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“Pumping Hot Water.”

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THE depth from which hot water of a given temperature may be pumped can be theoretically deduced from the formula

$$\log. p = A - \frac{B}{t} - \frac{C}{t^2},$$

and the inverse of the above

$$\frac{1}{t} = \sqrt{\left(\frac{A - \log p}{C} + \frac{B^2}{4C^2}\right)} - \frac{B}{2C}$$

in which p = absolute pressure, t = absolute temperature, and $A B C$ are constants. Both formulas are quoted from p. 283 of Rankine's “Rules and Tables;” or the same results may be more readily obtained from Regnault's Tables given at p. 263, Ganot's Physics (3rd edition).

Having had, however, frequent inquiries as to what could be done in actual practice by donkey-pumps for feeding boilers from hotwells, &c.; and supposing that possibly sufficient vapour might be evolved from the water at lower temperatures than those ascertained by the above rules to diminish seriously the quantity pumped, the Author carried out a series of experiments to obtain actual results.

The donkey-pump employed was single-acting, having a ram 3 inches in diameter, with a length of stroke of 7 inches. The pump was elevated to various heights; but the results being so nearly alike, allowing for difference in height and temperature, the Table given below for 15 feet may be taken as typical of all. The supply-tank stood on the ground, the water in it being heated by a jet of steam. The suction-pipe was led direct to the valve-box with only one bend, and the delivery-tank was elevated to about the same level as the pump, the water being discharged through a valve loaded to 60 lbs. per square inch. A large cock, fitted to the bottom of the delivery-tank, was kept open while the speed of the pump was being regulated, and was shut as

soon as the trial commenced. A certain depth of water always existed in the tank while the cock was open; this was carefully gauged and deducted at the end of the trial. The speed of the pump was regulated as nearly as possible to that given in the first column, and on each trial, as soon as the exact number of strokes was completed, the pump was stopped.

It will be seen that the results agree closely with those given by the above rules, the falling off in the quantity at the higher temperatures being most probably due to the friction of the water in passing through the pipes, valves, &c. It will also be observed that the speed of the pump had to be reduced for the higher temperatures, the speeds stated in the list being found to give the best results.

RESULTS of EXPERIMENT No. 3 with the PUMP 15 FEET ABOVE the
WATER-LEVEL.

Revolutions.	Temperature Fahrenheit.	Hot Water Pumped per Minute.
Per Minute.	°	Cubic Inches.
70	70	3,430
70	100	3,430
70	120	3,430
70	140	3,430
70	160	3,286
60	170	2,682
50	180	2,180

Each quantity stated is the mean of several trials. Above 180° Fahrenheit scarcely any water could be pumped. According to Regnault, 185° would be about the limiting temperature at 15 feet.