

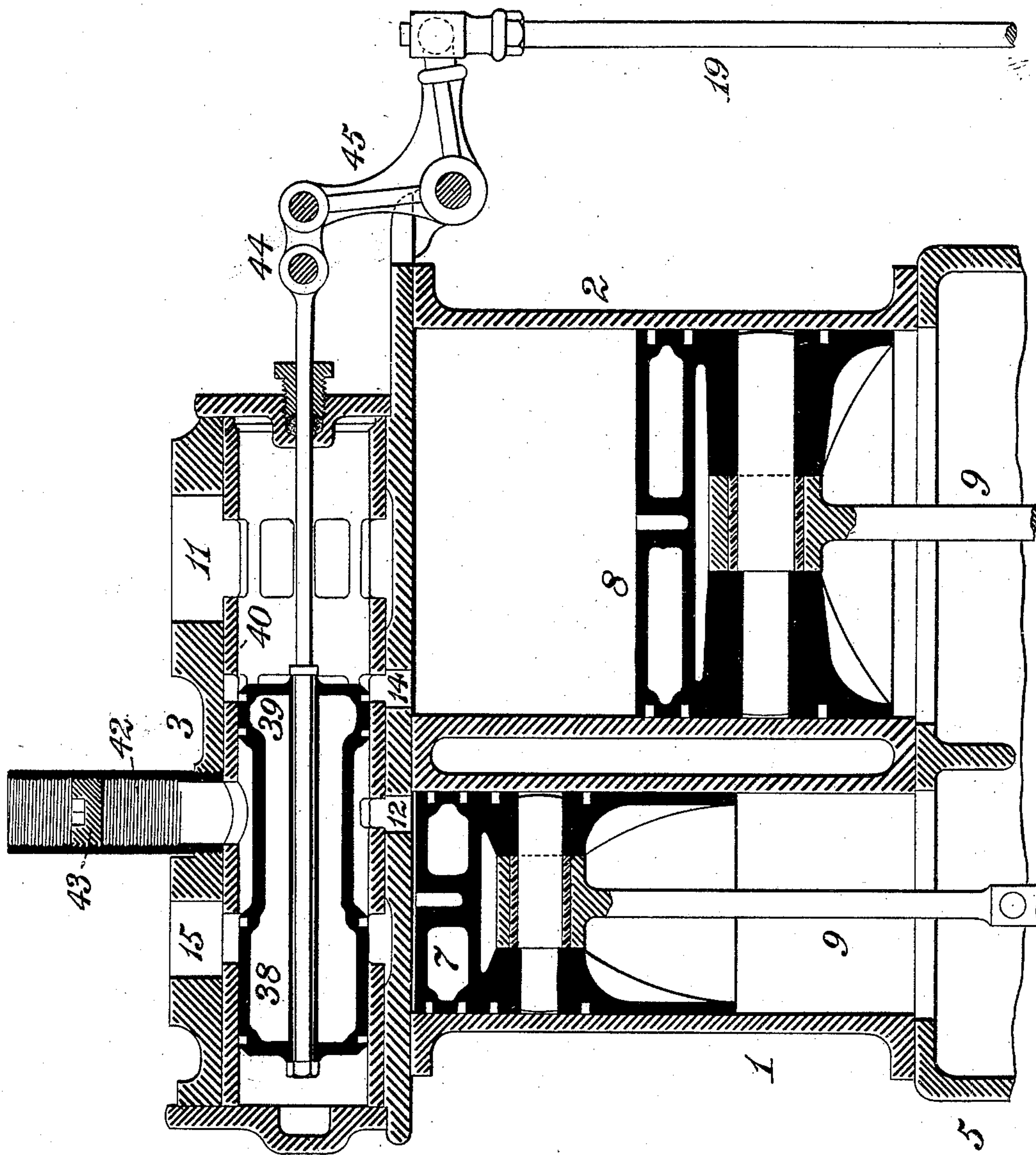
(No Model.)

H. H. WESTINGHOUSE & F. M. RITES.

STEAM ENGINE.

No. 396,635.

Patented Jan. 22, 1889.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

HENRY HERMAN WESTINGHOUSE AND FRANCIS M. RITES, OF PITTSBURG,  
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## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 396,635, dated January 22, 1889.

Application filed October 31, 1888. Serial No. 289,637. (No model.)

*To all whom it may concern:*

Be it known that we, HENRY HERMAN WESTINGHOUSE and FRANCIS M. RITES, citizens of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Steam-Engines, of which improvement the following is a specification.

Our present invention is an improvement upon that set forth in an application for Letters Patent filed by us March 17, 1888, Serial No. 267,519, the essential characteristic of which consists in the provision of a clearance-chamber of such capacity as to admit of terminal high-pressure compression being raised to substantially initial pressure, and its object is to enable a compound engine embodying the same to be readily and accurately adapted to the attainment of the above result under and in accordance with variations in the character and conditions of the motive fluid employed in and the duty performed by the engine, without necessitating absolute accuracy in the original proportionment of the clearance-chamber or involving any substantial or permanent objection by reason of accidental or inadvertent departure therefrom.

To this end our invention, generally stated, consists in the combination, with the valve-chest of a compound engine, of a clearance-chamber of variable capacity, said chamber being interposed between the high and the low pressure cylinders and communicating continuously with the high-pressure cylinder.

The improvement claimed is hereinafter fully set forth.

The accompanying drawing is a longitudinal central section through the cylinders and valve-chest of a compound engine, illustrating the application of our invention.

The engine is shown as of the Westinghouse single-acting type, having a high-pressure cylinder, 1, and a low-pressure cylinder, 2, which are secured side by side to the top of a crank-case, 5. The cylinders 1 and 2 are fitted, respectively, with pistons 7 and 8, which are coupled by connecting-rods 9, in the usual manner, to crank-pins upon double cranks on a suitable crank-shaft, which is fitted to ro-

tate in bearings in the lower portion of the crank-case, and which, not being essential to the explanation of our present invention, is not shown in the drawing.

The distribution functions of the engine are, as in our application before referred to, effected by a single distribution-valve, which reciprocates transversely to the axes of the cylinders 1 2 in a valve-chest, 3, which is secured to and forms the heads of the cylinders and is provided with nozzles or passages 15 11, to which a steam and an exhaust pipe are respectively connected. The valve-chest 3, which is preferably lined with a bushing, 40, communicates through ports 12 and 14 with the high and the low pressure cylinders, ports corresponding with the ports 12 14 and with the steam and exhaust passages being formed in the bushing 40. The distribution-valve is composed of a high-pressure section, 38, and a low-pressure section, 39, connected by an intermediate body of smaller diameter, so that an annular space shall be left between the periphery of the body and the valve-chest bushing, and is fixed upon a valve-stem, 16, to which reciprocating movement is imparted by an eccentric on the crank-shaft, the eccentric-rod 19 being coupled to the valve-stem by a bell-crank lever, 45, and link 44. The valve-section 38 effects admission and cut-off for the high-pressure cylinder 1, and the section 39 effects admission, cut-off, compression, and exhaust for the low-pressure cylinder 2 and exhaust and compression for the high-pressure cylinder. The setting and traverse of the valve are such that the high-pressure port 12 shall be continuously open, and by the closure of the low-pressure port 14 the valve coincidently initiates low-pressure expansion and high-pressure compression.

Our present invention is, similar to that set forth in our application before referred to, based upon our ascertainment by experimental research that a substantial advantage in the utilization of motive fluid is attained by effecting high-pressure compression to practically initial pressure, which result we effect in this as in the former instance by the employment of a clearance-chamber of



such volume as will permit compression to be raised to, without exceeding, initial pressure. The capacity of the clearance-chamber, while preferably bearing a ratio to that of the high-pressure cylinder substantially equivalent to the ratio of the high-pressure to the low-pressure cylinder, is not necessarily limited to such ratio, and differences in the character and conditions of motive fluid and duty in operation may render a greater or less departure therefrom admissible or advisable. In order to permit of the accurate adjustment of the volume of the clearance-chamber to a determined and desired degree, which may not always be readily effected in the original construction of the engine, as well as to allow of changes in its volume to be made from time to time, as may be found desirable, we provide a clearance-chamber of variable capacity the volume of which is capable of increase or diminution by ready and expeditious hand adjustment whenever required.

The clearance-chamber 42, which is herein illustrated, consists of a tubular or cylindrical chamber of proper strength, which is secured to the valve-chest 3 in such position that its open lower end shall be continuously in communication with the space within the valve-chest between the end pistons, 38 39, of the valve, and consequently with the high-pressure port 12 and cylinder 1. The chamber 42 is closed to the atmosphere by an adjustable head or plate, 43, which is connected to the chamber in such manner that it may be conveniently moved longitudinally and fixed at any desired position therein. In this instance the connection of the head to the chamber and its adjustment therein are shown as effected by means of an external screw-thread on the head engaging a corresponding internal thread in the chamber, the head being suitably recessed on its outer face for the reception of a wrench, by which it is turned. It will be obvious that the chamber might equivalently be bored out truly and the head be fitted to traverse therein, being provided with a threaded stem engaging a nut fixed to the outer end of the chamber, and that other

modes of connection and adjustment which are within the knowledge of those skilled in the art may be substituted, in the discretion of the constructor. As a mechanical equivalent for an adjustable head, a plunger fitted to traverse longitudinally in the chamber and passing through a properly-packed stuffing-box thereon may be employed to effect desired increase or diminution of the volume of the chamber.

Our improvement enables any inaccuracy in the original proportionment of the clearance-chamber to a determined volume to be readily and completely corrected, as well as provides means for effecting such variation in the volume of the chamber, without suspending or interfering with the operation of the engine, as may under different conditions be deemed necessary or advisable.

We claim as our invention and desire to secure by Letters Patent—

1. In a compound engine, the combination, substantially as set forth, of a valve-chest, a high-pressure cylinder communicating by a continuously-open port therewith, and a clearance-chamber of variable capacity which communicates continuously with the valve-chest and high-pressure-cylinder port.

2. In a compound engine, the combination, substantially as set forth, of a valve-chest, a high-pressure cylinder communicating by a continuously-open port therewith, a clearance-chamber which communicates continuously with the valve-chest and high-pressure-cylinder port, and an adjustable head or plunger adapted to traverse within and be fixed in different positions in the clearance-chamber.

In testimony whereof we have hereunto set our hands.

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