Air Formula No. 1.

$113\ \sqrt{RS}$ = v. practical.

What would be the velocity of water in a waterway 1,000 ft. long and 8 ft. square, with a head of 100 ft. of water?

$$\text{Area, } 8\text{ ft.} \times 8\text{ ft.} = 64\text{ ft.} = A. \qquad 102{\cdot}76\ \sqrt{RS} = 102{\cdot}76\ \sqrt{2 \times 0{\cdot}1}$$

$$R = \frac{A}{P} = \frac{64}{32} = 2\text{ ft.} = R. \qquad = 102{\cdot}76\ \sqrt{0{\cdot}2} = 102{\cdot}76 \times 0{\cdot}447$$

$$S = \frac{100}{1{,}000} = 0{\cdot}1 = S. \qquad 102{\cdot}76 \times 0{\cdot}447 = 45{\cdot}93372 = \text{theo. vel.}$$

$$\text{Coefficient} = 0{\cdot}32 = C. \qquad 45{\cdot}93372 \times 0{\cdot}32 = 14{\cdot}69 = \sqrt{}\text{vel.}$$

Air-pressure, 1·5524 in. on water-gauge = 8·07248 lb. per square foot.

$$\text{Area, } 8\text{ ft.} \times 8\text{ ft.} = 64\text{ ft.} = A. \qquad 113\ \sqrt{RS} = 113\ \sqrt{2 \times 0{\cdot}008072}$$

$$R = \frac{A}{P} = \frac{64}{32} = 2\text{ ft.} = R. \qquad = 113\ \sqrt{0{\cdot}016144} = 113 \times 0{\cdot}127$$

$$S = \frac{8{\cdot}07248}{1{,}000} = 0{\cdot}008072 = S. \qquad 113 \times 0{\cdot}127 = 14{\cdot}351 = \text{vel.}$$

Formula No. 6.

This is in accordance with the following rule:—

The velocity of air in airways is proportional to the square roots of their respective mean depths, pressure and length being the same.

It will be seen that the velocity of water under a pressure of 100 ft. is practically the same as the velocity of air under a pressure equal to 1·5524 in. on the water-gauge (or 8·07248 lb. per square foot).

$115\ \sqrt{RS}$ = velocity of air would make them more equal.

In the foregoing examples some of the calculations have been worked out in ordinary arithmetic, and some by logarithms, as in ordinary arithmetic. The method of working out the formula will be plainer and more easily understood by those who are not well up in the subject, but there is no doubt the calculations are much better and shorter when logarithms are used. The example given of the working of formula No. 4 by logarithms will show the great difference between the two methods if the same question be worked by ordinary arithmetic.

The formula for air ($113\ \sqrt{RS}$ = velocity per second) is a modification of Eytelwein's general formula for water: "The mean velocity (in feet per second) of water in pipes and channels is equal to the square root of *the hydraulic mean depth in feet multiplied by twice the fall (in feet) per mile*." Eytelwein's formula may also be stated as $\sqrt{R\ 10{,}560\ S}$ (or $10{,}276\ \sqrt{RS}$ = velocity per second).

Professor Rankine would state the above formula of Eytelwein's as: "The velocity of water (in feet per second) is equal to a mean proportional between the hydraulic mean depth (in feet) and the fall in 10,560 ft.; or thus, Mean depth : velocity : : velocity : fall in 10,560 ft.

Formula No. 1 ($113\ \sqrt{RS}$ = velocity in feet per second) would be stated by Professor Rankine thus: "The velocity of air in ordinary mine-airways (in feet per second) is equal to a mean proportional between the pneumatic mean depth (in feet) and 12,769 times the pressure in pounds per square foot divided by the length of the airway (in feet), or R : velocity : : velocity : 12,769 S.

In many instances the calculations vary to a slight extent, as the decimals are not carried out far enough for absolutely correct work; in fact, it is impossible to do absolutely correct work in calculations for the velocity of water and air, as very slight differences in the conditions materially affect the results, but with care the results for all practical purposes will be correct, although not precise.

The whole of the formulæ are new in their application to ventilation of mines, and experts to whom they have been submitted and by whom they have been examined consider the results quite as correct as the more complicated formulæ now in use.