PART II.

PAPERS.

9th March, 1893.

ADDRESS BY THE PRESIDENT,

Mr. R. POLLOCK.

Gentlemen,

In the following remarks I have to make by way of an Annual Address, in opening the Session of 1893, we must bear in mind that the Australian Colonies are experiencing a financial crisis probably unequalled in their history, and, as a very large majority of the engineering works carried out in this part of the world emanate from the Governments of the various Colonies, a period of financial depression presses with great severity on the members of our profession. Under these circumstances, therefore, it is a matter for congratulation that this Association has fully maintained the number of its members. The places of those who have resigned owing to depressed trade, necessitating a change of residence, have been filled by new members, who have seen the benefits to be gained by joining the Association, assisting us in disseminating engineering science, and keeping ourselves acquainted with the latest discoveries in older countries.

We much regret the loss of one of our Honorary Members, Lieutenant Colonel Cracknell, who died after a short illness on

Jan. 14th, in his 62nd year. Colonel Cracknell was Superintendent of Telegraphs, and President of the Electric Club of N.S.W. He was the introducer of the duplex and quadruplex system of telegraphy in this Colony. He had the respect and goodwill of all those who were brought in contact with him, and his loss is greatly felt throughout the Department.

Tredgold defines Engineering "to be the art of directing the great sources of power in nature for the use and convenience of man," but more than that, I consider that if war is ever to cease in the world, and the great brotherhood of man to be a reality it will be due to the genius of the Engineer, who may be looked upon as the pioneer of civilization; and to his work in constructing railways, roads, canals, steam navigation, the printing press, telegraph, &c., we owe the breaking down of the barriers of space and time which separated nations and communities, and to these and other inventions is due the enormous extension of commerce and personal communication, and every new discovery has a tendency to promote this intercourse by reducing its cost. The more people know of each other, the more they interchange ideas, the less likely they are to quarrel; this applies not only to nations, but to communities. The Conciliation Bills that are being introduced in this and other countries are merely schemes to persuade the representatives of capital and labor to meet together and discuss their differences in a rational manner.

Governments, by their action in erecting artificial barriers, prevent the people from enjoying the full measure of the advantages that our present appliances permit, but these will be ultimately abolished, and with greater facilities of intercourse, cheapened rates, &c., nations will refuse to be involved in war promoted generally by interested parties, who view the strife from a safe distance.

The continuous advance in all branches of Engineering, is, in my opinion, not due so much to a greater conception of large works in the minds of the designer, as to the vast improvement in the means of carrying out work. The Civil Engineer can give full vent to his inventive genius, as he knows the Mechanical Engineer will find ways and means to carry out his ideas at a reasonable cost. The projector of any work must show that there is a reasonable probability of it returning a fair per centage on its cost or the capitalist will not embark his money in the project.

The Pyramids of Egypt are a specimen of what feats could be accomplished by Engineers in the early days, and propably they will outlast most of our modern structures; but their utility is practically nil, while the cost must have been immense. It is evident there was no question of returning a fair per centage on the cost when they were designed.

To illustrate how practice and invention reduces the cost, take the three great tunnels under the Alps, all driven under similar circumstances—through the hardest of rock, and without the assistance of intermediate shafts. The Mount Cenis tunnel, finished in 1870, is about 7¾ miles long. Its construction took twelve years and one month, at a cost of £224 per lineal yard. The St. Gothard tunnel, finished in 1880, is 9¼ miles in length, and occupied seven and a half years in construction, at a cost of £142 per lineal yard. The Arlberg tunnel, 6½ miles in length, was completed in 1883, in three years and four months at a cost of £108 per lineal yard; so that you see in thirteen years, by experience gained and improvements in machinery for boring the rock, the cost per yard was reduced by one half, and no doubt if a fourth tunnel were made the cost would be still less. This reduction of first cost means a reduction in the cost of travelling, a material saving of time and space, and a great boon to the people of France and Italy, the two countries which those tunnels connect.

There is a tunnel at present being driven under the Thames at Blackwall, 27 feet in diameter, and about three quarters of a mile in length. The crown is *only* 7 feet below the bed of the river, which consists of shingley ballast and gravel. It is being carried out by the shield and air pressure system. A circular iron shield is forced through the soil by hydraulic jacks, the men working at the face under an air pressure of 35 lbs. per square inch. As the shield progresses, they fill up behind with the permanent structure, in this case consisting of cast iron segments, 2 inches thick, and then 14 inches of concrete. It is expected to be completed in about three years. The celebrated Thames tunnel, opened in 1843, was eighteen years in construction.

It is rather a satire on our nineteenth century civilization to think that political and military considerations still stand in the way of connecting France and England by a tunnel, which would be about 22 miles long, and would tend, in my opinion, more to obviate the chances of war between the two countries than all the treaties ever made. There is an alternative scheme of a bridge, but the majority of Engineering talent favor the idea of a tunnel, principally owing to its first cost being less, and also less to maintain. The immense increase in the span of our latest bridges has probably favored the idea of the latter scheme.

The Suspension Bridge connecting New York and Brooklyn was opened in 1883, it has a central span of 1595 feet and two side spans of 930 feet, each with a clear headway under the bridge of 125 feet, it cost £3,100,000, about three times the estimate. For some years this bridge held the premier place, it being the largest span in the world, but the Forth Bridge, completed in 1890 on the Cantilever principle, has two clear spans of 1700 feet each and two side spans of 680 feet each, and a clear headway of 150 feet. It was seven years in construction and cost three and a-quarter millions sterling, or about twice the estimate.

On November 7th, 1891, at the invitation of Mr. A. Johnstone, the members of the Association had an opportunity of inspecting the Long Bay Suspension Bridge, North Sydney.

It is, I think, the finest specimen of a Suspension Bridge to be found south of the Line. It has a central span of 500 feet and two side spans of 150 and 125 feet respectively, and crosses an arm of Middle Harbor called Long Bay at a height of about 150 feet above the water, and is the joint design of Professor W. H. Warren and J. E. F. Coyle, C.E.

We have had no opportunity of examining any bridge on the Cantilever type but there is a strong probability that the future bridge connecting North Shore to Sydney will be on that principle, and let us hope that when it is built this Association may be in full vigor and have an opportunity to criticise its construction.

I think that excursions like the above tend to draw the Members of the Association together and are as necessary for its welfare as reading and discussing papers; we get an object lesson in viewing the work itself that leaves a lasting impression on the memory, and I hope that in the coming Session the Council may be able to arrange several, and that the Members will do their best to attend.

On July 16th, at the invitation of Mr. J. F. Carson, the Members visited Arncliffe and examined the Sewerage Outfall Works, being the scheme for draining the western suburbs, part of the great sewerage plan for draining Sydney and suburbs, which, when completed, will make this city one of the cleanest and healthiest in the world. The bulk of the sewerage at present is discharged into the sea at Bondi, but personally I hold very strongly that discharging the sewage of a city into the river or sea is a mistake and only a temporary expedient, as sooner or later it becomes an intolerable nuisance.

It is estimated that the City of London throws away sewage to the value of one million sterling per annum, and that every day there is poured into the Thames 150,000,000 gallons, also that £40 000 are spent annually in chemicals for deodorizing before it is allowed to flow into the river.

New York is drained in the same manner as London. Berlin, Dantzic, and Breslau have for a number of years had successful sewage farms. Chicago is drained into Lake Michigan and it has been found necessary to drive tunnels two miles long under the Lake and connect them with the Lake by a vertical shaft in order to obtain water fit for drinking purposes. There can be no doubt whatever that the proper place for sewage matter is the land, and although there are mechanical difficulties at present in the way of distributing it they will ultimately be overcome, and in the time to come we shall look back with surprise on our present wasteful methods, and to my mind the greatest feature in the western suburbs sewerage scheme, that we had the privilege of visiting, was that the sewage was distributed over the land in the shape of a sewage farm, with, as far as I could learn, the happiest results.

One of our members, Mr. Cracknell, has devoted considerable time to this branch of the sanitary engineering, and formerly had a converter erected on the Botany Road that treated the sewage collected by the earth closet system very successfully, converting it into manure. By an ingenious arrangement the gases were led through the furnace and, from a personal examination, there was not the slightest smell. An arrangement of this kind on a large scale would, I fancy, be nearly self-supporting, especially if worked in conjunction with the treatment of town refuse. By the papers I note that this gentleman has erected in a neighbouring colony two destructors, one of which has been in constant work for twelve months, and treats all the refuse gathered in the streets without the aid of fuel, and is said to effect a saving of forty per cent. over any other apparatus of this kind; now, if this apparatus were modified the town refuse might furnish fuel for converting sewage matter into manure. This is a step in the right direction and I hope Mr. Cracknell will meet with the measure of success his efforts deserve. Engineering inventions that are of special benefit to this country should, I think, receive greater attention at the hands of this Association.

The trade in frozen meat that has sprung into existence during the last twelve years has attained immense dimensions, it has been the means of finding profitable employment for numbers, removes our surplus stock, helps to develop the resources of the country, and has benefitted the inhabitants of the Mother Country by reducing the price of butchers' meat at least 2d. per pound, say 20 per cent. The same means are now being used to ship Home butter and fruit. A vessel lately left a neighbouring colony with £36,000 worth of butter on board. The total export for the season is about 3,600 tons, giving a nett return of say £350,000, and there is no doubt that the fruit trade in the near future will become of very great importance. Many of our members are continually engaged with refrigerating machinery and are well able to read papers and give us the latest information on this subject, which is fraught with so much interest to every one in these colonies, and as I do not recollect any being read on this class of machinery I hope during the coming Session this will be altered and some of our members will give us the benefit of their experience.

In connection with this industry we should bear in mind that its development in this country is due, in a great measure, to the untiring energy and zeal of our fellow colonist, the late Thomas Mort, who spent many years of his life and a fortune in the task of successfully shipping frozen meat to the United Kingdom, and died when on the eve of success.

Refrigerating is also used with considerable success for sinking shafts through quick sands and drifts. The Poetsch freezing process was first applied sinking a rectangular shaft—15½ feet x 16½ feet, and 100 feet deep—at a mine in Michigan, U.S., in the following manner: Pipes, 8 inches diameter, 3 feet apart, were driven down in a circle round the shaft to be excavated, a solution of brine, containing about twenty-five per cent. of calcium chloride, cooled to a few degrees below zero by a Linde ice machine, was then circulated through these pipes, and in forty days an ice wall was formed round the shaft, and excavation went on, the shaft being afterwards lined with timber, brick, &c. This is a curious application of the principle of producing cold, its success would, I imagine, in some measure depend on the temperature of the atmosphere, which was not stated.

There is another most important matter to which, I think, I am justified in directing your attention, and that is the question of the conservation of water and irrigation; this, if carried out in a systematic manner, would do more to develop the resources of this country than either a protective or freetrade tariff, it appears to me that our legislators are continually grasping at the shadow and losing sight of the substance. It is no new science that we enter on. Irrigation has been practised for years in Egypt, India, America, and other countries. We had an excellent paper read last session, describing some of the large irrigation works in India, and those of our members who take an interest in this matter should read the report on the River Darling, by Messrs. McKinney and Ward, who show the immense amount of water that can be conserved at a comparatively small cost, and the great advantages the country would reap by a well-considered plan of impounding the waters of this River. Let us hope that the Government will grapple with this matter in earnest, at the same time we should recognize the great work the Tanks and Water Department have done in sinking artesian wells in the waterless back country, some of these wells yield as much as two million gallons per day. In the Bourke district alone some fifty wells have been sunk, private enterprise has also done good work in this direction, but as far as present experience in this and other countries goes, the supply of an artesian bore frequently diminishes. The Gooney Bore diminished in five years from one thousand to two hundred and sixty gallons per hour, and the American experience is said to be that the exhaustion of the supply is imminent; no doubt it depends a great deal on the rain-fall for a number of years, one year's heavy rain may replenish the subterranean supply, but it is evident that every precaution should be taken to prevent waste. That this is not done is apparent by the statement of the Department, that 16,000,000, gallons of artesian water flow daily to waste in New South Wales; this is too frequently caused by putting down the bore without a suitable valve on the top to shut off the water when struck, which rises in some cases to sixty feet above the surface, as there are no means of closing the pipe, or storing the water, the waste is enormous. We are promised useful legislation in this matter, and it cannot come too soon.

Situated as we are on an island continent, all our traffic with other countries must be by sea, the question of Marine Engineering should and does possess peculiar interest for us. The first paper read last session (by permission of the author) was on the progress of Marine Engineering during the last ten years, and it was a marvellous history, although the same may be said of almost every other branch of the science.

The ocean traffic may be divided into two classes—passenger and cargo steamers. It is found that it does not pay to carry general cargo at the high rate of speed that we all wish to travel at, and that, other things being equal, the fastest boat will command the passenger trade, this has given a great impetus to speed, and almost as a necessity, to increase the tonnage of the boats.

We have had letters posted in London and delivered in Sydney in twenty-nine days, and there is little doubt that when the present mail contracts expire, this time will be considerably reduced.

Some of the Atlantic flyers maintain an average speed of twenty knots per hour and an indicated horse-power of 20,000, and the two new boats, the "Campania" and "Lucania," are 12,500 tons gross, 597 feet long, 65 feet beam, 42 feet 9 inches deep, and to indicate 30,000 horse power, with an average speed