(No Model.) 2 Sheets—Sheet 1.

T. M. PUSEY.

VALVE GEAR FOR STEAM ENGINES.

No. 490,986. Patented Jan. 31, 1893.

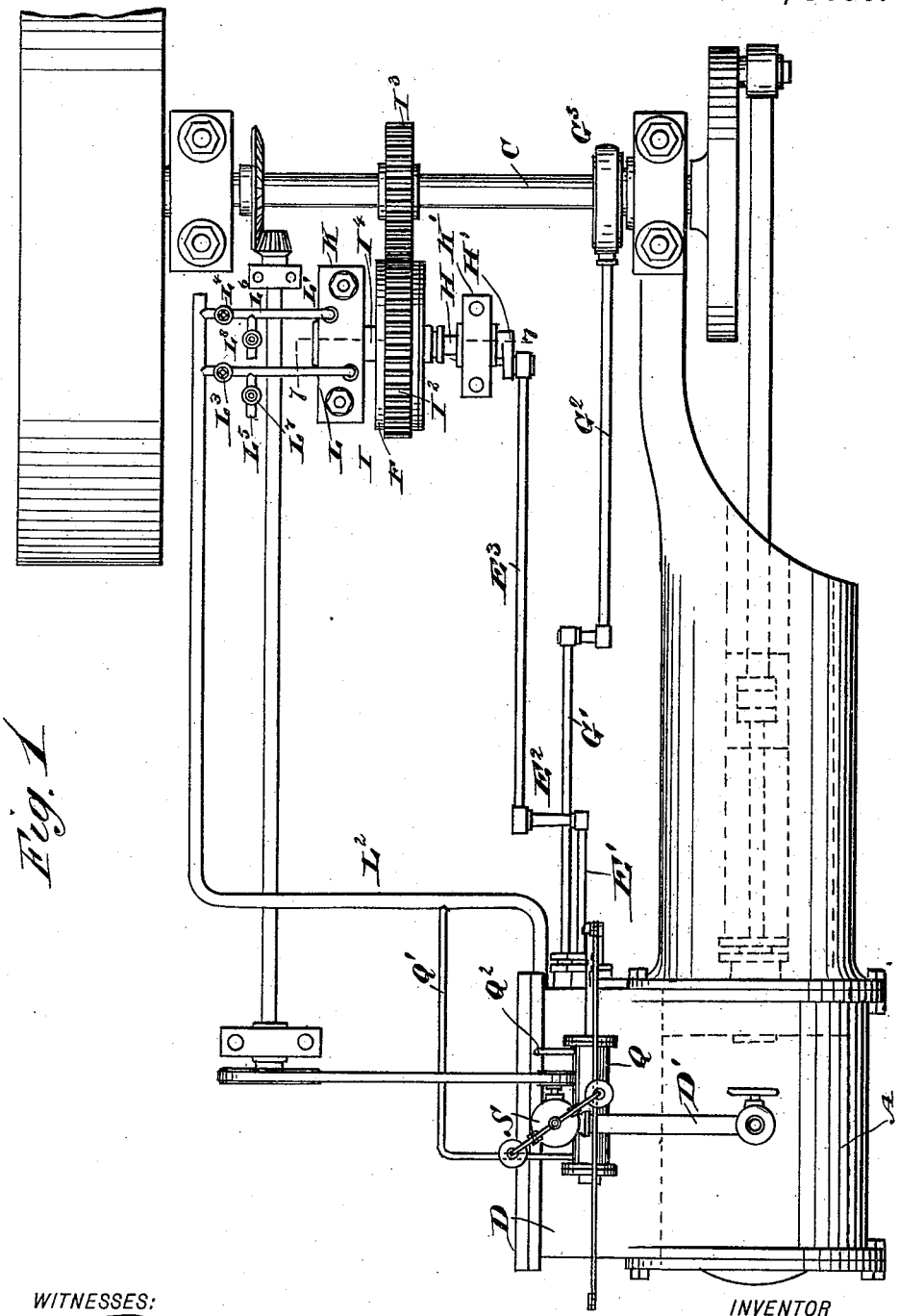

Fig. 1.

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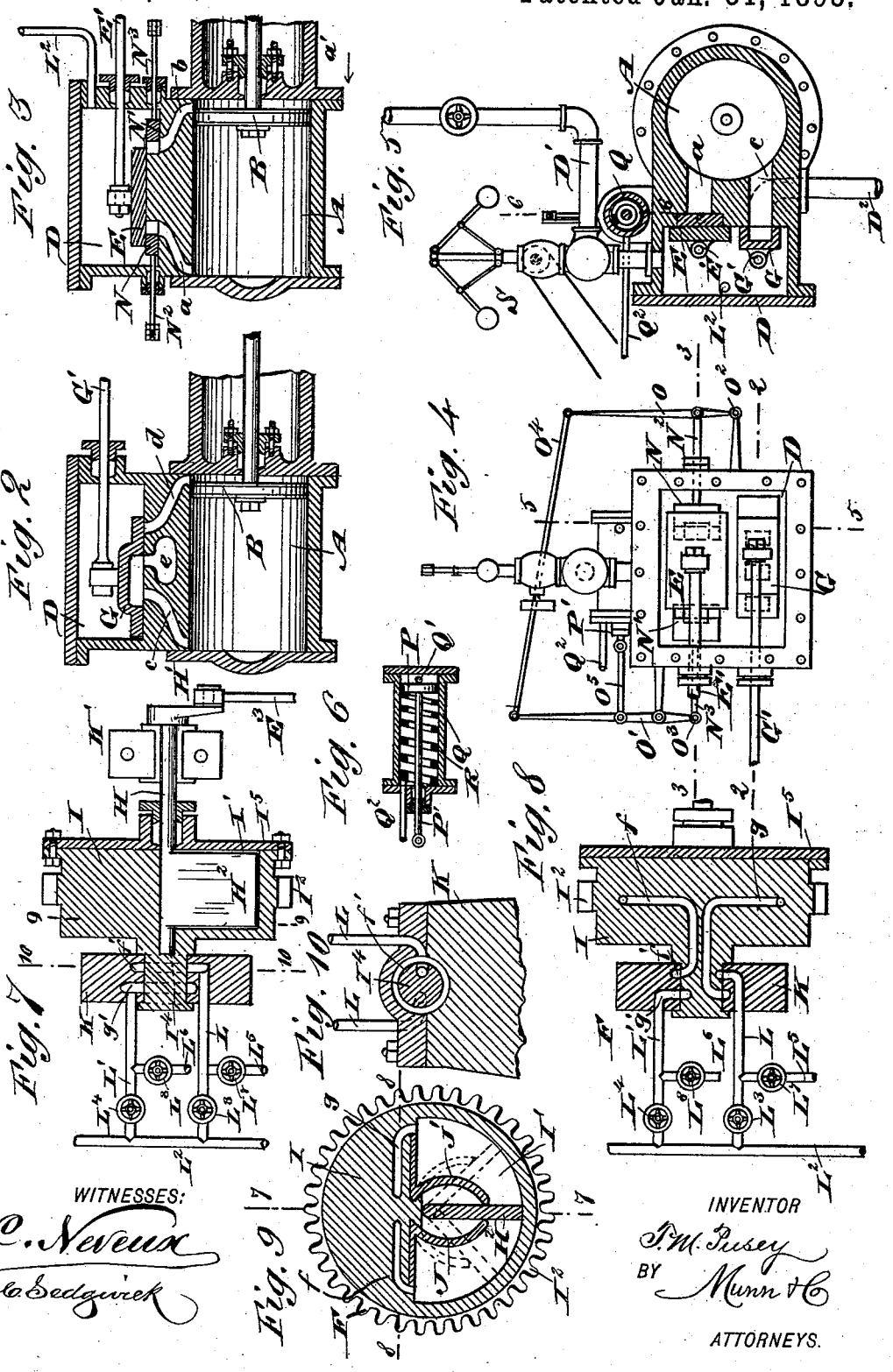

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THOMAS M. PUSEY, OF WEST CHESTER, PENNSYLVANIA.

VALVE-GEAR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 490,986, dated January 31, 1893.

Application filed June 22, 1892. Serial No. 437,571. (No model.)

To all whom it may concern:

Be it known that I, THOMAS M. PUSEY, of West Chester, in the county of Chester and State of Pennsylvania, have invented a new and Improved Valve-Gear for Steam-Engines, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved steam engine which is simple and durable in construction, very effective in operation and arranged to utilize the motive agent to the fullest advantage.

The invention consists principally of a variable shaft controlled by the pressure of the motive agent, rotated from the main driving shaft and connected with the valve governing the inlet of the motive agent to the cylinder.

The invention also consists of certain parts and details, and combinations of the same, as will be hereinafter described and then pointed out in the claims.

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 plan view of the improvement; Fig. 2 is a sectional plan view of part of the same on the line 2—2 of Fig. 4; Fig. 3 is a similar view of the part of the same on the line 3—3 of Fig. 4; Fig. 4 is a rear side elevation of the steam chest with the cover removed; Fig. 5 is a transverse section of part of the improvement on the line 5—5 of Fig. 4; Fig. 6 is a longitudinal section of the cylinder for controlling the port valves, on the line 6—6 in Fig. 5; Fig. 7 is a transverse section of the variable shaft on the line 7—7 of Fig. 9; Fig. 8 is a sectional plan view of the same; Fig. 9 is a sectional side elevation of the same on the line 9—9 of Fig. 7; and Fig. 10 is a sectional side elevation of one of the bearings for the variable shaft, on the line 10—10 in Fig. 7.

The improved steam engine is provided with a cylinder A in which is mounted to slide a piston B connected in the usual manner with the main driving shaft C of the engine. On the cylinder A is arranged a steam chest D having a steam inlet pipe D′ and connected by the ports *a* and *b* with the ends of the cylinder A and the said ports are controlled by a valve E mounted to slide in the steam chest D over the said ports as will be readily understood by reference to Figs. 3 and 4.

The slide valve E is controlled from a variable shaft H and for this purpose the valve stem E′ of the said slide valve is provided with a stud E^2 connected by a pitman E^3 with a crank arm H′ secured on said variable shaft H carrying a wing H^2 mounted to oscillate within a semi-circular recess I′ formed in the casing I. The steam chest D is also provided with two exhaust ports *c* and *d* leading to the ends of the cylinder but in a different plane from the inlet ports *a* and *b* as will be readily understood by reference to Figs. 4 and 5.

The exhaust ports *c* and *d* are governed by a slide valve G which is adapted to alternately connect the said ports with an outlet port *e* leading to the exhaust pipe D^2. The valve stem G′ for the exhaust port slide valve G is connected with the eccentric rod G^2 of an eccentric G^3 secured on the main driving shaft C.

By the arrangement described, the exhaust port slide valve G is controlled from the main driving shaft C while the inlet port valve E is controlled from the variable shaft H, the position of which varies according to the pressure of the motive agent entering the steam chest D as will be more fully explained. The casing I is formed on its periphery with a gear wheel I^2 in mesh with a gear wheel I^3 secured on the main driving shaft C so that a rotary motion of the latter is transmitted by the said gear wheels to the said casing I. The latter has its bearing at one end on the shaft H, as will be readily seen by reference to Fig. 7; the other end of the casing being formed with a trunnion I^4 mounted to turn in a bearing K. The shaft H is mounted to turn in a bearing K′. See Figs. 1 and 7. The wing H^2 is pressed on opposite sides by springs J and J′ fastened in the bottom of the circular recess I′ formed within the casing I, as above mentioned and illustrated in Fig. 9. The circular recess I′ is thus divided by the said wing H^2 into two compartments connected with the ports *f* and *g* respectively, extending rearwardly through the trunnion I^4 to lead into annular recesses F′ and G′ respectively, formed partly in the trunnion I^4 and the bearing K as will be readily understood by reference to Figs. 7, 8 and 10. The annular recess *f*′ is connected with

a branch pipe L and the other recess g' is connected with a branch pipe L′ both branch pipes L and L′ leading to a main pipe L^2 connected with the steam chest D. In the branch pipes L and L′ are arranged valves L^3 and L^4, of which one is closed when the other is open. In the branch pipes L and L′ are arranged outlet pipes L^5 and L^6 located between the valves L^3 and L^4 respectively, and the bearing K, and the said outlet pipes are provided with valves L^7 and L^8 of which one is closed while the other is open. Now, when the valve L^3 is open, the valve L^4 is closed and the valve L^7 is closed when the valve L^8 is open, so that the steam from the steam chest D can pass through the pipe L^2 into the branch pipe L and from the latter into the annular recess f' to the port f to one of the compartments in the recess I′ so as to exert a pressure against one side of the wing H^2, the opposite side of which is pressed on by the spring J′. Now, according to the pressure of the motive agent, the wing H^2 is swung more or less to one side against the spring J′ and consequently the position of the shaft H carrying the said valve is varied or changed relative to the revolving casing I. As the position of the shaft H changes, the position of the slide valve E is likewise changed owing to the connection between the said shaft and the said slide valve, as above described. When the engine is running in an opposite direction, that is reversed, then the valves L^3 and L^8 are closed and the valves L^7 and L^4 are opened so that the motive agent can pass from the steam chest D through the pipe L^2 into the branch L′ and from the latter into the recess g' and through the port g into the other compartment in the circular recess I′, so that the wing H^2 is pressed at its opposite side and is swung in the opposite direction against the tension of the spring J′. The steam in the other compartment can pass through the port f the recess f', branch pipe L and outlet pipe L^5 to the outer air, so that only atmospheric pressure is in this compartment, and the pressure of the steam in the other compartment is exerted against the wing H^2 pressed on by the spring J′.

In order to vary the amount of steam admitted through the ports a and b into the cylinder A I provide cut-off valves N and N′ adapted to open and close more or less the ends of the said ports opening into the steam chest D, see Figs. 3 and 4. The valves N and N′ are connected by their valve stems N^2 and N^3 with levers O and O′ respectively, pivoted on brackets O^2 and O^3 respectively, projecting from the ends of the steam chest D. The upper ends of the levers O and O′ are connected with each other by a link O^4 so that the motion given to one of the said levers is transmitted by the said link O^4 to the other lever and consequently both valves N and N′ shift simultaneously to enlarge or decrease the ports a and b. As will be seen by reference to Fig. 4, the fulcrums of the levers O and O′ are on opposite sides so that the valves N and N′ simultaneously open or close the ports a and b respectively. The lever O′ is pivotally-connected by a link O^5 with a piston rod P′ carrying a piston P mounted to slide in a small cylinder Q arranged on top of the steam chest D, see Figs. 4, 5 and 6.

The piston P is pressed on on one side by a graduated spring R so as to hold the said piston normally in an outermost position, as shown in Fig. 6. The cylinder Q on the other side of the said piston P is provided with a steam inlet pipe Q′ connected with the outer pipe L^2 leading from the steam chest D so that the motive agent from the latter can pass through the said pipe L^2, the pipe Q′ into the one end of the cylinder Q to press on the piston P against the tension of the spring R. The cylinder Q is provided on the side containing the spring R with an outlet pipe Q^2. In the inlet pipe D′ is arranged a governor S of any approved construction and driven by suitable mechanism from the main driving shaft C in the usual manner.

The operation is as follows: When the motive agent is admitted through the inlet pipe D′, into the steam chest D, then it passes through one of the ports a or b into the cylinder A, to push the piston B in one direction. As shown in Fig. 3, the steam will enter the port b so as to push the piston B in the direction of the arrow a', the other port a then being closed. At the same time the slide valve G is in the position shown in Fig. 2, that is the port d is closed and the other port c is connected by the slide valve G, with the port e leading to the exhaust pipe D^2 so that the exhaust steam on the opposite side of the piston can pass through the ports c and e and the exhaust pipe D^2 to the outer air. The position of the valve E relative to the opening of the port b now varies according to the pressure of the motive agent in the steam chest D on account of the variable shaft H controlled by the motive agent which entered the said steam chest D and which passed from the latter into one compartment of the circular recess I′ to press on the wing H^2 with more or less force, thus shifting the slide valve E to open or close the said port b more or less. For instance, if the pressure of the motive agent increases, then the wing H^2 is pressed more to one side and consequently, the slide valve E is shifted more to one side so that the port b is partially closed and consequently more or less steam is admitted through the said port b into the cylinder A. As the steam admitted however, is of a higher pressure it requires a less amount to move the piston B with the same force on its return stroke. As the piston B moves in the direction of the arrow a' on its return stroke, rotary motion is given to the shaft C whereby the casing I is revolved and with it the shaft H so that the valve E cuts off the steam in the usual manner, the cut-off however, taking place sooner in case the motive agent has a higher pressure as the valve E was shifted in the inverse

direction of the arrow a' as above described. When the piston B is at the end of its return stroke, then the valve E has shifted to open the port a and has closed the port b. The motive agent now enters the port a to force the piston B on its forward stroke in the inverse direction of the arrow a'. The above described operation is repeated the only difference being that the valve G is likewise shifted to connect the port d with the port e while the port c is closed. If the pressure in the steam chest D remains the same, then the valve E opens and closes the port a at the same ratio as it did the port b, but should the pressure vary, then the valve E is shifted owing to the different position of the wing H^2 and consequently more steam will be admitted to the port a on the decrease of the pressure in the steam chest and less steam will be driven at the increase of pressure within the said chest. At the same time that the valve E is shifted according to the pressure, the openings of the ports a and b are decreased by the valves N and N′ respectively, owing to the motive agent passing from the steam chest D through the pipes L^2 and Q′ into the cylinder Q in which the motive agent acts on the piston P and forces the same outward so as to impart a swinging motion to the levers O and O′ which thus shift the valves N and N′ inwardly toward each other to decrease the openings of the ports a and b. In case of decrease of pressure in the steam chest D the spring Q will force the piston P inward to the inlet of the pipe Q′ so that the valves N and N′ move simultaneously outwardly to fully open the ports a and b. It will thus be seen that the slide valve E for the motive agent inlet ports is controlled by the pressure of the motive agent entering the steam chest D. At the same time the size of the ports a and b is controlled in a like manner by the pressure of the steam, irrespective of the speed of the engine and irrespective of the governor S. Thus, with high pressure steam, the valve E is cut off sooner, so that but a small amount of steam is admitted to the cylinder and the amount admitted can fully expand before the piston reaches the end of its stroke.

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

1. A steam engine provided with a variable rotary shaft controlled by the pressure of the motive agent rotated from the main driving shaft, and connected with the valve governing the inlet of the motive agent to the cylinder, substantially as shown and described.

2. A steam engine provided with a slide valve controlling the inlet ports of the motive agent to the cylinder, a rotary crank shaft rotated from the main drive shaft and having its crank or eccentric connected with said slide valve, said shaft also being controlled by the motive agent through suitable connections, substantially as set forth.

3. A steam engine provided with a cylinder having separate inlet and exhaust ports, a slide valve for the said inlet ports and controlled through the medium of suitable mechanism by the motive agent entering the steam chest, and a slide valve for the said exhaust ports and controlled from the main driving shaft of the engine, substantially as shown and described.

4. A steam engine provided with a casing mounted to turn and driven from the main driving shaft, the said casing containing a spring pressed wing connected with the slide valve for the inlet ports, substantially as shown and described.

5. A steam engine provided with a valve operating and controlling mechanism comprising a casing mounted to turn and driven from the main driving shaft of the engine, a wing mounted to oscillate in the said casing and acted on by the motive agent leading to the casing from the steam chest, springs pressing on opposite sides of the said oscillating wing, and a shaft carrying the said wing and provided with a crank arm connected with the sliding valve for the inlet ports of the engine, substantially as shown and described.

THOMAS M. PUSEY.

Witnesses:
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WILLIAM CHALFANT, Jr.