1877.

NEW ZEALAND.

AMERICAN DREDGING SYSTEM

(CORRESPONDENCE AND PAPERS RELATIVE TO THE).

Laid upon the Table by the Hon. Mr. Larnach, with the leave of the House.

No. 1.

Mr. A. MORRIS to the Hon. the MINISTER for PUBLIC WORKS.

SIR,— 92, Liverpool Street, Sydney, 3rd September, 1877.

I have the honor to submit for your consideration the enclosed report on American dredges, which was published in the *Sydney Morning Herald.*

That report confirms the strong impression which all the Colonial Commissioners at the Philadelphia Exhibition entertained as to the superiority of the American type of dredge. It costs very much less than the endless-chain style; fewer hands are required to work it; its expenses for repairs do not exceed one-third of those of the other; and it can be used in heavy sea-ways and other places, where the dredge in ordinary use in these colonies can either not be employed at all, or cannot be worked advantageously.

The hulls of the American dredges can be readily and cheaply built in New Zealand, either of wood or iron, and, if your Government approve, I would venture to suggest that an order be sent to the American Dredging Company (whose address is 10, South Delaware Avenue, Philadelphia, Penn.), for such portions of the machinery as cannot be so well made in New Zealand; as also, in the first instance, such other parts as can, in order that your workmen may have the patterns to guide them.

I can promise that the American Dredging Company will furnish your Government with the working drawings and specifications of a dredge of whatever capacity you may require, and will send to your order all its machinery of the best construction.

If my proposition be received with favour, I would recommend that you should communicate direct with the Company, to avoid commissions and other charges, which swell the cost, and I can guarantee that there shall not be a single overcharge.

If, too, there are any improvements in American scows upon those made in Europe, they will be made known to you.

Should you wish it, I will urge upon the Company any points that you may deem desirable, or you can forward a copy of this letter.

I have, &c.,
AUGUSTUS MORRIS.

The Hon. the Minister for Public Works,
Wellington, New Zealand.

Enclosure in No. 1.

AMERICAN SYSTEM OF DREDGING.

[From the *Sydney Morning Herald*, Saturday, 1st September, 1877.]

WE are indebted to the Hon. the Premier (Sir John Robertson, K.C.M.G.), for the subjoined correspondence:—

"Sydney, August, 1877.

"SIR,—I have the honor to draw your attention to a valuable and important paper which I have received from the American Dredging Company, relative to the comparative merits of the English and American dredging systems.

"Although I am no longer Executive Commissioner, I should, I think, be wanting in my duty to the Government and to the colony, if I did not furnish all information of public interest which may come to me in consequence of the position at Philadelphia with which I was honored.

"As you are aware, from my official reports, I gave a good deal of attention to the dredging operations at Philadelphia and New York; but I always felt that professional men would require more exact data than I could convey from any unassisted observations of my own, and therefore I sought for help in what appeared to me to be the most reliable quarter.

"The American Dredging Company, desirous of learning all the newest improvements in dredging, sent to Europe their secretary, Mr. F. C. Prindle, an eminent civil engineer, who held for years the highest professional position in the service of the Government of the United States.

"Having been favoured with a perusal of several of the letters of Mr. Prindle to his Board of Directors, I begged that I might be furnished with such extracts as would be useful to the various Australian Governments. Since I left Philadelphia Mr. Prindle has returned, and condensed his letters into the form of a report, and from that report, which is not for publication, I have received the enclosed extracts, which convey verifiable information, and substantially in accordance with that sent by Mr. Robinson and myself.

"This American type of dredge can be readily built in this and the other colonies, and by its economy would enable very desirable and much-needed improvements to be accomplished.

"I have, &c.,
"Augustus Morris."

"Extract from the Report, 1877, of Franklin C. Prindle, C.E., and Secretary of the American Dredging Company, on Excavating Dredges of England, Scotland, &c.

"Philadelphia, 15th June, 1877.

"The excavating dredges employed in England and Scotland, and also in France, Belgium, and Holland, which I saw during my recent visit, are of the old-fashioned, endless-chain type; generally very strongly built, with iron hulls, and operated by large condensing engines, and fitted with very heavy and powerful dredging machinery.

"The following table gives the most important data pertaining to the most powerful and efficient dredges employed by the Mersey Dock and Harbour Board, at Liverpool, England; the Furness Railway Company, at Barrow, in Furness; the Clyde Trust, at Glasgow, Scotland; and the American Dredging Company, at Philadelphia, Penn., U.S.A.

Place.	No. of Dredge.	Original Cost.	Length.	Breadth.	Depth.	Draught.	Greatest Depth can dredge.	Height above Water necessary to lift Material for Discharge.	Capacity per Engine, hour.	Kind of Material lifted.	Coal, per hour.	No. of Crew required to operate.	Remarks.
		£	Feet	Feet	Feet	Feet	Feet	Feet	Cubic Yards.		lb.		
Liverpool...	6	12,000	100	40	10	...	34	17·5	100	Mud and sand...	300	12	Double reel of buckets.
Barrow ...	4	20,000	165	27	10·6	7	40	28	140	Hard gravel and sand	600	12	Single ditto, new machinery, coal, and capacity estimated.
Glasgow ...	1	7,923	157·5	32·3	10	7	32	37	67	Silt of sand and sewage	600	12	Double reel of buckets.
	8 9	17,653	161	29	10	6 to 7	28 30	30	178 129	Sand, silt, till, and gravel; ditto, ditto, and mud	600	12	Single ditto.
Philadelphia	4	5,500	99·6	35	9·6	5·5	50	4 to 8	150 300	Sand, clay, and mud	450	7	Single grapple bucket of five cubic yards capacity.

"By reference to the above it will be seen that in point of first cost, capacity per engine hour, consumption of fuel, and number of crew required to operate, the grapple dredge of the American dredging system is considerably superior to the endless-chain dredges named, and which are believed to be the best of the kind in Europe.

"Owing to the greater simplicity of the machinery of the grapple dredges and the fewer parts exposed to wear, the cost of repair, wear and tear, and maintenance is also much less. Upon this point the engineer of the Clyde Trust, in his official report, says: 'Repairs form a heavy item in the working expenses of a dredge. About an hour each day on the average is consumed in replacing pins, links, and buckets . . . and nearly every year each dredger is laid up for several weeks to undergo a thorough overhaul.'

"For the repair of its dredging plant, consisting of six steam dredgers, with the necessary barges, tug-boats, &c., he says: 'The trustees in 1857 erected on the side of the river at Dalmuir, eight miles below Glasgow, an extensive range of works, at a cost of £25,000.'

"They give employment to 140 hands. In the smiths' department, three heavy steam hammers are constantly employed forging the heavy links, pins, &c., required for the various dredgers.

"Place beside this statement the fact that for the repairs and maintenance of the fourteen dredgers of all kinds, owned and operated by the American Dredging Company, the employment of a single steam hammer in the smiths' department, and a force of fifty mechanics and labourers in all its shops, are found amply sufficient.

"Aside from the actual cost of repairs, it will, from the table, be easy to form comparative estimates of the cost of operating these several dredgers in any given locality.

"The cost of the American Dredging Company's No. 4 grapple, as given in the table, is the actual cost of production with wooden hull here, in currency. The cost of a similar one, with an iron hull, and fitted for salt-water service to compare with the iron hull dredgers named, would be about 36,000 dollars, or say about £6,500 if built in England.

"The best performance of the Clyde dredgers, according to the engineer's report, is 'Where good lifting sand was being dredged, one of the two most powerful of the trustees' dredgers lifted on each of five consecutive days in the month of August last 2,240 cubic yards, or about 2,800 tons, the engine

working nine hours the first day, nine and three-quarter hours the second, third, and fifth days, and nine and one-quarter hours the fourth day; the average strokes of the engine being thirty-three per minute, and the average depth of water that the buckets were working at twenty feet, or the performance of 236 cubic yards per engine hour. The performance of grapple dredges in the United States in good-lifting material has considerably exceeded the above; and the American Dredging Company's No. 4 grapple is now making a weekly average of 2,480 cubic yards per day of seven hours' work, or more than 300 cubic yards per engine hour.

"The endless-chain dredgers cannot dredge close alongside of quay walls, wharfs, &c., unless the bucket-reel is placed on the outside of the dredge and the material elevated to a great height sufficient to secure its flow through long inclined chutes across the dredge into the loading barges on the opposite side. The grapple dredgers meet with no difficulty of this kind and need no special adaptation for suck work.

"I saw no endless-chain dredgers at work or designed for operating in exposed localities. That system would be deemed very unserviceable for such work in the United States compared with the grapple dredgers now employed upon such work so efficiently, and with so little risk of injury.

"The use of endless-chain dredges for clearing docks, tidal basins, and narrow channels, &c., as observed at Liverpool and Birkenhead, serves in many cases to entirely interrupt traffic by reason of the hauling cables leading across the basins, and the dredge itself constantly moving back and forth while at work, or else the work of the dredging is continually interrupted, and at certain stages of the tides entirely suspended. For instance, at Birkenhead, where the entrance gates of the basin were opened for admission or removal of vessels, the dredger was removed from its work alongside the quay, where it remained idle till the gates were closed, when it was again placed in position, the hauling cables stretched across from side to side on the line of the 'cut' to be made, and the necessary side lines and anchors arranged before the work could proceed. The repetition of this at every tide must occasion much loss of time and needless expense, and could be wholly obviated by the use of the grapple dredge, which would have no lines out to interfere with passing vessels, the dredge being held in position securely by its speeds or heavy timbers let down through well-holes through the hull, to serve as anchors.

"With the endless-chain type it is necessary to continually move the dredger forward and backward, or sideways, and with considerable force in order to keep the buckets up to their work in the cut being made; while the grapple dredges make but comparatively few movements, and of several feet forward at a time as the bucket lifts vertically from the bed by successive grapples a cutting of greater width than the dredge itself, and to the required depth over all the space within the sweep of its boom, and need lines and anchors only in strong currents, tide-ways, and exposed localities.

"For cutting canals and draining ditches and forming embankments by placing the excavated material directly upon the bank on either side, the endless-chain dredges are not adapted. The grapple dredgers, however, will cut their own way their full width, and more, through low and marsh lands, uncovered even by high tides, and throw the material aside on either hand, or lift it into cars to be conveyed away.

"It will be noticed that in the endless-chain system it is necessary to elevate all the material lifted to a considerable height above the water surface (37 feet in No. 1, and 30 feet in No. 8 or No. 9 of the Clyde dredgers) in order to secure the proper inclination to the chutes for depositing it in the barge alongside. The American system elevates it sufficiently only for the bucket to swing clear of the barge-rail, and thereby saves the expenditure of about 175,000 foot pounds per minute in this work alone over the Clyde dredgers in their performance as quoted.

"The dredges in France and Belgium seem of a rather lighter construction, with less ponderous and costly machinery, and in many cases the power is transmitted from the engine to the tumbler shaft gearing by leather belting.

"In a dredger at work on the canal enlargement, near Ghent, I noticed that the contractor's locomotive placed in the hold was supplying the motive power, and transmitting it through two 9-inch leather belts from the forward driving wheels.

"In the new harbour at the mouth of the North Sea Canal, in Holland, there were several sand-pumping dredges at work lifting the material through a tube by the suction of a centrifugal pump placed a few feet below the surface of the water, and operated by machinery from on board an old vessel temporarily fitted for the purpose; but the best performance reported to me was only about 70 cubic yards lifted per hour.

"All the dredging plant that I saw on the Continent was owned and operated by contractors instead of municipal and other corporations; and, therefore, I was unable to obtain much detailed information in regard to their cost of construction, operation, capacity, &c.

"There is no doubt whatever of the great superiority of the grapple-dredge system over the endless-chain type in nearly every material point, except perhaps in the excavation of excessively hard material like the 'till' found at Glasgow, which is certainly the most tenacious and difficult to move of any material that ever came under my observation. But for general river and harbour improvements in exposed and sheltered localities, deep and shallow excavations, cleaning docks, slips, and basins; draining, dyking, and reclaiming marsh lands; removing boulders, snags, and wrecks; lifting broken and blasted rocks; pulling piles and filling piers; and the depositing of all materials lifted into barges or scows on either side, or upon piers, or into cars or tramways alongside for transportation inland; for filling in low places, &c., the grapple dredges are beyond all question by far the best adapted, while the endless-chain dredgers are unable to fulfil many of these conditions at all. The great superiority as to general adaptation for all kinds of work, together with the very much less cost of construction, maintenance, and operation, renders any consideration of adding endless-chain dredger to your plant wholly unadvisable.

"F. C. Prindle, C.E."

No. 2.

The Under Secretary for Public Works to Mr. A. Morris.

Sir,— Public Works Office, Wellington, 18th September, 1877.

I am directed by the Hon. the Minister for Public Works to acknowledge the receipt of your letter of the 3rd instant, relative to American dredges, and to express his thanks for the courtesy of your communication. The contents will receive the Minister's full consideration.

I have, &c.,

A. Morris, Esq., 92, Liverpool Street, Sydney, N.S.W.

John Knowles, Under Secretary for Public Works.

No. 3.

Mr. A. Morris to the Hon. the Minister for Public Works.

Sir,— 8th September, 1877.

Thinking you would wish to have before you anything which can be said on both sides of the question in respect to American dredges, I take the liberty of enclosing a correspondence which has appeared in the *Sydney Herald*.

The introduction of any one great improvement such as relates to dredging will of itself fully justify the expense incurred in sending Commissioners to Philadelphia.

I am, &c.,

The Hon. the Minister for Public Works, Wellington.

Augustus Morris.

Enclosure 1 in No. 3.

American *v.* Australian Dredges.

To the Editor of the *Herald*.

Sir,—In December last the subject of the relative efficiency of the best types of American and Australian dredges was, I thought, set at rest when it was shown in your columns that dredging was being performed in Newcastle much more expeditiously, and at less than half the cost quoted by your Centennial Exhibition reporter, as the contract rate for easier work then going on in the harbour of New York; but I observe in the *Herald* of Saturday that the question has been again revived by Mr. Augustus Morris, who furnishes a letter from a gentleman in the employ of the American Dredging Company, comparing some days' work in the United States with the returns of British and Continental machines.

These special performances during brief periods with "good lifting material" (mud) have but little value when they are given with the view of comparing the merits of dredges with others working under altogether different conditions—hard sand having to be lifted here, a material which, even according to Mr. Rendle, can only be dredged at half the speed at which mud is brought up. The actual cost per ton is what we have to look to, and some light is thrown upon this by your reporter, who has told us that "the rate of dredging (mud) in New York harbour to a depth of 25 feet, and removing the silt, is 10d. per yard, and that the Company have taken a contract to dredge out 500,000 tons at Baltimore, so as to give a depth of 20 feet, at 5½d. per yard, this price including the removing of the mud three miles away."

In a previous letter I stated that the dredge I have charge of (designed by the Engineer-in-Chief for Harbours and Rivers, and built in Sydney) had lifted 92,215 tons of hard sand in a month, at a total cost of (including coal, stores, wages, repairs, and interest on the value of the plant) 3d. per ton, or 4d. per cubic yard—this rate covering the expense of towing the barges to sea. During the month just passed (August), a still larger quantity has been dredged at a cost even less than the rate stated above, while, notwithstanding all the delays incidental to stormy weather, no less than one million and a half tons have been lifted by this one machine since it started dredging, about two years ago—an amount of work, I venture to assert, equal to the performance during the same period of the whole fleet (fourteen) of American clam-shell dredges put together. No extensive plant of "fifty mechanics and labourers and a steam hammer," such as the American Dredging Company have to employ, has been found necessary to uphold the machinery employed in effecting these results, the repairs, with trifling exceptions, having been performed by the dredge's crew.

Into the question of first cost I will be quite prepared to enter when Mr. Morris is in a position to let us know how many of the primitive-built and short-lived machines of his friends over the water it has taken to dredge 1,500,000 tons of sand in two years?

That the clam-shell dredge may be a convenient machine for removing mud and sewage from alongside jetties I am willing to concede; but I think the day is far distant when, for general purposes, it is likely to supersede the continuous discharging elevator dredge, which has proved so successful on the Clyde, the St. Lawrence, the Suez Canal, and in New South Wales.

Newcastle. A. B. Portus.

Enclosure 2 in No. 3.

American System of Dredging.

To the Editor of the *Herald*.

Sir,—Your correspondent Mr. A. B. Portus, refers in to-day's *Herald* with complacency to a former letter of his which he is pleased to think, at the time, sets at rest the relative efficiency of American and what he calls "Australian" dredges, very much to the advantage of the latter.

Mr. Robinson, in describing some dredging operations of the Morris Cummings Company, stated that the Company charged 20 cents currency, or 9d. per cubic yard of silt composed of sand and sewage. But the 9d. included the removal of the material from the punts to the railway wagons by a grapple bucket worked from the shore, its carriage some miles by rail, and also its further disposal over a swamp to raise it. I have before me an account of the charges made by the "Hercules," New South Wales Government dredge, for "lifting, towing, and disposing" of 13,640 tons, or 10,230 cubic yards of material similar to the above, which amount to £744, or nearly 17½d. per cubic yard. The 9d. of the American account included a large profit, but the cost in the colonial account is, I suspect, alone capable of being estimated. Again, when I stated that contracts were carried out at 10½ cents, or 4¾d. per cubic yard, the amount included a very considerable profit, while the 4d. per cubic yard of Mr. Portus's estimate is the bare cost. I saw a large contract being carried out for the United States Government for 15 cents, or 6¾d. per cubic yard, where the material was so tenacious that, instead of depositing it, as in the New York case, direct from the punts into the railway wagons, it had to be returned to the water alongside the pier to soften it before it was placed in the wagons, to be afterwards distributed over the island on which the navy yards at Philadelphia are erected. I had an opportunity of examining this account in the books of the American Dredging Company, and, after all costs, including interest of money, repairs, wear and tear, &c., had been deducted, I was surprised to find "dredging" so good a business.

I might here conclude, but as the confident statements made by Mr. Portus have a tendency to mislead the minds of persons in authority, and as the subject is too important to be lightly brushed aside, I will refer seriatim to the points which Mr. Portus has endeavoured to make.

In noticing the carefully-written report of the most eminent civil engineer in the United States in regard to dredging and harbour improvements, Mr. Portus refers to him as a gentleman in the "employ" of the American Dredging Company. He might as well refer to Sir John Hawkshaw, or to any other distinguished engineer in the same terms when he is retained by any company to advise on its operations. This is, however, not material to the issue; but when he says that the report goes no further than to compare "some days' work in the United States with the returns of British and Continental machines," he wholly misrepresents what Mr. Prindle has demonstrated, which is, that, as compared with the best Clyde dredge, the No. 4 American (iron) dredger costs only £6,500, as against £17,653 of the other; it can raise material from a depth of 50 feet, instead of from 30 feet only; it uses 25 per cent. less coal; it requires a crew of seven in place of twelve to work it; and when both are dredging the same good-lifting material, the American raises 374 cubic yards per engine hour, while the Clyde dredger raises no more than 236 cubic yards in the same time. And the American dredger does all this without involving its owners in a third of the expense for repairs which its rival does. Mr. Portus may rest assured that the "actual cost" is to be found in the figures given above, and not in contract prices, which include profits.

The dredge under the command of Mr. Portus does good work as compared with the Clyde dredges, but he is wholly mistaken if he imagines that the hard sand in the river near Newcastle is at all similar to the "till" referred to in Mr. Prindle's report, which is a provincial name for hard tough clay. The Australian dredge cost upwards of £30,000, £49,200 having been spent on dredge, tug, and punts; and at its best cannot lift more than 150 cubic yards of sand per engine hour, with a crew of fifteen, while, judging by English prices, an American dredge might be built in this colony for a sum not exceeding £10,000 which will do double the work with half the hands, and in stormy weather will not be compelled to leave off work, nor be subject to so much wear.

When Mr. Portus asserts that his one dredge can do more work during the same period than the whole fleet (fourteen) of the American Company's dredges, he simply discredits himself. Can folly farther go than to imagine that the most prosperous dredging company in the world would maintain an establishment of fourteen dredges, thirty or forty great punts, and the necessary steam-tugs, to dispose of during the year 550,000 cubic yards of such good dredging material as is to be found at Newcastle or at the Sydney Heads? How, too, a dredge which requires so few repairs can be called "short lived," I do not understand.

But in discussing this question we have much more authoritative figures to guide us than Mr. Portus gives. The Assembly has voted in committee for this year's dredging services the following amounts:—

Salaries of dredges and tugs	£18,038
Contingencies, including coals, repairs, &c....	37,559
Landing silt and forming ground	5,000
	£60,597

These sums represent, at 1s. per cubic yard, 1,211,940 cubic yards of dredging material.

How many cubic yards all the Government dredges in New South Wales lift during the year I have no means of accurately knowing, but I think I may safely assume that they do not exceed 2,000,000, at a cost of 7½d. per cubic yard; and this without any allowance for interest of money on capital, and for many other expenses which a private person would have to consider before he could declare a profit.

I trust that I have shown that, although I am not an engineer, I can come to a better conclusion on the evidence than Mr. Portus.

I have, &c.,

Sydney, 4th September. AUGUSTUS MORRIS.

No. 4.

Mr. A. Morris to the Hon. the Minister for Public Works.

Sir,— 92, Liverpool Street, Sydney, 5th October, 1877.

I have the honor to enclose a letter written to one of the local papers giving extracts from the Report of the British Commission on the Philadelphia Exhibition. Not being a professional man, I am anxious you should see that my reports are confirmed by competent authorities.

I also take the liberty of sending the concluding letters on the merits of the two systems of dredging, that the question may be fairly before you. I find, by a recent publication, that the American dredging system is being rapidly introduced into England.

I have, &c.,

The Hon. the Minister for Works, Wellington. Augustus Morris.

Enclosure 1 in No. 4.

Mr. Morris and Dredging.

To the Editor of the *Herald*.

Sir,—I have no desire to inflict needless torture upon Mr. Morris, in his present distressed state of mind about what he terms my rude language; but I cannot pass by without comment a portion of his last letter which bears upon the case, and in doing so I will trespass as little upon your space as possible.

I suggested that Mr. Morris should satisfy himself as to the dredge "Newcastle's" capabilities by seeing the machinery doing work at the rate of speed stated by me; but he chose rather to obtain official information on the subject, from which he found that 160,725 tons were lifted in thirty days, or 540 hours, an average of 297 tons per hour; but in the simple process of dividing the tons by the hours, Mr. Morris has made a palpable mistake against the dredge of nearly 100 tons per hour, his quotient being only 209, and he is quite jubilant about his imaginary discovery that the Australian dredge can only lift as much in an hour as the largest American machine. Correcting his error at once disposes of the arguments advanced by him to prove the cheapness of United States work over ours. One would have supposed that, before putting the result of his few hours' observations, and the scraps of hearsay evidence against the combined experience of English engineers, and twenty years' colonial working, Mr. Morris would have been careful that at least his figures were correct; but I am inclined to think, from this vital error, that his facts in many other cases are of the same slipshod character as his figures, and, even if not incorrect in the abstract, are divested of many qualifying circumstances which would very much alter the conclusions to be drawn from them.

It is contended that the clam-shell machine will work during weather when it is not too rough for punts to go to sea, but too lumpy for an elevator dredge to work. My reply to that is, that we have frequently worked with a heavy range on (and at times when seas would have swept over one of the dredges I have seen photographs of) and have not lost any of the sand on its way to the shoots—or "chutes," as Mr. Morris for the first time in this country calls them. (I presume the new word is either an adaptation from the French, or derived from the General bearing that name.)

We are told that the harbour of New York is in as exposed a situation as the eastern part of Newcastle harbour or Sydney heads—a statement to which I must certainly take exception. It is some years since I was in the United States, but I well remember the position of New York harbour; as to exposed dredging localities, there is no analogy whatever between the places named. We are at last furnished with an instance of some sand being dredged, the locality being Baltimore, but there is an ominous silence about the cost per ton or per yard, doubtless owing to the work being done by a slow-working machine made by the company—a modification of the ordinary spoon-dredge, and the only suitable appliance for sand. Their pamphlet describing the clam-shell or grapple dredge with Hall's dipper says: "Dredges of this class are not adapted for working advantageously in very hard material, compact clay, sand, or gravel with the ordinary dipper, the weight of the dipper being mainly relied upon for its penetration." In a previous sentence the dipper is spoken of as Hall's.

Mr. Morris says that he intends writing to Mr. Prindle for some stronger evidence in support of his case—a course certainly more satisfactory than his present conjecturing how difficulties in sand-lifting "may be" overcome, and much more likely to convince the sceptical than his begging of the question, and adducing hearsay statements and opinions of persons whose names are not even given, and whose testimony is valueless in a matter of this kind, to be decided only by tests on both sides of the most severe and undoubted description.

A. B. Portus,
Dredge "Newcastle," Newcastle Harbour.

Enclosure 2 in No. 4.

To the Editor of the *Herald*.

Sir,—I freely admit that, in dividing the total of the tons lifted during the thirty days selected out of twelve months by the number of hours, I incorrectly gave the quotient as 209, whereas it ought to have been 297: which, however, does not bring the performances of the Newcastle dredge up to those of the American. I am glad, nevertheless, that they are better than I thought.

In my last letter, following a statement based on good authority, that 300 cubic yards would be raised, this passage occurs: "But taking it for granted that the American dredge can only lift 150 cubic yards of sand per hour," &c. This was obviously only admitted temporarily for the sake of argument, but Mr. Portus treats it as a positive admission. Against such an interpretation of my

meaning I must protest, for I still maintain that the No. 4 American dredge can and does raise as much at least of "impacted" (as Mr. Portus terms it) sand as the Newcastle one does or can; and, further, it is guaranteed by the builders to dispose into punts 350 cubic yards, or more than 450 tons per hour, of such ordinary river silt as the other must have had to deal with on some of the selected days. (*Vide* capacity, page 15 of catalogue accompanying this letter.)

In estimating the merits of both systems, that portion of the question which points to the indisputable fact that dredges of the Newcastle type cost, relatively to the American, three times as much to build, and require twice as many persons to operate, must not be overlooked, although it has been systematically ignored or misrepresented by Mr. Portus. If this great outlay of the public funds, raised by loans, and the numerous hands referred to, could have been expended on the American system, we should have heard of fewer complaints of the inadequacy of the dredging plant of this colony.

I would gladly have concluded here, for I fear to weary your readers by dwelling too long upon one subject, however important; but as I perceive that my antagonist has been reinforced, I think it due to the public interests to explode a shell in the combined camp. I forwarded from Philadelphia a copy of the American Company's catalogue, which, as intended, found its way into the Department of Harbours and Rivers, and I imagine it is there still, for had Mr. Portus's quotation from it been based upon a personal inspection, it would not have been necessary for him to refer to photographs that he had seen, because he would have had before him the pamphlet, which abounds in woodcuts, and woodcuts only, of every class of the Company's dredges; and he would thus have learnt to distinguish the class which is adapted for operating in exposed localities from that which is not. And, although he has not been as candid in his admissions as one ought who desires truth more than victory, I scarcely think he would have been so reckless as to hazard the reference to Hall's dipper, if he had been in possession of the book from which he so "jubilantly" quotes the following passage: "Dredges of this class are not adapted for working advantageously in very hard material, compact clay, sand, or gravel, with the ordinary dipper, *the weight of the dipper being mainly relied upon for penetration.*" By a reference to the catalogue quoted from (pages 21, 25, and 29), it will be at once seen that the quotation relates solely to the smaller dredges, numbered 5, 6, and 7, which are equipped with dippers whose measurement capacity is respectively $3\frac{1}{2}$, $2\frac{1}{2}$, and $1\frac{1}{2}$ cubic yards, and therefore not so heavy as that used by No. 4 (the large dredge whose capabilities alone we have been comparing), which has a capacity 5 cubic yards, and which is specially adapted for dealing with hard sand, having the weight that is deficient in the others. The words I have italicized would have warned any one less eager to find a mare's nest, that Hall's dipper was unsuitable for dealing with very hard material, not from its principle, but only when its weight was insufficient; for on page 35 it is stated that this patent bucket has been proved by experience not to be liable to "bending or derangement, even in extremely hard work." How easily may any one, intent upon supporting a theory, regardless of facts, bring confusion on his argument. There was, moreover, less excuse for the inference that the American type of dredge was not equipped for dealing with the most difficult material otherwise than by Hall's dipper, because in the paragraph immediately following the quotation so ineffectually relied upon, it is stated, as I mentioned in my last letter, that "a special grapple (Holroyd's) is furnished independently for operating in compact clay, boulders," &c., and indeed, in all cases, the machinery best adapted to the desired work is constructed.

Further, it may be remembered that I merely referred to Hall's dipper in connection with the excavation of the Suez Canal, which abounds in quicksands. Had the perfected American machinery been in use on that great work, I am confident that over £2,000,000 would have been saved. When I say that American dredges are extensively employed in cutting channels through such flat marsh lands as are on the banks of the Hunter, for draining and diking them, it can readily be understood how useful they would have been on the Suez Canal. In the catalogue referred to above, it is pointed out by those whose character, experience, and self-interest are too great to permit them to mislead, that the Company's dredges, numbered 1, 2, and 3, which are fitted with the scoop-shaped dipper, and only on that account, are not adapted for working in exposed localities where the water is rough, or where ground-swells prevail, causing rolling or pitching, any more than are the bucket scoops of the Australian dredges, Mr. Portus to the contrary notwithstanding. The No. 5 American dredge and the other classes equipped with Hall's dipper are, however, especially adapted for operating in such exposed localities.

Mr. Portus would, doubtless, be delighted to divert my attention from a discussion on dredging to one on orthography, but I prefer to hand him, with his original "the General," over to some public school boy, remarking, however, that I spelt "chute" as Mr. Prindle does, and I still defer to his authority, because I am not aware that any English lexicographer gives "shoot" as a noun in the same sense as Mr. Portus does.

To deepen the channel so that large ships may enter at Baltimore, I have repeatedly said that the contract price was $4\frac{3}{4}$d. per cubic yard for dredging hard sand or whatever might come; and the sneering allusion made to the operations does not alter the facts as to speed and cheapness, nor make a spoon-dredge the best appliance for sand as, in his utter ignorance of the powers of the grapple-dredger, Mr. Portus assumes. And I can only suppose that he must have passed over New York Bay, outside the Narrows, in one of those thick fogs to which that exposed locality is occasionally subject.

Whether the statements that I have made in regard to the merits of the American system of dredging are "scraps of hearsay" only will be fully demonstrated when the public are in possession of the reports of Sir John Hawkshaw and Colonel Rich, R.E., contained in the report of the British Commission to America, which has been laid before the Imperial Parliament. From that report will be learned how Englishmen, the most eminent in their various professions, write of American methods; and the Australian people will marvel even more than they now do, why it is that, while private interests adopt to their great advantage American improvements, the governmental engineers in these colonies, with few exceptions, set their faces like flint against the experience in public works of 45,000,000 of people, mostly of our race, acting under conditions very similar to our own. Engineers from their

education, and properly so, are disinclined to accept new inventions until they have been submitted to the most rigid scrutiny; but American dredging, railway plant, and bridges have been tested, and proved as long as corresponding appliances in Europe; and, therefore, should without hesitation be adopted here because of their superiority. In the course of events it is to be hoped that there will be a Minister for Works, who, remaining long enough in office, will be patient enough to investigate evidence, and strong enough to enforce his conclusions.

In estimating the value of the evidence which has been produced during this discussion, it should be borne in mind that, on the one side, we have the report of the man who is the most eminent in his branch of civil engineering in America, and who, being thus highly qualified, was sent to Europe to make the systems of dredging in vogue there his special study; that he carefully estimated the qualities of the best dredge on the Clyde, which is similar to the best in this colony; that a willingness to adopt all mechanical improvements is an essential feature of American character; that the endless-chain type of dredge was well known and long in use in the United States, but has for nearly twenty years been wholly abandoned; and that the reports of all the Colonial Commissioners at the International Exhibition at Philadelphia agree in viewing the American system of dredging favourably, their impressions having mainly emanated from information derived from leading European engineers, who have since, by special reports to their respective Governments, confirmed them; while, on the other side, we have the opposing statements of a gentleman who has had no experience in dredging out of this colony; whose prejudices are so overmastering that they lead him to affirm that the one dredge at Newcastle, which is under his command, has lifted more hard sand in the same space of time than the whole fleet of fourteen belonging to the largest dredging company in the world; and whose animus is so great that he either inverts, misapprehends, or misrepresents every statement opposed to his own views.

I feel assured that an intelligent consideration of the evidence will satisfy the public, to whose judgment it is offered, that the American system of dredging has the following points of superiority over the one adopted in this colony:—

1st. Its first cost is at least one-half.

2nd. It can be worked with half the hands.

3rd. It lifts, in all cases, as much material, and, in some cases, much more than the other.

4th. It can operate in places and under circumstances where the other cannot.

In effect, it is cheaper, simpler, and better adapted to the objects required to be accomplished than the other.

Desiring that the colony should reap some material benefit from the expense incurred in taking part in the Centennial Exhibition, I have recommended the Minister for Works to cause to be built in this colony a dredge after the American type, on the understanding that the American Dredging Company will supply the working drawings and specifications, together with the machinery. In this way no error in construction can arise, and, with the possession of the patterns, much or all of the machinery can hereafter be made in the colony. By direct correspondence with the Company, all commissions and many other charges can be avoided, and the reputation of the Company is a sufficient guarantee that not a cent in excess of the amount charged to its numerous customers will be exacted. My letter, which was referred to the Engineer-in-Chief of Harbours and Rivers more than a fortnight ago, has not been reported on.

I shall now leave the subject in the hands of the Minister for Works, who will, I doubt not, give it, in the interests of the public, the attention it deserves.

Accompanying this letter is a copy of the catalogue so often referred to, in order that you, Mr. Editor, and those to whom you may be pleased to show it, may be satisfied as to the accuracy of my references.

I am, &c.,

Sydney, 22nd September. AUGUSTUS MORRIS.

REPORT of the BRITISH COMMISSION on the PHILADELPHIA EXHIBITION.

THE report of the British Commission on the Philadelphia International Exhibition, which has been presented to both Houses of the Imperial Parliament, has given unbounded satisfaction to the people of the United States. Official papers already published foreshadow the unfeigned admiration for American skill and industry, which may be looked for in the reports of the Commissioners of the different foreign Governments, but the verdict of Great Britain was not known until the publication of the first volume of the British report.

American achievments in arts, manufactures, and sciences are thoroughly appreciated, and praised without stint; and American superiority in certain directions is frankly admitted, while inferiority, where it exists, is lightly dwelt upon.

The expenses of the English Government, although not exhibiting, were £39,981, being £10,312 less than the amount (£50,293) so liberally voted by Parliament.

The total value of the British exhibits, exclusive of the fine art collection, was £250,000, and the expenses incurred by the 825 exhibitors were £120,000. No less than 587 of the exhibitors obtained awards based on special merits. India, Canada, and the colonies received 854 awards.

The value of the art contribution of England reached the sum of £200,000, and when it is stated that the total damage in handling, transporting, and exhibiting was but £34, which was paid by the insurance offices, some idea may be formed of the faithfulness and efficiency of American carriers, and the conscientiousness of American crowds.

Well may Colonel Sandford, R.E., the British Executive Commissioner, dwell on the perfection of the arrangements for exhibitors, and refer with grateful praise to the splendid hospitalities accorded to all visitors. The intense applause with which he was greeted on the evening when the rolls containing the awards were presented, by the distinguished assemblage which filled the Judges' Hall, was in special recognition of the part taken by Great Britain and her colonies to insure the success of the Centennial Exhibition.

The æsthetic influences of the Exhibition were finely illustrated in numerous ways during its progress, but no better testimony can be found than Lord Dufferin's reply to an address presented after its close by the Corporation of Ottawa. In the course of his remarks he said:—

"At no period in the history of the world have those bonds of sympathy and affection by which the members of the great Anglo-Saxon race are indestructibly united been drawn closer or rendered more sensibly apparent than at the present moment. The many proofs given by England of her friendly feeling towards the people of the United States have found their crowning expression in the noble way she has associated herself with them in celebrating the centennial year of their existence as an independent community, and nowhere has her Imperial dignity been more fitly or appropriately displayed than beneath the lucent roof of the Philadelphia Exhibition, where she sits enthroned amid her native treasures, and surrounded by the crowd of loyal colonies through whose intervention she not only extends her sceptre to the four quarters of the world, but has everywhere built up free institutions, and laid deep the foundations of an imperishable freedom. Facing her in generous emulation stands the United States, backed by the health of her virgin territories and the inventions of her ingenious artificers; and as you traverse the building from end to end, you almost forget to remember whether you be English, Canadian, Australasian, American, from Africa, or from India, in the proud consciousness that you are a member of that great Anglo-Saxon race whose enterprise has invaded every region, whose children have colonized two continents, whose language is spoken by one-third of civilized mankind, whose industry throngs the markets of the globe, and whose political genius has developed the only successful form of constitutional government as yet known to the nations of the earth."

An abstract of some of the reports will not, I hope, be uninteresting to your readers, and I will confine it almost altogether to those which treat of subjects of great economical importance to these colonies. I feel assured that general gratification will be expressed that the unprofessional judgments of the Australian Commissioners, who were first in the field with their reports, have been fully sustained by eminent British authorities.

Mr. Inspector Hagen, of the London Police, who reports on the sanitary and police arrangements, gives the following statistics in reference to the health of the residents on the Exhibition ground:—

Residents	1,158
Cases of fever	162
Deaths	26

So absolute was the sobriety and orderly conduct of American crowds, that he is enabled to say that "during the whole exhibition, with as many as 256,000 visitors in one day, scarcely a case of drunkenness was seen."

Captain Douglas Galton, to whom was committed the important charge of reporting on the railway section, shows what rapid improvements have been made in American railroad appliances. He says:—

"The Pennsylvania Railroad Company exhibited a section of their standard railway track. The main feature of the permanent way is in the shape of the head of the rail, the form of splice for the joints, the large number of sleepers, and the arrangement of the ballast. The rails are steel, of the Vignoles pattern. They are fished at the joint.

"There are two patterns of rails, one of 60-lb., the other of 67-lb. per yard.

"The 60-lb. rail is 4¼ inches deep, and the 67-lb. rail is 4½ inches. The head of the 60-lb. rail is 1⅜ inches deep, and the head of the 67-lb. rail 1½ inches deep. The splices are 2 feet in length; they are held by four bolts, two on each side of the joint. The outside splice has a tongue which passes over the flange of the rail and rests on the sleepers to which it is spiked.

"The joint is suspended midway between two sleepers, placed so as to be 10 inches apart between the edges of the adjacent surfaces. In winter 5-16 inch, and in summer 1-16 inch, are left between the ends of the rails to allow for expansion. There are 16 sleepers, 8 feet 6 inches long, 7 inches deep by 8 inches wide, to each 30-feet rail, the sleepers of the joints being placed 10 inches apart, and the others being evenly spaced between, but so that no sleepers should ever be more than 2 feet from centre to centre. The rails are spiked to each tie, both on the inside and outside.

"Great care is taken to obtain an even-bearing surface for the ties, which are not to be notched, but if twisted to be straightened with the adze. The subgrade is 31 feet 4 inches wide for the double road, and is formed with a slope from the centre towards each side, at an inclination of 1 in 20. The ballast is laid to a depth of not less than 12 inches under the sleepers, and is filled up evenly between, but not above the tops of the ties, and at the outer end sloped off to the subgrade. Where stone ballast is used it is broken evenly, and not larger than a cube that would pass through a 2½ inch ring. With double tracks, coarse large stones are placed in the bottom to provide for drainage, but care is taken to keep the coarse stones away from the ends of the ties.

"This road as exhibited, and for which an award was given, is the road in use over a large section of the Pennsylvania Railroad. It will be seen that this form of permanent way depends for its solidity mainly upon the large number of sleepers. The surface occupied by timber is nearly as large as that occupied by ballast. Therefore a lighter rail can be used than in this country, and so long as timber continues cheap this permanent way will hold its own. But the destruction of forests in recent years has been so great that this must soon cease. Another object obtained by this permanent way is that water drains off rapidly—a great matter in the hard frosts to which these lines are subject.

"A large amount of ingenuity is expended in the United States upon nut locks—*e.g.*, means for preventing the nuts which secure the fish-plates from becoming loose. None have as yet been found of such practical advantage as to obtain universal adoption; nor can it be expected that, with the forces always at work on a railway, anything can be devised which will do away with the necessity for frequent inspection."

Of the Wharbin switch, Captain Galton says it gives in practical working on railways great satisfaction, the principle being that it carries the train off the main line on to a siding without any break in the continuity of the main line rails, and he explains its arrangement. He praises the elliptical car

springs of various manufacturers, and the Godley spiral spring, the Miltimore wheel and independent axle, and describes at length the Henderson hydraulic brake, which he says is simple in construction and operation. He devotes a section of his report to American locomotives, which receive much commendation. "The most noteworthy exhibit in this class, of the latest style of modern American engines, was by the Baldwin Locomotive Works, of Philadelphia, owned by Messrs. Burnham, Parry, and Williams, and managed by their able partner, Dr. Williams," who, I may remark, may be expected to arrive in Sydney by the incoming mail steamer from San Francisco. Captain Galton, in referring to the performances of engines, adds:—

"In connection with these exhibits of locomotive engines, it is interesting to make some mention of the working arrangements on one of the portions of the Pennsylvania Railway, which I had the opportunity of observing.

"The principle of competition for securing economy of working is put in force as far as possible. The Manager of the Company informed me that they find it preferable to keep the several portions of the line distinct in regard to workshops, both for manufacture and repairs, and limited in respect to size to what one Superintendent can so look after as to know what work every man is doing; the idea being that thus a comparison can be instituted between the cost and quality of the work at the several shops.

"Similarly with the working of the engines, a strict comparison of the cost of running is kept and published among the men, and a system of premium is also adopted. The engineer, or what we term engine-driver, on American railways is a person generally of superior education to those on our railways. The engine itself is fitted up with great comfort in regard to seats and protection from the weather. There are guilds or associations to which the engineers belong.

"A system of premiums is, of course, subject to the difficulty that the engineer may occasionally supplement his supply of coal for the cars by taking coal from the trains or from shunting engines. It was stated that this was not found to be a practical inconvenience, as the number of premiums is sufficient to induce each to watch the others closely in that respect, and only one case of such an occurrence was known.

"There are monthly first-class premiums of 20 dollars to the engineer and 10 dollars to the fireman, and second-class premiums of 15 dollars to the engineer and 7 dollars 50 cents to the fireman, and annual first-class premiums of 100 dollars to the engineer and 50 dollars to the fireman, and second-class premiums of 75 dollars to the engineer and 37 dollars 50 cents to the fireman.

"The premium on passenger engines is based on the lowest cost per car hauled one mile; and for freight engines, the lowest cost per loaded car hauled one mile. The results for premiums are taken from the monthly and annual printed reports of the performances of engines. A mileage of 1,500 miles must be made in the month to entitle to monthly premium, and 18,000 miles in the year to entitle to the annual premium. The time kept is not directly brought into account in the table in awarding premiums, but it was stated that conduct generally was considered. In calculating the mileage of freight cars, five empty cars are counted as three loaded cars. A table given shows the average total cost per mile run, for the year 1875, on the Erie and Pittsburg division of the Pennsylvania Railroad to have been 18 cents."

This last extract will explain how it is that I have been enabled to speak so confidently of the superior capabilities of the American type of locomotive, as the distances run are publicly exhibited for the satisfaction of the engine-drivers. I have a record, on the authority of the companies themselves, of the distances run respectively during 1874 by the total number of locomotives on the four best English railways, and on four of the best American railroads (the Pennsylvania line not being included), by which it is shown that the engines of the American lines run upwards of 10,000 miles a year further than the English, and they do this at less cost per mile. This ought to be evidence enough to prevent £1,000 upon every engine imported being lost to this colony, as is the case at present.

Colonel F. H. Rich, R.E., makes a report on the "water transportation class," which was not large. He describes the dredging-machines of the American Dredging Company, which are spoken of as simple, cheap, and well adapted to the work for which they are designed. The paper boats are referred to as a novelty, and very strong in proportion to their weight. The rowing apparatus, by which the rower faces the bow, is favourably mentioned. He thinks well of Major Mallory's steam yacht, in which the screw not only propelled the vessel, but acted as the rudder. The yacht, which is 95 feet overall, can be turned round the whole circle, in a little more than its own length, in 1 minute and 45 seconds. This invention may probably be usefully applied to dockyard launches and for intricate river navigation, as the screw forms a most powerful and effective rudder. It can be moved to either side in a half circle, as the screw shaft is pivoted near the stern. The ice yacht exhibited by Mr. Irving Grimmel is considered deserving of commendation. It is rigged like a cutter, runs on three skates, and is reported to attain a speed of about 60 miles an hour with a favourable side wind.

Architecture and engineering, as displayed at the International Exhibition, is the subject of an able paper by Sir John Hawkshaw, C.E., F.R.S. He gives an interesting account of the engineering feat at Hallet's Point (Hell's Gate), and adds a full description of the United States steam drilling scow used in removing reefs and rocks under water. The engineering works in the Mississippi, the dredging of channels, erection of jetties, the construction of the harbour on Lake Huron, where the breakwater will be 7,000 feet long, and will enclose an area of 320 acres of 12 feet of water, and the great light-houses of the coast, are dwelt upon in detail; and then Sir John Hawkshaw refers in terms of admiration to some of the American bridges, and makes the following complimentary remarks:—

"From the magnitude and number of the public works in the United States, however, other lessons may be learned than those which tell only of the science and skill of its engineers. From what I have seen, they possess enough of both to fit them for the accomplishment of any work they are likely to undertake.

"The 70,000 miles of railway already constructed; the ramification of the electric telegraph, and its application to uses more extended and varied even than in our own country; the crowd of steam-boats wherever navigation is possible and public convenience can be promoted; the building of cities like Chicago, which, after the great fire, in four or five years has arisen out of its ashes a more beautiful

city than before—all these tell of the increase of wealth, and speak still more strongly of the public and patriotic spirit of the people.

"To me, who visited the United States on a former occasion, but so long ago that Chicago was then but a village, and Philadelphia had not more than one-half its present population, when its railways were only beginning to be made with wooden bridges and almost temporary works, when its vast mineral wealth was nearly untouched, and wood was burned where coal is now consumed, the astonishing changes and the vast progress since made, appear greater than perhaps they will do to others whose visits have been more frequent. However this may be, what I witnessed at the Exhibition at Philadelphia and in the districts I visited, impressed me very strongly with the energy of the people and the vast resources of this great country."

It would be well for the Minister for Works to consider whether a bridge of great durability could not be erected over the Parramatta River, designed and contracted for in America, by which £20,000 would be saved. I may here add that a friend has written to me from Philadelphia that the president of the American Dredging Company informed him that, in consequence of what I said in my reports from that city on dredging, some gentlemen from one of the Australian Colonies had visited his Company's works, and, being satisfied of the superiority of the American system, had made purchases satisfactory to both parties.

Mr. Lothian Bell, M.P., F.R.S., deals in a long and most attractive report with the iron manufactures of the United States. His report abounds in statistics, exhibiting the marvellous abundance and richness of the iron mines, and the progress made in converting the ore into pig, and then into the numerous articles of which it is capable. Mr. Bell does not spare to expose what he considers to be the evils and fallacies of protection, just as I have often heard him attempt to do, surrounded by a host of its most strenuous advocates. The following extract will give an idea of his line of argument:—

"Great force is attached by Americans to the immense advantage of providing the farmer with a ready market at his own door, and no one will deny that, unless the position is acquired at the expense of sound commercial principles, there is much to be said in its favour. The population of Indiana is probably about one and three-quarter millions, and so far back as 1870 its agricultural produce was estimated at something over two and a half millions sterling, and is probably far more at the present day. Ten years ago it was essentially agricultural, and, indeed, may be still so regarded. Upon the occasion of my first visit I examined a pork-curing establishment at Indianopolis, where 1,600 animals were slaughtered every day, and of these no inconsiderable proportion found its way to Great Britain. The inhabitants of Indiana were formerly in favour of any policy which was likely to promote their intercourse with ourselves, and, believing free trade the best calculated for this, the members sent to Congress, according to my informant, were anti-protectionists. About 1867 an iron furnace or two were built; the total number now in existence is nine, and the estimated annual make is 71,000 tons, or about 90 lb. per inhabitant per annum, that of Great Britain being close on 400 lb. But this production, along with a similar development of other branches of industry, has led the people of this State to do their best to exclude a return cargo from one of their best customers by sending as their representatives to the National Legislature gentlemen pledged to the maintenance of a high tariff. What must be highly satisfactory to such political economists is that in spite of the protective duty of 28s. per ton, most of their furnaces are out of blast, extinguished, not by the dreaded pig iron from Great Britain, but by the produce of those States which along with themselves are so loud in favour of protection to native industry, protection which in this particular case has utterly failed to secure its chief recommendation of providing a customer at the farmer's door in Indiana"

The protectionists answer this by asking if Indiana, or any other State of the Union, would have had any furnaces if the foreign manufacturer had been permitted to undersell in the market before the newly-established firms could produce the raw material, or whether it is not better to have furnaces out of blast than none at all? In the course of his observations, he remarks:—

"In the matter of intemperance it is extremely difficult for a stranger to draw any comparison which discloses accurately the real state of the case. All I can say is that the complaints of the employers in America were quite as numerous and quite as severe as those I am in the habit of hearing and experiencing in this country. In one case, that of the railway shops at Altoona, the plan of forbidding the sale of intoxicating liquors in the town had been tried with such unsatisfactory results that, on the petition of the railway company, the old order of things was re-established.

"According to my information, the native-born Americans evince more than a disinclination to apply themselves to the severe labour of the mine and the ironworks, and, in consequence, fresh hands are almost exclusively recruited from immigrants. What struck me upon many occasions was the number of small shopkeepers in places of comparative unimportance, indicative, it might be, of a preference for the greater ease of the employment as compared with severe manual labour."

Mr. Bell condenses his views into the following terse statements:—

"1. That the powers of iron-production between the years 1870 and 1875 were increased in the United States far beyond any possible requirements of the country.

"2. That the high prices which led to this permitted and induced the manufacturers to accede to demands from certain sections of the workmen which are now acting adversely to the true interests of the trade.

"3. That the same causes, reacting on the value of the raw material, along with the increased value of labour, as above stated, have unduly added to the cost of iron.

"4. That the interference with the laws which regulate the prices of commodities has in the case of anthracite coal added to the difficulties of the iron-smelters; and the sudden demand made on mines incapable of meeting it has increased those difficulties by an unhealthy addition to the selling price of iron ore.

"5. That the protective duties levied on foreign iron entering the United States by raising the price there are chargeable with a portion of the mischief.

"6. That the natural resources of the United States of America are such as to render any protective tariff on iron unnecessary, which tariff, moreover, is an injustice to other branches of industry."

Mr. John Anderson, LL.D., C.E., contributes an exhaustive paper on machines and tools for working metal, wood, and stone. Of the machinery tools he says that they have never, as a collection, been equalled either for quantity or for quality or for fitness. But the greatest display, which dwarfed all others, was that made by the celebrated firm of William Sellars and Co., of Philadelphia. This is the company whose "turn-tables" for locomotives I described in my "Observations on American Railroads," five of which have been ordered by one of the Australian Governments, and they deserve the attention of our authorities.

Mr. Frederick A. Paget, C.E., who laboured with tireless energy in describing the relative merits of the numerous varieties of sewing machines, speaks in the highest terms of the following: Wheeler and Wilson, Singer, Wilcox and Gibbs, Howe, Wilson, and Grover and Baker. He draws special attention to the friction-belt gearing for obtaining varying speed on sewing machines, which was exhibited by Howard, of Philadelphia; to Walter's hide-sewing machine, and also to Baker's; to Eickemeyer's hat-blocking machine; and to a button-hole machine of great merit; also to a cloth-cutting and many other similar machines.

Mr. John Coleman's report on the agricultural section is eminently worthy of study by our farmers. Machines for reaping, mowing, planting, hay-making, ditching and draining, &c., are all described by a practical hand.

Sir Sydney H. Waterlow, Bart., M.P., reports on printing and book-making, and says after the most critical tests the palm was given to the Walter printing press, which runs with less loss of time in changing the rolls of paper and restoring the broken web than any of the others, which perhaps may be accounted for by its greater strength.

The Hon. James Bain, Lord Provost of Glasgow, whose paper treats on the hardware section, acknowledges that it is but fair to the manufacturers of the United States to say that in beauty of design, artistic finish, and varieties of pattern, they surpassed all European exhibitors in that department.

Major W. H. Noble, R.A., presents a report on American firearms, which deserves much attention. Amongst other things, he describes the improved Gatling gun, its ordinary rate of rapid firing being 700 rounds a minute, making in deliberate practice a score of 660 hits out of 1,000 shots at a range of 1,000 yards.

Every other section of the great Exhibition finds a master to explain the worth or demerits of its different articles; and if there was space I could fill your journal with extracts from the reports worthy of perusal. The publication of these papers, which are contained in 332 octavo pages, cannot fail to prove of great benefit to American manufacturers, and they may well feel gratified with the treatment they have received from their brethren of the "mother-country."

There is a most valuable paper on education in the United States by Sir Charles Reed, F.S.A., LL.D., which cannot wholly be passed over, as it will be of great use in discussing the subject in this colony.

The following figures are so grouped as to be exceptionally striking:—

"The territorial area of the Union is 3,250,000 square miles, of which 2,265,625 are public land. One-sixteenth of this public land in the several townships is set apart for educational purposes, and called the School Lot or Sixteenth Section. This land has in most cases been sold, and the proceeds invested for school purposes, giving, with endowments, an annual sum of 5,175,166 dollars. Adding 58,855,507 dollars, arising from State and local taxation, we have the entire school income, irrespective of special funds, like that established by Mr. George Peabody, and now amounting to 2,000,000 dollars.

"No part of the school income is derived from children's fees. It is enough here to say that the free system is not unchallenged. Many of the best teachers affirm that the parents who pay nothing care nothing, and that to this cause must be ascribed much of the indifference which so largely prevails among the parents in the States."

The fact that the New England and Northern States are more advanced in education than the West is cited, and regret is expressed at the slow progress made in the South. He then continues:—

"As a matter of fact every Northern and Western State, except Maryland, has adopted a compulsory law of school provision. Each has its own Board of Education, to which it is left to provide the funds and organize the schools; but the bureau at Washington has no power beyond that of collecting and tabulating statistics. One disadvantage of this is that there is no uniform standard of teaching, or inspection, or examination throughout the Union; while a yet graver defect is that sufficient check is not exercised over the more ignorant districts. Mr. Wickersham impresses, as the first lesson of the Exhibition, 'that the policy of placing so much power in the hands of local School Boards, as is done by our laws, has its weak as well as its strong points. Among intelligent citizens, alive to the interests of education, it is worthy of all praise; but where an ignorant people, or a people in public spirit, elect School Boards like themselves, no policy could possibly be worse.'"

The subject of compulsory school attendance, and the separation of the races in the schools, are touched upon, and Sir Charles Reed adds this important testimony:—

"America has reaped the advantages of education in the quickened intellect, widely-diffused information, general sobriety, and trained mechanical skill of her citizens. This it is that has supported her in every department of commerce and art, and given backbone and fibre to her national life."

On the whole, Sir Charles thinks that England has nothing to fear in fair competition with America. There are excellencies in the systems of both countries worthy to be copied by each.

In contrast to the marvellous triumphs of invention and industry so enthusiastically portrayed in the reports of the British Commission, it will be useful for us to study the picture drawn by so distinguished a man and eminent patriot as Mr. Henry C. Carey, in a letter addressed to the President of the United States in June, a copy of which he kindly sent to me by the last mail.

In describing the disastrous effects of the Resumption Act, passed by Congress some two and a half years ago, by which it is enacted that gold shall in less than eighteen months hence be the sole legal tender in the United States, he says:—

"As a consequence of the policy which has been pursued, our people have in the short space of thirty months been taxed in destruction of the value of property to the extent of not less than 10,000,000,000 (£2,000,000,000), or more than the total cost of the recent war to both North and South, the shrinkage thus enforced having been accompanied by bankruptcy of savings banks, insurance companies, and other moneyed institutions, to the utter ruin of thousands and tens of thousands of depositors and stockholders, men and women, wives and children; by a destruction of railroad property and impoverishment of its holders that counts by thousands of millions of dollars; by a collapse of that coal region which had given to the Union, in the time of its greatest need, nearly all the force required for maintaining the blockade, for running our mills and furnaces, for enabling our people to contribute to the revenue; by a destruction of demand for labour that causes hundreds of thousands of men and women to remain idle when they would desire to be employed; by an almost entire annihilation of that immigration to which we ought at this moment to be becoming daily more and more indebted for the importation of working men and women, whose annual value to the nation counted by hundreds of millions, by a decay of moral feeling consequent upon the daily increasing difficulties of obtaining food, clothing, and shelter, by any exertion of honest effort, by an almost entire disappearance of that activity and energy which prevailed among our people when they were animated by hope—by that faith in the future which has now, by aid of successive finance Ministers who have followed in the footsteps of Secretary McCulloch, given way to an almost universal feeling of despair, and by a total disappearance of that national self-respect, which had existed when, setting at defiance the threats of foreign bankers, our people in the days of its most serious trouble gave to their Government all the aid it needed, and thus established monetary independence such as we never before had known, and whose destruction has, by Secretary McCulloch and his successors to the present hour, been since so sedulously sought."

With thousands of millions of dollars of mortgages covering a large portion of the real estate of the Union, with money at 6 to 12 per cent. in the commercial centres, to 20, 40, and even 60 per cent. in the agricultural and mining districts, we can indeed sympathize with the venerable prophet of protection, as in his 85th year, he weeps over the unhappy condition of the country he loves so well.

May he live to see to see the day when prosperity shall return to it in as unbounded measure as even his heart can desire.

The monetary state of America can be better understood by a study of Mr. Thomas Walker's letter on the land question. Let the Government suddenly resume all the money in the banks, which is due for land purchases, and then what would be the difference between the monetary condition of this colony and that of the United States?

I am, &c.,
AUGUSTUS MORRIS.

Sydney, 1st October.

No. 5.

The UNDER SECRETARY for PUBLIC WORKS to Mr. A. MORRIS.

SIR,— Public Works Office, Wellington, 20th October, 1877.

The Hon. the Minister for Public Works directs me to acknowledge the receipt of your letter of the 5th instant, enclosing copies of letters written to the *Sydney Morning Herald* relative to the American dredging system, and to thank you for the very useful information therein afforded.

I have, &c.,
JOHN KNOWLES,
Under Secretary for Public Works.

Augustus Morris, Esq.,
92, Liverpool Street, Sydney, N.S.W.

By Authority: GEORGE DIDSBURY, Government Printer, Wellington.—1877.

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