bacterial content interval in the final effluent. It should be added, too, that the equation of normal performance

$$C = \frac{\log y}{\log x}$$

offers a new quantitative measure of the efficiency of any plant, obtained by evaluating in any case the constant, C. Such a measure, among other qualities, has the advantage of a rational basis and a practical significance.

Value of Coefficient of Efficiency

What absolute value this constant, C, or the so-called "coefficient of efficiency," should attain is dependent upon individual opinion of "good performance." It is of interest to note, however, that, in a survey of 19 rapid sand filtration plants, varying in size from 2.2 to 30.0 million gallons filtered per day, the coefficient of efficiency of 17 of these plants has attained an annual average of over 2.5. The raw waters which these plants had to treat contained turbidities ranging from an annual average of 1 to 561 parts per million, and average bacterial contents from 350 to 16,500 per c.c. The 19 plants chosen, therefore, for the evaluation of C, are representative, in their initial conditions, of rapid sand filtration. The probable existence of the law of filtration, $y = x^c$, combined with known values of C, practically attainable, gives the investigator of filtration plant accomplishment the fundamental criteria with which to measure both the character and the amount of removal in any particular plant. The objection may be raised to the above method of critical standardization of plants, that all do not function in a similar manner, on account of differences in raw water, resulting from peculiarities of suspended matter, variations in resistance of bacteria, and other similar factors. The objection does not seem to the writer to be entirely valid, since peculiar characteristics of raw water are usually provided for by variations in design, such as increased periods of sedimentation and greater doses of disinfectant. It is reasonable to suppose, therefore, that given plants, initially properly designed for local conditions, should function according to some common law, since death rates under disinfection, devitalization and sedimentation, and filtration of bacteria differ in the degree, but not in the kind, of changes effected. The preliminary theory of bacterial removal by filtration is supported by the average monthly results from several large rapid sand plants in the United States. Since the death-rate of bacteria under the action of disinfectants, and under well-defined conditions, has been shown to follow in general the law:

$$C = \frac{1}{t^2 - t^1} \log \frac{y^*}{x},$$

it will be necessary to look for the causative factors of $y = x^c$ LAW in other phases of the system of rapid sand filtration. It is the writer's purpose to study further the bacterial removal in the individual and distinct processes of coagulation, sedimentation, and filtration proper, with a view to throwing further light on the problem of causation. Strictly speaking, the equation of a straight line curve plotted on logarithmic axes is $y = bx^c$, where b is the intercept on the y axis. In that case, C becomes

$$\frac{\log v - \log b}{\log x} \text{ rather than } \frac{\log y}{\log x}$$

Log b is infinitely small in our particular problem, since b, the intercept on the y axis, would be equivalent to those raw water counts which produce resultant final effluent counts of one. Since zero counts are rarely obtained in filtration plants, even with extremely low raw water counts, it is conceivable that the performance curve in the "normal operation" described above would intercept the y axis at some point approaching unit. Log b, therefore, would approach zero and could be neglected in the evaluation of C. It is evident, therefore, that

$$C = \frac{\log y}{\log x}$$

measures in each case, with sufficient accuracy, the slope or inclination of the performance curve, the significant index to the efficiency of bacterial removal.

FIREPROOFING SPECIFICATIONS

LAST year the committee on fireproofing of the American Society for Testing Materials submitted to that society a new tentative method for control of fire tests and classification of materials and construction as determined by test; also certain revisions of the existing standard tests for fireproof floor construction and for fireproof partition construction. In order that the proposed new standards should be as generally acceptable to the engineering world as possible, a series of conferences were inaugurated with representatives of the following technical organizations:

American Society for Testing Materials, National Fire Protection Association, U.S. Bureau of Standards, National Board of Fire Underwriters, Underwriters' Laboratories, Associated Factory Mutual Fire Insurance Companies, American Institute of Architects, American Society of Mechanical Engineers, American Society of Civil Engineers, Canadian Society of Civil Engineers, American Concrete Institute.

The recommendations of the committee comprised the joint action of the representatives of all these organizations. The results were very gratifying, and the work has been continued this year in the same co-operative way. Two conferences have been held.

The U.S. Bureau of Standards and the Underwriters' Laboratories conducted numerous experiments during the year investigating the adaptability of the proposed time-temperature curve for the control of fire tests. The curve operated so satisfactorily it was unanimously voted to make no change in it, nor in any other essential feature of the proposed new requirements.

The standards have been rearranged and simplified to some extent for sake of clearness, and the revisions of existing standards have been amplified to make them more definite. These changes, however, have not altered the general purpose of the requirements as submitted in tentative form last year.

The committee recommends that the proposed standard specifications for fire tests of materials and construction be referred to letter ballot of the society for adoption as standard. The effect of their adoption will be to discontinue existing standards and incorporate the whole subject of fire tests of materials and construction under one set of specifications.

The following is a report of the steel output of Canada in 1917, compared with two previous years, the December figures of last year being estimated:—

	1915. Tons.	1916. Tons.	1917. Tons.
Steel ingots	989,829	1,397,703	1,686,005
Direct castings	31,067	30,546	42,807
Total steel	1,020,896	1,428,249	1,728,812

The relative output of electric steel was as follows:—

	1915. Tons.	1916. Tons.	1917. Tons.
Electric steel	5,625	19,639	39,069