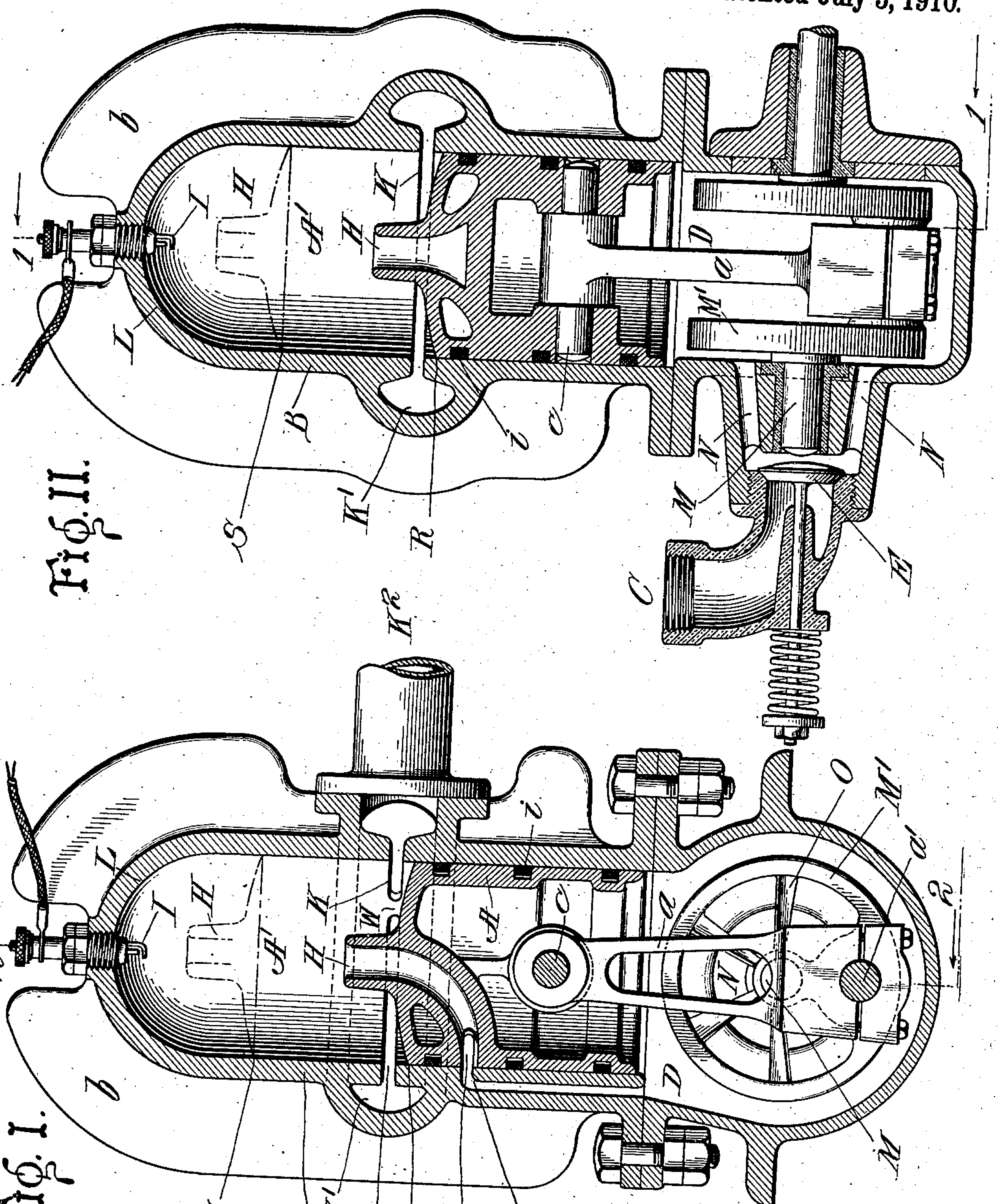
E. GATHMANN.

EXPLOSIVE ENGINE.

APPLICATION FILED OCT. 28, 1907.

963,366.

Patented July 5, 1910.



Witnesses:

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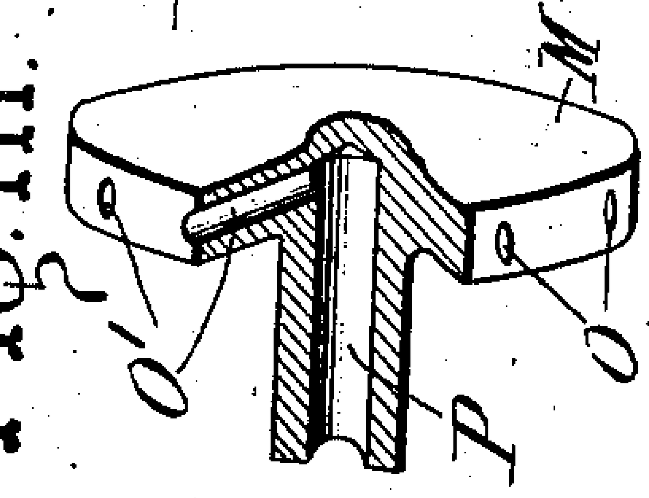

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UNITED STATES PATENT OFFICE.

EMIL GATHMANN, OF BETHLEHEM, PENNSYLVANIA.

EXPLOSIVE-ENGINE.

963,366. Specification of Letters Patent. **Patented July 5, 1910.**

Application filed October 28, 1907. Serial No. 399,448.

To all whom it may concern:

Be it known that I, EMIL GATHMANN, a citizen of the United States, residing at Bethlehem, in the county of Northampton and State of Pennsylvania, have invented a new and useful Improvement in Explosive-Engines, of which the following is a specification.

My invention relates to that type of explosive engines or motors, known to those familiar with the art as the two cycle engine, and the objects of my improvements are, first, to provide a means whereby I obtain a maximum charge of explosive mixture for each revolution of the crank shaft; and second, to inject such increased charge of explosive mixture into the explosive chamber of the engine in such a manner that the burned gases remaining over from a previous charge will all be driven out of the said chamber in a manner more effectively than has been accomplished hitherto; third, to produce the results as above stated at high speeds of the piston and with fewer operating parts than has before been possible. I attain these objects by means of the mechanism illustrated in the accompanying drawing and hereafter more fully described.

Figure 1 is a vertical section of the engine on line 1—1 of Fig. 2, showing the inlet ports from the crank-chamber to the cylinder. Fig. 2 is a vertical section of engine on line 2—2 of Fig. 1 showing the inlet port for explosive mixture from the source of supply to the crank chamber, a modified form of exhaust port being shown. Fig. 3 is a modified form of crank disk and shaft.

Similar letters refer to like parts throughout the several views.

The piston of the engine is designated at A, the cylinder at B, crank-chamber at D, primary intake port at C, which intake port is shown fitted with usual form of puppet valve E.

The cylinder B may be of the air or water cooled type. I have shown it as of the air cooled type, radiating ribs *b* being provided thereon. The piston A is connected to the crank-shaft M by any usual or desired form of piston rod *a* and crank *a′*, the connection to the piston being made by the pin *c*. These and several other features common to this type of engine do not form a part of my invention and will therefore not be further specifically described.

Detailed description of the engine and its operations is as follows:

The piston A makes an inward stroke from R to S within the cylinder B, thereby causing a partial vacuum in the crank-chamber D, and drawing the explosive mixture through the primary intake port C which is fitted with valve E. On the following outward stroke of the piston A, the mixture is compressed in the crank-chamber D, the valve E being in closed position at this time, and as the piston A uncovers the inlet port F in the cylinder B with a registering inlet port G located in the said piston, the pressure within the crank-chamber D drives a portion of its contents into the central portion of the cylinder B through the said registering ports F and G, the delivery or nozzle end H of the latter port being located on approximately the longitudinal axis of the inner portion of the piston A, while the intake or registering mouth of said port is located on the periphery of the said piston, piston rings *i* being preferably fitted and provided on both sides of said intake mouth. On the next inward stroke of the piston A, the charge is compressed to position as shown in dotted outline of the piston A′, ignition of the charge being accomplished at approximately this part of the stroke by means of the igniter I. The pressure rising upon the combustion of the charge, the piston makes an outward stroke, exhausting the expanded or partially expanded charge through the peripheral exhaust port K, which is opened by being uncovered by the piston A, the gases of the charge reaching approximately atmospheric pressure in the cylinder B by the time the port K is fully uncovered by the said piston, the gases issuing uninterruptedly into the annular primary exhaust chamber K′ and thence to the atmosphere by means of exhaust pipe K″ for convenience of conduction. The peripheral exhaust port K may be divided into several passages by means of webs W as shown in Fig. 1, but I prefer a clear annular opening as shown in Fig. 2. In the meantime a fresh charge of explosive mixture having been drawn into the crank-chamber D through primary inlet port C, by the inward stroke of the piston A, has been compressed in the crank-chamber by the outward stroke of the said piston, and the inlet ports F and G again registering immediately after the exhaust port K has been fully uncovered, a portion of the contents of the crank-chamber D, rush through the aforesaid registering inlet ports F and G and issuing inwardly from the delivery nozzle H in a practically homogeneous stream, impact upon the dome shaped cylinder head L, effectively driving the remaining products of the previous combustion out through the exhaust port K which remains uncovered at this time. The incoming charge impacting upon the central portion of the cylinder head L in a homogeneous stream by its rebound in mass and by its excess of pressure displaces the dead or exhaust charge bodily, and the latter all issues through the uncovered exhaust port K without any material mixing of the same with the new charge, as the former is bodily displaced downward and outwardly by the expanding of the denser and cooler fresh charge, into the primary exhaust chamber K′ and thence into the atmosphere through the pipe K″.

In order to insure of a maximum quantity of fresh charge entering the crank-chamber D, the primary inlet port C is located on approximately the axial line of the crank-shaft M, where the vacuum or suction is naturally the strongest, due to the motion of the moving parts in the crank-chamber, the highest pressure being obviously at the periphery and the lowest at center of motion. Passage N located about one of the crank-shaft bearings provides openings from the crank chamber D, to the inlet port C, when the valve E is in open position. The number and cross section of these openings should be such that the flow of the charge passing through the primary port C will not be reduced or retarded in any material degree. This passage N might be located directly in the crank shaft M and crank-disk M′ when the same is of sufficient size to allow of this construction as shown in Fig. 3, where crank-shaft M is shown as provided with a single central opening P and the crank disk M′ with a number of radial or tangentially disposed openings O′. A centrifugal or suction fan O is however preferably located at the intake end of the crank-shaft M which fan acts as an assistant or auxiliary to the pull of the partial vacuum induced in the crank-chamber D by the inward movement of the piston A, thus causing an increased flow of the charge of explosive mixture into the crank-chamber D, from the primary intake port C. This action is of especial value when the engine is running at a high rate of speed, as the pull or induction of the fan increases with the speed of rotation thereof, whereas the amount of induced vacuum due to the inward motion of the piston remains practically constant or is really somewhat less at high, than at low speed. The crank-shaft and disk constructed as shown in Fig. 3 would act in a manner similar to a fan, and as stated might be used in engines where such construction could be applied. A higher compression is obviously more advantageous in the crank chamber when the piston A is in rapid motion than when the same moves slowly, as the interval of time during which the ports F and G register, and during which the exhaust port K is uncovered, and consequently during which the flow of gases occur, is less during each stroke as the rapidity of motion of the piston A increases. To make this clearer: In the usual type of the two cycle engine, the faster the engine runs, the less is the volume of the charge that enters the crank-chamber and consequently into the cylinder, as the piston necessarily closes the inlet ports in less time, the higher the speed. In my construction this is however, not the case, as the higher the speed the greater the volume of the charge that is taken into the crank-chamber, and consequently the higher its compression therein upon the outward stroke of the piston. The required volume of charge will thus be forced into the cylinder in proportionally less time as the speed of the engine increases. The fresh charge entering the cylinder B through the nozzle or mouth H of intake port G which nozzle as shown in the drawing approaches closely to the igniter I, the charge about said igniter will be of greatest richness at this point and will therefore insure of ready ignition at the desired instant. Also the igniter I will be cooled by each inrushing charge as it impacts upon the same, thus the danger of premature ignitions will be prevented such as sometimes occur in the usual electric firings when the igniter remains very hot from previous electric sparks and explosion of charge.

Having thus described my invention, what I claim is:

1. In a two-cycle internal combustion engine, the combination of a crank case and a crank shaft therein, an intake passage leading to the crank case and located concentrically with the crank shaft, a suction fan located within the crank case adjacent to said intake passage and adapted to be driven by the crank shaft, and a passage leading from the crank case to the explosion chamber.

2. In a two cycle internal combustion engine, the combination of a crank case and a crank shaft therein, a primary intake passage located concentrically with the crank shaft and leading to the crank case, a suction fan located in the crank case adjacent to the intake passage, secondary intake passages located in the cylinder walls and working piston head respectively, said passages

leading from the crank case and registering at a predetermined position of piston stroke and an annular exhaust port and chamber located above the said secondary intake passage in the cylinder as shown and described.

3. In a two cycle internal combustion engine, the combination of a crank case and a crank shaft therein, a primary intake passage located concentrically with the crank shaft and leading to the crank case, a crank disk secured to the said shaft, means for inducing suction located within said crank case said means being formed in the crank disk, secondary intake passages leading from the crank case and located in the cylinder walls and working piston respectively, said passages registering at a predetermined position of the piston stroke and an annular exhaust port and chamber located above the said secondary intake passage in the cylinder.

4. In a two cycle internal combustion engine the combination of a crank chamber a crank shaft located therein, a primary intake passage entering said chamber, a suction fan located in said chamber adjacent to the intake passage and adapted to be driven by the crank shaft, and a communicating passage from the crank chamber to the explosion chamber.

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Witnesses:

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