The Manufacture of Blue Water Gas.

THE manufacture of water gas first became an industrial proposition in 1873 with the introduction of the intermittent system by Strong and by Lowe in the United States. Strong, who aimed at manufacturing blue water gas mainly for heating purposes, utilised the heat value of the "blow" gases to superheat the steam admitted to the generator. Lowe, on the other hand, aimed at producing a gas of high illuminating value, and utilised the large quantities of combustible gas produced during the "blow" periods for heating chambers in which enriching oil was decomposed. No real progress in the manufacture of water gas in Great Britain was made until 1888, when a plant was installed at the Leeds Forge. Since that time the utilisation of water gas has advanced rapidly, and the manufacture of water gas, both blue and carburetted, is now an important auxiliary in the production of gas for town supply.

The blue water gas process, according to general British practice, may conveniently be divided into two distinct operations. The hot fuel, usually coke, is first raised to a high temperature by the admission of air at such velocity that the pressure below the generator grate is 12 to 18 inches water-gauge. This operation, known as the "blow," occupies from one to three minutes. The gases produced are blown away to the atmosphere through the stack, either directly or after combination with air and passage through a waste heat boiler. When the temperature of the coke has been raised to the required degree, the air supply is closed, and the bed of fuel is submitted to the action of steam supplied at a measured rate. The steaming operation, which is known as the "run," occupies from four to ten minutes according to the cycle of operations adopted. The blow and run operations are carried out alternately during a period of several hours, at the end of which the operations are suspended for the removal of ash unless mechanical grates are provided.

BLOW PERIOD.—The addition of heat to the bed of fuel during the blow period results mainly from that developed by the oxidation of carbon to carbon monoxide and carbon dioxide, and provided other conditions remained unchanged, the degree of heat addition would be dependent on the proportion in which these two gases are produced. The principal reactions which take place may be represented by the equations:

$$(1)\ C + O_2 = CO_2 + 97{\cdot}3 \text{ Cal.}$$
$$(2)\ C + \tfrac{1}{2}O_2 = CO + 29{\cdot}0 \text{ Cal.}$$

The aim during the air-blow should therefore be to obtain the maximum amount of carbon dioxide and the minimum of carbon monoxide. The first reaction predominates at lower temperatures and the second at higher temperatures. The efficiency of heat generation therefore decreases with rise of temperature.

RUN PERIOD.—When steam is passed over incandescent coke, of the reactions which occur, consideration should be given to the following:

$$(3)\ C + H_2O = CO + H_2 \textit{ minus } 29 \text{ Cal.}$$
$$(4)\ C + 2H_2O = CO_2 + 2H_2 \textit{ minus } 19 \text{ Cal.}$$

At temperatures above 1000° C., the products of reaction of steam and carbon are almost entirely carbon monoxide and hydrogen. At lower temperatures the importance of reaction (4) increases, and the proportion of steam decomposed decreases.

From consideration of the reactions which take place in the intermittent process of manufacture of water gas, it is clear that in order to obtain high efficiency of heat addition during the air-blow, the fuel must be kept at a comparatively low temperature, and the time of contact of the gases with the hot fuel must be small. On the other hand, to obtain a high efficiency during the steaming operation, the fuel should be kept at a high temperature, and a longer time of contact must be allowed. It is evident, therefore, that these opposing factors must be taken into account in determining the conditions of best efficiency for the whole process.

During recent years, the large scale production of water gas has been the subject of investigations by a Research Committee of the University of Leeds and the Institution of Gas Engineers, and by the Fuel Research Board. From the data procured, thermal balances were constructed. As an example of a thermal balance under conditions typical of British practice, the following is taken from the tenth report of the Research Committee of the Institution of Gas Engineers:

HEAT BALANCES IN THERMS PER 1000 CUB. FT. WATER GAS MADE.

Heat supplied—		
(a) Coke to generator		4·900
(b) Fuel to raise steam to generator		0·551
(c) ,, ,, ,, turbine		0·643
(d) Sensible heat of air to blower	Minus	0·001
		6·093
Accounted for as follows—		
1. Water gas, potential heat		2·960
2. ,, ,, sensible heat		0·171
3. Steam not decomposed (total heat)		0·163
4. Blow gas, potential heat		1·042
5. ,, ,, sensible heat		0·462
6. Heat lost in raising steam to generator		0·165
7. ,, ,, ,, ,, turbine		0·193
8. Heat of steam used and lost in turbine and blower		0·446
9. Ashes, potential heat		0·207
10. Clinker ,, ,,		0·017
11. Dust ,, ,,		0·070
12. Ashes, clinker, and dust, sensible heat		0·020
13. Losses, not separately determined, leakages, radiation, convection, etc. (difference)		0·177
		6·093

In a paper presented a short time ago to the Institution of Chemical Engineers, Dr. M. W. Travers has studied the results of the investigations previously mentioned. Dr. Travers is of the opinion that in addition to thermal balances of the type illustrated, thermal accounts should be constructed to show the amounts of heat added to the fuel during the blow periods and abstracted during the steaming operations. These two amounts of heat should be identical provided that the whole of the necessary data is available with a high degree of accuracy. The problem, however, is complex, and many other factors in addition to the main carbon-oxygen and carbon-steam reactions must be considered. The coke supplied to the generator invariably contains moisture, hydrogen, sulphur, nitrogen, and ash, and these constituents take part in a number of reactions which cannot be neglected. The amount of water vapour in the air supplied to the generator also has an important effect on the heat account. Separate thermal accounts for the "blow" and "run" periods would undoubtedly be of value, but further study of the subject is required before these can be constructed with sufficient accuracy to enable trustworthy conclusions to be drawn.

A. Parker.

Obituary.

Prof. Axel Wirén.

The death of Prof. Axel Wirén of Upsala has deprived zoology of an able original worker and a distinguished teacher in the University of Upsala. Born on July 12, 1860, in Eskilstuna on the western or landward side of the province of Sodernau Land, about 50 miles west of Stockholm, and the eastern border of which (province) reached the sea, Wirén received his early education at the school of Norrköping, in which his matriculation examination also took place, and he afterwards entered the University of Upsala, where he graduated as Ph.D. in 1885, his thesis being on the circulatory and digestive organs of certain families of polychæts.

From the first the young graduate was attracted to marine zoology and at a time when several departments were sorely in need of scientific advancement. He set himself to work up the zoology of Upsala, especially the chætopods, and by and by he published a series of important researches in the Kongl. Svensk. Vetersk.-Akad. Handl., all finely illustrated by his artistic pencil, the plates varying in number from 5 to 10 (4to) in each communication. The accuracy and beauty of these plates and the value of the accompanying researches would alone have given him a solid reputation. They dealt chiefly with the circulatory and digestive organs of the polychæts, though the minute anatomy of the solenogastres was also worked out with conspicuous ability. Amongst his interesting novelties was the discovery of *Hæmatocleptis terebellidis*, a parasitic eunicid living in the wall of the chitinous stomach of *Terebellides Strœmi*—just as Spengel had found another polychæt, *Oligognathus Bonelliæ*, in the cœlom of Bonellia. Besides other papers he published one on *Nereilepas fucata* in its atokous and its epitokous forms, and the changes in its body-wall, as well as a work on the elements of zoology, a useful treatise for his students. He also gave an account of a visit he made to the museums and zoological institutes of Germany in 1891.

Besides his own strenuous labours in upholding zoology at Upsala—mindful of his responsibilities—Wirén encouraged the young graduates and others to carry on original work in his department, and exerted himself in founding the zoological institute of the University from which many important memoirs were issued. These were published in the series of the "Zoologiska Bidrag frän Uppsala" (large 8vo), edited by Prof. Wirén. The perusal of these fine memoirs (the expense of which was partly defrayed by the generosity of the late consul, R. Bünsow) raises a feeling of regret that, in a great country like Britain, zoological institutes on the sea beach should be closed for lack of men, interest, and money, instead of continuing the fascinating researches in marine zoology and botany—not to allude to the importance of these in connexion with the fisheries.

Prof. Wirén was elected to the chair of comparative anatomy at Upsala in 1893, after holding various minor posts. He became professor of zoology and Director of the Zoological Institute in 1908, and held these offices until his death on January 22 last. He worthily served his country and science.

W. C. McIntosh.

Mr. W. H. Finlay.

A correspondent at Cape Town sends us some particulars of the life and work of Mr. William Henry Finlay, formerly chief assistant in the Royal Observatory, Cape Town, who died there on December 7, 1924. Mr. Finlay was born at Liverpool on June 17, 1849, and educated at Liverpool College School. He proceeded to Trinity College, Cambridge, graduating 33rd Wrangler in 1873. In the same year he was appointed first assistant at the Cape Observatory, when Mr. Stone, who succeeded Sir Thomas Maclear, was H.M. Astronomer. Mr. Stone's directorate is chiefly remarkable for the enormous amount of arrear reductions of transit observations which he accomplished, and for his well-known 1880 Cape Catalogue of Stars. In all this work Mr. Finlay took his full share.

As an observer, Mr. Finlay was very zealous in the observation of comets and occultations of stars. He independently discovered the great comet of 1882, and also one, which bears his name, in 1886, and undertook the difficult task of computing its elements as well as of many another. Perhaps in astronomical circles he will be best remembered by his excellent Star Correction Tables, which exemplify the clear grasp he had of his subject, and the orderly practical habit of his mathematical mind.

In addition to his purely astronomical work, Mr. Finlay took an active part in the geodetic work which Sir David Gill, who succeeded Mr. Stone, undertook during his famous directorate. He took the principal share in the longitude operations for connecting Aden with Cape Town, and on his voyages to and from Aden he took advantage of the short stoppages of the steamer at Delagoa Bay, Quilimane, Mozambique, and Zanzibar to determine local time at these places with portable instruments, and to exchange time signals with Cape Town. These observations and the resulting longitudes were published in the Monthly Notices of the Royal Astronomical Society.

In 1887 Mr. Finlay undertook the discussion of the tidal records of Table Bay and Algoa Bay, and the result of his analysis, which is published in the Journal of the South African Philosophical Society, is still the