John F. Haskins.

Imp'l in injecting water into Air-compressing Pumps.

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Fig. 1.

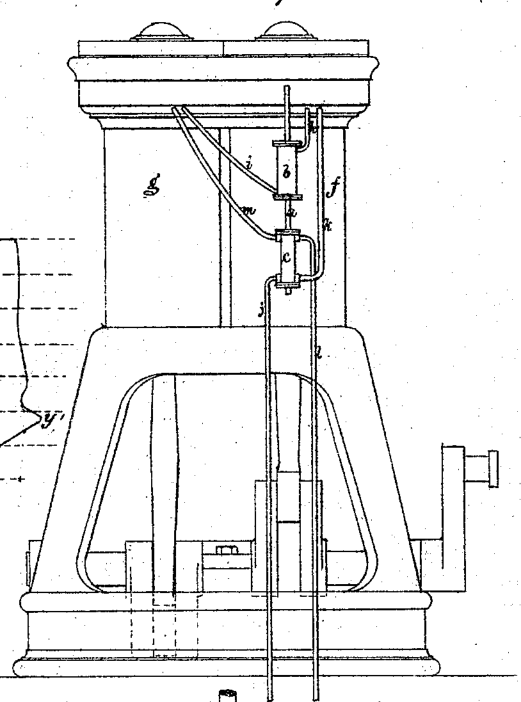


Fig. 3.

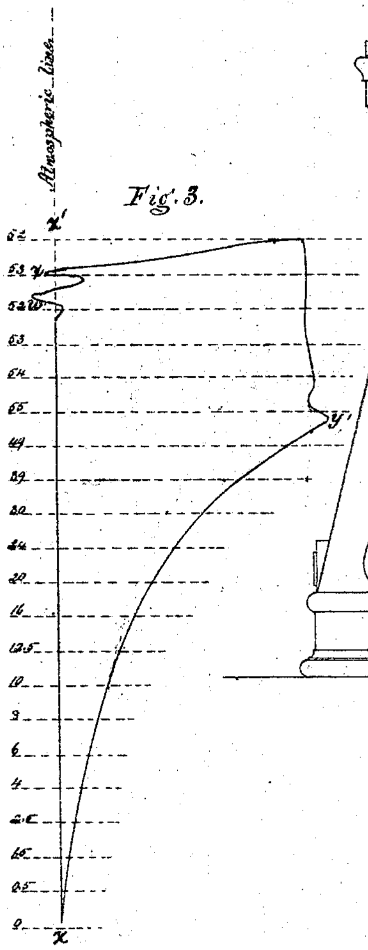
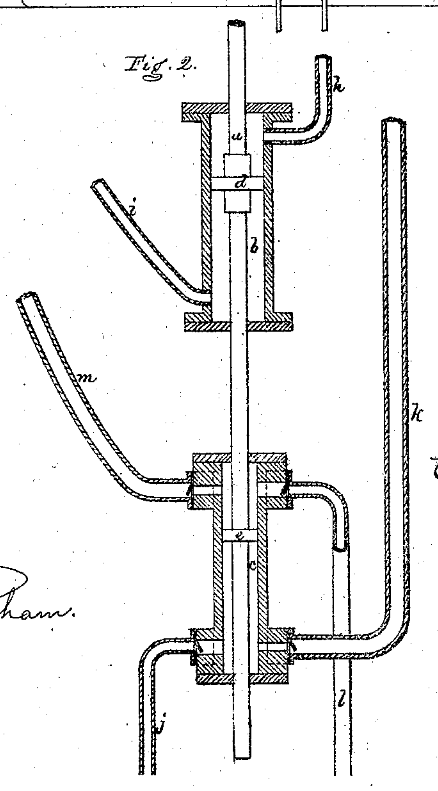


Fig. 2.



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UNITED STATES PATENT OFFICE.

JOHN F. HASKINS, OF FITCHBURG, MASSACHUSETTS.

IMPROVEMENT IN SUPPLYING WATER TO AIR-PUMPS.

Specification forming part of Letters Patent No. 117,626, dated August 1, 1871.

To all whom it may concern:

Be it known that I, JOHN F. HASKINS, of Fitchburg, in the county of Worcester and State of Massachusetts, have invented Improvements in Means for Supplying Water to Air-Compressing Pumps; and I do hereby declare that the following, taken in connection with the drawing which accompanies and forms part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

In compressing air it is well known that latent heat contained therein is rendered sensible, and that it has been found necessary to apply to air-compressing pumps, working rapidly and constantly, some means for absorbing and conducting off from the pumps the heat so made sensible to prevent the working parts from injury and expansion. It has been common, heretofore, to introduce water into air-compressing pumps, as closely as possible to the air-delivery valve, in one of two ways, viz.: First, by a pipe connected with a head of water, and having a check-valve to prevent entrance of air into the water-pipe or reservoir; and second, by a pipe connected with a pump worked by positive mechanical devices. In the first of these means the pump has been too much filled with water, and at times when none is needed and the water has been wasted; for the water would flow into the pump at the time when the piston was making its air-receiving stroke, and as the air-inlet valve opened to admit air water escaped past the valve and ran to waste. Still sufficient was left in excess of the amount needed to greatly diminish the air-compressing capacity of the pump and often to cause the piston to break the pump-head when the quantity of water was so great as to crowd the exit-passage from the pump. For in air-compressing pumps it is necessary, in order to produce the best results, to have the clearance-space between the compressing-piston and the delivery-valve as small as possible; hence the outlet-passages for the compressed air controlled by the delivery-valve are made small and are readily choked by excess of water, and when choked breakage ensues. In the second of the aforesaid old means for supplying water a pump was employed worked by positive connections, usually a crank or an eccentric, so that the delivery of such water-pump began at nothing and was accelerated to the middle point of the stroke of the pump and then diminished from such point to nothing at the end of the stroke.

In supplying water to pumps employed in condensing air the supply should be to produce the best effect—one which constantly increases so long as the pressure in the air-condensing pump increases. This result has not been attained hitherto. As the pressure in the air-pump increases so is the heat developed, and the supply of water needs to be given in a constantly-increasing ratio so as to absorb and carry off the constantly-increasing heat. In compressing a given amount of air of a given temperature to a given density a substantially uniform increase of temperature will be developed, and by experiment or by experience may be determined the proper amount of water needed to carry off the developed heat, and no more water than such amount should be employed.

By means of my invention, herein to be set forth, it will be seen how such quantity of water will be injected into the pump between its valves with a volume which increases in the ratio with which the pressure in the pump increases, and my invention may be stated as a process, which consists in supplying water to air-compressing pumps between the inlet and delivery-valves thereof, in a ratio proportioned practically to the increase of pressure developed in each action of such pumps.

The drawing shows in Figure 1, in front elevation, a pair of vertical single-acting air-compressing pumps operated from a driven shaft by cranks placed opposite each other or one hundred and eighty degrees apart. Fig. 2 shows, in vertical sectional elevation, the apparatus by which I carry into effect my invention of injecting water into the air-compressing pumps in a volume which increases in the same ratio that the pressure increases within each pump. The same apparatus is also shown in elevation in Fig. 1 as attached and connected to the pumps. Fig. 3 is a copy of a pressure diagram taken from an air-compressing pump, showing the pressures at the different parts of the stroke of the air-pump piston.

a is a piston-rod passing through suitable packing-boxes in each end of each of two cylinders, one, marked *b*, being an air-pump, and the other, marked *c*, being a water pump, the latter being worked directly by the former. On the piston-rod *a* are two piston-heads, *d* and *e*, the former fitting the bore of the air-pump *b* and the latter the bore of the water-pump *c*. The air and water-pumps *b* and *c* are both double-acting, the former being without valves of any kind and the latter being provided with outlet and inlet-valves of any suitable kind, located and arranged as is convenient and common in double-acting pumps. The upper end of the air-pump *b* is connected with the bore of the air-compressing pump *f* by pipe *h*, and the lower end of pump *b* with the bore of the air-compressing pump *g* by pipe *i*, the connecting-pipes *h* and *i* entering the cylinders *f* and *g* directly under the outlet-valves of said cylinders. It will now be seen that when the piston in cylinder *f* moves upward a portion of the air thereby compressed flows through pipe *h* and drives piston *d* downward, and that when the piston in cylinder *g* moves up and the piston in *f* moves down compressed air flows through pipe *i* and drives piston *d* upward, and thus the water-pump piston *e* is reciprocated. As the pressure in the cylinders *f* and *g* begins at nothing or at atmospheric pressure and increases until in the upward strokes of the pistons therein the pressure is sufficient to lift the outlet-valves of said cylinders against the pressure contained in the air-receiver with which such cylinders are connected, it will be obvious that the piston *d* of the small air-engine will move at an accelerated rate in its strokes, and that, consequently, the piston *e* of the water-pump will be similarly moved, thus giving to the air-compressing cylinders supplies of water which increase in the rate of their delivery in the proportion in which the air-pressures in the cylinders *f* and *g* increase. *j* and *k* are, respectively, the suction and delivery water-pipes by which cylinder *f* is supplied with water, and *l* and *m* are similar pipes for the supply of cylinder *g*. The piston-rod *a* is shown as extending through the upper head of cylinder *b* and through the lower head of cylinder *c*; but it will be evident said rod need not extend above piston *d* or below piston *e*, and that no positive mechanical devices are employed to reciprocate the said rod, which, and the piston-heads thereon, are moved entirely by the effect of air-pressure exerted and discontinued through pipes *h* and *i*. The amount of water delivered by each stroke of piston *e* may be regulated by regulating the length of stroke allowed, which regulation may be conveniently effected by placing stops on either side of piston *d*, which stops may be made adjustable and may be made to strike against elastic bunters secured on the inner sides of the heads of cylinder *b*. Fig. 3 is an exact copy taken from one cylinder of an air-compressing apparatus supplied with water by my process of delivering it thereunto in proportion as the pressure increases in the cylinders in which the air is compressed. $z\ z'$ is the base or atmospheric line. The compressing-piston starts at z and moves toward z', and the curved line terminating at y represents, by its distance from the atmospheric line the amount of compression obtained by the movement of the piston. At y the delivery-valve opens, and hence, as the piston moves on toward z', no further appreciable condensation of the air takes place, the piston merely acting to force the condensed air into a receiver of large capacity. When the air-pump piston starts on its return stroke the delivery-valve closes and the air in the clearances expands while the piston moves from z' to x. The vibration shown by the irregularity of the atmospheric line at $w\ x$ is caused by the opening of the inlet-valve, and the irregularity in the diagram at y is caused by the opening of the delivery-valve. As the pressure increases from z to y, so does the increase of pressure operate practically, through the means described, to deliver a quantity of water proportionate to said increase.

I claim—

The process herein described of injecting water into the cylinders of air-pumps, by using a part of the air compressed on the up-stroke as a motive power to the injector, so that the supply of water will be in direct ratio to the pressure generated, substantially as described.

JOHN F. HASKINS.

Witnesses:

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