No. 647,363. Patented Apr. 10, 1900.

C. M. BELL & G. E. BLAKE.

ROTARY ENGINE.

(Application filed June 15, 1899.)

(No Model.)

FIG. 1.

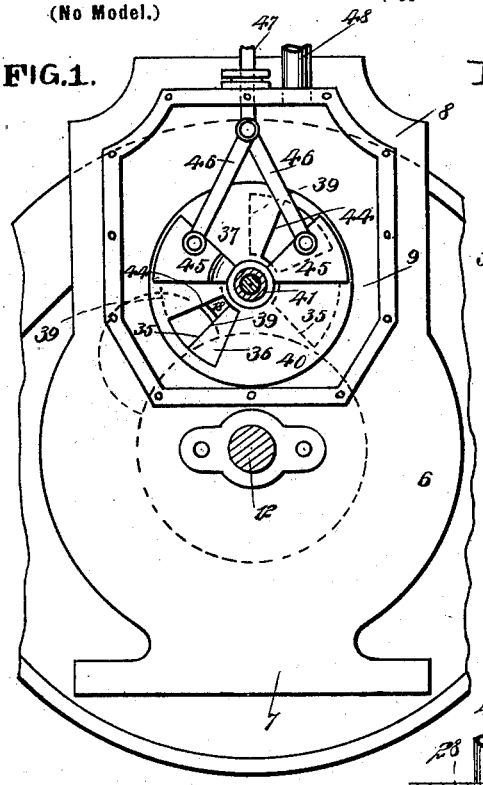


FIG. 2.

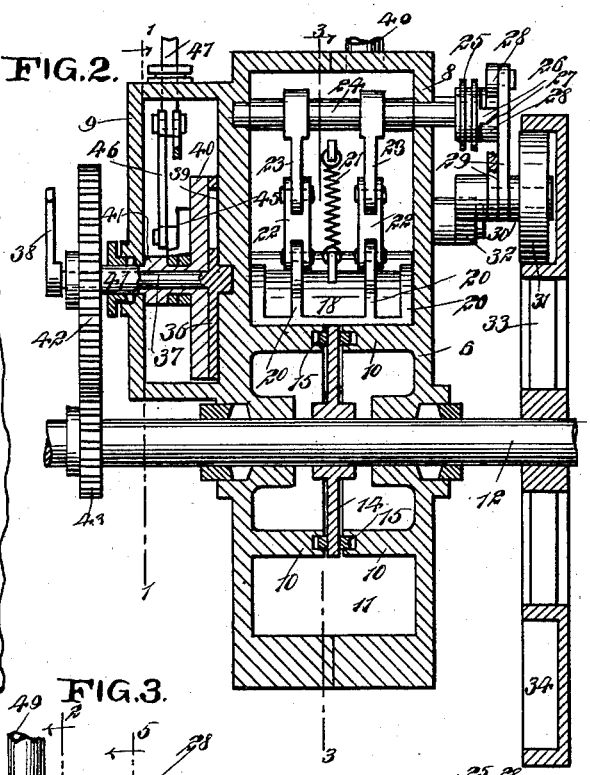


FIG. 3.

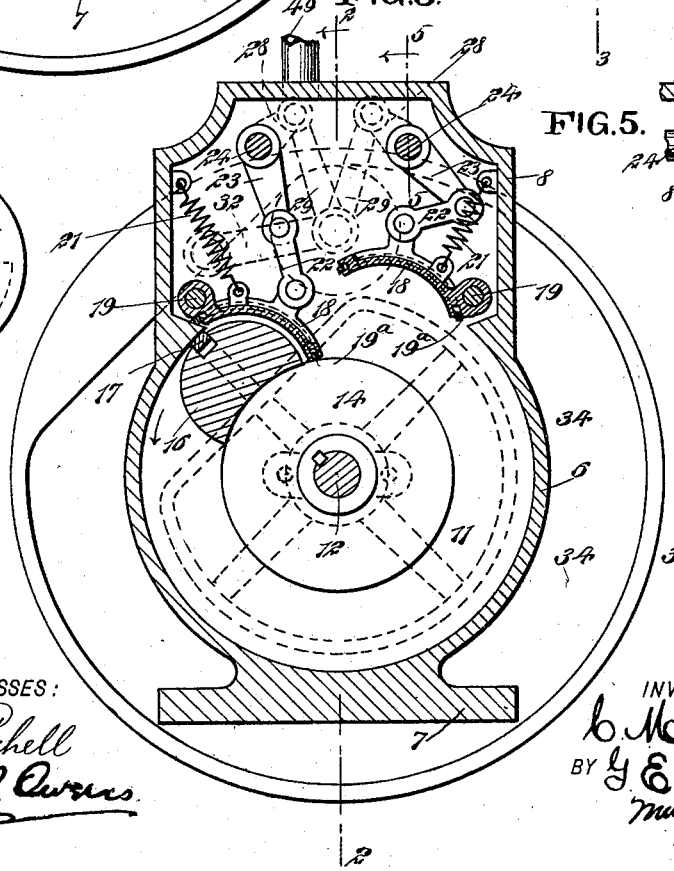


FIG. 4.

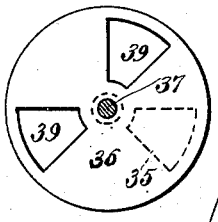
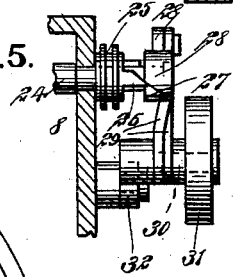


FIG. 5.



WITNESSES:

Donn Twitchell

Isaac B. Owens.

INVENTORS

C. M. Bell

BY G. E. Blake

Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

CARROLL MELVIN BELL AND GEORGE EDWARD BLAKE, OF GREENCASTLE, INDIANA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 647,363, dated April 10, 1900.

Application filed June 15, 1899. Serial No. 720,679. (No model.)

To all whom it may concern:

Be it known that we, CARROLL MELVIN BELL and GEORGE EDWARD BLAKE, of Greencastle, in the county of Putnam and State of Indiana, have invented a new and Improved Rotary Engine, of which the following is a full, clear, and exact description.

This invention relates to a rotary engine having a concentric piston working with shiftable abutments, so that the piston may be driven continuously, the abutments moving in and out of the path of the piston to permit the passage of the piston past the abutments.

This specification is the disclosure of one form of our invention, while the claims define the actual scope thereof.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is an elevation of the invention with the outer wall of the valve-chest removed and parts being in section on the line 1 1 of Fig. 2. Fig. 2 is a sectional view on the line 2 2 of Fig. 3. Fig. 3 is a sectional view on the line 3 3 of Fig. 2. Fig. 4 is a detail view of the reversing-valve with certain other elements, indicated by dotted lines; and Fig. 5 is a detail elevation, with a part of the exhaust-chest in section, on the line 5 5 of Fig. 3.

The engine has a casing or cylinder 6, mounted on a base 7 and communicating with an exhaust-chest 8, located at the top, and with a valve-chest 9, located at one side of the exhaust-chest. The interior of the casing or cylinder 6 is formed with two inwardly-extending and matching flanges 10, which form an annular chamber 11, through which the piston (to be hereinafter described) moves, such chamber 11 being concentric with the cylinder.

Mounted centrally in the cylinder or casing 6 is the main shaft 12 of the engine, to which is fast a disk 14, such disk extending between the adjacent edges of the flanges 10 and having steam-tight connection therewith by means of suitable packing 15. The shaft 12, with the disk 14, turns freely in the casing, and the disk carries the piston 16, which is formed with arc-shaped side walls and which has its inner wall concaved to run snugly on the flanges 10, so that the piston 16 may swing with the disk 14 continuously through the annular chamber 11. The piston 16 is provided at its inner end and side walls with packing 17, as shown. (See Fig. 3.)

Mounted in the lower portion of the exhaust-chest 8 and adapted to swing downward into the upper portion of the annular chamber 11, so as to engage with the flanges 10 of the cylinder 6, are two arc-shaped abutments 18, which are respectively pivoted on spindles 19, mounted in the exhaust-chest 8. The abutments 18 are disposed oppositely to each other—that is to say, with their free ends directly opposite—the abutments being adapted for use the one when the piston is driven in one direction and the other when the piston is driven in the reverse direction. As shown in Fig. 3, the left-hand abutment 18 is lowered to active position and the right-hand abutment is raised to inactive position, the piston being represented as moving in the direction of the arrow in said figure. The abutments 18 being arc-shaped conform with the shape of the sides of the piston 16, and the abutments are provided with steam-packing 19^a, extending around the edges of the abutments, so as to effect tight joints with the walls of the cylinder 6 and with the flanges 10. The abutments 18 are strengthened by ribs 20 and are connected, respectively, with retractile springs 21, which tend to raise the abutments. Each abutment has two links 22, pivotally connected with certain of the ribs 20 thereof, and these links 22 are respectively connected with crank-arms 23. The crank-arms 23 are two for each abutment and are carried on pairs of rock-shafts 24, mounted in the upper portion of the exhaust-chest 8. By the movement of these rock-shafts the abutments 18 are raised and lowered, as will be fully described hereinafter.

For the purpose of throwing the rock-shafts 24 each shaft is provided with a collar 25, splined on the shaft and having one or more studs 26, which are formed with beveled outer ends. (See Figs. 2 and 5.) These collars 25 form clutch members and are adapted to act with crank-arms 28, loosely mounted, respec-

tively, on the shafts 24 and having hubs formed with recesses 27, corresponding both in number and form with the projections 26. When the collars 25 are moved outward on the shafts 24, (see Fig. 2,) they will be locked with the crank-arms 28, and the movements of the crank-arms will be transmitted to the shafts. Connected with the respective crank-arms 28 are links 29, which are extended downward and loosely connected with the spindle 30 of an antifriction-wheel 31, the spindle and wheel being supported by an arm 32, pivoted on the outside of the exhaust-chest 8. The shaft 12 carries a wheel 33, formed with a cam-groove 34 therein, the cam-groove having a concentric portion broken by inwardly-disposed eccentric portions. (See Fig. 3.) As the wheel 33 turns with the shaft 12 the antifriction-wheel 31 when it engages the eccentric portion of the cam-groove 34 is thrown inward, thus drawing down the links 29 and rocking the shafts 24, provided the collars 25 are moved outward to engagement with the crank-arms 28. Assuming that the engine is to be driven in the direction of the arrow in Fig. 3, the collar 25 of the left-hand shaft 24 should be moved into engagement with the corresponding crank-arm 28 and the collar 25 of the right-hand shaft 24 should be moved out of engagement with the same. By this arrangement the right-hand abutment 18 is not operated, but is permitted to stand idle in the position shown in Fig. 3, the spring 21 serving to hold the abutment raised. As the wheel 31 drops with the links 29 the left-hand shaft 24 is rocked, and this shaft, through the medium of the arms 23 and links 22, periodically lifts the left-hand abutment 18. In operation these movements will be so timed that as the piston 16 approaches the left-hand abutment 18 it will be raised to permit the passage of the piston beneath the abutment, and then immediately after the piston passes the abutment is lowered to the position shown in Fig. 3. The purpose of beveling the outer ends of the studs 26 of the collars 25 and of forming the recesses 27 of corresponding shape is to permit the gradual shifting of the collars from one position to the other, so that when it is desired to reverse the engine the collar 25, which is moved away from its crank-arm 28, will be operated with gradually-decreasing movement. Thus in the operation of reversing, which (assuming that the parts are in the position shown in Fig. 3) requires the raising of the left-hand abutment and the lowering of the right-hand abutment, the abutments will be shifted gradually with step-by-step movements and will not be thrown suddenly from one position to the other. This peculiar form of the studs 26 and recesses 27 further serves to insure the raising of the abutments 18 even should the springs 21 fail to act, since, whether the parts 25 and 28 are closely engaged or not, the plane sides of the studs will always serve to raise the abutments to their upper position. The abutments are not thrown down, however, except when the studs 26 are fully received in their respective recesses.

The steam is fed to the valve-chest 9 and from the valve-chest to the cylinder 6 through either one of two ports 35. These ports are respectively related to the two abutments and are used independently, the one to drive the engine in one direction and the other to drive the engine oppositely. In Fig. 1 the ports 35 are indicated at the right by dotted lines and at the left partly by dotted lines and partly by full lines. For the purpose of controlling the ports 35 to thus control the direction in which the engine is driven we provide a circular reversing-valve 36, carried on a spindle 37, extending through the outer wall of the casing 6 and provided with a device 38 for permitting the operation of the spindle. The reversing-valve 36 is provided with two ports 39, (see Fig. 4,) respectively adapted to command the ports 35, so that by throwing the valve 36 either one of the ports 35 may be opened to the exclusion of the other. In Fig. 4 the position of the right-hand port 35 is indicated by dotted lines, and the left-hand port 35 is supposed to register with the right-hand port 39, this position of the parts being the same as that shown in Fig. 1. Therefore the right-hand port 35 is closed and the left-hand port 35 is opened. The passage of the steam into the cylinder is regulated by the circular steam-valve 40, which is mounted against the reversing-valve 36 and carried on a hollow shaft 41, which surrounds the shaft 37 and passes through the outer wall of the casing 6, the hollow shaft 41 carrying a spur-gear 42, which meshes with a pinion 43 on the shaft 12, whereby to continuously drive the steam-valve 40. The steam-valve 40 is formed with two diametrically-opposite ports 43 44 therein. These ports 44 are of the same size as the ports 35 and 39, and as the valve 40 turns continuously the ports 44 serve to open the operating-port 35 twice during a single revolution of the valve 40, the ports being closed thus to cut off the steam at all other periods of the operation. Two governor-valves 45 are provided and adapted, respectively, to the ports 35. These valves are mounted to swing on the hollow shaft 41 and are controlled by links 46, pivoted to the valves and to a governor-stem 47, which moves through the top of the casing 6 and has connection with the governor (not shown) in order that the valves 45 may be operated according to the speed of the engine, so as to automatically increase or diminish the amount of steam fed into the cylinder.

In the operation of the invention, assuming that the parts are adjusted as shown in the drawings, the steam passing into the valve-chest 9 through the steam-pipe 48 proceeds through the right-hand port 44 of the steam-valve 40 and the right-hand port 39 of

the reversing-valve 36 and finally through the right-hand port 35 of the cylinder 6, thus entering the cylinder at the left of the left-hand abutment 18. The position of this abutment is illustrated in Fig. 1. The steam thus admitted expands between the left-hand abutment 18 and the piston 16 and drives the piston in the direction of the arrow until the piston performs, approximately, a half-revolution. Thus the movement of the steam-valve 40 serves to place the left-hand port 44 thereof out of registry with the adjacent port 39 of the reversing-valve 36, and thus cuts off the steam, which condition continues until the other port 44 of the valve 40 registers with the port 39 of the reversing-valve 36. Meanwhile the piston continues its revolution until it approaches the position shown in Fig. 3. At this time, the cam-wheel 33 being so adjusted, the wheel 31 will be moved downward and the shaft 24 rocked to raise the abutment 18 and permit the passage of the piston beneath the abutment. Immediately after this occurs the abutment is thrown down again to the position shown in Fig. 3 and the above-described operation is repeated. To reverse the engine, the collars 25 are shifted, respectively, to opposite positions, and then the piston 16 will be driven in the direction reverse to the arrow in Fig. 3, in which case the left-hand abutment 18 becomes active. The exhaust passes from the annular chamber 11 into the exhaust-chamber 8 and from said chamber through the pipe 49.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. In a rotary engine, the combination of a circular cylinder and a steam-chest mounted on the same to communicate therewith, a piston mounted to move continuously through the cylinder, an abutment pivotally mounted in the steam-chest and adapted to swing down into the cylinder across the path of the piston, a rock-shaft mounted in the steam-chest, a crank-arm situated in the steam-chest and attached to the rock-shaft, a link connecting the abutment with the crank-arm to raise and lower the abutment, a clutch mounted on the rock-shaft, a crank-arm mounted loose on the rock-shaft outside of the steam-chest and adapted to be engaged by the clutch to fasten the second crank-arm to the rock-shaft, means moving in time with the piston for throwing said second crank-arm to operate the abutment, and valve mechanism controlling the inlet and egress of steam.

2. In a rotary engine, the combination with the cylinder, a piston and an abutment mounted to move in and out of the path of the piston, of a rock-shaft in connection with the abutment, a clutch member mounted on the rock-shaft, a crank also mounted on the rock-shaft, the clutch member and crank being relatively movable and respectively having a recess and a stud, one wall of the recess being beveled and one side of the stud being beveled for the purpose specified, and means moving in time with the piston for driving the crank.

3. In a clutch device, the combination with a shaft, of two clutch members mounted thereon, one clutch member being loose on the shaft and the other clutch member being splined thereon, and the clutch members respectively having a recess and a stud, one wall of the recess being beveled and one side of the stud being beveled to match with the recess.

4. In a valve mechanism for rotary engines, the combination of an oscillating reversing-valve formed with two ports respectively working with a similar number of ports in the steam-chest of the engine, an oscillating steam-valve mounted to turn concentrically to the reversing-valve and having two ports working with the ports of the reversing-valve, two independent cut-off valves mounted to swing on the steam-valve and working with the ports thereof, the cut-off valves working concentrically to the axis of the steam-valve and a governor having connection with the cut-off valves.

5. In a rotary engine, the combination with the steam-chest thereof, and a valve-chest passing to the steam-chest and communicating therewith by two ports, of a circular reversing-valve mounted to oscillate in the valve-chest and having ports working with the ports of the steam-chest, a circular steam-valve mounted to oscillate against the reversing-valve and turning concentrically thereto and having two ports working with the ports thereof, two independent cut-off valves mounted to swing on the axes of the reversing and steam valves and working with the ports of the steam-valve and a governor having connection with the cut-off valves.

6. In a rotary engine, the combination with a circular cylinder and with a steam-chest communicating therewith, of a piston mounted to move through the cylinder, abutments mounted in the steam-chest and movable downward into the path of the piston, rock-shafts mounted in the steam-chest, connections between the rock-shaft and the abutments to raise and lower the same, crank-arms working loosely on the rock-shafts, clutches adapted to fasten the crank-arms to the respective rock-shafts, a grooved wheel mounted to turn in time with the movement of the piston, means actuated by the wheel for driving the cranks, and valve mechanism controlling the inlet and outlet of steam.

7. A rotary engine, having a cylinder, a piston adapted to turn through the cylinder, an exhaust-chest mounted on the cylinder and communicating with the interior thereof, an abutment mounted in the exhaust-chest and capable of swinging down into the cylinder to permit the steam-pressure to act be-

tween the abutment and the piston, means connected with the abutment to raise and lower the same, a cam-wheel turning in time with the piston and actuating said means, and valve mechanism controlling the steam-feed to the engine, the valve mechanism being located at the side of the cylinder and serving to introduce the steam laterally of the line of movement of the piston.

CARROLL MELVIN BELL.
GEORGE EDWARD BLAKE.

Witnesses:
ARA BLAKE,
ROSE A. GAINER.