

tion was opened by the Queen, in Hyde Park, on May 1st, 1851. It was held in a vast structure of iron and glass planned by Sir Joseph Paxton, and called the Crystal Palace, which, as everyone knows, is now located at Sydenham. The building was 1851 feet long, by 408 wide, with an additional width of 48 feet for half the length; the highest portion was a centre transept 108 feet high; the area covered was 19 acres, equal to seven times that of St. Paul's. The exhibitors numbered nearly 16,000, about equally divided between British and foreign contributors. The cost of the structure was £170,000 (for use and waste, not for absolute ownership), which, in addition to the other expenses down to the close of the exhibition, made a total outlay of £292,795. The entire number of visitors was 6,039,195, averaging 41,938 per day. The total receipts from admission and other sources amounted to £505,107, leaving a surplus of £200,000.

## THEORY AND PRACTICE.

BY PETER ELLIS WELLINGTON

How often the remark is heard "Yes, it sounds all right in theory, but it does not work out in practice", in such cases which is at fault? Certainly not practice, for as Sir Humphry Davy declared "one fact is worth a thousand theories". Now, there are "theories and—theories," as the French say, and if theory and practice fail to agree it is mainly because the theory is incorrect, and not that theory and practice are incompatible. Theory and practice always agree when theory is sound; therefore, "practical" engineers should not despise theory because it sometimes fails to "show the reason why." It may seem peculiar, but sound theory is founded on fact, and it is a happy combination when practice and theory go hand-in-hand, and an engineer with a well-balanced mind commanding this combination is likely to be more successful than either the theorist or the practical engineer. Depend upon it, that when theory does not fit in with practice, it is not that theory, as theory, is of less value than practice, but because it has fallen short of its true value in that particular instance, or has been propounded on a false basis, since every fact must have its true theory somewhere, whether discovered and elaborated, or not. Probably the reasons why so few successful inventors spring from our colleges and so many come from practical men is that the practical man is in possession of ascertained facts based on his experience, which cannot be gainsaid; and whether these facts can be successfully theorised on or not, they are facts; and the practical man knows that if he bases his ideas on these solid facts he is on safe ground—hence the great value of actual experiment. Actual experiment may introduce important elements which theory may have overlooked or wrongly calculated; on the other hand, the inventor without theory, especially if his experience of facts is limited—and no man can experience all the facts in the engineering world—will have a hard row to hoe to bring his ideas to fruition. There is not the slightest doubt but that some theories are absolutely sound and consistent with solid facts, but since all progress is the result of evolution, theories must evolve, and some of the theories to-day must disappear and give place to others, as surely as the sun shines and that day follows night. Why are scientists so anxious to get to the North Pole? Why not be satisfied with their theory? Simply because they are in the habit, and properly so, of proving their theories by absolute fact, based on experiment or actual experience. Who would have divined the existence of electrical energy—now such a handmaid of our civilisation—apart from the experience, accidental or otherwise, of the effect of electricity on our senses? This is a self-evident fact, without a suspicion of theory. Theory has its place, but if we pin our faith wholly to it our progress will be slow and the practical experimentalist will distance us in the race of improvements, although he may wade through a maze of intricacies.

### NOTICE TO ADVERTISERS.

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## THE IMMENSITY OF SPACE.

THE first thing to realise about the stars is the immensity of the distances which separate them from one another. If we attempt to express such distances as those of the stars in ordinary units of measurement, we have to deal in numbers which are quite beyond any power of mental realisation. In order to get over this difficulty astronomers have introduced a new unit for the measurement of stellar distances. This is known as the light-year, or the distance which light, travelling at 186,000 miles per second, would traverse in a year. One very curious consequence follows from this way of measuring stellar distances. When we look at the star-strewn sky we are fathoming the depths, not merely of space, but of time. We do not see any star as it was when the light which affects our retina set out upon its journey. And, as almost all visible stars are set at very various distances from the earth, we see them all at different periods. If we look at the constellation of Orion, we see the bright star Bertelguex at the head of the constellation as it was 126 years ago, whilst Rigel at the foot is visible by light which must have started at least three centuries before it reaches us. Sirius, however, which "bickers" into red and emerald to the southeast of Orion, we see by light which only started eight or nine years ago. It is plausibly suggested that some of the faintest stars visible in our largest telescopes may be as much as 30,000 light-years

of her whereabouts over 700 miles. Being due at Plymouth early on a Friday morning she was in communication with her port on Wednesday at mid-day. The French liner "La Provence" lately was in communication with Poldhu and Cape Cod at the same time, being 1800 miles distant from England and 1700 from America.

## Britain's Seaborne Trade.

### REMARKABLE RECORD OF COMMERCIAL POWER.

A remarkable statement of Britain's seaborne trade is contained in a Blue-book on "the Navigation and Shipping of the United Kingdom for the Year 1905" just issued.

The total number of vessels of all nationalities which entered at ports in the United Kingdom during the year was 66,840, with a tonnage of 35,623,974. The total of trade, entries and clearances amounted to 112,040,734 tons, as against 104,773,168 tons in 1903.

London naturally occupies first place with 10,814,115 tons entered. Liverpool comes next with 7,806,844 tons, and Cardiff next with 4,337,720 tons. In 1903 Dover only entered 951,662 tons, whereas last year the total rose to 2,928,741.

The total number and tonnage of vessels belonging to the United Kingdom, which were actually



"PROGRESS" OFFICE AT THE NEW ZEALAND INTERNATIONAL EXHIBITION

away. The new star which recently displayed itself in Perseus was shown by an ingenious train of reasoning to be 300 light-years distant, so that in 1902 we were able to watch the progress of a stellar conflagration which really occurred about the time of the Spanish Armada. An ingenious French astronomer has based on this fact the pleasant phantasy in which he imagines that a disembodied spirit, able to move with the speed of thought, and endowed with supernatural powers of vision, may at will behold any incident which had ever taken place on the earth under an open sky by transporting itself through space to the point which the light waves emitted by that incident have reached in their endless journey. Such a being, placed at the distance of Canopus, might now be watching the massacre of St. Bartholomew, and by travelling thence in a straight line towards the earth it would be able to pass in panoramic view the whole subsequent course of the world's history. Of course, there would be considerable gaps, due to clouds, to the rotation of the earth, and to the fact that a great part of the earth's history has been conducted indoors. But the general idea is perfectly sound. The old superstition of the Recording Angel might be replaced by this modern discovery of light-waves which travel for ever out into boundless space with their story of human actions and sufferings.

The Hamburg-American liner "Kaiserin Auguste Victoria" has just made a record in giving notice

in trade or in fishing, were 14,521 vessels and 10,397,761 tons. The number of persons employed numbered 263,686, as against 257,937 in 1903, and 259,489 in 1904. The numbers of British, foreigners, and lascars employed in these three years were as follows—

	British	Foreigners	Lascars.
1903 ..	176,520 ..	40,396 ..	41,021
1904 ..	176,975 ..	39,832 ..	42,682
1905 ..	180,492 ..	39,711 ..	43,483

The total tonnage of vessels built (exclusive of vessels either for the Royal Navy or for foreigners) was 851,433 tons last year, compared with 629,069 in 1903. The tonnage of vessels built for foreigners was last year 197,015—234 vessels.

## Large Hydro-Electric Power Plant.

One of the largest artificial storage reservoir hydro-electric power plants in the world is under construction on the river Sihl, in the Canton of Schwytz, Switzerland. A dam 90 ft high and 350 ft long will impound the water in a lake with a surface area of two square miles. The capacity of the reservoir will be 25,360,000,000 gallons. The generating plant will be upon the shore of Lake Zurich, and will be operated under a head of 1575 ft. It is estimated that a continuous supply for 20,000 h.p. will be afforded, or for 45,000 h.p. if operated only ten hours per day.