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for its activity and vigour upon "the fearfully and wonderfully" organized substance which we call the brain. Our natural heritage largely determines our temperament and constitution, our proclivities to health and disease, to mediocrity or genius, to vice or virtue. Our parentage stamps its traces on the whole of our complex nature—body, soul, and spirit. The whole aim of education, secular and sacred, should be directed to discover our weak points, and resolutely to fortify them against the insidious attacks of every form of corruption from within and from without. To build up a character is the aim of Christianity, which is not only an article of faith, but also an attitude of the soul. Anyone who reflects upon the varieties of human temperament from the moment of our birth, must see how some natures require more than ordinary effort to keep the body under, and bring it into subjection. There are men whose very temperament stands between them and certain forms of vice, and whose freedom from "presumptuous sins" is not to be attributed so much to their superior virtue as to natural disinclination. There are men who loathe the very taste of strong drink, and there are others who may be said to have inherited it from their very birth. The Grace of God can subdue and soften the most unruly will, and regulate the most sinful affection, and without it no man, whatever be his constitutional tendencies, be they strong or weak, can ever hope to obtain the complete mastery over himself.

G. W. WELDON.

ART. VII.—"MEN OF INVENTION AND INDUSTRY."

Men of Invention and Industry. By SAMUEL SMILES, LL.D., author of "Lives of the Engineers," "Industrial Biography," "Self-Help," etc. Pp. 380. John Murray.

"THE true Epic of our time," has said Carlyle, "is not Arms and the man, but Tools and the man—an infinitely wider kind of Epic." Not of great soldiers or statesmen, nor of poets and philosophers, has the author of "Men of Invention and Industry" written Lives. In his earlier books he was the biographer of tool-makers, of engineers, of masons and mechanics. And in his later books—as attractive and as valuable—he has discoursed of homely virtues, of heroism in lowly life, of the dignity of honest labour. An eminent and most successful biographer, Dr. Smiles is quite as interesting when he illustrates Character or teaches Thrift.

His present work, which is sure to be well read, is highly informing and very readable. We are told about Pettit Smith, practical introducer of the screw propeller; of Harrison, inventor of the marine chronometer, and of "Astronomers in humble life."

A chapter of particular interest brings before us William Murdock, the developer and improver of the condensing steam-engine. Watt's great invention, it will be remembered, was backed up by Boulton, of Birmingham; in developing its powers and extending its uses, Murdock did much; and Murdock's portion of the work must be held in honour.

Of the Murdocks or Murdochs, originally Flemings, some were known in Scotland as builders and mechanics. One of the best-known members of the family was John Murdock, the poet Burns' first teacher, in the parish of Auchinleck, Ayrshire. One of Burns' finest songs begins:

> "Behind yon hills where Lugar flows,
> 'Mang moors and mosses many, O!"

That was the scene of William Murdock's boyhood. In his youth he helped his father—a very clever and intelligent man—in the mill, on the farm, and in the preparation of mill-machinery. He even built a bridge over the river Nith, near Dumfries; and it stands there to this day, a solid and handsome structure. But he had an ambition to be something more than a country mason. He had heard a good deal about the inventions of James Watt; and he determined to try whether he could not get "a job" at the famous manufactory at Soho.

It was in the year 1777, when he was twenty years old, that Murdock left his native place, and migrated southward. When he called at the Soho works, to ask for employment, Watt was away, looking after his pumping-engines in Cornish mines; but Boulton, who was usually accessible to callers of every kind, saw him:

> In answer to Murdock's inquiry whether he could have a job, Boulton replied that work was very slack with them, and that every place was filled up. During the brief conversation that took place, the blate young Scotchman, like most country lads in the presence of strangers, had some difficulty in knowing what to do with his hands, and unconsciously kept twirling his hat with them. Boulton's attention was attracted to the twirling hat, which seemed to be of a peculiar make. It was not a felt hat, nor a cloth hat, nor a glazed hat; but it seemed to be painted, and composed of some unusual material. "That seems to be a curious sort of hat," said Boulton, looking at it more closely; "what is it made of?" "Timmer, sir," said Murdock modestly. "Timmer? Do you mean to say it is made of wood?" "'Deed it is, sir." "And pray how was it made?" "I made it mysel', sir, in a bit laithey of my own contrivin'." "Indeed!" Boulton looked at the young man again. He had risen a

hundred degrees in his estimation. William was a good-looking fellow—tall, strong, and handsome—with an open, intelligent countenance. Besides, he had been able to turn a hat for himself with a lathe of his own construction. This, of itself, was a sufficient proof that he was a mechanic of no mean skill. "Well!" said Boulton, at last, "I will inquire at the works, and see if there is anything we can set you to. Call again, my man." "Thank you, sir," said Murdock, giving a final twirl to his hat.

Such, it seems, was the beginning of Murdock's connection with the firm of Boulton and Watt. When he called again he was put upon a trial job, and then, as he was found satisfactory, he was engaged for two years at 15s. a week when at home, 17s. when in the country, and 18s. when in London. Beginning as an ordinary mechanic, he applied himself diligently and conscientiously to his work, and gradually became Boulton and Watt's trusted adviser and co-worker.

In 1799, when he was only twenty-five years old, he undertook the principal management of the pumping-engines in Cornwall. His energy was immense. He was sober, and "most obliging." Till he had conquered the defects of the engines he gave himself no rest. When he had an important job on hand he could scarcely sleep. One night at his lodgings at Redruth, we read, the people were disturbed by a strange noise in his room. Several heavy blows were heard upon the floor. They started from their beds, rushed to Murdock's room, and found him standing in his shirt, heaving at the bedpost in his sleep, shouting, "Now she goes, lads; now she goes!"

Some of his leisure hours at Redruth were spent in inventing. He designed and constructed a model locomotive. The model stood only a foot and a half high; but it was big enough to prove that Murdock's principle was sound. It was supported on three wheels, and carried a small copper boiler, heated by a spirit-lamp. The little engine successfully hauled a model waggon round the room. This experiment took place probably in 1784. Watt's patent in that year, we know, included an arrangement for the use of steam-power in locomotion; but it was a speculation, and nothing was done. Watt, as well as Murdock, left it to others to work out the problem of the locomotive engine.

Among Murdock's discoveries at Redruth, also, was the application of gas for lighting purposes. "Several independent inquirers into the constituents of Newcastle coal," says Dr. Smiles, "had arrived at the conclusion that nearly one third of the substance was driven off in vapour by the application of heat, and that the vapour so driven off was inflammable. But no suggestion had been made to apply this vapour for lighting purposes until Murdock took the matter in hand." In 1792 his house was fitted up for being lit by gas. Soon

afterwards Murdock returned to London; and in 1802, on the occasion of the Peace of Amiens, the whole of the works at Soho were brilliantly illuminated with gas, the sight being received with immense enthusiasm.

After a few years it was proposed to light the streets by gas — a bold proposal. It was ridiculed by Sir Humphrey Davy, who asked one of the projectors if he intended to take the dome of St. Paul's for a gasometer! Sir Walter Scott, too, made clever jokes at the expense of those who proposed "to send light through the streets in pipes;" even scientific Wollaston declared that they "might as well attempt to light London with a slice from the moon." It has been so with all new projects. As John Wilkinson said of the first vessel of iron which he introduced—it was "a nine days' wonder, and afterwards a Columbus's egg." Westminster Bridge was lighted by gas in 1814; the city of Glasgow in 1817. Murdock's "light" was soon everywhere used.

Upon many mechanical contrivances the genius of this great inventor[1] left its mark. He died in 1839, in his eighty-fifth year, and was buried near the remains of Boulton and Watt.

Another very interesting chapter is that in which Dr. Smiles brings out the truth in regard to Koenig, inventor of the steam-printing machine. In the year 1814 (Nov. 29) the *Times* was printed by steam. The machine had been taken from Koenig's workshop, and fitted up in a room in Printing House Square. Although the operations had been conducted with great secrecy, the *Times* pressmen obtained some inkling of what was going on; and they vowed vengeance on the foreign inventor. Suddenly, one morning, Mr. Walter appeared among the pressmen, and brought copies of the paper as "already printed by steam!" In the *Times* of that day, it seems, appeared an article upon "the greatest improvement connected with printing since the discovery of the art itself." John Walter, who thus availed himself of Koenig's steam printing press, was virtually the inventor of the modern newspaper. His father (the first John Walter) made him editor and conductor of the *Times* in 1803, when he was only twenty-seven years of age.

For Mr. Walter's remarkable success, says Dr. Smiles, these

[1] His ingenuity was constantly at work. Sometimes he met with a rebuff. "Observing that fish-skins might be used as an economical substitute for isinglass, he went up to London on one occasion in order to explain to brewers the best method of preparing and using them. He occupied handsome apartments, and little regarding the splendour of the drawing-room, he hung the fish-skins up against the walls. The landlady caught him one day when he was about to hang up a wet cod's-skin! He was turned out at once, with all his fish!"

important qualities—enterprise, energy, business tact, and public spirit—sufficiently account. To these, however, must be added another of no small importance—discernment and knowledge of character. He collected around him some of the ablest writers of the age. But Walter himself was the soul of the *Times*. He gave the tone to its articles, and superintended its entire conduct with unremitting vigilance.

In illustration, several anecdotes are recorded. Here is one. In the year 1810 there was an unfair and threatening combination on the part of the *Times*' men, and a strike:

> Mr. Walter had only a few hours' notice of it, but he had already resolved upon his course. He collected apprentices from half-a-dozen different quarters, and a few inferior workmen, who were glad to obtain employment on any terms. He himself stript to his shirt-sleeves, and went to work with the rest; and for the next six-and-thirty hours he was incessantly employed at case and the press. On the Monday morning, the conspirators, who had assembled to triumph over his ruin, to their inexpressible amazement saw the *Times* issue from the publishing office at the usual hour, affording a memorable example of what one man's resolute energy may accomplish in a moment of difficulty.

Twenty-three years later Mr. Walter was quite as ready to lend a hand, if the need were pressing. "Thus it is related of him that in the spring of 1833, shortly after his return to Parliament as member for Berkshire, he was at the *Times* office one day, when an express arrived from Paris, bringing the speech of the King of the French on the opening of the Chambers. The express arrived at ten a.m., after the day's impression of the paper had been published, and the editors and compositors had left the office. It was important that the speech should be published at once; and Mr. Walter immediately set to work upon it. He first translated the document; then, assisted by one compositor, he took his place at the type-case, and set it up. To the amazement of one of the staff, who dropped in about noon, he 'found Mr. Walter, M.P. for Berks, working in his shirt-sleeves!' The speech was set and printed, and the second edition was in the City by one o'clock." Mr. Walter died in 1847.

Reviews.

Letters of the Rev. J. B. Mozley, D.D. Edited by his Sister. Rivingtons. Pp. 360. 1885.

RECENTLY, in recommending a new edition of Dr. Mozley's great work, "A Review of the Baptismal Controversy," we took occasion to pay a tribute of respect to the learned author. Professor Mozley, who with