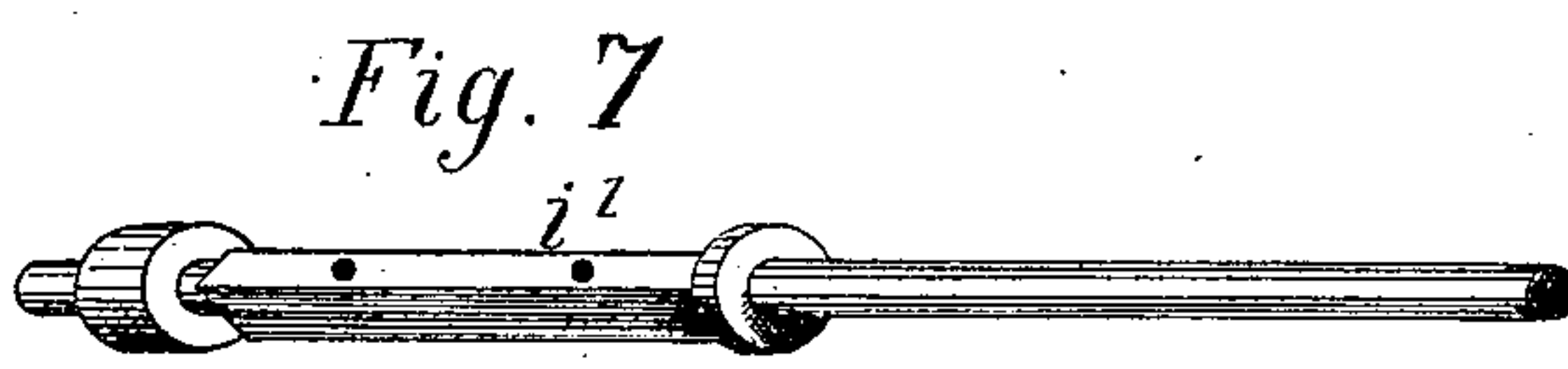
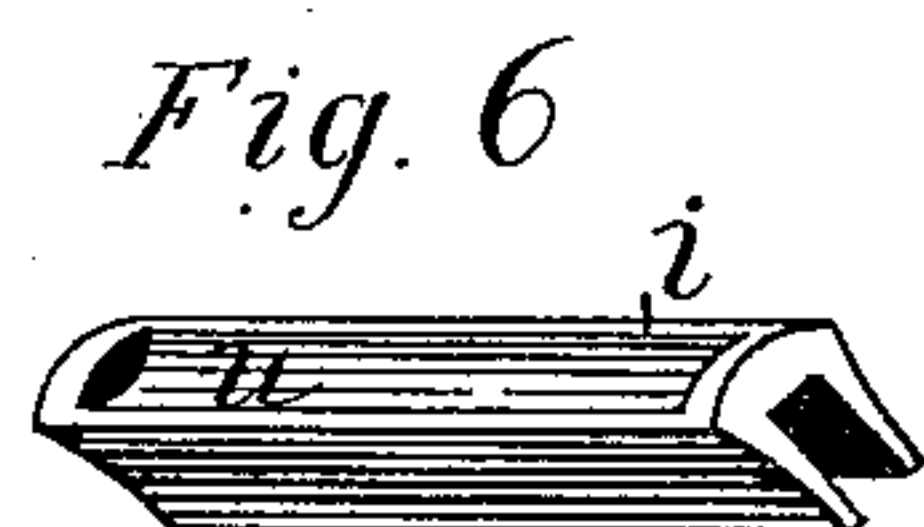
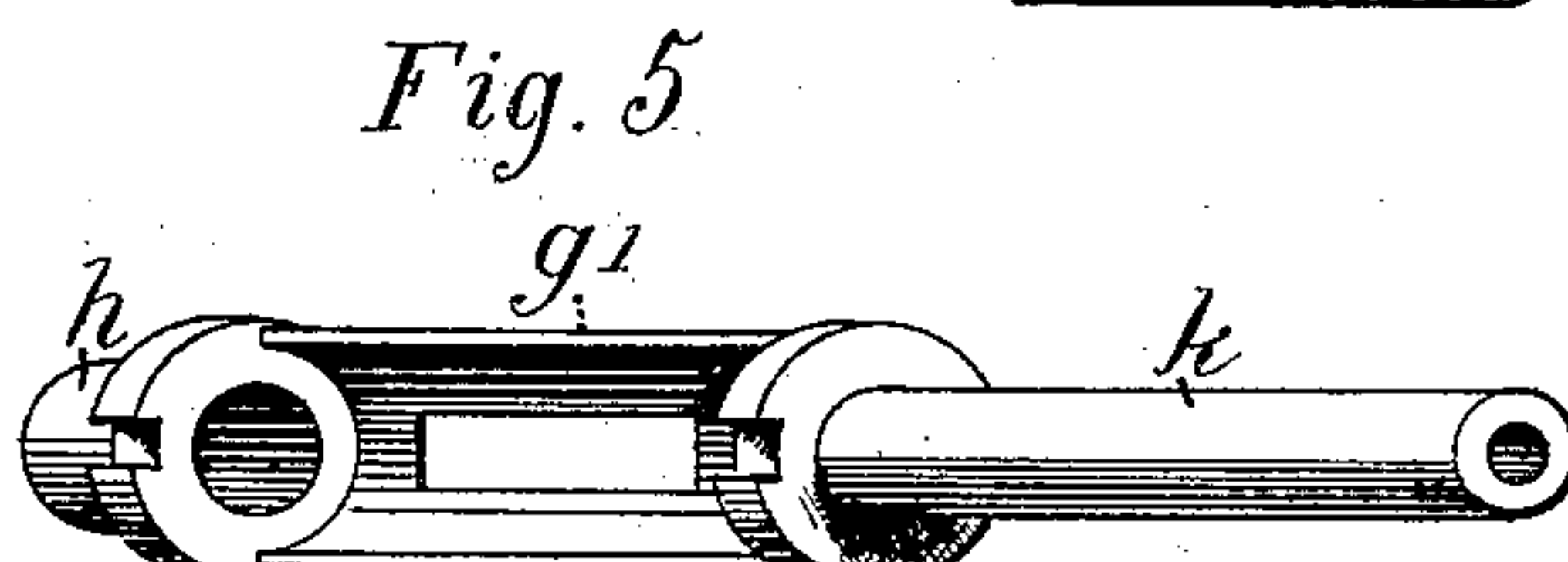
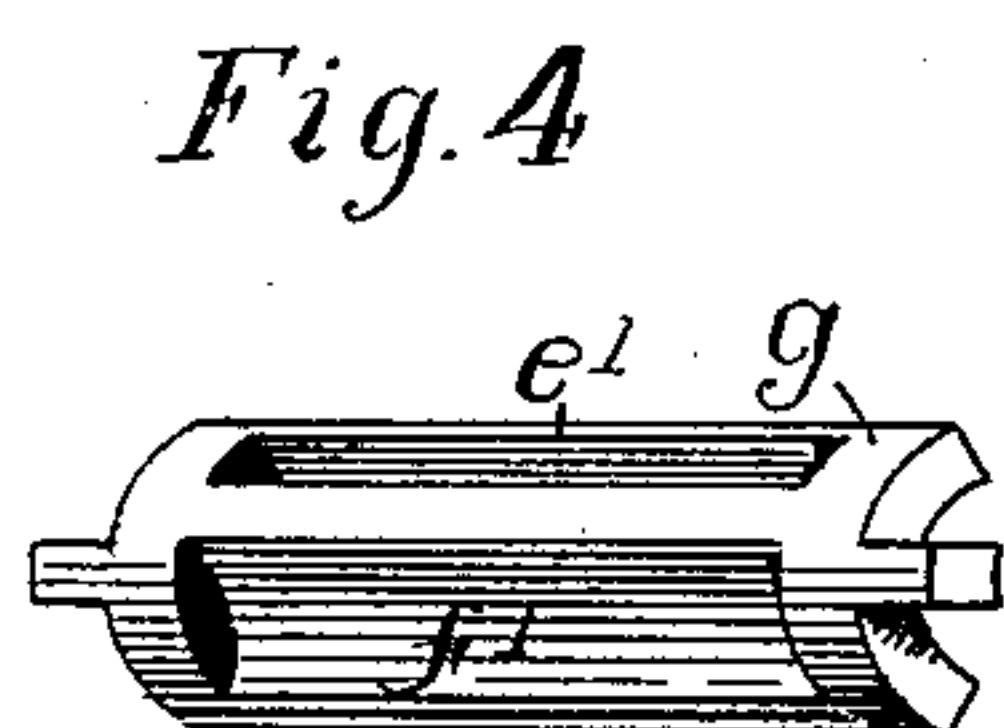
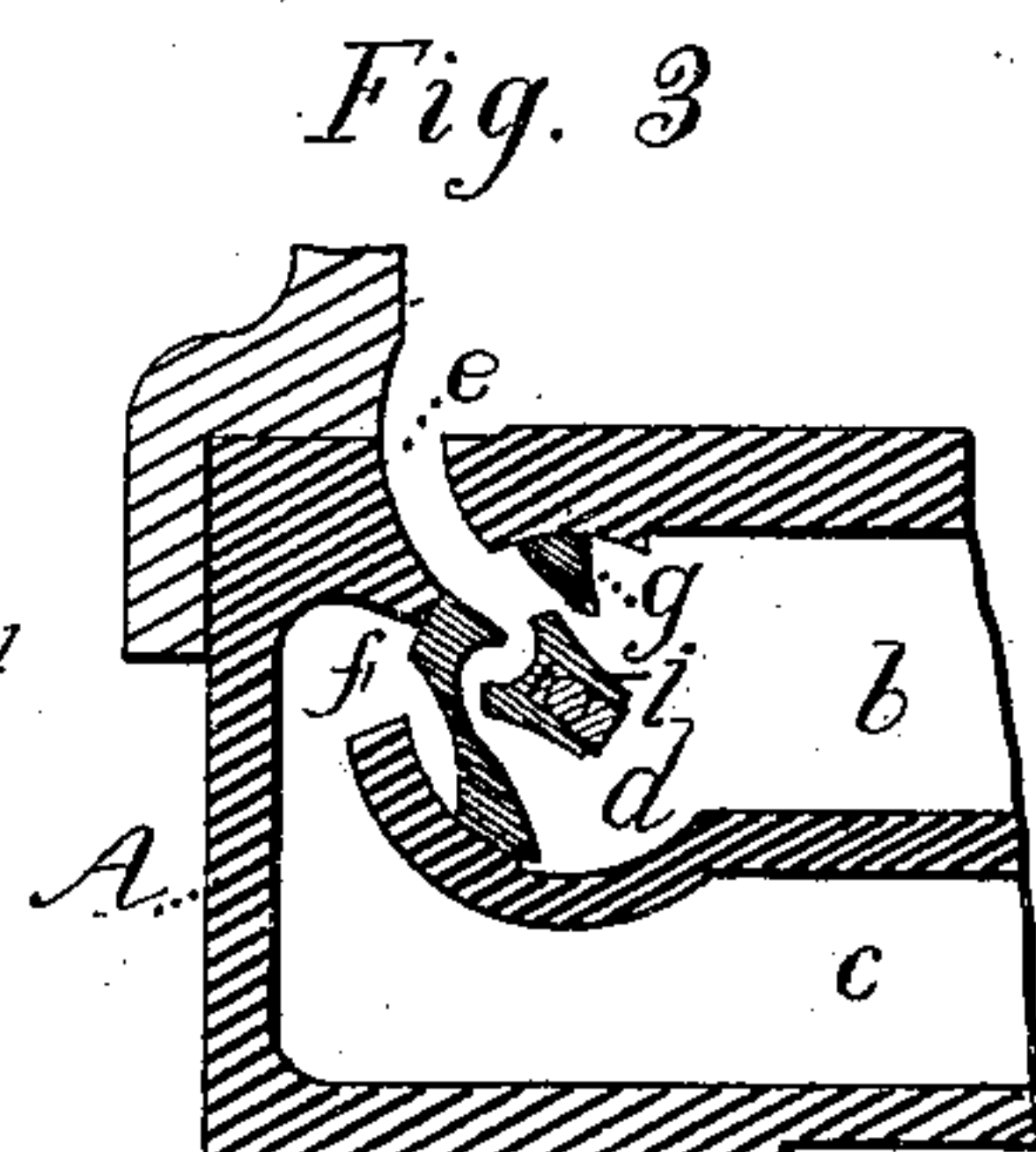
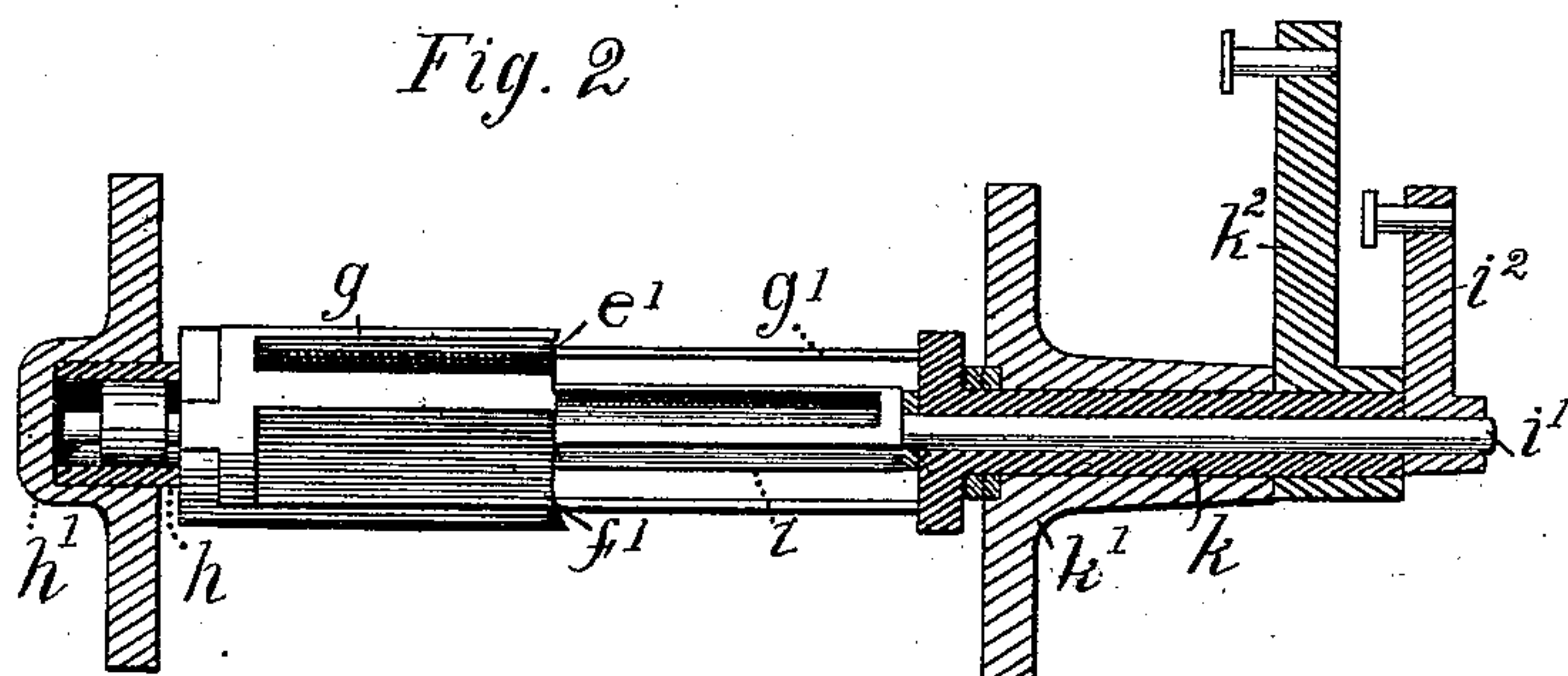
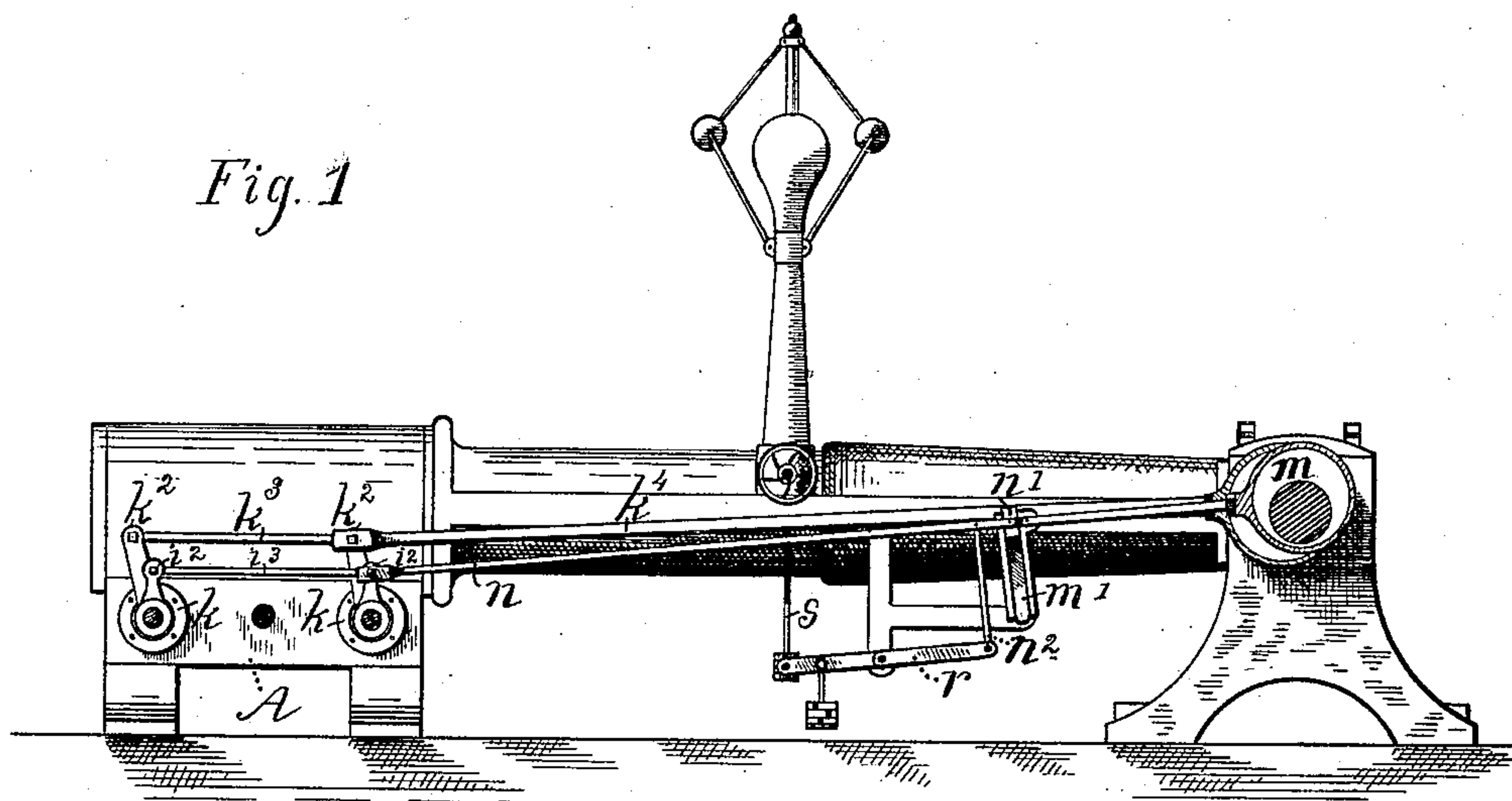


(No Model.)

N. W. TWISS.
VALVE GEARING.

No. 356,512.

Patented Jan. 25, 1887.



WITNESSES:
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NELSON W. TWISS, OF NEW HAVEN, CONNECTICUT.

VALVE-GEARING.

SPECIFICATION forming part of Letters Patent No. 356,512, dated January 25, 1887.

Application filed June 30, 1886. Serial No. 206,745. (No model.)

To all whom it may concern:

Be it known that I, NELSON W. TWISS, a resident of the town of New Haven, in the State of Connecticut, have invented new and useful Improvements in Valve-Gearing for Steam-Engines, of which the following is a specification.

The object of my invention is to provide an improved automatic cut-off-valve gearing for steam-engines; and the invention consists in the novel arrangement and combination of the valves and valve-driving gear, as hereinafter more fully described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a view of an engine embodying my improved gearing. Fig. 2 is a side elevation, partly in section, of the valves and their drivers. Fig. 3 is a vertical section longitudinally through the center of the steam-chest, showing an end-wise section of the valves. Fig. 4 is a view of the main valve. Fig. 5 is a view of the main-valve driver. Fig. 6 shows the cut-off valve, and Fig. 7 is a view of the cut-off-valve driver.

Referring to the drawings, A designates the steam-chest, which is located on the lower side of the cylinder and divided into two compartments, *b* *c*, forming, respectively, the steam and exhaust chambers. At each end of the steam-compartment *b* is a circular chamber, *d*, from which a port, *e*, leads into the cylinder, and another port, *f*, leads into the exhaust-compartment. The main valves are fitted to the cylinder-seats of the valve-chambers, and each has a port, *e'*, adjacent to the steam-port *e*, and a depression, *f*, adjacent to the exhaust-port *f*. Each valve is fitted in a driver, *g*, and held in place by rectangular projections at the ends, which fit corresponding recesses in the heads of the drivers. Each of the drivers has a short hollow journal, *h*, which projects on the front of the steam-chest, and is received in a suitable cap or bonnet, *h'*, bolted over the end of the valve-chamber. At the opposite end of each driver is a hollow stem or shaft, *k*, which projects on the back of the steam-chest, and is journaled through a suitable cap or bonnet, *k'*, bolted over the chamber at that end. Each of the stems receives a crank or lever, *k²*, and the cranks are connected by a rod, *k³*, and operated by the main eccentric-rod *k⁴*.

A cut-off valve, *i*, is arranged within each of the main valves concentric therewith, and fitted upon the rectangular part of a driver, *i'*, the stem of which is journaled through the hollow stem of the main-valve driver, and receives a valve-crank, *i²*. The driver is entered through the hollow stem *h*, and is provided at that end with a collar, which is journaled within the stem. Suitable friction-collars are arranged on the cut-off-valve driver stems, and also on the main-valve-driver stems to receive the steam-thrust on the drivers.

The cut-off valves oscillate over the ports *e'* in the main valves, and are free to adjust themselves on the seats thereof. The cut-off-valve cranks *i²* are connected by a rod, *i³*, and are driven by an eccentric, *m*, on the main shaft. The eccentric imparts motion to an oscillating link, *m'*, which is pivoted to a stationary part of the engine. A rod, *n*, connects the valve-cranks with the link, and is pivoted to a block, *n'*, which is fitted to slide in the link, so that it may be adjusted at different distances from the center of oscillation of the link, and thereby adapted to vary the throw of the cut-off valve. A rod, *n²*, is pivoted to the cut-off-valve rod *n* near the end which is attached to the link-block, and connected to a beam or lever, *r*, which is hinged on a stationary part of the engine. The opposite end of the beam is connected to the governor-rod *s*, which is moved up and down by the action of the governor. The movement of the governor therefore raises or lowers the valve-rod *n* at the end which is connected to the link *m'*, and the throw of the cut-off valve is thereby varied according to the distance of the link-block from the center of oscillation of the link. The cut-off eccentric is so adjusted on the shaft that when the link-block is at the upper end of the link, as shown in Fig. 1, the valve has its greatest throw.

The cut-off valve allows free passage of steam through the port in the main valve during about five-eighths of the stroke. When the link-block is near the center of oscillation of the link, the cut-off valve remains nearly stationary and in such position that the port in the main valve oscillates upon it and is closed by it while over the steam-port *e'* into the cylinder, so that no steam is admitted to the piston. To effect this movement of the valves the cut-

off eccentric requires to be placed at an angle of about thirty degrees in advance of the main eccentric.

Each of the cut-off valves has a depression, *u*, in its face, and a corresponding depression is formed in the seat of the main valve, so that the opening for the admission of steam is always twice the amount of the valve movement.

It will be seen that the ratio of steam-opening to valve movement may be still further increased by multiplying the number of steam-openings from the cut-off valves into the main valves. The speed of the engine may be increased or diminished by adding or removing weights to or from the governor *r*, as shown.

I claim as new and desire to secure by Letters Patent—

1. The combination, with a steam-chest and its cylinder, of a pair of oscillating main valves operated by hollow stems provided with cranks, a rod connecting the cranks, a pair of oscillating cut-off valves, each arranged within and concentric with the main valves and operated by stems journaled through the main-valve stems, and provided with cranks, and a rod connecting the cut-off-valve cranks, all driven by suitable valve motion, substantially in the manner described.

2. In a valve-gear for steam-engines, the combination, with the cylinder and steam-chest, of the main-valve drivers *g'*, provided with the journals *h*, and hollow stems *k*, having the cranks *k²* secured thereon, the main valves *g*, held by the drivers and having the ports *e'* and depressions *f'*, the cut-off-valve stems *i'*, journaled within and concentric with

the main-valve drivers, the cut-off valves *i*, carried upon the drivers, the rods *k³*, connecting the cranks *k²*, and the rods *i³*, connecting the cut-off cranks *i²*, all operated by suitable valve motion, and combined substantially in the manner and for the purpose described.

3. In combination, a pair of oscillating main valves having their valve-stems connected by a rod, *k³*, and operated by the main eccentric, a pair of cut-off valves arranged within the main valve, with their driving-stems journaled through the driving-stems of the main valve and connected by a rod, *i³*, the link *m'*, journaled to a stationary part of the engine and oscillated by a cut-off eccentric, *m*, a valve-rod, *n*, pivoted to a link-block in the link *m'* and connected to the cut-off valves, and the rod *n²*, pivoted to the valve-rod *n* and operated by the governor to vary the oscillation of the cut-off valves, substantially as described.

4. In valve-gear for steam-engines, the combination of the main valves *g*, the main-valve drivers *g'*, cranks *k²*, connecting-rod *k³*, cut-off valves *i*, drivers *i'*, cranks *i²*, connecting-rod *i³*, the main eccentric and the main eccentric-rod *k⁴*, cut-off eccentric *m*, the link *m'*, connected to the cut-off eccentric, the valve-rod *n*, connected to the link-block *n'*, and the rod *n²*, operated by the governor, all combined substantially in the manner and for the purpose specified.

NELSON W. TWISS.

Witnesses:

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EDWIN C. DOW.