(No Model.) 3 Sheets—Sheet 1.

F. W. DEAN.

INTERCEPTING VALVE FOR COMPOUND ENGINES.

No. 474,000. Patented May 3, 1892.

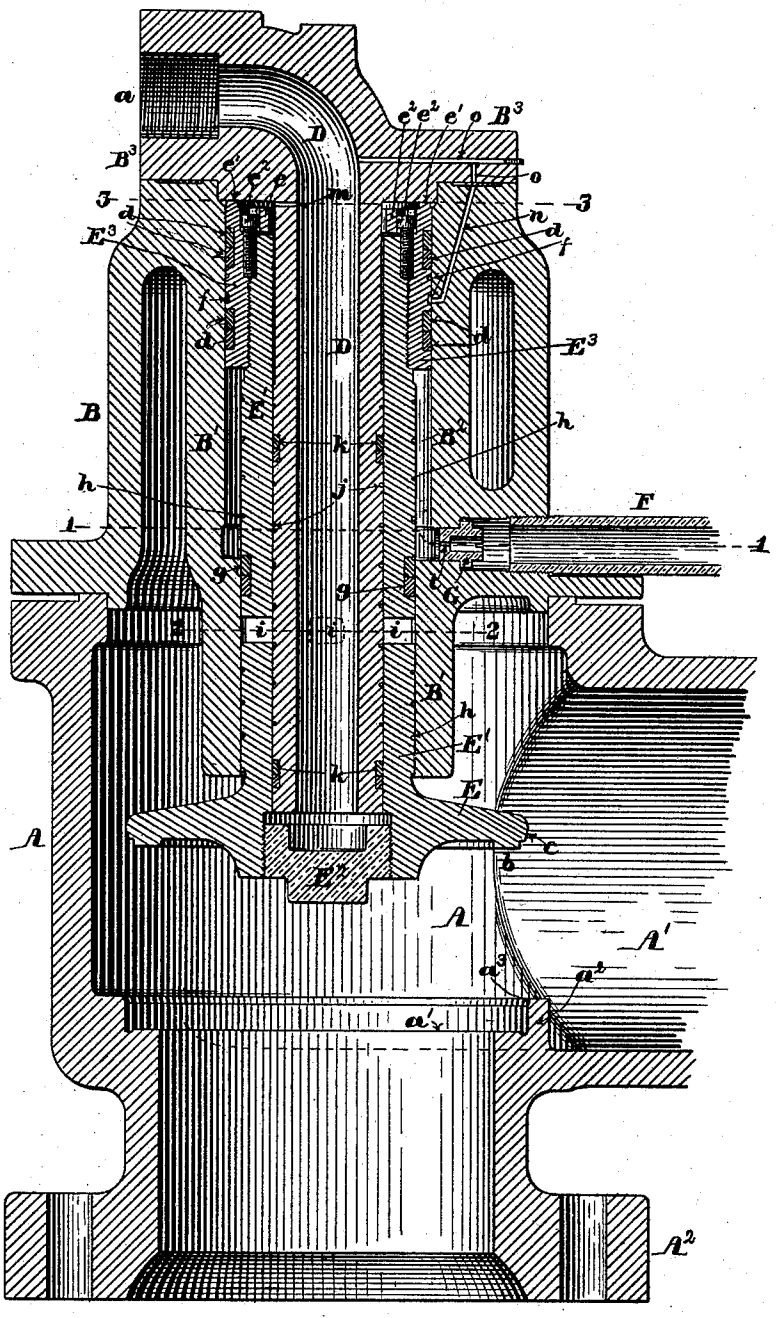

Fig. 1.

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H. E. Lombard

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(No Model.) 3 Sheets—Sheet 2.

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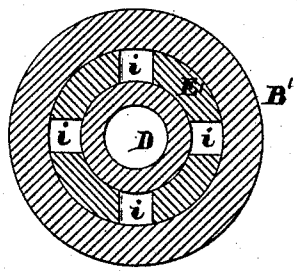

Fig. 3.

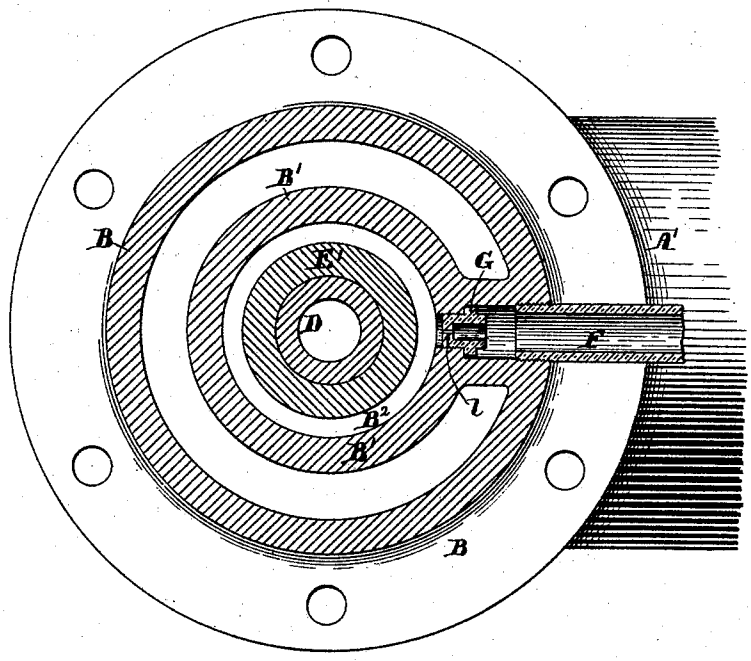

Fig. 2.

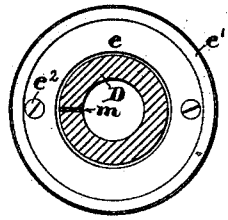

Fig. 4.

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(No Model.) 3 Sheets—Sheet 3.

F. W. DEAN.

INTERCEPTING VALVE FOR COMPOUND ENGINES.

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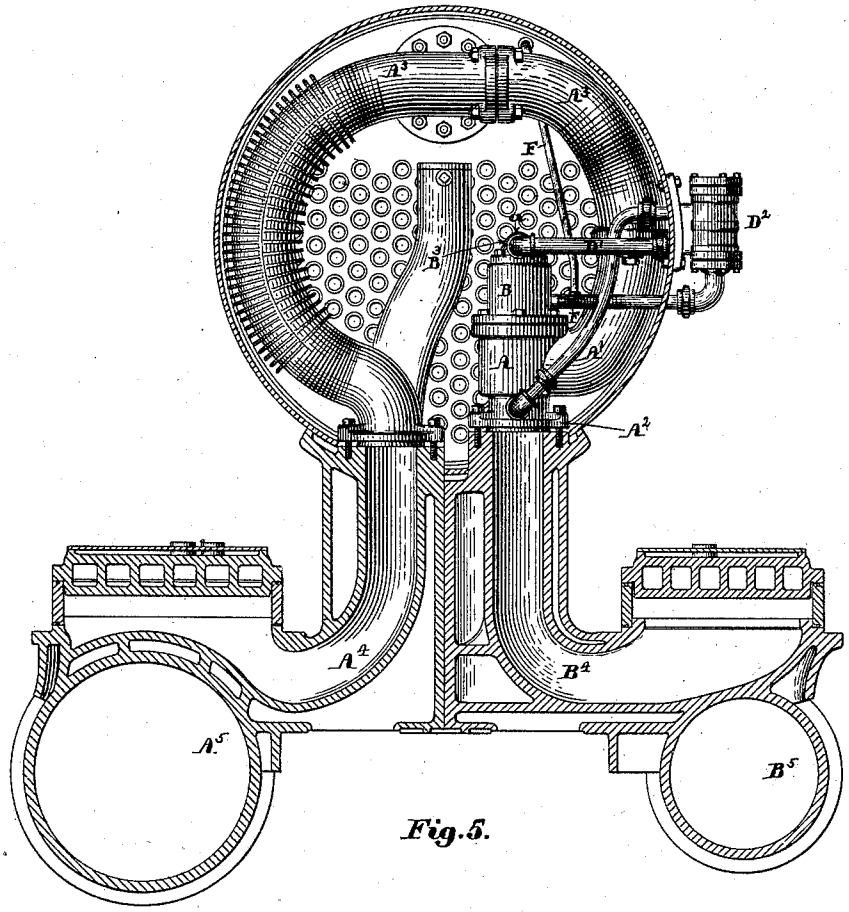

Fig. 5.

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UNITED STATES PATENT OFFICE.

FRANCIS W. DEAN, OF CAMBRIDGE, MASSACHUSETTS.

INTERCEPTING-VALVE FOR COMPOUND ENGINES.

SPECIFICATION forming part of Letters Patent No. 474,000, dated May 3, 1892.

Application filed December 17, 1891. Serial No. 415,360. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS WINTHROP DEAN, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Intercepting-Valves for Compound Engines, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to intercepting-valves for compound engines and is an improvement upon the intercepting-valve shown and described in the Letters Patent No. 459,779, granted to me September 22, 1891; and it consists in certain novel features of construction, arrangement, and combination of parts, which will be readily understood by reference to the description of the drawings and to the claims hereinafter given and in which my invention is clearly pointed out.

Figure 1 of the drawings is a central vertical section of my improved valve. Fig. 2 is a sectional plan of the same, the cutting plane being on line 1 1 on Fig. 1. Fig. 3 is a horizontal section on line 2 2 on Fig. 1. Fig. 4 is a partial sectional plan, the cutting plane being on line 3 3 on Fig. 1; and Fig. 5 is a transverse vertical section through the smoke-box of a locomotive-boiler and the two steam-cylinders of a compound engine, with my improved intercepting-valve casing shown in elevation in its proper relation to the other parts of the boiler and engine.

In the drawings, A is the main casing of the valve, provided with the pipe A′, opening from the chamber of said casing and communicating at its outer end with the curved pipe A^3, and through it with the curved pipe A^4, leading to the steam-chest of the low-pressure cylinder A^5 of the engine, the base-flange A^2 of the casing A being connected to the upper end of the exhaust-pipe B^4, leading from the high-pressure cylinder B^5, as shown in Fig. 5.

To the upper side of the casing A is firmly bolted the secondary casing B, provided with the inner pendent tubular hub B′, which extends into the chamber of the casing A and is bored out to form a cylinder having two different diameters, the upper portion B^2 of which is the larger, as shown and described in said prior patent before cited.

The upper end of the cylinder B^2 is closed by the cap B^3, having formed thereon or connected thereto the pendent pipe or tube D, the bore of which extends in a curved form through the cap B^3, and is threaded at *a* to receive the end of the pipe D′, leading from the interior of the converting-valve D^2, as shown in Fig. 5.

The interior of the casing A is provided with the valve-seat *a*′, which is surrounded by the raised rib a^2, having the upper portion of its inner surface beveled, as shown at a^3 in Fig. 1.

E is the valve provided with the annular seating-surface *b*, and the tubular stem E′, formed in one piece with said valve, the outer surface of said stem being fitted closely to the smaller bore of the pendent hub B′ and the bore of said stem being fitted to form a steam-tight bearing on the pendent tube D, as shown in Fig. 1. The bore of the stem E′ extends through the valve E, but somewhat enlarged in diameter, and has formed therein a female thread, in which is screwed the plug E^2, the upper end of which is somewhat removed from the lower end of the pendent tube D when said valve is raised to its highest position, as shown in Fig. 1.

The outer periphery of the valve E has its lower corner beveled, as shown at *c*, and its greatest diameter corresponds to the inner diameter of the rib a^2, surrounding the seat *a*.

The upper end of the tubular valve-stem E′ has screwed thereon the sleeve-like piston E^3, provided at its upper end with the inwardly-projecting flange *e* and the upwardly-projecting annular lip *e*′, and is prevented from becoming unscrewed from said stem by the screws e^2, fitted to tapped holes formed with their axes coinciding with the line of division between said piston-sleeve and said valve-stem, as shown in Fig. 1. The piston E^3 has formed in its periphery two circumferential grooves, in each of which are fitted two metal packing-rings *d d*, and it also has formed therein two smaller grooves *f*, which assist in preventing the passage of steam from the annular chamber below said piston to the chamber above the same. The valve-stem E′ is also provided with a pair of metal packing-rings *g g*, fitted to work in the lower and smaller portion of the pendent cylinder B′, and also with a series of water-packing

grooves *h h*, and has cut through it just below said packing-rings a plurality of rectangular or flat-bottomed radial openings *i*, said openings being so located relative to the seating-face of the valve and the lower end of the pendent tube D that the said openings will not begin to be uncovered by passing below the lower end of said tube until the valve E has descended nearly to its seat and its outer periphery is partially inclosed by the annular raised rib a^2.

The exterior of the pendent tube D has formed therein a series of water-packing grooves *j j* and two larger grooves, in each of which are fitted two metal packing-rings *k k*, all for the purpose of making a steam-tight joint between said tube and the valve-stem E′.

Live steam direct from the boiler is admitted to the chamber B^2 through the pipe F, the upper end of which communicates through the tube-sheet with the steam-space of the boiler, as shown in Fig. 5; but instead of the steam having free access to said chamber through an opening of the size of said pipe, as in my prior patent, the steam is wire-drawn through a very small hole *l* in the plug or bushing G, as shown in Figs. 1 and 2.

The tube D has drilled through it just below its junction with the cap B′ a small hole *m*, through which steam may pass from the interior of the tube D to the chamber above the piston E to aid in forcing the valve to its seat.

The casing B has formed in its upper part a small vent-hole *n*, the lower end of which opens into a groove *f* in the piston E^3 when in its highest position, and its upper end communicates with the annular chamber formed in the upper packing-face of said casing B. The cap B^3 is also provided with a vent-hole *o*, extending from the under side of its flange or its packing-face to the interior of the steam-passage through said cap and tube, as shown in Fig. 1, whereby any steam leaking from the chamber B^2 and passing the lower packing-rings *d d* into said groove *f* can escape into the tube D, instead of finding its way past the upper packing-rings *d d* into the chamber above the piston E^3.

The area of the annular lower end of the piston E^3 should be approximately equal to the area of the lower end of the pipe D, so that the pressure of steam in the chamber B^2 will nearly counterbalance the pressure of steam in the pipe D, tending to move the valve E downward, and so maintain said valve in its elevated position until steam enough has passed through the small hole *m* into the chamber above said piston and its stem to overcome the upward pressure of the steam in said chamber B^2, when the valve E will be moved downward as fast as the steam can pass through said orifice *m* until the valve has nearly reached its seat, and its periphery is partially inclosed by the annular rib a^2, at which time the lower sides of the openings *i i* will begin to be uncovered by the pipe D and the steam contained in said pipe and the chamber below it will escape into the chamber A and pipe A′, thus causing the speed of the downward movement of the valve E to be reduced to such an extent that it shall come in contact with its seat without any perceptible slam or jar. By making the openings *i i* rectangular or with their lower sides flat they can be placed at such a distance above the seating-surface of the valve that said valve may be moved considerably nearer to its seat before said openings are uncovered by passing below the end of the tube D, and when they begin to be uncovered a free passage of the steam through the tube D, the openings *i i*, and the pipe A′ to the low-pressure cylinder is obtained with a considerably less downward movement of the valve E than would be necessary if said openings were circular, as in my prior patent before cited.

By admitting the live steam from the boiler to the chamber B^2 through the small orifice *l* in the bushing G the upward movement of the valve E, which is started promptly by the steam in the chamber B^2, which is substantially at boiler-pressure, in its continued upward movement will be somewhat retarded by the restricted supply of steam which can pass through said orifice *l*, and as some steam will remain in the chamber above the piston, which can escape only as fast as it is forced through the orifice *m*, the upward movement of the valve will be arrested without slam or jar.

The construction shown and described insures the opening of the valve E before the pressure of exhaust-steam in the high-pressure exhaust-passage accumulates above the receiver-pressure, and thus relieves the high-pressure piston of the early back-pressure, as the valve E, being acted upon by the steam in the chamber B^2 at substantially boiler-pressure, is made to open promptly, when the converting-valve is closed and a passage is opened from the interior of the tube D to the atmosphere, and is also opened in advance of an accumulated back-pressure on the high-pressure piston.

I have herein described that the cap B^3 is connected by a pipe with the converting-valve, as described in my prior patent, herein referred to, and as a consequence of said connection it follows that when the converting-valve is closed the steam in the tube D is free to escape into the open air, and as said converting-valve is closed as soon as the high-pressure cylinder begins to exhaust it follows that before the pressure of the exhaust can accumulate above the receiver-pressure the pressure above the valve E will have been relieved and the pressure in the chamber B^2 will have commenced to raise said valve E to open communication to the receiver.

The descent of the valve E in closing is retarded by the pressure in the chamber B^2, the steam in which acts as a cushion and pre-

vents the descent of said valve any faster than said steam can be forced through the orifice *l* into the pipe F against boiler-pressure.

I claim—

1. In an intercepting-valve for compound-engines, the combination of the casing A, provided with the valve-seat *a'*, the casing B, provided with the pendent cylinder B', having two different interior diameters, the valve E, provided with the tubular stem E', fitted to the smaller diameter of said cylinder, the piston E^3, secured to the upper end of said stem and fitted to the larger diameter of said cylinder, the cap B^3 for closing the upper end of said cylinder, and the tube D, connected to and pendent from said cap and extending downward to or below the lower end of the cylinder B' and fitted steam-tight to the interior of the valve-stem E', an orifice leading from the interior of said tube to a chamber above the valve-stem and piston, and a plurality of radial openings through the valve-stem at such a distance above the valve as to be covered by the pendent tube D until the valve has descended nearly to its seat, substantially as described.

2. The combination of the casing A, provided with the seat *a'* and the annular rib a^2, the casing B, provided with the cylinder B', having two different interior diameters, the valve E, provided with the seating-face *b* and having an outside diameter corresponding substantially to the inner diameter of the rib a^2, the tubular valve-stem E', provided with the orifices *i i*, made rectangular or having flat bottoms, and also with the packing-rings *g*, and the packing-grooves *h* in its periphery, the piston E^3, secured to the upper end of said valve-stem and provided with two pairs of packing-rings *d d* and the packing-grooves *f* in its periphery, the cap B^3, provided with the pipe connection *a*, the pendent tube D, connected to said cap and extending downward within the valve-stem to a point below the lower end of the cylinder B' and provided in its exterior with two pairs of packing-rings *k* and a series of packing-grooves *j* and at its upper end with the orifice *m*, leading from the interior of the tube D to the chamber above the valve-stem and piston, the pipe F for supplying live steam from the boiler to the chamber B^2, and the bushing G, provided with the contracted orifice *l*, all constructed, arranged, and operating substantially as described.

3. The combination of the casing A, provided with the seat *a*, the casing B, provided with cylinder B', having two different interior diameters, the cap B^3, provided with tube D, opening through said cap at *a*, and with the escape-orifice *o*, the valve E, provided with the tube-like stem E', the piston E^3, secured to the upper end of said stem and provided with the packing-rings *d d* and grooves *f f*, a pipe or passage for admitting steam from the boiler to the annular chamber below said piston, and the discharge-orifice *n*, communicating at one end with the orifice *o* and at its other end with the interior of the cylinder B' at a point coinciding with one of the grooves *f* in the piston when said piston is in its highest position.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 10th day of December, A. D. 1891.

FRANCIS W. DEAN.

Witnesses:
N. C. LOMBARD,
WALTER E. LOMBARD.