

and there is in use to-day what is known as pneumatic displacement pumps which can be installed and have been installed a distance of three miles from the point of delivery. What is done is, there is built in the ground a concrete sump and there is installed in this sump a pair of tanks which are connected up with one common discharge pipe to the point of discharge required. There is then installed a compressor at the most convenient place, generally where the water is being consumed and an air line is run to the tanks, the tanks being submerged in the water fill through their automatic valves, the air pressure being turned on comes down first on top of the water in one of the tanks. This is discharged out, when the tank has emptied the air switches and rushes in on top of the other tank, the tank just emptied filling again with water by gravity, while the other is being discharged. In Hickory, North Carolina, the municipal waterworks have their tanks submerged in the river three miles away. Their pumping station is located on the railroad and there is a ten inch stream of water being pumped continuously to the town against a three hundred and twenty foot elevation. Analysis and biological test of the water before and after being pumped at the station sees a marked improvement in quality resulting from the thorough aeration and, therefore, oxidation of organic matter. This information may be news to you, gentlemen, but it shows an important use which compressed air is and can be put to in the field of water pumping.

As to the question of cost of so many thousand cubic feet of free air, I will take an instance as given in the paper read by James F. Lewis, of Chicago, before the Canadian Mining Institute a few years ago. There has been but very little data accumulated from actual practice regarding the cost of making compressed air. We have the following from the A. T. & S. F. Railway shops at Topeka, Kansas:

Steam pressure, 80 pounds.

Air pressure, 100 pounds.

Tons of coal of 2,000 pounds per month, 155.

Cost of coal per month, \$139.50.

Cost of coal per ton, 90 cents.

Amount of free air per minute, 1,712 cubic feet.

Amount of free air per day of ten hours, 1,027,584 cubic feet.

Amount of free air per month of 31 days, 31,855,104 cubic feet.

Revolutions per minute, 50.

Pounds of coal per 1,000 cubic feet of free air, 9.7.

Cost per 1,000 cubic feet of free air, .00437 cents.

The above compressor is fitted with Meyer adjustable steam valve, compound air cylinders, with mechanical air valves on low pressure cylinders. Air is taken from outside