No. 821,707. PATENTED MAY 29, 1906.

W. R. DAWE.

ROTARY ENGINE.

APPLICATION FILED JAN. 24, 1906.

3 SHEETS—SHEET 1.

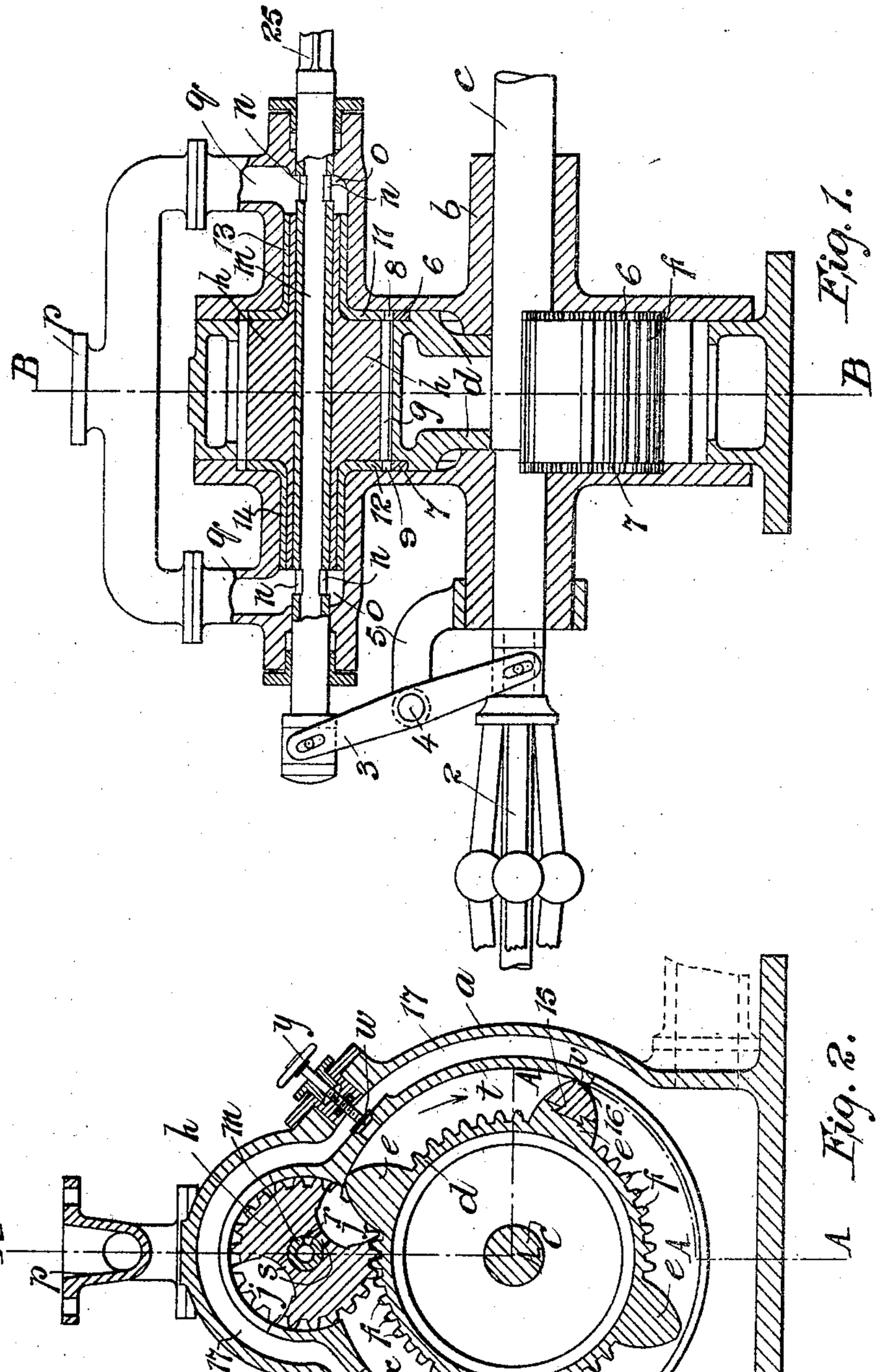

Fig. 1.

Fig. 2.

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Inventor:

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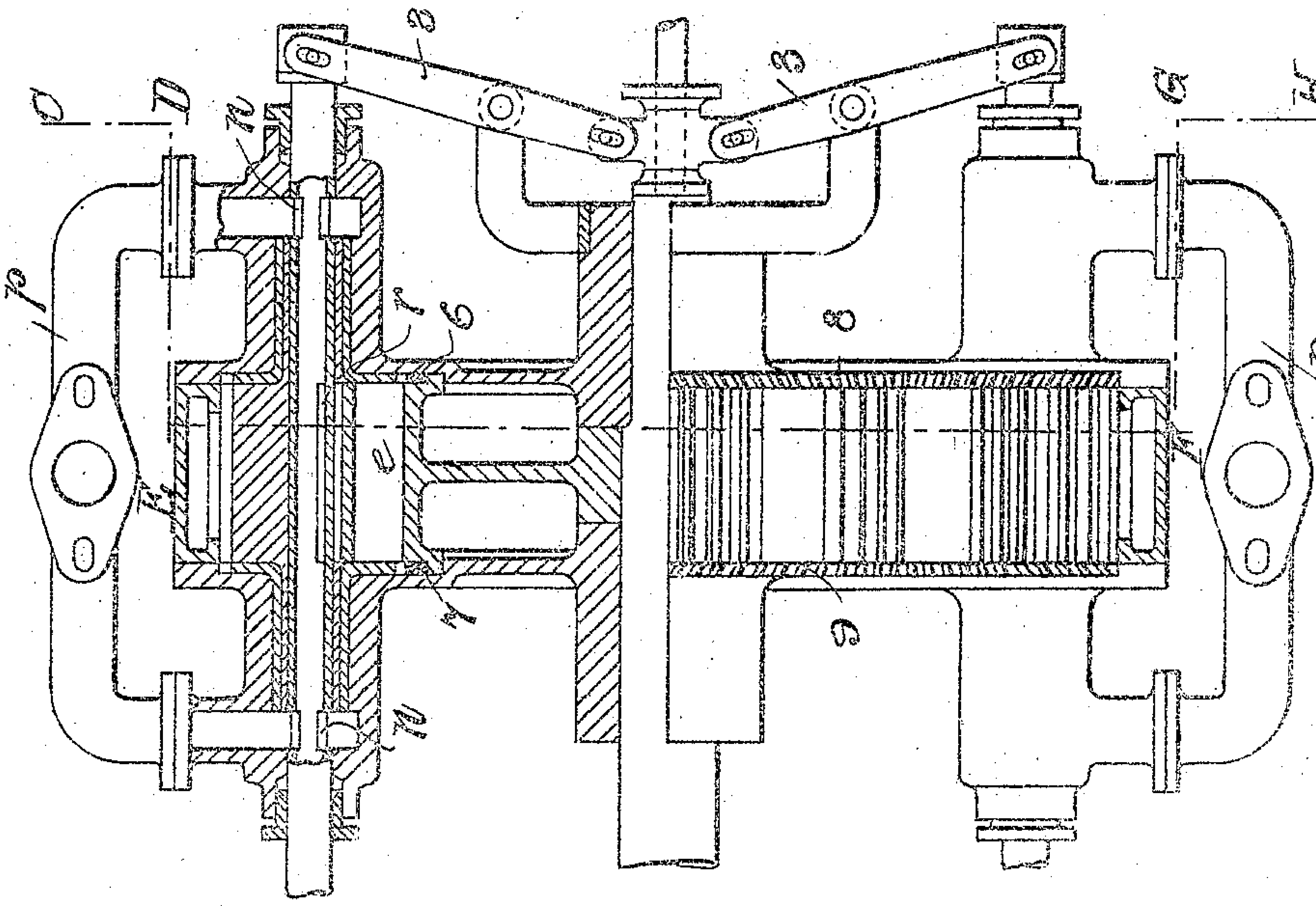

Fig. 4.

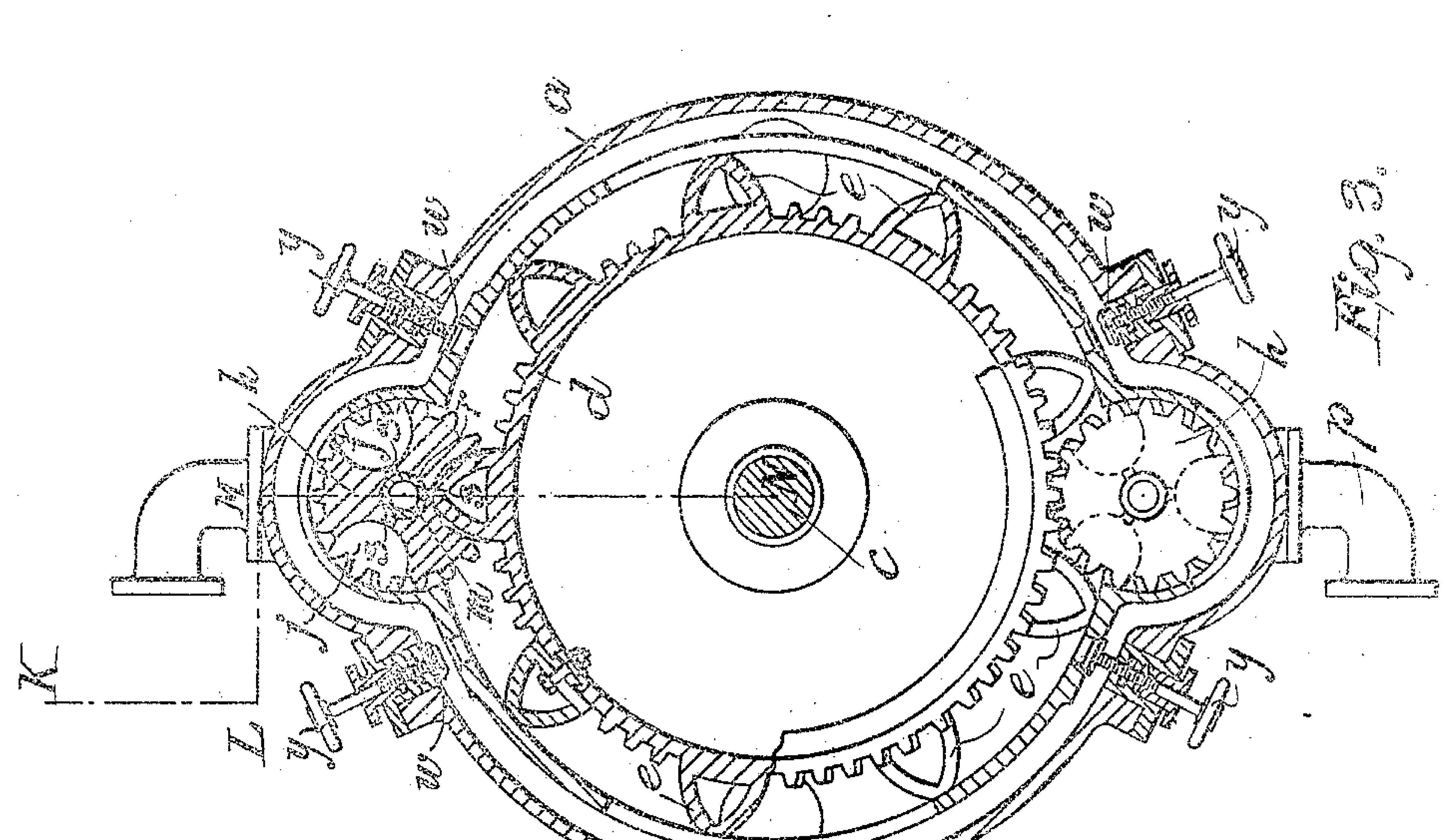

Fig. 3.

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3 SHEETS—SHEET 3.

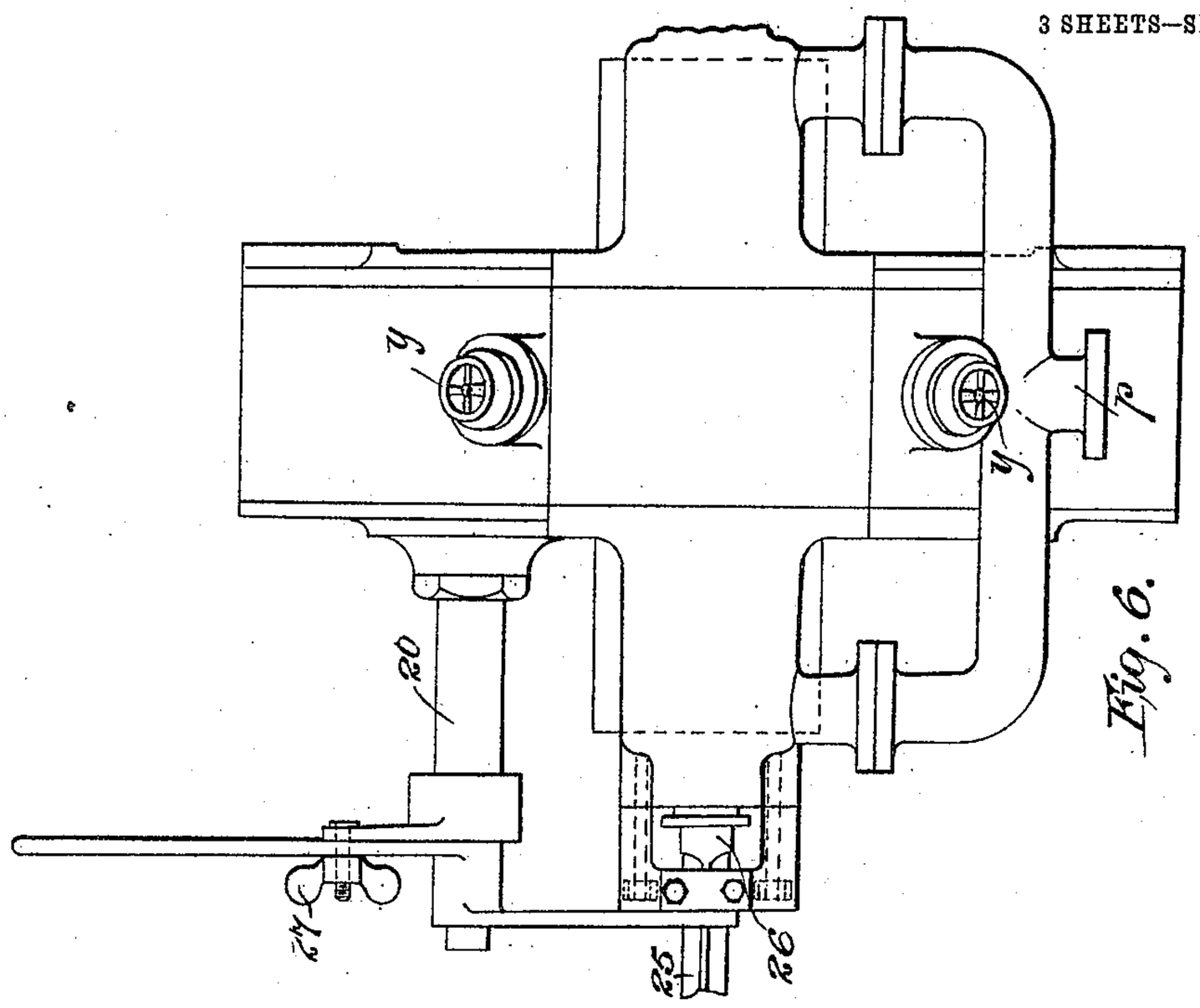

Fig. 6.

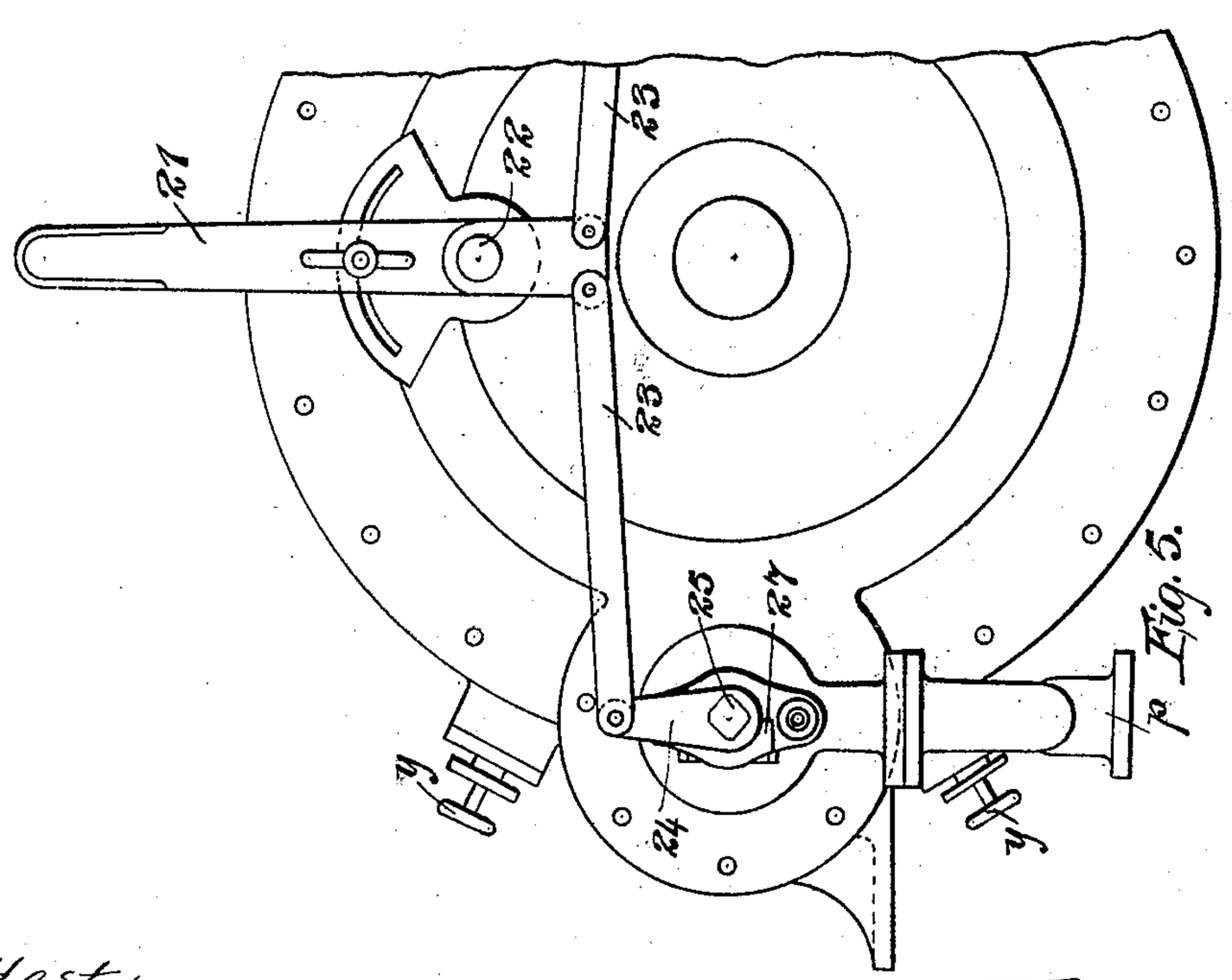

Fig. 5.

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UNITED STATES PATENT OFFICE.

WILLIAM ROGER DAWE, OF SHEFFIELD, ENGLAND.

ROTARY ENGINE.

No. 821,707. Specification of Letters Patent. Patented May 29, 1906.

Application filed January 24, 1906. Serial No. 297,657.

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 Rotary Engines, of which the following is a specification.

My invention relates to a rotary engine which may be actuated by steam or other suitable elastic fluid.

Referring to the accompanying drawings, which illustrate my invention—

Figure 1 is a section on the line A A A A of Fig. 2 of a single-acting engine constructed in one convenient form according to my invention. Fig. 2 is a cross-section on the line B B of Fig. 1. Fig. 3 is a vertical section taken on the line C D E F G H of Fig. 4 of a modified form of engine which is double acting. Fig. 4 is as regards its upper part a section on the line K L M N of Fig. 3 and as regards its lower part a side elevation of the engine with part of the casing removed. Figs. 5 and 6 are respectively front and side elevations of a double-acting engine constructed according to my invention, showing the mechanism for varying the point of cut-off and reversing.

Referring, in the first place, to Figs. 1 and 2, *a* is a casing of cylindrical form. This casing is provided with bearings *b b* for a shaft *c*, on which is secured a drum *d*, which is preferably hollow. This drum carries a number of pistons *e*—four in number in the present case. The drum carries between the pistons a number of teeth *f*. These teeth gear with teeth *g*, formed on a cylindrical valve *h*, whose axis is parallel to the axis of the shaft *c*. The valve *h* is provided with recesses *j*, with which engage the pistons *e*. The pistons *e*, in fact, act as large teeth. Arranged in the interior of the valve *h* and coaxial with it is a tube *m*, which acts as an auxiliary valve, and this tube is provided at its ends with ports *n n*, which when the tube is in a certain angular position put the interior of the tube in communication with the annular spaces *o o*. These annular spaces are supplied with live steam by means of the forked pipe *p* and the passages *q q*. The tube is also provided with a port *r*, and the valve *h* is provided with two ports *s s*. Each of these ports *s* is adapted when the main valve is in a certain position relatively to the tubular valve *m* to allow steam to pass from the interior of the tube *m* to one of the recesses *j*. In the position of the parts shown in Figs. 1 and 2 the port *r* is coming into line with one of the ports *s*. The steam is about to pass into one of the recesses *j*, when it will exert its force on one side of the piston *e* and urge this piston forward in the direction of the arrow. The rotation of the drum *d* rotates the valve *h*, due to the intermeshing of the teeth, and when the piston *e* has moved forward a certain prearranged distance the port *s* moves out of line with the port *r* and steam is cut off. The steam then expands in the space behind the piston *e* until a predetermined point is reached. The casing *a* is provided with a liner *t*, which extends about two-thirds of the way round the casing in the inside thereof. A space is left between the casing and its liner, and the exhaust-pipe communicates with this space. The dotted lines at *u* show one possible position of the exhaust-pipe. When any piston *e* reaches the end of the liner at *v*, the steam contained behind the piston is liberated and passes to exhaust. Either before this or just after this event steam is allowed to act on the succeeding piston. The valves *w w* are relief-valves. Only one of these is opened at one time. This depends on the direction in which the drum is rotating. It will be seen that when the pistons are rising on the left side of the drum, as seen in Fig. 2, steam at exhaust-pressure is trapped in the space *x*, and as the piston behind it rises this steam would be compressed but for the fact that the relief-valve *w* is provided to relieve the pressure. The left-hand valve in Fig. 2 is opened when the drum is rotating in the direction of the arrow. When the engine is a reversing one, a relief-valve is provided at the other side of the casing, as shown in Fig. 2. Hand-wheels *y* are provided for operating the valves. The speed of the engine can be automatically controlled by causing a governor to give an axial movement to the tubular valve *m*. In Fig. 1 the governor 2 acts on the tubular valve *m* through the agency of the lever 3, which is fulcrumed at 4 to a bracket 5, carried by the casing. An increase in the speed of the engine causes an axial movement to be given to the tubular valve *m*, so as to put the ports *n* partly out of coincidence with the chambers *o o*, so as to throttle the steam entering the tubular valve *m*. A decrease in the speed of the engine gives an axial movement to the tubular valve *m* in the opposite direc-

tion, so as to increase the openings for the passage of steam. Besides the teeth and the pistons *e*, which act as teeth, I may and preferably do provide the drum with two extra sets of teeth, one set on each end of the drum. In the construction shown in Figs. 1 and 2 I attach annular plates 6 and 7 rigidly to the ends of the drum, and I provide these annular plates with teeth 8 and 9, which gear with teeth formed on the main valve *h*. The teeth on the main valve *h*, which gear with the teeth 8 and 9, are preferably not formed integral with the body of the valve *h*, but are attached thereto. In the design shown in Figs. 1 and 2 these side teeth are cut on the plates 11 and 12, which are attached to the ends of the main valve *h*, and these plates 11 and 12 are provided with tubular extensions 13 14, which surround the reduced ends of the valve *h*. The teeth 8 and 9 are preferably set, respectively, one-third of a pitch and two-thirds of a pitch in advance of the teeth *f*. This is done with a view to obtaining smooth running. I may, if desired, provide the pistons *e* with removable ends 15, as shown in the case of one piston in Fig. 2. These removable ends can be replaced by others when they get worn. I may, if desired, cut grooves in the removable or fixed ends of the pistons, as shown in the case of the removable end 15 of one of the pistons shown in Fig. 2, the grooves being indicated by the numeral 16. These grooves tend to prevent the escape of steam past the end of the piston. I may, if desired, so arrange the liner *t* with respect to the casing *a* that a passage or jacket 17 extends not only round the greater part of the drum *d*, but also round the main valve *h*. This jacket serves to lessen the radiation of heat from the working parts and also tends to lessen the transmission of noise and vibration from the working parts.

Referring now to Figs. 3 and 4, a double-acting engine is here shown. There are two valves *h h*, one arranged at the top of the casing and the other at the bottom of the casing, and there are nine pistons. Each valve has three recesses *j*, and each valve makes three revolutions for one revolution of the drum *d*. Each recess is provided with a supply-port *s*, as in the single-acting form of my invention just described. The end teeth 8 and 9 in this case are made helical and are arranged right and left handed, respectively. Both the tubular auxiliary valves are adapted to be acted on at the same time by the governor through the agency of the two levers 3 3. In other respects this form of my invention resembles that before described. I may have more than two main valves *h*, if desired. If I employ two, they may either be arranged one at the top of the casing and one at the bottom, or one at each side of the casing at equal heights, or otherwise as may be desired, and when more than two valves are employed these may be arranged as desired around the casing. The valves should be equally spaced around the casing.

Referring now to Figs. 5 and 6, a valve-controlling mechanism is here shown. A lever 21 is pivoted at 22 on a fixed shaft 20, carried by the casing. The lower end of the lever has pivoted to it two links 23 23, each of which is pivoted at its other end to an arm 24, which engages with the squared end 25 of a rod 26, which is either formed integral with or rigidly attached to the auxiliary tubular valve *m*. (Shown in Figs. 1 to 4.) The rod 26 is free to move axially through the arm 24 and through the fixed bracket 27, which serves as a fulcrum for the arm 24. In the engine shown in Figs. 5 and 6 there are two main valves, and therefore two auxiliary valves. Steam is conveyed to the auxiliary valves *m* by means of two forked pipes *p*, of which only one can be seen. These forked pipes are the same as those shown in Figs. 1 to 4. When only one main valve is employed, then only one link 23 is necessary, and when more than two main valves are employed then more than two links are required. It will be obvious that in all cases all the valves can be controlled from one lever 21. The lever 21 by altering the angular position of the auxiliary valves *m* alters the points in the rotation of the main valves *h*, at which steam can pass to the recesses *j*. This allows the cut-off to be varied and the direction of rotation of the engine to be reversed. The thumb-screw 27 allows the lever 21 to be locked in any required position.

I may employ two or more engines constructed according to my invention in series, so as to form a compound engine, steam exhausting from the first engine passing to the next in succession, and so on.

Engines constructed according to my invention allow a very high power to be obtained in a machine of relatively small bulk and allow of reversing being accomplished with ease.

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

1. In rotary engines in which a drum carrying a plurality of pistons rotates within a casing, the combination with a steam-admission and cut-off valve geared directly to the said rotating drum, of an auxiliary valve situated within the said admission and cut-off valve, which auxiliary valve is adjustable axially for the purpose of regulating the amount of steam supplied to the engine and is adjustable angularly for the purpose of regulating the point of cut-off, substantially as described.

2. In rotary engines, in combination, a casing, a drum adapted to rotate within the casing, a plurality of pistons carried by said

drum, a tubular steam-admission and cut-off valve provided with a plurality of central ports adapted to admit steam to act on said pistons, an auxiliary tubular valve situated within the said steam-admission and cut-off valve and provided with ports at its ends and means for adjusting the said auxiliary valve both axially and angularly, substantially as described.

3. In rotary engines in which a drum carrying a plurality of pistons rotates within a casing, the combination with a steam-admission and cut-off valve of an auxiliary valve, ports provided in said auxiliary valve, recesses provided round said ports for supplying steam thereto, a governor acting on said auxiliary valve to move said ports out of coincidence with said recesses and so regulate the amount of steam supplied to the engine, substantially as described.

4. In rotary engines in which a drum carrying a plurality of pistons is mounted on a shaft and rotates within a casing, the combination with a steam-admission and cut-off valve of an auxiliary valve situated within the said steam-admission and cut-off valve and of a centrifugal governor mounted on the aforesaid shaft and adapted to give an axial movement to the said auxiliary valve, substantially as described.

5. In rotary engines, in combination, a casing, a drum adapted to rotate within the casing, three sets of teeth and a plurality of tooth-like pistons carried by said drum, the outside sets of teeth being placed different amounts in advance of the central set, 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:

WILLIAM MABE,

WALTER EDWARDS