As for the after-conversion of the pentasulphide itself into thiosulphate, we have to recognise, first, the occurrence of its hydrolysis into calcium hydroxide, hydrogen sulphide, and sulphur, a fact already shown in this paper to be established; secondly, the atmospheric oxidation of the hydrogen of the hydrogen sulphide; thirdly, the reaction between the sulphur and this and additional lime to form thiosulphate, with, again, some pentasulphide; and, fourthly, a succession of these changes by which the pentasulphide recurs in less and less quantities down to nothing.

The after-conversion of the pentasulphide into thiosulphate can take place in this manner completely only when it is in contact with the lime of the waste. Where it is decomposed by the air in absence of lime, but two-fifths of its sulphur can become thiosulphate, the rest being left free; while if the contact with air is too extensive, hydrogen sulphide will escape and some lime be left, with, of course, less even than two-fifths of the sulphur as thiosulphate. Lastly, when "yellow" liquor is used to lixiviate fresh waste, the supply of lime will be too small for the conversion of all sulphur into thiosulphate when the lixivium reacts with the air, and there will consequently be sulphur deposited and hydrogen sulphide will escape. It was escape of hydrogen sulphide from this cause that rendered this mode of lixiviating unmanageable in the hands of Mactear. Omitting intermediate stages, the equation giving the result will show this—

and with a greater proportion of pentasulphide, or by the action of still more oxygen, sulphur will be deposited. A thick paste of "yellow" liquor and solid waste may (theoretically) be oxidised by the air, without liberation of either sulphur or hydrogen sulphide, thus—

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The next meeting will be held on Dec. 2, when Mr. W. J. A. Donald will read a paper on "The Chrome Tanning Process."

A Meeting was held in the Rooms, 207, Bath Street, on
Tuesday, May 13, 1884.

MR. E. C. C. STANFORD IN THE CHAIR.

ON THE COMPOSITION OF TOBACCO.

BY JOHN CLARK, PH.D., ETC.

THE tobacco plant is very extensively cultivated in various parts of the world, and after it has reached its maturity it is cut and dried on poles. When the plant is in proper condition, the leaves are stripped from the stalk, sorted and cured, by which means they are converted into the tobacco of commerce. The good leaves are called "wrappers," and the infirm or defective ones, which are separated from the others, are called "mediums and fillers." The term "strips" is applied to tobacco leaves, from which 20 to 25 per cent. of the stem or midrib has been removed to suit the requirements of manufacturers in this country more especially. Tobacco is largely imported into the United Kingdom, partly in the manufactured state, but principally in the unmanufactured or leaf form.

Through the kindness of a well-known firm of tobacco manufacturers, I have been furnished with authentic samples of the principal varieties of leaf tobacco, imported into this country, and the accompanying table gives the proportions of mineral matter or ash, alkaline salts, and sand, which these contain. For the sake of comparison the results are all stated in the dry tobacco, and in order to ensure greater accuracy, the analysis was, in each case, made with several leaves, which were separated into laminae and stem, and the whole of each incinerated. The difference in the composition of the laminae and the

stem is very marked, especially as regards alkaline salts, and is of importance more especially to the snuff manufacturer.

rule from 14 to 22 per cent. Cigars, even the cheapest, are comparatively dry, and contain, as a rule, only from 10 to 12 per cent. of water.

	COMPOSITION OF VARIOUS KINDS OF LEAF TOBACCO.								
	WHOLE LEAF. Dried at 212° F. per cent.			LAMINÆ. Dried at 212° F. per cent.			STEM. Dried at 212° F. per cent.		
	Ash.	Alk. Salt.	Sand.	Ash.	Alk. Salt.	Sand.	Ash.	Alk. Salt.	Sand.
U. S. Kentucky	19.11	6.81	2.57	18.93	5.43	3.06	21.69	13.51	.68
do.	18.50	6.68	1.82	15.50	2.77	2.39	26.07	16.68	.38
do.	25.99	9.69	3.51	21.88	6.70	4.17	29.36	20.01	1.10
do. Strips.....	15.73	4.31	2.61	15.57	1.07	2.71	16.95	6.35	1.37
U. S. Missouri.....	20.06	5.07	1.63	20.16	2.62	5.27	22.61	12.72	1.00
do.	22.01	6.32	3.51	21.36	4.00	3.88	23.62	12.37	1.53
do.	18.83	4.81	2.61	17.18	2.83	3.21	22.17	10.68	.92
do.	18.36	1.60	3.11	17.05	2.50	1.07	22.30	11.10	1.49
U. S. N. Carolina	11.50	5.99	.63	12.98	3.92	.71	18.61	11.72	.23
Paraguay	30.80	8.15	12.32	31.07	6.37	11.41	30.37	11.78	4.91
Brazil—Carmen	20.51	7.81	.42	20.12	7.21	.16	20.86	9.37	.31
Holland	21.83	11.37	.13	20.16	8.90	.55	25.15	17.20	.12
Turkey—Cavallo	13.79	5.05	3.06	12.17	2.91	3.15	18.11	11.76	1.87
do. Latakia	19.50	7.19	.55	21.80	8.28	.72	15.14	7.73	.21
do. Samsoun.....	18.39	0.98	.19	17.59	5.32	.11	21.72	13.42	.60
Japan	15.67	0.86	.50	11.60	5.59	.51	19.81	11.55	.35
China	18.58	2.10	6.30	17.91	1.66	6.91	20.57	5.27	3.61
Havana	20.99	8.19	1.02	20.91	7.51	1.01	21.02	10.33	.92
Manilla	21.80	6.51	.11	21.25	5.49	.13	22.50	9.09	.11
German	22.27	3.76	1.79	22.12	2.78	1.87	23.13	4.63	1.39
Sumatra	18.61	7.20	.13	18.71	6.59	.09	18.14	9.11	.28

	Average of Whole Leaf per cent.	Average of Laminæ per cent.	Average of Stem per cent.
Ash or Inorganic	20.32	19.21	21.92
Alk. Salts	6.47	4.98	11.41
Sand	2.48	2.46	1.15

The unmanufactured tobacco which is imported into this country, is converted into roll or spun tobacco, cut tobacco and cigars, and the refuse is used for making snuff. Roll tobacco is the staple manufacture in Scotland and Ireland, and cut tobacco the staple article in England.

In the manufacture of roll tobacco, the leaves are moistened with water, spun into various sizes of twist, made up into rolls, and pressed. The liquid or juice which exudes under pressure is used as a sheep dip. Cut tobacco is made by moistening the leaves, cutting them into the desired size, and drying on plates. Sometimes it is made into cakes in the first instance, and afterwards cut.

When we compare the composition of roll and cut tobaccos with that of the leaf from which they are made, we find that the difference lies almost entirely in the amount of moisture, and as manufacturers are not allowed to add anything but water and a little oil to tobacco, you will not err very much in assuming that as a rule the cheapest qualities of roll and cut tobaccos contain most water. Thus in 15 samples of the cheapest roll tobacco I found an average of 41.66 per cent. of water.

The lowest qualities of cut tobacco, such as are largely manufactured and consumed in England, contain as much water as the cheapest roll tobacco, whereas the finer qualities of cut tobacco contain as a

The difference in cheap cigars is due chiefly to the weight of the material, but also to the quality of the tobacco and the labour, machinery being used in the manufacture of the lower qualities, whereas the higher qualities are nearly all hand made.

The large quantity of water contained in the cheapest tobacco, and which frequently amounts to about 50 per cent., is not, in my opinion, introduced to please the palate of the working man, but simply on account of the keen competition between rival manufacturers, and the low price at which tobacco is sold; and in the interest both of the working classes and of tobacco manufacturers themselves, I think it is very desirable that some limit should be placed to the amount of water which may be sold as tobacco.

Snuff.—I stated that the refuse tobacco was employed in the manufacture of snuff. This refuse consists of stems, tobacco smalls, and sweepings. These are moistened with water, subjected to a process of fermentation, which lasts from about six weeks to two months, then ground, mixed with alkaline salts to preserve the snuff, and flavoured when desired. Nothing is allowed to be added to snuff except the carbonates, chlorides, and sulphates of potash and soda, and carbonate of ammonia. It is also provided by Act of Parliament that any snuff found to contain, after being dried at 212° F., more than 26 per cent. of such salts, including those naturally in the tobacco, will be liable to forfeiture and a penalty of £50. From my table of analyses you will observe that not only does the proportion of alkaline salts vary in different tobaccos, but the stem contains a much larger proportion than the

leaf. On this account it is necessary that the snuff manufacturer should know the quantity of alkaline salts in his snuff material, in order to obtain an article of uniform composition. Some manufacturers go by rule of thumb, and in attempting to work close to the legal limit, they run a serious risk of unintentionally incurring the penalty. As a matter of fact, three samples of snuff, in 1883, were condemned by the Somerset House Authorities because they contained an excessive proportion of alkaline salts, and the manufacturers were prosecuted. The more intelligent of the snuff manufacturers, however, analyse their snuff material, and are thus able to keep within the legal limit.

The principal alkaline salts which are added to snuff are chloride of sodium or common salt, carbonate of potash, and carbonate of ammonia, all of which are allowed by Act of Parliament, and therefore no exception can be taken to their addition, so long as the total quantity does not exceed 26 per cent. in the dry snuff. In addition to alkaline salts snuffs usually contain from 25 to 45 per cent. of water, with the exception of a kind of snuff called "High Toast or Irish Blackguard," which is very dry and contains from 5 to 8 per cent. Sometimes they also contain a considerable quantity of sand. In the several hundred samples of snuff which I have had occasion to examine for different manufacturers the average quantity of sand was about 5 per cent. in the dry snuff, and sometimes fell as low as a half per cent., but in many samples the quantity exceeded 10 per cent., and in one case I found as much as 30.94 per cent. of sand in the dry snuff. The greater part of this sand is probably derived from the sweepings of tobacco, on which duty has been paid, and I have no doubt the snuff manufacturer considers himself justified in selling it as snuff. But it appears to me to be very desirable in the interest of snufflers, that some limit should be placed on the quantity of sand which may be sold as snuff: more especially as the particles of sand are frequently very sharp, and have a tendency to produce inflammation of the mucous membrane of the nose, and it is to this, probably, that we owe the popular notion that snuff is sometimes mixed with ground glass to give it additional piquancy.

When from any cause snuff is spoiled, the manufacturer may export it, and obtain a drawback of 3s. 7d. per lb. on the real tobacco which it contains.

The Government standard for tobacco is as follows:

	Per cent.
Organic Matter.....	70.52
Inorganic.....	15.48
Water.....	11.00
	100.00

This is equal to 18 per cent. of ash or inorganic matter in the dry tobacco. This standard is in my opinion too high as the average percentage of inorganic or ash in the dry leaf tobaccos which I have examined is 20.32, and the stem from which snuff is largely made contains still more. The result is that the tobacco manufacturer not only loses the value of the tobacco over and above the duty, but also a part of the duty which he has paid. This matter concerns the tobacco manufacturer alone, but I would point out that the authorities in Somerset House in fixing such a high standard for tobacco are benefiting the public at the expense of the manufacturer, whereas in the case of milk the low standard which they employ is a loss to the public and gain to the dishonest dealer.

DISCUSSION.

Dr. CLARK, in reply to a question of the Chairman, said that he did not discuss the question of the com-

position of the ash, or of the alkaline salts of the of the tobacco plant, as that had been very well investigated. The alkaline salts consist chiefly of carbonate of potash, chloride of potassium, and sulphate of potash.

Obituary.

GEORGE WILLIAM WIGNER, F.I.C.,
F.C.S.

President of the Society of Public Analysts.

Died October 17th, 1884, aged 42 years.

GEORGE HENRY HERBERT,
*Of the Firm of C. O. McAllum and Herbert,
of Newcastle-on-Tyne.*

Died November 9th, 1884.

Journal and Patent Literature.

II.—FUEL, GAS, AND LIGHT.

Improvements in the Manufacture of Illuminating Gas.
Dingl. Polyt. Journ. 253 (6) page 233-244.

BULL'S Gas, Light, and Coke Co., Liverpool, Germ. Pat. 26093, 1883, propose to use powdered and desulphurized coal for the manufacture of gas. "Coal-duff" is ground in a mill N (figs. 1, 2, 3) and discharged through C into a jacketed cylinder A. An endless screw conveys the coal to the top end of A, where a pipe S allows of the escape of sulphurous gases. Through the pipe b the fuel is emptied into the mixing apparatus D, where it is mixed with tar or naphtha. From here the so prepared coal is emptied through a door t into the vessel E which moves on rails. By the withdrawal of a slide s the coal falls into the retorts F, which are of a conical shape, and set in two parallel rows. Each retort has a neck fitting exactly into the bottom of E; a door v serves for discharging the contents of a retort into bogies L. In the inside of the retorts there is a pipe J tapering towards the bottom, and provided with holes for conducting the gas generated through branches Z to the hydraulic main. Heating gas is produced in the generator M, and the air necessary for combustion enters through pipes k heated by fire-gases. In order to remove as much sulphur as possible from the coal-duff employed in this process, it is first exposed to the air, then washed and powdered. By passing through the heated cylinder A it is dried, and gives off sulphurous acid, which escapes at S. In this manner the fuel is said to reach the mixing apparatus D completely dry and nearly free from sulphur. On account of the latter circumstance the gas needs no purifying, and since no carbon is combined with sulphur the lighting power of the gas is increased.

For the manufacture of lighting and heating gas, B. Andreane, Vienna (Ger. Pat. 26985, 1883), empties coal through a hopper a (figs. 4, 5, 6) into retorts b, where it is subjected to destructive distillation. The gases given off are purified as usually. The coke formed is discharged into the chamber f, lying below, and can be withdrawn as such or converted into water-gas in the same place; or it can be burnt for heating the retorts. In the latter case the combustion gases are made to heat steam boilers, and afterwards pass into a chamber r to give off the greater portion of their heat. To convert the coke in f into water-gas the air openings are shut off and superheated steam is made to meet the incandescent coke.