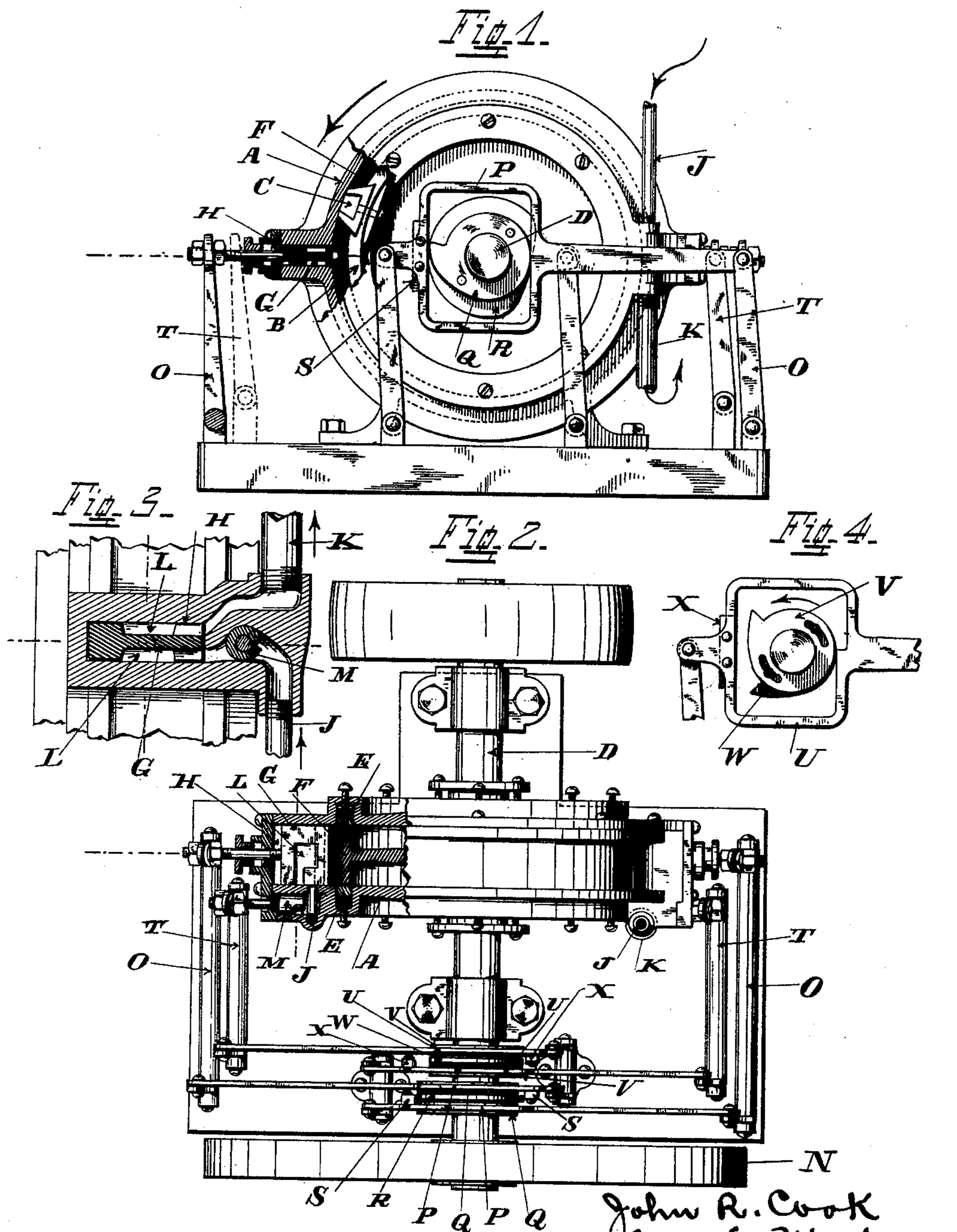


(No Model.)

J. R. COOK & C. S. HINCHMAN.
ROTARY ENGINE.

No. 414,192.

Patented Nov. 5, 1889.



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JOHN R. COOK AND CARY S. HINCHMAN, OF RUSHVILLE, INDIANA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 414,192, dated November 5, 1889.

Application filed April 16, 1887. Serial No. 235,003. (No model.)

To all whom it may concern:

Be it known that we, JOHN R. COOK and CARY S. HINCHMAN, of Rushville, Rush county, Indiana, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

This invention pertains to rotary engines operated by steam or other pressure medium. Our improvements will be readily understood from the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is an end elevation of our improved rotary engine, portions being broken away and exhibiting certain parts in vertical section; Fig. 2, a plan of the same, portions being broken away and portions being shown in horizontal section; Fig. 3, a vertical section, upon an enlarged scale, through one of the valve-cases; and Fig. 4, an end elevation of the shaft, showing arrangement of cut-off cams and one of the yokes engaged by them.

In the drawings, A represents the cylinder of the engine, the same having a fixed disk-like case accurately bored, and accurately faced upon its inner surfaces; B, the revolving piston, the same being a disk accurately fitted sidewise within the cylinder and having a true cylindrical periphery somewhat smaller than the diameter of the cylinder; C, a lobe projecting radially from the piston of which it forms a rigid part, and reaching into steam-tight contact with the bore of the cylinder and with the inner face thereof, the steam-tightness being secured by packing of the character usually employed in such machines; D, the shaft of the engine, the same passing axially through stuffing-boxes in the cylinder-heads and being supported by suitable bearing-boxes, the shaft being rigidly secured to the piston so as to revolve with it; E, annular packing arranged in the cylinder-heads and bearing against the side faces of the piston at its periphery, this packing serving to prevent steam finding its way inward beyond the periphery of the piston; F, the annular steam-spaces formed between the periphery of the piston and the bore of the cylinder, this space being swept by the piston-lobe as the piston revolves; G, valves fitted to slide steam-tight in cases forming radial outward extensions of the steam-space

F, there being two of these valves arranged diametrically opposite each other, these valves presenting inward against and in steam-tight contact with the periphery of the piston and serving to divide the steam-space F into two spaces; H, the cases in which these valves slide, the case being the full width of the cylinder; J, the steam-pipes by which steam is led from the source of supply to the interior of these cases, there being one steam-pipe for each case, the two being formed, if desired, by two branches from a single main pipe; K, exhaust-pipes similarly arranged and in free communication with the valve-cases; L, pockets formed in the faces of the valves G, these pockets having side channels leading to the edge of the valve which passes the ports by which the steam-pipe and exhaust-pipe communicate with the valve-case, whereby, while the channels are passing the ports the steam-pipe will be in communication with one of the pockets of the valves and the exhaust-pipe in communication with the other pocket of the same valve, the pockets reaching such distance toward the inner edge of the valve that when the valves are inward against the piston the pockets will be in communication with the steam-space F of the cylinder, and when the valves are withdrawn to allow the piston-lobe to pass both pockets are cut off from the steam-space; M, a cut-off valve arranged one at each of the valve-cases previously referred to, these valves being shown as of the reciprocating-piston type, the office of these valves being simply to open and close communication between the steam-pipe and the steam-pocket in the side of the appropriate valve G, these cut-off valves, as well as the valves G, being operated through the medium of stems projecting outward through stuffing-boxes in the valve-cases, the movement of all of the valves being radial to the cylinder; N, the fly-wheel fast upon the shaft; O, double rocker-arms journaled below and outside the valve-cases, and having each one of their arms connected with a stem of a valve G; P, cam-yokes provided with outwardly-extending rods connecting each with one of the rocker-arms O, the yokes engaging cams upon the engine-shaft; Q, a cam, one for each of the

yokes P, secured to the engine-shaft, these cams being provided with a single outwardly-projecting lobe adapted as the cam revolves to engage one of the inner faces of the yoke and push the yoke outward, thus serving to oscillate the appropriate rocker-arm O and withdraw its valve G, so as to permit its piston-lobe to pass the valve, the office of the cam Q being simply to move the yoke in one direction corresponding with the opening motion of its valve; R, a cam secured against the face of the cam Q, this cam having the form of a circle minus a segment, the segment-relief being disposed diametrically opposite the lobe upon the cam Q, the cam R being disposed to one side of the yoke which the cam Q engages; S, a yoke-block secured against the face of each of the yokes P, these blocks forming a side extension of the yoke P in a position to be engaged by the periphery of the cam R, this yoke-block being upon that side of the shaft away from the valve which this yoke is to operate; T, a pair of double rocker-arms similar to those previously mentioned, but connected with the stems of the cut-off valves N and having special yokes operated by special cams; U, yokes connected with the rocker-arms T, and constructed and arranged substantially like the yokes P; V, cams secured to the shaft and serving to operate the cut-off yokes U precisely as the cams Q operate the main-valve yokes P, the cams V having each a single radial lobe to effect the outward movement of the appropriate yoke, the office of these cams being to move their yokes outwardly only, corresponding with the open position of the cut-off valves; W, cams similar in form to the cams V and secured adjustably alongside the same, these cams W lying to one side of their yokes, as was the case with the cams R; X, yoke-blocks upon the yokes U, to be engaged by the lobes of the cams W.

It is requisite that the steam-pipe J shall deliver into the upper pocket of the valve G upon one side of the engine, as seen in Fig. 1; but in the case of the other valve G the steam-pipe must deliver to the lower pocket of the valve, as seen in Fig. 3.

If it be desired, for the sake of appearance and ease of pipe-fitting, that the two steam-pipes shall approach the valve-cases in one direction and the two exhaust-pipes in the other direction, the matter may be arranged for by so constructing the valve-cases that the steam and exhaust channels therein cross each other on one of the valve-cases, thus causing the steam-pipe entering the valve-case from above to deliver the steam to the lower pocket of its valve, while the exhaust-pipe leading downward will receive steam from the upper pocket of this valve. Normally both valves G occupy an inner position against the periphery of the piston, being held in that position by the peripheries of the cams R bearing against the appropriate

yoke-blocks. When the piston-lobe C has passed one of the valves G, the valve is quickly pushed inwardly against the piston, and is held in such position by its cam R engaging the yoke-block. In Fig. 1 assume that the piston-lobe, moving in the direction indicated by the arrow, has passed the valve G, and that the valve has moved inward, thus introducing an abutment in the steam-space behind the piston. A steam-tight space will thus be formed between the valve and the piston-lobe, and the steam has free admission to this space through the lower pocket of the valve. The action of the steam will force the piston-lobe onward, thus causing revolution of the piston-shaft, &c. This action of the steam would under ordinary circumstances continue until the lobe had passed around to the other valve G, which would be withdrawn by its cam, so as to let the lobe pass, after which the steam would act between the piston-lobe and the new steam-abutment formed by the last valve passed, and so on. As soon as the lobe has passed a valve G and the valve has moved inward the steam-space through which the lobe has previously been passing will be in communication with the exhaust-pipe through the medium of the valve-pocket upon that side of the valve which the lobe approaches in passing. Thus in Fig. 1 assume the left-hand valve G to be still pressed closely against the piston. The steam between the approaching lobe and the valve will pass freely outward through the upper pocket of the valve, and thence to the exhaust-pipe. As the shaft revolves the cams R, engaging the blocks S, hold the valves G tightly against the piston, and at the proper points in the revolution of the shaft the lobes of the cams Q move the valves quickly outward, and the cams R return them quickly to their normal position, the cams Q acting on their yokes and the cams R acting on the blocks S. This arrangement of double cams and a yoke with a side extension renders possible and exceedingly prompt motion by means of cams acting entirely by peripheral contact.

As thus far indicated, it will be apparent that steam at full pressure will have followed the lobe throughout its entire trip from abutment to abutment, and the expansive force of the steam will not therefore have been utilized. To overcome this defect is the office of the cut-off valves. The cut-off valves are reciprocated by the cams V and W, the cams V moving the cut-off valve open while the cams W close the valves. The lobes of the cams V and W can be adjusted into any desired relationship with each other, so that the closing motion of the cut-off valve will follow the opening motion at any desired interval, and the arrangement of double cam and yoke with side extension renders possible an exceedingly prompt valve motion by cams acting by peripheral engagement only. The cams V are to be so set that when the valve G is moved

inward to form an abutment behind the passing piston-lobe the cut-off valve will be open so as to permit steam to flow freely to the spaces between the abutment and lobe, and the cam W is to be so set that it will close its cut-off valve at the desired time to effect the desired degree of expansion. The cut-off valve being balanced will remain in either open or closed position, and the cams have only therefore to effect the movements. The cut-off valves are simply piston-plugs, which reciprocate over and close their ports, and thus obstruct the steam-pipe for the time being. These piston-valves fit their cylindrical seats, and the full pressure of steam is always against one end of the valve, and the body of the valve has a longitudinal channel to permit the full pressure of steam to act against the other end of the valve.

We claim as our invention—

1. In a rotary engine, a cylinder A, provided with oppositely-disposed radial valve-cases H, having steam and exhaust connections J K, piston B, having lobe C, valves G, fitted to engage directly with the periphery of the pis-

ton, and having pockets L, shaft D, secured to the piston, cams Q R, secured to the shaft, yokes P, having yoke-blocks S, and double rocker-arms O, connected with said yokes and said valves, combined and arranged to operate substantially as set forth.

2. In a rotary engine, a cylinder A, provided with oppositely-disposed radial valve-case H, valves G, piston B, having lobe C, shaft D, secured to the piston, cams Q R, secured to the shaft, yokes P, engaging such cams and connected to said valves, inlet and exhaust connections to said valve-cases, cut-off valves M in said valve-cases, adjustable cams V and W, secured to the shaft, and yokes U, provided with yoke-blocks X, engaging said cams and connected with said cut-off valves, combined and arranged to operate substantially as set forth.

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