(No Model.) 2 Sheets—Sheet 1.

E. F. C. DAVIS.

COMPOUND ENGINE VALVE OPERATING DEVICE.

No. 566,266. Patented Aug. 18, 1896.

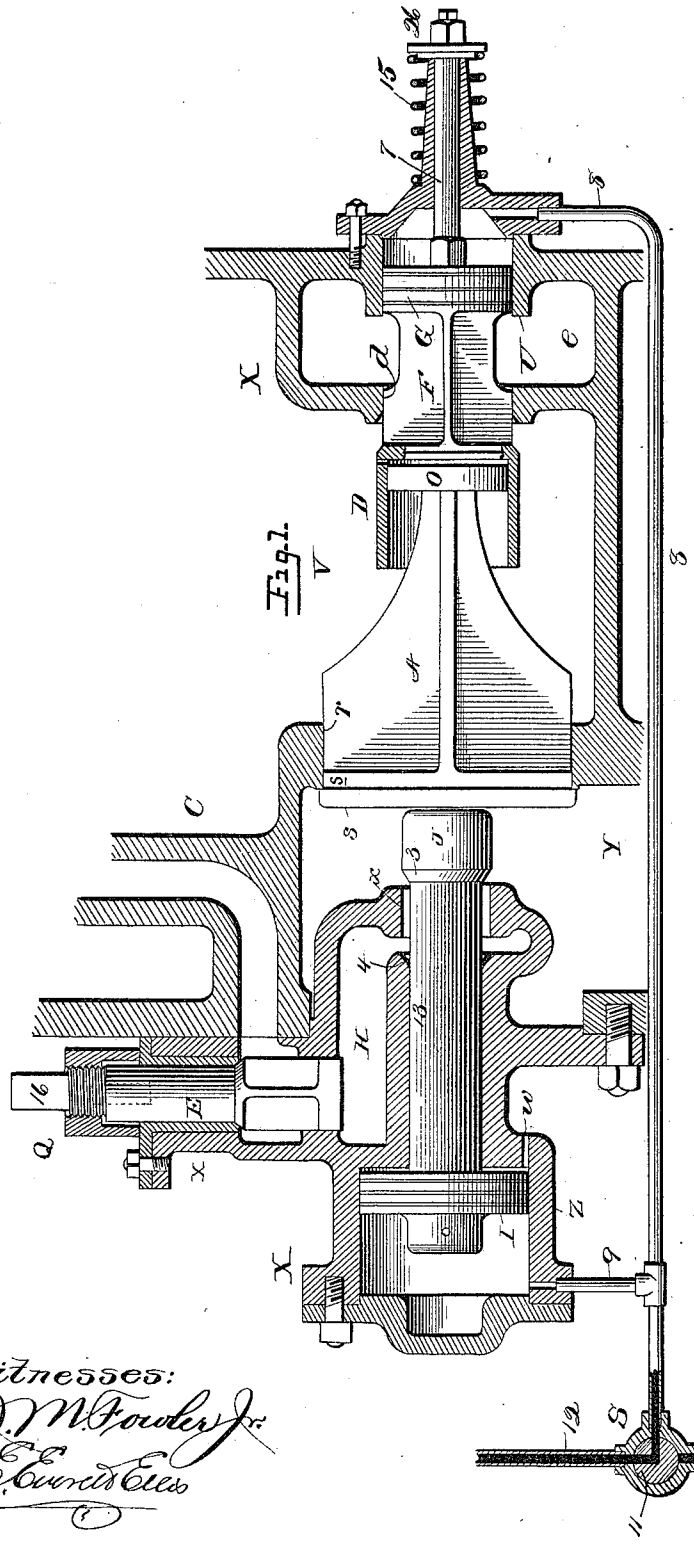

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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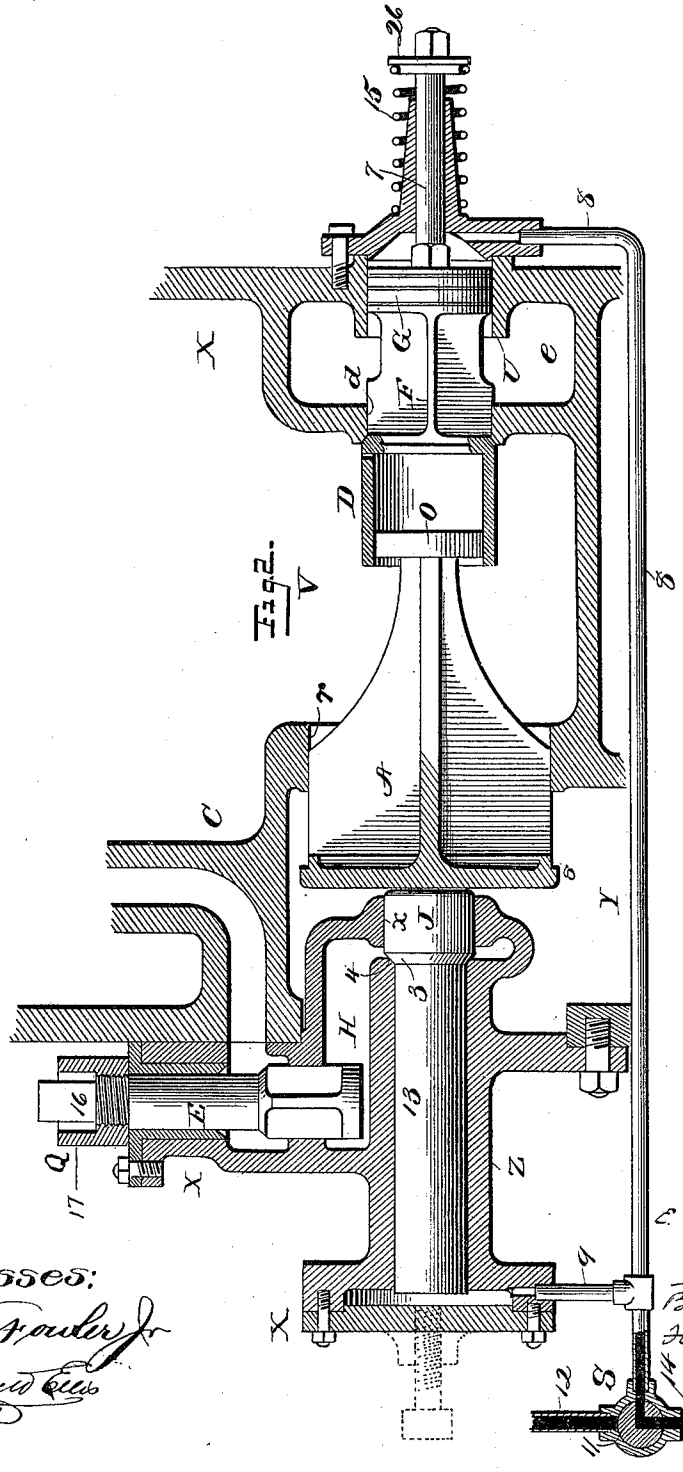

Witnesses:
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E. Everett Ellis

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UNITED STATES PATENT OFFICE.

EZEKIEL F. C. DAVIS, OF RICHMOND, VIRGINIA, ASSIGNOR TO THE RICHMOND LOCOMOTIVE AND MACHINE WORKS, OF SAME PLACE.

COMPOUND-ENGINE-VALVE-OPERATING DEVICE.

SPECIFICATION forming part of Letters Patent No. 566,266, dated August 18, 1896.

Application filed April 10, 1894. Serial No. 506,997. (No model.)

To all whom it may concern:

Be it known that I, EZEKIEL F. C. DAVIS, a citizen of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Compound-Engine-Valve-Operating Devices, of which the following is a specification.

My invention relates to valve devices for compound engines; and it consists in constructing the same to reduce the expense of fitting, to permit either engine to be run independently of the other, and to facilitate the manipulation and general efficiency of the apparatus, as fully set forth hereinafter, and as illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal section of a compound-engine-valve device, showing the position of the parts when the engine is running with the high-pressure cylinder only; Fig. 2, the same, showing the position of the valves just before starting and when the engine is working compound, and illustrating a modification of some of the parts.

The casing X of the valve device is suitably constructed to support the parts described hereinafter, and preferably is a part of the saddle of the engines, and has a partition C, dividing the receiver into two sections V Y, and in this partition is a port *r*, to which is fitted the intercepting valve A. This valve A is provided with a lip *s*, which will close the port *r* before the valve fully reaches its seat, and from the wings of the valve extends a projection carrying a piston O, which fits a cup or dash-pot D upon the head of an emergency-valve F. The emergency-valve is fitted to a port *d*, communicating with an exhaust-chamber *e*, leading to the stack.

J is the admission-valve, having an enlarged head adapted to a port *x* in the casing and a beveled face 3, adapted to a narrower seat 4 in a passage H, supplied with live steam. The valve J, which constitutes also a motor, is independent of the intercepting valve, but will bear against the center of the head of the same and push it inward and close the port *r*, when live steam is admitted to the passage H, the steam acting on the exposed portion of the face 3 and carrying the head of the valve J through the port *x*, the communication between the live-steam passage and the part Y of the receiver that leads to the low-pressure cylinder being opened as the head of the piston-valve moves out of the port *x*.

In the passage H, at any suitable point between the admission-valve J and the throttle, is arranged a reduction-valve of any suitable construction and character.

In other constructions invented by me the reducing-valve is arranged parallel to the admission-valve, but this necessitates the use of a casing of greater diameter than is desirable, and I have found that the parts may be rendered more compact and that the manufacture may be facilitated by arranging the reduction-valve E at right angles to the line of the admission-valve J, as shown, in a vertical position.

In order to open the emergency-valve F when it is desired to run simple, I provide a piston G, connected with said valve, fitting a cylinder U in the casing, the stem 7 of the piston extending through the head of the cylinder and having a collar 26 bearing on a spring 15.

With the cylinder U communicates a pipe 8, leading to a valve device S, having a two-way plug-valve 11, whereby the pipe 8 may be put in communication with a pipe 12 leading to the boiler or with a port 14 communicating with the atmosphere.

If the intercepting valve is open and the emergency-valve closed, the engine running compound, and it is desired to have it run simple, the valve device S is turned to admit pressure of steam (or any other suitable motor fluid) to the cylinder U, when the emergency-valve will be opened and the exhaust from the high-pressure engine can pass to the stack. It is, however, necessary to close the intercepting valve on or before the opening of the emergency-valve, and I therefore provide means for applying the motor fluid to positively close the intercepting valve. To this end I provide the casing with a cylinder Z, to which steam may be admitted through a branch pipe 9 from the pipe 8 to act upon a piston I, connected to the stem 13 of the valve J, as shown in Fig. 1, or it may act directly on the

end of the stem 13, as shown in Fig. 2. By this means steam is admitted simultaneously to operate both the admission-valve J and close the intercepting valve and to open the emergency-valve, each being operated positively. When the engine is again to be run compound, the plug of the valve device S is turned to put both cylinders U Z in communication with the atmosphere, when the spring 15 in connection with the superior internal pressure will cause the emergency-valve F to be closed, and the accumulation of pressure in the receiver will force open the intercepting valve A and carry with it the admission-valve J. The face 3 of the valve J and the lip *s* of the valve A are so arranged that the port *x* will be closed just as the lip *s* passes from the port *r*, so that the port *r* is opened as or after the port *x* is closed. In like manner when the engine is first started and steam is admitted to the passage H the admission-valve will be practically closed before the port *x* is opened, so that there can be no escape of high-pressure steam from the section Y to the section V of the receiver.

The opening of the throttle and passage of live steam to the passage H will of course throw the admission-valve J very quickly to the right and tend to bring the intercepting valve violently against its seat. Where the admission-valve has the piston I connected therewith, as shown in Fig. 1, the said piston I moving toward the right rapidly will compress the air in the cylinder Z, which can escape only slowly through a vent *w*, and this will tend to prevent too sudden action of the said valve, securing a cushioning effect; but where the intercepting valve is disconnected from the admission-valve or where the latter does not have any piston, as shown in Fig. 2, a sudden reduction in the pressure in the part V of the receiver might still result in a violent closing of the intercepting valve, for which reason I provide the valve with a piston O, adapted to a pot D upon the intercepting valve. I do not, however, broadly claim a dash-pot device between the valves A and F, as this is not my invention.

In my arrangement of two-cylinder compound locomotives if the high-pressure engine breaks down the slide-valve may be disconnected and placed central, so as to cover the ports, and the locomotive can be operated by the low-pressure engine as well as if it were an ordinary simple locomotive.

If the low-pressure engine should break down, or if even the low-pressure steam-chest should be broken off in a side collision, I can operate the locomotive from the high-pressure engine by simply closing the reducing-valve and opening the emergency-valve.

To avoid the necessity of disconnecting the slide-valve, I provide means whereby the reducing-valve may be secured in a closed position to prevent the passage of high-pressure steam to the low-pressure steam-chest, and I also provide means whereby the intercepting valve may be maintained upon its seat. Thus the reducing-valve has a stem 16, which extends through the casing, and in connection with this stem I employ a locking device that will hold the valve in a position to close the passage H. Thus the stem may have a slot *n*, (shown in dotted lines, Fig. 1,) so arranged that a key may be passed through the slot bearing on the upper end of the slot and upon the casing to hold the valve in a closed position. I prefer, however, to make use of a nut Q, adapted to a threaded portion of the stem 16 and having a flange 17 at one side. When the nut is in the position shown in Fig. 2, the valve is at liberty to play to any necessary extent. If, however, the low-pressure engine should break down, the nut is reversed to bring its flange to bear upon the casing, as shown in Fig. 1, when the reducing-valve will be locked in a closed position.

As the pressure upon the high-pressure side of the receiver in such case will tend to open the intercepting valve I provide means for holding it closed. Thus a screw-bolt extending through the head of the cylinder Z might be turned to bring its end to bear against the piston I and hold the latter and the valve A in their inward position. When, however, I make use of the means described for bringing a motor fluid against the pistons operating the intercepting and emergency valves, such motor fluid will serve in the exigency referred to to hold the intercepting valve in place, because in such case the motor fluid is passed to the cylinder U to open the valve F to permit the high-pressure engine to exhaust to the stack, and at the same time the pressure is admitted to the cylinder Z and acting upon the piston I will close the intercepting valve and hold it closed notwithstanding the fact that the reducing-valve has been set to cut off the pressure on the low-pressure side of the intercepting valve.

Inasmuch as the intercepting valve is disconnected from and independent of the motor or admission valve, extreme accuracy in boring the seats or ports *r x* so as to insure absolute parallelism is unnecessary, inasmuch as the valves will coöperate to all necessary degrees, but can move if necessary upon lines not exactly parallel, thereby accommodating themselves to wear or imperfections in fitting, and yet securing tight joints.

Another advantage of the independent relation of the admission-valve and intercepting valve is that when live-steam pressure would rise too high in the low-pressure cylinder overbalancing pressure on the end of the admission-valve will force it back, so as to throttle the steam, and thus prevent rising too high in said cylinder.

I do not here claim the combination of motors and pistons with the emergency and intercepting valves, nor do I here claim arranging a reducing-valve between the admis-

sion-valve and the throttle, as these features are embodied in a separate application for Letters Patent.

The claims in this case are distinguished from those in my other pending application, Serial No. 506,338, by the independent relations of the intercepting valve and the admission-valve, which are in this case disconnected from each other. They are also distinguished from those in my pending application, Serial No. 506,176, by being based on the independent reducing-valve, and they are also distinguished from my pending application, Serial No. 507,578, in which the claims are based solely on the reduction-valve.

Without limiting myself to the precise construction and arrangement of parts shown, I claim as my invention—

1. The combination in a compound-engine-valve device, of an intercepting valve, an admission-valve, and a reduction-valve, each capable of movement independent of the others, but the intercepting valve arranged to be closed by the admission-valve, substantially as and for the purpose set forth.

2. The combination with an intercepting valve, of an independent admission-valve fitting a port communicating with the live-steam passage and a cylinder Z and piston I constituting a motor for the admission-valve, and an independent emergency-valve, substantially as set forth.

3. The combination in a compound-engine-valve device, of an intercepting valve, an admission-valve, and a reduction-valve, each independent of the other, and a motor for operating the admission-valve, and a hand-control device for controlling the flow of motor fluid to and from the said motor, substantially as described.

4. The combination of the independent intercepting, admission, and reduction valves, and emergency-valve, and a hand-control device for positively and simultaneously actuating the admission and emergency valves to open the admission and emergency valves and close the intercepting valve, substantially as set forth.

5. The combination with a reducing-valve having a threaded stem extending beyond the case, of a reversible nut having an annular flange at one side adapted to surround the valve-stem and gage the opening of the valve or close it by being reversed on the stem substantially as set forth.

6. The combination of the intercepting valve, admission-valve arranged centrally in line therewith, and reduction-valve arranged at an angle to the admission-valve and controlling the flow of live steam to the admission-valve, substantially as described.

7. The combination of an intercepting valve independent of the admission-valve, and a dash-pot for reducing the closing action of the intercepting valve, said admission-valve adapted to close the intercepting valve substantially as set forth.

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

EZEKIEL F. C. DAVIS.

Witnesses:

WALTER T. WELLER,

R. J. ROUSE.