3dly. "On the nature and application of the volatile products of coal." In treating this portion of the subject—many of the observations on which have been necessarily anticipated in the preceding sections—the author traces the application of carburetted hydrogen gas to the purposes of artificial illumination from the year 1798, when its first successful application was made by Murdock at Soho; he then proceeds to Dr. Henry's investigations of the phenomena of its production and combustion; the variation of the intensity of light obtained from carburetted hydrogen, due to the proportion of carbon contained in it; the difference in the gas obtained from different qualities of coal; the superiority of the illuminating power of the gas from Cannel coal; and the still greater power of that produced from the decomposition of oil, which is 2 to 2½ times greater than that of coal gas. He then mentions the other products of coal by distillation, such as ammoniacal liquor, carbonic acid and oxide, sulphuretted hydrogen, tar, essential oil, naptha, petroleum, asphaltum, and other substances. The paper concludes by pointing out the advantages which would result from the production of such gas as is usually given out at the beginning of the distillation of coal, as it contains 2 volumes of gaseous carbon united with 2 volumes of hydrogen, and its illuminating power is consequently more than double that of ordinary coal gas.

Mr. Parkes observed, that the quantities of air required for the combustion of different fuels as determined in the laboratory and on the large scale of practice, were frequently very different. It might be quite correct that a given weight of coal would require more air for its perfect combustion than the same weight of coke. There was great difficulty in ascertaining the fact practically, under steam-boilers, as the gases given out by the coal must have air supplied to them distinct from that which passed through the grate to ensure their perfect ignition, and many circumstances prevented the consumption of air from being exactly measured. Generally, he had found it necessary to use wider spaces between the grate bars for coke than for coal. In some late experiments very carefully made on a boiler invented by Mr. A. M. Perkins, equal weights of coal and coke required the same time for their destruction on the same grate, the apertures of the damper and ash-pit door, which were used to govern the draught, being precisely the same. Coke effected a greater evaporation than coal at similarly rapid and slow rates of combustion; and in every case the temperature of an oil bath at the foot of the
chimney was higher with coke than with coal. It must, however, be remarked, that no process had been used to ignite the gases which escaped from the furnace uninflamed. He had tried different kinds of coke, coal, and anthracite at this boiler, and the same fuel in every instance performed a greater evaporative effect at a slow than at a rapid rate of combustion. He thought that much of the air which entered the grate of a boiler passed through the fire unconsumed, for want of time to effect a sufficiently intimate combination with the fuel. In some experiments lately made at Swansea on the properties of anthracite, Dr. Schafteutl had found from analysis, that no less than 40 per cent. of the products of combustion taken from the chimney consisted of oxygen, yet he had effected the large evaporation of 11 lbs. of water with 1 lb. of that fuel.

Mr. Field stated, that Mr. Cooper had expressed an opinion that in the use of coke as a fuel, a less portion of heat reached the chimney than with coal, on account of the large quantity of unconsumed air that passed through the fire, owing to the open spaces necessarily existing between the pieces of such a dry fuel as coke; whereas in a fire made of binding coal, nearly the whole of the air combined with the fuel in its passage through the body of fire.

Mr. Pellatt observed, that although in practice coke appeared to require more air to support combustion than coal did, yet long experience had taught him to believe that when coal was exposed to a rapid combustion, it required more air than coke.

In answer to an observation that some experiments lately made on the measurement of the quantity of air which entered the blast furnaces of Sir John Guest at the Dowlais Iron Works might bear on this subject—Mr. Farey objected to the application of such results to determine the question, as the air is injected with considerable force into a furnace; there is frequently a great reflux of blast from the Tuyere when the furnace is working close; whereas when it is working open the flame at the top shows that the passage of the air through the mass of burning fuel is very free, and that consequently a portion of it passes off unconsumed. He had found in his experiments on blast furnaces, that unless there was a redundancy of carbon, and a deficiency of oxygen, there was no chance of making good iron.