

and logic by the university of Oxford in 1661, and was knighted in 1674. In 1680 he was elected to the presidency of the Royal Society, and in 1685 he entered Parliament as the representative of the borough of Plympton. While superintending the erection of St. Paul's all the salary Wren received was 200l. He was also used by the commissioners in other respects with extreme illiberality and meanness, and was obliged to yield so far to their ignorant clamour as to alter the design of his building, and to decrease the size of his dome, which he had intended should spring from the outside large gallery which surrounds it. If he had had the moral courage of Michelangelo, we should have had yet a nobler monument of his fame. Michelangelo, like Wren, had obstacles thrown in his way, and we are told the following anecdote:—Under the papacy of Julius III. the faction of Michelangelo's rival, San Gallo, gave him some trouble respecting the building of St. Peter's, and went so far as to prevail upon that pope to appoint a committee to examine the fabric. Julius told him that a particular part of the church was dark. "Who told you that, holy father?" replied the artist. "I did," said Cardinal Marcellus. "Your eminence should consider, then," said Michelangelo, "that besides the window there is at present, I intend to have one in the ceiling of the church." "You did not tell me so," replied the cardinal. "No, indeed, I did not, Sir; I am not obliged to do it, and I would never consent to be obliged to tell your eminence or any other person whosoever anything concerning it. Your business is to take care that money is plenty in Rome, that there are no thieves there,—to let me alone, and to permit me to proceed with my plan as I please." Wren's ungrateful employers, in 1718, dismissed him from his place of surveyor of public works: he was at this time in the 86th year of his age. This great and good man died at Hampton Court on the 25th February, 1723, in the 91st year of his age. His remains were accompanied by a splendid attendance to their appropriate resting-place under the noble edifice which his genius had reared, and over the grave was fixed a tablet, with the following inscription:—"Beneath, is laid the builder of this church and city, Christopher Wren, who lived about 90 years, not for himself but for the public good. Reader, if thou seekest for his monument, look around."

Great architects, if united with their works any other pursuit or study, have generally fixed upon some branch of science or art connected with architecture: thus, Michelangelo was a sculptor; Inigo Jones was a painter, and then an astronomer. But Sir John Vanbrugh was a dramatist as well as an architect; he wrote "The Provoked Wife," "Esop," and other comedies, and built Blenheim and Castle Howard.

Were I to give the character of each and all the eminent architects of this or any other country, they would serve to show how great was the amount of their labour, and with what cheerfulness and perseverance they pursued their tasks at the commencement of their career, and with what determined energy they maintained their name and fame after they had risen to excellences: nor will the characters of civil engineers lose by comparison with the already-named artists.

When the state of civilization and trade in England required more convenient and cheaper modes of transit for its goods than the common roads and waggons of the day afforded, a system of inland navigation was proposed, and Mr. Smeaton was employed in making rivers available for this purpose: afterwards, more direct routes became desirable, and canals were projected, in imitation of those made before by the Dutch and French. The Duke of Bridgewater was the great patron of these schemes, and brought forward James Brindley, who constructed for him the canal called the Bridgewater Canal, between Liverpool and Manchester. This immense work, the idea of which was ridiculed by most of the scientific men of the period as impracticable, Brindley undertook, and completed so as to form a junction with the Mersey. This success caused him to be employed, in 1766, to unite the Trent and Mersey, upon which he commenced the Grand Trunk Navigation Canal. From this main branch Mr. Brindley cut another canal near Haywood, in Staffordshire, not-

ing it with the Severn in the vicinity of Bewdly, and finished it in 1772. From this period scarcely any work of the kind in the kingdom was entered upon without his superintendence or advice. Among other designs, he prepared one for draining the fens of Lincolnshire, and the Isle of Ely, and another for clearing the Liverpool Docks of mud, which was especially successful. The variety of his inventions, and the fertility of his resources, were only equalled by the simplicity of the means by which he carried his expedients into effect. He seldom used any model or drawing, but when any material difficulty presented itself, he used to seclude himself for days, or until an idea presented itself to him for overcoming it; and so partial was he to inland navigation, that upon the question being put to him by the opposition to one of his schemes, "For what purpose he imagined rivers to have been created," he at once replied, "Undoubtedly to feed navigable canals." The intensity of his application to business brought on a fever, of which he died in 1772, in the fifty-sixth year of his age.

John Smeaton, another engineer, who did much to advance his profession in this country, may almost be said to have been born an engineer, his genius appeared at so early an age. His playthings were not those of children, but the tools which men employ. Before he was six years of age, he was discovered on the top of his father's barn, fixing up what he called a windmill, of his own construction; and at another time, while he was about the same age, he attended some men fixing a pump, and observing that they cut off a piece of the bored pipe, he procured it, and actually made a pump with it, which raised water. When he was under 15 years of age, he made an engine for turning, and worked several things in ivory and wood, which he presented to his friends. A part of every day was occupied in forming some ingenious piece of mechanism. In 1751 he began a course of experiments to try a machine of his own invention, to measure a ship's way at sea, and made two voyages to try the effect of it, and also to make experiments upon a compass of his construction. In 1753, he was elected a fellow of the Royal Society, and the number of papers he published in their transactions, will show how highly he deserved the honour of being enrolled a member of that useful and important body: in 1759 he received the gold medal.

In 1775, the Edlystone Lighthouse, was burned down, and Mr. Smeaton being recommended to the proprietors of that building as an engineer in every way calculated to rebuild it, he undertook the work, which was completed in 1759. To this work I shall allude more particularly when instructing you in the building of lighthouses, as the practice of building then adopted has been continued to this day. But the part of Mr. Smeaton's life I would more particularly draw your attention to is this. During many years he was a frequent attendant upon Parliament, his opinion upon various works begun or projected being continually called for; and in these cases his strength of judgment and perspicuity of expression had full scope.

It was his constant custom, when applied to, to plan or to support any measure, to make himself fully master of the subject, to understand its merits and probable defects, before he would engage in it. By this caution, added to the clearness of his expression, and the integrity of his heart, he seldom failed to obtain for the Bill which he supported the sanction of Parliament. No one was ever heard with more attention, nor had any one ever more confidence placed in his testimony. In the Courts of Law he had several compliments paid him from the bench, by Lord Mansfield and other judges, for the new light he always threw on difficult subjects. Mr. Smeaton died in 1792, in the 69th year of his age.

John Rennie, to whom England is indebted for some of her noblest engineering works, was born on the 7th of June, 1761, at Phantassie, in the parish of Prestonkirk, in the county of East Lothian. His father, a highly respectable farmer, died in 1766, leaving a widow and nine children, of whom John was the youngest. The first rudiments of his education were acquired at the village school. It so happened that he had to cross a brook on the way, which, when flooded, obliged him to

make use of a boat kept in the workshop of Mr. Andrew Meikle, an ingenious mechanic, well known in Scotland as the inventor of the threshing machine. In passing so frequently through this workshop, young Rennie's attention was directed to the various operations in which the men were engaged; and they, catching the interest he took in their labours, were in the habit of lending him tools and showing him their use. In the evenings he amused himself with endeavouring to imitate the models he had seen at the shop; and it is related that, at little more than ten years of age, he had completed the models of a windmill, a pile-engine, and a steam-engine. Rennie continued at the Preston school till twelve years of age, when, having had a quarrel with his master, he entreated to be allowed to leave, and, at his own request, was placed for two years with Mr. Meikle. At the end of that time, feeling that a constant application to manual labour was likely to retard his mental improvement, he determined to become a pupil of Mr. Gibson, an able mathematical teacher at Dunbar. Here he soon attained great proficiency, and in less than two years returned to Mr. Meikle with a mind well stored with mathematical and physical science. His first essay in practical mechanics was the reaping of a corn-mill in his native village; and before he was eighteen years of age he had erected several others. During this time he occasionally visited Edinburgh, to pursue his studies in physical science, under Professors Robinson and Black. The former of these gentlemen may perhaps have laid the foundation of his future fortune, by introducing him to Messrs. Boulton and Watt, of Soho. Deeming the capital the proper theatre to try the strength of his own powers, Rennie settled in London, after having been a few months only with Boulton and Watt, who had confided to him the superintendence of the mill-work of the Albion Mills then erecting. Mr. Rennie was thus led to study hydraulic engineering, in which he became so celebrated as, after the death of Smeaton, to have no rival. Amongst the most celebrated works of this great engineer must be mentioned—besides numerous mills, bridges, canals—London, Waterloo, and Southwark bridges, the Lancaster Canal, with the aqueduct over the Lune, the breakwater in Plymouth Sound, and the improvements in the dockyards at Portsmouth, Plymouth, Chatham, and Sheerness. The industry of Mr. Rennie was so great, that he never suffered amusement of any kind to interfere with his business, which frequently occupied him twelve, and sometimes fifteen hours in the day. He was clear in his mode of communicating information to others, and pleased when he found that information was desired. He was never actuated by professional jealousy, or selfish feelings, but was always kind and condescending to the more humble members of his profession. Mr. Rennie died on the 16th of October, 1821, in the sixtieth year of his age, and was buried in St. Paul's, where his remains repose near to those of Sir Christopher Wren.

Thomas Telford was born in 1757, and commenced his life as a shepherd boy in Eskdale; but his early and eager love of knowledge led him to seek abroad an occupation more suited to his inclinations. He first repaired to Edinburgh, where he studied architecture with unremitting application, although he must have earned his daily bread by the labour of his hands. In 1782 he was emboldened to try his fortune in London, and was (as he states in his life, written by himself), fortunate enough to be employed at the quadrangle at Somerset-place, where he acquired much practical information, both in the useful and ornamental branches of architecture. After a residence of two years in London, he was engaged in superintending the building of a house in the Portsmouth Dockyard. During the three years, he remarks, that I was employed in building the commissioner's house, and of a new chapel in the Dockyard, I had an opportunity of observing the various operations necessary in the foundation and construction of graving docks, wharf walls, and similar works, which afterwards became my chief employment." When he left Portsmouth, he was appointed surveyor to the county of Salop, and to this, and the connections formed at this time, he was indebted for a very favour-