W. W. WHEELER.

ROTARY ENGINE.

APPLICATION FILED OCT. 1, 1907.

906,759.

Patented Dec. 15, 1908.

4 SHEETS—SHEET 1.

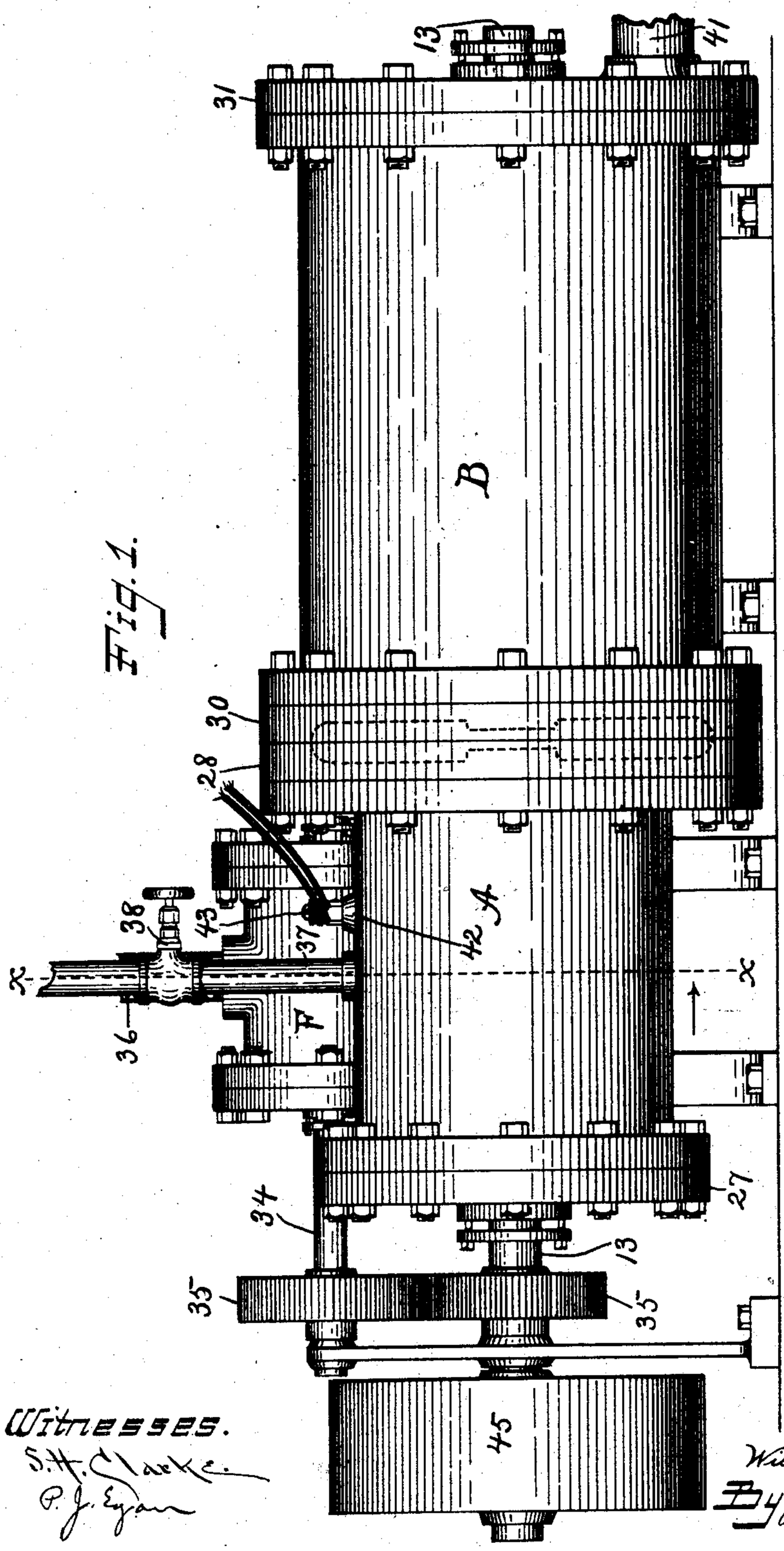

Fig. 1.

Witnesses.

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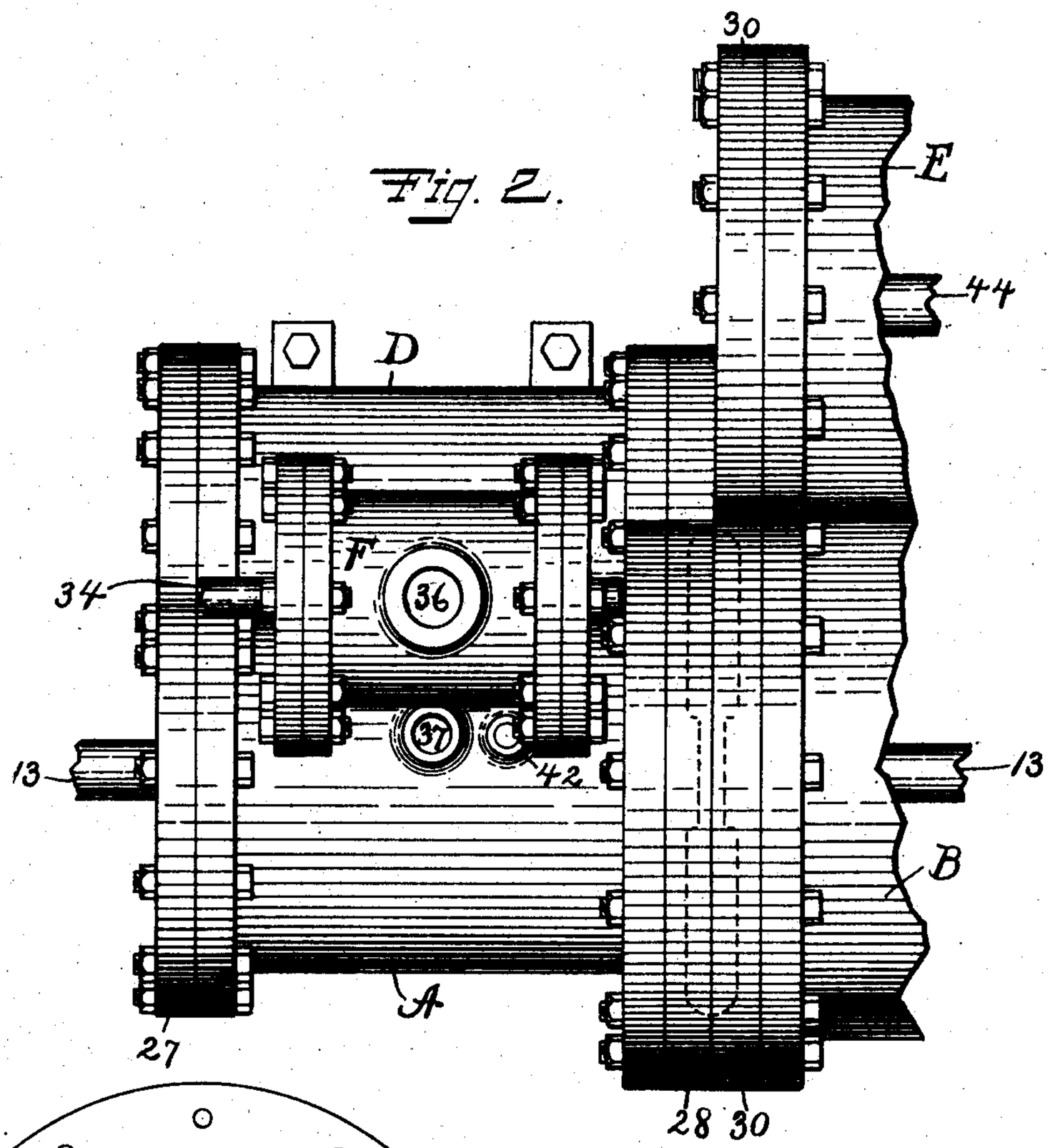
4 SHEETS—SHEET 2.

Fig. 2.



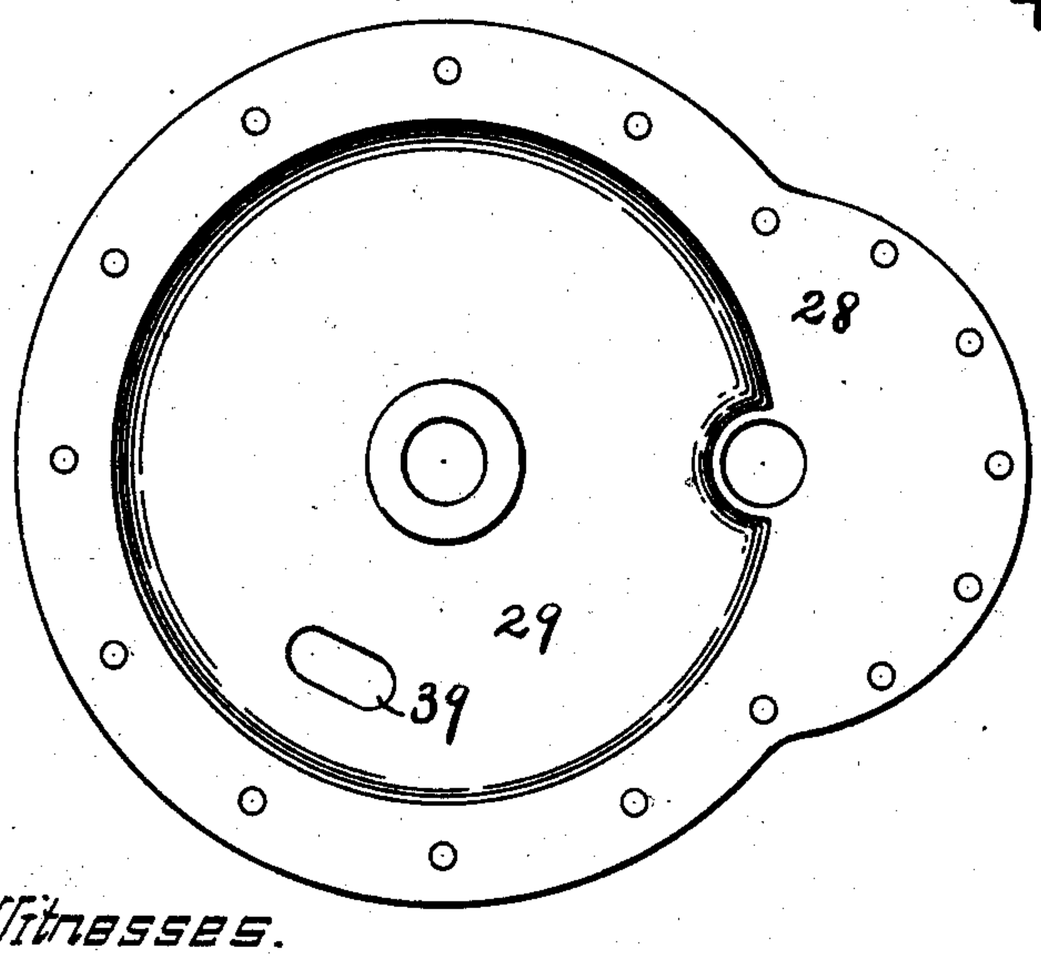


Fig. 3.

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4 SHEETS—SHEET 3.

Fig. 4.

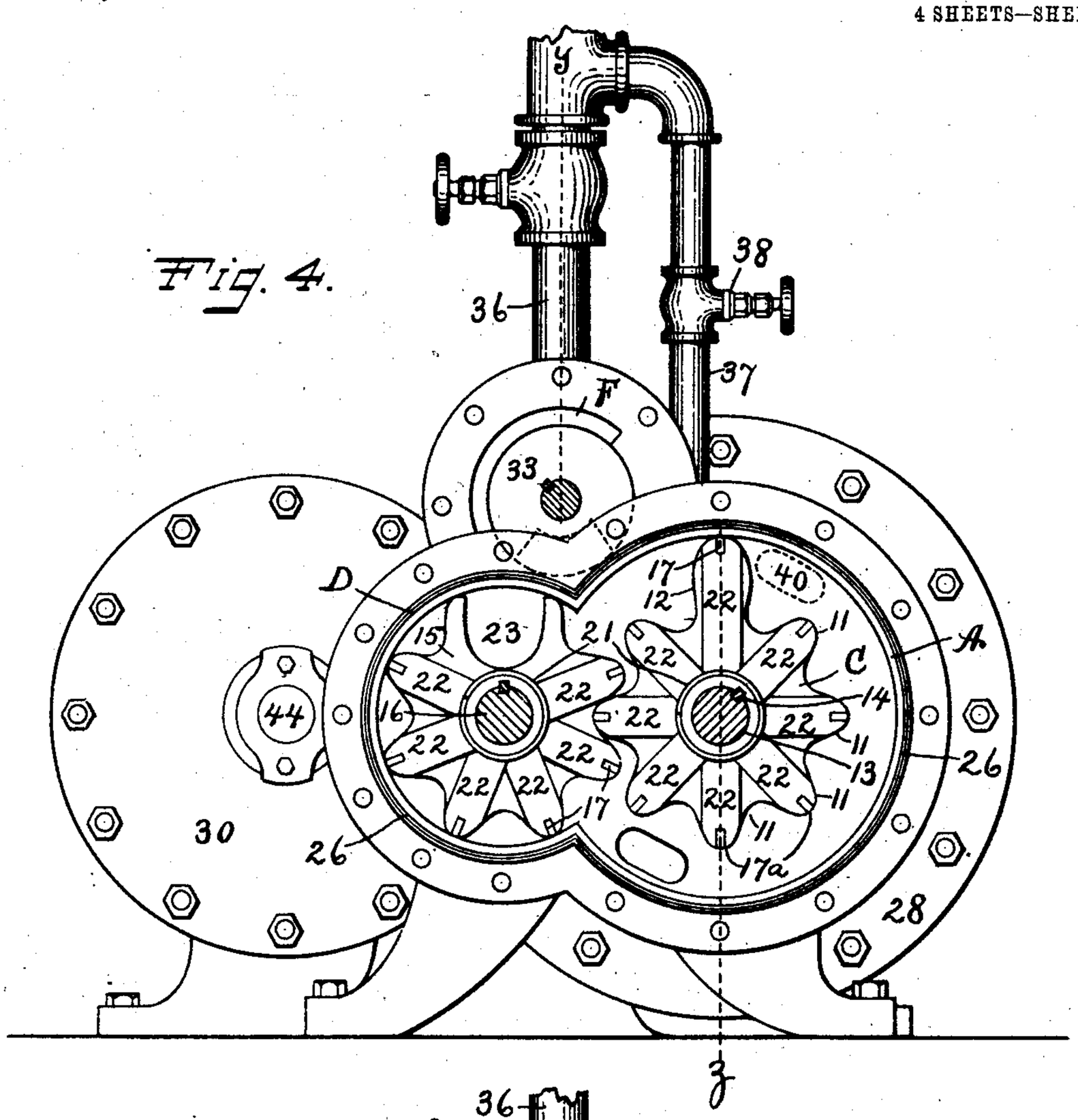
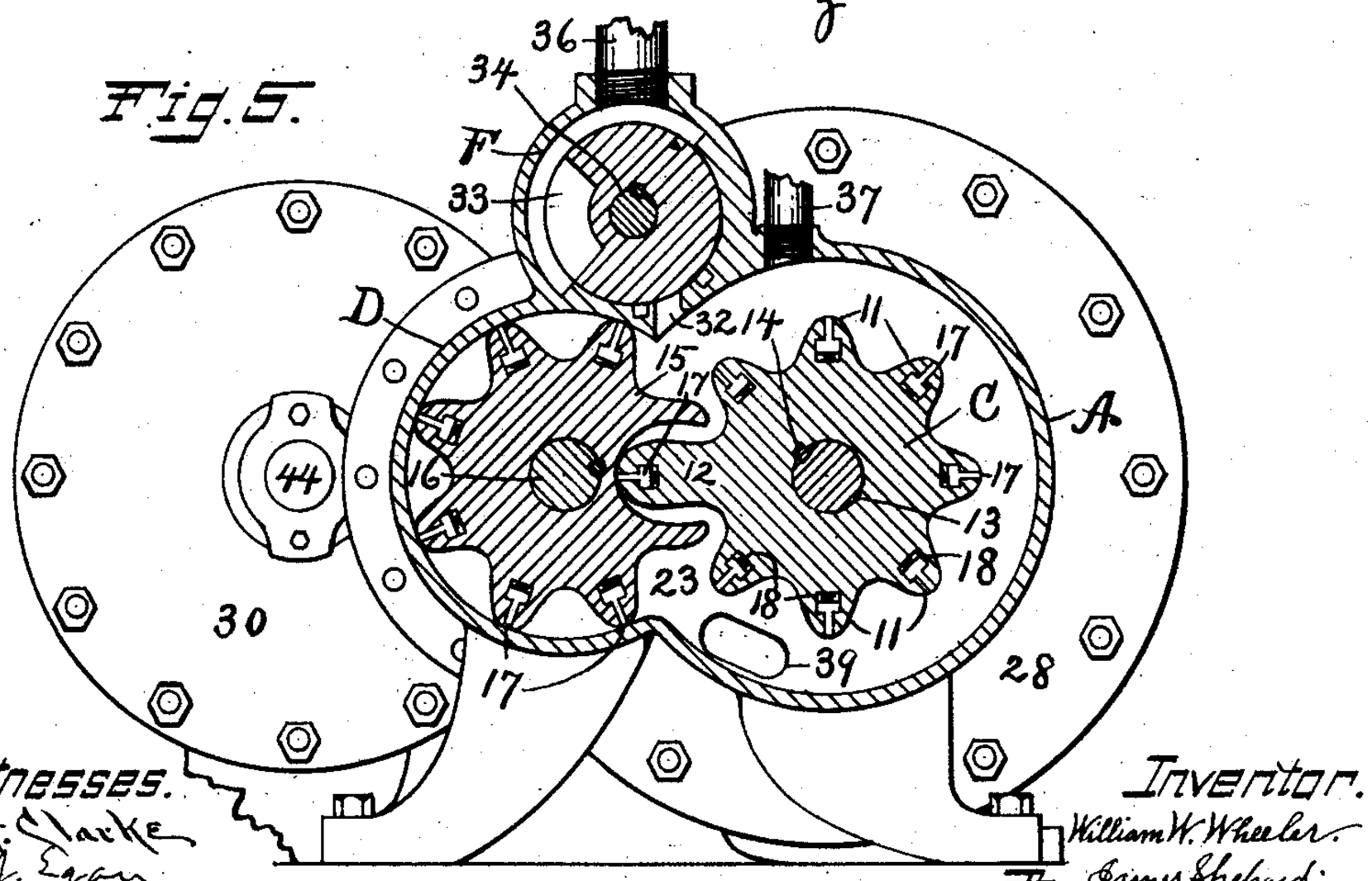


Fig. 5.



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4 SHEETS—SHEET 4.

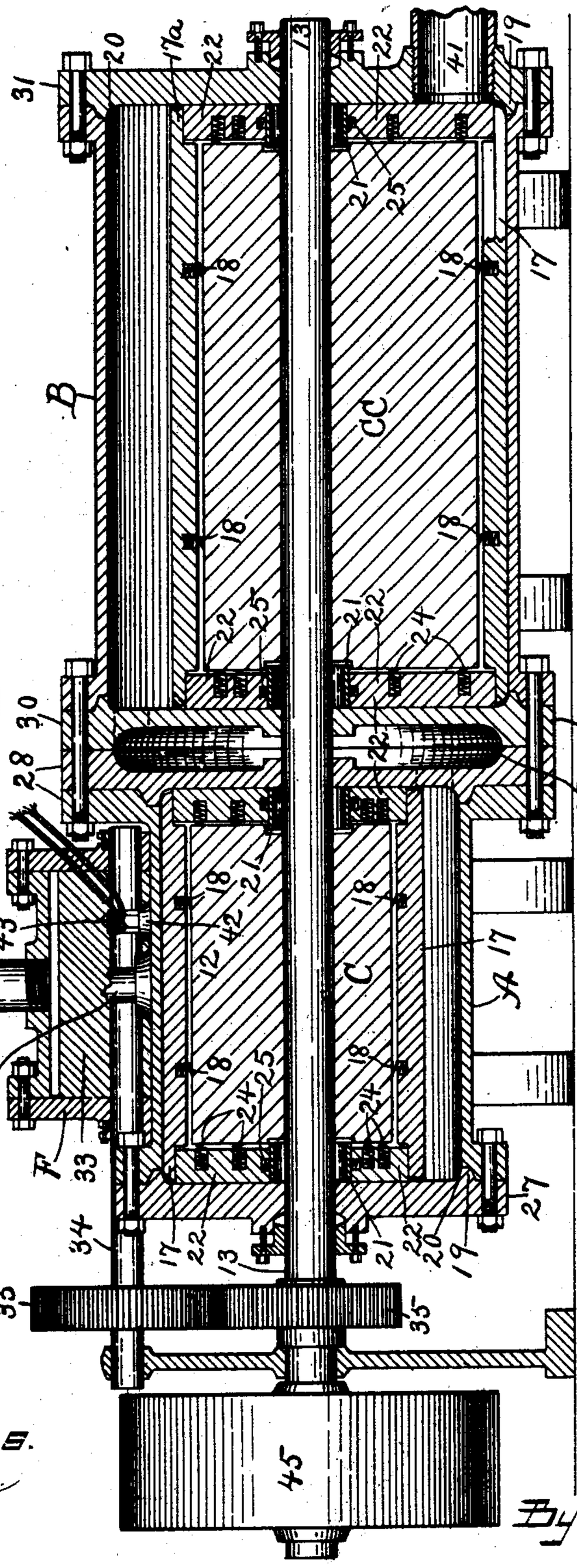
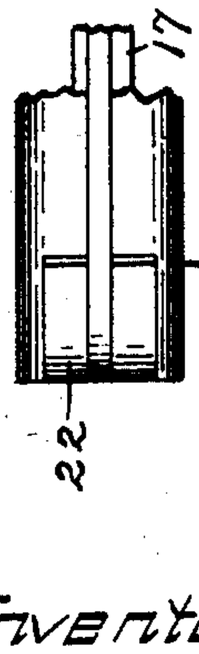


Fig. 5.

Fig. 6.

Fig. 7.



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UNITED STATES PATENT OFFICE.

WILLIAM W. WHEELER, OF MERIDEN, CONNECTICUT.

ROTARY ENGINE.

No. 906,759. Specification of Letters Patent. Patented Dec. 15, 1908.

Application filed October 1, 1907. Serial No. 395,341.

To all whom it may concern:

Be it known that I, WILLIAM W. WHEELER, a citizen of the United States, residing at Meriden, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to improvements in rotary engines, and the main object of my improvements is efficiency in operation, particularly with reference to better utilizing the expansive force of the steam; to the employment of a compound rotary engine, and to the special construction and arrangement of the packing strips.

In the accompanying drawing: Figure 1 is a front elevation of my engine. Fig. 2 is a plan view of a part of my engine. Fig. 3 is a detached side elevation of one of the end plates, caps, or heads of the smaller cylinder, showing one side wall of the intermediate steam chamber or passage that lies between the smaller and larger cylinders. Fig. 4 is a side elevation or end view of my engine with the caps or heads removed from the smaller cylinder and from the valve chamber. Fig. 5 is a vertical section of the same on the line *x x* of Fig. 1, parts of the steam pipe and the by pass pipe being shown in elevation. Fig 6 is a longitudinal vertical section partly on the line *y* and partly on the line *z* of Fig. 4, an end portion of one of the packing strips at the lower side being shown in side elevation. Fig. 7 is a plan view of a portion of the long tooth of one piston, together with one of the peripheral and end packing strips in place therein. Fig. 8 is a side elevation showing the outer end of one of the end packing strips. Fig. 9 is a side elevation of a part of one of the peripheral packing strips, and Fig. 10 is an end view of the said packing strip.

A, designates the smaller or primary cylinder and B the larger and secondary cylinder, the same being concentrically arranged in longitudinal alinement with each other as to their main part. Each cylinder is provided with a sub-cylinder that opens into the cylinder on one side. The engine is of the gear type, the rotary pistons being in the form of a gear with one long tooth which wipes the wall of the cylinder, the said piston working in connection with a rotary cut off gear in the sub-cylinder.

The piston C for the main or smaller cylinder A, has seven short teeth 11 and one long tooth 12. This cylinder is mounted on the main shaft 13, to which it is keyed in any ordinary manner, as for example, by means of the spline 14. The long tooth wipes the inner wall of the cylinder A and is in effect the piston face against which the steam, gas, or other motive fluid acts to drive the piston round and round.

The cut-off gear 15 is mounted on a shaft 16 in the sub-cylinder D, in a position parallel to the main shaft 13. The teeth of the cut-off gear are of uniform length and their ends wipe the inner wall of the sub-cylinder. The space between two of these teeth is made wider and deeper than the space between the other teeth in order to work in connection with the long tooth of the piston. In order to insure a tight fit the ends of all of the teeth, excepting the two teeth on each side of the deep space 23 of the cut-off gear 15, are grooved longitudinally and provided with packing strips 17 that extend substantially the whole length of the cylinders. These strips are shouldered to prevent them from moving outwardly too far and are forced outwardly by means of springs 18 in substantially the ordinary manner of similar packing strips in common use. But instead of making the cylinders and sub-cylinders with the ordinary right angular corner, I counter bore the ends of these cylinders (as at 26, Fig. 4,) and form the heads or end plates with a projecting rim 19, Fig. 6, that fits the said counter bores of the cylinders and I finish the inner wall of this rim on a curve of about one quarter of a circle to form the rounded corner 20 of each cylinder and sub-cylinder. The ends of most of the packing strips 17 are correspondingly curved, but in order to allow for longitudinal expansion of the said strips, I make them a little too short to fill the said corner as shown in Fig. 6. The ends of each piston and cut off gear have the bore for their shafts counter bored at each end to receive the split rings 21, which are formed of resilient metal and which form a seat or yielding abutment for the radially arranged end packing strips 22. These end packing strips are to make the pistons and cut-off gears tight at the cylinder ends under various expansion in the longitudinal direction of the cylinders. They are arranged in radial grooves with springs 24 to force them outwardly in the longitudinal direction of the cylinders and with other springs 25 between their inner ends and the split rings 21 to act in connection with the said split ring for forcing these

end strips outwardly in a radial direction. The inner ends of these strips are curved so as to approximately fit the curve of the split rings. Their outer ends are shaped to correspond with the shape of the teeth and to fit the rounded corner 20 of the cylinders, and also slotted to receive the ends of the longitudinal or peripheral packing strips as shown. It will thus be seen that the longitudinal and end packing strips coact with each other so as to always make a tight joint at the rounded corners of the cylinders. The longitudinal packing strips in the short teeth of the pistons do not reach the rounded corners of the cylinders and hence it is not necessary to round off the corners.

The right hand end of the main cylinder A and sub-cylinder D, as shown in Figs. 1 and 2, is covered by a plate-like cap or head 27 which is secured thereon in any proper manner as for example by bolts or screws. The opposite end of the said cylinder and sub-cylinder is covered by a similar cap or head 28. The face of this head 28 which is exterior to the main cylinder A, is provided with a substantially annular recess as shown in Figs. 3 and 6, and as indicated by broken lines in Figs. 1 and 2 to form one wall of a steam chamber or passage 29 between the main and secondary cylinders A and B. The adjacent end of the secondary cylinder and its sub-cylinder E is covered by a similar cap or head 30 which is provided on one face with a like annular recess to form the other wall of the steam chamber 29, and a like cap or head 31 without such annular recess covers the right hand end of the secondary cylinder and its sub-cylinder.

The main shaft 13 extends through the main and secondary cylinders and their several heads as best shown in Fig. 6. The said secondary cylinder is provided with a piston C C and its sub-cylinder is provided with a cut-off gear, the same as for the cylinder and sub-cylinder A and D, only the said cylinders, piston and gear are larger and longer. The cut-off gear for the sub-cylinder E is mounted on the shaft 44.

On the top of the main cylinder and its sub-cylinder is the valve chamber F having a port 32 that opens into the main cylinder. Within the said chamber is a rotary valve 33 of an ordinary construction. The valve is mounted on the valve shaft 34 and connected with the main shaft 13 by means of the gear wheels 35, so that the valve and pistons on the main shaft rotate in unison with each other. The valve chamber is supplied with steam through the steam pipe 36 and I prefer to also employ a by-pass pipe 37 having a cock 38, the said by-pass opening into the main cylinder as shown.

The exhaust 39 for the main cylinder opens into the intermediate steam chamber or passage 29. This chamber is provided with an opening 40 that leads into the secondary cylinder B. The said opening is indicated by broken lines in Fig. 4, and is opposite the exhaust opening 39. The final exhaust is through the pipe 41 of the secondary cylinder. The main cylinder A is provided with a socket 42 into which a spark plug 43 may be secured in case the engine is to be driven by an explosive gas instead of by steam. The main shaft 13 is provided with a driving pulley 45.

The valve 33 is so arranged relatively to the piston C as to open or uncover the port 32 and let steam into the cylinder A about the time that the long tooth 12 passes the said port and to close or cover the said port at about one quarter of a revolution thereafter. The engine then runs by the expansive force of the steam until the long tooth 12 of the piston C reaches the exhaust port 39 and lets the steam escape. The shaft 16 has no gear or connection with the piston shaft except that provided by the gears of the piston and cut-off gear, so that there is always a contact of the piston teeth with the cut-off gear which tends to keep them tightly closed against each other. The packing strips 17 project slightly so as to make a tight joint between the ends of the cut-off gear and wall of the sub-cylinder while the said strips in the piston make a tight joint between the ends of the piston teeth and spaces between the teeth of the cut-off gear. The packing strip in the long tooth 12 also acts to make a tight joint between the end of that tooth and the wall of the main cylinder A. It should be noted that the piston has only one long tooth whereby I am enabled to employ a rotary cut-off valve and the said piston can be driven a full half of a revolution by the expansive force of the steam. This could not be done if the piston had two or more long teeth, nor if all of its teeth were of the same length. The end packing strips 22 make a tight joint at the ends of the cylinders and sub-cylinders under the variations in the length of the pistons and cylinders. These end packing strips and longitudinal strips overlap each other so as to always close the corners of the cylinders and this is perfected and insured by providing the cylinders with the rounded corners.

The steam passes from the exhaust port 39 of the cylinder A into the intermediate steam chamber or passage 29, and then moving to the diagonally opposite side of the cylinders enters the secondary cylinder near the top through the port or opening 40. The two pistons are so placed on the shaft 13 that the long tooth of the cylinder CC is at the bottom when the long tooth of the cylinder C is at the top, as shown in Fig. 6, and consequently the main piston C is about ready to exhaust and let in steam through the intermediate chamber and port 40 into the top of the secondary cylinder as the long tooth of

the piston CC passes the said port 40, thus making the two pistons work alternately and avoiding "the dead center". In case the engine should be stopped when the steam is shut off with the rotary valve in a position that closes the port 32, then the cock 38 of the by-pass pipe 37 may be opened to let in steam for starting the engine. If the piston C should be stopped with its long tooth between the exhaust port 39 and the delivery end of the by-pass pipe, then the steam would rush through the main cylinder A through the intermediate chamber 29 and port 40 into the secondary cylinder, the piston for which will then be in a position to have its long tooth between the port 40 and the final exhaust 41 so that the engine would be started through the secondary piston and cylinder. After the engine is started the by-pass cock may be closed. Both of the pistons are keyed to the shaft 13 by means of a spline 14 so as to rotate with the said shaft, and the cut-off gears are mounted in the same way. I prefer to have these pistons and gears fitted loosely enough on the shaft and splines so as to move slightly thereon in the longitudinal direction of the shaft to allow for expansion of the metal and prevent these pistons and gears from bearing against their cylinders at one end harder than they do at the other end.

I claim as my invention:

1. In a rotary engine of the gear type, the combination of a cylinder and sub-cylinder with a cut-off gear having teeth of uniform length for wiping the wall of the sub-cylinder, the said cut-off gear also having a deep space between two of the said teeth and shallower spaces between the other teeth, a piston having a series of teeth one of which is of a length for wiping the wall of the said cylinder and the said deep space of the said cut-off gear and the other of which teeth are short for coacting with the shallower spaces of the said cut-off gear, radially arranged packing strips let into and projecting beyond the ends of the piston and extending from near the center of the piston to the outer ends of its teeth for bearing on the inner end walls of the cylinder, and longitudinally arranged packing strips extending throughout the length of the said teeth at their outer ends.

2. In a rotary engine, the combination of a cylinder having end walls with a rotary piston mounted therein, a set of radially arranged packing strips mounted in one end of the said piston, a like set of packing strips mounted in the opposite end thereof, springs for forcing the said strips laterally outwards in bearing contact with the walls at the opposite ends of the said cylinder, and a resilient split ring let into the opposite ends of the said piston for forcing the strips of each set longitudinally outwards, the inner ends of the said packing strips being seated on the peripheries of the said split rings.

3. In a rotary engine of the gear type, the combination of a cylinder and sub-cylinder having end plates with a piston and cut-off gear, the said piston having a long tooth, a secondary cylinder having end plates, a sub-cylinder, piston and cut-off gear, a main shaft extending longitudinally through the said two cylinders with the said two pistons mounted thereon, the long teeth of the said two pistons projecting in opposite directions from the said shaft, the end plates intermediate the said two cylinders having in their confronting faces a steam passage leading from a port in the end plate of the said cylinder into a port opening into the said secondary cylinder.

4. In a rotary engine, the combination of a cylinder having an inner rounded corner at each end with a rotary piston mounted in said cylinder, a radially arranged end packing strip let into the ends of the piston for bearing on the end walls of the cylinder, and a longitudinal packing strip for bearing on the main wall of the said cylinder, the said strips overlapping each other and both being rounded at their corners in conformity to the rounded corners of the cylinder.

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Witnesses:

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