

No. 771,037.

PATENTED SEPT. 27, 1904.

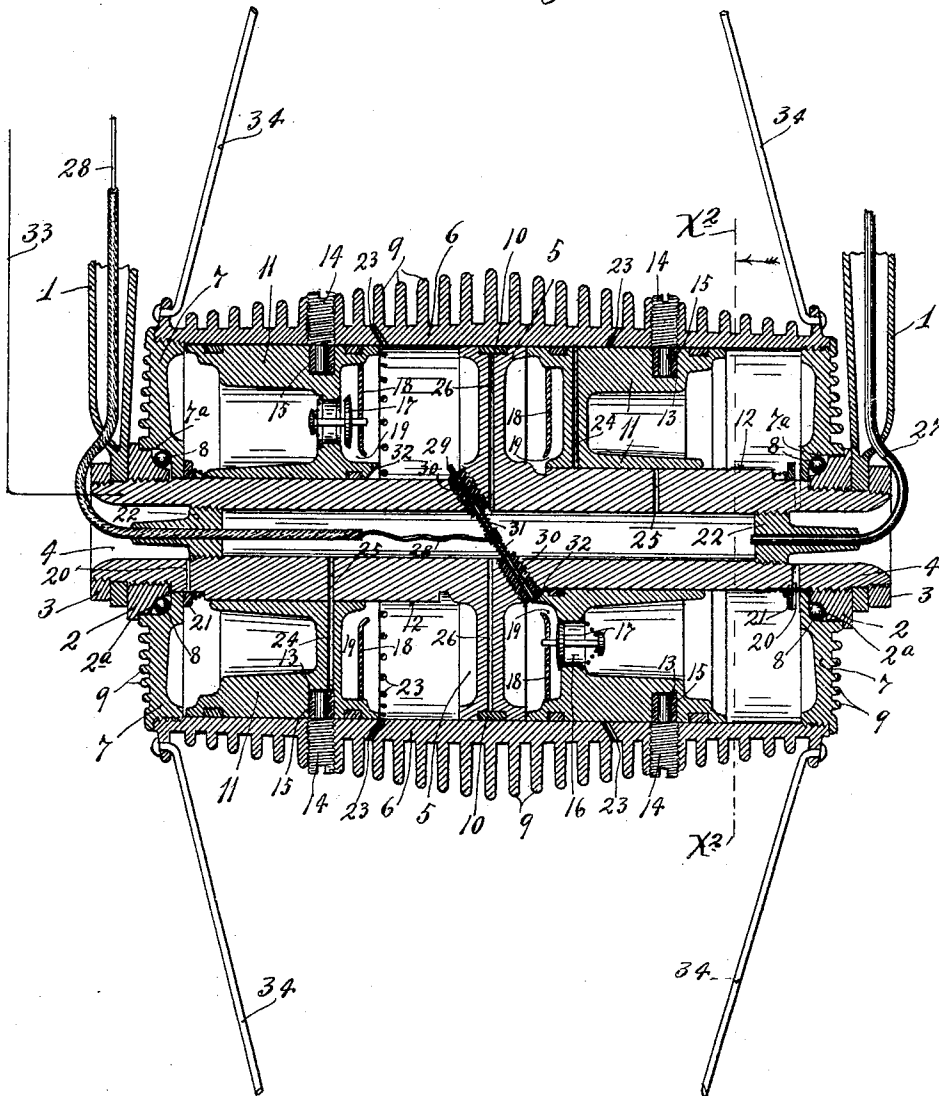
M. BECK.
EXPLOSIVE ROTARY ENGINE.

APPLICATION FILED JAN. 30, 1904.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses.
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2 SHEETS—SHEET 2.

Fig. 2.

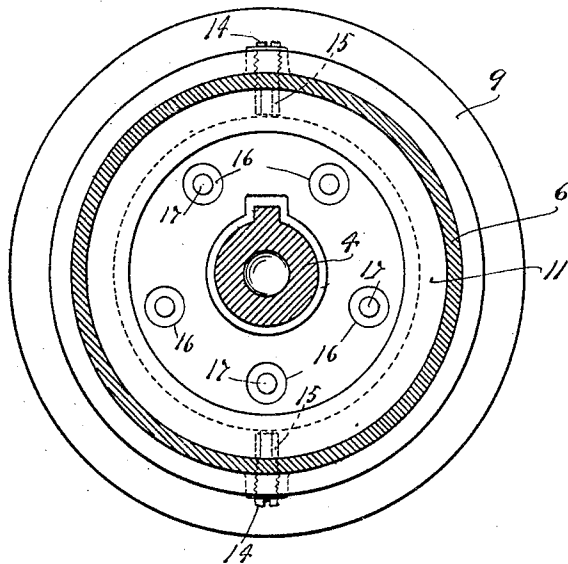
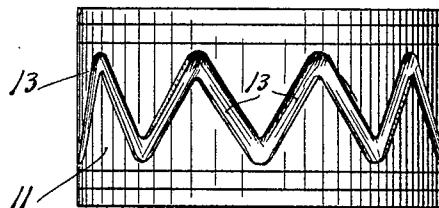


Fig. 3.



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UNITED STATES PATENT OFFICE.

MICHAEL BECK, OF MINNEAPOLIS, MINNESOTA.

EXPLOSIVE ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 771,037, dated September 27, 1904.

Application filed January 30, 1904. Serial No. 191,246. (No model.)

To all whom it may concern:

Be it known that I, MICHAEL BECK, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Explosive Rotary Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates to explosive engines of the rotary type, and has for its especial object to provide an engine of this character having a rotating cylinder adapted for use as the hub of a wheel to impart rotary motion directly to the wheel. An engine of this character is adapted for use to propel bicycles, automobiles, and similar vehicles, but is also adapted for more general use.

The invention consists of the novel devices and combinations of devices hereinafter described, and defined in the claims.

In the accompanying drawings, which illustrate my invention, like characters indicate like parts throughout the several views.

Figure 1 is a horizontal section taken centrally through my improved explosive engine and showing the cylinder thereof employed as the hub of the traction-wheel of a bicycle. Fig. 2 is a transverse vertical section taken on the line $x^2 x^2$ of Fig. 1, and Fig. 3 is a detail view of one of the reciprocating pistons of the engine removed from working position.

The numeral 1 indicates the rear forks of the bicycle-frame, to which is rigidly secured, by means of pairs of clamping-nuts 2 3, a non-rotary hollow spindle or sleeve 4, having at its central portion a transversely expanded or extended piston-like abutment 5. The clamping-nuts 2 3 are screw-threaded on the ends of the spindle 4 and clamp the ends of the frame-forks 1. The inner nuts 2 are formed on their inner surfaces with annular ball-runways 2^a, in virtue of which they afford bearings for the rotary hub-forming cylinder of the engine. This rotary hub-forming cylinder is made up of a barrel 6 and heads 7, which heads are formed at their

hub portions with ball-runways 7^a, between which and the ball-runways 2^a are interposed bearing-balls 8. As shown, the heads 7, as well as the barrel 6, are formed with radiating ribs or projections 9, adapting the motor to be cooled by air. The central abutment 5 of the spindle 4 fits the bore of the cylinder-barrel 6 and is preferably provided with a packing-ring 10, forming a tight joint therewith, but permitting the said barrel to revolve freely around the said abutment. By the abutment 5 the cylinder is divided into two compartments, and working axially on the spindle 4 within each of these compartments is a reciprocating piston 11, which is held against rotation on the said spindle by a key 12 on the latter. These reciprocating pistons 11 are provided with endless zigzag cam-grooves 13, cut in their peripheral surfaces, as best shown in Fig. 3. The cylinder-barrel 6 is provided with inwardly-projecting studs 14, having rollers 15 at their inner ends that work in the zigzag cam-grooves 13 of the respective pistons. As shown, there are two such studs and rollers for each cam-groove. The cam-grooves 13 and roller-equipped studs are so arranged that the two pistons will be simultaneously moved in the same direction, and the one will stand in its extreme position toward the abutment 5, while the other stands in its extreme position away from said abutment, and vice versa. Opening through the web of each piston 11 is a plurality of ports 16, which ports are normally closed by spring-seated valves 17, that are adapted to be opened under compression produced in the outer ends of the cylinder, as hereinafter described. The stems of the valves 17 work through seats formed in an annular deflecting-plate 18, secured to the respective pistons and terminating short of the hub thereof to afford an annular passage 19.

Opening through the ends of the spindle 4 from the bore thereof into the cylinder just inward of its head are air-supply ports 20 that are normally closed by annular spring-pressed valves 21, slidably mounted on the said spindle. Just inward of the ports 20 the bore of the spindle 4 is closed by plugs 22.

At points that are just passed by the pis-

tons in their extreme outermost positions the cylinder-barrel 6 is provided with two circumferentially-arranged series of small exhaust-ports 23. Each piston is provided with one or more radial oil-passages 24, extending from the bearing-surface of its hub to the bearing-surface of its periphery, and the spindle 4 is formed with radial oil-passages 25, with which the said oil-passages 24 are adapted to register when the said pistons are in their extreme outermost positions. Radial oil-passages 26 also preferably lead from the bore of the sleeve 4 to the periphery of the abutment 5 through the seat provided for the packing-ring 10.

An oil-supply tube 27, which, as shown, is passed through one of the forks 1, is extended through one of the plugs 22 into the inclosed portion of the bore of the spindle 4. An insulated wire 28, which, as shown, is passed through the other of the forks 1, is passed through the other of the plugs 22 into the inclosed bore of the spindle 4 and is attached to a double-ended sliding electrode 29, which electrode works through insulating-sleeves 30, set into the spindle 4 in such positions that one end of said electrode projects into one compartment of the cylinder, while the other end thereof projects into the other compartment of said cylinder. Light springs 31 tend to yieldingly hold the electrode 29 in an intermediate centered position. The hub of each piston 11 is formed with a beveled cam-nose 32, which constitutes the second member of the electrode of the sparking device and is adapted to engage with the corresponding end of the sliding electrode 29 when the said piston is in an extreme position toward the abutment 5, as shown at the right in Fig. 1.

The current to produce the spark is supplied from a battery or other source (not shown) through the insulated wire 28 and through a lead wire 33, which may be applied to any suitable part of the engine—as, for instance, to the hollow spindle 4.

The numeral 34 indicates the spokes of the wheel, of which the cylinder described constitutes the hub.

In the operation of this engine I preferably employ kerosene or some of the slower burning or combustible oils, and this is conducted into the closed bore of the non-rotary spindle 4 through the supply-tube 27, and from thence it is conducted through the radial ports 24 and 25 and the ports 26 to the inner surface of the cylinder-barrel 6, and through the ports 25 it is also conducted to the bearing-surfaces of the spindle 4 and hubs of the pistons 11. Under the reciprocating movements of the pistons films of oil are continuously distributed over the surfaces of the cylinder-barrel and spindle, and it is of course evident that the films of oil thus left will readily commingle with air when the latter is brought into

contact therewith within the cylinder, and especially when it is thus brought into contact under compression. It should also here be kept in mind that under the reciprocating movements of the pistons the cylinder and the wheel of which it constitutes the hub will be rotated under the action of the zigzag cam-grooves 13 of the said pistons acting on the roller-equipped studs of the said cylinder. The two pistons are given their compression-strokes and all other corresponding strokes in reverse order, so that a double-acting engine, operating alternately, is afforded. In the position of the parts shown in Fig. 1 the right-hand piston has compressed its charge, which charge will be exploded as soon as said piston is given its initial movement toward the right. The left-hand piston has just reached its exhausting position, and its valves 17 are opened by the compression of air in the left-hand outer end of the cylinder. It may be here stated that the double engines herein employed act upon the two-cycle principle, and hence it will be understood that the air which is being passed through the ports opened by the said valves 17, as just noted, serves to blow out the dead air or products of the last previous explosion. It will of course be understood that the annular air-inlet valves 21 will open only when the pistons make their inward strokes, at which time fresh air is drawn in through the air-ports 20, and it will also be understood that the spark to produce the explosion is produced under the initial outward movement of the pistons. It should be here further stated that when a heavy oil is employed a slow explosion or combustion, as distinguished from an abrupt or quick explosion, is produced. It will also be understood that the air is commingled with oil both in the outer and in the inner portions of the cylinder. The oil, of course, serves to keep all of the frictionally-engaging parts well lubricated.

It will of course be understood that the engine described is capable of modification within the scope of my invention as herein set forth and claimed.

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

1. The combination with a spindle having a central abutment, of a pair of reciprocating pistons mounted for straight-line movements thereon, said pistons having endless zigzag peripheral cam-surfaces, and a cylinder rotatively mounted on said spindle and fitting around said abutments and said pistons, and having studs or projections coöperating with the cam-surfaces, substantially as described.

2. The combination with a non-rotary spindle having a central circular abutment and formed with oil-delivery ports, of a pair of pistons mounted for straight-line reciprocating movements upon said spindle, a cylinder rotatively mounted on said spindle and in-

closing and fitting said abutment and said pistons, said pistons having zigzag peripheral cam-grooves, and said cylinder having roller-equipped studs working in said cam-grooves, 5
valved ports affording communication between the chambers on the opposite sides of said pistons, exhaust-ports formed in said cylinder, valved air-inlet ports opening into the ends of said cylinder, coöperative oil-delivery ports in said spindle and in said pistons, 10
and an electric igniter having electrodes located in said cylinder on the opposite sides of said abutment, said electrodes being arranged to be brought in contact and to be separated 15
at the proper times by the movements of said pistons, substantially as described.

3. The combination with a hollow non-rotary spindle having a central circular abutment and plugs in its bore inward of its outward extremities, of a pair of pistons mounted for straight-line reciprocating movements on said spindle, valved passages in the webs of said pistons, annular deflecting-plates carried by said pistons inward of said valved 20
passages, zigzag peripheral cam-grooves 25

formed in said pistons, a cylinder rotatively mounted on said spindle and fitting and inclosing said abutment and said pistons, and provided with roller-equipped studs engaging the cam-grooves of said pistons, valved air-ports opening into the ends of the cylinder 30
through the outer ends of said spindle, an oil-supply pipe leading to the inclosed portion of the bore of said spindle, coöperating oil-delivery ports in said spindle and in said pistons, 35
and an electric igniter involving a double-ended insulated electrode mounted in said spindle with its ends projecting on the opposite sides of said abutment, and electrodes carried by the pistons and arranged to be 40
brought into contact with the ends of said former-noted electrode in alternate order, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

MICHAEL BECK.

Witnesses:

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F. D. MERCHANT.