$$x = h\left(\frac{V_g\frac{273}{T} + V_f a}{P_0} + A\frac{273}{T}\right),$$

where V_g = c.mm. gas in the bulb down to the "O" mark on the manometric tube,
V_f = c.mm. acid in reaction bulb,
a = Bunsen absorption coefficient of CO_2,
P_0 = pressure of one atmosphere expressed in mm. of Brodie solution,
A = area of cross-section of manometer tube in sq. mm.

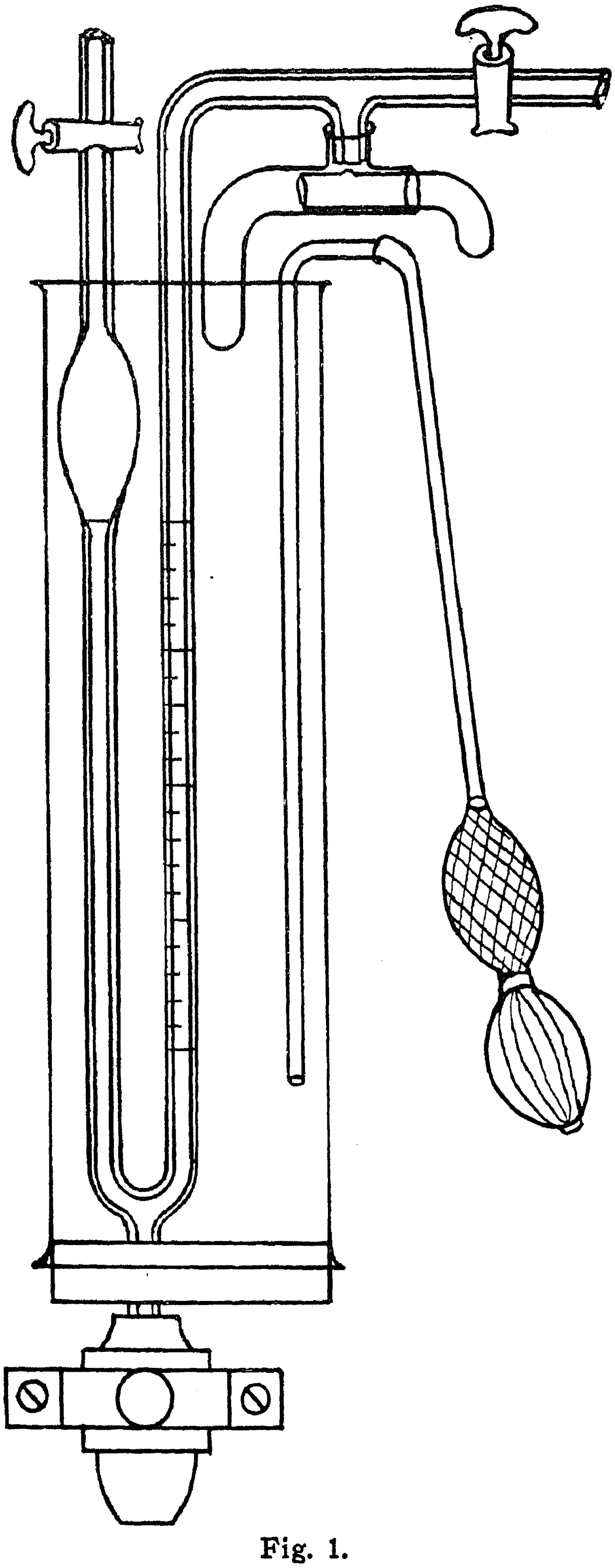

Fig. 1.

Having obtained the amount of carbon dioxide evolved in c.mm. at N.T.P. the percentage of carbon dioxide in the soil is easily computed. One c.mm. of carbon dioxide at N.T.P. weighs 0·001977 mgm., and the percentage by weight of carbon dioxide in the original sample, say x, is given by the following formula :

$$x = \frac{V \times 0{\cdot}1977}{w}$$

where V = volume of carbon dioxide in c.mm. at N.T.P.
w = weight of the sample in mgm.

The accuracy of the apparatus is ± 1·25 per cent. The various details as to construction, manipulation and computation will appear elsewhere.

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August 16, 1935.

[1] Thunberg, *Skand. Arch. Physiol.*, 1927, **35**, 163.
[2] Singh and Mathur, *Biochem. J.* (in course of publication).

Relative Wood Preservative Efficiency of the Tri- and Pentavalent Forms of Arsenic.

ALTHOUGH it has been unanimously accepted that arsenic, in all its forms, is highly toxic and is an efficient wood preservative, there has been considerable divergence of opinion on the question of the relative wood preserving efficiency of tri- and pentavalent compounds of arsenic. For example, Kunkel[1] mentions that pentavalent arsenic is less poisonous than trivalent arsenic.

The writer has had for over 42 months several test specimens of wood, of 12 species, that were treated with two different concentrations 1½ per cent. and 2½ per cent. in aqueous solution of As_2O_3 and of As_2O_5. The specimens were 24″ long, 2″ × 2″ in cross-section. They were impregnated under identical conditions of pressure (in the cold) with the above solutions. The treated pieces were allowed to air-dry, and then laid down in the antiseptic test-yard of the Forest Research Institute, Dehra Dun. The average annual rainfall in the region of the test is about 80 to 100 inches. In the case of the specimens treated with 2·5 per cent. of As_2O_3 and of As_2O_5, there is practically no difference in the present condition of the test pieces. 7 out of 12 have been destroyed in each case. One has been moderately white-ant and fungus attacked, and the rest have been slightly fungus attacked. All the 12 untreated controls have been destroyed within 42 months.

As regards specimens treated with 1·5 per cent. of As_2O_3 and As_2O_5, the results are slightly in favour of the latter.

In view of the above, and despite the much greater tendency of As_2O_5 (as compared to As_2O_3) to leach out of wood, it would appear that the wood-preserving efficiency of As_2O_5 against termites and fungi is not inferior to that of As_2O_3.

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[1] *Handbuch der Toxikologie*, Jena, 1901, p. 262.

Tuberculation of Water Pipes.

THE views held by different investigators with regard to the formation of tubercles in pipes are rather conflicting. Most of the earlier workers[1] consider that the tubercles are simple chemical precipitations. A few of them have also suggested that iron organisms like *Leptothrix*, *Gallionella*, *Cladothrix*, *Crenothrix*, and *Spirophyllium*, when present, play only a very subordinate or secondary rôle in the formation of these nodular excrescences. Other authors[2] have stated that tubercular incrustations are solely due to the abstraction of iron by *Gallionella*, *Leptothrix* and *Spirophyllium*. It also appears that many of the earlier workers have confused the slow appearance and steady development of the tubercles or "limpet" like structures with the sudden visitations[3] of the filamentous forms like *Crenothrix* and *Cladothrix* that occasionally occur in water reservoirs and conduit pipes. The persistence of tubercles inside the pipe, in spite of the incessant flow of water through it, has not been adequately explained.

With a view to studying the relation between the tubercle and the surrounding water in the pipe, a detailed chemical and bacteriological analysis of some of the tubercles was carried out as also a set of samples of water taken from different parts of a town supply system.

TABLE I.

Chemical Composition of Tubercles in Cast Iron Pipes.*

Constituent	Percentages on dry weight							
	Samples							
	I	II	III	IV	V	VI	VII	VIII
Iron (Ferrous as FeO)	3·7	4·6	3·1	2·1	6·7	6·4	8·2	2·4
Iron (Ferric as Fe_2O_3)	69·5	68·5	68·7	65·0	67·9	70·7	72·0	66·0
Aluminium (as Al_2O_3)	7·6	8·2	9·8	12·1	6·2	8·0	7·5	12·7
Silica	6·0	5·7	3·1	3·3	6·6	5·9	3·9	3·4
Phosphoric acid (as P_2O_5)	0·2	0·1	0·4	0·4	0·1	0·3	0·2	0·3
Manganese (as MnO_2) .. .	0·2	0·1	0·2	0·4	0·6	0·2	0·2	0·7
Calcium (as CaO)	1·3	1·4	0·8	0·7	1·8	0.9	0·6	0·7
Magnesium (as MgO)				Traces				
Total nitrogen	0·05	0·05	0·14	0·20	0·09	0·11	0·08	0·15
Total carbon	1·96	1·65	3·57	5·28	1·21	1·22	1·06	2·20
Loss on ignition	8·8	8·4	12·8	11·5	9·2	8·7	9·2	11·7
Moisture content	15·57	17·44	6·83	36·79	29·48	34·87	37·56	3·93

I. Collected from dead end of the main containing filtered and chlorinated water for washing the filter units.

II. Similar to I, but collected from a different end.

III. Collected from the leading main to the General Hospital.

IV. Collected from a hatch box in the 9″ water main carrying filtered water.

V. Collected from a hatch box in the 30″ water main carrying raw river water.

VI & VII. Similar to V, but collected from different portions of the water main.

VIII. Collected from an old pipe which was cut out from the Distribution System from near the Power House. The main is 8″ in diameter.

* The samples were obtained through the courtesy of the Water Works Engineer, Trivandrum (South India) to whom the author's thanks are due.