COAL TAR.—COLOURS.

JUBILEE OF THE INDUSTRY.

(BY PROFESSOR EASTERFIELD.)

LAST year the jubilee of the Coal Tar Colour Industry was celebrated, the first patent for a colouring matter prepared from tar having been taken out by William Henry Perkin, on August 26th, 1856. The story of Perkin's discovery and its consequences are sufficiently remarkable to be worthy of narration.

Sixteen years before the patenting of Mauve, Liebig published his now classical work on Agricultural Chemistry, and it was largely because of the interest that Liebig's discoveries aroused in England, that a small body of men, most active amongst whom were the Prince Consort and Sir James Clark, decided to found a Royal College of Chemistry in London. One of Liebig's pupils, Dr. Hoffmann, was appointed principal of this institution, which was opened in 1845.

Hoffmann's first research, conducted under Leibig's direction, had been upon the nature of coal tar, and it was not unnatural that he should interest his students in the same substance. In 1849 Mansfield first prepared pure benzol from coal tar in the College laboratories. Two years later he lost his life in attempting to prepare the liquid on a manufacturing scale for the first International Exhibition.

ANILINE PURPLE.

Perkin, a boy of 18, was in 1856 an assistant in Hoffmann's research laboratory. In such a position he had naturally little time for private research, but by fitting up a small laboratory in his father's house he was able to carry on experiments of his own in the evenings. During the Easter vacation of 1856 Perkin tried the action of bichromate of potash upon aniline, a nearly colourless oil prepared from coal tar benzol. A black substance resulted, which, when further examined, was found to contain a dye stuff, mauve or aniline purple. Samples of silk dyed with the material were submitted to Messrs. Pullar, of Perth, who reported favourably upon the value of the discovery, stating that the fastness of the dye was superior to that of similar shades obtained by the use of vegetable colouring matters.

So sanguine were Perkin, his father and his brother, of the success of Aniline Purple, that in 1857 they built a factory for the preparation of the substance. The technical difficulties in the way of the manufacture must have been enormous, for few of the chemicals required for the process were at that time commercial products. For example, neither pure benzol nor strong nitric acid—the starting points in the manufacture of aniline—could be bought, but had to be prepared in the works. The special apparatus for the manufacture had to be designed by the firm, since no similar process had ever been carried out on a manufacturing scale. Finally after the dyestuff had been produced in quantity, careful investigation was necessary in order to find the conditions under which the fabrics would dye with a pure and even colour. Almost a greater difficulty than that of the manufacture was the opposition shown by the calico printers to the use of the synthetical dyestuff. This opposition disappeared when it was found that the French printers were using mauve in comparatively large quantities, and the demand for this, the parent of the coal tar colours, became so great that the supply could not keep pace with the orders. At the present day mauve is a dyestuff of comparatively small importance, but the pioneer work of the Perkins made the way comparatively easy for the enormously large number of coal tar colours which were to follow.

MAGENTA AND THE ROSANILINES.

In 1859 magenta was prepared by Verguin in France, and in the following year two of Hoffmann's pupils, Medlock and Nicholson, independently patented a process for manufacturing this beautiful dyestuff by heating aniline with arsenic acid, a process by which enormous quantities of this dye have been prepared. Nicholson subsequently showed that the red dye was changed to a blue when boiled with more aniline. Hoffmann then, having investigated the connection between the colour and constitution of these new dyes, succeeded in preparing a series of "substituted Rosanilines" (Hoffmann's Violets) which gave beautiful shades when applied to textile fabrics.

All the dyestuffs that I have so far mentioned are derived from benzol (C_6H_6) or the closely related hydrocarbon toluol ($C_6H_3CH_3$), and may be said to belong to one type.

THE AZO-DYES.

A perfectly different class of dyestuffs derived from aniline and its congeners is that known as the Azo-dyes. The first representative of this class was prepared by Perkin and Church, but the research was not followed up. The chief pioneer in this class of dyes was Peter Gricss, who was for a short time one of Hoffmann's assistants. It is probable that at the present day this is the most important of all the classes of dyestuffs, since practically all shades of colour can be obtained, and particularly those shades which are lacking in the magenta or rosaniline series. Hundreds of these dyestuffs have been patented, but it is only the fittest which survive in trade competition; and it may be said that no dye is prepared on a large scale at the present day unless it is either (1) of extraordinary beauty; (2) or is fast; (3) or easily applied to the fabrics.

ALIZARIN—THE DISPLACER OF MADDERS.

Another of Perkin's great triumphs was the manufacture in 1869 of alizarin, identical in all respects with the dyestuff of the madder plant. This dyestuff has completely displaced madder in the dyeing of the ever popular Turkey Red. It is prepared from anthracene, a nearly colourless hydrocarbon existing in the pitch which remains in the ordinary process of tar boiling.

INDIGO.

The most remarkable modern development in the coal tar colour trade has been the manufacture of indigo identical in all its properties with the vegetable product. Such a manufacture would have been impossible had not the inner structure of the natural dyestuff been clearly discerned. This remarkable piece of scientific work has been accomplished by Baeyer, whose researches in the subject extend over a period of twenty five years. The material from which indigo is now manufactured is naphthalene, the colourless substance which so frequently causes annoyance by depositing in the gas pipes and stopping the gas supply. Naphthalene is present to the extent of about 6 per cent. in ordinary coal tar, and the manufacture of indigo from it has reduced the commercial price to an extent which threatens to ruin the indigo trade of India, just as the production of anthracene has destroyed the madder industry.

OTHER TAR CHEMICALS.

Apart from the manufacture of colours, a large number of important pure chemicals are prepared from tar. It is only necessary to mention carbolic acid, phenacetin, antifebrin, antipyrin, and salicylic acid to recall the fact that medical science has availed itself to no small extent of coal tar as a source of invaluable drugs.

GERMAN ENTERPRISE.

It is not a little remarkable that whilst Great Britain is the greatest tar-producing country in the world, nine-tenths of the refined chemicals prepared from tar are manufactured in Germany, and that Switzerland stands next to Germany as a coal-tar colour producing country. The reason of this is to be found in the fact that in German works the value of research has been appreciated to a higher extent than in the factories of other countries. One result of this policy is that if a foreign firm patents a new dyestuff, the German firms can usually produce a new process for preparing the compound more cheaply than the foreigner. The size of some of the German firms is astounding; thus the Ludwigshafen works employ a staff of about 20,000 workers, amongst whom are 120 highly trained scientific experts. To the outsider it would seem as though such a staff of investigators would soon find all that was to be known about tar and its products. As with other subjects, however, so with tar—the more we discover, the wider does the field of possible discovery seem to become; and it is probable that our knowledge of the chemistry of tar is in reality only in its infancy.

In 1895 England exported to Germany aniline dyes to the value of £28,000, and imported £656,000 worth of the same class of goods. In 1905 the export had fallen to £20,400 and the import had risen to £1,000,000. A still more startling change has occurred in the indigo trade. In 1895 England exported £257,000 worth of indigo to Germany, and imported only £2,000 worth from Germany. The figures for 1905 are, indigo exported to Germany £2,000, indigo imported from Germany, £158,500.

Orepuki Shale.

Southland News learns on excellent authority, that the Orepuki Shale Works will resume operations at an early date, and that arrangements with that object in view are now being made Over £100,000 has been expended in this industry which, at the outset, met with obstacles that unfortunately necessitated a stoppage of operations The industry is one of such importance to the colony as well as to the district in which it is located, that Parliament will do well in revising the tariff next session to give special consideration to the claims of this large enterprise.