

possible. The working of Siemens' regenerative furnaces, although easily understood, is almost as wonderful. It needs no strong prediction to declare that the means which give such a perfect control of temperature, without diluting the flame with uncombined oxygen, and which afford so great an economy of fuel, must come into very general use."

"To go on with inventions in connection with railways:—Who, upon learning the construction of the Injector, would have foreseen that it would work at all? Going a little further back, Eugene Bourdon's discovery, in his workshop, that a coiled still-worm tended to straighten itself under pressure, led to an invention which has conferred great benefits upon locomotive practice, by increasing the security of working and economising fuel. How much complication was removed from locomotive pistons by the introduction of Mr. Ramsbottom's slight and wiry rings, which it was believed by many would scratch the cylinders (and at first they occasionally did), and never remain tight? Messrs. Miller and Wakefield's steam-packed pistons embody an equally neat idea, but this idea—although we believe it was really adopted in practice by Spiller, of Battersea, twenty years ago—was once pronounced absurd by more than one engineer. Then there are Mr. Adams' radial bores which have attained to a thoroughly established success in the face of much and generally expressed doubt. The spring-seated tyres, by the same gentleman, have by far outworn tyres set in the ordinary manner, and it is clear that what saves tyres must save the rails. We do not know that there is any 'if' in the way of the success of the spring tyres, but even if they have not yet wrought a general change in the opinions of practical men, they have certainly attained a measure of success which, at one time, many would not have been willing to admit as possible. Another successful application which, until the success had been proved, many engineers would have rather ridiculed than doubted, is that of Mr. Ramsbottom's water troughs for 'picking up' water into tenders in rapid motion. It is a great deal to have proved that no real difficulty has been found from dust or dirt in the water, and that during the first winter of its trial the trough failed once only from freezing up, and then only in consequence of the water being allowed to stand in it without the disturbance due to a current running through it. Our readers will have observed that, encouraged by so much success, more than one engineer is now considering the practicability of extending the water troughs; so as to give a continuous supply of water for any distance, without a tender, and, if found desirable, as upon trial it might be, to condense not the whole of the steam, for a part is needed for draught, but all remaining below the back pressure line at each stroke."

"The success of underground railways, both in a mechanical and a pecuniary point of view, is more than many could foresee, and our own columns of former years even testify that we then found ourselves compelled to doubt at least the commercial success of such lines—a success which has proved so great that we are glad to acknowledge that we have been disappointed by it. The success of the pneumatic post is already established, and

we may now look, with some confidence, to the like success of the Waterloo and Whitehall Pneumatic Railway, the works of which, it is promised, will be finished in a year."

"In marine engineering, it is not many years since there was great unbelief in the economy, and even in the admissibility of the screw propeller. Less than three years ago, some of the cleverest engineers and shipbuilders in the kingdom pronounced twin screws, with independent engines, to be disadvantageous, if not impracticable. Now there can hardly be two opinions as to their value. One of the best points in connection with the modern screw engine is the wood bearings now so generally employed. They were designed in their present form by Mr. George D. Kittoe, and were very shortly afterwards adopted by the leading engineer, in the face of much doubt, we need not add. The re-introduction of super-heated steam, and the revival of surface condensation, have greatly qualified engineering opinion also. The use of marine governors, now so general, is in strong contrast with the once-prevailing belief in their utter uselessness. In nearly all these instances our readers will see that we are keeping within a very recent period of time, seldom extending so far back as the memorable week in January, 1856, when *THE ENGINEER*, fresh from our printers, first met the smile of public approval. We can write with confidence, now, of the ascertained advantages of invention which then were either unknown, or pining in the cold shade of unbelief. Belief was then unprofessional—unbelief, professional."

"How many engineers a few—a very few—years ago believed in steam fire-engines? The late Mr. Braidwood, who, of all men, one would suppose, was the best qualified to judge, refused to countenance them until years after they had taken their place in the established brigades of American cities. Captain Shaw has encouraged them, and the result is that they have been greatly improved, and now even surpass the best American steam fire-engines. They are now thought indispensable to the protection of London, as, indeed, of any city or town of sufficient size to maintain them."

"It was not many years ago when English engineers thought a turbine a toy, and a centrifugal pump an ingenious puzzle in central forces—an hydraulic teetotum for the edification of the disciples of science who throng the Polytechnic. Yet both the turbine and the centrifugal pump are now known to utilise from 70 to 80 per cent. (and sometimes more) of the power applied to them; and this is more than can be said of the old lumbering water-wheels, or of other than the best made pumps."

"What may be said of the now acknowledged value of machine-made bricks, of water-pressure engines, and of the simple and beautiful 'disintegrator,' now used by the artificial manure manufacturers? A few years ago there was nothing like the good old hand moulds for the wretchedest bricks; water-pressure engines, although anybody might have invented them, were not believed in; and the 'disintegrator' was rather a curious example of a Catherine wheel revolving within a scintillating and bristling radiance of superphosphates than a useful and acknowledged invention."