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CHEMICAL SOCIETY'S ROOMS, BURLINGTON HOUSE,
Monday, 3rd April, 1882.

PROFESSOR F. A. ABEL, C.B., F.R.S., IN THE CHAIR.

SMOKE NUISANCE ABATEMENT.

BY T. TYRER.

THE following is a report of the discussion on Mr. Tyrer's paper on "Smoke Nuisance Abatement," read before the meeting of this section on Dec. 12th, 1881.

Mr. TYRER gave a *résumé* of his paper, and pointed out that while the opening and closing of the furnace door was undoubtedly a most effectively simple method of preventing smoke by the supply of air, it was then necessarily a case of "enough and to spare," and as such wasteful, and therefore unscientific. There was in his paper no reference to the use

of liquid fuels, such as petroleum. There were undoubtedly many processes and conditions in which both gaseous and liquid fuels were unsuitable, if not inapplicable, but it was a fact that neither had been very extensively tried, and certainly few exhaustive trials of liquid fuel had been recorded. The other day he read in an American publication an account of an examination of the application of a liquid fuel in the works of Mr. W. C. Barnes, of Hackney Wick, the well-known manufacturer of nitrobenzol. An abstract is here given:—

The apparatus is of a very simple character. It consists of a superheater arranged in the tube itself, and a kind of injector placed in an inclined position just above the fire door. The petroleum or other hydrocarbon to be burned is led to the injector through a pipe furnished with a cock which can regulate the supply, and it is there met by the steam which has passed through the superheater, and which has thus had its temperature raised to about 600° Fahr. The hydrocarbon is injected as a fine spray, together with superheated steam.

The combustion is stated to be perfect, and control over the quantities of steam and petroleum equally so. Continuing the abstract, it stated that—

At Mr. Barnes's factory, 15,210lb. of water were evaporated in five hours in one of the boilers, by the consumption of 800lb. of oil, or an evaporation of 19lb. water to 1lb. of oil. Taking into consideration that the pressure at which the boiler is worked is 23lb., and that the feed-water was 66° Fahr., this performance is equal to the evaporation at atmospheric pressure from a temperature of 212° of 23lb. water per pound of oil burned. The fuel used was the waste product left from coal tar after the distillation of the naphtha and light oils. It weighed 63lb. a cubic foot, and was a refuse at the factory.

Mr. Tyrer said he had not seen the apparatus referred to in the foregoing quotation, but he conceived such results justified the belief that, certain mechanical contrivances provided, successful results would follow the use of liquid fuel. The question, to what extent liquid fuel can be economically substituted for coal, was one difficult to reply to in specific terms. Price would affect the question materially, and with the increasing utilisation of hydrocarbons and consequent dearness thereof, this may become absolutely prohibitory. He knew that in the Royal Navy somewhat extended trials had been made, but, so far as he had been able to ascertain, fuel in this form had been discontinued. Was it because of the difficulty of safe storage? He believed that very lately some method had been devised for using petroleum in conjunction with steam, by which very much more work was obtained from that hydrocarbon than was the case in the abstract he had read. Indeed, the apparatus in question was to be seen at the Co-operative Laundry at Hammersmith.

Mr. F. MAXWELL LYTE said he was witness to the experiments with liquid fuel carried on at Mr. Barnes's works. He believed they were conducted by Admiral Selwyn.

Mr. H. N. CRELLIN said: Mr. Tyrer, in the remarks he has just made in continuation of his paper, has alluded to the difficulty of regulating the air supply

of furnaces and controlling the action of the stoker, and he has also alluded to the use of liquid fuels. Between these topics there is an even more intimate connection than is at first sight apparent, inasmuch as the adoption of a well-matured system of utilising liquid fuel would probably prove the most effectual method of smoke abatement. Before entering upon the subject thus suggested to us of the burning of liquid fuel, it may, however, be well to notice the completely unscientific character of the process of combustion as conducted in ordinary fireplaces and furnaces. The air supply being derived mainly from beneath the fire, the maximum of heat is developed precisely where its action is most injurious, destroying the firebars, while the minimum temperature is found at the surface, where useful work has to be done in heating the room or the boiler, as the case may be. In furnaces this defect is, without doubt, in some measure obviated by those smoke-consuming arrangements in which an increment of air is supplied through the furnace door. But in such cases the defect is overcome at the considerable cost of lowering the temperature of the furnace. An even better result, unaccompanied by this serious drawback, may, however, be obtained by the use of a combined jet or blast of steam, air, and liquid fuel, from a simple and effective apparatus, which has been devised by myself and Mr. C. Spencer Rolfe, and which forms, in fact, a part of our improved method and apparatus for utilising liquid fuels. In its entirety this apparatus consists of a lamp, with a wire-gauze or other suitable wick, which is employed, first, to sufficiently heat the boiler to enable a start to be made, and, secondly, to ignite jets composed of liquid fuel, which is by the aid of the steam finely divided and heated to the flashing point. By this system we believe that the solution of the problem of utilising liquid fuel is considerably advanced, when compared with the efforts of others in the same direction, and important advantages are secured in respect of economy in the use of the fuel, in the safety and efficiency of the process, and likewise in the minimising of the labour and attention requisite in the employment of liquid fuel. By means of our apparatus, a very intense and pure flame is obtained, which may be used not only for generating steam but for smelting and other purposes. As has been mentioned already, the jet arrangement for injecting a blast composed of steam, liquid fuel, and air, may be, and in fact has been, already applied in conjunction with the ordinary furnace, where it has been found to possess the merits of greatly economising fuel, consuming the smoke which may be given off by the solid fuel used in the furnace, and also affording the means of very quickly getting up steam after the furnace has been damped down—a point of no little importance in many cases. It is evident that the period of greatest smoke production—i.e., of greatest waste—is when fresh fuel is added in considerable quantity. At such a moment, when an increase of draught is desirable, there is necessarily a diminution of it, and it is then especially that the liquid fuel jet, with its intrinsic energy independent altogether of the chimney draught, produces its most beneficial results. When the jet is used, all dampers should be closed, and the whole of the air supply should be derived from the jet apparatus, as it is precisely to this use of the hot blast acting from above, and causing the fuel to burn from the surface downwards, in lieu of the usual cold current wastefully blowing through the fuel from below, that the resulting great economy of fuel is due. The percentage of saving effected naturally varies with the class of boiler to which our apparatus is affixed, but, as an example, I may state that our arrangement applied to a multitubular boiler, having

exceptional demands on it for steam, produced a saving of about 30 per cent. The first cost of this apparatus is so small, while the saving in fuel and the other advantages I have enumerated are so considerable, that there appears to be a great probability that this application of liquid fuel, among others, may be largely extended in the immediate future.

The CHAIRMAN said that experiments with liquid fuel of a very exhaustive character had been conducted by Admiral Selwyn, at Woolwich Dockyard, before it was diverted to other uses. There was so much to be said with regard to the important questions involved in Smoke Abatement, that had not even been remotely referred to that evening, that there was ample field for useful discussion, and he thought the subject might, at a fitting opportunity, be still further considered. He understood that in the Liverpool Section this question was receiving similar attention, and most probably valuable information would be found to have been elicited.

Monday, 13th March, 1882.

MR. DAVID HOWARD IN THE CHAIR.

MANUFACTURE OF SULPHATE OF ALUMINA FROM BAUXITE.

BY D. E. R. NEWLANDS.

WHEN I undertook to read a paper before the London, Section of the Society of Chemical Industry, it was my intention to describe in detail the various processes which have been carried out or suggested for the production of sulphate of alumina, whether from china-clay, alunite, eryolite, bauxite, etc., but after due consideration I thought it advisable to restrict myself to its manufacture from bauxite only, touching but slightly upon other matters. My reasons for so doing are threefold—first, that the manufacture of sulphate of alumina from china-clay and other clays is well understood; secondly, the time at my disposal would not permit justice to be done to so extensive a subject; and, thirdly, my brother and myself have been engaged principally in experiments for the purpose of obtaining a pure sulphate of alumina from bauxite. Nearly all the bauxite used in the United Kingdom is obtained from Irish Hill, near Larne, in the County of Antrim, Ireland. It was discovered in this place by Mr. Alexander Sutherland, who is now the managing director of the Irish Hill Mining Company. According to this gentleman's views it is a purely miocene lacustrine deposit. It immediately underlies a basaltic plateau, occupying, in this respect, the same position as the iron ores found in the same district. Three qualities are raised and sold. The first is found in a seam from 4ft. to 7ft. thick, close up to the basalt, and only separated by a very thin layer of lignite. The second is found under the first, and is of about the same thickness. Under this there is found a thickness of about 40ft. of the third quality. The amount of iron in the different qualities varies with the lowness of the strata from 0.5 per cent. to as much as 20 per cent. Bauxite presents advantages over most other sources of alumina, and particularly over its most important rival, china-clay, in that it is by far more easily soluble in acid than the latter, and can be dissolved without the aid of extraneous heat. The only disadvantage attending its employment is the somewhat larger proportion of iron which it contains. In this paper I propose to describe the production of crude sulphate of alumina, the removal of the iron contained in the mineral previous to its conversion into sulphate of alumina, and the removal of iron from the crude sulphate of alumina by means of chemical precipitation, and also by mechanical means,