

Patented Aug. 28, 1866.

A circular diagram with a shaded central region. The shaded region is a circle with diagonal hatching. Inside this shaded circle is a smaller circle with a cross-hatch pattern. The label 'G' is to the left of the shaded circle, 'E' is to the right, and 'S' is below it. There are also some small, less legible characters near the bottom of the shaded circle.

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IMPROVEMENT IN AUTOMATIC STEAM-VALVES.

Specification forming part of Letters Patent No. 57,509, dated August 28, 1866.

To all whom it may concern:

Be it known that we, GEORGE W. HOPKINS and ELISHA HOPKINS, both of the city of Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Improvement in Automatic Valve Devices for Steam and other Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form part of this specification, and in which—

Figure 1 represents a vertical longitudinal section of a horizontal steam-engine cylinder with its automatic valve, constructed according to our improvement, attached. Fig. 2 is a similar view of the same, but with its movable parts differently situated; and Fig. 3, a transverse section through one of the necks of the piston-valve.

Our improvement relates to that class of valves in which the engine-piston direct is made to control the action of the valve by alternately establishing and shutting off communication with steam-passages as it (the piston) moves or slides over them, and which passages are connected with an outer valve-cylinder containing a piston-valve that, acted upon by the steam from the engine-cylinder as certain passages are uncovered by its piston, automatically reverses the motion of the engine by changing the steam-ports and exhaust-passages open to the engine-cylinder on opposite sides of its piston; and our invention consists in a novel combination, with a suitably-constructed valve-piston, of a metallic ring or packing at or near opposite ends of the valve-cylinder, and made capable of sliding in reduced portions of said cylinder, and being acted upon by the valve as it slides, and to which it forms a packing, to alternate the steam-passages of the engine-cylinder that communicate with the piston-valve to operate it, and so to reverse the steam and exhaust ports on opposite sides of the engine-piston.

To enable engineers and others to make and use our improvement, we will now proceed to describe it as represented in the accompanying drawing, in which similar letters of reference indicate corresponding parts throughout the several figures.

The portion marked A represents a horizontal engine-cylinder, B the engine-piston,

and C its rod. D is the valve-cylinder, reduced in diameter at either end to form comparatively small cylinder $d d'$; E E', a double or divided piston-valve, with an exhaust chamber or space, F, between its two heads, that work in the larger portion D of the cylinder. G is the valve-rod, that may pass out through stuffing-boxes at one or both ends of the valve-cylinder.

The two heads E E' of the valve-piston have necks projecting from their outer faces. These necks are, at their outer ends, $e e'$, of the diameter of the small cylinders $d d'$ of the valve-cylinder, so as to work in a close or steam-tight manner therein; but between these outer ends $e e'$ and the heads E E' said necks form reduced portions $f f'$, so as to give a free escape for steam past and round them when they project into the cylinders $d d'$. Such portions $f f'$ of the necks are provided near their roots, or adjoining the outer faces of the head, with ribs or radial projections $g g'$, made capable of freely entering the cylinders $d d'$, but not so as to close the steamways over which they, or rather the lower of such ribs, alternately, as regards the two necks, pass and lie.

S S' are metallic rings or packings sprung round the reduced portions $f f'$ of the necks, and fitting in a steam-tight manner, but so as to be capable of sliding, within the mouths of the cylinders $d d'$.

H H' are the main steam-inlets. They enter the small cylinders $d d'$, and communicate alternately with the engine-cylinder by steamways $h h'$, accordingly as the valve is situated. These steamways also form exhaust-passages in opposite positions of the valve, accordingly as they communicate respectively with exhaust-passages $i i'$ in and through or along the heads and necks of the double or divided valve.

I is the delivery-outlet to the exhaust. It communicates alternately, by ports $k k'$, with the space or chamber F, lying between the valve-heads, accordingly as the valve is placed.

$l l'$ are steamways connecting the engine-cylinder with the small valve-cylinders $d d'$ at or near the mouths of the latter.

From this minute description of the details a short explanation will suffice to make clear the operation of the several parts.

Supposing the engine piston and valve to be

in the positions represented in Fig. 2, steam will be admitted by the right-hand inlet, H, into the small valve-cylinder *d*, and from thence, through the passage *h*, behind the engine-piston B, which will cause the latter to be driven in the direction of the arrow shown in said figure, the adjoining steamway *l* being closed by the shoulder of the enlarged portion *e* of the neck in the movement of the valve to its position in this figure, shifting the ring or packing S over said way; but when the engine-piston has continued its motion from right to left so far as to just pass or open in its rear the corresponding way *l'*, steam from the engine-cylinder will enter the way *l'*, and passing the radial stops *g'* and round the reduced portion of the neck between the ring S' and outer face of the valve-head E', and into the enlarged portion of the cylinder D, will act upon the said head and force the valve to the position shown in Fig. 1. By this time the engine-piston will have arrived at the end of its one stroke and the shoulder of the enlarged portion *e'* of the neck will have shifted the ring S' so as to close the way *l'*. The steam inlet H' will be opened so as to freely communicate with the cylinder *d'*, and, by the way or passage *h'*, with the other side of the engine-piston to impel it in an opposite direction. The same motion, too, of the valve shuts off the communication of the valve exhaust-passage *i'* with the way *h'*, and by the action of the radial stops *g* causes the ring S to be moved so as to open communication of the way *l* with the rear or outside of the valve-head E, closes the steam-inlet H, and establishes a free opening for the valve-passage *i* with the way *l*, exhaust-chamber F, port *k*, and main outlet I. A similar action of the

valve-heads and necks with their rings, in controlling the several or their respective steam and exhaust ways, takes place automatically, as described, as the engine-piston approaches each end of its cylinder.

The steam contained in the space lying between either outer end of the piston-valve and adjacent valve-cylinder cover will act as a cushion, to check the valve overshooting itself and too abrupt motion of it when shifted by the action of the steam on the valve-head; or a metallic or other stop may be provided and the valve otherwise cushioned; also, stops may be furnished the rings S S', to prevent them being forced too far into the cylinders *d d'*.

The motion of the engine may be reversed by shifting the valve by hand by means of the valve-rod G.

For engine pumping and other purposes where a sudden opening of the ports is desirable, this our improvement will be found an advantageous one in valves of the description referred to.

What we claim as new, and desire to secure by Letters Patents, is—

The combination, with a piston-valve constructed substantially as described, of the sliding rings, S S', arranged and operating, in connection with the valve-heads and their necks, to produce the operation of the valves by steam from the cylinder, essentially as herein set forth.

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Witnesses:

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