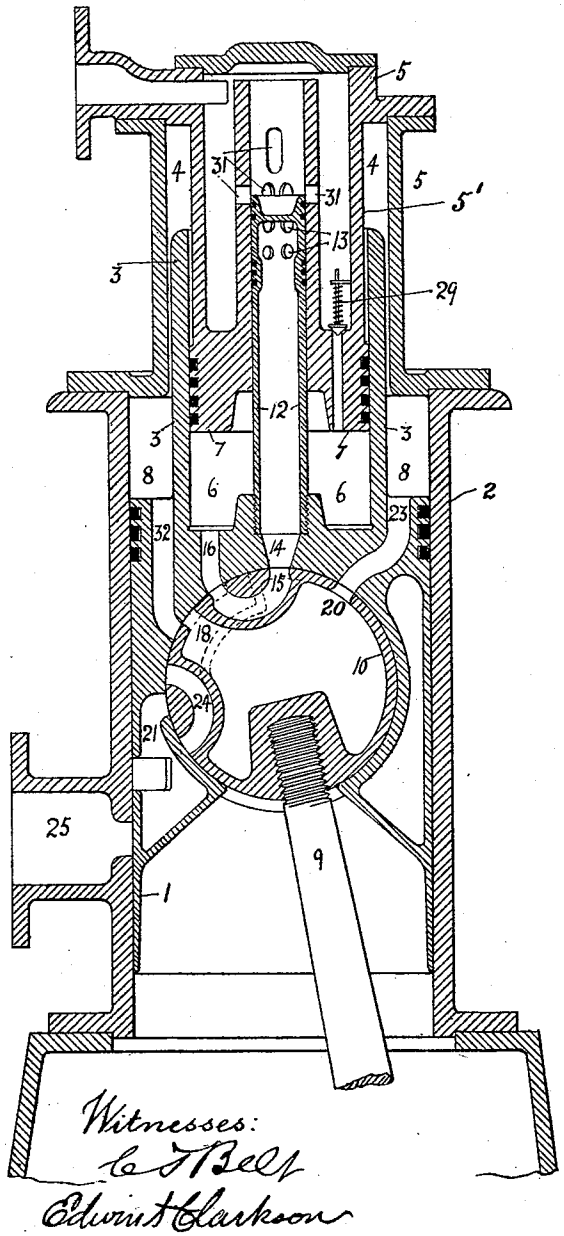
(No Model.) 3 Sheets—Sheet 1.

W. T. LORD.

STEAM ENGINE.

No. 459,407. Patented Sept. 15, 1891.

Fig. 1.



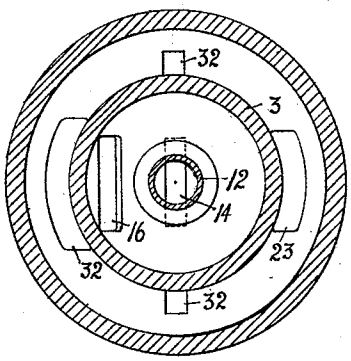


Fig. 2.

Fig. 4.

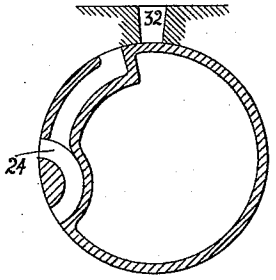
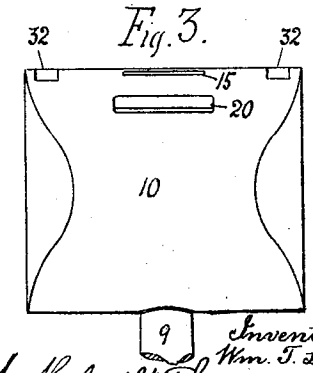


Fig. 3.



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STEAM ENGINE.

No. 459,407. Patented Sept. 15, 1891.

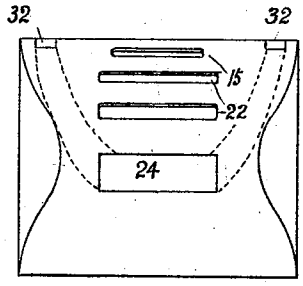
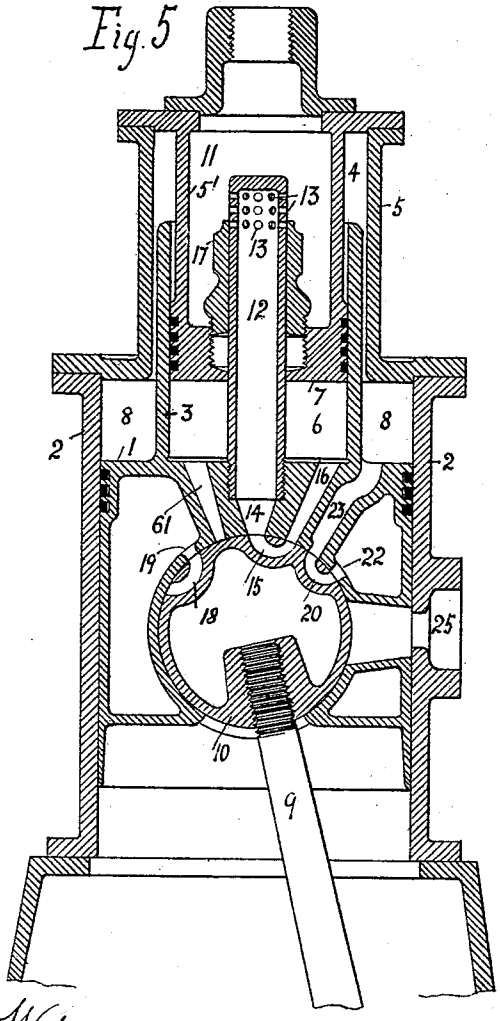


Fig. 6.

Fig. 5



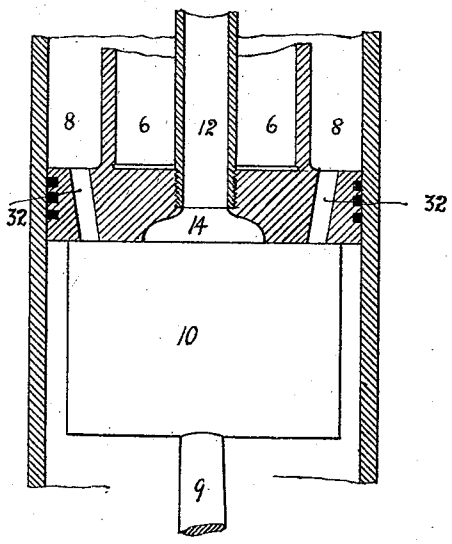


Fig. 7.

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(No Model.) 3 Sheets—Sheet 3.

W. T. LORD.

STEAM ENGINE.

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Fig. 9.

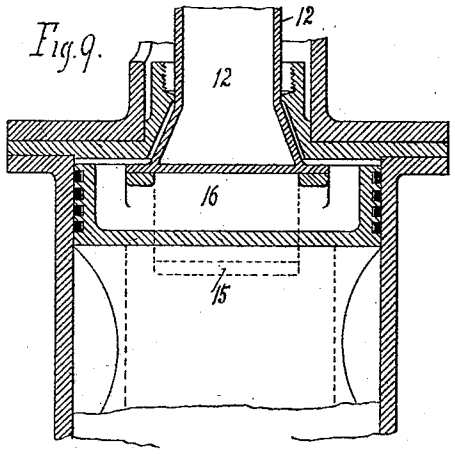


Fig. 8.

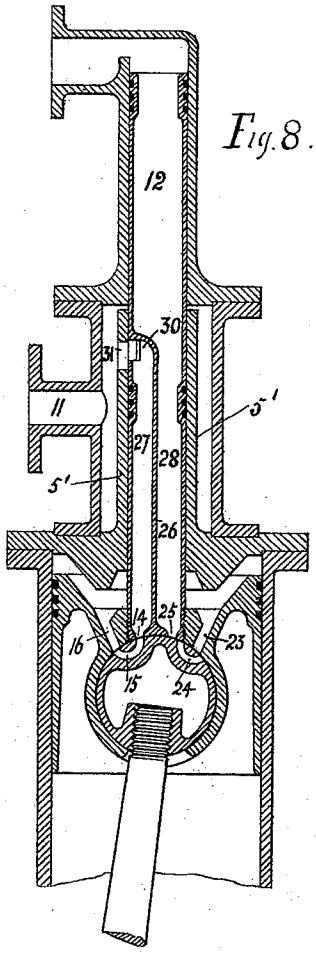
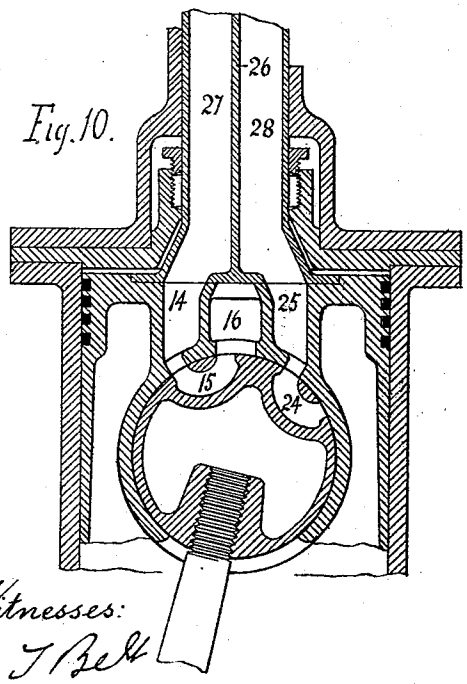


Fig. 10.



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UNITED STATES PATENT OFFICE.

WILLIAM T. LORD, OF HAMMERSMITH, ENGLAND.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 459,407, dated September 15, 1891.

Application filed March 3, 1891. Serial No. 383,655. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM TURNER LORD, a subject of the Queen of Great Britain and Ireland, residing at Hammersmith, in the county of Middlesex, England, have invented certain new and useful Improvements in Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to motive-power engines of that class in which a trunk-piston working in a cylinder is connected to the engine crank-shaft by a connecting-rod secured to the said piston by an oscillating valve or cheese-and-cylinder joint provided with suitable ports and passages, by means of which the admission and exhaust of steam to and from the cylinder is regulated or partly regulated; and it consists, principally, of an improved combination of parts whereby the steam is admitted to the said oscillating valve.

In the accompanying three sheets of illustrative drawings, Figure 1 is a vertical section of the cylinders of a compound vertical high-speed engine constructed according to this invention. Fig. 2 is a horizontal section of the same. Fig. 3 is an elevation of the cheese, showing the arrangement of ports. Fig. 4 is a view of the supplementary exhaust-passages. Fig. 5 is a vertical section of a compound vertical engine, showing a modified arrangement of intermediate receiver; and Figs. 6 and 7 show the modified arrangement of exhaust ports and passages suitable for the same. Fig. 8 is a vertical section of a vertical simple engine constructed according to this invention, and Figs. 9 and 10 show a modified arrangement of the ports and passages in the cheese and cylinder specially applicable to a reversing-engine.

Referring to Figs. 1 to 7, inclusive, the piston 1 works in the cylinder 2 and is provided with an annular extension 3, working in an annular space 4 in a casting 5, fixed to the upper side of the cylinder 2, the inner circumference of the annular space being provided with ring or other suitable packing at its lower end. The center of the annular extension 3 thus forms a moving high-pressure steam-cylinder 6 with a fixed piston 7, and the low-pressure steam acts on the annular surface of the piston 1 outside the extension 3, it being admitted to the space 8. The connecting-rod 9 has a hollow cylinder or cheese 10, fixed to one end and fitting into and working in a cylindrical recess in the piston 1, and thus forming an oscillating joint. The cheese 10 and cylindrical recess are provided with ports and passages for the steam, as clearly shown, and in Figs. 1 to 4 the intermediate receiver is formed in the hollow cheese 10, and in Figs. 5 to 7 the receiver is formed in a hollow space in the piston 1, or it may be formed partly in the cheese 10 and partly in the piston 1. The steam, instead of being admitted through ports and passages formed in the piston 1 and cylinder 2, as is usual, is admitted, as shown in either Fig. 1 or Fig. 5, to a steam-chest 11, formed in the casting 5′. A pipe 12, closed at its upper end, but formed with openings 13 in its circumference at this end, leads to a passage 14, provided with a port working in conjunction with a port of a passage 15 in the cheese 10, the said passage 15 having another port working in conjunction with the port of a passage 16, leading through the piston 1 to the high-pressure cylinder 6. The pipe 12 works in an extension 17, fixed on the piston 7, and either the extension 17 is provided, as shown in Fig. 1, with openings 31, communicating with the steam-chest 11, or, as shown in Fig. 5, the pipe 12 projects into the steam-chest. In the downstroke the high-pressure steam is admitted from the steam-chest 11 through the openings 13, pipe 12, and passages 14, 15, and 16 to the high-pressure cylinder 6, and is cut off as soon as the openings 13 either pass below the openings 31 in the extension 17, Fig. 1, or enter the extension 17, Fig. 5. The cut-off is varied either by increasing the size or number of the openings 31, Fig. 1, or by adjusting the extension 17, Fig. 5. The port of the passage 16, Fig. 1, also works, or the port of a separate passage 61, Fig. 5, in the piston leading to the high-pressure cylinder 6, works, in conjunction with the port of a passage 18, in the cheese 10, and either, as shown in Fig. 1, leading to the interior of the cheese 10, or, as shown in Fig. 5, having another port working in conjunction with the port of a passage 19, leading to the receiver

in the hollow space of the piston 1. A passage 20 in the cheese 10, either, as shown in Fig. 1, leading from the said receiver, or, as shown in Fig. 5, having a port working in conjunction with a port of a passage 22, leading to the said receiver, has a port working in conjunction with a port of a passage 23, leading through the piston 1 to the low-pressure cylinder 8. It will thus be seen that during the upstroke the high-pressure cylinder 6 exhausts into the intermediate receiver through the passages 16 and 18, Fig. 1, or 61, 18, and 19, Fig. 5, and during the downstroke, while high-pressure steam is admitted to the cylinder 6, as above described, steam from the intermediate receiver passes into the low-pressure cylinder 8 by the passages 20 and 23, Fig. 1, or 22, 20, and 23, Fig. 5. A branched passage 32, Fig. 1, with or without the supplementary end passages 32, Figs. 2, 3, and 4, or separate passages 32, Figs. 5 to 7, leading from the cylinder 8, have ports working in conjunction with ports of passages 24 in the cheese 10, having a port working in conjunction with the port of a passage 21, leading to the exhaust 25 through ports in the piston 1 and cylinder 2. The exhaust from the low-pressure cylinder 8 thus takes place during the upstroke through the passages 32 24 21 and when the port in the piston 1 is opposite to the port in the cylinder 2. A relief-valve 29, opening into the steam-chest 11 from the cylinder 6, serves to prevent excessive cushioning at the end of the upstroke in the high-pressure cylinder, and can be arranged to open at any determined pressure.

In the simple engine shown in Fig. 8 the steam and exhaust both take place through the pipe 12, which is divided by a partition 26, as clearly shown. The steam enters at 11 and passes to the cylinder by the openings 31, the part 27 of the pipe 12 and passages 14, 15, and 16, and exhausts by the passages 23, 24, and 25 and part 28 of the pipe 12. The position of the port 31 in relation to the port 30 determines the point of cut-off.

In a modification shown in Figs. 9 and 10 steam enters by the passages 27, 14, 15, and 16 and exhausts by the passages 16, 24, 25, and 28. To reverse the engine, the passage 28 is made the steam-inlet and the passage 27 the exhaust.

What I claim is—

1. In a steam-engine, the combination, with a cylinder, of a piston sliding therein, an oscillating valve on the end of the connecting-rod and pivoted in the said piston, a stationary casting, such as 5′, supported above the cylinder, and a pipe 12, secured to the said piston for admitting steam to the said valve and provided with packing devices, such as rings or a stuffing-box, whereby it may slide steam-tight within the said casting, which is in direct communication with the steam-pipe, substantially as and for the purpose set forth.

2. In a steam-engine, the combination, with the stationary cylinder 2, of the piston sliding therein and having the cylinder 3 secured to it, an oscillating valve on the end of the connecting-rod and pivoted in the said piston, the stationary casting 5′, supported above the cylinder 2 and forming the piston of the cylinder 3, and a pipe 12, secured to the said sliding piston for admitting steam to the said valve and provided with steam-packing devices, such as rings, whereby it may slide steam-tight within the said casting, which is in direct communication with the steam-pipe, substantially as and for the purpose set forth.

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

WILLIAM T. LORD.

Witnesses:
WALTER J. SKERTEN,
GEO. M. RUSHLIN.