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PATENTED JAN. 2, 1906.

D. MILLS.
AIR PUMP.

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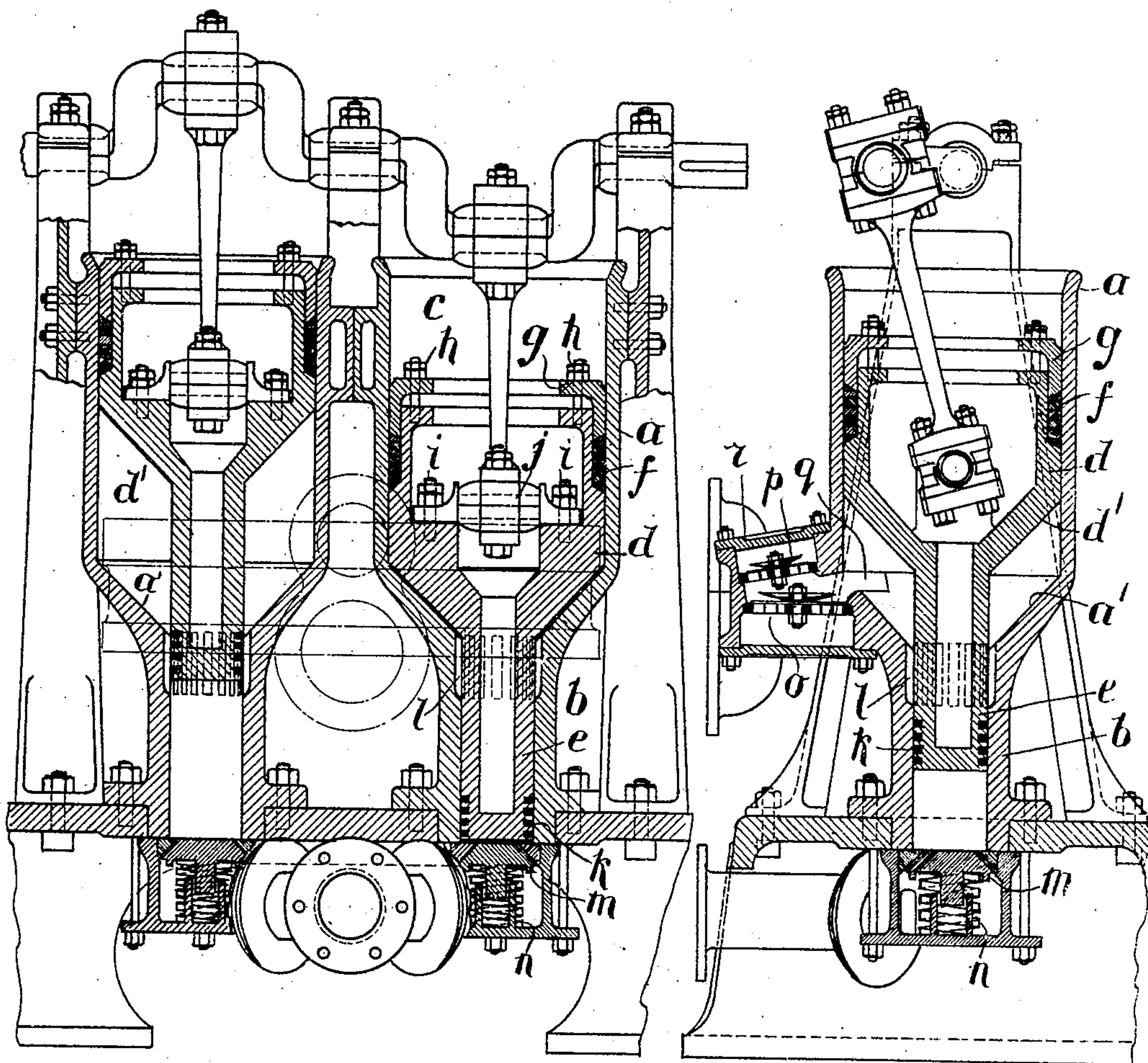


FIG. I.

FIG. II.

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DAVID MILLS, OF EAST RAND, TRANSVAAL.

AIR-PUMP.

No. 809,002.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, DAVID MILLS, a British subject, residing at the East Rand Proprietary Mines, Limited, East Rand, in the Colony of Transvaal, have invented certain new and useful Improvements in Air-Pumps, of which the following is a specification.

The present invention relates to air-pumps such as are employed for exhausting steam-engine condensers; and its principal object is to provide a pump capable of producing and maintaining a higher degree of vacuum than has been the case heretofore. To that end the pump is constructed upon a novel principle which enables the clearance-spaces to be reduced to a minimum and which, further, while reducing the number of valves and packings requiring adjustment, permits ready access to those that are employed. Another feature conducive to the same end is the absence of the objectionable churning together of air and water, which is a defect of many existing air-pumps.

A further object of the invention is to provide an air-pump adapted to pump direct to the boilers, which may thus either replace the usual feed-pumps or serve as an auxiliary in case of their breakdown.

The invention is broadly characterized by the use of a compound pump-barrel, the upper part of which is of considerably greater diameter than the lower part, having a corresponding double piston working therein—that is to say, a valveless-disk piston for the upper part, from the under side of which extends a plunger fitting the lower cylinder. Further, the arrangement is such that during the suction-stroke mixed air and water are drawn into the larger cylinder, while a vacuum is produced in the smaller barrel. At or near the termination of said stroke communication is opened between the lowest point of the upper barrel and the smaller barrel, whereby the solid water collected in the former is caused to flow into the plunger-barrel both by its own weight and by the superior pressure due to the presence of water-vapor in the larger barrel. Upon the return stroke the communication is again cut off, the water is expelled from the plunger-barrel by one orifice, while the remaining contents of the larger cylinder, consisting now of air with some water-vapor, are discharged through a separate outlet.

Referring now to the accompanying drawings, which illustrate the preferred embodiment of the invention, Figure I is a longitudinal vertical section of a pair of the improved pumps, and Fig. II is a vertical section taken at right angles to Fig. I of one pump with the piston at half-stroke.

The pump-barrel consists of the upper part *a* and the lower smaller part *b*. The bottom *a'* of cylinder *a* is coned, as shown, to facilitate the flow of the water collected on it into the lower barrel. The top of the barrel is open, and when the piston is at its lowest position the uncovered walls *c* of the upper cylinder are cooled, whereby vaporization is minimized and the vacuum is improved. The two piston parts *d e* are formed in one casting and being hollow are kept cool by the air. In some cases cooling-water may be circulated above the piston *d*. The upper portion *d* of the piston is provided with ordinary soft packing *f*, retained by the gland *g*, the nuts *h h* for adjusting which are readily accessible from above, as are also the studs *i* for retaining the gudgeon *j*. The bottom *d'* of the piston *d* corresponds in shape to the cylinder-bottom *a'* and is carefully fitted, so as to reduce the clearance to a minimum. For the same reason the plunger *e* approximates closely in diameter to the plunger-barrel *b*. It is packed with several Ramsbottom rings *k k*. *l l* are vertical ports or grooves which afford communication between the two cylinders when uncovered by the rising of the plunger. In the left-hand pump, Fig. I, the plunger is raised sufficiently to uncover the ports and connect the two cylinders.

The water-discharge valve *m* is located in the bottom of the plunger-barrel and may be an ordinary non-return valve controlled by a strong spring *n*.

The arrangement of the inlet-valve *o* and the air-discharge valve *p* is clearly shown in Fig. II and is such that there is little dead space between them and the piston *d*. The inlet-valve is the larger and is fitted in from below close to the common cylinder-port *q*. The air-discharge valve *p* is somewhat smaller and is located as close to *o* as possible, being inserted through the cover *r*.

It will be evident that the absence of solid water under the larger piston and the free discharge from under the plunger upon the downstroke enable the clearance-spaces un-

der the piston and the plunger, respectively, to be made very small without danger. Again, the small area of the ram renders it capable of pumping the condensed water directly to the boilers, if required.

Although the combination of a pair of pumps working alternately is considered a desirable arrangement, yet it is to be understood that the improved pumps may be used singly or combined in any number according to the circumstances.

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

1. In a steam-engine air-pump and in combination, a pump-barrel having a large upper part and a small lower part, a valveless piston working in the upper part, from the under side of which extends a plunger working in the lower part, an inlet-valve for the upper part, outlet-valves for the upper and lower parts respectively, and means for making communication between the lowest point of the upper part and the lower part at or near the termination of the suction-stroke and for

breaking the communication at or near the commencement of the discharge-stroke.

2. In a steam-engine air-pump and in combination, an open-topped upper cylinder having a conical bottom surmounting a smaller cylinder, a piston working in, and corresponding in shape to the larger cylinder, from the under side of which piston extends a plunger working in the smaller cylinder, vertical ports formed in the upper part of the smaller cylinder adapted to be uncovered by the plunger at or near the end of the suction-stroke and to be again covered by it at or near the commencement of the discharge-stroke, an inlet and an outlet valve communicating by a common port with the under side of the larger piston and a valve for discharging from under the plunger; substantially as hereinbefore described and illustrated by the accompanying drawings.

Johannesburg, December 8, 1904.

DAVID MILLS.

Witnesses:

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