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Patented Oct. 14, 1902.

W. NORRIS.
MOTOR VEHICLE.

(Application filed Nov. 5, 1901.)

(No Model.)

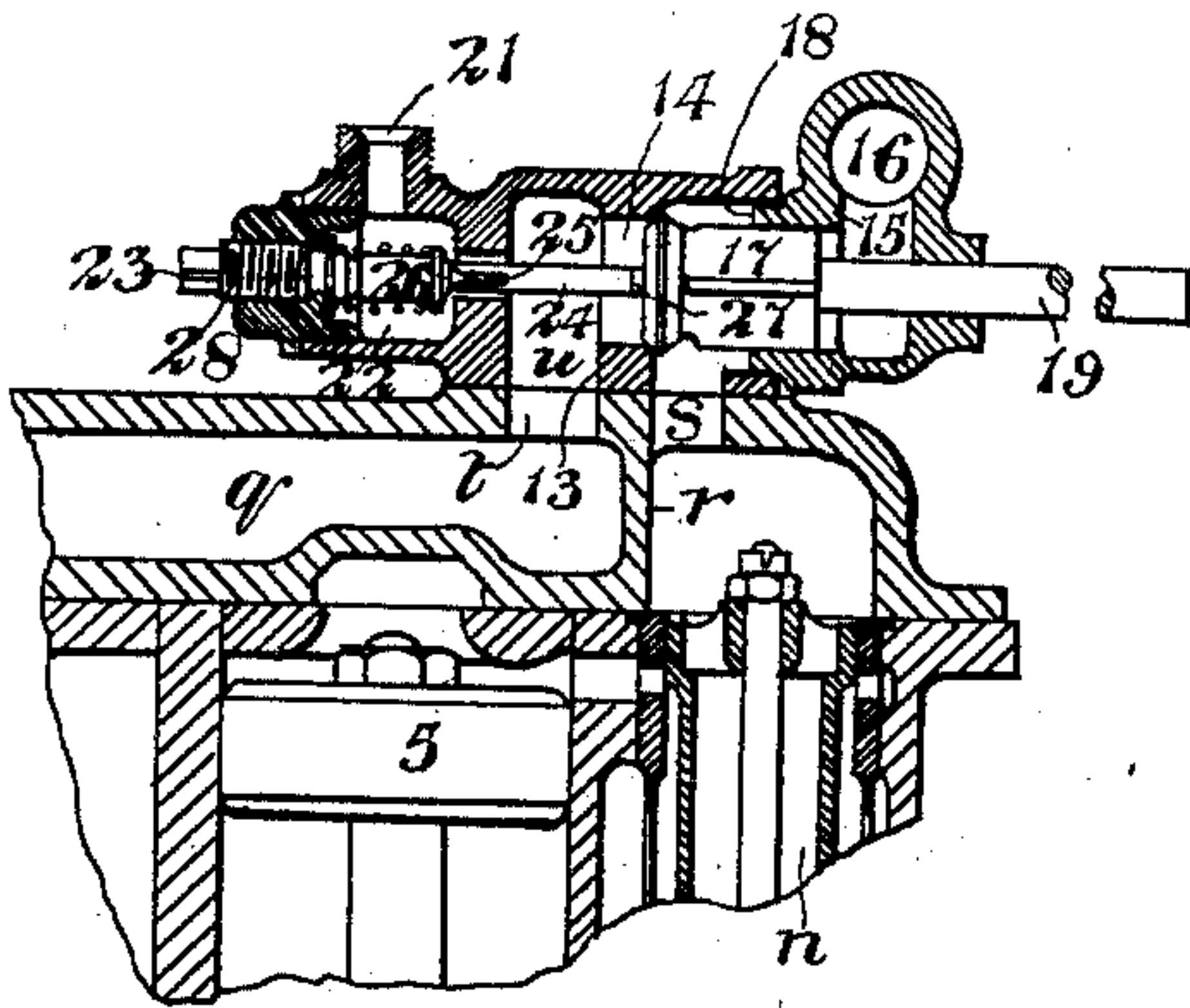


Fig. 2.

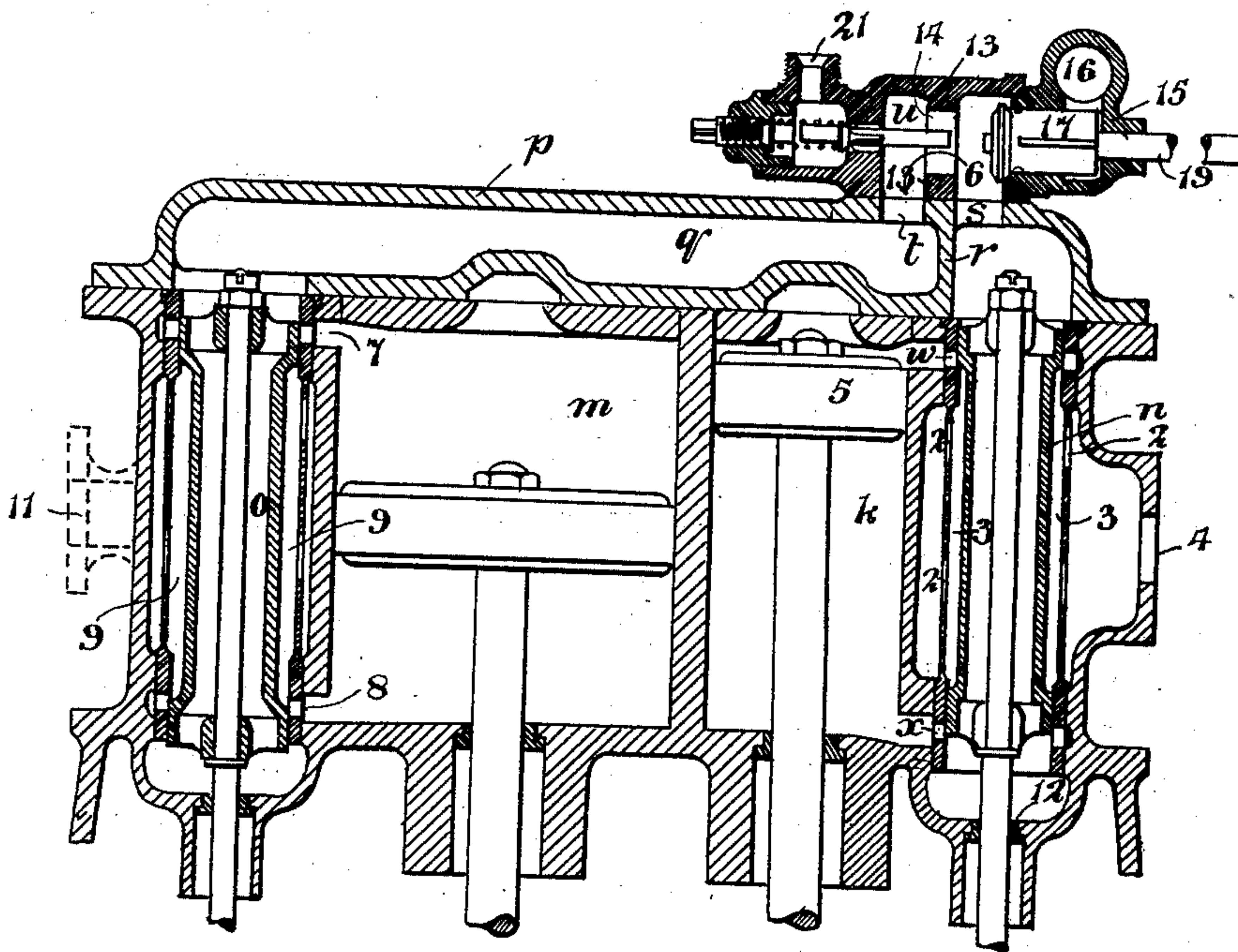


Fig. 1.

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MOTOR-VEHICLE.

SPECIFICATION forming part of Letters Patent No. 711,118, dated October 14, 1902.

Application filed November 5, 1901. Serial No. 81,278. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM NORRIS, a subject of the King of Great Britain and Ireland, residing at Cooper road, Preston, England, have invented certain new and useful Improvements Relating to Motor-Vehicles, (for which I have made application for Letters Patent in Great Britain, No. 9,584, bearing date May 8, 1901,) of which the following is a specification.

My invention relates to a compound engine which is particularly well adapted for motor-propelled vehicles. Its object is to provide an improved construction and arrangement of cylinders, piston, and intercepting-valves.

My invention consists in an improved arrangement of cylinders and piston-valves, the cylinder-cover being adapted to act as a steam-receiver, and in improved intercepting and live-steam-admission valves operating in conjunction with the piston-valves for exhausting the steam from the high-pressure cylinder to the atmosphere and admitting live steam to the low-pressure cylinder.

Referring now to the accompanying drawings, Figure 1 is a part vertical section of the cylinders of my improved compound engine, showing the piston-valves, steam-receiver, and intercepting valve device. Fig. 2 is a vertical section of the latter and part of the high-pressure cylinder of the engine, showing the live-steam-admission valve open to admit steam to the low-pressure cylinder and the intercepting-valve open to allow exhaust-steam from the high-pressure cylinder to escape to the by-pass.

In carrying out my invention as illustrated in Fig. 1 I arrange the high and low pressure cylinders *k* and *m* side by side and provide each cylinder with a high and low pressure piston-valve *n* and *o*, respectively. I provide the ends of the cylinders and valve-casings remote from the crank-shaft with a hollow cover *p*, which acts also as a steam-receiver *q*. A partition-wall *r* in the hollow cover separates the high-pressure valve-chest from the main part of the steam-receiver *q*; but communication between them may be effected through holes *s* and *t*, formed in the cover, one on each side of the partition-wall *f*, and through the steam-chest *u* of my intercepting-

valve, (to be hereinafter described,) which is secured to the cylinder-cover opposite these holes.

The high-pressure piston-valve *n* is hollow and open at both ends. It slides within a cylindrical casing *v*, provided with ports *w* and *x*, opening into the back and front of the high-pressure cylinder, and holes 2 2 in its cylindrical surface between the ports *w* and *x*, which holes 2 2 form communication between the valve-chest and an annular space 3 around the body of the piston-valve. The low-pressure valve *o* is constructed in a similar manner to the high-pressure valve, but is of somewhat larger size. The manner in which the valves control the steam admission and exhaust will be readily seen by reference to Fig. 1, which shows the high-pressure piston just commencing its forward stroke and the low-pressure piston about the middle of its backward stroke.

High-pressure steam enters the high-pressure valve-chest at the inlet 4 and passes by holes 2 and the annular space 3 into the steam-port *w* to the back of the piston 5. The forward end of the cylinder is now exhausting through the port *x*, through the hollow piston-valve *n*, steam-chest *u* in the path indicated by the arrow 6, whence it passes along the receiver *q*, through the port 7 into the back end of the low-pressure cylinder. Exhaust from the other end of the low-pressure cylinder takes place through the port 8, around the annular space 9 of the low-pressure piston-valve *o* to the exhaust-pipe 11.

When admitting high-pressure steam to the forward end of the high-pressure cylinder, steam flows around the annular space 3 into the cylinder by way of the port *x*, while at the same time the other end of the cylinder is exhausting into the receiver, whence it passes through the hollow piston-valve *o* and port 8 into the forward end of the low-pressure cylinder. Exhaust from the back end of this cylinder then takes place through the port 7, annular space 9 into the exhaust-pipe 11.

It will be observed that by arranging the high-pressure steam-valve in the manner just described high-pressure steam is prevented from acting on the stuffing-box 12.

It is sometimes convenient to exhaust the steam from the high-pressure cylinder direct to the atmosphere and to admit live steam to the low-pressure cylinder, and for this purpose I employ a double-faced valve to control a by-pass opening to the atmosphere. This valve serves the double purpose of an intercepting-valve and an emergency-valve. It also controls the admission of live steam to the receiver. In Fig. 1 the valves are shown closed in the manner employed when working the engines as compound; but in Fig. 2 they are shown arranged to exhaust the steam from the high-pressure cylinder to the atmosphere and supply live steam to the low-pressure cylinder. The device consists of a chest *u*, communicating with the receiver and piston valve-chest by the holes *s* and *t* and provided with a partition-wall 13, coinciding with the partition *r* of the cylinder-cover. A passage 14 is formed in the partition-wall 13 of sufficient area to permit the free passage of steam from the high-pressure to the low-pressure cylinder when compounding, and I secure to the valve-chest *u*, opposite the passage 14, a casting 15, opening to the atmosphere by the pipe 16. Within this casting I guide a combined intercepting and emergency valve 17, having double faces, one of which is adapted to seat against the face 18 of the casting 15 when the engine is compounding and the other against the edge of the passage 14 when exhausting the high-pressure cylinder through the by-pass to the atmosphere. The valve 17 may be operated by a rod 19 in any suitable manner. To admit live steam to the receiver, I provide the valve-chest *u* with a steam-inlet 21, communicating with a valve-box 22, which contains a spring-controlled valve 23, guided within a passage 25, leading to the valve-chest *u*, by means of vanes formed on an extended rod 24. When the valve 17 is closed to the atmosphere, the spring 26 and the pressure of steam in the valve-box 22 holds the valve 23 closed, as seen in Fig. 1; but when the valve 17 is open to the exhaust by-pass and closes the passage 14 a projection 27, formed on the valve 17, coming into contact with the rod 24, opens the valve 23, thus admitting live steam to the receiver *q*, as seen in Fig. 2. I may provide the valve-box 23 with a screwed plug 28 to hold the valve 23 tightly against its seat when required. It will be observed that this device renders stuffing-glands entirely unnecessary.

Instead of exhausting into the atmosphere the steam from the by-pass may be led into a feed-water heater.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a compound engine, in combination, a high and a low pressure cylinder with corresponding valve-chests, a cylindrical valve-casing in each chest, steam-ports between the casings and both ends of their respective

cylinders, a hollow piston-valve open at both ends within each casing, an annular space between each valve and each casing, passages in the casings forming communication between the chests and annular spaces, a hollow cover closing the back end of both cylinders, a partition dividing the hollow space of the cover into two portions one of which communicates with the interior of the high-pressure valve and the other communicates with the interior of the low-pressure valve, an intercepting-valve chest fixed to the hollow cover, a steam-passage on each side of the partition communicating with the intercepting-valve chest, an exhaust-steam outlet in the low-pressure valve-casing in direct communication with the annular space, and means for operating the valves, substantially as described.

2. In a compound engine, a high-pressure and a low-pressure cylinder, a steam-receiver adjacent to said cylinder, an intercepting-valve chest communicating with said steam-receiver, a high-pressure valve, a by-pass leading from the high-pressure valve through the valve-chest, a double-faced valve, within the valve-chest, one face of said valve acting as an emergency-valve, to close the by-pass when the engine is compounding and the other face acting as an intercepting-valve to close the passage to the steam-receiver, when the high-pressure cylinder is exhausting through the by-pass, means for operating the double-faced valve, a steam-admission valve, a spring in contact with said valve, said valve being normally held closed by the spring and the pressure of live steam, and a projecting guide-rod carried by the valves whereby it may be opened by the double-faced valve when the by-pass is opened.

3. In a compound engine, in combination with a steam-receiver, an intercepting-valve chest, a by-pass from the engine high-pressure valve through the valve-chest to the atmosphere, a passage from the valve-chest to the receiver, a double-faced valve within the valve-chest, one face of said valve acting as an emergency-valve to close the by-pass to the atmosphere when the engine is compounding, and the other face acting as an intercepting-valve to close the passage to the steam-receiver when the high-pressure cylinder is exhausting to the atmosphere through the by-pass, means for operating the double-faced valve, a steam-admission valve normally held closed by a spring and the pressure of the live steam, a projecting guide-rod carried by the latter valve, whereby it may be opened by the double-faced valve when the by-pass is opened, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

WILLIAM NORRIS.

Witnesses:

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