

(No Model.)

4 Sheets—Sheet 1.

A. R. BENN.
ROTARY ENGINE.

No. 520,554.

Patented May 29, 1894.

Fig. 1.

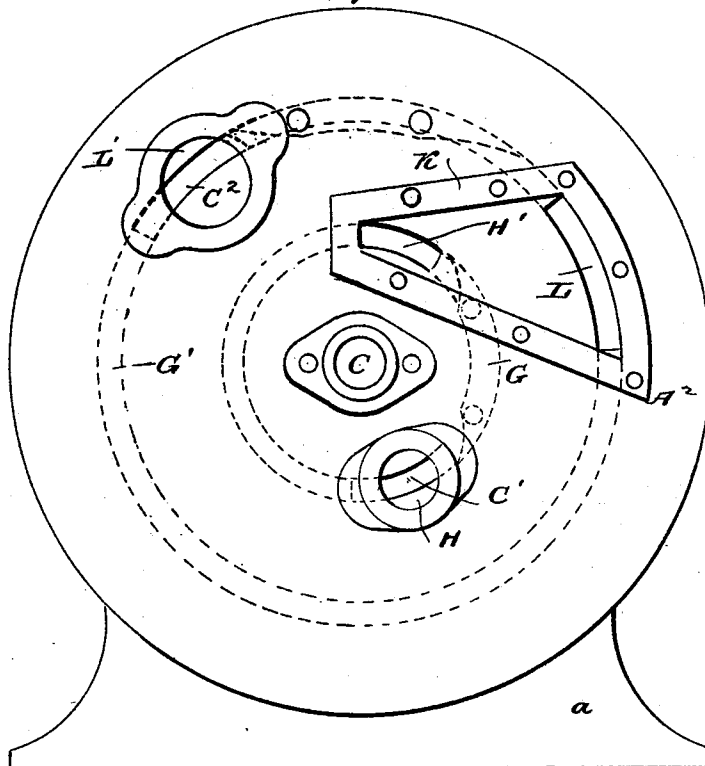
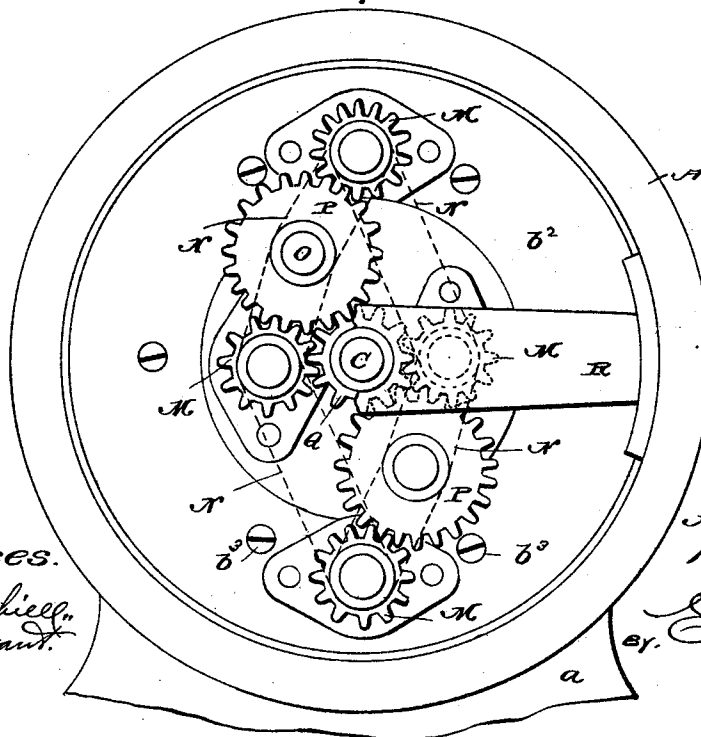


Fig. 2.



Witnesses.

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Att'y's.

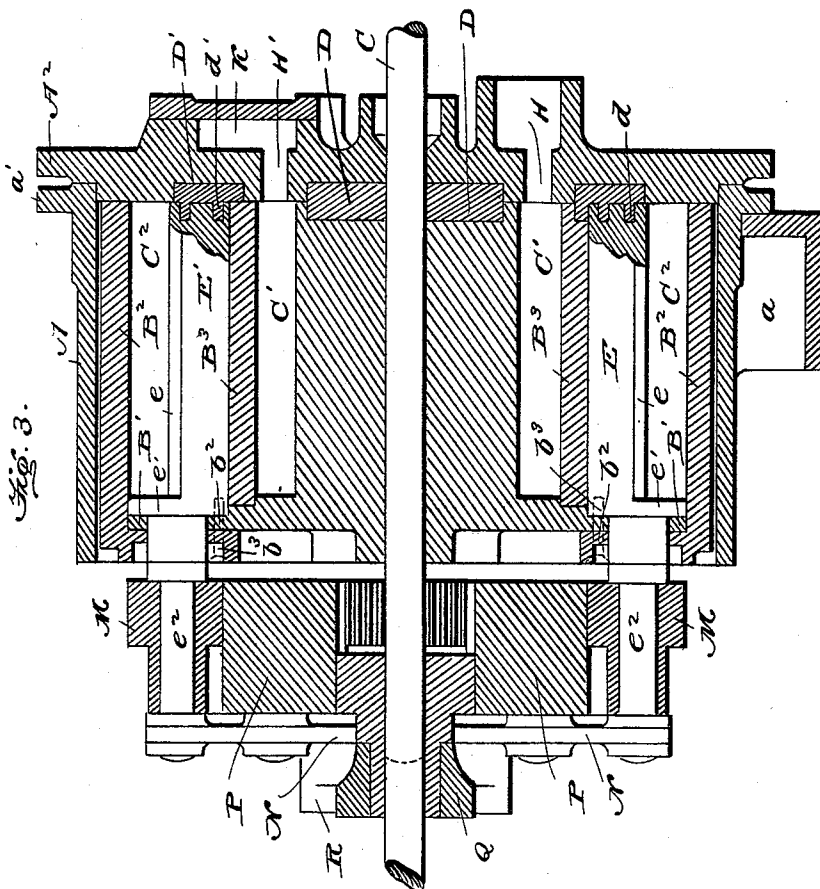
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4 Sheets—Sheet 2.

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Fig. 4.

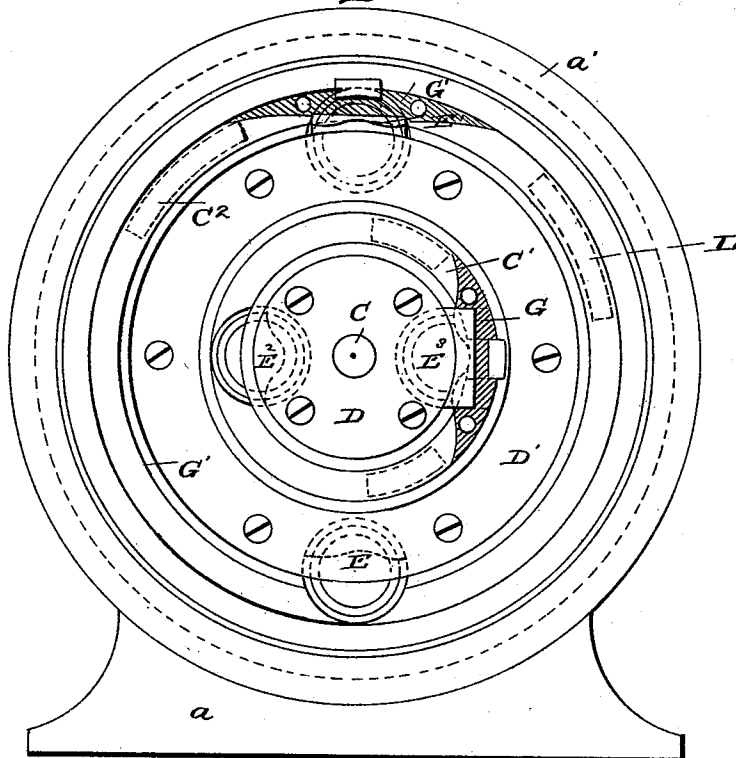


Fig. 5.

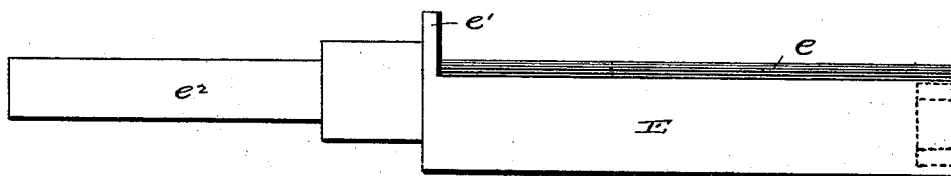
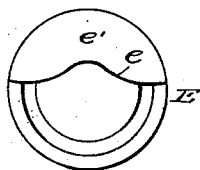


Fig. 6.



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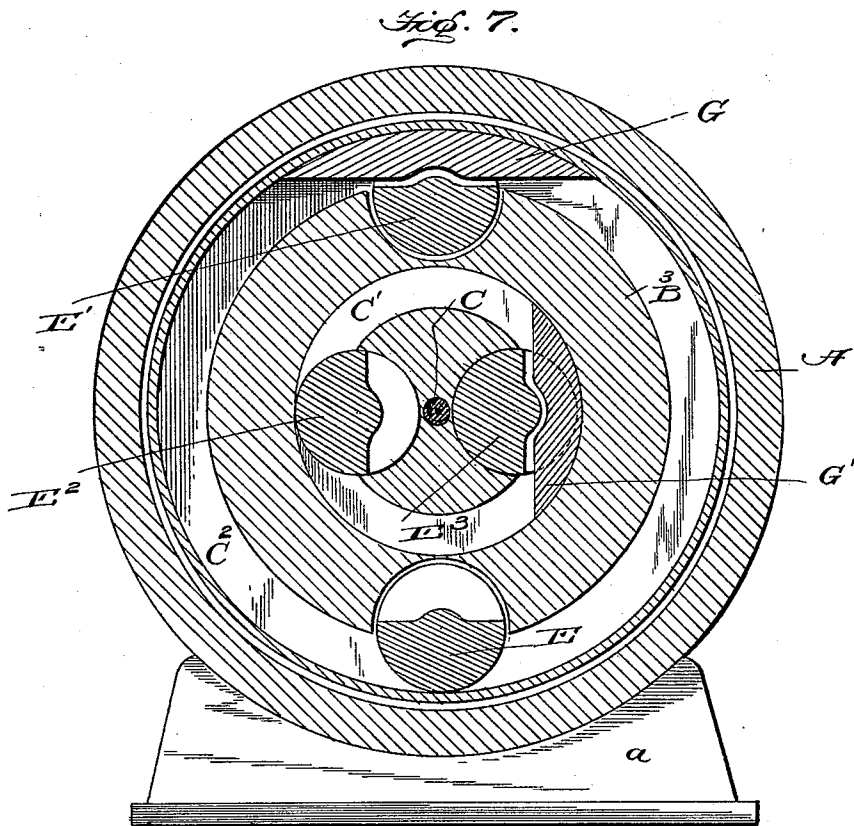
(No Model.)

4 Sheets—Sheet 4.

A. R. BENN.
ROTARY ENGINE.

No. 520,554.

Patented May 29, 1894.



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UNITED STATES PATENT OFFICE.

ALFRED R. BENN, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF TO
EDWIN REYNOLDS, OF SAME PLACE.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 520,554, dated May 29, 1894.

Application filed March 16, 1893. Serial No. 466,326. (No model.)

To all whom it may concern:

Be it known that I, ALFRED R. BENN, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in 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 invention relates to improvements in rotary engines and it consists in the peculiar construction and arrangement of parts as will be hereinafter fully pointed out and claimed.

In the accompanying drawings—Figure 1 is a front elevation of an engine constructed in accordance with my invention. Fig. 2 is a rear elevation of the same. Fig. 3 is a longitudinal vertical sectional view. Fig. 4 is a front end elevation of the revoluble cylinder, the front head of the engine being removed; and the abutments being shown in section. Figs. 5 and 6 are respectively a detail side and end elevation of one of the rotary pistons of the engine. Fig. 7 is a sectional view on the line x, x , of Fig. 3.

Like letters of reference denote corresponding parts in all the figures of the drawings, referring to which—

A designates the exterior cylindrical casing or shell of my improved engine which shell is suitably mounted and supported on a base piece a . The front end of the shell or casing A is closed by a head A^2 which is detachably connected, by means of suitable bolts or similar fastening devices, to an integral annular flange a' of said shell.

Within the cylindrical shell A is arranged a revoluble cylinder the hub B of which is suitably keyed or otherwise rigidly secured to the main driving or power shaft C of the engine, said shaft extending entirely through the hub B and having one end fitted in a central bearing in the front head A^2 of the engine. The hub B is provided at its rear end with an integral annular flange B' which extends outwardly from said hub and contacts at its outer edge with the inner surface of the outer shell B^2 of the revoluble cylinder. In the inner face of the flange B' is formed an annular recess or groove in which is fitted

the rear end of an intermediate shell B^3 which thus operates to divide the interior of the revoluble cylinder into two independent concentric steam ways or chambers, C' , C^2 , which open through the front of said cylinder and are closed at that end by the front head of the engine, and at their rear ends by the flange B' of the hub B. The outer shell B^2 of the revoluble cylinder is provided at its rear end with an integral inwardly projecting flange b^2 which extends across a portion of the rear outside surface of the flange B' and the flanges b^2 , B' , and intermediate shell B^3 are firmly and securely connected together, so as to form steam tight joints at the rear ends of the concentric chambers or steam grooves C' , C^2 , by suitable bolts b^3 or similar fastening devices. In aligned grooves or recesses formed in the adjacent faces of the head A^2 , the hub B and the outer shell B^2 are fitted piston supporting plates D, D' . As shown in the drawings the piston supporting plates are of greater diameter than the piston seats which are formed in the hub and intermediate shell of the revoluble cylinder and said plates are rigidly secured in recesses or grooves in the hub B and shell B^2 but are loosely fitted in the grooves in the inner face of the head A^2 .

In suitable seats formed in the intermediate shell B^3 of the revoluble cylinder at diametrically opposite points are fitted rotary pistons E, E' , and similar pistons E^2 , E^3 , are fitted in seats formed at diametrically opposite points in the hub B.

As shown in Figs. 5 and 6 the main body of each of the pistons is provided on one side with an undulatory surface e and at one end with a circular piece e' which projects some distance beyond the surface e of the piston. Each of the pistons is supported by a stem e^2 which passes through aligned openings or passages in the flanges B' , b^2 , of the hub and outer shell of the revoluble cylinder, and by means of inwardly projecting annular flanges or ribs d , d' , formed integral with or otherwise rigidly secured to the supporting plates D, D' , and fitting in grooves formed in the forward end of the body of the piston. The rotary pistons E, E' , E^2 and E^3 project beyond their seats and into the adjacent steam ways

or grooves in the revoluble cylinder, and said pistons are provided with the undulatory surface e in order that as said cylinder is revolved they will be able, by means of mechanism to be hereinafter described, to clear the abutments G, G' , which are rigidly attached to the head A^2 of the engine and extend into the steam ways in the revoluble cylinder. The inner faces of the abutments are made undulatory, being exactly the reverse of the undulatory surface of the rotary pistons. The inner steam way or groove C' of the revoluble cylinder communicates with an inlet port H formed in the head A^2 of the engine and through which steam or other suitable expansive fluid, such as air or gas, can be admitted to the revoluble cylinder. Said inner steam way or groove also communicates, through a port H' which is arranged on the opposite side of the abutment G from the inlet port H , with a steam chest K carried by the head A^2 and said steam chest communicates, through a port L formed in the head A^2 , with the outer steam way C^2 . In the head A^2 on the opposite side of the abutment G' from the port L is formed an exhaust port L' .

The stems of the rotary pistons extend through suitable stuffing boxes and on said stems near the rear outer ends thereof are secured pinions M , the hubs of said wheels being connected by bars or members N .

On studs O attached to the flanges B' of the hub B are journaled gear wheels P which mesh with the pinions M on the valve stems, as shown in Fig. 2 of the drawings.

A gear wheel Q is attached to a bracket or arm R rigidly attached to the external shell or case A and said gear Q meshes with the teeth of the gears P . The power shaft C extends loosely through the hub of the gear wheel Q and beyond such wheel or the front of the casing A said shaft is provided with suitable connections for transmitting power to any desired machine, &c.

The operation of my invention may be briefly stated as follows—Steam or other suitably expansive fluid is admitted to the inner steam way C' of the revoluble cylinder and striking against one of the rotary pistons E^2 , therein operates to revolve the cylinder. As the piston against which the expansive fluid is operating passes the port H' , said fluid escapes or passes through such port and into the steam chest. From the steam chest the expansive fluid, exhausted from the inner steam way C' , passes through the port L into the outer steam way C^2 and operates against one of the pistons E, E' , therein. As the cylinder revolves and the operating piston passes the exhaust port L' , the expansive fluid passes through said port into the external atmosphere. As the revoluble cylinder is rotated, the intermediate gears P which mesh with the central gear Q are revolved in the same direction as the cylinder and the pinions M on the piston stems, which pinions mesh with the intermediate gears P , operate to revolve

the pistons as the cylinder is rotated so that the undulatory surface thereof will be presented to the abutments in the steam ways as the pistons pass the same, and the pinions on the stems of the pistons are always maintained in the same relative positions. The rotary pistons are successively brought into position to be operated upon by the expansive fluid.

From the foregoing description and the drawings, it will be seen that I have provided a very simple and strong engine in which the full force of the expansive fluid will be employed and, by which a greater amount of power can be obtained from a given amount of such fluid than is possible in engines of this class as ordinarily constructed. The friction on the pistons is also reduced as it requires considerably less power to operate pistons constructed as herein shown and described and to cause the same to clear the fixed abutments in the steam ways than it does to overcome the severe strain required to bring the pistons or wings of the common form inwardly to clear the abutments.

Although I have spoken of my improvements as particularly adapted to be operated by steam, yet I am aware that equally good results can be obtained from my invention when either air or gas is used as the expansive fluid.

I am aware that changes in the form and proportion of parts and details of construction of the devices herein shown and described as an embodiment of my invention can be made without departing from the spirit or sacrificing the advantages thereof, and I therefore reserve the right to make such changes and alterations as fairly fall within the scope of the same.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a rotary engine, the combination with an external shell or casing, of a revoluble cylinder arranged within said shell or casing and having two concentric steam ways formed therein and communicating with a steam chest, carried by the external shell, and, respectively, with the inlet and exhaust ports, an abutment fixed in each of the steam ways, two rotary pistons arranged in the inner steam way, two rotary pistons arranged in the outer steam way, between the pistons in the inner way, and mechanism for positively rotating the pistons, as the cylinder is revolved, to enable them to clear the abutments in the steam ways, substantially as described.

2. In a rotary engine, the combination with an external cylindrical shell or casing, of a revoluble cylinder arranged within the shell and consisting of a hub provided with an annular outwardly extending flange at its rear end, and concentric shells B^2, B^3 , attached to the flange of the hub and arranged to provide concentric steam ways, pistons arranged in said steam ways, a head attached to the

external casing and provided with inlet and exhaust ports, each of which communicates with one of the steam ways in the cylinder, and with fixed abutments which extend into
 5 said steam ways, and a steam chest connecting the concentric steam ways in the cylinder, substantially as described.

3. In a rotary engine, the combination with an external casing having inlet and exhaust
 10 ports formed in its head, of a revoluble cylinder arranged within the casing and provided with concentric steam ways which communicate with the inlet and exhaust ports, supporting plates attached to the said cylinder
 15 and fitting loosely in grooves in the head of the external shell, said plates being provided on their inner faces with annular ribs or flanges, abutments carried by said head and extending into the steam ways in the
 20 cylinder, a series of rotary pistons fitted in seats in the cylinder and having one end grooved to receive the flanges on the supporting plates, said pistons having a portion of their exterior surfaces made undulatory to
 25 allow them to clear the abutment in the steam ways, and a steam chest connecting the steam ways of the cylinder, substantially as described.

4. In a rotary engine, the combination with
 30 an external cylindrical shell, of a revoluble cylinder arranged within the shell and consisting of a hub having an outwardly extending annular flange at its rear end, an outer shell provided at its rear end with an inwardly
 35 wardly extending flange which extends partially across the flange on the hub, and an intermediate shell having its rear end fitted in a groove in the inner face of the flange and forming two concentric steam ways in said
 40 cylinder, a head plate attached to one end of the external shell and provided with inlet and exhaust ports which communicate with

the steam ways in the cylinder, abutments attached to the inner face of the head of the external shell and extending into the steam
 45 ways in the cylinder, a series of rotary pistons fitted in seats formed in the cylinder and adapted to extend across the steam ways therein, said pistons having a portion of their surfaces made undulatory to enable them to
 50 clear the abutments, and a steam chest connecting the steam ways in the cylinder, substantially as described.

5. In a rotary engine, the combination with an external shell or casing, of a revoluble
 55 cylinder having concentric steam ways formed therein and communicating with exhaust ports and inlet ports in the external shell, a steam chest attached to the external shell and connecting the steam ways of the cylinder,
 60 abutments attached to the external shell and extending into the steam ways in the revoluble cylinder, the inner faces of said abutments being of undulatory form, a series of pistons fitted in seats formed in the cylinder
 65 and adapted to extend across the steam ways therein, the stems of the pistons extending beyond the rear side of the cylinder and a portion of the body of said pistons being of undulatory form, pinions secured on the
 70 stems of the pistons in rear of the intermediate gears, P, mounted on studs, carried by said cylinder, and meshing with the pinions on the piston stems, and a central gear secured on an arm or bracket attached to the
 75 external shell and meshing with the intermediate gears, P, substantially as and for the purpose described.

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

ALFRED R. BENN.

Witnesses:

EDWARD F. OXLEY,
 HENRY H. PETTIT.