

(No Model.)

2 Sheets—Sheet 1.

J. KLEIN.
COMPOUND ENGINE.

No. 494,425.

Patented Mar. 28, 1893.

Fig. 1.

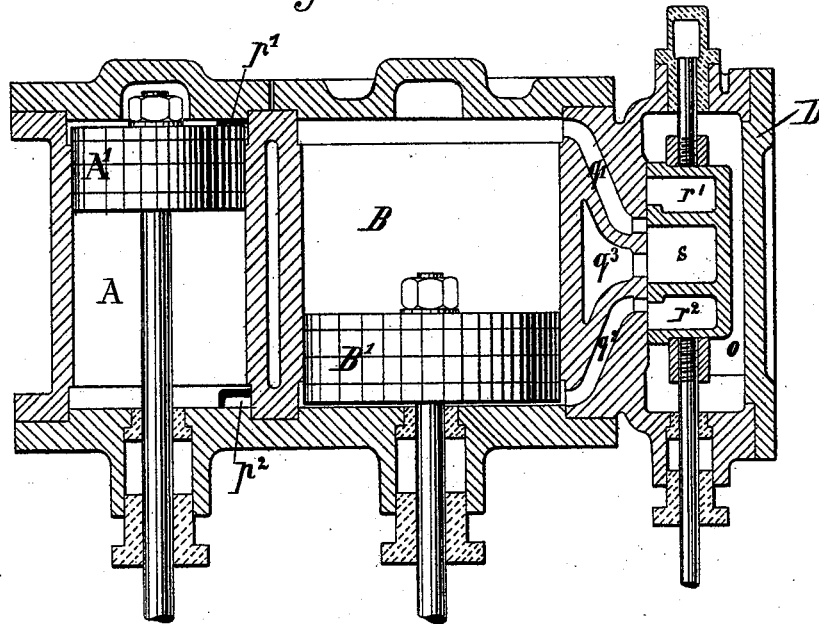
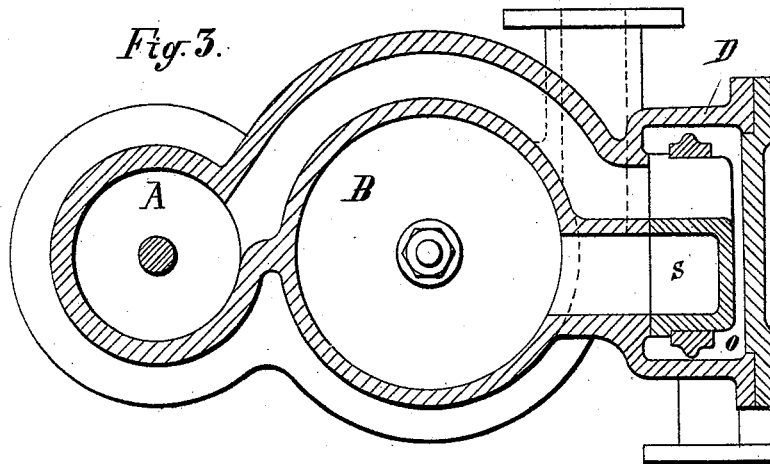


Fig. 3.



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2 Sheets—Sheet 2.

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Fig. 2.

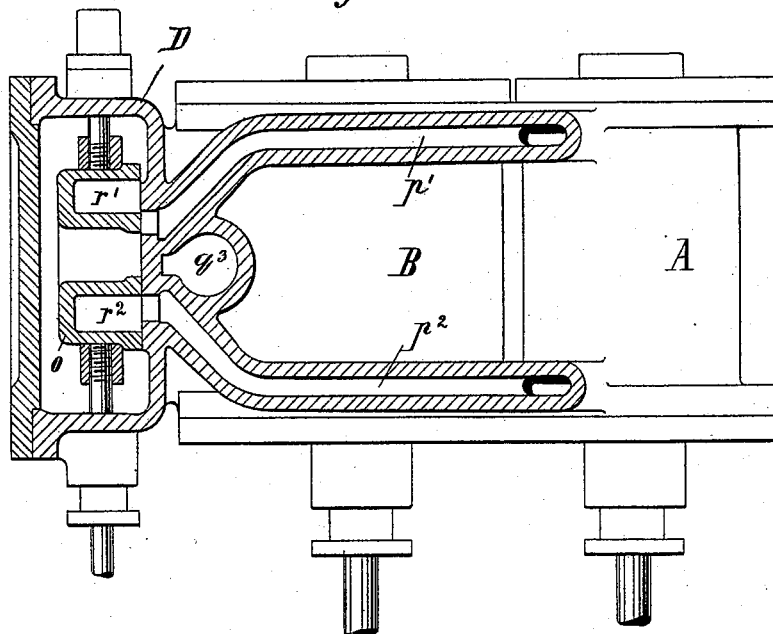


Fig. 4.

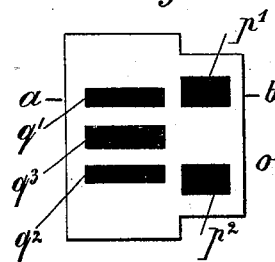
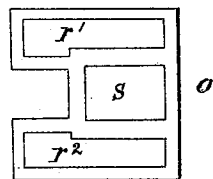


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHANN KLEIN, OF FRANKENTHAL, GERMANY.

COMPOUND ENGINE.

SPECIFICATION forming part of Letters Patent No. 494,425, dated March 28, 1893.

Application filed December 6, 1890. Serial No. 373,743. (No model.) Patented in Germany February 28, 1889, No. 54,439.

To all whom it may concern:

Be it known that I, JOHANN KLEIN, a subject of the King of Bavaria, residing at Frankenthal, in the Kingdom of Bavaria, have invented new and useful Improvements in Expansion Distributing Valve Motion for Compound Engines, (for which I have obtained a patent in Germany, dated February 28, 1889, No. 54,439,) of which the following is a specification.

The invention relates to improvements in valves for compound engines, and the object of my invention is to produce a simple valve for connecting the cylinders of a compound engine, and for exhausting the same, so that nearly the whole force of the steam will be utilized.

To this end my invention consists in certain features of construction and combinations of parts, which will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a longitudinal section of the two cylinders A and B arranged side by side showing the passages of the low pressure cylinder. Fig. 2 is a section through the steam chest and the passages of the high pressure cylinder. Fig. 3 is a section of the inlet and outlet passages on the lines *a b* in Fig. 4. Fig. 4 is a plan view of the valve seat; and Fig. 5 is a view of the valve seen from beneath.

The steam inlet and outlet is effected in the two cylinders A and B by one single valve *o*, arranged close to the large cylinder B, to slide in the steam chest D. The slide valve *o* has a chamber *r'* at one end and a similar chamber *r''* at the other end, the chambers being wider than the center of the valve and being adapted to be brought opposite the passages to the high and low pressure cylinders. The valve has also a central space *s* adapted to connect with a cylinder passage from the low pressure cylinder and with the main exhaust pipe, so that the cylinders may exhaust through it. The valve is connected with the engine in the usual way so as to move in unison with the pistons. There are for the small cylinder two inlet and outlet passages *p'* and *p''*, but there is no steam eduction (exhaust)

pipe. The large cylinder has two inlet and outlet passages *q'* and *q''* and a steam eduction (exhaust) pipe *q'''*. As the slide valve *o* is arranged as close as possible to the large cylinder B, the passage *q'* and *q''* of this cylinder are short, while the passages *p'* and *p''* of the small cylinder are very long.

Figs. 1 to 3 of the accompanying drawings show the position and length of the passages *p'*, *p''* and *q'*, *q''*.

The constructions shown in Figs. 1 to 5 work as follows: Supposing the piston A' of the small cylinder A to be in the rear end position, and the piston B' of the large cylinder in the front end position. When the piston A' owing to the admission of steam through the passages *p'* moves forward, the steam having done work in front of the piston A' and the steam contained in the passage *p''* and in the chamber *r''* passes into the passage *q''* and in consequence, in front of the piston B' of the large cylinder B. The steam having done work behind the piston B' of the large cylinder, flows through the hollow space *s*, of the valve *o* and from thence to the eduction (exhaust) passage *q'''*. As before stated there is but one slide valve for the two cylinders, which valve is cast in one piece, and the passage of the steam from one cylinder to the other takes place in the valve itself or in two separate chambers *r'* and *r''* arranged in the valve. In the small cylinder only the steam admission is to be regulated, while the escape of the steam is coincident with the steam admission of the large cylinder, and for this reason, there is only the steam admission in the part of the valve belonging to the large cylinder which is to be regulated. When the steam enters the small cylinder it flows in through the passages *p'* and *p''*. The long inlet passages *p'* and *p''* for the small cylinder and the chambers *r'* and *r''* in the valve form the reservoirs for the large cylinder, in which a determined quantity of steam is measured, which then expands into the large cylinder. The quantity of steam, which in Fig. 1 arrives in front of the piston B' of the large cylinder B and expands in consequence in the large cylinder, is composed of the steam contained in cylinder A in front of the piston A', in passage *p''* and in the space *r''* of the slide. When the stroke changes, the long passage *p'* or *p''* of

the small cylinder and the space r' or r^2 belonging thereto, are under the same pressure as in the small cylinder itself, and for this reason the initial tension of the large cylinder is equal to the final tension of the small cylinder. When the stroke is terminated, the steam of the passage p' or p^2 and of the space r' or r^2 has expanded toward the large cylinder and the pressure remaining in the same is not lost as at a fresh filling so much less steam is necessary. The steam is completely utilized, as the passages of the large cylinder are very short and the clearance in consequence very small.

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

The combination with the small cylinder A, large cylinder B placed side by side and each having a piston, and the steam chest on one side of the cylinder B, the valve seat having

two ports from which lead two passages p' p^2 to the ends of the cylinder A, two ports in the vertical planes of the ports leading to passages p' p^2 and from which extend short passages q' q^2 leading to the ends of the cylinder B, and the exhaust passage q^3 between the two passages q' q^2 , of the single valve o having two elongated end ports r' r^2 to connect the ports of passages q' p' and q^2 and p^2 respectively and a shorter intermediate port s of greater width than said end ports and adapted to connect passages q' q^2 with the exhaust port q^3 , substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHANN KLEIN.

Witnesses:

R. H. GROFF,
M. BESSLER.