(Model.)

2 Sheets—Sheet 1.

E. C. JOHNSON.

STEAM ENGINE.

No. 453,643. Patented June 9, 1891.

FIG. 1.

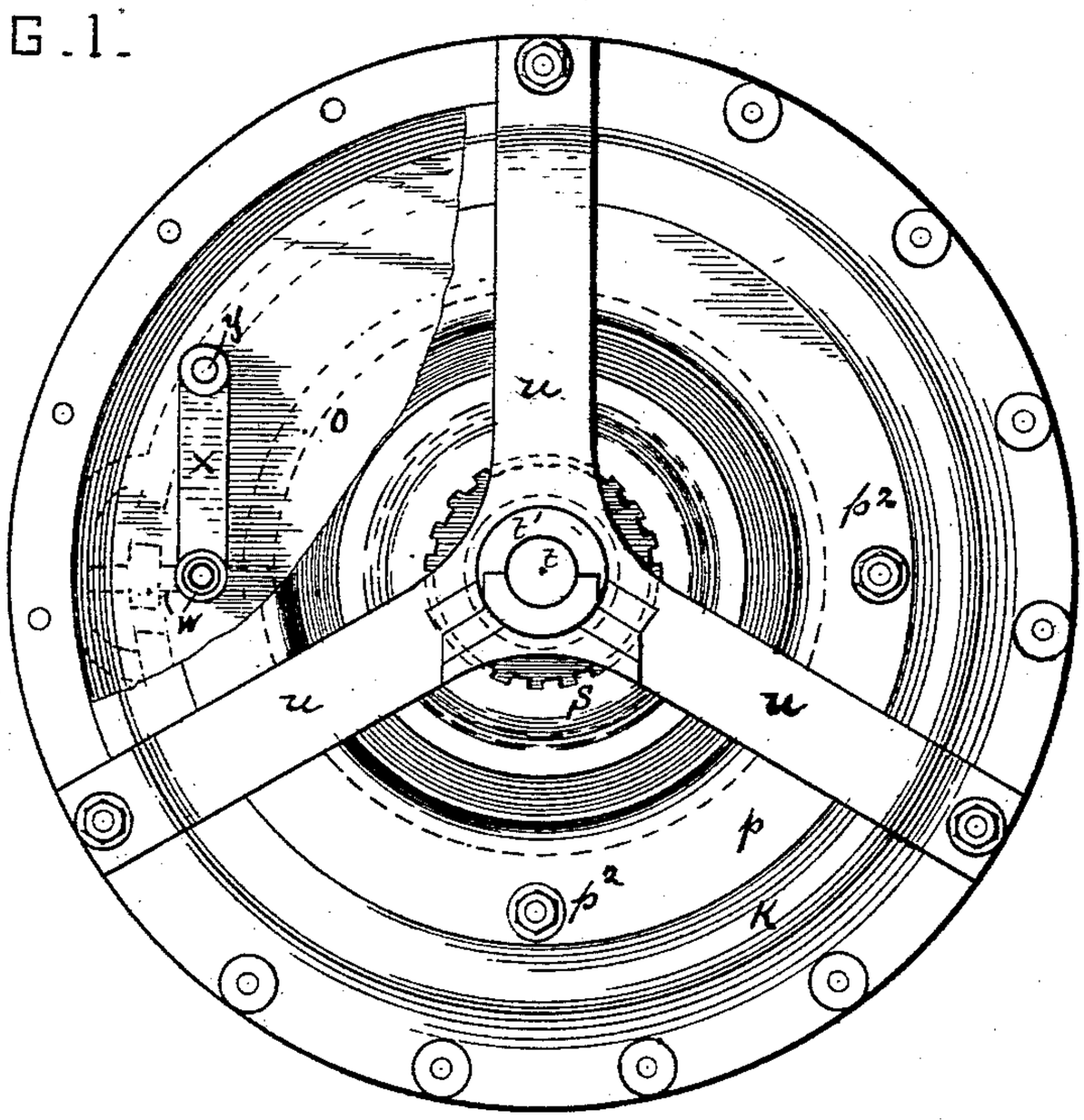


FIG. 3.

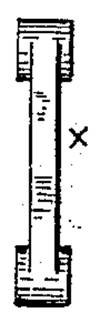
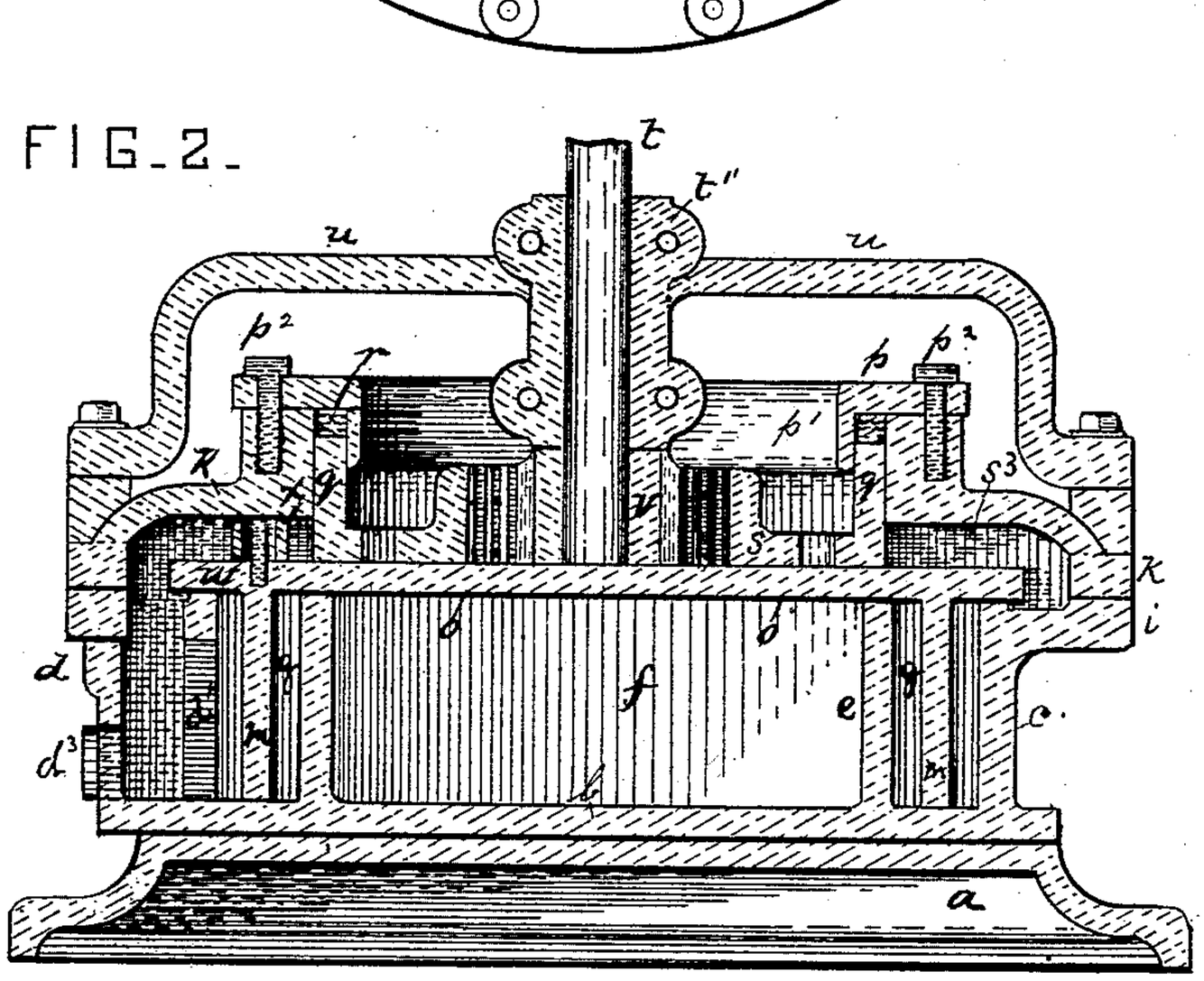


FIG. 2.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(Model.)

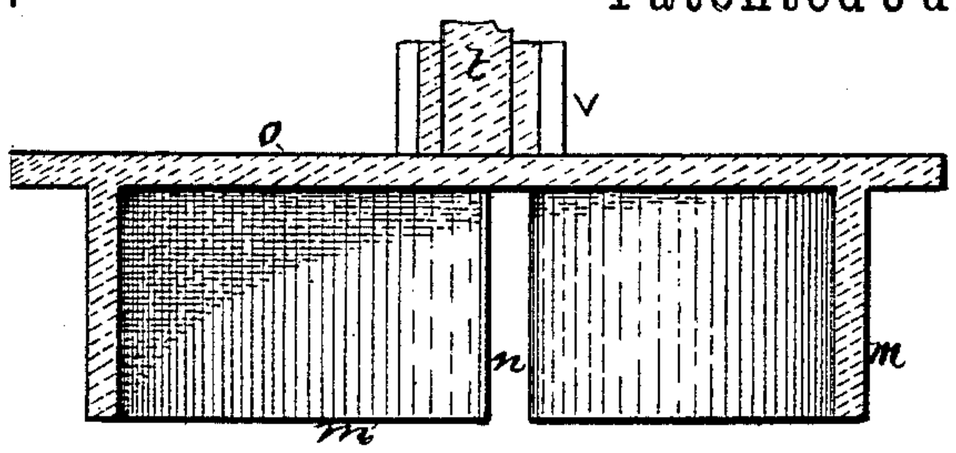
2 Sheets—Sheet 2.

E. C. JOHNSON.

STEAM ENGINE.

No. 453,643. Patented June 9, 1891.

FIG. 4.



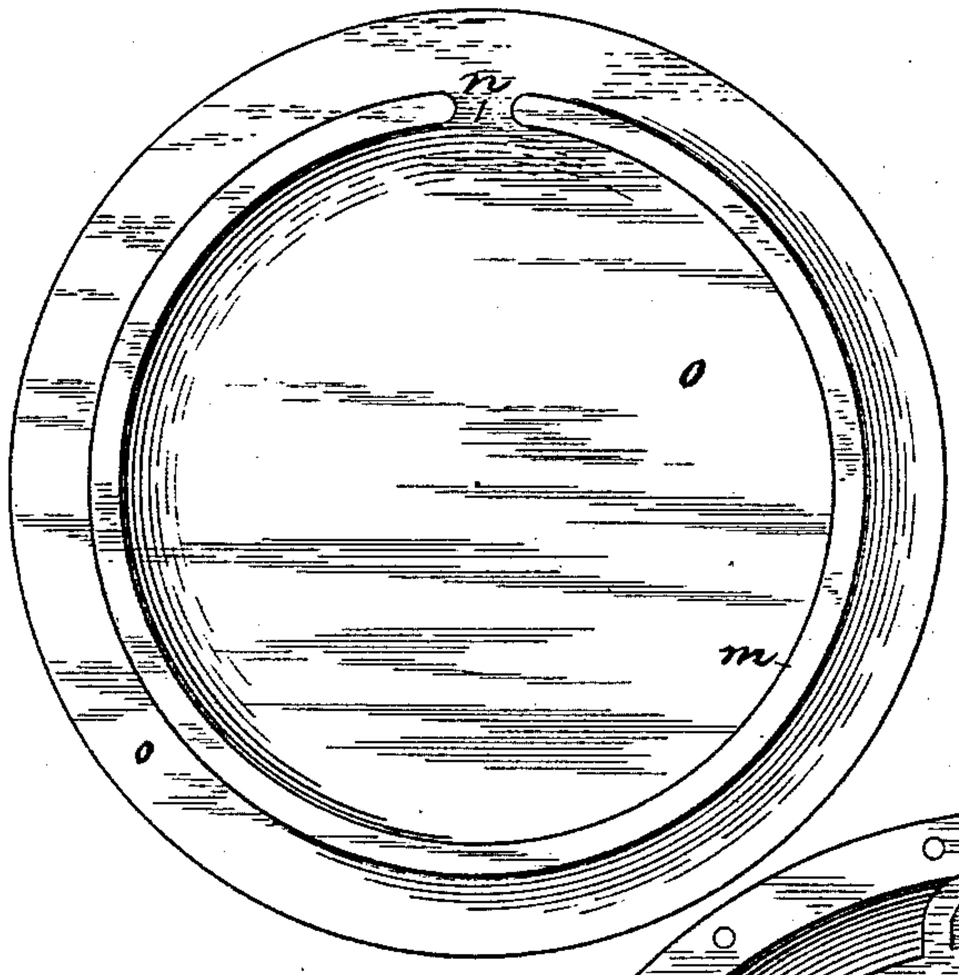
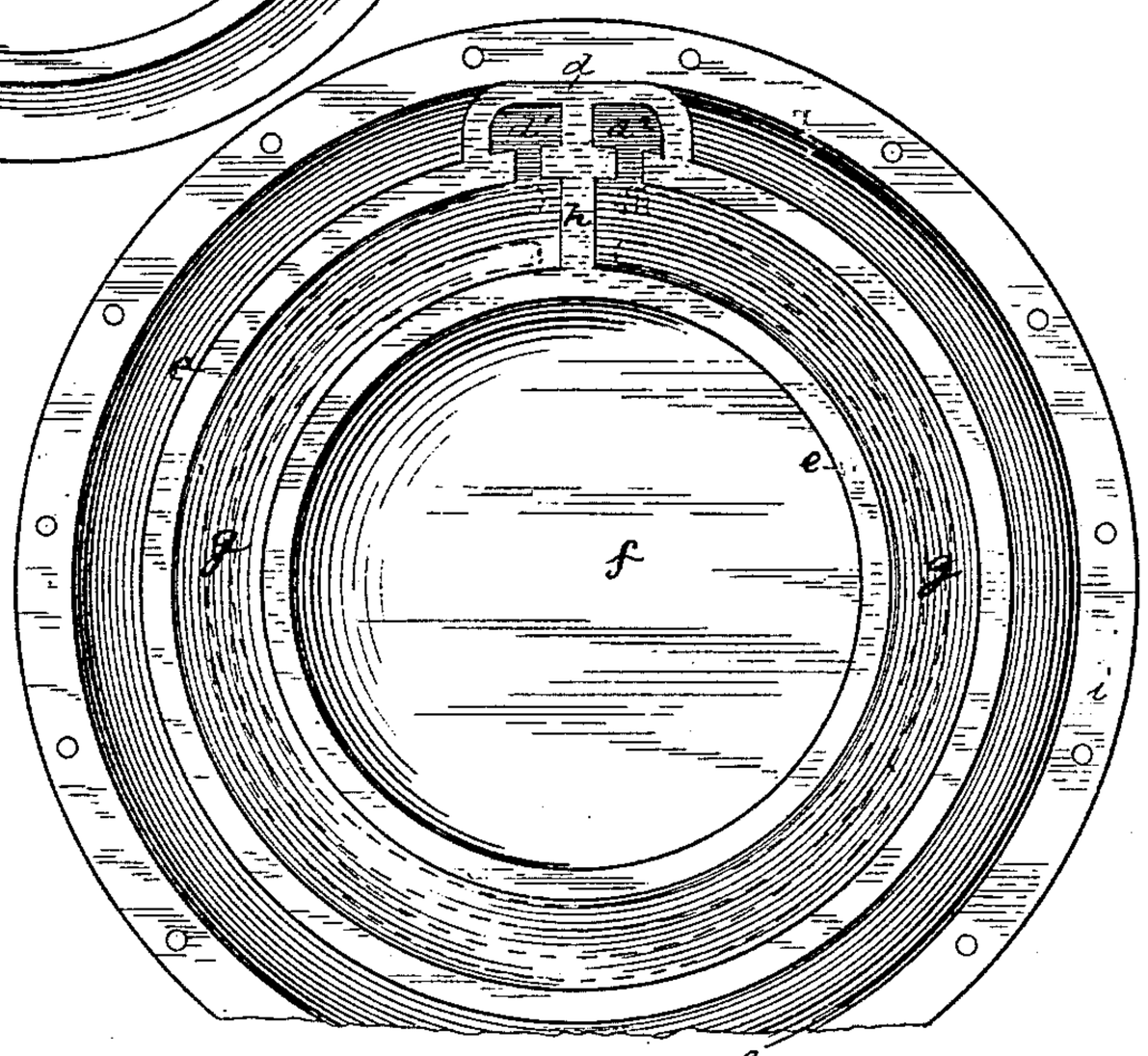


FIG.

FIG. 6.



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UNITED STATES PATENT OFFICE.

EDWARD C. JOHNSON, OF KEOKUK, IOWA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 453,643, dated June 9, 1891.

Application filed September 11, 1890. Serial No. 364,665. (Model.)

To all whom it may concern:

Be it known that I, EDWARD C. JOHNSON, residing at Keokuk, in the State of Iowa, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to cycloidal engines having vertical cylinders. The engine illustrated has a single cylinder and single-acting piston.

The object of the invention is to produce a cycloidal engine with connections from the piston to the driving-shaft and a guiding-fulcrum from which the piston swings in its movement, and also to improve the construction of the engine and casing.

Figure 1 is a plan of the engine, part of the piston-head or cover being broken away. Fig. 2 is a vertical section through the center of the piston and casing. Fig. 3 is a detail of the link. Fig. 4 is a section of the piston and gear, partly broken away. Fig. 5 is a bottom plan of the piston. Fig. 6 is a top plan of cylinder, partly broken away.

The reference-letter *a* indicates the supporting-base of the engine, and *b* the cylinder supported thereon. The cylinder *b* has an outer annular casing *c* with a steam-chest *d* at one side and an inner ring of the same height as the casing. The inner circular chamber *f* may be empty or steam may be permitted to enter, so as to balance the piston. The rings *c* and *e* are connected at the side of the casing next the steam-chest by the partition *h*, which partition crosses the chamber *g*. The outer upper edge of the ring *c* has a flange *i* to receive the cylinder head or cover *k*. A ring or broken hollow cylindrical piston *m* enters the chambers *g*, the width of the ring being the same as that of the walls *e c* and its diameter such that when placed in chamber *c* the outer face of the ring will rest against the outer casing *c* at one side, while the inner face of the ring rests against ring or wall *e* at the other side of the engine. The ring *m* is broken, leaving a space *n* a little wider than the thickness of partition *h*, and a disk *o* surmounts the ring and projects at each side thereof. The disk *o* is surmounted by a cover *k*, which cover is cut away at its central portion, and a ring *p* is secured to the inner edge of the cover having a downturned flange *p'*. The ring *p* is held to the cover by bolts p^2. A ring *q* lies between the inner edge of the cover *k* and the flange *p'* and projects down onto the disk *o* of the piston. Packing *r* serves to close the ring *q* closely against the top of cover *o*. The steam-space outside the packing-ring *r* above the disk should about equal the under surface of said disk exposed to pressure, so that the piston will be balanced.

The central part of piston-disk *o* has an annular internal gear-piece *s* secured thereto concentric to the disk *o*. The shaft *t* has its bearings *t'* in cross-bars *u* above the cover. The bearing *t'* is long to relieve the shaft *t* from tendency to cramp. The end of shaft *t* next the disk *o* has a pinion V attached.

The piston-disk *o* has an upwardly-projecting pin *w*, which enters one end of a swinging link *x*, the other end of the swinging link *x* being pivoted to the cover *p* by a pivot *y*. The piston-ring *m* is eccentric to the chamber *g*. Chamber *g* has an entrance-port *d'* and an exhaust-port d^2 through the steam-chest *d*. The steam-chest *d* has a port d^3, through which steam enters. The steam bears the piston-ring across the chamber *g*. Steam enters said chamber first outside and then inside the ring *m*, bearing on the ring and rocking disk *o* about partition *h*, the link *x* connecting the piston to the fulcrum *y*. The oscillating movement of the disk *o* causes the teeth of gear *s* to engage the teeth of gear V and drive said gear V and the shaft *t*. The engagement of the teeth of gear *s* with gear V is continuous, but the teeth engage only on one side at a time. The gear *s* has more teeth than gear V (being larger in diameter) and each oscillation of the disk *o* moves the gear V one tooth. Gear V being attached to shaft *t*, said shaft will turn with said gear.

The disk *o* overhangs ring *c* so far that the edge of said ring is covered when disk *o* moves with its ring-piston across the casing. The steam enters space s^3 above the disk and between the outer edge of cover *k* and the ring *q*, serving to balance the pressure on disk *o*. The steam passes from the outer to the inner

side of ring *m* alongside the partition *h*, or ports may be made through the ring near the space *n*.

The single-acting engine is very simple. A compound cycloidal engine of the vertical type may also be made.

What I claim is—

1. In a steam-engine, the gyrating cycloidal broken piston-ring attached to a disk and working eccentrically in a divided annular fixed chamber or cylinder and a ring connected to the cover and bearing on this disk, substantially as described.

2. The combination of the fixed cylinder and gyrating piston, substantially as described, the cover, and a ring secured to the cover and having its edge covered by a packing and supported by a flange attached to the cover, so as to bear on the head of the piston, substantially as described.

3. The combination of the divided annular steam-chamber, the broken-ring piston secured to a disk and resting in said chamber, and a link pivoted to said disk and to the cover and serving as a guiding-fulcrum, substantially as described.

4. The combination, with the divided cylinder, of the broken-ring piston therein and attached to a disk covering said cylinder, and a movable link pivoted to the disk and cover or casing, substantially as described.

5. The combination of the divided annular fixed cylinder, broken-ring piston attached to a disk overlying the cylinder and gyrating therein, a ring-cover over the outer edge of the piston-disk, and a ring within the cover, bearing on the disk.

6. The divided annular fixed cylinder, the broken-ring piston arranged to gyrate therein, and a gear attached to the gyrating piston and arranged to engage another gear on a suitable support or driving-shaft, substantially as described.

7. The divided annular fixed cylinder, the broken-ring piston eccentric to said cylinder and having a disk provided with an internal gear, and a shaft concentric with the cylinder, supported in bearings above the disk and having a pinion thereon, substantially as described.

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

EDWARD C. JOHNSON.

Witnesses:

W. A. BARTLETT,

PHILIP MAURO.