TO FIND THE COMPARATIVE ECONOMY OF TWO BRIDGES OF DIFFERENT COST AND DURABILITY, THAT WILL ANSWER THE SAME PURPOSE EQUALLY WELL WHILE THEY LAST.

'Let $C$ be the cost and assumed real value of one of them, $T$ the time it will last, $a$ the compound interest on one dollar for that time, at whatever rate money is worth to the party paying for the bridge, and $L$ the loss on the bridge at the end of the time $T$, or the amount which it would take to make it as good as new. Let $R$ be the real value of the other bridge, $C'$ its cost, $T'$ its duration, $a'$ the compound interest on one dollar for that time, and $L'$ the loss on the bridge at the end of the time $T'$, or the amount required to make it as good as new. And let $V$ be the real value of the bridge that would last forever if all circumstances should remain constant.

'Now, supposing that the money required for building had been borrowed for an indefinite time, the actual expense at the end of the time $T$ to the party paying for the bridge which would last forever would be $a'V'$; and the actual expense at the end of the same time for the first bridge, after making it as good as new, would be $aC + L$. These two quantities are equal: therefore the hitherto unknown value of $V$ is

$$C + \frac{L}{a}.$$

'Similarly, at the end of the time $T'$, the expense for the bridge which would last forever would be $a'V'$; and that for the second bridge, after making it as good as new, if the cost had been the real value $R$, would be $a'R + L'$. As before, these two values are equal; and therefore,

$$V = R + \frac{L'}{a'}.$$ 

Equating the two values of $V$ gives

$$C + \frac{L}{a} = R + \frac{L'}{a'},$$

and

$$R = C + \frac{L}{a} - \frac{L'}{a'}.$$