

great as  $R$ . The method may be applied to  $\kappa R$ , and we have the following theorem :

**THEOREM :** *If no denominator of odd rank, after the first, in the complete quotients obtained by expanding  $\sqrt{\kappa R}$  in a continued fraction, turns out to be a perfect square, the expansion being carried out until the numerator of the last convergent is greater than  $\kappa R$ , then the factors of  $\kappa R$  differ by more than  $2\sqrt[4]{\kappa R}$ .*

As an example of the application of this theorem to the discovery of prime factors, take Jevons's\* number  $8616460799 = R$ . No perfect square appears in the denominators of the complete quotients obtained in expanding  $\sqrt{R}$ , whence one infers that the factors differ by more than  $608 = 2\sqrt[4]{R}$ . Similar failure attends the expansion of  $\sqrt{2R}$ ,  $\sqrt{6R}$ , and  $\sqrt{30R}$ . On expanding  $\sqrt{210R}$ , however, the third denominator is found to be the square  $11881 = 109^2$ . The numerator of the second convergent is 2690321; we know then that the numbers  $2690321 \pm 109$  contain the desired factors of the given number. The factors are 89681 and 96079.

The most advantageous value of  $\kappa$  to take is the product of the smallest distinct primes. Thus if  $\kappa = 30$  and the factors of  $R$  are  $p$  and  $q$ , then the factors will be discovered if  $p - 30q$ ,  $2p - 15q$ ,  $3p - 10q$ , or  $5p - 6q$  are less than  $2\sqrt[4]{30R}$ .

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## PROJECTIONS OF THE GLOBE APPROPRIATE FOR LABORATORY METHODS OF STUDYING THE GENERAL CIRCULATION OF THE ATMOSPHERE.

BY PROFESSOR CLEVELAND ABBE.

THE general circulation of the atmosphere is controlled by the general distribution of land and water, and by the insolation, with its resultant temperature, evaporation and clouds. In the analytic treatment of this problem, beginning with D'Alembert, Ferrel, and Erman, as well as in the more elegant works

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\* Jevons, Principles of science, p. 123, "Can the reader say what two numbers multiplied together will produce the number 8616460799? I think it unlikely that anyone but myself will ever know." I think that the number has been resolved before, but I do not know by whom.