

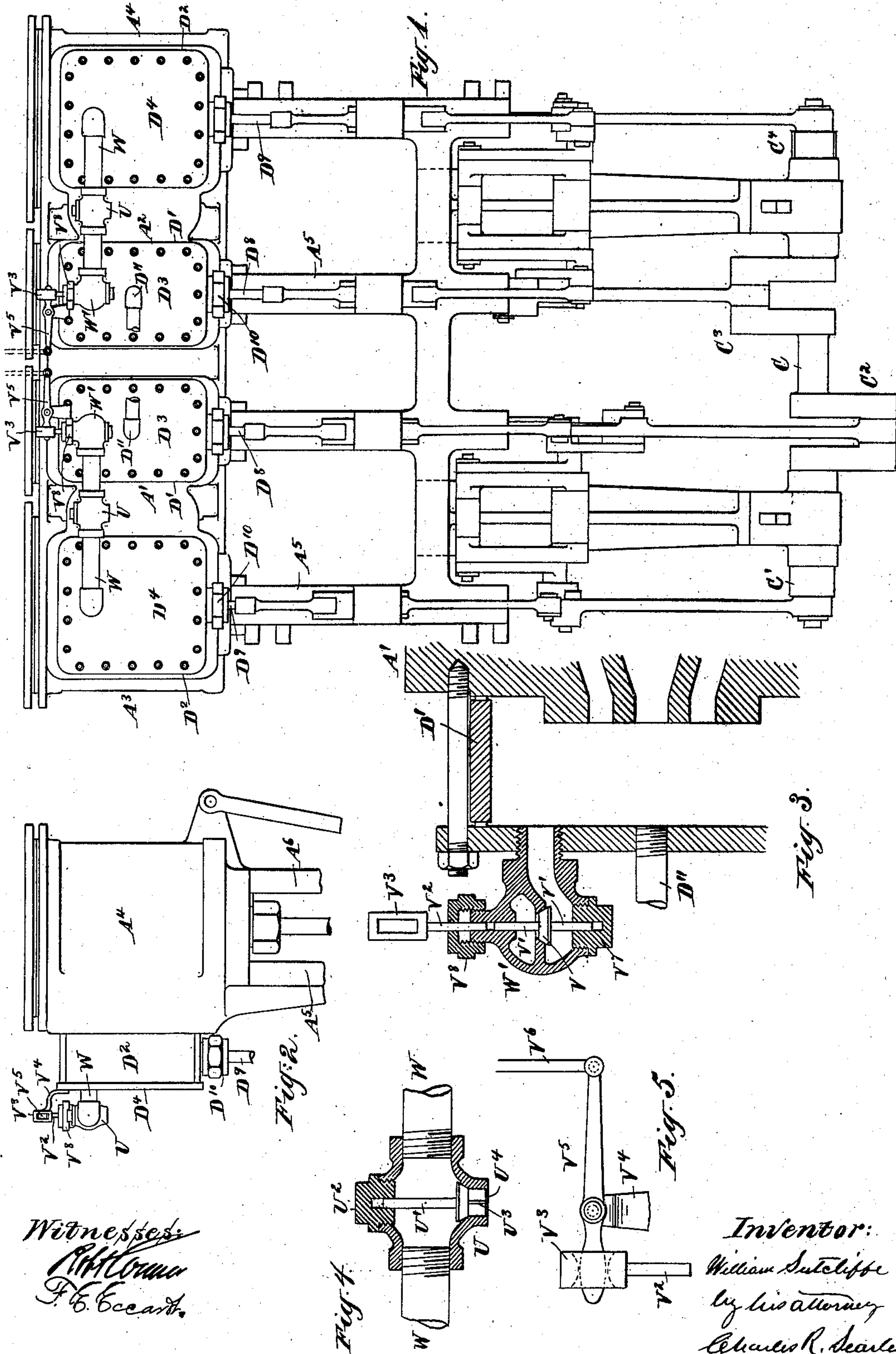
No. 737,294.

PATENTED AUG. 25, 1903.

W. SUTCLIFFE.  
STEAM ENGINE.

APPLICATION FILED AUG. 2, 1902.

NO MODEL.





# UNITED STATES PATENT OFFICE.

WILLIAM SUTCLIFFE, OF PATERSON, NEW JERSEY.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 737,294, dated August 25, 1903.

Application filed August 2, 1902. Serial No. 118,045. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM SUTCLIFFE, a citizen of the United States, residing in Paterson, in the county of Passaic and State of New Jersey, have invented a certain new and useful Improvement in Steam-Engines, of which the following is a specification.

The invention relates to engines of the compound non-condensing type, and more especially to means for supplying steam at high pressure to the low-pressure cylinder when required and for relieving the engine when running idly.

The object of the invention is to provide simple easily-operated means for allowing the direct transfer of steam from the high-pressure steam-chest to the low-pressure chest when an increase of power is temporarily required and for automatically relieving the engine from back pressure when running with steam shut off under certain conditions.

The invention consists in certain novel features of construction and arrangements of parts by which the above objects are attained, to be hereinafter described.

The accompanying drawings form a part of this specification and show the invention as I have carried it out.

Figure 1 is a front elevation showing a double compound engine equipped with my invention. Fig. 2 is a corresponding side view of a portion. Fig. 3 is a vertical section, on a larger scale, through a portion of one of the high-pressure steam-chests and its relief-valve. Fig. 4 is a vertical section showing an auxiliary valve. Fig. 5 is an elevation showing a means for operating the relief-valve.

Similar letters of reference indicate the same parts in all the figures.

I will describe the invention as applied to a double compound engine designed and arranged for service in driving a motor-vehicle or similar duty. In the engine shown the four cylinders are arranged side by side with their axes parallel and in the same plane, the high-pressure cylinders  $A^1$  and  $A^2$  lying adjacent to each other between the low-pressure cylinders  $A^3$  and  $A^4$ . A steam-chest  $D^1$  for each high-pressure cylinder and a steam-chest  $D^2$  for each low-pressure cylinder are mounted upon the front faces of such cylinders and provided with chest-covers  $D^3$   $D^4$ , secured to the chests and cylinders, as usual. The valve-seats may be plane, adapted to serve with slide-valves of the usual  $D$ -valve type, operated by valve-stems  $D^8$   $D^9$ , extending through stuffing-boxes  $D^{10}$  and moved through suitable connections to any preferred form of valve-motion. The cylinders contain pistons joined to cross-heads arranged to slide in guides  $A^5$   $A^6$  and having connecting-rods to the cranks  $C^1$ ,  $C^2$ ,  $C^3$ , and  $C^4$ , set quartering to each other on the main shaft  $C$ , supported in the frame  $A$ . Steam admitted to the high-pressure steam-chests  $D^1$  through pipes  $D^{11}$  from a boiler (not shown) acts upon the high-pressure pistons, as usual, and escapes through passages cored in the engine-casting or otherwise to the low-pressure steam-chests  $D^2$  and exerts its remaining force upon the low-pressure pistons and is thence exhausted.  $W$  is a pipe leading from the cover of the high-pressure steam-chest  $D^1$  to the cover of the adjoining low-pressure chest  $D^2$ , and  $W^1$  is a valve-casing located in the pipe and containing a downwardly-opening valve  $V$ , adapted to be held to its seat by the pressure in the chest  $D^1$  and prevent the flow of steam from the latter through the pipe. A similar pipe and valve are provided for the second high and low pressure valve-chests. A description of one will suffice. The valve  $V$  is guided by a stem  $V^1$ , extending upwardly and downwardly from the conical body, the lower portion being received in a corresponding cavity in the screw-plug  $V^7$  and the upper portion in a hole in the casing extending to the stuffing-box  $V^8$ . The upper part of the stem terminates just below the stuffing-box, in which is received the lower end of a rod  $V^2$ , arranged to slide in the axial line of the stem and adapted when depressed to abut against the upper end of the stem and force the valve from its seat, and thus permit steam to flow through the pipe  $W$  to the low-pressure chest as long as the valve is held open against the pressure in the pipe. The valve seats itself when released by excess of pressure on the high-pressure side, due to the fact that the valve is never held open long enough for the pressure to equalize on both sides. The valve is forced momentarily from its seat to admit all



the pressure-steam to the low-pressure cylinder in starting, with the high-pressure piston on the center, and also to admit steam momentarily and intermittingly to the low-pressure cylinder when an extra amount of power is wanted for a short period. The mechanism for thus depressing the valve may be in a variety of forms. I have shown the rod  $V^2$  as provided with a slotted head  $V^3$ , in which is received one end of a lever  $V^5$ , fulcrumed to a support  $V^4$  on the chest-cover or other fixed portion. The opposite end of the lever is engaged with a link  $V^6$ , leading to a hand-lever or other operating means (not shown) located at any convenient point.

In the act of starting the engine or under other conditions in which extra power is required for a short period the lever  $V^5$  is moved to force the valve  $V$  from its seat and allow high-pressure steam to flow directly to the low-pressure chest and exert its force on the large area of the low-pressure piston until the inertia of starting or other temporary increase of load is overcome.

When the engine is running idly with steam shut off—as, for instance, in motor-vehicle service when the vehicle is descending a grade—the reduction in pressure will cause the valve  $V$  to leave its seat by gravity and permit free circulation between the high and low pressure chests, thus preventing any pumping up of pressure.

In order to admit air freely under the conditions described, I introduce an auxiliary valve  $U$ , arranged to seat itself by gravity and be held to its seat by pressure in the pipe  $W$ , but to lift easily and allow air to enter the pipe when the pressure therein falls below that of the atmosphere. The valve  $U$  has a stem  $U^1$  above, received in a cavity in the plug  $U^2$ , and is provided below with guide-wings  $U^3$ , matching to the interior of the inlet-orifice  $U^4$ . An important function performed by the valves  $V$  in an engine having the cranks

set at angles of ninety degrees to each other, as illustrated in the drawings, is in starting the engine when the high-pressure crank is on the center. By forcing down the valve steam under full pressure exerts its force on the low-pressure crank, which at that time is in position for effective action on the shaft. The levers  $V^5$  may be connected to operate both valves simultaneously or may be operated singly, if preferred.

The invention may be used with a single compound engine of any ordinary or approved construction. The auxiliary relief-valves  $U$  may be dispensed with without seriously impairing the successful operation of the invention. I prefer the whole as shown.

I claim—

In a compound engine, the combination with the high and low pressure steam-chests, of the pipe  $W$  connecting the same, a valve-casing located in said pipe, a valve in said casing to control the flow through said pipe and held normally closed by steam-pressure in the high-pressure steam-chest and automatically opened by gravity when the pressure is reduced, means for mechanically forcing said valve from its seat to allow steam from the high-pressure steam-chest to flow directly to the low-pressure steam-chest when required, an auxiliary relief-valve in said pipe and movable in a plane parallel with the first-mentioned valve to open automatically when the pressure on said pipe falls below the external pressure and interposed between said casing and the connection of the pipe with the low-pressure steam-chest, substantially as and for the purpose specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

WILLIAM SUTCLIFFE.

Witnesses:

CHARLES R. SEARLE,  
C. E. ABERT.