

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXX.—No. 17.
[NEW SERIES.]

NEW YORK, FEBRUARY 14, 1874.

[\$3 per Annum
IN ADVANCE.]

JAMES YOUNG, FOUNDER OF THE PARAFFIN OIL INDUSTRY.

"It would certainly be esteemed one of the greatest discoveries of the age if any one could succeed in condensing coal gas into a white dry solid odorless substance, portable, and capable of being placed upon a candlestick or burned in a lamp," says Liebig in his "Familiar Letters on Chemistry," dated 1843. Seven years later James Young, the subject of the accompanying portrait, completed a long series of experiments with the successful extraction of paraffin from Boghead coal, and then, patenting his discovery, opened to the world a great and growing industry.

Mr. Young began life as a joiner, learning his trade in his father's shop. His spare time, however, was devoted to the study of chemistry and he eventually adopted that profession, becoming at first assistant to Professor Graham in the London University, and subsequently manager of Muspratt's and afterwards of Tennant's chemical works. In 1848 he resigned his position in order to embark in the manufacture of lubricating and burning oil from petroleum; but as his spring became exhausted, he began a series of investigations in order to find an artificial substitute for the natural oil.

From his own internal consciousness Mr. Young evolved the conclusion that petroleum, or its substitute, might be produced by the action of heat on the coal, the vapor going up into the sandstone to be condensed. The ultimate result of his researches was that, out of a cannel that came to be mixed with the soda ash for making the alkali, he got a quantity of liquid that contained paraffin.

Patenting his discovery, Mr. Young, with ten others, established works for the manufacture of paraffin at Bathgate, Scotland, in the center of the Torbane Hill coal field, a district peculiarly rich in cannel, and began the manufacture of which he is the founder.

Commencing with the raw material, which is principally a stone of slaty texture and a dusky brown color, we may explain that shale pits are generally worked in juxtaposition with the crude oil manufactories. The shale pits vary in depth from twenty to forty fathoms. The best quality is that which, when cut with a knife, does not splinter, but gives off a continuous shaving, such as would be got from a piece of soap or wax. On reaching the pit bank, the shale is tumbled into a crusher, in passing through which it is ground to pieces, sufficiently small to pass easily down the retorts. The more common retort is a flattened cylinder of cast iron, about twelve feet long, which contracts towards the ends, both of which are open, and its lower end dips two or three inches into a shallow pan filled with water. After the retort has been filled with broken shale, the furnace is brought into operation, so as to raise its middle zone to a low red heat. The process of distillation then goes on continuously. At a temperature of 300°, the hydrocarbons contained in the shale are given off in the shape of gas, which is, to a large extent, condensable. At most of the crude oil works, the incondensable vapor is collected in a gas holder, and used for lighting the workshops. The oil obtained from the decomposition of the coals, having assumed the form of vapor, is collected in a large main having connections with the retorts. Through this main the vapor is con-

veyed to the condensers, which, as a rule, are similar to those used in gas works. As it passes through the condensers, the vapor is reduced to a liquid form, in which state it is run off into reservoirs, some of which contain as many as 100,000 gallons.

On leaving an apparatus called a separator, in which the two components of oil and water are parted from each other, the process of purification commences by a second distillation. The dark green fluid called crude oil, which at this stage has an appearance not unlike natural rock oil or petroleum, is now pumped into large iron pans, where it is boiled to dryness. In this way the hydrocarbons are once more

ting machine. The air thus refrigerated is brought to be on a stream of brine, which it converts into a freezing mixture, thus enabling solid paraffin to be produced in the hottest summer weather. Remaining in solution at a temperature of 60°, paraffin coagulates into the solid form when the temperature is reduced to 32°. Crude solid paraffin is now worth from \$150 to \$175 per tun in England. Paraffin candles, from which a clear, lustrous, and perfectly odorless light is obtained, are made at most of the principal Scotch oil works.

In addition to the Bathgate works, Mr. Young also projected the Addiewell works, on a very extensive scale. The land leased for their requirements extended to some three or four thousand acres, all containing shale and other minerals; while some forty acres were set apart for the site of the works. The retort sheds are upwards of 200 yards in length, and each shed contains a double row of retorts. There are altogether close on 400 retorts at these works. This represents a capacity for distilling over 3,000 tons of shale per week, and producing 120,000 gallons of crude oil, yielding 50,000 to 60,000 gallons of burning oil, in addition to about 12 tons of refined paraffin, and a large quantity of lubricating oil. To accomplish these results, the appliances are necessarily on a large scale. The heavy vapors are collected in two underground tanks, each capable of containing 12,000 gallons. Any vapor which does not liquefy in the condensing main is passed through a four inch cast iron tubular condenser, which is made up of 1,300 nine feet lengths, or a course of nearly two and a quarter miles! For the purposes of distillation upwards of twenty 2,000 gallon stills, made of malleable iron, are erected. There is a similarly large number of refining stills, each capable of containing 4,000 gallons. A number of immense store tanks, each capable of containing 15,000 gallons, are fitted up contiguous to the refining kilns, being so situated that they can collect the oil as it passes from one stage of the refining operations to another. The building in which the various oils are subjected to chemical treatment is four hundred feet in length and eighty feet wide. It has two fireproof gables, cutting off in the center the engine house from which the machinery is actuated. Underneath the roof of the building there are altogether upwards of a hundred large cast iron vessels, with a capacity varying from



JAMES YOUNG, FOUNDER OF THE PARAFFIN OIL INDUSTRY.

driven off in the form of gas, which, when condensed, yields an oil still rather green in color, but much thinner, lighter and purer than before. The oil in this state is taken to a set of closed vessels, where it undergoes a sort of scouring process, by being stirred up with sulphuric acid. Run off into a settler, still further purified, it rises to the top, where a black tar, formed by the combination of sulphuric acid with various impurities, subsides to the bottom. Being again similarly treated with caustic soda, the oil is still further refined, previous to being passed on by pumps to undergo a third distillation, which is pursued with vitriol and soda, until it becomes a thin, light, and perfectly colorless fluid. This is paraffin oil.

Solid paraffin is obtained from the thicker and heavier oil, of which about twenty gallons are evolved from every hundred gallons of crude oil put through the refining process. The solid paraffin is made by the application of a refrigera-

3,000 to 500 gallons. Upwards of 1,000 hands are employed at Addiewell, and in the shale pits adjoining over 500 miners are at work. One and a quarter million cubic feet of gas are produced at the works daily. The Addiewell shale yields from thirty to forty gallons of crude oil per tun, of the specific gravity of 0.870.

Within the comparatively short space of twenty years, the mineral oil trade has attained such a magnitude that it gives employment to over 7,000 workmen, who earn weekly something like \$50,000 in wages. At the present time about 800,000 tons of shale oil are annually distilled, producing nearly 30,000,000 gallons of crude oil, while the quantity of refined burning oil obtained from the crude product is close upon 12,000,000 gallons per annum, in addition to solid paraffin, naphtha, and other chemical products.

Of Mr. Young's more personal history we have left our selves little room to speak; but this is the less to be regret-

