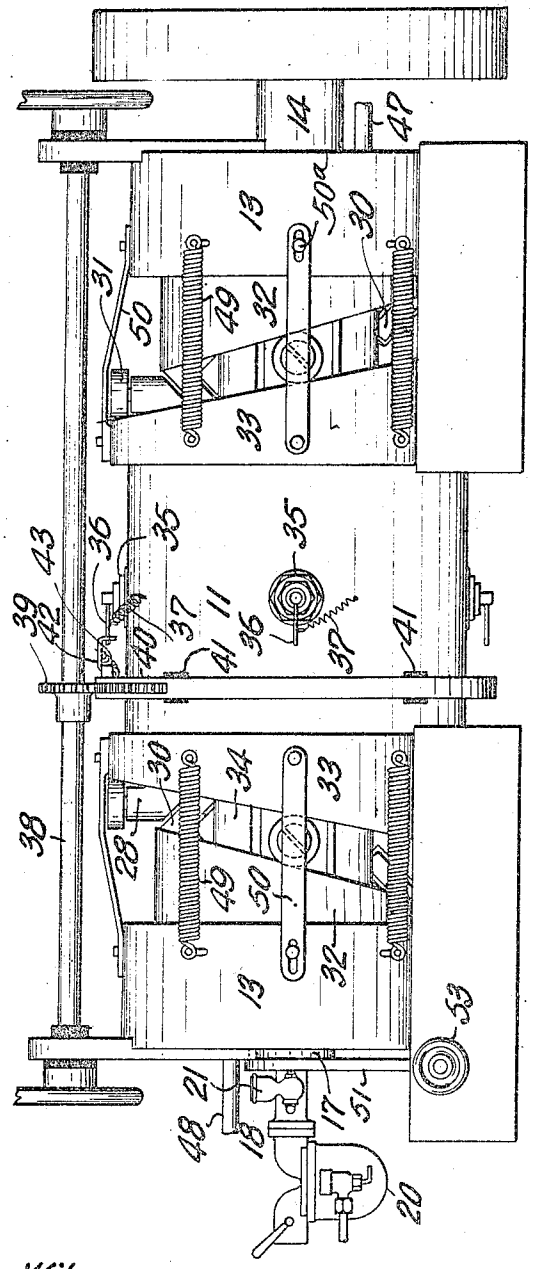

FIG. 1.

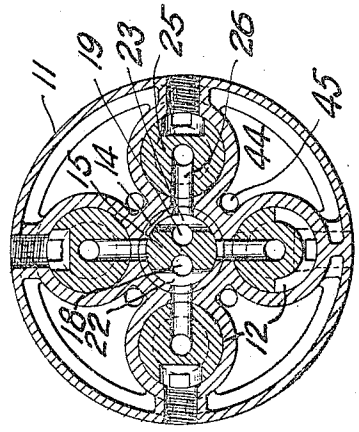

FIG. 3.

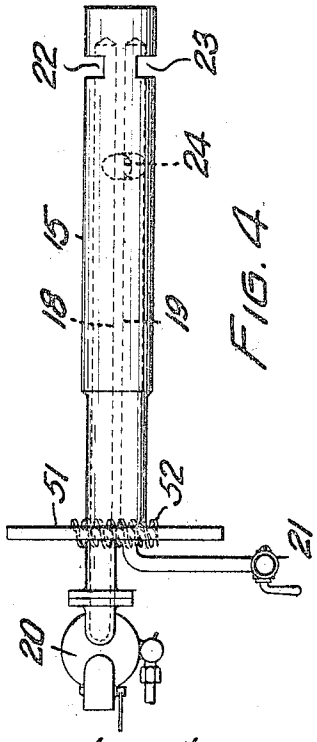

FIG. 4.

Witnesses

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2 SHEETS—SHEET 2.

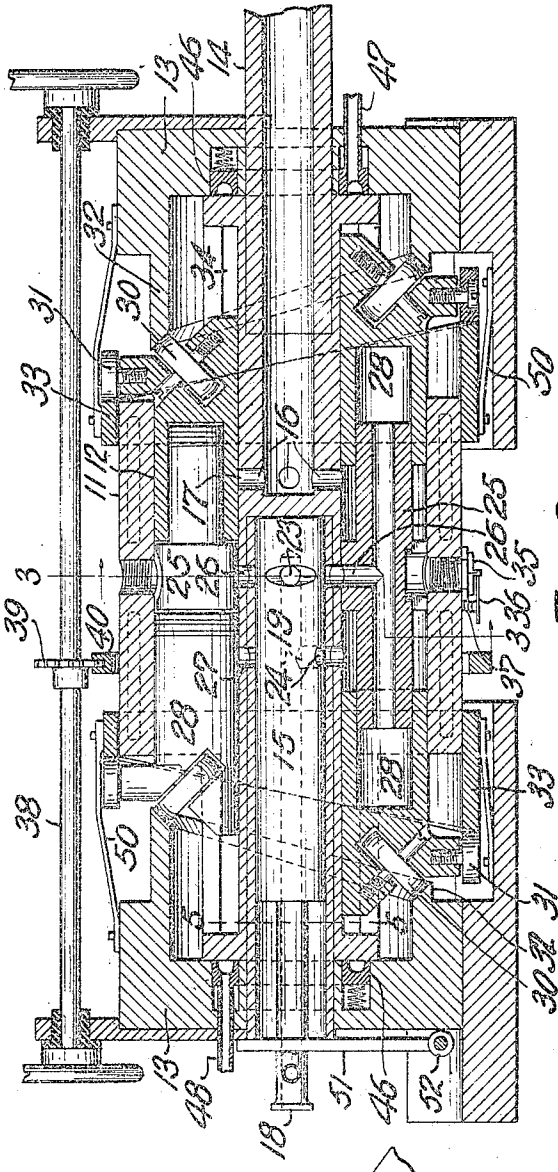

FIG. 2.

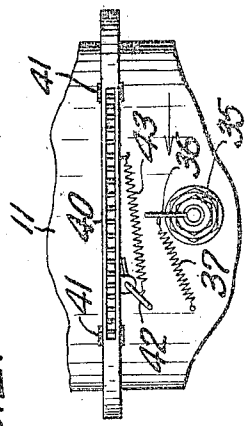

FIG. 6.

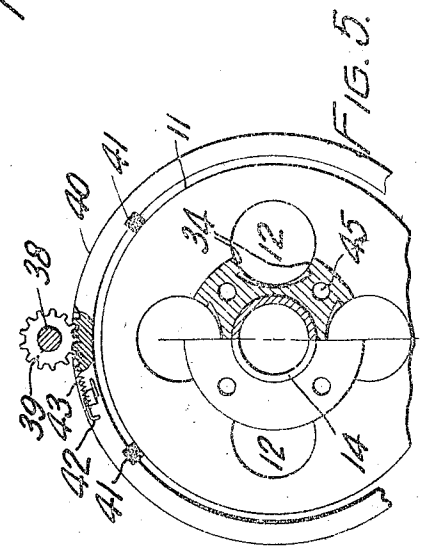

FIG. 5.

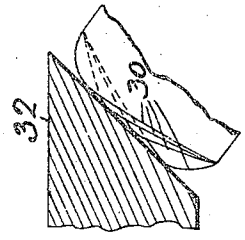

FIG. 7.

Witnesses

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UNITED STATES PATENT OFFICE.

CRAVEN ROBERT ORD, OF McADAM JUNCTION, NEW BRUNSWICK, CANADA.

ROTARY EXPLOSIVE-ENGINE.

1,209,995. Specification of Letters Patent. Patented Dec. 26, 1916.

Application filed May 24, 1915. Serial No. 30,019.

To all whom it may concern:

Be it known that I, CRAVEN ROBERT ORD, a citizen of the Dominion of Canada, and resident of McAdam Junction, in the Province of New Brunswick and Dominion of Canada, have invented certain new and useful Improvements in Rotary Explosive-Engines, of which the following is a full, clear, and exact description.

This invention relates to explosive engines, and is designed as an improvement on my former Patents, Nos. 968,969 and 1,104,539.

The object of the present invention is to adapt an engine of the type shown in my former patents to operate with explosive fuels.

The invention consists broadly of a rotor having bores parallel with the axis thereof, and each containing a fixed piston and a pair of sleeves sliding between the fixed piston and the rotor, and forming at the same time moving pistons for the rotor bores and moving cylinders for the fixed pistons. The engine receives gas and exhausts through the hollow shaft supporting the rotor.

In the drawings which illustrate the invention: Figure 1 is a side elevation of the engine. Fig. 2 is a vertical longitudinal section thereof. Fig. 3 is a section on the line 3—3, Fig. 2. Fig. 4 is a plan view of the valve. Fig. 5 is an end view of the rotor half in section on the line 5—5, Fig. 2. Fig. 6 is a fragmentary plan view illustrating the ignition mechanism. Fig. 7 shows a detail of the cams and rollers.

Referring more particularly to the drawings, 11 designates a cylindrical rotor having a plurality of bores 12 arranged axially parallel with the rotor axis. The rotor is mounted in bearings 13 on hollow shafts 14 and 17, the shaft 17 having a valve 15 revoluble therein, and the shaft 14 communicating with exhaust ports 16 leading from the rotor bores.

The valve 15 has two longitudinal passages 18 and 19, the former of which connects with the carbureter 20 and the latter with a priming valve 21. These passages have ports 22 and 23 positioned midway between the ends of the rotor when the valve is in place, while the passage 19 has a second port 24 which may be termed a transfer port located a suitable distance around the circumference of the valve from the port 23 and a suitable distance along the valve from the same port.

Each bore of the rotor contains a hollow fixed piston 25 mounted at its center and open at the ends, and so formed as to leave free a passage for gas from end to end of the bore externally as well as internally thereof. A port 26 is formed jointly in each piston and in the rotor adapted to connect the ports 22 or 23 with the interior of the fixed pistons. The rotor is in addition provided with ports 27 adapted to connect the rotor bores with the valve port 24.

A sleeve 28 is slidably mounted in each end of each bore, and engages externally with the wall of the bore, and internally with the fixed pistons 25. The outer ends of these sleeves are closed, and provided with suitably disposed rollers 30 and 31 traveling on cams 32 and 33. Extensions 34 from the rotor form guides in which the outer ends of the sleeves travel, and which take up the inward thrust of the rollers 30 on the cams 32, as explained in my previous patents.

A spark plug 35 is provided for each bore of the rotor and is radially disposed midway between the ends of the bore. These spark plugs each contain a revoluble core having a radially projecting external arm 36 drawn in one direction by a spring 37 connected between the arm and a fixed point on the rotor. A suitably journaled shaft 38 is provided above the engine axially parallel therewith, and carries a pinion 39 meshing with a toothed ring 40 mounted on the outer surface of the rotor and having its bearing points formed of blocks of insulating material 41, which electrically separate the ring from the cylinder. A pivoted circuit maker 42 is mounted on the ring and is drawn constantly in a direction opposite to the spark plug arms 36 by a spring 43.

The cooling means for the rotor consists of water passages 44 formed between the bores, as clearly shown in Fig. 3 and communicating at each end with passages 45 formed through the guides. A grooved, spring-pressed ring 46 is mounted in each bearing 13 with the groove facing the ends of the guides, so as to be in constant communication with the passages 45. Water inlet and outlet pipes 47 and 48 are connected one to each ring through the bearings. The cam rings 33 are slidable longitudinally of

the rotor and are connected with the cams 32 or with the bearings, if desired, by tension springs 49 and slotted links 50 arranged alternately with springs, and engaging pins 50ª in members 13. The springs provide resilient mountings for the cam rings 33 while links 50 prohibit excess movement thereof. A lever 51 is attached to the end of the valve, and is provided at its free end with spiral teeth (not shown) which mesh with a worm wheel 52 mounted in the bed of the engine and operated by a hand wheel 53, so that the valve may be moved relatively to the rotor to regulate the intake and compression of the gas.

The operation of the device as regards cooperation between the rollers 30 and cams 32 during the inward and outward movement of the sleeves causes rotation of the rotor, as fully described in my former patents, and need not be enlarged upon. Fuel supplied from the carbureter through the passage 18 is drawn through the valve port 22 and piston ports 26 into the hollow pistons in rotation by the outward movement of the sleeves on said pistons. Inward movement of the sleeves, after the ports 22 and 26 are out of register, compresses the charge in each piston in rotation and forces it through the ports 26 and 23 into the passage 19, which forms a compressed gas receiver, and from which the gas escapes through the port 24 into the rotor bore opposite to that in which it was compressed, and at a point where the sleeves are remote, so that there is ample space in the annular chamber formed between the rotor bore wall and the fixed piston, for the reception of the gas without any increase in pressure. Further movement of the rotor brings the ports 26 and 24 out of register and causes the sleeves to approach one another, so that the charge is compressed uniformly around the spark plug. At a suitable degree of compression, the explosion occurs in each bore successively and the expanding charge drives the sleeves apart, so that eventually the exhaust port 16 is uncovered. After the exhaust port is fully open, and the pressure of burnt gas is reduced approximately to very slightly above atmospheric pressure, a fresh charge comes into the annular space through the stages previously described, and has the effect of driving out the last of the burnt charge before the exhaust port is covered by the inwardly moving sleeves compressing the charge. This continues in rotation in each bore. The cam ring 33 is for the purpose of insuring outward movement of the sleeves, and consequently the intake of fresh charges, and also to hold the rollers 30 against the cams 32, thus preventing rattling or hammering. The action in all bores is the same, and is therefore summarized by tracing the action of a single bore as follows:—Starting at the top of the rotor where the sleeves 28 are together, the rotation of the rotors draws the sleeves apart, creating a suction in the hollow piston 25 and resulting in an indrawing of gas through the valve port 22 and rotor port 26 through one-half revolution. During the succeeding half revolution when the port 26 is out of register with the port 22 and coming into register with the port 23, the approaching sleeves drive the gas out through the port 23 into the passage 19, from which it escapes to another bore. During the first half revolution just mentioned, explosion and expansion of a previous charge occur in the annular space between the piston and rotor bore, and the outwardly moving sleeves uncover the exhaust port 16 for the escape of the burnt charge, and the port 27 registers with the transfer port 24, so that the fresh charge compressed in the passage 19 by another piston is admitted to drive out the exhaust and fill the bore ready for compression during the second half of the revolution. In other words, during the first half revolution, intake of charge occurs inside the piston, and explosion and expansion followed by exhaust and the admission of a compressed charge take place outside the piston. On the second half of the stroke, compression into the transfer passage 19 occurs within the piston and compression for explosion occurs outside the piston. It will be noted in Fig. 2 of the drawings that the rotor admission port 27 of each bore is closer to the center thereof than the exhaust port 16, so that the port 27 is fully uncovered by the sleeve when the exhaust port is only partly uncovered. Backfiring through the transfer port into the transfer passage or reservoir 19 is prevented by the relation between the rotor and the valve, which is such that the valve port 24 does not register with the rotor admission port 27 until the exhaust port 16 is fully open, and the exhaust pressure reduced below the gas pressure in the transfer passage 19. The reason for this arrangement is that the port 27 is uncovered by the sleeve before the exhaust port 16 is uncovered by its sleeve at the opposite end of the bore. This would allow the exhaust to strike back into the fresh gas before escaping to the atmosphere, but to prevent this, the valve keeps the port 27 closed until after the exhaust port 16 has been uncovered and exhaust has taken place. The valve then uncovers the admission port 27, allowing the fresh gas to rush in from the transfer passage through the valve port 24, which now registers with the port 27, and driving before it any remaining burnt gases and forcing the same out through the exhaust port 16, which is still more or less open. As the sleeves approach one another, the port 16 will be covered, while the ports

24 and 27 will still be in register, and fresh gas continues to flow from the transfer passage in the valve into the rotor bore, from which it cannot escape, owing to closure of the exhaust port. On further rotation of the rotor, the port 27 is closed by the sleeve and compression of the new charge commences. It will be seen that the engine is thus of the two cycle type, and that the yieldable cam rings 33 are not needed to draw the sleeves outwardly when the engine is working and explosions occurring in proper sequence.

Water for cooling the cylinders enters through the pipe 47 and flows all around the shaft in the grooved ring 46, from which it flows through the ports 45 into the water chambers 44, between the rotor bores, and then out at the other end of the rotor through a similar arrangement. The ignition arrangements as shown in the drawings are of the make and break type. As the rotor moves, the arms 36 of the spark plugs engage and disengage the arm 42 of the ring 40, the spring mounting of the arms permitting them to slide over each other. When it is desired to change the point at which sparking takes place, so that ignition will occur at either greater or less degree of compression, the shaft 38 is rotated and the pinion 39 thereon moves the ring relatively to the rotor. The tread surfaces of the rollers 30 are curved in such manner that the rollers travel in different paths on the cam 32, in order to distribute the wear and prevent the rollers grooving the cams, as would occur if all traveled in the same path.

Having thus described my invention, what I claim is:—

1. In an engine, a rotor having a bore parallel with the axis thereof, a piston of smaller diameter than the bore rigidly mounted at its center in the bore, a fixed cam ring, a sleeve having its outer end closed mounted in each end of the bore and slidably engaging the rotor and piston, a movable cam ring, a roller on the outer end of the sleeve engaging the fixed cam ring, and a second roller on the outer end of the sleeve engaging the movable cam ring.

2. In an engine, a rotor having a pair of bores parallel with the axis thereof, a tubular piston of smaller diameter than the bore fixed in each bore, a sleeve slidable in each bore engaging the rotor and fixed piston, hollow shafts passing into the rotor, an exhaust port in each bore a predetermined distance from the center thereof communicating with one hollow shaft, a gas port connecting the hollow shaft and tubular piston, a second gas port a predetermined distance from the first, and a valve in the other hollow shaft arranged to cover and uncover said gas ports.

3. In an engine, a rotor having a bore parallel with the axis thereof, a fixed piston, and a pair of moving pistons in said bore, a passage extending concentrically through the rotor, a valve in said passage, an exhaust port connecting the bore and passage and controlled by one moving piston, and a plurality of gas ports connecting the bore and passage and controlled jointly by the other moving piston and the valve.

4. In an engine, a rotor having a pair of bores parallel with the axis thereof, a passage formed concentrically through the rotor, a tubular piston of smaller diameter than the bore fixed in each bore, a sleeve in each bore slidably engaging the bore, and piston, a port connecting the interior of the piston with the rotor passage, a port connecting the annular space between the piston and rotor with the rotor passage, a valve in said passage, a port therein arranged to communicate with the first mentioned rotor ports alternately, and a transfer port in said valve arranged to connect the first mentioned rotor port of one bore with the second mentioned rotor port of the other bore intermediate the communication of the first mentioned valve port with the first mentioned rotor port.

5. In an engine, a rotor having a bore parallel with the axis thereof, a member slidable in said bore, a fixed cam ring, a roller mounted on the slidable member engaging said cam ring and arranged to drive the member into the rotor, a yieldably mounted cam ring, a second roller on the slidable member engaging the yieldably mounted cam ring and arranged to withdraw the slidable member from the rotor, and means for limiting the yield of said second cam ring.

6. In an engine, a rotor having a plurality of bores arranged parallel with the rotor axis, a cam ring at the end of the rotor having a conical surface, a piston slidable in each bore of the rotor, a roller having a rounded tread mounted on each piston and engaging said conical cam surface, said rollers being formed to travel in different paths on the cam.

7. In an engine, a rotor, a plurality of spark plugs projecting from the curved surface thereof, a gear toothed ring revolubly mounted on the rotor and electrically insulated therefrom, an arm on said ring positioned to be engaged by the spark plugs successively, a shaft arranged axially parallel with the rotor, and a pinion thereon meshing with the gear teeth of the ring.

8. In an engine, a rotor having a plurality of bores arranged parallel with the axis thereof, guides extending at the ends of the rotor, chambers formed in the rotor intermediate the bores thereof, passages through the guides communicating with said chambers, and a grooved ring at each end of the rotor in the path of the guide passages hav-

ing the grooves thereof communicating at all times with the passages, an inlet pipe communicating with the groove of one ring, and an outlet pipe communicating with the groove of the other ring.

9. In an engine, a rotor having a plurality of bores arranged parallel with the axis thereof, hollow shafts supporting the rotor, ports connecting the bores with said shafts, a normally stationary valve in one shaft controlling certain of the ports of each bore, and means for rotating the valve relatively to the rotor.

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

CRAVEN ROBERT ORD.

Witnesses:
GRACE M. ORD,
LEWIS G. SPEEDY.