PART II.

PAPERS.

8TH MARCH, 1894.

ADDRESS BY THE PRESIDENT.

MR. R. POLLOCK.

IN thanking you for the honour you have conferred upon me by electing me to another term of office in the Presidential chair, I am well aware that this is due, not to any particular merit on my part, but in a great measure to the fact that we, in common with most Australian institutions, are suffering from financial difficulties; and, under these circumstances, the Council thought it best to recommend the members not to make any change. At the same time it must be borne in mind that this Association has amongst its members representatives of every branch of Engineering, and for this reason frequent changes in the chair are essential to its well-being and progress. I must also here express my gratitude to the members for the kindness and consideration universally extended to me during my last term of office, and venture to hope that the same will be continued.

During the past year we have to lament the death of three of our members, viz., Mr. James Grant, of Grant Bros., Pyrmont; Mr. Harry Hudson, Jun., of Hudson Bros., Clyde; and Mr. Albert Leahy: the last-named gentleman dying in England, where he had gone with the view of providing assistance to start the iron industry in this Colony.

For some years past the Presidential Address has bewailed the prevailing depression, but I think the past year of 1893 is the worst the Australian Colonies have ever seen. Commencing with heavy floods in Queensland, the Hunter River district, and the northern part of New South Wales; then the suspension of the various banks in Queensland, Victoria, and New South Wales for a time paralysed all business, while the coal strike in England (which is said to be the greatest in history) and the depreciation of silver assisted in intensifying the distress and retarding recovery; and in April and May, 1893, business men were asking where the crash would stop; but, owing in a great measure to the steps taken by the Government, the panic was allayed, and the solid foundation that Australian prosperity rests upon made itself apparent. We can now look back and benefit by our past experience, and I think out of evil will come good. We are now learning both public and private economy; while the system of recklessly expending borrowed money has, I trust, come to an end. The resources of the Colony should now in a great measure be developed by private enterprise. The population show an inclination to go out into the country districts; in fact, a considerable number have gone to South America to found a New Australia; and although these pioneers may carry our best wishes for the realisation of their hopes, I think that most of us will live to see them return wiser if poorer men. There is also a disposition shown to develop the co-operative principle, which, in my opinion, is the only true way to obviate the everlasting disputes between capital and labour.

No doubt the market values of landed property, shares, &c., have fallen greatly, but the real wealth of the country remains; the cattle and sheep are multiplying, the amount of land under cultivation is being extended. It is anticipated that this year we shall have a surplus of grain to export; our export of wine steadily increases, our mineral wealth is being developed daily. Last year Australia produced 1,922,000

ounces of gold, and, as far as can be seen at present, this year's production will be more. The Broken Hill silver mines added 15 million ounces of silver to the world's stock. Last year the Sydney and Melbourne Mint coined upwards of seven million sovereigns; so that there is no cause for alarm. The criticism we have been subjected to, although perhaps not very truthful in many cases, still will do us good, and impress upon us the necessity of economising. Our exports will increase, and, with industrial peace in Great Britain, we may expect a better market and higher prices. Until the population of these Colonies largely increases, we must be a producing country; that is, our wealth must be produced from the soil in some form or another; and the sooner we recognise this fact, and take steps to get the population settled on the land, the sooner will be our return to permanent prosperity.

We have an example of this in the neighbouring Colony of New Zealand. A few years back she was sunk in financial troubles, and now her stocks stand the highest in the London market; and, as far as I can judge, she owes her present prosperity in a great degree to her development of the frozen meat industry, coupled, no doubt, with economical Government. Let us compare this industry in the two Colonies.

New South Wales depastures about three and a-half times as many sheep as New Zealand; yet last year New Zealand exported about 2,000,000 frozen sheep, against New South Wales 360,000; and yet, with a judicious system of distribution at the other end, the market is practically unlimited.

The carrying and distributing of meat, fish, dairy produce, &c., is in its infancy, and is capable of immense development; and it is one of the duties of this and other kindred associations to see that in the race this Colony is not left behind.

There was an excellent paper read at the close of last session on refrigerating machinery, and followed up by an object lesson in the members visiting the wool-dumping and refrigerating plant of Messrs. Geddes and Co., North Sydney; also the

Woolloomooloo Fish Markets, where we saw the Linde Company's system of refrigerating in full work, which is said to be one of the most improved types of refrigerating plant; and the general opinion seems to be that the principle of producing cold by compressing and expanding air will be entirely superseded by the ammonia process.

There is no doubt it is to the invention of the air process we owe the introduction of the system of carrying frozen meat, as it is simple, easily worked, and not likely to get out of order, but more expensive to work than the ammonia process; but this latter process has been now so perfected, and the liability of leakage so reduced, that it is as reliable as the air principle; more convenient in working, and much higher in efficiency.

It is also found that beef when chilled, that is, carried in a temperature of 28¾°, brings in the English market 1d. to 1½d. per lb. more than when frozen, and the shipowners are having this fact brought home to them; and the latest steamers built for the meat trade are fitted with the Linde type of refrigerating plant, and also have special chambers in which to carry experimental shipments of chilled beef. If this succeeds—and there is no reason to doubt its success—a very large impetus will be given to the export of meat. No doubt this will principally benefit Queensland, but we will reap some advantage, if in an indirect way.

The Ammonia process also lends itself more easily to moderate and regular temperatures; and lately a Dr. Shiels has invented an automatic temperature regulator by which the temperature in freezing and cooling rooms can be kept uniform, only varying 2 degrees. This is an important factor in carrying butter, cheese, and fruit.

Great Britain imports about 110,000 tons of butter every year, valued at 12 millions sterling; and owing to the fact that the Australian summer corresponds with the European winter, we have an immense advantage, for at least four months of the

year, over our European and American competitors. The only thing required of us is, honesty and carefulness in packing and preparation. Our produce frequently fails to command a market, owing to the want of care in this respect. Furthermore, there must be the most improved and economical machinery for the manufacture, and this is a matter that concerns this Association, whose object is to meet, and by discussion arrive at the best means of applying economic machinery, and distribute the information to those interested. It is only by such means we can keep in the front rank; competition is keen, and those countries that supply the English market will not let us willingly share it.

I may here direct your attention to a refrigerating machine, also on the Ammonia principle, that is manufactured in the Colony (Auldjo's patent). It is used with complete success in Arnott's Biscuit Factory, Newcastle, and other places. The largest yet made is of 5 tons refrigerating capacity, but it is expected that orders for larger machines will shortly be received. The patentee, who is a member of this Association, claims that this machine is cheaper, simpler, and as efficient as any of the imported machines; and I trust Mr. Auldjo will read a paper on it, and give the members an opportunity of discussing its points.

It was long thought that that part of Australia known as the Northern Territory, owing to its climate, could only be developed by alien labour; but its capabilities as a grazing country for cattle are now being realised, and an export trade in horned stock has sprung up, and steps are being taken to establish a trade in meat between Cloncurry and the outside world by way of the Gulf of Carpentaria. This will necessitate refrigerating plants being established in the immediate neighbourhood, and thus make another outlet for members of our profession.

The general principles of preserving meat sweet, that is, from becoming tainted, may here be briefly enumerated: There

is a great deal in the state the animal is in, immediately before being killed; thus, a hare that is hunted and killed by dogs, the flesh will become tainted much sooner than one that is shot. Cattle that are hurriedly driven any distance and then slaughtered, the meat becomes tainted in a shorter time than if the animal had been quietly grazing in a paddock up to the time of being killed. In seal-hunting, the seals, after being driven away from the sea coast to the slaughtering paddocks, are allowed to remain there some time before being killed; if not, the fur is much depreciated in value. The reason of meat becoming tainted and putrid is owing to the impurities in the air. Meat exposed to pure air will remain sweet and good an indefinite time, quite independent of the temperature. When we preserve meat by the application of cold, we freeze or numb the bacteria that inhabit the air, and render them harmless. In the case of mutton this is simple, as extreme cold does not appear to deteriorate the carcass; but in the case of beef, owing, probably, to the size of the veins, freezing bursts them, and when the meat is thawed the juices escape, and the meat loses its value; hence the higher price given for chilled beef.

It is a matter for regret that up to the present time our legislators have not dealt with the subject of irrigation and the conservation of water. Artesian wells are being sunk in the back country with the greatest success. Very recently, at Dunbridge, water was struck at a depth of 2,550 feet, the flow being 1,700,000 gallons per day; another near Collarendabri, where the supply is about 3,000,000 gallons per day; and Mr. Boultbee, the Superintendent of Public Watering Places, reports that the three main stock routes from the Queensland border may now be considered complete, as far as water supply is concerned, and strongly urges the necessity of legislation to regulate the flow of artesian wells, with a view to prevent waste of the precious fluid; and he points out what a valuable asset this Colony possesses in its artesian bores, the water from which in very many cases, is being poured wastefully on the ground.

Legislation on these matters cannot come too soon, as, according to the best authorities, the artesian supply may gradually diminish if largely drawn upon.

In the United States they pay great attention to the phenomena which govern the occurrence of artesian water, and their legislation on these matters is full and complete. Recently the International Irrigation Congress, with about one thousand delegates, met at Los Angelos, in California, to hold a week's session. Los Angelos itself has in ten years increased its population from 10,000 to 60,000, and in it and the four adjoining countries there are no less than sixty irrigation companies, and the value of land has increased from £7 to £30 per acre.

In Arizona a Scotch company, called the South Gila Irrigation Company, are building a masonry overflow dam across the Gila River 50 feet high and 1,200 feet long; this will connect with a canal 60 miles long, which will water 150,000 acres of land which is much drier than our back country.

A whole new theory and art of cultivation is springing into being. The idea of sowing crops, planting orchards, and trusting to heaven to water them, is dying out; science is coming to the front; and although the recent attempts to produce rain by means of exploding charges in the clouds failed, yet the agriculturist is finding that in many cases it pays him to employ the engineer to guarantee him a supply of water for his crops at stated intervals; and it behoves us to see that the supply of subterranean water that is now known to exist in the most arid parts of this Colony is used to the best advantage. As an asset, I doubt whether it is second to our goldfields; but the drawback is, that at present we are not sufficiently educated to appreciate it, nor do we make the best use of the benefits nature has placed at our disposal.

As regards the general progress of Engineering science during the past twelve months, it has no doubt been somewhat retarded by the depression that has extended more or less over the civilised part of the world. Some of our members were

privileged to be able to visit the Chicago Exhibition, where they would see and be in touch with the very latest inventions and appliances in Engineering. I trust these gentlemen will, during the coming Session, give us, their less fortunate brethren, the benefit of their experience, by reading papers on matters which they consider will be of interest to the Colony.

Electrical science has probably made more progress, and has been less affected by depression, than any other branch of Engineering, while the cost of electrical lighting is being steadily reduced. At Newcastle, in England, it is 4½d. per B.T.U., the average cost in the United Kingdom being 6d. per B.T.U., equal to gas at 3s. per thousand cubic feet, and in the near future it will be as cheap as gas; in fact, at Smithfield Market, in London, it is already supplied at the same rate as gas, the conditions there being very favourable to the electric light, that is, a large number of consumers are supplied within a small area, and the supply is continuous for several hours; the economy in the manufacture of gas being that its manufacture is carried on continuously throughout the twenty-four hours, the varying demand being met by storage which is cheap and easy.

The patent for the Incandescent Lamp expired in England in November last, and last month in the Colonies; this has reduced the cost of lamps some 60 per cent.; and as they are renewed, say, three or four times per year, it will mean a considerable saving.

One great advantage of the electric light is, the improved health of those working in the lighted rooms. As the lamp is hermetically sealed, it does not vitiate the air; on the other hand, gas rapidly affects the atmosphere of a room. In lighting the London Post Office with electricity, Mr. Preece says that the absence through sickness has diminished to such an extent that the value of the services was equal to the cost of the light, so he reckoned they got the light for nothing.

In our own city the light is slowly but steadily extending its sphere; as witness the City Bank, Young and Lark's, Hordern's Extension, Post Office, Martin Place, The Strand, The Balmain New Ferry Boats, the "Alathea," and other installations—all erected during the last twelve months; and no doubt it is the light of the future. General opinion seems to be that electricity will be the light of the higher-class house, and gas for those houses where it has a value for domestic cooking; but the Electrical Engineer is already attacking the cooking problem, and at the Chicago Exhibition there was a large display of electrical cooking apparatus; and on its behalf it is claimed that, owing to the equal distribution of heat, the joint needs no basting, while pancakes are cooked without butter or fat of any sort; so that there is practically no smell, and the cooking could be carried on on the dining table, as far as smell or dirt is concerned. The ironing of clothes was also done by electricity; that is, the wire is connected to the flat-iron instead of heating it by fire or gas. It is said that electric heat for the cooking, washing, and ironing for a family of six persons can be supplied in most American towns for about £12 per annum. No doubt the above statements must be received with a certain amount of caution, but it brings to our mind the continuous advance of the science.

Our neighbours in Melbourne are already far on with an electrical installation to light the whole of their city. The following brief description (for which I am indebted to the courtesy of Mr. Arnott) may be of interest:—The engine-house is situated in Spencer Street, and consists of engine-room, boiler-house, coal storage for 200 tons, fitters' shop, engineer's residence, lamp-testing room, &c. The plant is laid out in four sections, each section consisting of a compound surface condensing engine of 300 indicated horse-power, working on to a counter-shaft 30 feet long. The counter-shaft is 120 feet long, in four sections, and runs the whole length of the building. The sections are connected by compound clutches. Steam is supplied

by Babcock and Wilcox boilers at 150lb. pressure. Five arc dynamos are driven off each section of counter-shaft, and provision is also made for driving a 1000-light incandescent dynamo. The switch-board is elevated 7 feet above the floor, and approached by two staircases; there are fifteen circuits running outside, and twenty circuits from dynamos to switch-boards. The cables are carried overhead, but it is hoped to be able to place them underground shortly. The arc lamps are 1,200 nominal and 700 actual candle-power, requiring a current of 6·8 amperes, at a potential of 45 volts. The incandescent lamps are all in series with the arc lamps, taking the same current and a potential varying with the candle-power, viz., from 12 to 18 volts, the lamps varying from 25 to 32 candle-power. The feature of this system, as compared with the parallel system, is that the fall in potential in the leads will not affect the light, the current being constant and equal at all points of the circuit, whether at the generating station or five miles from it. All the lamps are fitted with automatic cut outs, so that should an accident happen to a lamp the current will pass on undisturbed.

Telephony, although not making very rapid progress in our neighbourhood, is advancing greatly in America and Europe, and we shall see the time that we shall look for a telephone in a house just as we do for a door-knob. The opening of the telephone line from New York to Chicago, a distance of 994 miles, marks an era in the history of telephony. This is the longest line in existence at present.

At Leeds, in the centre of England, the Government are erecting a telephone exchange with which every chief town in the United Kingdom will be connected, so that a man sitting at his desk in London will be able to converse with his correspondent in Glasgow, Aberdeen, or Belfast. At present, according to Mr. Preece, it is almost a necessity that the wires be erected overhead, as perfect telephony would be impossible for long circuits with underground wires. This difficulty will

no doubt be overcome in the future; in fact, Sylvanus P. Thompson, in a paper on "Ocean Telephony," says, "No reasonable electrician can doubt for a moment that ocean telephony must come, or that the resources of science are equal to the solution of the problem." It is reported that the Automatic Telephone Company of Canada propose to run a metallic copper trunk line from Halifax to Vancouver, a distance of 3,500 miles, with local plant at the chief intermediate towns.

Switzerland has about 10,000 miles of telephone wires, and over 10,000 subscribers; Belgium has 12,000 miles of wire, and about 6,000 subscribers; and in Germany there are 70,000 miles, and about 50,000 subscribers. This will give you a faint idea of the increasing popularity of the telephone service in other countries.

The Phonograph, though not popularly introduced into these Colonies, is rapidly being utilised in America for every-day purposes. In large offices it is superseding the shorthand writer; correspondence is spoken into the machine, and then given out to the typewriter at leisure. For acquiring the correct pronunciation of foreign languages it is invaluable, and dispenses with the necessity of living in Paris or Berlin to acquire French or German. It never tires or loses its temper with a dull pupil, but will repeat the lesson over and over again.

At the Chicago Exhibition was exhibited the telantograph, or long distance writing machine, one of the latest marvellous developments of electricity, invented by Professor Elisha Gray; a skilful arrangement by which the written message sent is received also written, dispensing with the ordinary electric signalling alphabet. Thus, a banker can sign his cheque a hundred miles away, and the artist can transmit his sketch right from the spot to the engraving room.

A new and improved method of electric welding has been invented by Mr. Julian, of Brussels, which is, shortly, as follows:—When the poles of a source of electricity are im-

mersed in acidulated water, and a powerful current passed through, oxygen is given off at the anode or positive pole, and hydrogen at the cathode or negative pole, in this case an iron bar. On increasing the strength of the current, the development of the gas is so raised that the iron bar is completely encased by hydrogen, and is no longer in contact with the water. As the hydrogen encasing the bar offers a strong resistance to the current, the electric energy is converted into heat, and both the hydrogen and the iron bar become glowing hot; it is said that by this means a temperature of 4,000° can be obtained; and this while the bar is actually submerged below water. There is said to be by this method no difficulty in regulating the temperature from 1,000° to 1,200° for forging and welding; but in welding by the electric arc it is very difficult to adjust the temperature, so that the welded surface presents an uneven appearance, and has to be subsequently touched up. Iron bars up to 1 in. diameter can be welded by this process with a current of from 100 to 200 volts, which is very low compared with those required by the Thompson process.

In the transmission of energy by electricity, the completion of the Niagara Utilisation Works is looked forward to with great interest by Electrical Engineers, and there is no doubt its successful inauguration and financial success will give an impetus to this branch of engineering.

Within the last few months a small pumping plant, where the power is transmitted electrically, has been applied to the Co-operative Colliery, Newcastle, by Mr. Laidley, their Consulting Engineer; and as this is, I think, the pioneer plant in Australia, it is worthy of notice. The pump is one of Tangye's horizontal belt-geared type, 6in. diameter x 12in. stroke, and delivers 5,200 gallons of water per hour through a 3in. pipe, against an actual head of 90ft. The generator and motor are Crompton series wound machines, placed half-a-mile apart, the generator being driven by a 6½in. x 7½in. vertical Tangye