

used, is because the vibration of the used rails tends to shake off the rust formed, so as to prevent its prolonged contact with the metallic iron from accelerating the corrosion of the latter.

THE MECHANIC OF THE FUTURE.

An esteemed correspondent desires us to call attention to the difficulty in finding mechanics able to fill situations where special knowledge is required, and to the hindrances thrown in the way of capable men by trade rules and customs, prescribed and enforced in the interest of the worthless and incompetent.

This country is almost overstocked with professional men; and whenever education and ability are united in a young man, he is almost sure to quit the practical part of his trade, and become a consulting engineer and an expert, living by fees instead of by wages, and selling his knowledge and not his skill. Thus, men of brains are taken out of the really working class; and many manufacturers look in vain, in the rank and file of their establishments, for men capable of being master mechanics. The question as to where our leaders and foremen are to come from is deserving of our best consideration; for there are many influences at work which are retarding the progress of the American working man. Boys and young men should especially bear in mind the value of acquiring a thorough knowledge of all branches of the trade by which they intend to earn their bread, so as to become capable leaders and instructors of others, less gifted and fortunate than themselves. The gentleman above referred to recently needed a first class machinist to superintend a certain branch of business, the specialties of which would require a few months of attentive study and practice. It is difficult to believe that the rules of a trade society, ostensibly organized for the protection of the rights of working men, prevented a skilled artisan from leaving an inferior position to be a superintendent; but it is nevertheless a fact. He stated that the union to which he belonged would not allow him to work for an hour at less than a certain rate, even though his temporary reduction should certainly lead him to permanent employment of great responsibility and credit, and consequently large remuneration. The employer, naturally averse to having his liberal offer thus treated, at once declined to promote the man on any terms whatever, as no one who would thus debar himself from getting on in the world was fit to be put over others, who would naturally follow his example and imbibe his ideas.

So many qualifications are wanted in a manager and superintendent of a machine business that fitness for the post is rare, and the ambition to fill it creditably ought to stimulate our workmen to study and improvement.

CHARACTERISTICS OF A BUSINESS KING.

During his career as a great contractor, the late Thomas Brassey was engaged in the construction of railways in England, France, Spain, Italy, Belgium, Saxony, Bohemia, Austria, Hungary, Moldavia, Syria, Persia, India, Australia, Canada, and South America, aggregating something like six thousand five hundred miles, besides water works, drainage schemes, docks, bridges, and other important undertakings. In the execution of these great works, he had, at various times, twenty-seven different partners; four hundred million dollars of other people's money passed through his hands; and at times the army of workmen to which his contracts gave employment numbered as many as eighty thousand men.

Such a record, to say the least, entitles Mr. Brassey to a high place among the great captains of industry to which the age of railway construction has given birth and occupation; and as one of the pioneers of a new order of men, his character is peculiarly worthy of study, more especially as he represents a type of man which the world is likely to have more and more need of with the spread of the industrial civilization which distinguishes our modern times.

Abundant materials for the study of Mr. Brassey's qualifications for an industrial leader are furnished in the volume on his "Life and Labors," prepared by Sir Arthur Helps; and though it is never safe to assume that all the characteristics of a successful man were essential or helpful to his career, and therefore worthy of imitation by those who would aspire to similar success, we may nevertheless easily detect those which were strikingly helpful; while the doubtful ones, even those most widely at variance with the popular ideal, may possibly have been factors worthy of recognition.

Before entering upon any analysis of Mr. Brassey's character, it is proper to notice, first, an important condition of his success in the great business of his life, a condition without which every other qualification would have been wasted. His business training was such as to give him a practical knowledge of nearly every kind of labor necessary to be understood for the accomplishment of great works of construction. This we put before any personal characteristic, since no man, however well fitted by Nature for the rank of master, can command to good purpose without a minute personal knowledge of the work to be done, a fact which ambitious youngsters are very apt to overlook. Mr. Brassey was fortunate in not being sent to school until he was twelve years old. At sixteen, he was apprenticed to a surveyor and real estate agent,—something different, by the way, from what the term implies with us—who subsequently took him into partnership. His first work of consequence was in connection with the laying-out of the once celebrated Holyhead road, of which all England was very proud. At the death of his instructor, Mr. Brassey became sole agent and representative of the owner of a large estate, in the care of which he had brickyards and limekilns to superintend. Later he

had the management of a quarry, from which stone was taken for a viaduct on the Liverpool and Manchester Railway, the first for passenger traffic ever constructed. It was in connection with this quarry that Mr. Brassey made the acquaintance of George Stephenson, under whose advice he made his first (unsuccessful) tender for a railway contract. His next attempt was to better purpose; and at the age of twenty-nine, Mr. Brassey entered upon his life work as a railway contractor. His first undertakings received his personal supervision to their minutest details, thus laying the foundation for the higher and more valuable art for which he became celebrated in after years, the art of dealing with details in masses.

Thus Mr. Brassey was prepared by education for dealing with the great problems of railway construction. Let us consider briefly the personal qualities which he brought to the work. In the first place, he had the energy needful for great accomplishment. Said one who worked under him for many years: "If he'd been a parson, he'd have been a bishop; if a prize fighter, he would have had the belt." The physical basis was sound and enduring, and his activity untiring. With great capacity for hard work, he keenly enjoyed working hard, not so much for the profit it would bring as for the pleasure of doing. He could not bear to have work drag, nor to leave anything which he undertook undone or half done. Even when the pushing forward of work, arrested by accident or otherwise, involved the taking upon himself responsibility for expense which belonged elsewhere, he did not hesitate to go forward.

A striking illustration of this spirit occurred in connection with the Paris and Rouen Railway, his first great foreign contract. In the carrying out of this work, he was restricted in his choice of certain materials to French products; and in consequence of inferior lime for mortar, a rapidly built viaduct—a huge brick construction, a hundred feet high and a third of a mile long, costing \$250,000—fell down in utter ruin. It was suggested that, on representing the facts of the case to the directors of the company, some alleviation of his loss might be obtained. His reply was: "No: I have contracted to make and maintain the road, and nothing shall prevent Thomas Brassey from being as good as his word." Without stopping to discuss the question of responsibility in the matter, new materials were secured, and the work was reconstructed with a rapidity that was accounted marvelous. It is a satisfaction to record that the company voluntarily assumed the cost of the new structure.

With all his anxiety to have work done rapidly and well, Mr. Brassey never wasted his energy in worry. Having given his best efforts to ensure success, he was content to await the result and abide by it with perfect equanimity. This, as Sir Arthur justly remarks, is a great felicity of temperament. It gives a man of much work the staying quality known as "bottom" in a racer, and enables him to meet inevitable reverses without being crushed or disconcerted. It is the basis of the two-o'clock-of-the-morning courage, which the first Napoleon used to rejoice in, a quality which Mr. Brassey had to an eminent degree. If called up suddenly in the middle of the night, upon some urgent peril or difficulty, he met the alarm with perfect coolness; sat down to consider and calculate what was the best mode of obviating the danger; and before break of day, when he had to proceed to the scene of action, he was ready with his plan. Like master, like man. His example could not but be felt by his assistants, who took courage at his stability of mind, and gave their fullest confidence to a leader who always seemed ready for any emergency. In addition to this imperturbable presence of mind, Mr. Brassey evidently possessed singularly quick and comprehensive powers to take in the essential conditions of a problem at a glance, uncommon power of rapid calculation, and great ability for organization—qualities which not only inspired his staff with confidence in times of difficulty or danger, but enabled him to administer complicated affairs with a royal ease and facility.

It was in dealings with his agents, however, that his most striking characteristics were displayed. In the course of his career, he carried into execution nearly two hundred contracts, many of them involving hundreds of miles of railway. The works for which he made unsuccessful tenders amounted to upwards of seven hundred million dollars. It is obvious that no man could examine the details of works of such variety and magnitude. He must necessarily trust largely to his agents; and it was in the choice of these, and his subsequent treatment of them, that Mr. Brassey's business sagacity came into full play. He chose his agents with great care and with consummate judgment. After that, he placed implicit trust in them; and though capable of exercising the most minute supervision and criticism, he never judged by details, but looked to results. His system of keeping accounts was what most men would consider loose, and his agents were entrusted with vast sums of money to be expended almost at their discretion; yet his financial secretary and confidential adviser upon all monetary matters testifies that not one of his representatives was ever known to deceive or rob him. When asked if this was to be taken as a proof of the general honesty of mankind, Mr. Tapp replied: "Not exactly that. I think it rather more shows that he placed so much confidence in those whom he employed, and put them, as it were, so much upon their honor, that they would not deceive him; and that people, who might not have acted uprightly with other masters, did so with him because they felt responsible to him, and also a certain amount of pride in being confided in by him to such an extent that they really carried on the business as if it were their own." His biographer adds his personal belief that the system of trust which Mr. Brassey adopted uniformly, in respect to all those who worked under him, was

such as would be generally successful if carried out with that perfect faith and completeness which he always manifested in these transactions—a belief which might be considered Utopian had it not such a substantial backing in Mr. Brassey's large experience.

In another connection, Sir Arthur observes that where most men fail in governing is in not entrusting enough to those who have to act under them. Most men intend well, and try to do their best as agents and subordinates; and he is the great man who succeeds, with the least change of agents and subordinates, in making the most of the ability which he has to direct and supervise. Besides, men must act according to their characters; and he who is prone to confide largely in others will mostly gain an advantage in the general result of this confidence, which will far more than counteract any evil arising from that part of the confidence which is misplaced.

That a man whose ruling passion was the execution of great works in a way which should win him renown for faithfulness, punctuality, and completeness in the execution of his undertakings should succeed, as Mr. Brassey did, by such a mode of dealing, with those on whose faithfulness and integrity his reputation depended, is cogent evidence that his plan of action was not far from correct. Not only did Mr. Brassey trust his subordinates, but they trusted him as implicitly. In the earlier part of his career, when each contract had his personal supervision, he allotted to each nominal sub-contractor his portion of the work, and fixed the price for it. Says one of them: "They did not ask him any questions. He said: 'There is a piece of work for you. Will you go into it? You will have so much for it.' And then they accepted it, and went to work." Their invariable willingness to take the work at his valuation was accounted for by the conviction, which each of them had, that if any mistake had been made, to their injury, Mr. Brassey always stood ready to make good the loss. In case a job turned out more difficult than had been anticipated, no appeal would be made; the work would go on according to contract until Mr. Brassey made his customary tour of inspection, when he never failed to recognize the contractor's position, and voluntarily set it right. When his undertakings became too extensive to be thus minutely inspected, the same policy was carried out through resident agents. To many this course may seem very unbusiness-like, but the result uniformly proved the wisdom of it. By treating his agents generously, he secured generous service in return, and was able to withdraw his attention more and more from matters of detail. He never wasted his time in doing work that an agent or sub-contractor could do just as well. As to mere money grubbing, one of his principal agents testifies that he had not any of that in his composition, but he knew the value of money as well as any one, and how far a pound would go: nevertheless he had no greediness to acquire wealth, and he was always ready to give away a portion of his profits to anyone who was instrumental in making them, and that to a remarkable extent.

For illustrations of Mr. Brassey's hatred of contention, his uniform courtesy, his large-hearted unselfishness, his frank appreciation of merit of all kinds in others, and other qualities which pertain to the man rather than the contractor, we have no space. At the busiest period of his life, he would travel hundreds of miles to be at the bedside of a sick or dying friend or associate, to give what aid or consolation he could: a spirit which his staff rewarded as it deserved. The regard and affection which Mr. Brassey won from all those who served under him were most strikingly manifested during his last fatal illness. Men of all classes, humble navvies as well as trusted agents, came from great distances solely for the chance of seeing once more the old master they loved so well.

At a time when there seems to be a growing belief that a masterly man must be a stern disciplinarian, rough rather than gentle, brusque rather than courteous, exacting, watchful, a believer in the vile theory that every man must (in business) be treated as a rascal until he proves himself something better, it is singularly pleasing to review an exceedingly successful career, throughout the whole of which the opposite qualities are conspicuous. At a time, too, when financial treachery and eye service are supposed to be predominant, when the most minute and exacting checks upon the free conduct of agents fail to prevent "irregularities," it gives one fresh confidence in the general honesty of human nature to see the spirit of trustfulness made the basis of a great business, and to see it justified by service honorable to the highest degree.

That Special Edition.

The issue of a Special Edition of ONE HUNDRED THOUSAND copies of the SCIENTIFIC AMERICAN will come off soon after the first of December.

The names of parties to whom this large number of papers will be sent have been selected with care, and the publishers guarantee the issue to be fully 100,000, and it will probably reach 150,000 copies. The probability of this excess over the one hundred thousand is predicated on last year's experience. We then guaranteed 60,000, but actually printed and mailed 120,000 copies.

The papers will be mailed in separate wrappers, and the postage prepaid to every post office in the United States, Canada, and the adjoining Provinces.

The space allotted for illustrating new machinery and inventions is nearly all taken; but a few more good engravings, of first class inventions, may find place in the editorial pages, if immediate application is made. There is also a very little more space left for advertisers. See page 365 of this paper for particulars.