(No Model.) 2 Sheets—Sheet 1.

E. C. JOHNSON.

STEAM ENGINE.

No. 453,642. Patented June 9, 1891.

FIG. 1.

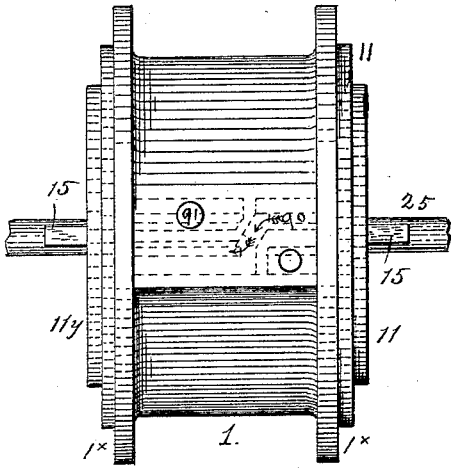


FIG. 6.

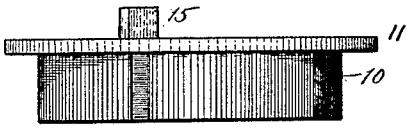


FIG. 3.

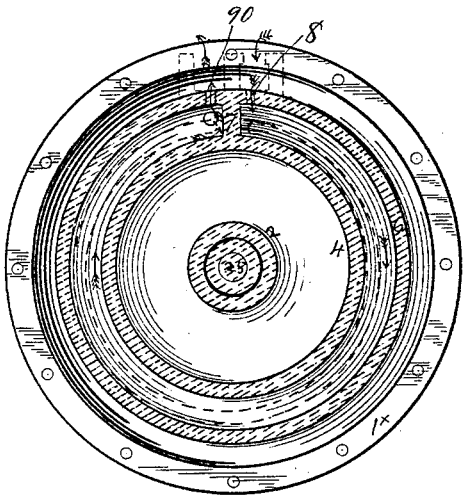


FIG. 2.

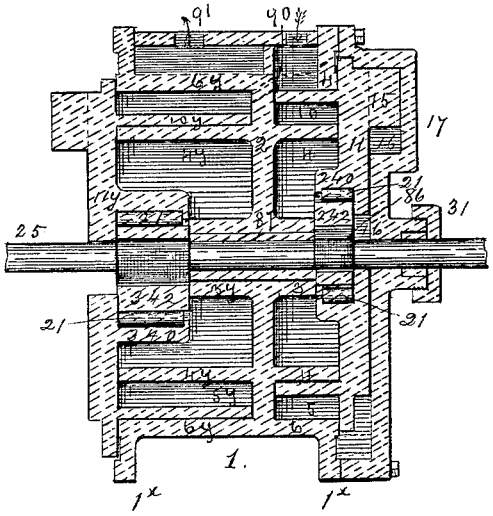
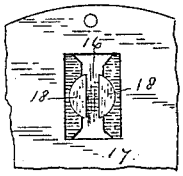


FIG. 7.



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(No Model.) 2 Sheets—Sheet 2.

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STEAM ENGINE.

No. 453,642. Patented June 9, 1891.

FIG. 4.

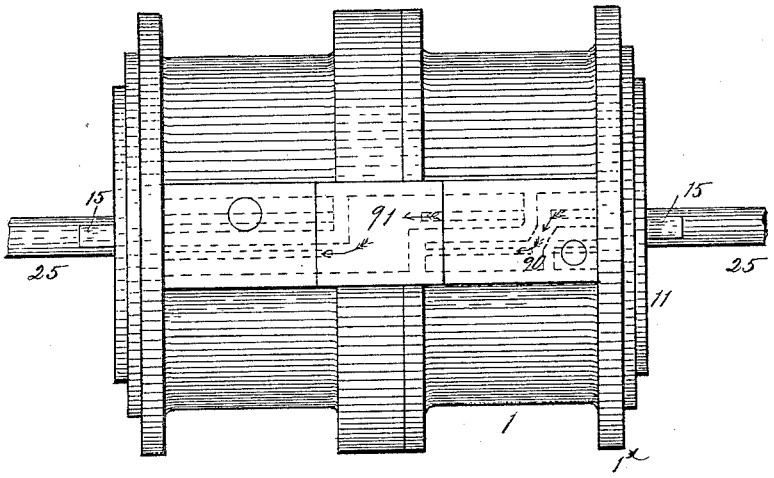
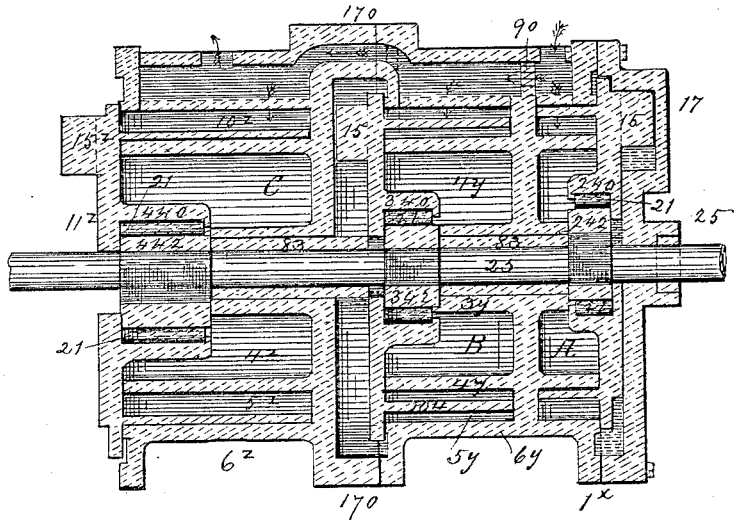


FIG. 5.



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UNITED STATES PATENT OFFICE.

EDWARD C. JOHNSON, OF KEOKUK, IOWA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 453,642, dated June 9, 1891.

Application filed September 11, 1890. Serial No. 364,664. (No model.)

To all whom it may concern:

Be it known that I, EDWARD C. JOHNSON, residing at Keokuk, in the county of Lee and 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 or gyratory steam-engines of the compound or multiple expansion variety.

The object of the invention is to produce a compound or multiple expansion engine of the cycloidal type in which the steam shall be controlled in its passage without other valves than the pistons of the engines; also, to connect the cylinders to the shaft by means of eccentrics; also, to improve various parts of the engine.

Figure 1 is a plan of a compound engine, showing the cylinders, pistons, and shaft with cylinder-heads removed. Fig. 2 is a central vertical section of the cylinders, pistons, and connections with one cylinder-head removed. Fig. 3 is an end elevation of one of the cylinders, one position of the ring piston being shown in dotted lines. Fig. 4 is a plan of a triple-expansion engine with cylinder-heads omitted. Fig. 5 is a vertical central section of same, one cylinder-head omitted. Fig. 6 is a side elevation of piston. Fig. 7 is detail plan and partial section of the rockers and chamber in which the piston-guide works.

The numeral 1, Figs. 2 and 3, indicates the supporting-base of the compound engine. The cylinder supported on said base has a central partition 2. At each side of this partition there is a hub 3 and 3^y, extending out from the plate. Rings 4 and 4^y project from the base or partition at a distance from the hubs, and rings 6 and 6^y surround these last rings, forming a casing and leaving chambers 5 and 5^y between. The chamber 5^y is deeper than chamber 5, and each chamber 5 and 5^y is partitioned by a cross-plate 7. The chambers 5 and 5^y are therefore a little less than complete annular chambers.

One end of chamber 5 has an inlet-port 8. The other end has an exhaust-port 90, which leads to the larger annular chamber 5^y.

The chamber 5 contains piston 10. This piston is a broken annulus projecting from a disk or plate 11. The ring 10 is of the width of the rings 4 and 6, so that when the ring 10 is in the annular chamber the disks 11 will rest on top of rings 4 and 6 of the cylinder, and the breach 12 in the ring straddles the partition 7. The ring piston is of such diameter that its outer surface lies against ring 6 at one side of the cylinder, while its inner face lies against ring 4 at the other side of the cylinder. Ring 10 will be eccentric to rings 4 and 6, and disk 11 will be eccentric to the cylinder. The break 12 is preferably somewhat wider than the thickness of partition 7, or steam-ports may pass through the ring 10 near the break. The disk 11 has a projection 15 extending from its face opposite the break. This projection or guide rests between rockers 18 18 in recess 16 in the casing 17. The casing or cylinder-head 17 is bolted or otherwise secured to the flange 1^x of the cylinder, and has a stuffing-box 31, through which the central shaft 25 passes. The central part of disk 11 has an inwardly-projecting ring 240. This ring contains anti-friction rolls or cylinders 21, which rest on an eccentric-disk 242, attached to the shaft 25, and adjustable on a squared portion 86 of said shaft by means of shims. The shaft 25 rests in a sleeve 87 in hubs 3 and 3^y.

Now if steam be admitted to the chamber 5 it will swing the ring piston 10 from its support 15, and as its movement is eccentric the ring or collar 240, bearing on eccentric 242, (through the anti-friction rolls 21,) tends to rotate said eccentric and the shaft 25 with it.

Piston 10^y in the chamber 5^y is of the same construction of the piston described, except as to width, and is similarly supported, guided, and connected to shaft 25, except the greater projection of eccentric 342 is on the opposite side of said shaft from that of eccentric 242.

The steam from chamber 5 exhausts through port 90 to the chamber 5^y, where it is allowed to expand in the larger chamber, and pressing its piston conveys movement to the shaft by means of the disk 11^y engaging the eccentric. The steam from chamber 5^y exhausts through chamber-port 91. The eccentrics being on opposite sides of the shaft, the pistons nearly balance each other.

A triple-expansion engine on the same principle is shown in Figs. 4 and 5. The piston-

head 170 is practically a cover like the cover 17, but is continued at its opposite face to form chamber 5^z by means of rings 4^z and 6^z. The piston 10^z works therein and is connected to the disk 11^x, as has been described of other pistons.

The chamber 5^z is deeper than either chamber 5 or 5^y, and the piston of course corresponds. The steam is therefore permitted to expand still more in chamber 5^z than in the chamber 5^y. The eccentrics 242, 342, and 442 are relatively connected to the shaft 25 in such manner that the pistons will about balance each other on the shaft. The collars 240, 340, and 440 correspond, and anti-friction rolls are preferably interposed in each case. The shaft 25 is surrounded by split sleeves 83 within the several hubs of the steam-cylinders. Steam will be admitted to the space A, B, and C to balance the pistons and will generally be admitted to a corresponding area at the opposite side of the piston-disks, thus balancing the pressure.

It will be understood that the addition of cylinders may be carried on as far as desirable.

What I claim is—

1. A cycloidal engine of the character described, having a plurality of steam-cylinders with divided annular chambers, a plurality of broken-ring pistons fitted to such chambers, as described, and having disks covering the ends of the cylinders, the chambers successively increasing in capacity, and connecting-ports leading from a smaller into a larger steam-chamber, substantially as described.

2. The combination, with the divided annular steam-chamber, of a broken-ring piston embracing the partition of the chamber, a disk attached to the ring and overlapping the cylinder end, a collar on said disk, and an eccentric-piece on the shaft, on which said collar bears, substantially as described.

3. The cylinders having a single central partition and fixed hubs and rings projecting in opposite directions therefrom, forming broken annular chambers of the character described, and two pistons, one at each side of the central partition, each piston having movement about its own hub and in its own chamber, in combination, substantially as described.

4. The combination, with the central shaft, of the plurality of eccentrics secured thereto and projecting with their greatest extension in different directions, and the plurality of pistons (working in cylinders, as described) of unequal capacity and arranged to balance on the eccentrics, substantially as described.

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

EDWARD C. JOHNSON.

Witnesses.
W. A. BARTLETT,
PHILIP MAURO.