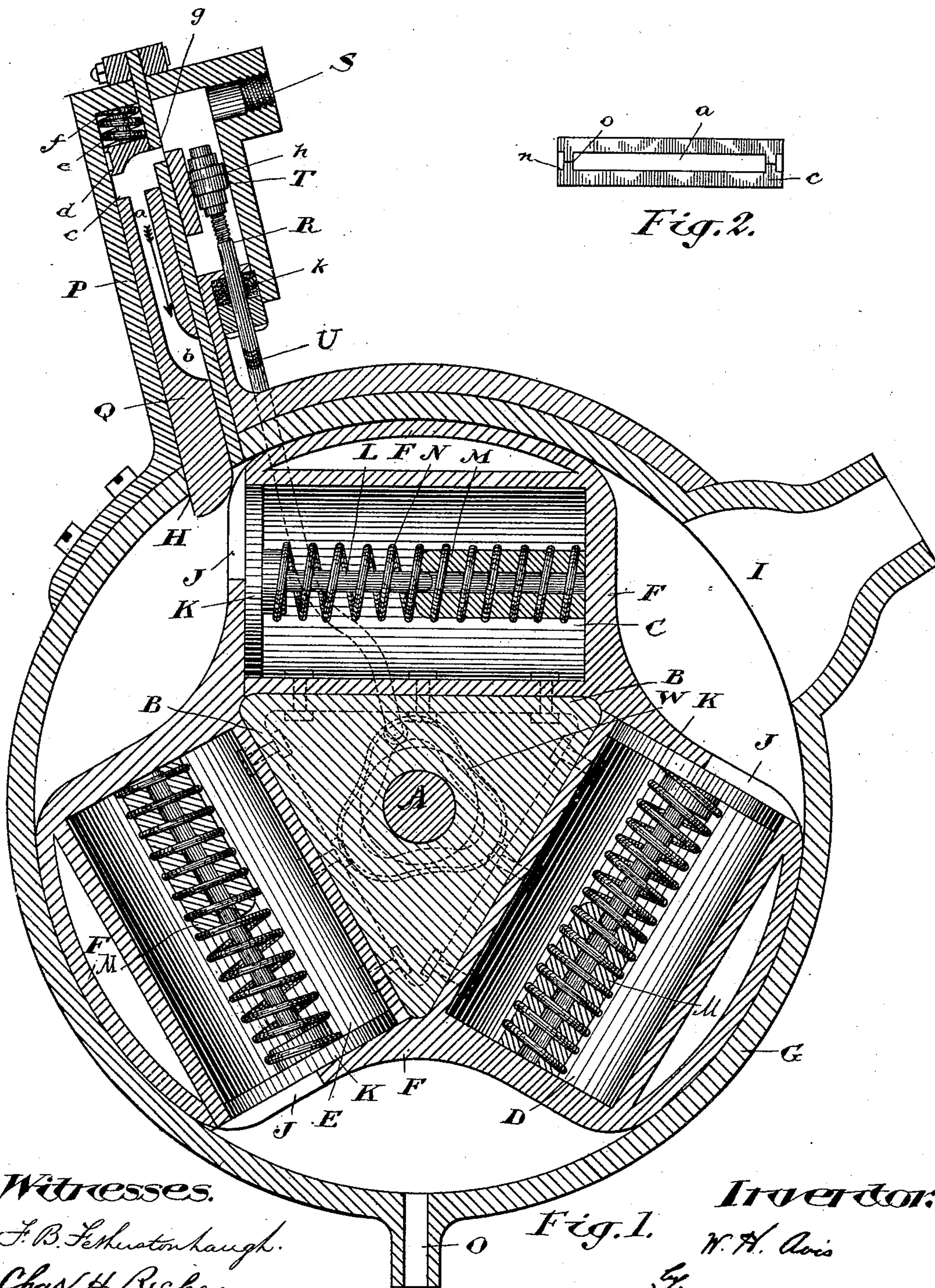


(No Model.)

W. H. AVIS.
ROTARY ENGINE.

No. 427,952.

Patented May 13, 1890.



Witnesses.

J. B. Fetherstonhaugh.
Chas. H. Riches

Fig. 1.

Inventor:

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Atty

UNITED STATES PATENT OFFICE.

WALTER H. AVIS, OF DOVERCOURT, ASSIGNOR TO ROBERT CHARLES FISHER,
OF TORONTO, ONTARIO, CANADA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 427,952, dated May 13, 1890.

Application filed August 24, 1889. Serial No. 321,818. (No model.)

To all whom it may concern:

Be it known that I, WALTER HERBERT AVIS, manufacturer, of the village of Dovercourt, in the county of York, in the Province of Ontario, Canada, have invented a certain new and Improved Rotary Engine, of which the following is a specification.

The object of the invention is to devise a rotary engine which will be economical of steam, continuous in its action, and which will minimize the friction of the parts, and adapted for a machine where the action is reversible or not; and it consists, essentially, of a central shaft on which is formed a bed for cylinders fitted with piston-heads on pistons working in a sleeve on said cylinders and having strong vertical springs attached to the piston-heads and bases of the cylinders, and designed to throw each of the piston-heads back to its normal position at the mouths of the cylinders as soon as the head of each cylinder passes the exhaust-port and the steam which has just compressed the helical spring attached to the piston-head has become exhausted. The case which holds the cylinders is undulating in surface, and a hollow inlet-valve derives a reciprocating motion as the undulations of this case move under it and as steam is supplied or cut off. A sliding valve, which admits or cuts off the steam from the hollow sliding inlet-valve, is worked by a bent rod attached to a cam on the central shaft.

Figure 1 is a sectional view of rotary engine. Fig. 2 is a detail showing head or top of hollow inlet-valve or plunger.

In Fig. 1, A is the central shaft to which motion is to be given. On it is formed the bed-piece B, which is preferably triangular in section, to which is bolted the cylinders C, D, and E. These cylinders are attached or built onto an inner casing F, with undulations or concavities formed on its surface, as shown, and the convex portions thereof fit closely against the inner surface of the outer cylinder G of the rotary engine. This outer cylinder G has an opening at H for inlet-port, and a larger opening at I for exhaust-port, and an opening at O for a drain-pipe for condensed

steam. These openings are tapped to receive pipes, and the inner casing F has openings at J, over the mouths of each of the cylinders C, D, and E. Each of these cylinders is fitted with a piston K and piston-rod L, which works in a hollow sleeve M, fixed in the base of each cylinder, and a strong helical spring N is attached at one end of the piston K and at the other to the base of the cylinder, so as to keep the pistons up at the mouths or tops of the cylinders when they are not compressed or forced down by the action of the steam. In the drawings all the pistons are shown in this normal condition with no steam-pressure therein.

The opening at H has fitted to it a casing or cylinder P for the hollow inlet-valve Q, which is a hollow plunger, preferably square in section, as shown in Fig. 2, hollowed at *a*, and curved so as to form an opening on its side at *b*. Its top is as shown in Fig. 2, with solid piston at *c*, on which the steam acts to force the plunger down. The top of this cylinder P has a buffer *d*, perforated with a hole to receive the central pin *e*, and having attached to the buffer *d* a helical spring *f* to keep it in the normal position shown in the drawings and to admit of compression.

R is a valve-chest, with its interior square in section, and there is an opening at *g* in the cylinder F into this valve-chest. *h* is a slide-valve, adapted to open and close the opening *g* as the slide-valve is caused to reciprocate.

S is the steam-inlet into the valve-chest R, tapped to receive the steam-pipe communicating with the boiler.

T is the cylindrical head of the curved rod U, which cylindrical head is fixed to the slide-valve *h* and works in the square interior of the steam-chest R. The rod U is curved, as shown, and is adapted to work through the opening in the bottom of the valve-chest. *k* is packing, so as to make the valve-chest tight. The rod U is curved, so as to clear the revolving-cylinders C, D, and E, with a wheel at its inner end to follow the track in the cam W, which is rigidly attached to the central shaft A.

As shown in the drawings, the steam is par-

tially shut off from the head *c* of the plunger Q and the engine is at rest; but the steam is beginning to act on the plunger, and it is shown in the act of descending to admit steam
5 in the cylinder.

To operate the engine, the shaft A is caused to rotate slightly by suitable leverage. This causes the rod U to draw down the slide-valve *h* and admit the steam from the boiler through
10 the opening *g* into *c*, the solid portion of the head of the plunger Q, and into the hollowed portion thereof *a*. The pressure of steam on the solid portion *c* of the head of the plunger causes the plunger or hollow inlet-valve Q to
15 descend, and the rounded end thereof, pressing against the concavity on the inner casing F, causes the latter to rotate. As soon as the opening *b* descends sufficiently to clear the inner face of the outer cylinder G, the steam
20 pressure is admitted through the opening J in the inner casing F to the piston K, which causes it to descend into its cylinder, compressing the helical spring N, causing all the cylinders to rotate, carrying with them the
25 bed-piece B, which is rigidly attached to the central shaft A. Before the head of the cylinder C reaches the exhaust-port I the steam is cut off and works expansively on the piston K. When the steam reaches the exhaust-port
30 I by the rotation of the cylinders, it escapes and the spring N in the cylinder C springs back, throwing up the piston to its normal position, as shown in the drawings. The rod U, connected with the sliding valve *h*, which
35 has cut off the steam from the hollow inlet-valve Q, is caused to again reopen the steam-inlet *g* by the action of the revolving cam W on the shaft A, so as to cause the plunger or hollow inlet-valve Q to descend again, it hav-
40 ing been forced or slid up again into the position shown in the drawings by the inclined surface of the revolving inner casing F, passing under its curved under surface. The same operation is repeated with each cylin-
45 der as it comes up and a continuous rotation of the shaft A is caused, the pistons regaining their normal position as the exhaust-port is reached. The compression of the pistons under the action of the steam causes a more
50 even and continuous motion to be given to the central shaft than if the pistons were fixtures.

Fig. 2 is the detail of the head of plunger Q, in which *a* is the hollow portion, and *n*
55 elastic steel bands, which are acted upon by the steam coming from the hollow portion of plunger through holes *o* to the seating of said bands, so as to make the bands to act as packing.

A cam-rod (not shown in the drawings) may be pivotally attached to the plunger Q, and connected with a cam on the main shaft
60 in such manner as to cause the plunger to return to the head or top of the casing when the steam is shut off. I should also mention

that an engine constructed in accordance with my invention will be an admirable water-en-
gine.

It will be understood that the valve Q may be operated, if desired, by an eccentric and
70 rod in the same manner as the valve T is operated.

No claim is here made, broadly, to the arrangement of the reciprocating pistons in cylinders rotating within a casing, nor to the
75 arrangement of the pistons, sleeves, and springs in said cylinders, as these features are shown in my application, Serial No. 272,653, filed May 3, 1888.

What I claim as my invention is—

1. In a rotary engine, the combination of an outer cylinder provided with suitable inlet and exhaust openings, cylinders attached to a bed-piece formed on a central shaft, each cylinder being provided with a sleeve, and a
85 piston whose rod is adapted to work in said sleeve, and a helical spring surrounding said rod and sleeve, the cylinders being built in or forming part of an inner casing with undulations or concavities formed on its sur-
90 face, the convex portions of said inner casing being designed to fit close against the inner surface of the outer cylinder and having openings therein to admit steam to the cyl-
95 inders, a plunger or hollow inlet-valve designed to be forced down when steam is admitted thereto by the sliding valve attached to the bent rod operated by a cam on the central shaft, which sliding valve is adapted
100 to cut off or admit steam to the hollow inlet valve or plunger, the curved bottom of which impinges on the undulating surface of the inner casing as it is caused to rotate, the steam and rotating inner casing giving
105 a reciprocating motion to the hollow inlet-valve or plunger, substantially as described and specified.

2. In a rotary engine, the combination of valve-chest R, sliding valve *h*, head T, and curved rod U, passing through outer casing
110 G and operated by cam W in central shaft A, plunger or hollow inlet-valve Q, with opening *b*, adapted to reciprocate in casing P, inner casing F, and cylinders C, D, and E, provided with pistons K, helical springs N, and
115 outer casing provided with inlet and exhaust ports and drain-outlet O, substantially as described and specified.

3. In a rotary engine, the combination of an inner casing F, having an undulating sur-
120 face forming concavities and convexities, as shown, outer casing G, and cylinders C D E, provided with piston-heads K, pistons L, helical springs N, sleeve M, and means for admitting steam to the piston-heads and ex-
125 hausting it therefrom through ports in the outer casing G, the bed B, central shaft A, and cam W, which operates the curved rod U, connected with the valve *h*, substantially as described and for the purpose specified. 130

4. In a rotary engine, the combination of cylinder P and outercylinder G, provided with inlet and exhaust ports, the hollow inlet-valve or plunger Q, having opening *a* in its top, valve
5 *h*, adapted to reciprocate through motion derived from central shaft A, and independently of the plunger Q, valve-chest R, having opening *g*, and steam-inlet S, substantially as described and specified.

Toronto, July 5, 1889.

WALTER H. AVIS.

In presence of—

CHARLES C. BALDWIN,
W. G. McMILLAN.