

papers (Whatman's No. 5) and then tested for the alumina reaction. The whole series, excluding the control, gave a positive reaction. A slightly weaker reaction was obtained from number 3, while the control, consisting of water and lime, alone gave a negative reaction.

Considerable other work has been carried out, and every endeavor made to find a water in Ontario that had been treated with alum in the laboratory, or mechanically filtered after the application of aluminum sulphate, which would not give a positive alumina reaction. Samples under observation included:—

- 1.—Drifting-sand filtered water.
- 2.—Mechanical gravity filtered water.
- 3.—Mechanical pressure filtered water.
- 4.—Well water treated with  $\text{Al}_2(\text{SO})_3$ .

Very careful technique and negative controls, having a similar degree of alkalinity were found to be always necessary in order that strictly accurate reactions could be recorded. On account of the large number of examinations involved, and the absence of any known rapid method for estimating minute traces of alumina, it was not found practicable to make quantitative estimations.

#### All Yield Positive Reaction

So far, we have been unable to find a water which after treatment has not yielded a positive alumina reaction. We believe that the principal points involved are the hydrogen ion concentration of the water under treatment, and the colloidal nature of the alumina when in solution.

It seems to us very doubtful that the complete removal of decomposed alum in water having a similar hydrogen ion concentration ( $p_H$  8.0–8.6) can be achieved by filtration. Laboratory experiments have shown alumina to remain in solution after standing for a period of four months, but it was noticed that the hydrate underwent a change, and probably became an aluminate,—in what form, we are at present unable to say. Of recent date chemists would appear to be satisfied with distinguishing only two sets of colloidal solutions, which they have called solutions of alumina and metalumina.

So far as we are in a position to judge, the residual hydrate in the Toronto water is harmless, has no corrosive properties and is devoid of all sanitary significance. Rudolph Thompson, of the laboratory staff, has taken an active part, along with the writers, in the whole of the experimental work carried out.

#### Summary of Observations

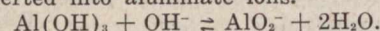
Following is a summary of observations and probable fate of hydrosols in mechanically filtered water:—

1. Effluents from all treated waters examined gave positive reactions.
2. Intensity of reaction slowly diminished on long standing, but after four months was still perceptible.
3. If 25 c.c. of concentrated salt solution (commercial NaCl) were added to one litre of treated water, no reaction could be observed after 60 days.
4. Freezing did not affect the reaction, neither did boiling.
5. Concentration by boiling to one-tenth of original bulk threw down a rather abundant crystalline precipitate which included considerable Al. The clear solution no longer gave the reaction.
6. Filtered through six thicknesses of Whatman's No. 5 filter paper, the reaction was still obtained. There was evidence of adsorption of sol by the paper.
7. The sols freely ascended bibulous paper,—over 13 cm. in 48 hours.
8. Water of  $p_H$  8.0–8.6, yielding no reaction if brought into contact with alumina gels, or if passed through a filter paper which has adsorbed alumina sols, will yield a positive reaction.
9. Non-reacting Al in solution can be brought to react by slightly acidifying, boiling, cooling and restoring the original  $p_H$  value by cautious addition of ammonium carbon-

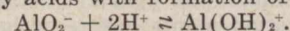
ate. The presence of iron may interfere with this test, as hæmatoxylin combines with iron in preference to alumina when both are present together in reactive form.

These reactions can be accounted for if we assume:—

- (a) Hæmatoxylin enters into reaction with alumina sols but not with aluminate ion.
- (b) Alumina gel is readily peptised in presence of OH-ion, even at  $p_H$  8.0.
- (c) Alumina sols are not stable in presence of OH ion, but are converted into aluminate ions.



- (d) Aluminate ions are stable in presence of OH ion, but are decomposed by acids with formation of aluminum ions.



- (e) The degree of dispersion of the sols is probably greater

- (A) In presence of NaCl.
- (B) With increased OH-ion concentration.
- (C) After severe filtration.

- (f) Higher dispersion accelerates the course of reactions.

These assumptions should not be regarded as anything more than a first approximation. The reactions which actually take place are in all probability far more complex.

#### AMERICAN WATER WORKS EXHIBITS

APPLICATIONS for exhibit space at the fortieth annual convention of the American Water Works Association, to be held June 21st to 25th in Montreal, should be mailed at once to Burt B. Hodgman, care of the National Water Main Cleaning Co., 50 Church St., New York City, who is chairman of the exhibit committee of the Water Works Manufacturers' Association.

All exhibits will be placed in Windsor Hall, which is a room 50 by 100 ft. Space can be reserved only for members of the Water Works Manufacturers' Association. The rate has not yet been determined, but will be a uniform price per square foot, and will be announced after it is known just what the expenses relating to the exhibits will be. All applications for space must be made upon the association's printed, formal application blank.

To avoid customs charges, United States firms who wish to send exhibits should consign their packages to themselves, Windsor Hotel, care of W. P. Lunny, Montreal, Que. These firms should also invoice the goods to themselves, Windsor Hotel, care of W. P. Lunny, Montreal, Que. Invoices should be made in triplicate on export forms which will be supplied by Mr. Hodgman upon request. Goods should be valued at market value in the United States, and invoices should be marked: "For exhibition purposes, annual convention, American Water Works Association, Windsor Hotel, Montreal." The declaration on the back of the invoice must be signed. One copy of the "Oath for return of American products exported" must be made and signed before a notary public or a U. S. customs collector. The three invoices and the oath for return of American products must be mailed to W. P. Lunny, 6 St. Sacrament St., Montreal, Que., when the goods are shipped. Freight or express should be prepaid. There will be a charge of \$4 to each exhibitor for customs broker's fee for handling each firm's entire exhibit in and out of Canada. Exhibitors should note that no water connections will be allowed in Windsor Hall.

Among the graduates this year at the University of New Brunswick are three civil engineers and one electrical engineer. In the arts course there are 17 graduates, and in forestry there are 10.

Contract for the manufacture of twenty Armstrong shovels has been awarded to the Port Arthur Shipbuilding Co., of Port Arthur, by the Lake Superior Loader Co., of Duluth, Minn. It is the intention of the latter company to organize a Canadian branch in Port Arthur.