(No Model.) 4 Sheets—Sheet 1.

N. W. TWISS.

STEAM ENGINE VALVE.

No. 473,486. Patented Apr. 26, 1892.

Fig. 1

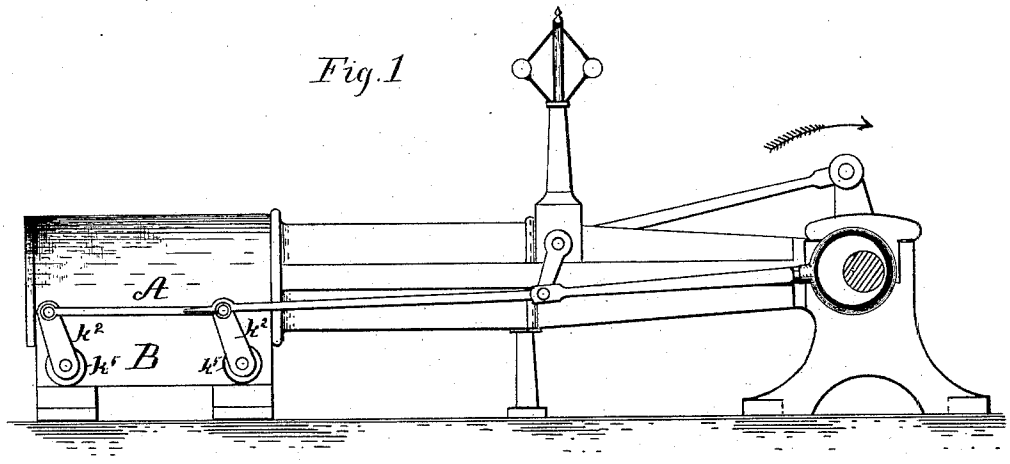


Fig. 2

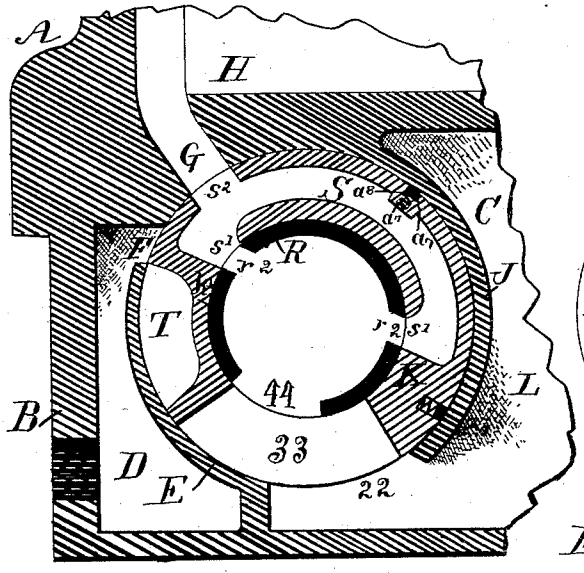


Fig. 3

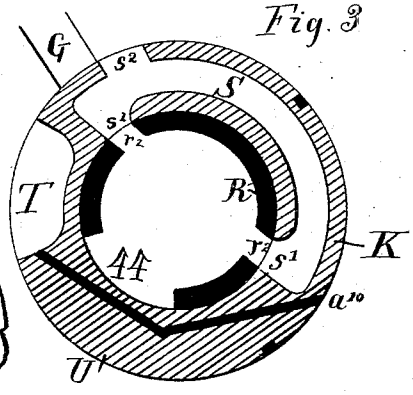
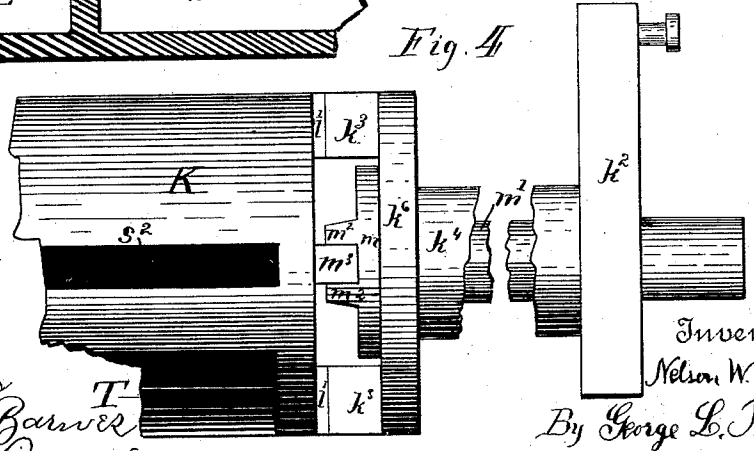


Fig. 4



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(No Model.) 4 Sheets—Sheet 2.

N. W. TWISS.

STEAM ENGINE VALVE.

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Fig. 5

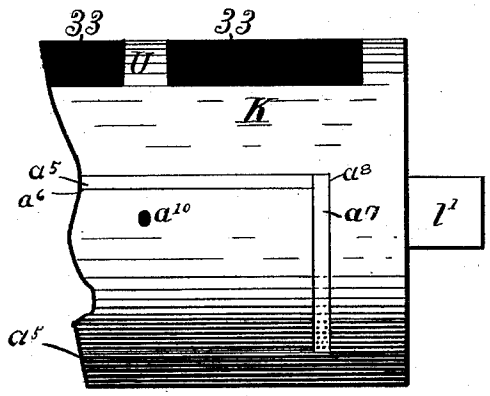


Fig. 6

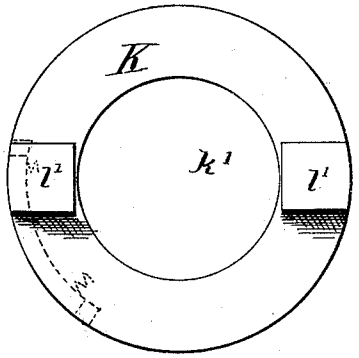


Fig. 7

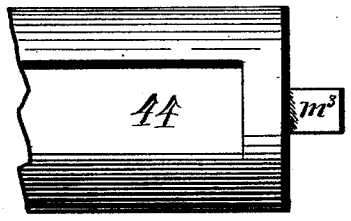


Fig. 8

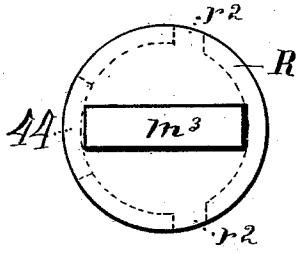


Fig. 9

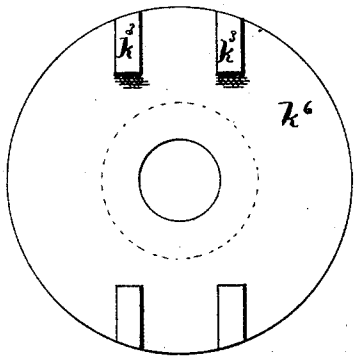
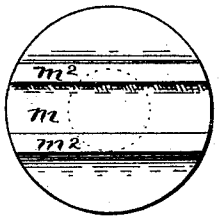


Fig. 10



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N. W. TWISS.

STEAM ENGINE VALVE.

No. 473,486. Patented Apr. 26, 1892.

Fig. 11

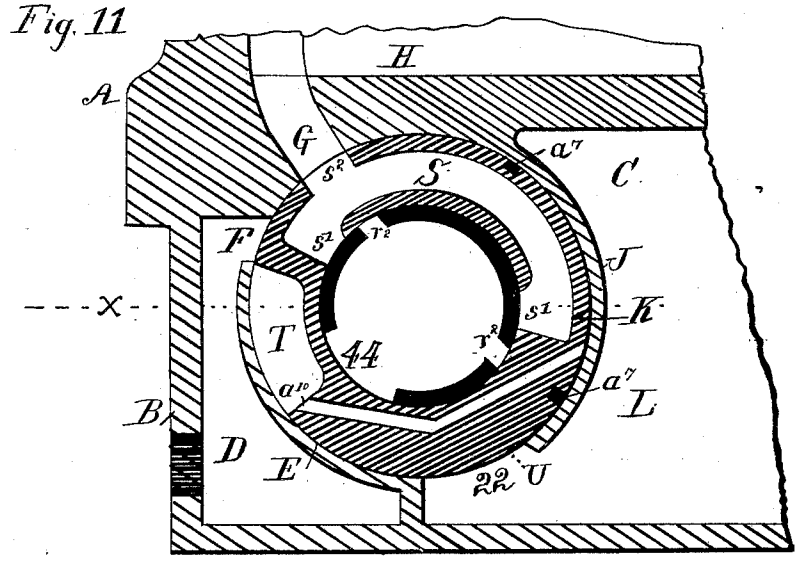
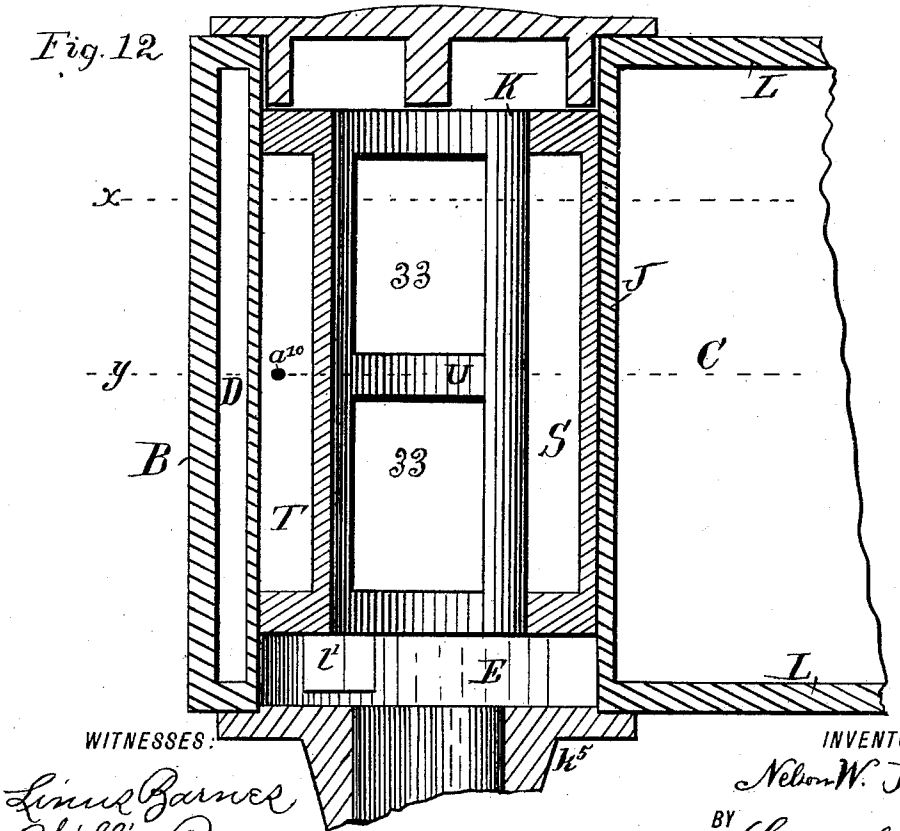


Fig. 12



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STEAM ENGINE VALVE.

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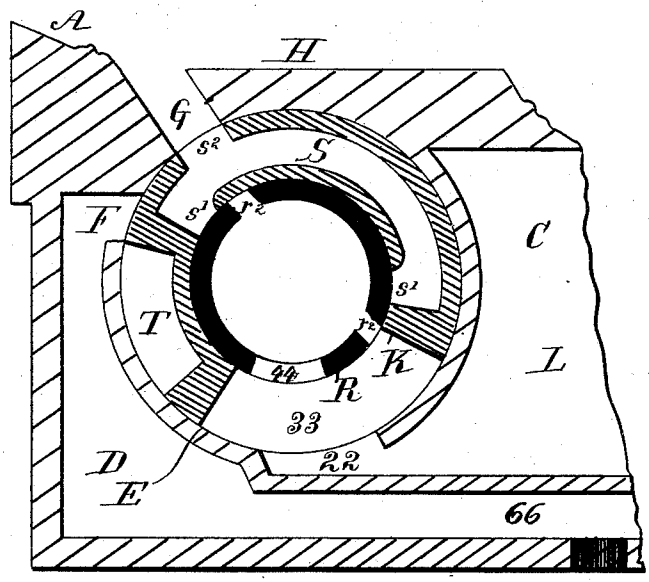
Fig. 13



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UNITED STATES PATENT OFFICE.

NELSON W. TWISS, OF NEW HAVEN, CONNECTICUT.

STEAM-ENGINE VALVE.

SPECIFICATION forming part of Letters Patent No. 473,486, dated April 26, 1892.

Application filed June 27, 1891. Serial No. 397,742. (No model.)

To all whom it may concern:

Be it known that I, NELSON W. TWISS, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Steam-Engine Valves, of which the following is a specification.

My invention relates to steam-engine valves of that class in which an oscillating single-acting main valve at each end of the cylinder is combined with an independently-oscillating cylindrical cut-off valve vibrating within the main valve and adapted to admit steam from the interior outward through the main valve to the cylinder-port. Letters Patent of the United States No. 212,285, granted to me February 11, 1879, are for valves of this class, upon which my present invention is an improvement, having for its object to adapt the construction both of the main and cut-off valves to insure practically-balanced steam-pressures upon them and to provide for large steam-openings relatively to the valve's travel, all as hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a side view of an engine provided with valves of the class embodying my improvements. Fig. 2 is a cross-sectional view through the valve, and steam-chest at that end of the cylinder farthest from the crank, the main valve being represented wide open and in the position shown in Fig. 1 and the cut-off valve also being open. Fig. 3 is a view corresponding to Fig. 2, but showing the main valve in closed position on the point of opening and with the cut-off valve in the position in which it travels with the main valve up to the point of cut-off. Fig. 4 shows parts of the valves and their drivers in side elevation. Figs. 5 and 6 are side and end views of the main valve, showing the driving projections. Figs. 7 and 8 are side and end views of the cut-off valve, showing the driving projection. Fig. 9 is an inner end view of the main-valve driver, and Fig. 10 is an inner end view of the cut-off-valve driver. Fig. 11 is a sectional view similar to Fig. 2, but showing the cut-off valve closed; and Fig. 12 is a horizontal section through the main valve and steam-chest on the line x, Fig. 11, the dotted lines x and y therein denoting the sectional planes on which the Figs. 2 and 13 and Figs. 3 and 11 are respectively taken. Fig. 13 shows a modification in which the exhaust-chambers are joined by a lengthwise chamber beneath the steam-chamber.

Referring to the drawings, A in Fig. 1 designates an engine-cylinder, and B denotes the steam-chest beneath the cylinder, which is divided into the usual steam and exhaust compartments C and D, (shown in the sectional views, Figs. 2 and 11,) which represent the end of the cylinder farthest from the crank. At each end of the steam-chest is a circular horizontal transverse valve-chamber E, directly at the end of the steam-compartment C and adjacent to the exhaust-chamber D at the end of the cylinder, from which suitable pipe connections may be made to the atmosphere or the condenser, and, if desired, both of the exhaust-chambers may be joined by a lengthwise passage 6 6 beneath the steam-chest. The usual exhaust-port F opens from the valve-chamber into the said exhaust-chamber and the steam-port G provides communication from the valve-chamber to the cylinder-space H. From the steam-compartment steam is admitted to the valve-chamber through an opening 22 in the bottom thereof, as shown.

The main valve K is of annular cross-section, having a concentric cylindrical chamber k' throughout for the reception of the cut-off valve R, fitting and adapted to oscillate therein. Said main valve is formed with a passage or steam way S, opening into the chamber k' through suitable ports s', which are not located diametrically opposite each other, but are arranged a little to one side of a diametral plane through the valve. A port s^2 opens from the said passage S to the outside of the valve in position to coincide with the steam-port G, opening into the cylinder. An exhaust-cavity T is provided on the side of the valve adjacent the end of the cylinder, which is adapted to cover or span the ports G and F and form a communication from the cylinder-space H to the exhaust-compartment D. In the lower side of the valve a port or opening 33 is adapted to admit steam from the steam-compartment to the interior of the

valve, and said opening is divided into two parts by a transverse bridge U, midway the length of the valve. The cut-off valve R is cylindrical and hollow and is fitted to oscillate in the chamber k' in the main valve. Steam is admitted to its interior through an opening 44, corresponding to the openings 33 and 22 in the main valve and valve-chamber. Nearly-opposite steam-ports r^2 are arranged therein slightly to one side of a diametral plane through the valve and adapted to correspond to the ports s' in the main valve, so that both said ports may open at once, for the purpose hereinafter described. Each main valve is driven by a suitable driver k^6, provided with suitable projections k^3, engaging suitable projections l' on the end of the valve, which driver has a hollow stem k^4, extending out through the bonnet k^5 of the valve-chamber, and carries a crank k^2, which receives motion from the eccentric of the engine and suitable connections, the two valves being coupled together and oscillated as one plain slide-valve in the ordinary and well-known manner, not requiring further description.

The cut-off valve is driven by means of a driver m, having a stem m', journaled within the main-valve stem k^4, and suitable projections m^2, engaging a suitable projection or tongue m^3, which is formed on the end of the valve, as shown in Figs. 7 and 8.

The cut-off valve may be actuated by an ordinary eccentric or by any other well-known means of driving cut-off valves; but the operating devices here contemplated comprise the disengaging cut-off mechanism shown and described in Letters Patent of the United States granted to me February 11, 1879, and numbered 212,285.

The cut-off mechanism forms no part of my present invention and need not be here shown or further described, my present improvement relating to the main and cut-off valves and valve-chambers.

In operation it will be seen that by means of the construction of the ports s' and their uniting-passages S in the main valve and the corresponding ports r^2 in the cut-off valve a given amount of travel of the circumference of the cut-off valve provides twice that amount of steam-opening into the cylinder—that is, the motion of the valve is reduced just one-half for a given amount of steam-opening and the cut-off will be twice as sharply effected as if a single opening of twice the width were employed, and the wear of the cut-off valve will be proportionately reduced. As the openings s' in the main valve are set slightly to one side of a diametral plane therein, the cut-off valve is therefore nearly balanced, but with a sufficient excess of pressure on the back thereof to keep the valve tight against its seat and also automatically compensate for wear. Thus while it is kept tight and firmly seated it is practically balanced and will oscillate in its bearings with minimum friction. The main valve is also sufficiently balanced by means of the devices shown in Figs. 2, 5, and 6, which consist of two longitudinal bars a^5, fitted loosely in corresponding grooves a^6 in the valve on the side opposite from the exhaust-cavity, and segmental parts of circular rings a^7, fitted in corresponding grooves a^8, joining the ends of the lengthwise grooves, the said pieces being jointed together at their corners and held tightly against the surface of the valve-chamber by suitable springs a^9, together with steam-pressure underneath them, thus forming a balancing area, from which steam-pressure is excluded, and any leakage of steam into said area is prevented from accumulating pressure by a relief or drip passage a^{10}, bored through the valve from the said area to the exhaust-cavity T through the bridge U. The said area is proportioned to practically balance the exhaust-cavity of the valve, while insuring its being kept tight upon its seat, over the exhaust and steam ports F G and automatically adjusted to compensate for wear.

I claim as my invention—

1. In steam-engine valves, the combination, with the steam-chest having a cylindrical valve-chamber opening into the steam-compartment and radial ports communicating, respectively, with the exhaust-compartments and steam-cylinder, of an oscillating annular main valve having an exterior exhaust-cavity and steam-port conforming to the ports of the valve-chamber, an opening into the steam-compartment, a passage within extended circumferentially, its annular body communicating with said steam-port, and interior multiports connecting said passage with the central concentric chamber, a hollow oscillating cut-off valve fitting said central chamber and having ports opening from its interior outward corresponding to the internal ports of said main valve, and a suitable opening adapted to receive steam from the steam-compartment, and suitable drivers for operating the said valves, substantially as and for the purpose specified.

2. In steam-engines, the combination of the steam-chest provided with the cylindrical valve-chamber having an opening into the steam-compartment and radial ports communicating, respectively, with the exhaust-compartment and steam-cylinder, an oscillating annular main valve having an exterior exhaust-cavity and steam-port corresponding to the ports of the valve-chamber, an opening for admitting steam into its central chamber, a passage S within its annular body communicating with the external steam-port, and the interior ports s', opening from the central chamber of the valve into said passage S nearly opposite each other, but slightly off from a diametral plane through the valve, substantially as specified, an oscillating hollow cut-off valve fitting within the main valve and having an opening adapted to admit steam into its interior from the steam-com-

partment, and nearly-balanced steam-ports r^2, slightly off from a diametral plane, as specified, and corresponding to the ports s' of the main valve, and suitable drivers or stems engaging and adapted to operate the said valves, substantially as specified.

3. In combination, the steam-chest having a cylindrical valve-chamber E at each end thereof, having the ports 22, F, and G, the annular main valve K, provided with the ports 33 T s^2, passage S, and interior ports s', the cut-off valve R, having the ports 44 and r^2, the main-valve driver k, engaging the valve and provided with a hollow stem journaled in the bonnet of the valve-chamber, the cut-off-valve driver engaging the cut-off valve and journaled in the hollow stem of the main-valve driver, and suitable levers or rock-arms secured on the ends of said driver and adapted to be operated by the valve connections of the engine, substantially as and for the purpose specified.

4. In a cylindrical oscillating steam-valve having steam and exhaust ports, the combination of the longitudinal and segmental packing-bars fitted in grooves within the valve and springs for expanding said bars, forming a balancing area opposite the exhaust cavity, and the valve having a drip or relief passage from said balancing area to the exhaust-cavity, substantially as and for the purpose specified.

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