No. 848,447. PATENTED MAR. 26, 1907.

W. R. DAWE.

VALVE MECHANISM FOR ROTARY ENGINES.

APPLICATION FILED JULY 6, 1906.

3 SHEETS—SHEET 1.

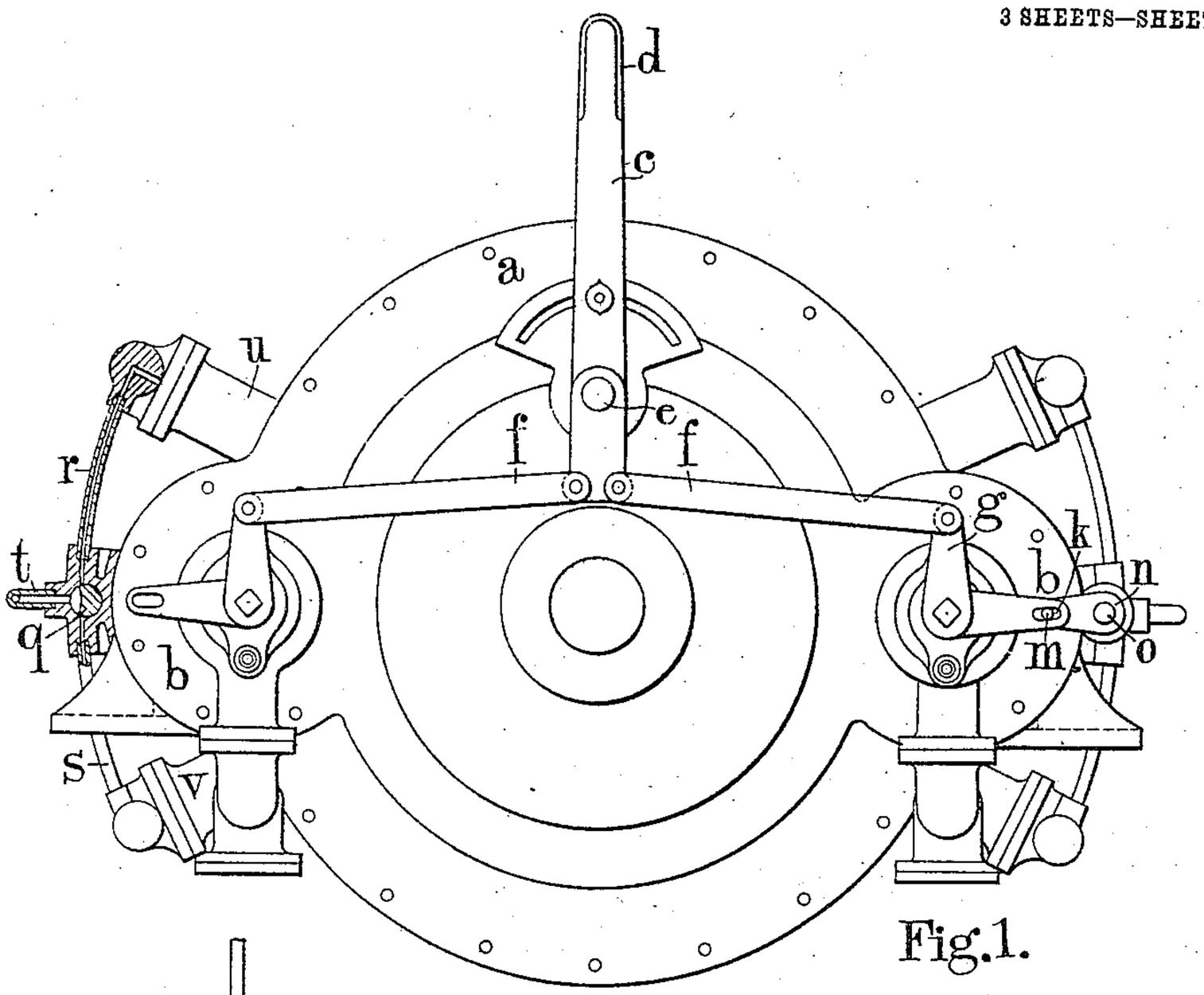

Fig.1.

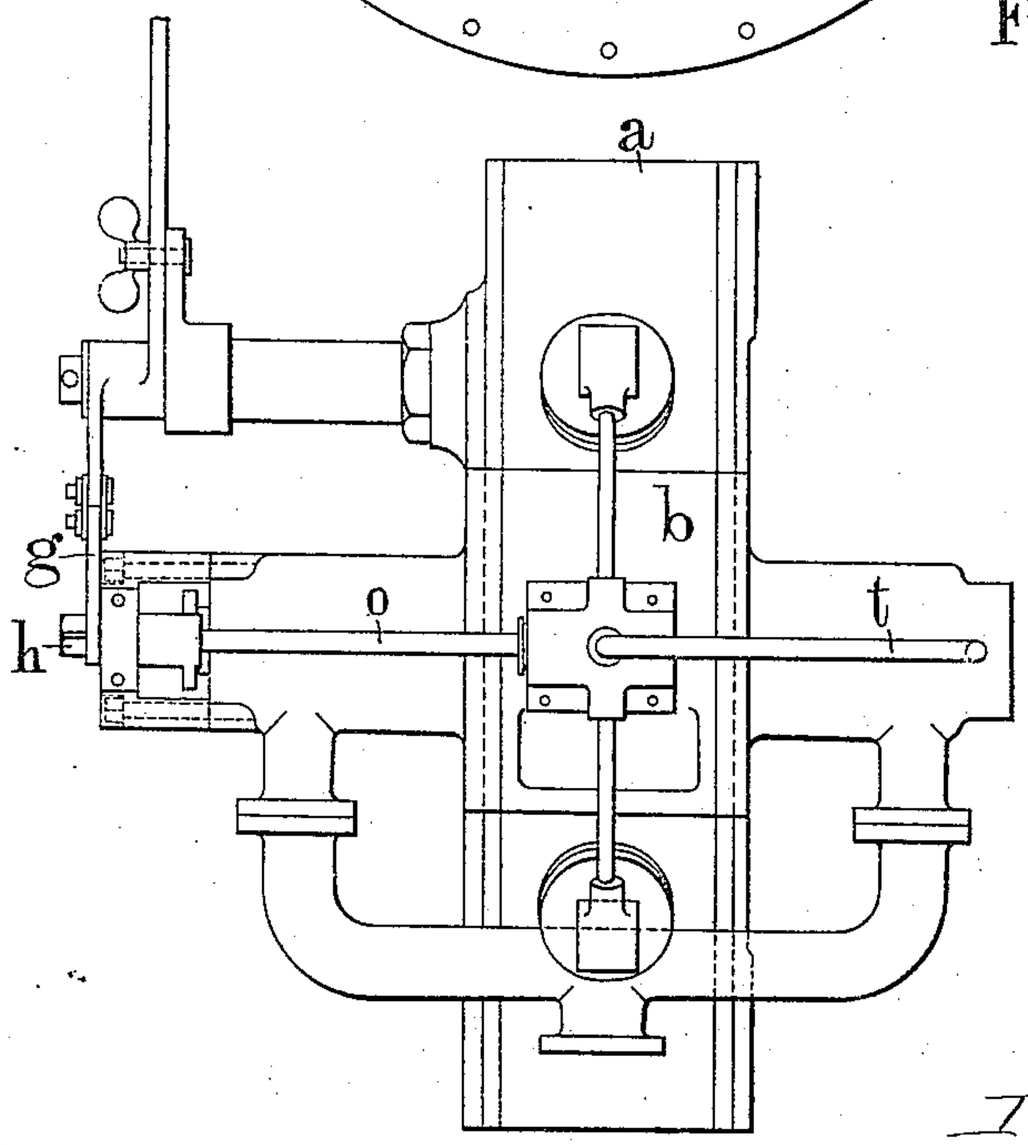

Fig.2.

Attest:
Edward N. Dalton
L. B. Middleton

Inventor
William R. Dawe
by Spear, Middleton, Donaldson & Spear
Attys

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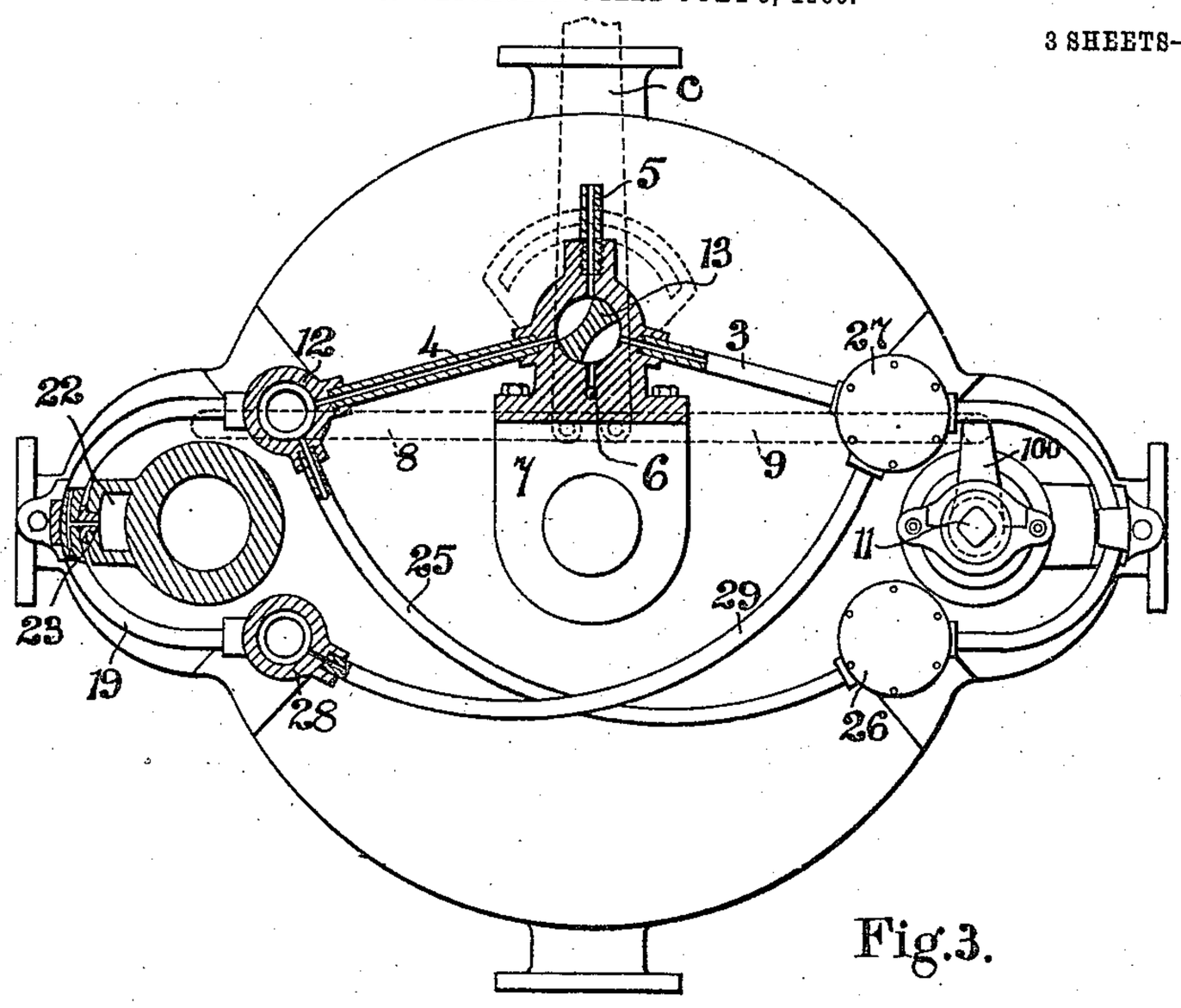

Fig. 3.

Fig. 4.

Attest:
Edward N. Sexton
L. B. Middleton

Inventor
William R. Dawe
by Spear, Middleton, Donaldson & Spear
Attys

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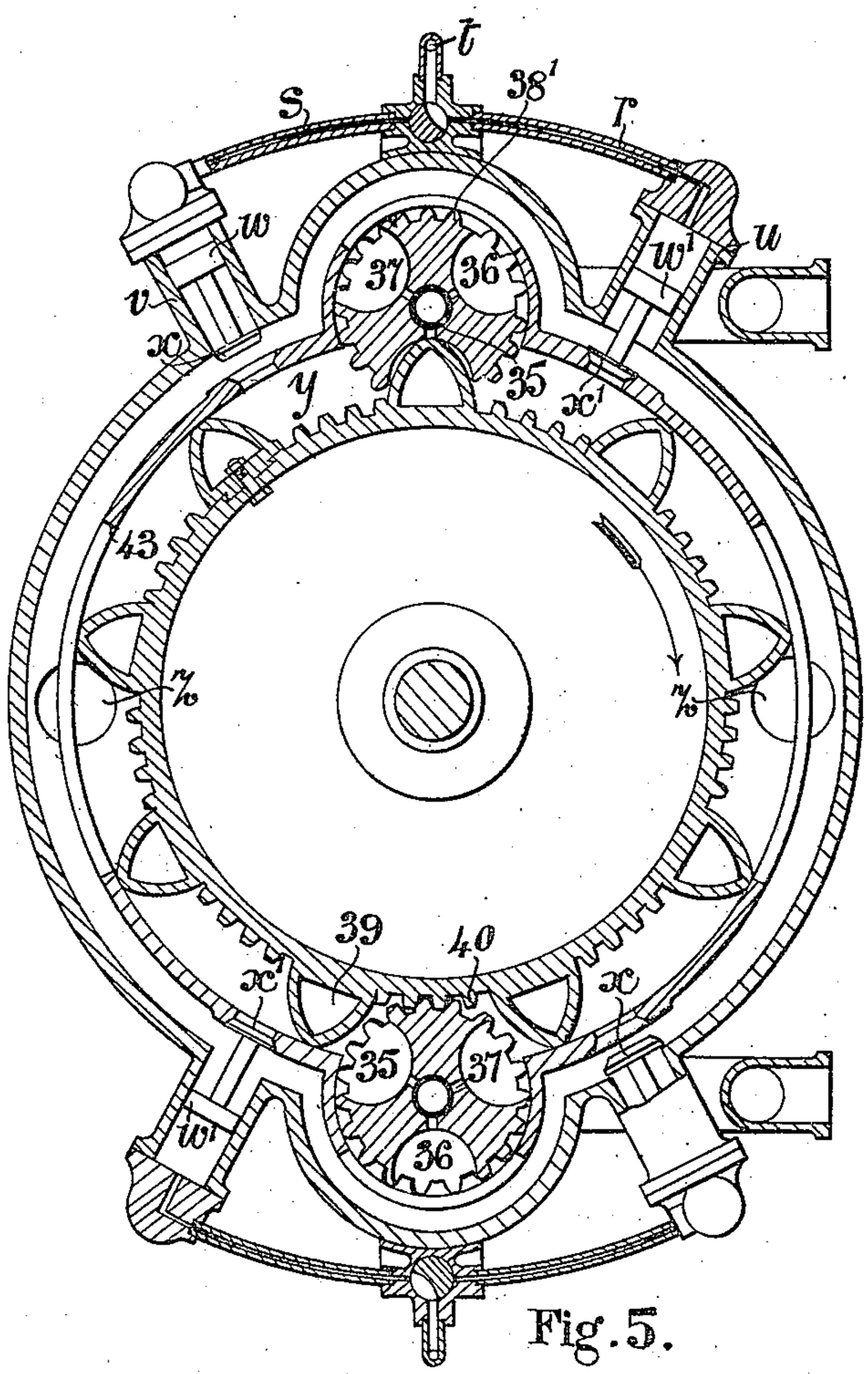

Fig. 5.

Attest:
Edward N. Sarton
L. B. Middleton

Inventor
William R. Dawe
by Spear, Middleton, Donaldson & Spear
Atty's

UNITED STATES PATENT OFFICE.

WILLIAM ROGER DAWE, OF SHEFFIELD, ENGLAND.

VALVE MECHANISM FOR ROTARY ENGINES.

No. 848,447. Specification of Letters Patent. Patented March 26, 1907.

Application filed July 6, 1906. Serial No. 325,001.

To all whom it may concern:

Be it known that I, WILLIAM ROGER DAWE, a subject of the King of Great Britain and Ireland, residing at 212 Barnsley road, Sheffield, in the county of York, England, have invented new and useful Improvements in Valve Mechanism for Rotary Engines, of which the following is a specification.

My invention relates to valve mechanism for rotary-piston engines.

My invention consists in mechanism whereby a single movement given to a lever can give motion to a valve, so as to alter its angular position with a view to reversing the direction of rotation of the engine and at the same time can admit steam to one and cut off steam from the other of a pair of cylinders, each of which contains a piston and a valve operated by said piston, the result being to open one relief-valve and close another relief-valve. All the valves just described may be provided in duplicate or triplicate or otherwise multipled and all may be operated by the one lever.

Referring now to the accompanying drawings, which illustrate my invention as applied to a rotary-piston engine, Figure 1 is a front and Fig. 2 a side elevation of an engine constructed with valve mechanism according to my invention. Fig. 3 is a front elevation, and Fig. 4 a plan, partly in section, of an engine fitted with a modified form of valve mechanism constructed according to my invention. Fig. 5 shows in section one form of my invention fitted to a rotary engine.

Referring in the first place to Figs. 1 and 2, *a* is the casing of a double-acting rotary engine. *b b* are the chests for the main valves, which supply steam to the engine. *c* is a reversing-lever provided with a handle *d* and pivoted on a fulcrum-pin *e*. To the short arm of this lever is pivotally connected one end of each of two links *f f*. The other end of each link is pivoted to one arm of a bell-crank lever, as *g*, which is fast upon the squared end *h* of a shaft which is arranged coaxial and engages with the stem of an auxiliary steam-valve, such as 35 in Fig. 5, which is adapted to control the flow of steam from the steam-supply pipe to the engine through the ports 37. The other arm of the bell-crank lever *g* is provided with a slot *k*, and in this slot works a pin *m*, which is carried by an arm *n*, which is fast upon a shaft *o*, which is adapted to actuate a valve *q*, (see left-hand side of Fig. 1,) situated in the casing *p*. The valve *q* according to its position can put either the pipe *r* or the pipe *s* or neither of these in communication with the pipe *t*. I may, if desired, arrange that when one of the pipes *r* or *s* is in communication with the steam-supply pipe the other is in communication with exhaust, as shown at 6 in Fig. 3. The pipes *r* and *s* cannot, however, both at the same time be put in communication with the steam-pipe. The pipes *r* and *s* lead to the cylinders *u* and *v*, in which are situated pistons which are adapted to actuate relief-valves.

The pistons and relief-valves are shown in Fig. 5. *w* and *w'* are the pistons, and *x* and *x'* the relief-valves. When the relief-valves are off their seats, as shown at *x* in Fig. 5, steam can pass from the working chamber *y* of the cylinder to the exhaust-passage *z*. A pair of relief-valves is provided for each steam-admission and cut-off valve—that is, there are two relief-valves in a single-acting engine, four in a double-acting engine, and so on.

A double-acting engine is shown in Figs. 1, 2, and 5, and there are therefore two pairs of relief-valves. It will be obvious from what has been said that when one relief-valve of each pair is open the other one of the same pair will be closed and one valve of the other pair will be opened and the other closed. Instead of employing the slot-and-pin arrangement for connecting the bell-crank lever *g* with the arm *n* I may employ two toothed quadrants, one carried by the bell-crank lever and the other by the arm *n*. The pistons when acted on by steam on their upper sides hold down their valves on their seats, but when relieved of the pressure of steam on their upper sides they will allow their valves to be opened by the pressure beneath them. The shafts having the squared ends *h* are adapted to operate the auxiliary valves—such as 35, Fig. 5, before mentioned—so as to control the direction of rotation of the engine, and the valves *q* are so arranged in combination with these auxiliary valves that in whichever direction the engine is rotating the proper relief-valves are opened and the proper ones closed. It will be seen that by means of a single motion given to the lever *c*

everything is done that is necessary to reverse the engine.

Referring now to Figs. 3 and 4, the valve mechanism here shown is in its general nature the same as that just described, but in its details is different. The reversing-lever *c* is rigidly connected to the stem 2 of a valve 13. This valve in adapted to place either or neither of the pipes 3 or 4 in communication with the steam-admission port 5. When one of the pipes 3 or 4 is in communication with the steam-supply, the other pipe is in communication with the exhaust-passage 6. The valve 13 acts as a fulcrum-pin for the lever *c*. To the short arm 7 of the lever *c* is pivoted one end of each of two links 8 and 9, the other end of each link being pivoted to a lever 100, which is fast on a shaft 11. This shaft is in axial alinement with and adapted to operate the auxiliary valve (such as 35, Fig. 5) for controlling the supply of steam to the engine. The pipe 4 leads steam to a cylinder 12, in which is situated a piston 10. A plunger 14 is connected to the end of the piston 10, and at the end of the plunger is placed a valve 15, which controls an opening 16, leading from the acting part of the cylinder 17 to the exhaust-passage 18. The tube 19 is in communication with an annular passage 21, situated in the cylinder around the plunger 14. The pipe 19 also communicates with the chamber 22 by means of a small passage 23. (See Fig. 3.) The passage 22 is supplied with live steam through the admission-port 24. When the top of the cylinder 12 is by means of the pipe 4 put in communication with the steam-supply pipe 5, the piston forces the valve 15 against its seat. When, however, steam is shut off from the top of the cylinder 12, the pressure of the steam in the annular passage 21, together with the pressure of the steam in the working chamber 17, against the face of the valve 15 raises the piston and valve and allows steam in the chamber 17 to escape past the valve into the exhaust-passage 18.

The upper part of the cylinder 12 is by the tube 25 put in communication with the upper end of a similar cylinder 26, which is similarly provided with a piston and valve, so that the valve actuated by the piston in the cylinder 26 rises and falls from and onto its seat at the same time as the valve 15. The cylinders 27 and 28 are arranged similarly to the cylinders 12 and 26 and are similarly provided with pistons and valves. The top end of the cylinder 27 is by the pipe 29 connected with the top end of the cylinder 28. It will therefore be seen that according to the position of the lever *c* the proper relief-valves can be closed and the proper relief-valves opened for the working of the engine in either direction. The same movement of the lever acts through the agency of the links 8 and 9 to operate the auxiliary valve for controlling the supply of steam to the engine.

Referring now to Fig. 5, a double-acting rotary-piston engine is here shown fitted with valve mechanism constructed according to the first form of my invention. The engine is rotating in the direction indicated by the arrow, and steam is passing from the steam-supply pipe past the auxiliary valve 35 at the bottom of the engine through the port 37 in the main steam-valve 38 to the recesses 36 and is acting on the piston 39, which has just moved past the valve. The relief-valves *x'* are closed and the valves *x* open. As the drum 40 rotates the piston 39, just referred to, moves forward until the steam which is contained behind it is liberated at 42 and passes to the exhaust-pipe *z*. As the piston continues to advance and passes the point 43 any steam trapped between it and the upper valve 38' passes to exhaust past the upper relief-valve *x*. The same cycle of operations is of course going on at both sides of the engine. When the lever *c*, Figs. 1–4, is moved to reverse the engine, the auxiliary valves 35 are given a movement—in this case a third of a revolution—backward, and at the same time steam acts, as before described, to close the relief-valves *x*, and the relief-valves *x'* are allowed to be opened, and the engine is ready to rotate in the reverse direction.

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

1. In reversing mechanism for rotary-piston engines, in combination, a reversing-lever, a controlling-valve adapted to be operated from said reversing-lever, pistons adapted to be acted on by steam supplied by said controlling-valve and relief-valves controlled by said pistons, substantially as described.

2. In reversing mechanism for rotary-piston engines in combination, a reversing-lever, a controlling-valve adapted to be operated from said reversing-lever, auxiliary steam-valves also adapted to be operated from said reversing-lever, pistons adapted to be acted on by steam supplied by said controlling-valve and relief-valves controlled by said pistons, substantially as described.

3. In reversing mechanism for rotary engines, in combination, a reversing-lever, auxiliary steam-valves operated by said reversing-lever, a controlling-valve also operated by said reversing-lever, cylinders having steam and exhaust connections which are opened and cosed by said controlling-valve, pistons within the said cylinders and relief-valves controlled by said pistons, substantially as described.

4. In reversing mechanism for rotary-piston engines, in combination, a reversing-lever, auxiliary steam-valves operated by said reversing-lever, a controlling-valve also op-

erated by said reversing-lever, cylinders having steam and exhaust connections which are opened and closed by said controlling-valve, steam-pipes connecting together said cylinders in two sets, pistons working in said cylinders and relief-valves actuated by said pistons, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM ROGER DAWE.

Witnesses:

LUTHER J. PARR,

CHAS. N. DANIELS.