R. M. Brereton in 1908

REMINISCENCES

OF AN

OLD ENGLISH CIVIL ENGINEER

1858-1908

BY

ROBERT MAITLAND BRERETON, C. E.

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Dedication

To my oldest and best professional friend

James Forrest

Who I have personally known ever since 1853, as the highly esteemed, and appreciated by all insiders and outsiders, Secretary of the Institution of Civil Engineers during half a century of its life, and who is now our much honored Honorary Secretary. In these two positions he has splendidly represented and promoted the best interests of this great and most important institution during three-fourths of its life of eighty years—from 1828 to 1908.

Preface

This book of personal reminiscences, observations and experiences of an English civil engineer may, I trust, serve to interest some of my old and young friends and acquaintances in the progress that has been made in the material betterment of human life since the commencement of the Railway Age in the first half of the last century. It may also, I hope, serve to encourage the rising generation of the profession, in every branch of their calling, to persevere in the pursuit of useful knowledge from the fount of nature and to see that their foundations of knowledge are of the best and most reliable materials. The present age is one of the fast moving and electric-motor predisposition, in which safe and wholesome foundations are apt to be too much "scamped." In North America, more especially, I have found "fakement" of every kind and false pretensions in every professional calling more or less prevalent and injurious to the public weal. The too ardent desire to "get-rich-quick," regardless of conscience, has a lowering tendency on the physical, moral and spiritual tone of man. The period on which I entered into professional life would naturally appear a very slow one to this twentieth century mind; but it was a safe, sound, honest and thoroughly reliable one. The profession of the civil engineer, at all times and in all generations possesses the highest ideal of any other in relation to the material progress and well-being of human life on earth. The more that the civil engineer studies nature's laws, actions and reactions, visible and occult, the more useful member of the social and industrial life of the community he becomes. I believe fully in both the beneficent and the malevolent effects of environment on the young mind. The careful study of environment is too much neglected by parents, educators and employers. I believe thoroughly in wholesome recreations for mind and body in old and young. I have always been a lover of cricket, tennis, fishing, shooting, hunting and boating. I have played my part in all parts of the cricket-field of life, and what scores I have made have been won off my own bat. I have experienced in full measure the "ups and downs" and the "downs and ups" again during the past forty years; I remain still game, active, cheery and hopeful of the future. I realize that there

is One-All-Controlling and All-Wise—ordering and guiding the course of every one born into the world. So I take my medicine of trouble, trial, disappointment and annoyance in a philosophical spirit and am content with the measure of antidote and elixir of health in mind and body allotted to me. I was not born with the "silver-spoon" in my mouth, and my professional callings have never been in the directions whence pensions proceed. During the past fifty-five years Providence has always opened a way for employment; so that I have never known idleness nor ennui, except through periods of sickness and accident.

ROBERT MAITLAND BRERETON.

Woodstock, Oregon, February 28, 1908.

Reminiscences

of an

Old English Engineer

1858-1908

Half a century of active and continuous employment in the various fields of civil engineering in parts of the world-wide British Empire and in the United States of North America may contain matters of interest to my old and young friends wheresoever they be.

The twentieth and thirty-first of January, 1908, were two fiftieth anniversaries in my professional career. The latter date recalled the launching of the Great Eastern steamship at Mill Wall, on the Thames. I believe I am the only living engineer who had been employed by Mr. I. K. Brunel, her designer and builder, in his office, and witnessed her construction during 1854-5. I was not a witness of the launching ceremony in 1858, as I was then in India, engaged in the survey and staking out of the Great Indian Peninsula Railway, which was to connect Bombay with Calcutta and Madras. Cyrus Field told me in 1871, in New York, that if he had not had the fortunate opportunity to charter this gigantic vessel for the laying of his perfected cable on the bed of the Atlantic Ocean in 1865-6, he could not have made such a success of it. We should realize that the laying of this cable was the most important international link and economic event between England and North America since the first discovery of America by John and Sebastian Cabot in 1497-8.

England on this fiftieth anniversary had the opportunity of recalling to mind the great name and master-genius of one of her most famous civil engineers, who had during the first half of the last century designed and built the largest steam vessels—the Great Britain and the Great Western—for international commerce across the Atlantic Ocean. He, too, had had the foresight to realize the fact that growing population and increase of commerce in the future would require a broader width of gauge for railways than the ordinary old wagon gauge of England.

If the Railway Age had started in America at the present time, there can be little doubt that the engineers of the great continental lines would adopt a seven-foot gauge for the traffic.

January 20th was the fiftieth anniversary of my camp in Khandeish, being surprised and looted by the Bheels, and my miraculous escape from death at their hands, on two separate occasions, was within a few hours on that date. The story of this is given in copies of the official correspondence, which will be found in the appendices relating to my services in India. At the time of this incident I was serving directly under Mr. Robert W. Graham, who had come to India in 1850 with Mr. James J. Berkley, the chief engineer, and Mr. C. B. Ker, second chief engineer. He (Graham) was third chief engineer and the superintending engineer of the Thul Ghat contract and of the Northeast line through the Nassick, Khandeish, Asseerghur Jungle, Nerbudda Valley, Berar and Nagpore districts. I cannot say too much of the long-continued consideration, uniform kindness and true friendship he favored me with during a period of eight years from 1857 to 1865. Naturally, he was a staunch upholder of the "contract system," and followed the policy of his chief in this view. From a civil engineering standpoint he won high honor for the skillful laying out and construction of the Thul Ghat incline, which formed far away the most difficult piece of work on the entire railway system out from Bombay to Calcutta.

Robert Stephenson, the other great engineer, cotemporary with Brunel, was the consulting engineer in England for the Great Indian Peninsula Railway when I was appointed, in December, 1856, a second-class assistant on the staff in India. At his death, in 1859, Mr. George Berkley became the consulting engineer. He was knighted after the completion of the line to Calcutta. When I arrived in Bombay in January, 1857, the line had been opened to traffic for a few miles only out of Bombay, so I became a witness of the laying out, construction and completion of the great through railway system, connecting Bombay with Calcutta and Madras, from its infancy, during the fourteen years of my service in India.

During the first ten years of this period the policy of the company—approved by the government of the East India Company until 1858, and after that date by the government of India under the crown—was to have all the construction work done by contract, so as fast as the line was surveyed and permanently staked out it was let, in certain lengths, under this contract-system, to firms of English

JAMES J. BERKLEY
First Chief Engineer of the G. I. P. Ry.

R. W. GRAHAM
Chief Engineer, G. I. P. Ry.

JOHN H. ABBOTT

WILLIAM AHER

Two of my staff and best friends on the railway construction and in the "shikar" line.

contractors, such as George Wythes & Co., Adamson & Clowser, Lee Watson and Aiton, Bray & Co. This system endured, as a whole, until 1867. Except in the cases of the Bhor and Thul Ghats portions this system was not such a successful one as was hoped for. It proved in the long run both expensive and slow in progress. It gave the conscientious members of the engineering staff—who were proud and jealous of their profession and its reputation in India—continued anxiety, and caused a far heavier demand for their constant and vigilant supervision of the masonry works in progress; this especially so in cases where such works were sublet to small contractors.

The great drawback and danger to masonry construction in India and in all dry climates arises from the sun-rays, and from hot, dessicating winds during the dry seasons of the year, when this work is mainly in progress. By these agents the chemical cementing process in the mortar is arrested for lack of the moisture which has been evaporated. It was ever a hard job for the superintending engineers to get the contractors' agents and native masons to keep the exposed green portions protected from the sun and hot winds and constantly wetted. Under the contract system it was almost impossible for the company's engineers—who had long lengths of line under construction to supervise—to ensure this necessary watering, for as soon as their backs were turned it was too often neglected, though they had their native inspectors on the works. Time and again I have ridden back unexpectedly and found this neglect proved. Then the style of masonry adopted was what is termed "coursed rubble facework, with rubble backing." This consisted of stone dressed on the exposed face and on the bed, and the use of long stones, termed "binders," overlapping each other, to tie the facework with the rubble backing. The specifications for this class of work were all that could be desired for securing solid and substantial structure. This style of masonry was very neat looking from the outside view, but it formed a *quasi* veneer-work only, unless the specification in regard to the number of "binders" and to the solid bedding and "grouting" of the rubble backing was strictly adhered to. It was in this class of construction that the contract system proved a failure and an enduring source of anxiety and worry to the company's engineers. It was so easy for the contractors' local agents and native workmen to "scamp" this work. The proof of this was furnished when No. 12 contract was opened to public traffic; then the vibration from passing trains caused over a score of viaducts and bridges to

crack and tumble, causing serious delays and expense in reconstruction. The broken piers displayed the "scamped" construction in the absence of the specified number and size of "binders," in the vacant spaces and unsolidity of the rubble backing, and in the perished state of the mortar from the lack of moisture during construction. The stone material was mainly what is termed in the Deccan "moorum"; it is a tough basaltic lava that has no bedding-planes like limestone and sandstone. The Deccan contains the most extensive area of this rock, so far known, in the world: the Columbia River and Snake River basins contain the second largest.

The large and wealthy contractors in England had great influence with the managing director and the consulting engineer in London. For some of us who were conscientious and active in our duties there were heart-breaking times when our honest and righteous refusal to pass such defective work was overruled or ignored by higher authority. I had my full experience of this when assistant resident engineer in charge of the contract sections through the Berar, Nagpore and Deccan districts.

On one occasion, when in charge of No. 18 contract, from Goolburgah to Raechore within the Nizam's dominion, whilst I was busy marking defective work on one of the bridges, the contractor's agent came up from behind and gave me a lick on the head from a heavy stick, which stunned me for a minute. I did not condescend, in the presence of the native workmen, to assault him in return, but quietly wrote out on a leaf of my pocket book an order for him to stop all masonry work pending the chief engineer's decision in the matter, and ordered my assistants not to measure any more work for the time being. The chief engineer appointed a committee of two of my brother officers from other districts to examine the condemned work, they fully endorsing my action in the matter. At this period Mr. J. R. Rushton was chief engineer. He was an excellent, practical and thoroughly conscientious engineer, and one who earnestly supported his staff in their efforts to secure honest and sound work being done by the contractors. He, however, was not appreciated or supported by the authorities in London and gave up his position. At this period, also, Captain Sherard Osborn, R. N., was the company's first created agent in India. He was the historian of "The Career, Last Voyage and Fate" of Sir John Franklin. I had known him at home before coming to India, so I had in him a friend and a warm supporter in my efforts to secure good and solid work on

View of one of the Viaducts on the G. I. P. Railway, between Bhosawell and Jubbulpore, in course of construction during the dry season of 1869, showing the style of "Coursed-Rubble-Facework with Rubble-Backing."

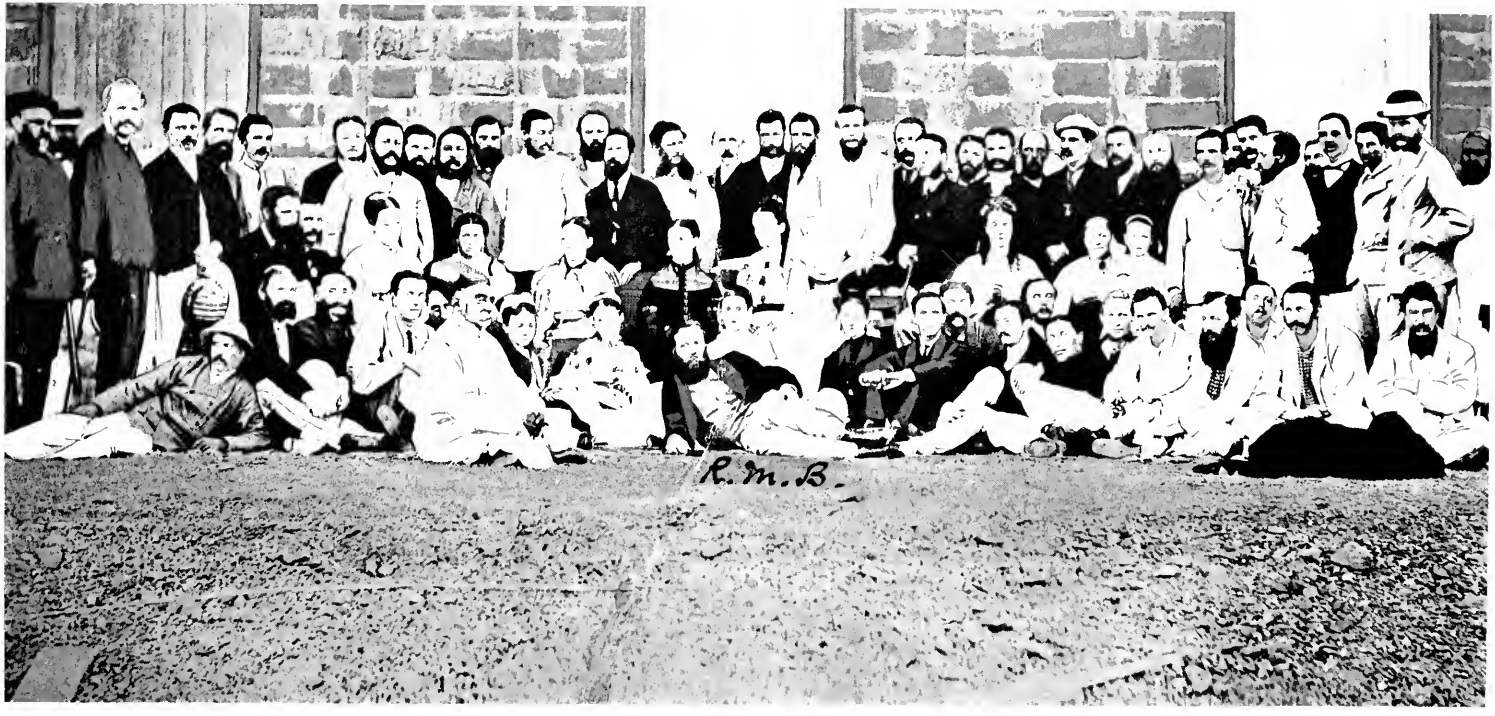
the railway. Unfortunately he, too, was not supported or treated fairly by the authorities at home, and left in 1866. He was succeeded as agent by General Harry Rivers, R. E., who had been the government engineer for railways from the time I came to India. He knew me well and my services during and after the Bheel troubles in 1858. We were warm friends till he died. He retired from the position in 1868, through not receiving the support or fair treatment of the board of directors.

During 1866-7 the line was completed to Bhosawell, near the Taptee river, and the point of junction of the Nagpore branch with the main line to Calcutta. The catastrophe attending the failure of the viaducts and bridges on No. 12 contract at this period caused the board to send out their consulting engineer in 1867 to make a thorough examination of the masonry construction of the entire system. After his careful examination he prepared a schedule of all works requiring reconstruction. This was called a "reconstruction schedule." A specified fund, called "The Casualty Fund," was provided from periodical contributions from revenue to meet the cost of reconstruction. Very serious delay in the completion of the through line from Bombay to Calcutta was the outcome of the contract system, which then received its death-blow.

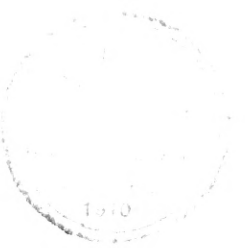
The contractor-firms of the main line from Bhosawell to Jubbulpore and of the Nagpore branch threw up their contracts. The board in London, with the approval of the government, decided to appoint two chief engineers for the entire system. I was appointed chief engineer of the North-Eastern, or Calcutta and Nagpore, division, and Mr. Henry LeMesurier chief engineer of the South-Eastern, or Madras, division. He had been one of the resident engineers on the East Indian Railway. Mr. Walter Knox was appointed the company's agent in Bombay. He remained with us only sixteen months, and was succeeded by Mr. LeMesurier, who also retained the chief engineership of the South-Eastern division.

I entered on this appointment in July, 1868, and undertook to carry out for the company the unfinished construction to completion of my division, with the aid of my carefully selected staff of old G. I. P. brother officers. I completed the junction with the East Indian line at Jubbulpore on March 8, 1870, a period of nineteen months. This was fully eighteen months sooner than the board, the agent, the consulting engineer, or the government railway engineers considered possible when I started in. I was considered rash by

many when, in the spring of 1869, I reported to the board that "all the mass of work in hand will be successfully completed in May, 1870," and for giving Lord Mayo, the Viceroy, the same assurance. How was it done in that short period? The answer is: In the first place, I was most fortunate in having at my back and call a splendid staff of every grade, whose heart was in their work; who possessed a thoroughly practical knowledge of construction in every branch and skill and perseverance in overcoming every kind of obstacle and difficulty; who believed in me and trusted me to the core. In the second place, I adopted the American system in railway construction; that is, I had temporary rail-tracks constructed across the rivers and nullahs to enable us to get the bridge work and permanent way materials hauled ahead during the dry season of the year, as during the rainy season the roads through the black soil of the Nerbudda valley were impassable for about four months, and all this heavy material from England had to come from Bombay. We hustled Mr. Warden Morrice, the excellent storekeeper in Bombay, almost out of his wits to supply our requirements; also Mr. Henry Conder, the able and active general traffic manager, who was everlastingly being coaxed into lending extra aid in the rapid forwarding of our freight. I owed much of my success to his cordial co-operation during the whole of that strenuous period. This period—now that I look back upon it—formed the most strenuous one of my entire professional life. It was a hustle and a bustle through the hottest and the wettest portions of the year. In 1869 a violent outbreak of cholera swept through the Nerbudda valley, followed by a terrible famine. Thousands of our native workmen fled from the works. Hundreds died from cholera and famine in these districts. Cholera gave me a taste of its grip, but my soul fought for its body and won. My staff was greatly discouraged by this condition of affairs. Fate seemed determined to balk our best efforts, but *nil desperandum* was the voice we listened to, and *Opitulante Deo* (God helping), my old family motto, was my trust. During this period neither my staff nor I had any let-up from our strenuous efforts, except during the Christmas week of 1869, when I had the pleasure of entertaining them and their wives and other friends from Nagpore, Khandeish, Nassick, Poona and Bombay, at Bhosawell. Then and there we enjoyed an all-round good time with cricket, music and dancing. Some of my staff and I were lovers of "shikar," but during this time the tigers, panthers, bears, wild boar, sambhar, chetal, antelope,



1869 Christmas week party of G. I. P. Railway Staff and friends from Poona, Bombay, Nassick, Khandeish, Jubbulpore, Berar and Nagpore, held at Bhosawell Junction. The old Parsee, Pallonjee Pestonjee, proprietor of the Adelphi Hotel, Byculla, Bombay, was the caterer.



J. W. Pearson

Hamilton Maxwell

Mrs. C. Johnson

Henry Conder

Hugh Swan

Pearson was my right hand in executive work: Maxwell, Bombay merchant, a very close friend: Mrs. Johnson, wife of Colonel Charles Johnson, of Simla; Conder, General Traffic Manager of the G. I. P. Railway; Swan, Assistant Traffic Manager of the G. I. P. Railway. All of them old and staunch friends.

bustard, florikin and quail in the jungles and plains, along the line through Asseerghur, the Nerbudda valley and Berar, were left undisturbed by us. The third attribute to my success was in my being always enabled to get on well with all classes of the natives. I was but a poor Hindoostanee and Mahratta linguist. I knew just enough of the language to make myself understood and to guess at what they were talking about. I had small knowledge of simple medicinal and surgical appliances, which also helped them to like me.

They all seemed to like and respect me during my sojournings amongst them in the Admednuggur, Khandeish, Berar, Nagpore, Asseergur, Nerbudda valley and Deccan districts. Sir Salar Jung bears testimony to this mutual good will in his long letter to me of December 24, 1866, a copy of which will be found in the appendices. My love for shikar and animals and birds of all kinds kept me on good terms with the Bheels—after they had quieted down—and the jungle folks in Berar, Nagpore, Asseergur and Deccan (Hyderabad) districts. Salar Jung lent me two of his elephants for a time, which enabled me to bag a few tigers.

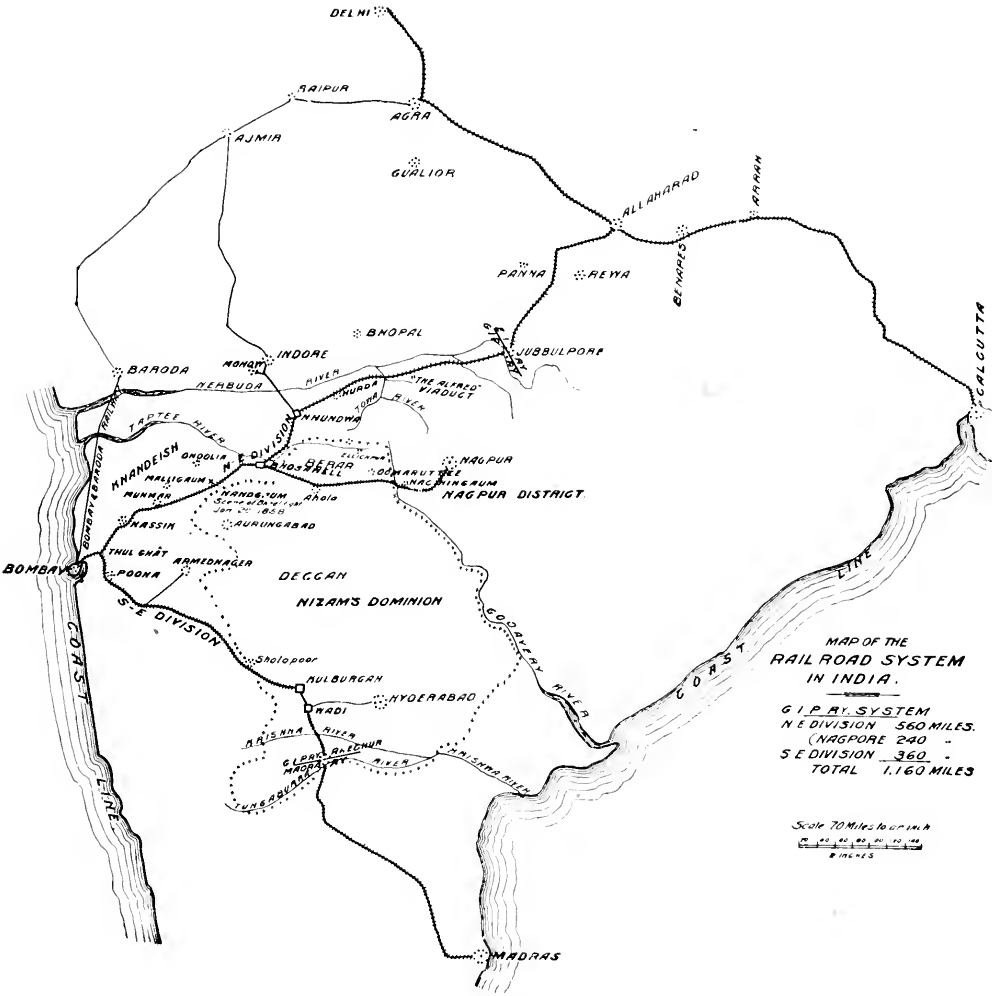
At last, on the seventh of March, 1870, two months sooner than I had promised the company in the spring of 1869, the through and unbroken line between Bombay and Calcutta was ready for the Viceroy and the Duke of Edinburgh to open to the public on the morrow. On Monday, March eighth, we got the two trains from Bombay, containing the Viceroy and the Governor of Bombay—Sir Fitzgerald Seymour—and their staff, and another special containing Sir Salar Jung and other guests, through to Jubbulpore at 7:30 P. M. The Duke of Edinburgh, who came from Calcutta by the East Indian line, had arrived at 4 P. M. Then and there the Viceroy—Lord Mayo—with the silver-plated hammer provided for the occasion, struck the silver key that connected the G. I. P. rail with the E. I. rail. H. R. H. the Duke of Edinburgh gave it an extra royal tap; thus was our achievement perfected. That eighth of March day was an awfully anxious and fatiguing one for me and the staff. Our worthy locomotive superintendent—C. W. Hawkins—in his zealous pride for the appearance of his department, had put his newest and gorgeous locomotives to haul the Viceroy's train into Jubbulpore. The engine machinery being new, worked, Oh! so stiffly, and the boilers were "priming" all the way from Hurda to Jubbulpore, so that it took twelve hours to run the distance of 128 miles, which could have been covered in six hours if older rolling stock had been used.

Among our guests on this opening ceremony were H. E. the Commander-in-Chief, Sir William Mansfield; The Resident at Hyderabad, Mr. Charles Saunders (whose father and family I knew well when I was a young engineer on the Great Western Railway, of which he was for many years the secretary); Sir Alfred Spencer; Mr. John Morris, Chief Commissioner of the Central Provinces; H. H. the Maharajah Holkar; H. H. the Maharajah of Kewal; H. H. the Maharajah of Punnah; the Rajah of Negode; the Rajah of Myhere, and Sir Salar Jung, the Nizam's great minister, who had left Hyderabad for the first time in his life, to attend this opening and the durbah which followed. A part of what the Viceroy and Governor-General spoke on this occasion I have given in the appendices. For the further entertainment of the Duke of Edinburgh a "drive" of a great stretch of tiger and deer-haunted jungle was organized by Mr. Malcolm Low, assistant commissioner, and other officials. In this it was said over two thousand natives were employed to form a line of beaters. On the day after this I took H. R. H. to open the Towa River viaduct; this he named "The Alfred" viaduct. After that he went to Bombay.

A month later I had to seek a rest for mind and body, and obtained two months' leave of absence from the agent. Lord Mayo had invited me to Simla, as he wanted to consult me concerning future extensions of the railway system in India being carried out by the government of India. This matter he had referred to in his speech at Jubbulpore. The success attending this rapid completion of the line by the company's engineering staff astonished the supreme and local governments, and greatly gratified the traveling and commercial public. It had served to open the eyes of all India to what could be done by English civil engineers, free from red-tapism and backed by intelligent and liberal-minded authorities at home and in India. At Simla I met many old friends, and made many new ones. In July, 1870, there occurred a great public sensation caused by the catastrophe at Allahabad through the fall of new barrack buildings, and also by the failure of others at Jubbulpore. The Governor-General wished me to serve with Colonel Anderson, R. E., on a committee to investigate and report on these buildings, and telegraphed to Bombay to obtain the agent's consent to my doing so; this was granted.

After I had completed this work for the government of India, I returned to Bombay, in August, 1870. I had not received a word

R. M. Brereton in 1870


MAP OF THE
RAIL ROAD SYSTEM
IN INDIA.
G. I. P. RY. SYSTEM
N E DIVISION 560 MILES.
(NAGPORE 240 "
S E DIVISION 360 "
TOTAL 1.160 MILES
Scale 70 Miles to an inch
DELHI
RAIPUR
AGRA
AJMIR
GUALIOR
ALLAHABAD
ARRAH
BENARES
PANNA
REWA
BHOPAL
INDORE
MOHAW
JUBBULPORE
CALCUTTA
BARODA
NERBUDA
RIVER
"THE ALFRED" VIADUCT
TOWA RIVER
KHUNDWA
TAPTEE RIVER
BOMBAY & BARODA RAILWAY
KHANDEISH
DHOOLIA
N. E. DIVISION
BERAR
BHOSAWALL
OOMARUTTEE
NAGPUR
NAGPUR DISTRICT.
MALLIGAUM
MUNMAR
Akola
AURUNGABAD
NASSIK
THUL GHÂT
BOMBAY
POONA
AHMEDNAGER
DECCAN
NIZAM'S DOMINION
S. E. DIVISION
GODAVERY RIVER
Sholopoor
KULBURGAH
WADI
HYDERABAD
KRISHNA RIVER
TUNGABUDRA RIVER
KRISHNA RIVER
COAST LINE
COAST LINE
MADRAS

of recognition or thanks for my services from the board or from the consulting engineer in London since the completion of the line. The only person at home who had been connected with the board that I knew well was Mr. Hugh Childers, M. P.; he had been chairman. I had written him a full description of the opening. His reply I have given in the appendices. I found on arriving in Bombay that Mr. LeMesurier, the agent, had received instructions from the board to terminate my services with the company. He never told me or wrote me about this, and I have never seen or heard the managing director's directions in this matter.

What he did do was to get Colonel Trevor, R. E., the secretary to the Government Railway Department, to inform me. Of course I felt it keenly, though the warm farewell I received from the staff gave balm to the wound. On my return to London in October, I saw the managing director at the office, but I never saw the members of the board, and was never asked to attend it.

The managing director said he regretted that my services had been terminated, and asked me if I would be willing to return to India as chief engineer of the entire line, with Mr. LeMesurier as agent. Of course I declined this proposition, as my place had already been filled by a worthy member of the old staff, and Mr. LeMesurier and I could never have worked together harmoniously. He had been neither generous nor helpful to me during the last year of my hard efforts. The managing director informed me that the board had not liked my going to Simla to recruit, and that it did not like the Governor-General's remarks, made at the opening dinner, regarding the future policy of the government of India concerning further railway construction in India. No pecuniary reward for my services, outside of the salary due, was offered me. I was received with comparative coolness by the consulting engineer and by the then government director of the Indian Railway Companies.

The Duke of Argyll—then Secretary of State for India—received me very kindly. Lord Mayo had written in my favor to him. He presented me at the levee held in March, 1871, and entered my name on the list for future consideration for the C. S. I. honor. Sir William Baker, to whom Sir Henry Durand had written about me, also showed me much kindness, and Lord Lawrence, ex-Viceroy and ex-Governor-General, did the same; also Sir Cecil Beadon and several others prominent in Indian affairs. The fact was, I had antagonized the contractor element in London by show-

ing what the company's engineering staff could do without the contract-system. Furthermore, I had annoyed the consulting engineer by having rejected a lot of wood-sleepers ("ties" these are termed in America), which had been sent to India. These were not up to the dimensions of the specification; the wood was of inferior quality, and the creosoting was insufficiently done. The government engineers had seen these sleepers and had supported me in my action. My greatest satisfaction arose from the undeniable fact that the achievement of success was solely due to the efforts of the oldest members of the company's engineering staff, who began their services under those able chief engineers, Mr. James J. Berkley and Mr. Robert W. Graham. Thus ended my fourteen years of professional services in India. I had, on the whole, enjoyed a happy and most interesting life there. I had many close friends on the staff and outside of it. I had been on intimate terms with Mr. Samuel Mansfield, collector of Khandeish, and with his assistant, Digby Neave, whom I nursed when he was mauled by a bear, and died. I was on the same good terms with Captain Arthur, Frank Souter and Oliver Probyn of the police, and with Mr. F. S. Chapman, collector of Nassick. Also with Captains Cadell, James Stubbs and Allardyce of the Berar Commission, when my headquarters were at Oorawuttee. Also with Colonel Elliott, chief commissioner at Nagpore in 1862; Colonel Spence, commissioner; Colonel Snow, assistant commissioner; Wm. Hickey, C. E.; Colonel Shakespear, the great Shikaree; Captain F. G. Steuart of the police, and Dr. Hislop, missionary of the Presbyterian Church. At a later date I saw much of Mr. Richard Temple, Colonel Elliott's successor, and his cousin, Harry Rivett-Carnac, B. C. S.; Major Dennys, commissioner, and Colonel Moxon. Still later I knew well Mr. John Morris, who succeeded Mr. Temple as chief commissioner of the Central Provinces; William Ramsey, B. C. S.; Malcolm Low, B. C. S., commissioners, and many others of those provinces. In the Deccan I knew well Sir George Yule, minister at Hyberadad; Major James Stubbs, Captain Campbell and Sir Salar Jung. I also knew and corresponded much with Captain Meadows Taylor, who had lived for many years in the Deccan, and who wrote so many charming Deccan stories. He and I were greatly interested in the very ancient stone circles and cromlechs, which were so numerous and extensive between Goolburgah and the Krishna river; of these the Mahratta folk had no tradition. Taylor thought they might be the necropolis of the ancient Scythian wanderers. Limestone and

Sir Richard Temple

Harry Rivett-Carnac

Mrs. Spence

Rev. Dr. Hislop

These were among my best friends in Nagpore.

FRANK SOUTER
(Police)

SAM. MANSFIELD, B. C. S.

A. R. NAIRNE, B. C. S.

MR. AND MRS. "JIM" OLIPHANT

These five were among my warmest friends in the Bombay Presidency, from 1860 to 1870.

Col. Peter Lumsden

Mrs. Lumsden

Charley Bernard, B. C. S.

Mrs. Bernard

All old Simla friends

granite form the rock formation of that region, so that the huge blocks of stone were readily obtainable.

The walls around the city of Raechore, south of the Krishna river, contain blocks of stone of prodigious dimensions. The joints on the beds are so close together that I could not get a knife-blade between; no mortar was used. I had many intimate friends during these years in Bombay and Poona. Among these were Sir Bartle and Lady Frere; Colonel Bell, R. E.; Lionel Ashburner, B. C. S.; Edwin Arnold; Barrow H. Ellis; Sir William and Lady Sandhurst; Alfred Lyall, B. C. S.; General Rivers, R. E.; Colonel Robert Phayre, Quartermaster-General; Colonel and Mrs. Lyons; Captain Dods; Frank Wyllie, B. C. S.; J. E. Oliphant and wife; A. R. Nairne, B. C. S.; George Taylor, of the Supreme Court; Colonel and Mrs. Marriott; Captain White, R. E.; Captain Hancock, R. E.; Captain Gus LeMesurier, R. E.; Robert Ryrie; Hamilton Maxwell; John L. Kipling (father of Rudyard), and Captains John and Godfrey Clerk, and Charles Grant, B. C. S., who had been at school with me.

At Simla my principal friends were Colonel Dan Robinson, R. E., who was a connection; Colonel Charles Johnson, whose wife was also a connection; Sir Henry Durand; Sir Henry Maine; Sir Edward Clive Bayley, B. C. S., who was at Hayleybury with my brother Henry; Captain Edward Brooke, private secretary to the Viceroy, who was a fellow-pupil with me at Southgate in 1851, under Rev. Charles Bradley; Colonel Yule, R. E.; Colonel O. T. Burne; Colonel and Mrs. Peter Lumsden; Mr. and Mrs. Robert Egerton, B. C. S.; General Richard Strachey, R. E.; Major Edward Bourke, and Charles Bernard, B. C. S., and wife.

In England I had known well Sir Arthur Cotton and Sir Proby Cautley, both of irrigation fame in India—the latter I used often to meet at the Henry Boulderson's, B. C. S., whose eldest daughter married my brother Henry; the former helped me a good deal in my irrigation work in California;—Roger Pratt and William Lee Warner, both of the Bombay C. S.; being Norfolk men, they had known me from boyhood and saw my work in India.

North America

Thirty-seven years of my life had been passed in England and in the Eastern Hemisphere of the globe, and in the spring of 1871 Fate, Destiny or Providence, whichever it may be called, gave me a "switch-off" into the Western Hemisphere. Primarily, I sought it for a complete change of earthly scene and climate, as a tonic for a relaxed condition in mind and body which ensued from hard work and a long spell of years in India. North America was a country I had long desired to become acquainted with. Fennimore Cooper had fired the spirit of my boyhood for a pioneer life with his novels of "The Spy," "The Last of the Mohican" and "The Pathfinder." Then, too, America was so intimately connected with the finest and most daring explorers of England from such an early period—1497-8, when the Cabots were the first to discover it. This was over a year before it was seen by Columbus, and was 122 years before the formation of the East Indian Company (in 1600), and 260 years prior to Clive's victory at Plassey (in June, 1757), which secured the establishment of the British power in India. It was eighty-two years before Sir Francis Drake landed in California and hoisted the flag of England thereon, and seventy-six years before he (the first English commander) crossed the Isthmus of Panama, and saw the Pacific Ocean. North America was, therefore, England's first continental heritage. Speaking of Clive, I can mention, as a matter of personal family interest, that he was seventh in descent from the marriage of his ancestor, Richard Clive of Huxley, Cheshire and of Styche, Shropshire, with Jane Brereton, second daughter of Sir William Brereton of Brereton, Cheshire. The period of the discovery of America by the Cabots is also interesting to me because my direct ancestor, Sir Randle Brereton, of Malpas, Cheshire, was Chamberlain of Chester and Knight of the Bed-Chamber, to both Henry VII and Henry VIII, for over forty years, as our family records show. His first cousin, Humphrey Brereton, was, during this period, esquire to Lord Derby and a personal attendant on Princess Elizabeth of York. Miss Agnes Strickland, in her history of the Queens of England, gives a full account of him, and of his agency in the getting of Henry, then Earl of Richmond, to come over from Brittany to fight Richard III for the crown of England. Thus I conclude that both of the above Breretons had probably seen and known both John and Sebastian Cabot. Again, I find another family link

Portrait of Sir William Brereton, of Handford, Cheshire, born 1604, died 1661, the Ninth Baronet of England in 1626. Commander-in-Chief of the Parliamentary forces in Cheshire, Shropshire and Staffordshire during the civil wars; a member of the Plymouth Company and owner of 300 square miles of New England Territory in 1629. Portrait is copied from the original in John Vicar's "England's Worthies Under Whom All the Civill and Bloudy Warres Since Anno 1642 to Anno 1647 Are Related."—(Published in 1647.)

Map of Boston, Massachusetts, and surrounding district, including Noddle Island, called Brereton Island in the Seventeenth Century; forming a portion of the territory purchased by Sir William Brereton in 1629; upon which he planted a few English families.

Sir THOMAS FAIRFAX *Knight* Generall *of the Forces raiſed by the* Parliament.

SUFFER the Bearer hereof *Mr John Brereton Citizen of London* who was in the City and Garriſon of OXFORD, at the Surrender thereof, and is to have the full benefit of the *Articles* agreed unto upon the Surrender, quietly and without let or interruption, to paſſe your Guards with *his* Servants, Horſes, Armes, Goods, and all other neceſſaries, and to repaire unto *London* or elſewhere upon *his* neceſſary occaſions. And in all Places where he ſhall reſide, or whereto he ſhall remove, to be protected, from any Violence to *his* Perſon, Goods, or Eſtate, according to the ſaid *Articles*, & to have full Liberty at any time within Six Months, to goe to any convenient Port, and to Tranſport ſelfe, with *his* Servants, Goods, and Neceſſaries beyond the Seas; And in all other things to enjoy the Benefit of the ſaid *Articles*. Hereunto due Obedience is to be given, by all Perſons whom it may concerne, as they will anſwer the contrary. *Given vnder my Hand and Seale the* 24th Day of *June* 1646.

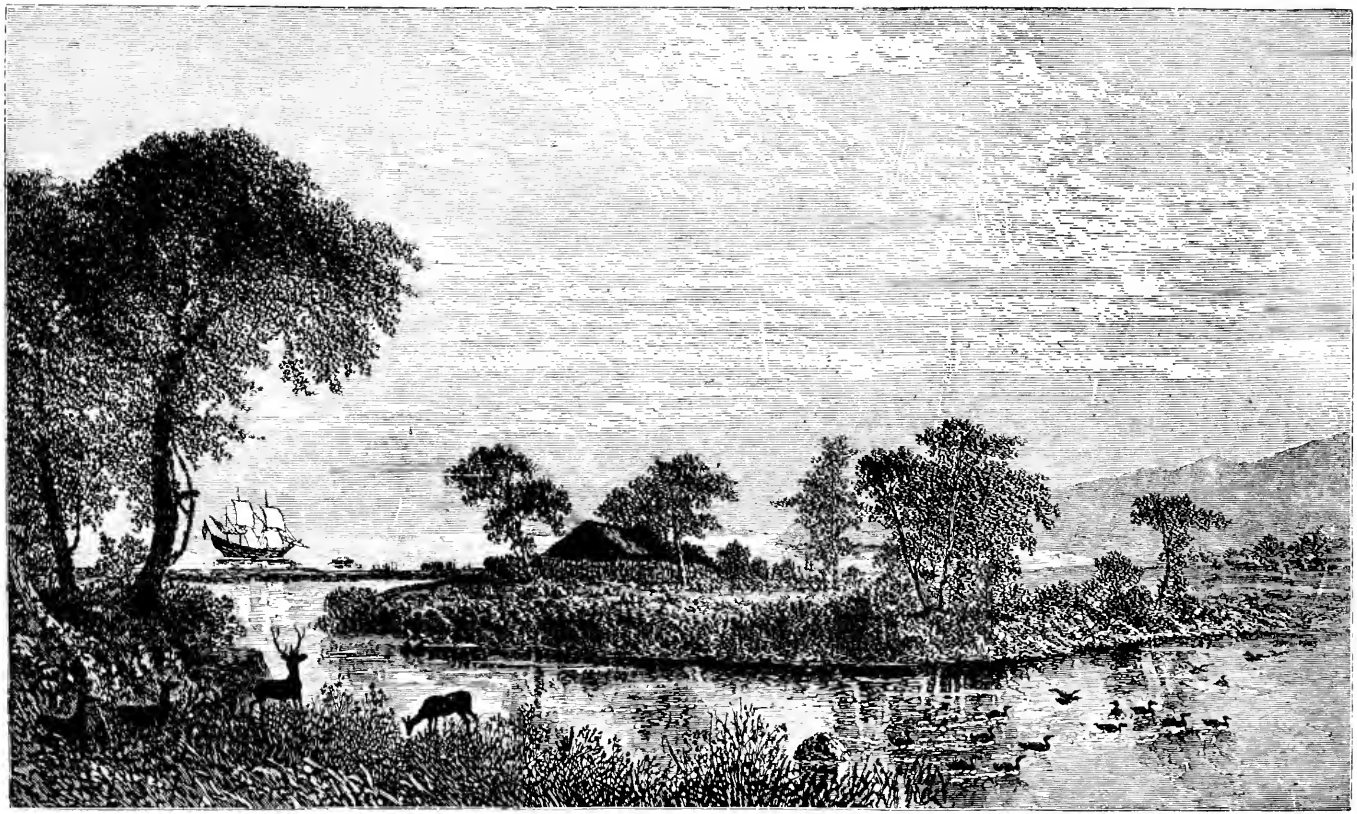
To all Officers and Souldiers vnder my Command, and to all others whom it may Concerne.

Fairfax

A B.

Facsimile of a document found in a lumber room in Shaw House, Newbury, Buckinghamshire, England. In this house King Charles I was besieged by the rebels. The document is a pass, signed by General Thomas Fairfax, Third Baron, for Mr. John Brereton, of London, his servants and baggage to pass in and out of the lines around Oxford in 1646. It is in splendid preservation, framed and hung in the Hall. The present owner is Mr. Eyre. This is the only known and latest record of John Brereton, the companion of Bartholomew Gosnold, and the historian of the first English voyage to the coast of New England, and first attempt at settlement thereon in 1602.

Tercentenary Memorial to Bartholomew Gosnold and his companions, who landed on this islet in the lake on Cuttyhunk Island on the 4th of June (O. S. May 25), 1600, and built thereon the first English habitation in New England, and sowed English grain seed.



An ideal view of Cuttyhunk Island with its Islet thereon, named Elizabeth Island by Gosnold and companions, off the coast of New Bedford, Massachusetts. On this Islet they erected the first English habitation in New England in May and June, 1602, and sowed English grain seed on the Island.

Cuttyhunk Island, off the coast of New Bedford, Massachusetts, as it appears today.

of interest with North America made during the summer of 1602, in which John Brereton was one of Captain Bartholomew Gosnold's companions in the first direct English voyage to Massachusetts (then known as the Norumbega region) with the view of effecting the first English settlement north of Virginia. He wrote a very interesting history of this voyage and first attempt at settlement on the coasts of New England; this he addressed to Sir Walter Raleigh. This is now a rare tract; an original copy was sold in New York for over $3,000; there are three copies in the British Museum. I have a copy of the one above mentioned; it is in black letter type. I find also yet another interesting family link with the early days of New England. This was through Sir William Brereton, of Handford, Cheshire; he was Commander-in-Chief of the Parliamentary forces under Oliver Cromwell, in Cheshire and Staffordshire; he was known as "The Warrior," and was a member of the Plymouth Company, under whose auspices the Plymouth colony of 1619-20 was planted in Massachusetts. He purchased from John Gorges, the son of Sir Ferdinando Gorges, three hundred miles of territory along the Bay of Massachusetts in 1629. This comprised the grant originally made to Robert Gorges by the Plymouth Company; it included Noddle Island, which was then known as Brereton Island. Sir William settled a few English families on portions of this territory, and at a later date the Massachusetts Bay Company obtained a royal charter which embraced this Brereton property, and so Sir William lost it. East Boston stands today on Noddle Island and Boston, Cambridge and Harvard University stand on other portions of this territory. From the foregoing family relations with North America I did not feel myself in the light of an "alien," but as one "free-born" when I first visited the United States in the spring of 1871, and ever since I have felt myself pretty much at home. I have for nearly forty years of intermittent sojourning in America enjoyed the warm friendship of many Americans and their families. I found another link between the mother country and the United States which connects the memory with the period of the first discovery of America under England's auspices, in 1497-8. I find this link is not generally known or appreciated as it should be, either in America or in England. This is one of the United States' beautiful patriotic anthems, *"America"* or *"My Country 'Tis of Thee."* It was composed in 1832, but is not nearly so old as *"The Star-Spangled Banner,"* which Samuel Arnold composed in the eighteenth century. The

music of *"America"* is so similar to that of our *"God Save the King,"* that the origin of the latter invites attention on both sides of the Atlantic. This dates back to January, 1485-6, the date of the marriage of Henry VII and the Princess Elizabeth of York. The words and the music of the national anthem composed and first sung on that occasion closely resemble our "GOD SAVE THE KING." The words are:

"God save King Henrie wheresoe'er he be,
And for Queene Elizabeth now pray wee,
And for all her noble progenye;
God save the Church of Christ from any follie,
And for Queene Elizabeth now pray wee."

Our Anglo-American cousins in the United States have hitherto given Columbus too much and the Cabots too little credit and glory for the great discovery of America. Their English History in the Public Schools, such as I have seen during the last quarter of a century, has ascribed the discovery to Columbus and has given him further credit for finding that the earth was of round form. It seems to me that the main object of correct historical education in the Public Schools should be in the direction and in the cultivation of facts that tend to promote national pride and Anglo-American sentiment in regard to the greatest portion of North America wherein the English language and English traditions are dominant, and not so much overlaid with the glamour of Spanish-American sentiment that pertains more naturally to Mexico, Central and South America.

Columbus discovered the West Indies, but that did not make him the discoverer of the great continent of the Western Hemisphere. If the Cabots had only discovered Newfoundland, they could not have claimed to be the first who saw and set their feet on the New World. Before Columbus saw the mainland of South America in August, 1498, Sebastian Cabot had landed in England American Indians and samples of copper and other products of North America. These successive issues of English history for the use of the schools furnish, more or less, dramatic parade of the voyages of Columbus garnished with glowing incidents: such as the mutiny of his sailors at sea; his piteous plea with them for the "one day more"; the moving lights on the unseen and unknown shore at midnight; the wild enthusiasm of all that burst forth at the break of day when they saw the shore of the Island "hard abeam." These glowing and

First North American Indians seen in London: introduced in England by Sebastian Cabot in the summer of 1498, before Columbus saw the Continent of South America in August, 1498.

1474-1557

Portrait of Sebastian Cabot, born in Bristol in 1474, died in London 1557, who with his father, John Cabot, discovered the continent of America in 1497-8; who was Pilot-Major of England and served under Henry VII, Henry VIII and Edward VI, from whom he received a pension.

exciting word-pictures have hitherto fired the children's imagination and have made the Columbus story an enchanting epic. Columbus reported he had discovered that the earth was of a "pear-shape"; but the Cabots discovered more nearly its oblate-spheroid form, and so knew that the degrees of longitude diminished as they approached the pole. Hence, they steered a northwest course from England in their search for Cathay, the Eldorado of that age.

These school histories furnish very little information concerning the later life of Sebastian Cabot in England, which is interesting and historical. How he had served as mariner and chief naval authority under three English monarchs—Henry VII, Henry VIII and Edward VI; how he had been Pilot-Major for both Spain and England; how he had been chosen first Governor of the Muscovy Company of London, which sent Sir Hugh Willoughby to explore a northwest course to the East Indies, in 1554, which position he held till he died in 1557. He had inspired some of the London merchants to get Henry VIII to send out two exploring expeditions on this same course. Richard Hakluyt tells how Robert Thorne—a leading London merchant—wrote to the King, as follows:

"There is left one way to discover, which is to the northe, for "that of the foure partes of the world, it seemeth three partes are "discovered by other Princes. For out of Spaine they have discovered "all the Indies and Seas Occidentall, and out of Portingall all the "Indies and Seas Orientall, so that by this part of the Orient and "Occident they have compassed the world; so that now rests to be "discovered the sayd northe partes, the which, it seemeth to mee, is "only your charge and duty. Because the situation of this, your "Realme, is nearest and aptest of all others."

During Elizabeth's reign this same instinct for northwestern exploring expeditions prevailed under her auspices. The first of these was that of Sir Humphrey Gilbert, which had such a tragic ending. Then followed that of Gosnold, in 1602, which was made mainly under the auspices of the Earl of Southampton, and without Sir Walter Raleigh's consent. Gosnold was the first English mariner who endeavored to steer a direct sailing course for the Massachusetts coast, instead of following the usual roundabout Columbus-route by way of the West Indies. He failed in his out-bound voyage, owing to contrary winds, but succeeded on his return. This course has been, more or less, adhered to ever since that date. Apropos of the foregoing Anglo-American sentiment in favor of the Cabots is the

fact disclosed in the directories, available in every large city and town throughout the States and Territories of the Union, of the actual residence of a very large percentage of the present population whose surnames are distinctly of English, Scotch, Irish and Welsh origin. The last census statistics show that this Anglo-American population—descended from the earliest colonists of New England —constitutes about one-fourth of the entire population of the United States. This fact seems to afford one of the strongest arguments that could be presented to leading educationists for giving the Cabots a more prominent place in the Public School teachings. "Blood is thicker than water!" The social and commercial relations now existing between England and the United States—now so intimately united by electric cables and wireless telegraphy—are closer together and more valuable than ever they were before since the seventeenth century, that war or any bad-blood feeling between them is unthinkable.

Both ancient and modern history shows very clearly to us that through the Providence of our Creator and Father there is the beginning and the fullness of time in the discovery and use of the natural resources of earth by mankind. England under the intuition and guidance of the Cabots in the 15th century sought for their Eldorado in the Eastern Hemisphere by the way of the north-west and found North America—the greatest Eldorado of modern time in its marvelous natural resources. Sir Francis Drake landed on the coast of California in 1579, but knew not of the natural wealth in gold it contained. The Spanish adventurers and missionaries were there for two centuries and were blind to the wealth under their feet. William C. Ralston and his co-argonauts of '49 had their eyes fixed on the gold-placers, the gold and silver veins of the Comstock and on the irrigable lands of the great central valleys, but they were blind to the indication of the natural oil resources, which the iridescent sea coast from Santa Barbara to San Diego so clearly revealed. Many hundreds of California and Nevada prospectors had traversed the gold region of Tonopah and Goldfield, but their eyes were blind to the marvelous richness thereof, because they could not find therein the "ear-marks" of their previous experience. The prospectors of Nevada and Utah were blind to the vast outcroppings of copper ore in the Ely and Bingham Canyon districts, which today are the largest deposits known in the world, and which can be mined with unprecedented cheapness. The Oregonians are yet blind to

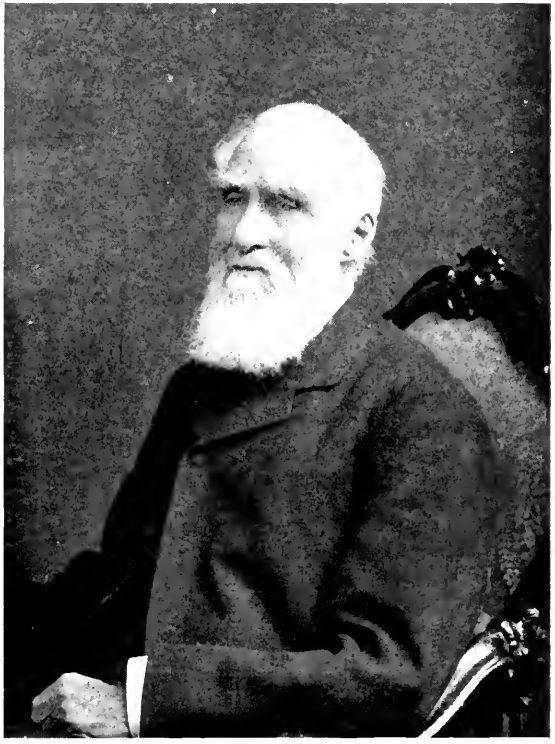
the vast extent and wealth of their oil-fields, which Nature has provided and stored during millions of years in the cretaceous and tertiary rock-formations, both east and west of the Cascade Range, under the most favorable climatic conditions for the profuse life of the animal and vegetable organisms which form the origin of petroleum. Truly there is a Providential Control which at one time blinds and at another time reveals the vast natural resources of Nature to the eyes of men, during duly appointed periods of national upbuilding.

As an English engineer, who had witnessed the early days of the Railway Age in England and in India, I was naturally greatly interested in the construction, working and maintaining of the American great continental railway system from the Atlantic to the Pacific, then in progress. We had been greatly handicapped in making more rapid progress with the work in India, through the lack of the American system of simplification in the way of patterns and counterparts for bridge and locomotive construction. In England and in India we had an abundance of cheap labor, whereas in America the invention and use of labor-saving machinery of every kind of device was an absolute necessity. My trip through North America during 1871 took me through the New England states, portions of the Southern states, the Middle West states and territories and the states and territories of the Pacific coast. I also visited Victoria and the Fraser river, British Columbia. At Victoria I became well acquainted with Sir James Douglas, who was then the Lieutenant-Governor, and the oldest living Hudson Bay Company's factor in North America. He had been Dr. John McLoughlin's first assistant in the Oregon territory; so that his mind was a veritable storehouse of most interesting reminiscences of the adventurous days of the company's employes in that vast region. Dr. McLoughlin had been the foremost commissioner of the company in the Oregon country, previous to its transfer to the United States, and after that for many years he was the grand and noble figure in Oregon. Today Oregonians remember him with love and respect as "The Father of Oregon."

During this period I had met and been entertained with much kindness by Cornelius Vanderbilt, "the Commodore," and the creator of the immense Vanderbilt fortune. I knew William B. Astor, then the head of the great Astor family and the largest real estate owner within the city of New York; he gave over half a million dollars to

the city's largest library. I was personally acquainted with Peter Cooper, the great American inventor, manufacturer and philanthropist; he took me all through his Cooper Union for the education of the working classes. His memory is still held in great esteem by all classes of Americans. Among others I knew well and with whom I became great friends were Cyrus Field, of Atlantic cable fame; Philip Schuyler, whose ancestor was the first American in the 18th century to mine and ship copper ore to Swansea, and to employ English mechanics and machinery in such mining; Alfred Craven, C. E., then chief engineer of the Croton Water Works, which supplied New York; Walter W. Evans, C. E., one of the old pioneer engineers of the Erie Canal; James B. Eads, C. E., who designed the great bridge across the Mississippi river at St. Louis, and who constructed for the government the "blanket-form" of jetties at the mouth of that river; Senator Carl Schurz, at that time one of the brightest intellects in Congress; Thomas A. Scott, president of the Pennsylvania Railroad, and one of the great railway financiers of that day; Jay Cook, who distinguished himself during the Civil War of 1860-2 in floating government bonds, and, later, those of the Northern Pacific Railroad.

At Washington I was kindly received by Sir Edward Thornton, our Ambassador, who introduced me to General U. S. Grant, the President. On my route to California I stayed with General Philip H. Sheridan at Cheyenne; there I had my first hunt with the American bison. At San Francisco, I became well acquainted with William C. Ralston, the cashier of the Bank of California, who was then the greatest promoter and supporter of every kind of industrial progress in California and Oregon; Wm. Lane Booker, British Consul, and Bishop Kip of California, by whom I was married in 1873. In September, 1871, my first professional renewal began. During the winter, spring and summer of that year a severe drought prevailed throughout California, and a general outcry for irrigation arose. I was then in Victoria, B. C., and received word from Mr. Ralston to come and see him. On my arrival in San Francisco, August, 1871, Ralston and his associates persuaded me to stay with them and inaugurate a great irrigation enterprise for the San Joaquin valley. Upon this enterprise I was engaged during the following five years. With the assistance of my staff I made an extensive examination of all the natural water resources of the western slopes of the Sierras which commanded the San Joaquin valley lands. For



Sir William Lane Booker
H. B. M. Consul-General

Wm. Ingraham Kip, D. D.
Episcopal Bishop of California

ALFRED CRAVEN, C. E.

WALTER W. EVANS, C. E.

Two of my oldest and best American civil engineer friends.

the purpose of showing Californians the benefits to be derived from a proper system of irrigation, I placed about 6,000 acres, on the west side of the San Joaquin River, under cultivation and irrigation. The results therefrom astonished and gratified Ralston and his associates, as well as a large party of the leading Californians whom I invited to witness this artificial oasis and reclamation of desert lands. During the winter of 1872-3 the leading men of California sent me on a mission to Washington to interest President Grant, his Cabinet and Congress in the importance of irrigation for the arid lands of the West; as I had shown that such much needed and extensive enterprises were far beyond the ability of private capitalists to carry out. I was enabled to secure the attention and interest of the members of Congress in the matter; so that on the third day of March, 1873, (the day that Grant entered on his second term of office) Congress passed its first (on record) act in regard to irrigation. By this act a commission was appointed to examine into and to report to the next meeting of Congress the required system of irrigation for the San Joaquin, Tulare and Sacramento valleys of California. For the drawing up of this report I furnished the commissioners with ample information concerning the irrigation system carried out by the government of India, and of similar works in Italy and Spain. A digest of these was made in their report. The above mentioned act of Congress and other matters relating to it, are given in the appendices. In 1875, a most severe financial crisis arose in California, during which my friend Ralston died. Enterprises of every economic importance suffered a long-continued blight. My enterprise came to an end. The completed works together with the acquired important water-rights fell into the hands of Miller and Lux, the great landowners. I suffered a heavy pecuniary loss, as I was compelled to sell the 4,250 shares I had in this enterprise (for which I had paid $34,000) to Miller and Lux for $1,000. After a lapse of a decade (during which population had greatly increased and railroad communications had multiplied) the public demand in the Western states and territories again became more emphatic for Government action in irrigation matters. Congress listened more attentively, with the result that the present Reclamation policy and system of the United States was born. In order to carry out the irrigation enterprise in California I had refused the offer, made me in 1872, through Dr. Pole, the Honorary Secretary of the Institution of Civil Engineers, to go to Japan as Chief Engineer of Railways for the Govern-

ment of Japan. I had also declined an offer from the Queensland Government to take the Chief Engineership of the railroad system in that colony. My old friend Richard Vicars Boyle, C. E., who went to India about the same time I did, and who distinguished himself so highly in fortifying and defending the house at Arrah during the mutiny, for which he was rewarded with the C. S. I., went to Japan. During 1876-7 I found employment as consulting engineer, and, for a time, general manager for the Richmond Company of London, whose mines and works were at Eureka, Nevada. This closed for a few years my professional career in America. I have since then witnessed the vast and beneficient effects which have arisen from extensive irrigation on the plains of California. In 1871-2 I had seen them more or less a desert, and very sparsely populated. All these are thickly inhabited today, large cities and towns abound, fruit orchards and alfalfa fields cover millions of acres that once were barren. The value of these lands has risen from $2 an acre to $500, and more, within the life of a generation. California and Oregon fruits supply the Eastern and Middle West markets, as well as the markets of Europe. So I can well be satisfied with the mite, in the way of illustration, I gave during that 1871-5 period.

During my irrigation mission to Washington in 1872-3, among those who were most interested in my work and who gave me warm support, were General A. A. Humphreys, Chief of the Public Works; Dr. Henry, Secretary of the Smithsonian Institution; James G. Blaine, Speaker of the House of Representatives (I was well acquainted with his sister-in-law, Miss Abigail Dodge—known as "Gail Hamilton"); General William T. Sherman; General George B. McClellan and his family; General W. S. Hancock; General John C. Fremont, "The Pathfinder of the West"; Thomas F. Bayard, Senator for Delaware, a most charming man, afterwards Secretary of State, and, later, Ambassador to England; William B. Stewart, Senator for Nevada; Roscoe Conkling, Senator for New York, a great athlete and fine pugilist; Samuel S. Cox, one of the Representatives for New York, and generally known as "Sunset Cox"; James A. Garfield, one of the Ohio Representatives, and, later, twentieth President of the United States; Admiral Charles Wilkes, who had during the forties of the last century, explored the coast of Oregon and the Columbia river, and whose first cousin, Dr. Wilkes of New York, was one of my best friends in America; General Joseph R. Hawley, Representative for Connecticut, another most

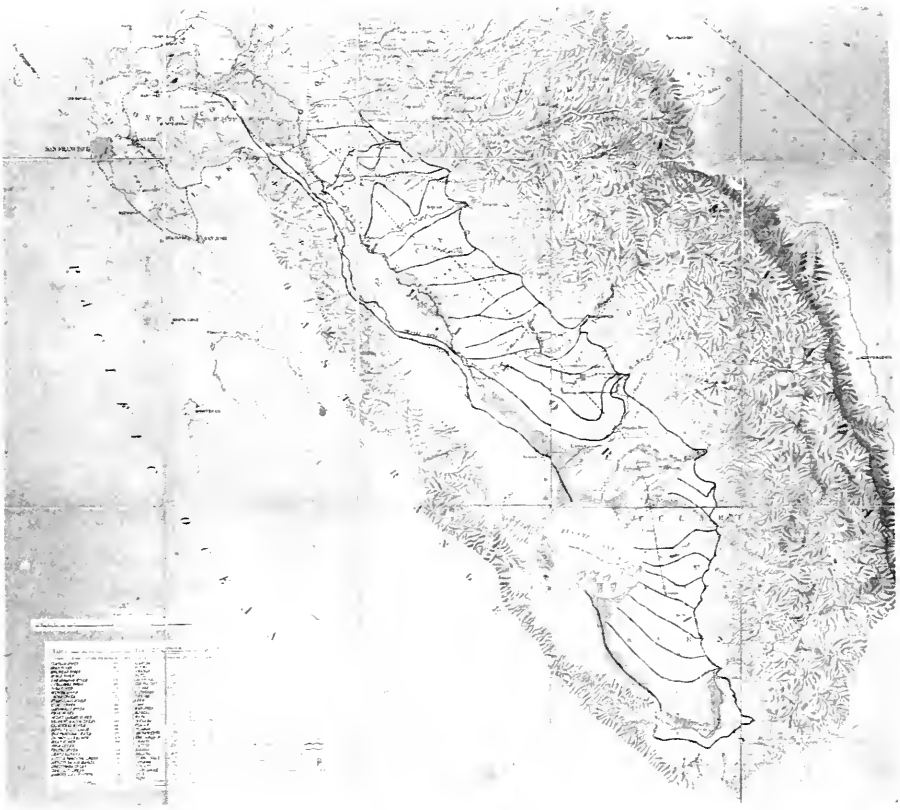
attractive personality; J. C. Bancroft Davis, Under-Secretary of State, he and his charming wife showed me the greatest amount of kindness and hospitality, both at this period and previously, in 1871, when I first visited Washington; and Samuel Ward, then the greatest of "lobbyists" in Congress, he was a thorough gentleman and one of the most genial and kindest hearted of men I have ever met. He helped me greatly in my mission and was my *chaperon* and right hand at the several dinners I gave to the members of Congress and others. This was the only expense I incurred during the six months I remained in Washington on this mission.

During my irrigation enterprise in California, Sir Arthur Cotton was fighting the fight of his life in his controversy with Sir Proby Cautley regarding irrigation in India and their rival designs and accomplishments in that important field. He took the warmest kind of interest in my Californian work, and wanted me to try and induce the government of India to use the labor-saving machinery I was using on my canal building. In the appendices will be found some of his letters to me on this subject, and one I received from Sir Louis Malet, and one from Sir Douglas Forsyth during this period, 1871-6. I had been looking into the merits of the railway-gauge controversy that was going on in England and in India. I had assisted Sir John Fowler, C. E., and Sir Richard Strachey, R. E., in drawing up their reports on the metre gauge for India. I was an advocate for its adoption for immediate requirements, so far as regards embankments and cuttings, but I was firm in the wisdom I had learned while serving under Mr. Brunel and from having seen the dense population in certain parts of India, that all long tunnels, viaducts and bridges should be constructed for a wider gauge service, which would be needed in the future, and when the maximum width and height of the rolling stock possible for narrow gauge lines would prove unequal to the demands of the traffic. I was also interested in studying and comparing the duty and operating of American and English locomotives, and wrote a minute report thereon for the information of the India Office and the Colonial Office, and gave a copy of same to the Institution of Civil Engineers.

The accompanying map of the San Joaquin valley of California and schedule tables of irrigable areas and of mountain catchment areas represent as a whole the irrigation systems I surveyed, estimated on, and set forth in my reports during the period from 1871 to

1876. All of these are embraced in the report which the commissioners made and which was submitted to Congress by President Grant in March, 1874. (See appendices.) The map shows the main canal laid out along the west side of the San Joaquin river, from Tulare Lake to Antioch on Suisun Bay, 180 miles in length, and designed for irrigation and navigation. The map also shows the main catchment canal and its several branches along the east side of that river from Bakersfield on Kern river to Stockton, which was 240 miles in length, not including the several branches. These two systems embraced an irrigable valley area of about 12,500 square miles, or 8,000,000 acres of more or less rich lands, which at that time were subjected to frequent periodic drought, containing a very sparse and scattered population, no railroad conveniences, and used mainly for cattle and sheep ranges. The main portion of the catchment areas—of about 30,000 square miles—comprised the western slope of the Sierra Nevada range. At this period the measured annual precipitation of the valley, south of Stockton, averaged only six inches. The average annual precipitation (rain and snow) upon the western slopes of the Sierras, east of the valley, increased from about eighteen inches in the foothills to fifty-eight inches at the summit, showing an average depth of about fifty inches over the main portion of the catchment area. This available natural water supply furnished the confidence I then entertained in the future success of an extensive irrigation system for this great valley. The traveler by railroad today along this valley, from Stockton to Bakersfield, can obtain ample evidence of the outcome I foretold nearly forty years ago. Old Henry Miller (firm of Miller & Lux), of San Francisco, can testify to the marvellous transformation of the valley throughout, better than any one now living, for he has known it intimately for over half a century.

The company I represented possessed none of the lands subject to irrigation from the canal systems. It had secured the water-rights and right-of-way for the enterprise, and its policy was to levy certain rates per acre for the use of the water. I soon saw that this would not prove a profitable or an equitable arrangement for the company. The lands that could be irrigated by our enterprise were mainly owned by Miller & Lux, William S. Chapman, Isaac Friedlander, Timothy Paige and T. Grayson. Miller and Lux were cattlemen and controlled the San Francisco meat market, and did



Map showing R. M. Brereton's projected irrigation system of canals in the San Joaquin Valley, 1871-6.

TABLE

Showing Area in Square Miles of Catchment Basins.

NAME OF RIVER OR CREEK	Catchment Area Square Miles
Kern River	2,382
King's River	1,889
San Joaquin River	1,631
Tuolumne River	1,514
Merced River	1,073
Stanislaus River	971
Cache Creek	1,025
Stony Creek	591
Cosumnes River	590
Puta Creek	584
Mokelumne River	573
Walker's Basin Creek	461
Calaveras River	390
Arroyo Los Gatos	343
Big Panoche Creek	319
Chowchilla River	304
Bear River	300
Posa Creek	278
Fresno River	258
Cantua Creek	164
Little Panoche Creek	136
Arroyo De Los Banos	125
Orestimba Creek	125
San Luis Creek	81
Arroyo Del Puerto	79
Total Square Miles	16,130

TABLE

Showing Area in Square Miles in Each County, and Area of Valley Irrigable Compared with Catchment Area of Mountain.

NAME OF COUNTY	Area of Valley Square Miles	Area of Catchment Square Miles	Total Square Miles
Alameda	6	74	80
Calaveras	.....	1,037	1,037
Contra Costa	159	177	336
Fresno	3,270	5,560	8,831
Kern	2,798	2,642	5,440
Mariposa	.....	1,418	1,418
Merced	1,312	607	1,919
San Joaquin	1,271	121	1,392
Stanislaus	1,015	504	1,519
Tulare	2,476	3,270	5,746
Tuolumne	.....	1,942	1,942
Totals	12,307	17,352	29,659

not care to be bothered with settlers on their lands; the others held their lands for speculative purposes and expected to realize enormous profit from the sale of them as soon as we furnished the water. The water, therefore, was of no financial value without the land, and the land was useless for cultivation and settlement without the water. After constructing forty miles of canal and putting six thousand acres under irrigation, to show the innate richness of the soil, and through that evidence proving the great future value of the enterprise, I proposed that the landowners should join hands with the company by putting 100,000 acres of irrigable land to combine with the water enterprise. That they should receive for the same 100,000 shares of the company, at the par value, $25 per share, or $25 per acre, the same land being, at that period, assessed at one-tenth of that value. I estimated that the cost of irrigating these lands would be $25 per acre. This would make the working capital required for the 100,000 acres $2,500,000. Mr. Ralston suggested that I should go to London and endeavor to raise this working capital. I went to London in 1874-5 and got friends there to form a syndicate to provide this amount of money on the understanding that the 100,000 acres should form the security basis for this investment. The landowners, however, backed out of this proposition; so I had to abandon the syndicate arrangement. With the exception of Miller & Lux, all the landowners went bankrupt during the financial crisis of 1875. They had previously mortgaged their lands to the Bank of California, which foreclosed on them.

Many years after, my friends, William Alvord, president, and Thomas Brown, cashier of the Bank of California, told me that this mortgage on these lands by Ralston had proved an excellent investment for the bank, by which it had realized a very large profit. Alas! for Ralston, he died broken-hearted at this financial crisis through the cold-blooded desertion in his hour of need of those he had most helped to become millionaires in California and who possessed the financial ability for his rescue. I was at the great public meeting held in Union Hall, September 8, 1875, to express the public sense of the loss California had sustained by his death. There were fully eight thousand of his friends at this meeting. I was one of the ninety elected vice-presidents thereof. Among these were John W. Taylor, Colonel W. H. L. Barnes, General John Hewston, Louis Sloss, Rev. A. L. Stone, Rev. Horatio Stebbins, Wm. F. Babcock, H. M. Newall, Wm. T. Coleman, Henry T. Scott, Irving M.

WILLIAM C. RALSTON—1872

California's greatest Captain of Industry and promoter of development and progress among the Argonauts of '49 in San Francisco.

Scott, I. Friedlander, Peter Donahue, H. B. Tichenor, J. C. L. Wadsworth, J. R. Keene, Rev. John Hemphill, D. D. Colton and Wm. M. Lent. All of Ralston's great fortune went to meet the claims of the depositors. California never had before, nor since, so great an industrial backer or so enlightened and far-seeing a promoter of the development of its vast natural resources.

South Africa

During 1878 I was engaged as consulting engineer by a syndicate formed by Cecil Rhodes, of Kimberley, S. A., and my old friend, Thomas Rudd, chairman of the South Africa Gold Fields Company in London, for the supply of water to the diamond mines, and in the furtherance of the railway from Cape Town to Kimberley.

County of Norfolk

1879-85

In 1879 I was appointed by Quarter Sessions, surveyor of the roads and bridges of my native county. This was a new position created by the county authority to carry out the provisions of a new act of Parliament in regard to the management and maintenance of the public roads throughout England. I found this a very arduous and tedious work. It called for consummate tact, patience and perseverance on my part to overcome the many long-continued and deeply-rooted prejudices of the land-owners, tenant-farmers and other rate-payers who had lived all their life under the former parochial system of maintaining the roads, and, yet, who wanted good roads, but begrudged the cost. The old turnpike system of making and maintaining what were the main roads before the introduction of the railway innovation, had become obsolete because the railway lines had diverted the traffic along other roads which before had only little traffic over them and which now required the outlay of considerable money to meet the requirements of the public. As this money had to be provided out of the parochial rates and the roads maintained to a much higher standard than ever before, in order to obtain contributions from the county treasury, it is easy to imagine how great was the "kick" against the new order of things and the open and secret hostility I had to overcome. The new Highway Act was most unjust in the case of the limited area of parochial assessment. The idea of its framers was to create a system of districts and to indirectly abolish the parochial management. But in conservative old England any innovation for the public benefit was sure to meet with private opposition of one sort or another. I had had full experience of this twenty-five years before when engaged in surveying the early railway lines through private properties for a right-of-way. I worked hard and faithfully in this extensive field for six years, and at the end of it I had succeeded in winning the appreciation of the bitterest of my former opponents. The entire community expressed regret at my leaving. A testimonial of appreciation of my services was presented me; this was signed by the High Sheriff, the Lord-Lieutenant, the Prince of Wales, and by nearly all the principal land-owners, tenant-farmers and other rate-payers in the county. Copies of these are given in the appendices.

We the Principal Landowners and Ratepayers of Norfolk desire to record our hearty appreciation of the efficient manner in which, during the past six years, our County Surveyor of Roads and Bridges, Mr. Robert Maitland Brereton C. E. has performed his County duties.

We consider that by the energy ability patience and tact he has displayed during this period he has fairly earned this Testimonial.

We are sorry that the County is about to lose his services and we trust that this Testimonial may assist him to obtain an appointment wherever he may go.

[illegible]	High Sheriff	March 7th 1885
Leicester	Lord Lieutenant	Jan 1885
Albert Edward P.	Sandringham	January 1885
Dl. Probyn. Lt. Genl	Comptroller & Treasurer to H.R.H. The Pce. of Wales	January 1885.
J. T. Norwich	Bishop of the Diocese	January 1885
Kimberley	Secretary of State for India	Jany. 1885
Wodehouse	Witton Park	January 1885
Albemarle	Quidenham Hall	Feb - 1885
Walsingham	Merton Hall	Feby 1885
Rosebery	Postwick Hall	Feb. 1885
Suffield	Gunton Park	Feb - 85

Facsimile of Testimonial given to R. M. Brereton by the County of Norfolk, bearing the autographs of the Sheriff, the Lord Lieutenant, and the present King of England, then Prince of Wales.

Mining Experiences

Previous to my entry into the civil engineering line, under Mr. Brunel's auspices in 1853, I had taken courses in practical mechanics, etc., at King's College, London. I had also attended geological and mining lectures in the Royal School of Mines in Jermyn street, given by Sir Roderick Murchison and Dr. John Percy; the latter was a personal friend for many years after. During my service under Mr. Brunel on the Saltash bridge and in the construction of the Cornwall railway, I had many opportunities of visiting some of the large copper and tin mines and seeing the methods of ore treatment. During my stay of a few years at Nagpore, India, I had the privilege of an intimate friendship with Dr. Hislop, the missionary of the Presbyterian Church of Scotland, who had studied geology at St. Andrews, and who was a really good geologist—with him I enjoyed many a geological ramble. My special attention to mining and geological matters was given during my intermittent sojournings in North America. My observation and practical experience in these lines were mainly obtained on the Pacific Coast and in Montana. In November, 1871, I examined and reported on the North Bloomfield placer mine and its extensive water-supply system for Mr. Ralston. My friend, Hamilton Smith, C. E., was then in charge of that property. During 1876-7 I was connected with the management of the Richmond mines and reduction works at Eureka, Nevada, as consulting engineer and general manager. In that work I engaged the services of my friend, James D. Hague, M. E., one of the best and most experienced mining experts in the United States. I also secured the services of Anton Eilers, the most experienced metallurgist of the day in the lead and copper smelting and refining business, and had Professor Thomas Price, of San Francisco, who had been trained at metallurgical works in Swansea, to assist me from time to time. In 1885 I was general manager of the Montana Company's mines and works at Marysville, Montana.

In connection with mining and geological experiences, I had the pleasure of knowing well Professor Joseph D. Whitney, U. S. Geologist for the State of California; Professor Jean L. R. Agassiz, the Swiss-American Geologist and Naturalist; Clarence King, the organizer of the present U. S. Geological Survey Department and a leading geologist and mining expert; Melville Attwood, M. E.;

Louis Janin, M. E.; Professor Thomas Egleston, M. E.; A. J. Bowie, M. E.; O. Hofmann, M. E., and A. D. Foote, C. E.

During the past eighteen years I have been engaged as consulting engineer in examining and reporting on the geological, mineralogical and mining features of nearly all the principal mineral districts of California, Nevada, South Dakota, Oregon, Washington, Idaho, British Columbia, Southeastern Alaska, and the Northwest Provinces of Canada. I have found the study of these natural resources most interesting and most instructive. But in regard to the financial operations connected with the promoting and working of mines in North America, I have personally known such an utter lack of morality and good faith and such a selfish plundering of the public on the part of the insiders, that I have found this branch of my professional career to be the least agreeable and satisfactory of any I have known many friends ruined in fortune and reputation by the selfish rascalities practiced on a gigantic scale by promoters and owners of such properties, and I have in a pecuniary way suffered heavily myself therefrom.

Promoters with their agents in London and in America have been most unscrupulous in their extensive operations and had fooled their reputable associates. I had warned Lord Dufferin and others to be on their guard in their association with Whitaker Wright, but my warning came too late to save them. In 1888-9 I was offered good positions in the Transvaal, S. A., but my inside knowledge of the wild financial operations in London and at the Cape and my distrust of the Boer element made me decline them.

THE LATE DUKE AND DUCHESS OF SUTHERLAND, COUNTESS OF CROMARTY

Scotland

1886-88

In June, 1886, the late Duke of Sutherland appointed me his commissioner in the highlands of Scotland, and also one of the directors of the Highland Railway. At this period the Crofter and Cottar communities around the north and west coasts of Sutherland and Rossshire and in the interior were in a very dissatisfied and unruly state of mind and were committing considerable mischief. At a recent election of a member of Parliament for Sutherland, they had rejected their former and natural representative, Lord Stafford, and had elected an outsider. This was a great disappointment to the Duke and the Sutherland family. The position of commissioner of this very large estate (the largest in Great Britain), embracing about a million acres in the counties of Sutherland and Rossshire, and containing the largest population of crofters in Scotland, demanded the exercise of the utmost firmness, tact and conciliatory manner in dealing wisely and humanely with this disturbed community.

In the Highlands the spirit of progress and enlightenment in human well-being was flowing in; the old feudal style of authority and subjection was rapidly weakening. "Old times had changed, old manners gone!" The former management of the crofter community had been mainly and closely in the hands of local factors serving under the commissioner, who was the Duke's representative in all matters. Some of the factors had been holding their local dictatorial authority over the crofters for nearly a life-time, so that the factorial authority was bitterly hated and resisted by the crofter generally at this period. The factors were being constantly abused and insulted; one of them was dosed with rotten eggs. Such was the condition of affairs when I went to Sutherland in June, 1886. These large estates of the Duke and Duchess consisted of deer forests, salmon rivers and lochs, mixed shootings and fishing, and sheep farms, more or less surrounded by crofter holdings. It seemed to me that my best policy to follow under these very unfavorable conditions was one of a more democratic spirit and less of the aristocratic one, which had previously been the rule. I therefore made it my business to go freely and fearlessly among the crofters and face to face listen patiently to their alleged grievances and wants and assist, so far as my powers and duties to the estates permitted, in

the well-being of the crofter community. This policy did not please the factors, who were four in number, but it pleased the crofters and their leaders and lessened in large degree the spirit of mischief and made me popular with the sportsmen and sheep-farm tenants and Free Church ministers in Sutherland. During my holding the commissionership I never received the slightest disrespect or was shown any ill-feeling on the part of the crofters. The resident sheriff-substitute of the county, who had not been on cordial terms with my predecessor, maintained most pleasant official and social relations with me. Mr. R. Macdonald, M. P. for Ross and Cromarty, and Mr. Angus Sutherland, M. P. for Sutherland, both of whom represented the crofter interests in Parliament, also gave me their co-operation. I assisted them in persuading Mr. Joseph Chamberlain, M. P., and Mr. Jesse Collins, M. P., to visit Sutherland and Rossshire and talk to the crofters in the furtherance of their welfare; in the quieting of their mischievous and unruly spirit towards the principal land-owners, and in advocating emigration of the young people to Canada and the coasts of British Columbia. I gave the crofters along the coast and in the interior lectures on the natural resources of the sea in the way of fishing industry, and of the same in British Columbia which I had seen. I pointed out to them how small were the agricultural profits from the lands they were craving for, owing to the unfavorable climatic conditions; how the Duke had, as they well knew and seen, expended a large amount of capital in trying to reclaim such moorland, and had failed to achieve any economic success, since nature fought against such enterprise. What was thought of my management of the Sutherland estate by the crofters, sheep-farm and sporting tenants during the time I held the commissionership is shown in the appendices.

During the entire period of my business and personal relations with the Duke and Duchess I never received an unkind word or complaint from either of them. The Duke's letter to me of June 5, 1888, and the Duchess's letter of November 9, 1888 (given in the appendices), show their real feelings towards me. Lady Stafford afforded me the greatest possible help with the crofter community by her philanthropic enthusiasm and persevering efforts in the inauguration of an annual bazaar at Golspie for the sale to southern visitors of their excellent hand-made productions, which resulted in substantial pecuniary benefit to them. Lady Stafford thought that still better prices could be obtained for their woolen goods if the scent of

peat-smoke could be avoided, and so she requested me to look into the matter. As peat fuel was the only one the crofters had, it was natural that their wools and cloth therefrom would be, more or less, tainted with this odor. So in my mission amongst the crofters I advised them to keep the wool and the cloth exposed as much as possible to the air and wind. The crofters readily agreed to this suggestion, as they saw the prospect of obtaining better sales.

Unfortunately for me, the hostile element working against my democratic policy in the management, made false statements to Lord and Lady Stafford in the matter, saying I had in my addresses to the crofters stated that Lady Stafford could not sell their woolens by reason of the "peat-reek," and hence it was represented to Lady Stafford that the crofters were incensed against her philanthropic efforts by having cast a slur upon their work. Naturally, Lady Stafford felt this keenly, and so Lord Stafford wrote to me complaining about this alleged mischief on my part. The letters I received from the ministers among these crofters (which appear in the appendices) show very clearly that there existed no ground whatever for such misrepresentations.

North America Again

1889-1908

In 1889, after retirement from the commissionership, I again returned to North America with my young family. I had been appointed consulting engineer and general manager of an extensive gold mining property on Douglas Island, in southeastern Alaska, which had been reported on as possessing great promise. Upon a careful examination of the property, I found it had been heavily "salted" by the vendors and was utterly worthless. The vendors had fooled the experts who had been sent out to examine the property, by having dosed the quartz outcrops and the extensive diamond-drill cores, first with sulphate of iron and then with chloride of gold obtained from the chlorination works of the adjacent property. Also by bedding many hundreds of tons of eight and ten-dollar ores from the adjacent mine with consummate skill along the vein, below the surface, and afterwards in covering the same over with the thick Alaska moss, which rapidly, in that moist climate, assumed a natural appearance. The quartz on the two properties was identical in outward appearance and in being mineralized with iron pyrites, so as to deceive the eye of the very elect. Over two years had been spent on this clever and extensive system of "salting." The vendors' assayer, who had invented this process, had been paid $25,000 for his services. The vendors were prosecuted in the San Francisco courts, the evidence against them being complete, but owing to the tedious delays and appeals the trial occupied a long period, during which two of the principal sinners died, and the two who possessed most of the plunder became bankrupt through large investments in unprofitable coal properties in California. These could have been convicted and sent to the penitentiary, but the money could not have been recovered, so further legal proceedings were dropped.

The English and German investors lost over a million dollars by this swindle. I lost through it $60,000, and had to start life afresh on my professional basis. Having a young family of boys to educate and train, I could not afford to return home to seek another position of importance, and during this time some of my most influential friends in England had died. During the past eighteen years I have been following my profession as a consulting engineer in the fields of irrigation, real estate and mining of a more or less fortuitous

character. I have been blessed all these years in Oregon with continuous good health and good spirits and great activity in body and mind. I have found in Oregon the finest climate on earth, a state possessing great natural resources in field, forest and mine, most inviting to settlers and capitalists; and, lastly, and not least, I have found many good friends among all classes.

A Word for Portland Oregon

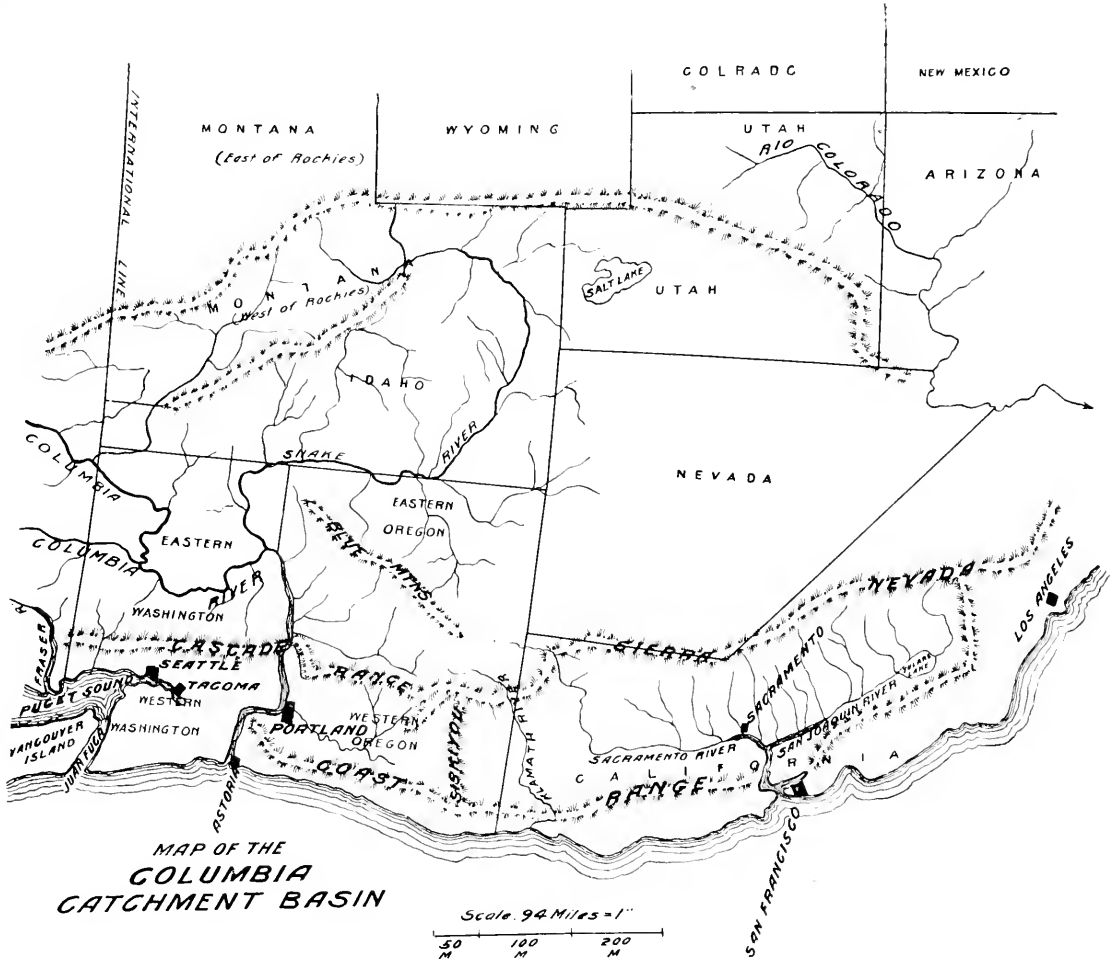
Columbia River, the great river of the West, forms the backbone of Portland's present and future outcome. As the combined Mississippi and Missouri Rivers represent the watershed-area of the Middle West, and the Mackenzie River that of the Northwest Provinces of Canada, so does the Columbia River with its great Snake River and Willamette tributaries represent the watershed-area of the Northwest portion of the United States. The accompanying watershed map and the following schedule of the watershed-area of the Columbia River, in square miles, furnish the best comprehensive indication of the magnificent future of Portland.

WATERSHED IN SQUARE MILES.

Within State of Montana	300×100=30,000
Within State of Idaho	450×160=70,000
Within State of Washington	200×200=40,000
Within State of Oregon (East)	200×200=40,000
Within State of Oregon (West)	150×100=15,000
Total	195,000
Within British Columbia	30,000
Grand total	225,000

Excluding the area north of the International line, the total watershed of the Columbia basin covers about 125,000,000 acres. Assuming that forty per cent. of this area is available for agricultural purposes, that gives 50,000,000 acres for settlers; a large portion of which is irrigable. Hence, it is possible to foresee a population therein of fifteen millions; such is Portland's future business outlook.

San Francisco, Tacoma and Seattle possess no similar waterway connection with the country east of the Cascade and Sierra Nevada ranges; such as forms the bulk of Portland's future trade. San Francisco, in this agricultural aspect, has only the Sacramento and San Joaquin Valleys, the watershed of which contains about 60,000 square miles=38,000,000 acres, forty per cent. of which gives 15,000,00 acres for agriculture. Then Portland has an interior forestal backing in the way of lumber greater than San Francisco, Tacoma and Seattle combined. San Francisco has only two


COLRADC
NEW MEXICO
MONTANA
(East of Rockies)
WYOMING
UTAH
RIO COLORADO
ARIZONA
INTERNATIONAL LINE
MONTANA
(West of Rockies)
SALT LAKE
UTAH
IDAHO
COLUMBIA
SNAKE RIVER
NEVADA
EASTERN OREGON
BLUE MTNS
EASTERN WASHINGTON
COLUMBIA RIVER
CASCADE RANGE
SEATTLE
TACOMA
PUGET SOUND
WESTERN WASHINGTON
FRASER
VANCOUVER ISLAND
JUAN DE FUCA
PORTLAND
WESTERN OREGON
COAST RANGE
KLAMATH MTNS
ASTORIA
KLAMATH RIVER
SIERRA NEVADA
LOS ANGELES
SACRAMENTO
SAN JOAQUIN RIVER
SACRAMENTO RIVER
CALIFORNIA
SAN FRANCISCO
MAP OF THE
COLUMBIA
CATCHMENT BASIN
Scale 94 Miles = 1"
50 M
100 M
200 M

railroad systems, the Southern Pacific and Santa Fe; Portland will very shortly have four railroad connections—the Southern Pacific, the Northern Pacific, the Great Northern and the Canadian Pacific systems. San Francisco has its splendid natural harbor, and so possesses a great marine and commercial advantage. From an engineering point of view there can be no doubt about a forty-foot depth of river channel being secured and maintained between Portland and the open sea. The vast extent of back country through which the Columbia and its tributaries flow (so rich in the natural resources of "field, forest and mine"), fully justifies the expenditure of the needed capital upon the improvement of the Columbia River and its main tributaries. During the past twenty years my professional engagements have carried me throughout the vast watershed-area of the Columbia River. I have seen and studied the wonderful natural resources therein, and, hence, I dare to predict that Portland is bound to become the largest and wealthiest commercial and manufacturing city on the Pacific Coast. Its temperate, healthy climate, the vast natural resources of the interior, the abundance of water-power available from hundreds of sources and a most beautiful surrounding country cannot fail to attract and hold both population and capital.

Furthermore, I believe it possible, and even probable, for Portland's more rapid growth in population and wealth in the near future, through the development of the now occult and wholly unexplored natural resources of what should be Oregon's own oil-fields. My faith in the existence of these is based upon the fact that the oil-fields of California are mainly found in the geological strata known as the Miocene or Neocene sandstones and shales, and, more especially, in the geological horizon of the Middle Miocene rocks. Oregon possesses, from my own personal observation and study, a far greater area of these oil and gas Miocene formations than California. In Eastern Oregon, especially, and in the Willamette Valley to less extent, these Miocene formations abound. In Eastern Oregon these are known to be fully 3,000 feet in vertical thickness, and extend in width over one hundred miles. These are marvelously rich in fossiliferous, diatomaceous and foraminiferous organic materials of marine origin. These form the accepted sources of petroleum, bitumen and asphalt on the Pacific Coast. Before the Cascade and Coast ranges of mountains were elevated the waters of the Pacific Ocean extended eastwards to the western slope of the Blue Mountains, and these Miocene strata formed the bed of that ocean.

The fact that petroleum is recognized as being associated with salt or marine materials adds significance to the probable value of these vast fossiliferous deposits in Oregon. The tremendous force and extent of the upheaval of these mountain ranges caused the pressure and heat in these Miocene strata which have made them metamorphic, anticlinal and vastly disturbed. Through this squeezing and crumpling process on these rich vegetable and animal-organic strata, petroleum, bitumen and asphalt would be the outcome. Hence, as 40 years ago I ventured to predict for California vast material betterments from irrigation of the semi-arid lands, so now I venture to predict the same for Oregon, both from the irrigation of its arid lands and from research of its vast marine fossiliferous sub-lying strata. I would say to my Oregonian friends: "Seek by deep-test-sinking and you may probably find your oil-measures; from which Portland and the state at large will prosper exceedingly."

In this connection it should be well borne in mind by capitalists that a considerable area of these marine Tertiary formations in Eastern Oregon are overlaid by Pliocene and later geological sedimentary deposits and Columbia basaltic lava-flows; also, that they are underlaid by the Cretaceous formation, in which, so far, fossiliferous materials are not so abundant, or encouraging to petroleum findings. Hence, in order to avoid useless expenditure of capital in test-sinking exploration-operations, skillful and experienced geologists and civil engineers should be employed in the supervision of the exploratory operations.

The foregoing history of my active and continuous professional services, embracing a period of fifty-four years in the Eastern and Western Hemispheres of earth, exemplifies what an English civil engineer, like hundreds of others, can find to do in following usefully his noble and ever-needed profession. The institution of which I have been a member since January, 1865, was formed in June, 1828, primarily with the object of "promoting the art of directing the great resources of power in nature for the use and convenience of man." I sincerely trust that it may serve to encourage younger engineers to show grit and perseverance in following their profession, and to realize the most important fact that a good name and a conscience "void of offense towards all men" are better than riches and will give them the best kind of peace of mind to the end of this earthly life. The practical and varied experiences of over forty years in England, Scotland, India and North America have taught

me how hard is the endless fight for honesty, and for the righteous performance of duty, for the progress and betterment of the world against the open and insidious forces of selfish conservatism, and what Americans term "graft." I had to struggle against this natural selfish and wolfish nature of the human in India as represented by the contract system. I underwent the same conflict in America in the cases of the Richmond, Montana and Alaska mines. I fought the same fight in my native county of Norfolk, wherein the absurd and unfair parochial system of maintaining the much-used public highways had to be overcome, and in which the political element, for the sake of keeping and winning votes, was my open and secret opponent. I met with the same opposition in the Highlands of Scotland from a small cabal of factors and others, who wanted to maintain their former unfair authority over the crofters, which had caused them to revolt, and who desired to retain, for their own selfish aims and patronage, the Duke's shootings and fishings.

The spiritual side of man being the primal and the eternal one, and the representative of the real "ego" or individualism of the human in creation, is naturally, to oneself, the most important subject of thought in this life. So I review the past and the present personal experiences gained in boyhood, youth, prime of manhood and old age. Brought up from infancy in the doctrines and dogmas of the Church of England, I had naturally been fully impregnated with them, and had, more or less, lived up to them until past my physical prime. I had witnessed and studied the human spiritual faith of the white, brown, red and black races of Europe, Asia, North America and Africa, and, in a limited measure, had considered the outcome thereof. The first important impression on my mind in regard to the spiritual and ethical sides of living humanity I gained from my acquaintance with Dr. David Livingstone in Bombay during the winter of 1865, just before he left for Zanzibar on his last return to Dark Africa. I had listened with the greatest interest to his recitals of his life and experiences among the Hottentots, who were on the borderland of the human and the ape. These revealed to my mind most forcibly the remarkable difference existing in the spiritual and physical conditions of humanity within the British Empire. The antipodean difference in the standard of civilized spirituality and morality within this world-wide empire was, and still is, most striking to every thoughtful mind. Therein was our beloved Queen Victoria on the throne of England, who represented womanhood at its best and all that was pure and righteous in the highest sphere of England's social life; and therein was the brutish Hottentot and the Black Indigene of the Australian bush. I then remembered that our race had lived in the stone age and were barbarians and given to human sacrifices under the druidical theocracy but 2,000 years back in the era of earthly life. This realization made me comprehend better than ever before that though our Creator had made all races of man on earth physically of one blood, He had started them in this earth stage of eternal life from a very low round of the ladder of evolutionary progression. This made me appreciate the truth and the caution in those words of our Christ, "I judge no man." Our Creator and Father alone can be the judge of the measure of each human conscience of good and evil, which

alone is the measure of its moral development. I realize, too, that we are the parents of our children's physical bodies only. "Call no man on the earth your father; for One is your Father; He is in heaven," was the teaching of Jesus, who also preferred (in this sense) to call himself the Son of Man, thus making God *The Man.* This, too, made me realize that this physical world of ours is intimately associated and intermingled with the spiritual, or more refined realms of matter, which human intellect has failed to fathom; that there are myriads of human-spirit entities awaiting their destined moment of incarnation; among whom are those of antipodean difference in spiritual and ethical characteristics. We parents, however highly civilized and refined we be, cannot control this destined flow of emigration of immortal human entities into our family circle and social life in this world. Everywhere we see its actuality in what we are apt to term the "black sheep" in so many families. It seems to me that this undeniable evidence should serve to call out our highest charitable sense of humane action in our treatment of criminals and insane, and in our fuller charitable feelings towards all men, civilized and refined, as well as ignorant and brutish. I recognize the difference between the hereditary physical attributes, strength and weakness, of the bodily framework and the hereditary spiritual outcome in mind and individuality. The former is purely of a temporal and materialistic nature; the latter is of an eternally upward predisposition through its origin. It is only from the latter that we are able to realize the full force and meaning of the Brotherhood of Man and the Fatherhood of God. I do not say that personally I believe from faith and a Christian training, but that I now *know* from personal instinct, and review of a long life, that I and all mankind are spirits from the Alpha and to the Omega of our eternal life. Our life here seems to me like a chess-board and variety of movable figures thereon, controlled or ordered, *nolens volens* on our part, by what we are wont to term Providence, destiny or fate. I further realize that the truest happiness and the best spiritual and physical health we can enjoy in this life, from boyhood to oldest age, is found in active, useful and constant physical and mental employment and activities. Nature "abhors a vacuum," and, in the animated world around us, shows us that the busy bee and the ant, and not the drone, serve to develop the useful features and resources of mundane existence. Hence from this knowledge and observation I believe that our next stage in life will demand and develop the

same progressive outcome of activity and strenuous endeavor for which we shall be fitted by a more refined condition of body. In this life we perceive two living forces at work—the automatic and the voluntary. The automatic action of the heart, lungs and digestion never ceases, never is weary. On the other hand, the muscular and nervous systems, being under the control of the will, need the intermissions of rest and sleep.

Those of my old friends and acquaintances still living will, I feel sure, appreciate some of these old-time reminiscences.

ROBERT MAITLAND BRERETON.

Woodstock, Oregon, February, 1908.

APPENDICES

Professional Services in
ENGLAND
SCOTLAND
INDIA
NORTH AMERICA
SOUTH AFRICA

Indian Mutiny Period

BOMBAY PRESIDENCY

TROUBLE WITH THE KHANDEISH BHEELS IN 1858

Mandoor, Khandeish, January 21, 1858.

R. W. Graham, Esq.

My Dear Sir: There has been a fearful business here. Five hundred Bheels got into a formidable place in Sakee (River), just where the road from this to Nandgaum crosses, night before last. They looted the whole of my kit, smashed my instruments, and I had two most wonderful escapes from certain death. About 450 troops of all sorts attacked them about 11:30 yesterday and could do nothing against the rascals, who were invisible. Montgomery, head of the police, severely wounded; Stewart of the Nizam's killed; Davidson of the Twenty-first very dangerously, and Chamberlain of the Twenty-first; four officers out of seven, and over 60 men killed and wounded.

The Bheels had the best of it and repulsed the whole force three times and ultimately kept their own (ground). I was for three hours under fire; it was a horrid sight to see the fellows knocked over. The Bheels took my gun and rifle and ammunition.

The old (Bheel) watchman of mine was the leader of the party who plundered my kit and he smashed my theodolite. I have sent word to Hawkes and Blake to go into Malligaum directly, as the authorities say they are not safe. I have told them to let Pocock know. You had better not come this way, unless with great care, as no one knows where the Bheels may be; there is another force of them somewhere about. The Bheels are sure to be furious and excited after their victory, such as it was. I will let you know further particulars in a day or two; I am writing under difficulties. I am not safe anywhere alone for thirty miles round. The whole of my cooking pots and pans are gone and warm clothing; in fact, all my valuables. I have had a wonderful escape on two occasions and can but be thankful. They have sent to Malligaum for guns, and till these arrive nothing will be done against the Bheels.

(Signed) R. M. BRERETON.

R. W. Graham to James Berkley, Chief Engineer.

Nassick, Jan. 23, 1858.

My Dear Berkley:

I enclose you a letter received last night from Brereton, giving an account of an attack on his tents by the Bheels, and the very disastrous affair in which our forces were worsted, on the following day. I take this opportunity of expressing my hope that the company will not allow him to suffer any pecuniary loss. He has suffered directly from the disturbed state of the country, and in consequence of his steady and persevering discharge of his duties in a district which has for long been more or less threatened.

A report from the officer in command to Mr. Chapman, who is with me, fully confirms all the particulars in Brereton's letter. It has been a most disastrous affair.

(Signed) R. W. GRAHAM.

R. M. Brereton to J. J. Berkley, Chief Engineer.

Munmar, Feb. 5, 1858.

My Dear Sir:

I beg to submit, for your kind consideration, the enclosed list of articles of property, looted and damaged by the Bheels on the 20th ultimo, trusting that you will submit the same to the company as a claim for compensation.

As no precaution on my part could have prevented the loot, and as I have jeopardized my life and property for the last three months in a district peculiarly dangerous, from the shelter it affords to the Bheels, owing to the dense jungle and hilly country, I hope the company will not object to my claim for compensation. The recent fight will, I think, sufficiently show the dangerous character of the Bheels, and what little mercy one may expect from them now, if placed in an unprotected and isolated position. The danger, however, I have most to fear is from a Ramoosee and about twenty of the Issool Bheels. This man was in my employ for several months, and when the first rising of the Bheels in these parts took place he bolted and joined the rest. He and the Issool Bheels were the parties most active in the looting of my kit on the twentieth, and he has sworn to

kill me should he get a chance, for having, as he imagines, given intelligence to the police authorities and been the cause of their being disarmed a few months since. If, therefore, the company will allow me the protection of a guard till the authorities have reported the country to be safe again, I shall be quite willing to continue my field operations; but without a guard, I do not feel disposed to give the Bheels a further chance at me; particularly after what I have undergone lately, and the narrow escapes I have had. The few articles that the Nizam's cavalry found after the fight, I had to pay one hundred rupees to get, as their officer stated that all property found after a fight was "loot" and at the finder's disposal.

(Signed) R. M. BRERETON.

J. J. Berkley to W. Langdon, Secretary, G. I. P. Ry. Co.

Bombay, March 6, 1858.

Sir: I have the honor to report that on the twentieth of January, last, while Mr. Brereton was zealously discharging his duties to the company, his camp was surprised by a large gang of Bheels, who were immediately afterwards attacked by Capt. Montgomery's force. Mr. Brereton behaved with much coolness and judgment and had a miraculous escape for his life.

I enclose a note from Mr. Brereton to myself, dated the fifth of February, a schedule of his losses and a note from Mr. Graham testifying to Mr. Brereton's zeal in the company's service, and to the inevitable character of the attack that was made upon him.

Under the circumstances of this case, I trust the committee will allow compensation to be paid to Mr. Brereton and move the government to sanction it.

As the field operations in Khandeish upon contract No. 12 are very urgent, I recommend that all those officers whose duties call them out into the disturbed district should be allowed a guard of four men which Capt. Arthur will allot to them, upon such officer undertaking to pay the guard at the rate, I believe, of seven rupees a month to each man.

(Signed) JAMES J. BERKLEY.

W. Langdon, Secretary, G. I. P. R. Co., to Capt. H. Rivers, R. E.

Bombay, 12th March, 1858.

Sir: I am desired by the committee of directors to bring to the notice of the Right Honorable the Governor in Council that on the twentieth of January last Mr. Brereton, assistant engineer, while engaged in staking out the line along contract No. 12 had his camp surprised and plundered by a large body of Bheels, who were afterwards attacked by Captain Montgomery's force.

For particulars of this case I have to refer you to copy of the letters respectively, from Mr. Brereton, dated the 21st January and 5th ultimo, and Mr. Graham's letter of the 23rd January, sent herewith.

2. Mr. Brereton now seeks compensation for his losses, amounting to rupees 1,553, as per schedule, which accompanies; the committee having looked into the claim and being of opinion that it is not unreasonable, instruct me to recommend to the favorable consideration of his Lordship in Council the grant to Mr. Brereton of compensation in the amount stated.

3. As the field operations in Khandeish upon contract No. 12 are very urgent, the committee would also recommend that all those officers of the company whose duties call them out into the disturbed district should each be allowed a guard of four men which Captain Arthur will allot, upon an undertaking being given to pay each man so employed at the rate of rupees 7 per mensem.

(Signed) W. LANGDON.

Resolution of Government No. 251 of 1858, March 25th.

1. The grant of compensation sought by Mr. Brereton to the amount of rupees (1,553—) one thousand five hundred and fifty-three is sanctioned.

2. The decision of Government on the railway company's application for police guards (paid by them) for their engineers in districts where there is a probability of disturbance, will be communicated from the Judicial Department.

(Signed) W. HART,
Secretary to Government.

Later Lord Elphinstone, the Governor-in-Council, passed a resolution commending the services of those of the G. I. P. Railway Engineering Staff who were employed in the disturbed districts.

The Following is the First Testimonial for His Services Received by Robert Maitland Brereton, Civil Engineer, in 1856.

From Mr. T. H. Bertram, M. Inst. C. E., Resident Engineer of the Great Western Railway, Paddington, London, October 23, 1856.

"I have much pleasure in certifying that Mr. Robert M. Brereton, having been placed by Mr. Brunel on the engineering staff here, during the execution of very extensive works connected with the new station arrangements of the London terminus, has had considerable experience in building, both in bridges and in warehouses, workshops, etc., and in iron girder-work, timber framing, road making and rail laying, as well as in hydraulic and other machinery.

He has been careful and zealous in the superintendence of the works under his care, and has proved himself an intelligent and efficient assistant, while his gentlemanly demeanor and conciliatory manner have made him deservedly popular with every one."

(Signed) T. H. BERTRAM, M. Inst. C. E.

Government and Other Recognition of Mr. R. M. Brereton's Services in Making Rail Connection Between Bombay and Calcutta, March, 1870.

No. 1272 of 1870. Resolution.—His Excellency (Sir Seymour Fitzgerald) the Governor in Council desires, on the retirement of Mr. Brereton, to record his sense of the valuable services tendered by that gentleman, more especially, in furthering the through opening of the Great Indian Peninsula Railway line to Jubbulpore, in March last.

2. The establishment of an unbroken communication between Calcutta and Bombay is one of the most important events connected with the progress of railways in India, and government consider that to the energy, activity and skill displayed by Mr. Brereton, the avoidance of further delay in the completion of the line is mainly due. His

Excellency in Council learns with regret that Mr. Brereton's connection with the Great Indian Peninsula Railway Company is about to terminate.

(Signed) J. L. TREVOR, Lieut. Colonel, R. E.,
13th September, 1870. Under Secretary to Government.

From Captain Edward Brooke, Private Secretary to Lord Mayo.

Simla, September 8, 1870.

My Dear Brereton:

The Viceroy desires me to inform you he is very greatly pleased with all you have done in connection with the Great Indian Peninsula Railway, and that he will not forget you when a chance arises.

Very sincerely yours,

(Signed) EDWARD BROOKE.

Extract From the Viceroy's Speech at the Opening, March 7, 1870.

"On this day the great distance of 1,070 miles of the Great Indian Peninsula Railway system has been opened to the public; Calcutta and Bombay are brought into close connection and this great peninsula is at last bridged by a railway 1,800 miles in length.

"When we look back to the history of this undertaking, we must recollect the very great difficulties which attended its early progress. The thing is now comparatively easy, much more is known, the organization of labor is less difficult and our able engineers have the light of experience and history to guide them. But in the early days of this undertaking far greater difficulties, which no longer exist, had to be encountered, and therefore we must make due allowance for what may seem a rather protracted period over which these works have extended. During that time periods of great scarcity occurred; the mutiny also occurred in the early history of this enterprise, and there have been several violent outbreaks of disease, so when we look back upon the whole history of this railway we may well wonder at the perseverance by which in its earlier stages the work was carried on. * * * * In a generation we have placed in India as great results of British enterprise as exist in any other part of the world, and those gigantic monuments of early rule will, for ages, remain as lasting memorials of the good we have done and of the benefits

we have conferred on the people of this country. But last they will, and it may happen that a thousand years hence, Mr. Brereton's ghost may still hover with anxious solicitude over the unbroken piers of the Towa Viaduct, when Macauley's New Zealander is sitting on the ruins of London Bridge."

Mr. John Morris, Chief Commissioner of the Central Provinces, in proposing Mr. Brereton's health at the opening, spoke as follows: "The completion of this railway is of the deepest interest to the officers of this commission, for there can be no doubt but that the opening of the railway will be a most important boom to these provinces. Hitherto the Nerbudda valley has been almost perfectly closed for four months of the year, but this will no longer be the case, and consequently for the future the prices of the Nerbudda valley will be equalized. * * * * Then, speaking of the works, I would express my thorough conviction that the success with which they have been crowned, and the solidity of their construction, is chiefly due to the untiring energy and the indefatigable labor of the chief engineer and his staff, who have worked with indomitable perseverance through heat, rain and disease to make up for the shortcomings of a former mistaken system which brought about the casualties of last year. Those labors alone are sufficient to prove that the service is one of danger as well as toil. It is not for me to thank him formally, for that has already been done by a far more distinguished person; but having had opportunities of seeing their labors and estimating their value, I must take this opportunity of expressing my thanks to him and assistants, and I beg to commend to your hearty acceptance the toast which I now have to propose—the health of Mr. Brereton, the chief of the engineer staff of the Great Indian Peninsula Railway Company."

Letter from George Turnbull, Chief Engineer of the East Indian Railway, who Attended the Opening of the Line.

My Dear Brereton: I most sincerely congratulate you on this very successful opening through to Jubbulpore. It is a very great achievement and one that you may well be proud of. You were quite right to open through when you did. Such a concurrence of Prince and Viceroy does not happen every day.

Very truly yours,

(Signed) GEORGE TURNBULL.

Letter from Sir Neville Chamberlain, A. D. C. to H. R. H. the Duke of Edinburgh, who Attended the Opening and Durbar.

Dear Mr. Brereton: I am desired by His Royal Highness to say that he will be much obliged to you, if you will send him a good photograph of the "Alfred Viaduct." His Royal Highness has been greatly pleased, and interested, in having been allowed to take part in this great opening of the through line, between Bombay and Calcutta, and he congratulates you on your success.

I enclose seven photographs bearing His Royal Highness' autographs, and the Duke requests that you will distribute them, as may seem best to you, among the most deserving of those gentlemen who have struggled so hard with you to complete the line on time.

Very truly yours,

(Signed) NEVILLE CHAMBERLAIN,

Letter from Captain Arthur B. Haig, R. E., Equerry to H. R. H. the Duke of Edinburgh, on Receipt of the Photograph.

Clarence House, Nov. 5, 1871.

My Dear Sir: His Royal Highness desires me to express to you his warm thanks for it. It will always remind him of a very interesting and important event during his Indian tour.

Very truly yours,

(Signed) ARTHUR B. HAIG, Equerry.

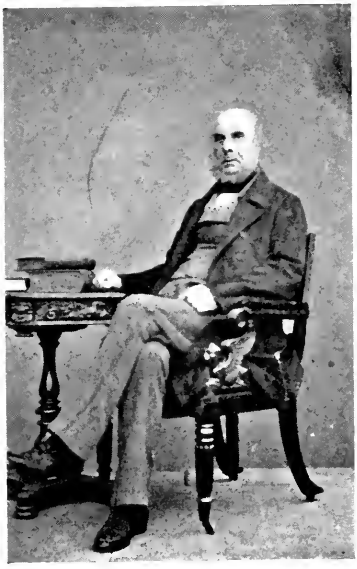
Letter from Sir Henry Durand, Member of the Supreme Council.

Murree, September 7, 1870.

My Dear Brereton:

Yours of thirty-first only just received. I write, however, on the chance of this reaching you in time to wish you a pleasant journey home and stay there. You will, of course, call on Sir William Baker at the India Office, to give him all information as to your labors on the G. I. P. Ry., and please mention my name to him. This is mail day, and I hope to send him a line about yourself. If you look to

H. R. H. The Duke of Edinburgh
1870



Mr. and Mrs. Henry Boulderson,
Bengal Civil Service. The oldest and the best of my Indian friends.

employment in India, keep your name before the S. of S. at the India Office and the Government of India out here, for sometimes men are wanted suddenly.

Sincerely yours,

(Signed) H. DURAND.

Letter from Colonel H. D. Daly, Resident at Indore.

My Dear Mr. Brereton: The Maharajah wishes me to thank you for all your kindness and assistance, and for your hospitality to him during his recent trip to Jubbulpore to meet the Viceroy and the Duke of Edinburgh. Your success is wonderful, and you certainly deserve all the credit of the achievement.

Very truly yours,

(Signed) H. D. DALY.

Letter from Sir Salar Jung, who Attended the Opening and Durbar.

My Dear Mr. Brereton: I write a few lines to congratulate you on your very successful achievement. I am delighted with all I have seen. These railways are really wonderful inventions, and I hope we may soon have one to Hyderabad. I go on with Mr. Saunders tomorrow to Benares, and then we visit Calcutta and Madras. I will write you more fully on my return to Hyderabad.

Very truly yours,

(Signed) SALAR JUNG.

Letter from Lord Lawrence, ex-Viceroy.

26 Queen's Gate, W., December 3, 1870.

My Dear Sir: I quite concur in the general view which has been taken in India of your labors and merits in regard to the Jubbulpore Railway, and I shall be very glad if the authorities reward them in a suitable manner. Very truly yours,

(Signed) LAWRENCE.

Extract from "The Times of India," Bombay, September 14, 1870.

A CIVIL ENGINEER.

"Mr. R. M. Brereton, C. E., recently chief engineer of the North-Eastern branch of the G. I. P. Railway, leaves India by the outgoing mail, after an arduous service of fourteen years. Ever since 1856-7 Mr. Brereton has been at work doing his part, and that a very substantial one, towards carrying out the principal railway comunications of this Presidency. This service was fittingly brought to a close by his strenuous and successful exertions, and those of his assistants, in completing the line through that once terrible Nerbudda valley, thereby bringing Eastern and Western India into easy and speedy communication with one another. All the proceedings connected with the ceremonial opening of the junction last March, when their Excellencies Earl of Mayo and Sir Seymour Fitzgerald held high festival in celebrating the event, are duly remembered in Bombay.

"It is said that, thanks to Mr. Brereton's exertions, and the vigor which he was enabled to inspire in all concerned, the junction was effected eighteen months earlier than it had been calculated would be required. If we put the time saved at twelve months, that represents a large gain to the company and the public—to the former a year's interest on the capital expended between Bhosawell and Jubbulpore, and a year's profit on the traffic, not only of that section but of the new through trade, which was until now impossible. And the traveling public have been saved for the same twelve months the extra fatigue and cost of the roundabout Nagpore route.

"It is no extravagant eulogium to say that Mr. Brereton is one of the worthiest representatives of the civil engineers who have carried out the present Indian railway system. In this character, a complimentary dinner was given him on Monday evening by his associates and comrades. Some seventy or eighty were present, including several of the B. B. and C. I. staff. Mr. LeMesurier, the agent of the G. I. P. Railway, presided. Though the gathering was large, its strictly private character was maintained, and we have no report to give of the good speeches which were, we doubt not, then delivered. We believe that, as usual, Mr. Brereton took occasion to do full justice to the engineers, contractors and other helpers with him in the great work. It is understood that Mr. Brereton (who

has fairly earned and secured the confidence of the local and supreme governments) is not unlikely to return to this country in some independent capacity, in connection with public works.

Another Bombay Paper of September 13, 1870, Refers as Follows to the Resolution Passed by the Governor in Council in Special Acknowledgment of Mr. Brereton's Services.

"In placing this recognition on permanent record, the government has said no more than what is really just of one who, in all but the technical meaning of the term, must be classed amongst its valuable public servants. And, by contrast with the bearing of Mr. Brereton's own superiors to him, this freely rendered testimony on the part of Sir Seymour Fitzgerald and his colleagues is all the more valuable and significant. If what we hear of the G. I. P. directors' conduct toward their indefatigable and faithful servants be correct, another proof has been given of their incapacity, or the unfitness of their executive for dealing prudently and wisely with the great interests under their orders in this remote land. But it is the G. I. P. Board rather than Mr. Brereton who, in the long run, will suffer from any want of liberality on their part."

Letter From Mr. Hugh Childers, M. P., First Lord of the Admiralty, and Previously Chairman of the G. I. P. Railway Company.

Whitehall, S. W., April 20, 1870.

My Dear Mr. Brereton:

Although I am no longer connected with the G. I. P. Railway Company, I take the greatest interest in its welfare, and I am very much obliged to you for the account of the opening, etc. I heartily congratulate you on your successful achievement. It is remarkable how little notice this has attracted here, and that the completion of one of the greatest thoroughfares in the world has hardly been worthy of a paragraph.

Very truly yours,

(Signed) H. C. E. CHILDERS.

The Following is the Only Public or Private Recognition of His Services of Fourteen Years' Duration That Mr. Brereton Ever Received From the Board of Directors in London. It is taken from the Board's Report to the Proprietors, Read at the 39th Half-Yearly General Meeting, May 14, 1869.

"Paragraph 3. The company's officers in India continue to bestow their earnest attention, on effecting the completion of through railway communication with Calcutta and Madras at the earliest date possible. In furtherance of this object, Mr. Knox, the agent, in company with Mr. Brereton, chief resident engineer of the northeast division, and the government engineer, inspected the whole of the northeast line in course of construction to Jubbulpore, during the month of November last, and as the result of this visit altered arrangements were adopted, with the sanction of government, for carrying on the works of the several sections from the end of the open line at Beerh to Jubbulpore, the operation of which has enabled Mr. Brereton in a recent report to express his conviction "that all the mass of work in hand will be successfully completed by May, 1870.' The directors have great pleasure in recognizing the skill and energy evinced by Mr. Brereton in the performance of very arduous duties, by which considerable difficulties have been overcome, and the execution of work of a satisfactory character secured."

Letters From Salar Jung, Administrator of the Nizam's Dominions, Showing His Appreciation of Mr. Brereton's Work in the Deccan.

Between 1865 and 1867 Mr. Brereton was resident engineer of No. 18 contract, betweeen Goolburgah and the Krishna River, within the Nizam's Dominion. Returning from Hyderabad (where he had been on business matters to see Sir George Yule, the Resident, and Salar Jung), in November, 1866, his horse fell on its side and Mr. Brereton's left leg was badly broken between the knee and ankle. This occurred when about 60 miles from Hyderabad; the only surgical aid then available was at Secunderabad, so he had himself carried on a charpoy conveyed on the heads of men and women, from village to village, to the house of his friend, Major James Stubbs, who was then first assistant to Sir George Yule, where he was at-

tended by Dr. Pemberton, the residency surgeon. It took over forty hours to reach Secunderabad; in which he suffered much pain from the jolting method of conveyance. The following is copy of a letter written by Salar Jung to Major Stubbs:

Hyderabad, Nov. 21, 1866.

My Dear Major Stubbs:

I heard with much concern yesterday from Sir George Yule that Mr. Brereton had met with a severe accident. I am anxious to know about him and trust the accident does not entail very much suffering. Pray kindly assure him of my sympathy and my earnest hope that he will be all right again very soon; and be able to give me his opinion about the steam carriage; for I am sure neither his friends nor the public can spare for any lengthened time the counsels and assistance of a man of his talents.

(Signed) SALAR JUNG.

The Following Letter Was Written by Salar Jung to Mr. Brereton:

Hyderabad, Dec. 24, 1866.

My Dear Sir:

I was about replying today to your note to Sir George Yule when I received yours to me of this date; I shall, therefore, write to you direct, as by understanding my views on the question of your employment by this Government you will be better able to decide definitely for yourself. I have perused your letter to Sir George Yule with attention, and as I am sure you would wish me to express my opinions candidly, I shall do so at once.

In the first place, the special "consent of the Nizam" to secure your services is a difficult matter. I need not enter into particulars; but as H. H. has authorized me to carry on the general administration of the country, it is wholly unnecessary in such a case as this to apply to him for special permission in your behalf, though of course I shall mention the subject to H. H. when I have an opportunity. It would appear singular, and be out of the usual course, to apply formally for sanction in your individual case. I have mentioned to Sir George Yule that I was prepared to set aside four lacs of rupees annually, namely, three lacs for irrigation works and one lac for roads, etc. This amount I would be able to lay out on these works

every year, unless some extraordinary and unavoidable demand was made on the government treasury, such for instance as that of this year for feeding the poor, at a rate which amounts to six lacs of rupees in the year; although even with this drain in our resources, I could at present meet the allotment for irrigation works, etc. But what I mean is that some great and unforseen demand may arise in some future year which might prevent my appropriating the full sum I have mentioned for public works, though of course every exertion would be made not to cripple the execution of these works. The risks attending the service of this state are not more I think than are met with under most governments, except, perhaps, the British. But I do not think there is any fear of an English gentleman losing his post under this government, even if I were to quit office; as it is not usual to dismiss any person employed by this government when once he has been entertained.

Of course the chief engineer would not only have works of irrigation to carry out, but all public works, such as jails, roads, etc., and he would be furnished with competent assistants and office establishments for such works, though this need not necessarily mean the dismissal of the present engineering establishment in the Circar's service, if found equal to the work required of them. The salary granted to the highest officers under the government hardly ever exceeds Rs. 1000, but your high attainments and qualifications render it necessary to offer you a higher rate. If, therefore, you could accept two thousand halee rupees per month and traveling allowance of Rs. 10 a day, this Circar would be able to avail itself of your services. It is not about the outlay of the money that I have had or have any hesitation, but there is a necessity under present circumstances of endeavoring to make the salaries of the servants of government proportionate to one another; but I consider yours an exceptional case, as I know you personally myself, and, independent of your professional zeal and qualifications, I am aware you have a good knowledge of the people of the country and understand the way of dealing with them in a spirit of kindness and conciliation. Allow me to say a few words with reference to one point in your note—the inferiority as a class of the Talookdars, admitting this with reference to some of them, and that the engineer department will be entirely beyond their control, even the limited interference with the present engineers being removed; still the engineers must necessarily have some connection or correspondence with the Talookdars, and not only with

them but with the accountant's department, the judicial and the police departments, etc., and they must all endeavor to work harmoniously with one or another. If you or I were to find the Talookdars and people ignorant, and leave them so, we should scarcely be fulfilling our duty, as all our efforts are intended to promote the moral and intellectual, as well as the material improvement of the people of the country. If you resolve upon entering the service of the government, this point should be borne in mind with a determination that, notwithstanding the disgust you may experience from the incapacity and ignorance of any of the officers of the government and the people in general, you would still try to do them good and to improve their condition. I have commenced some irrigation works already and shall not be able to extend them as I wish till I receive your reply, with which I trust you will favor me with as soon as possible. Very truly yours,

(Signed) SALAR JUNG.

(Note: I did not accept this offer, as I preferred to remain with the G. I. P. Railway till it was connected with Calcutta. R. M. B.)

Copies of Papers Referring to One or Two Special Services Rendered to Government by Mr. Brereton in 1864 and 1870, by the Permission of the Chief Engineer of the G. I. P. Railway in 1864 and by the Agent in 1870.

From Colonel A. G. Crommelin, R. E., Secretary to Chief Commissioner of the Central Provinces to the Commissioner, Nagpore, No. 390, of April 14, 1864.

Sir:

I am directed to acknowledge receipt of the Proceedings of the Local Committee of Nagpore, submitting a report drawn up by Mr. Brereton, Resident Engineer, Railway Department, regarding supply of water to the city of Nagpore from the Telinkheree and Ambajhirree tanks. This question has long been under consideration and the chief commissioner (Mr. Temple) considers that Mr. Brereton deserves the acknowledgment of the administration for the effective assistance rendered in the matter.

(Signed A. G. CROMMELIN.

From Major J. B. Dennys, Vice President, L. C., Nagpore, to Mr. Brereton, No. 54, March 31, 1864.

Sir:

I have much pleasure in forwarding you copy of a local committee meeting resolution, conveying their thanks for your able report, embodying a scheme for supplying pure filtered water from the Telinkheree tank to Nagpore. The report has been sent to the Secretary to Chief Commissioner P. W. D., for an opinion as to the plan which the committee should adopt.

(Signed) J. B. DENNYS.

Extract from the Proceedings of the Local Committee, March 29, 1864.

"That the best thanks of the committee be conveyed to Mr. Brereton for his valuable and comprehensive report. The committee is aware that Mr. Brereton employed time which might have been devoted to his own enjoyment and to recruiting his failing health, in making the observations and enquiries necessary for this report, and they therefore consider that their thanks are due to Mr. Brereton, not only for the able report which he has given them, but for the sacrifice of his own personal comfort which was incurred in preparing it. (Signed) "W. MUNTON,

"Secretary L. C."

From Colonel A. G. Crommelin, R. E., Secretary to the Government of India, P. W. D. (Buildings and Roads), to R. M. Brereton, Esq., Chief Engineer G. I. P. Railway, No. 691 B-M, of 7th July, 1870, Simla.

Sir.

The Governor General in Council particularly desires to obtain the joint opinion of yourself and Colonel Anderson or the state of some unfinished barracks at Jubbulpore, in the walls of which cracks have appeared, and regarding the further treatment of which a difference of opinion exists between the officiating chief engineer and the committee that was appointed to examine the buildings.

I am, therefore, to state that His Excellency in Council will feel much obliged to you if, after the committee (of which you are a member) has completed its investigations at Allahabad, you will proceed with Colonel Anderson to Jubbulpore, for the purpose specified and favor the Government of India with a report, drawn up jointly by Colonel Anderson and yourself, on the causes of the cracks in the barracks, and as to the steps which it will be desirable to take with regard to the completion of the buildings.

(Signed) A. G. CROMMELIN,
Colonel, R. E., Offg. Secretary to the Govt. of India.

Government of India Public Works Department, Buildings and Roads, No. 685, B-M. Simla, July 6, 1870.

Accident to Store Room in the New Gun Carriage Factory, Allahabad, Read Letter No. 1774, Dated 1st July, 1870, From the Superintending Engineer, Third Circle P. W. D., N. W. Provinces.

Resolution.—The Governor General in Council has received with much concern a preliminary report from the superintending engineer of the circle of a very serious accident that has occurred at Allahabad. A large portion of a very extensive godown under construction in the new gun carriage factory has fallen down and a serious loss of human life has been the consequence. The causes of this lamentable accident must be investigated most fully, and a special committee of the following officers, selected as being entirely unconnected with the design or construction of the building, should be at once assembled at Allahabad for this purpose:

President—Major General Travers, V. C. C. B., Commanding the Allahabad Division.

Members—Colonel J. C. Anderson, C. S. I. R. E., Offg. Inspector General of Irrigation. Mr. R. M. Brereton, Chief Engineer, G. I. P. Railway. Mr. Brereton has consented to serve on the committee subject to the approval of the agent of the G. I. P. Railway, which has been requested by telegraph.

2. The committee should meet at the earliest possible date, and the government of the N. W. Provinces should issue such instruc-

tions as will ensure every information being placed before it, as also the presence at Allahabad to give evidence before the committee of the chief engineer and secretary to that government, and of all officers superintending, executive and subordinate, who may have been in any way concerned with the design or construction of the building.

3. The committee will submit their report to the Government of India through the Government N. W. Provinces and should record their opinion not only as to the causes which have led to the catastrophe, but also as to the responsibility of the several officers of the public works department, contractors or others who may have been concerned in the erection of the building.

4. The committee should also examine all the other buildings of the new factory and particularly those that will be subjected to the vibration of machinery, in view to ascertain and report whether they are trustworthy.

Order—Ordered that this resolution be communicated to the Government of N. W. Provinces and the military department for information, and such further action as is called for to give complete and immediate effect to the wishes of the Government of India in this department. Also to the Government of Bombay in the public works department (railway branch) for information in continuation of the telegram of the 5th instant. Also to Colonel Anderson and to Mr. Brereton for information and guidance.

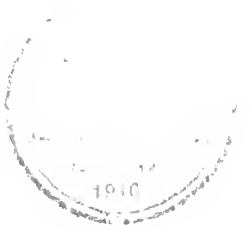
(Signed) A. G. CROMMELIN,
Col. R. E., Offg. Secretary to the Government of India.

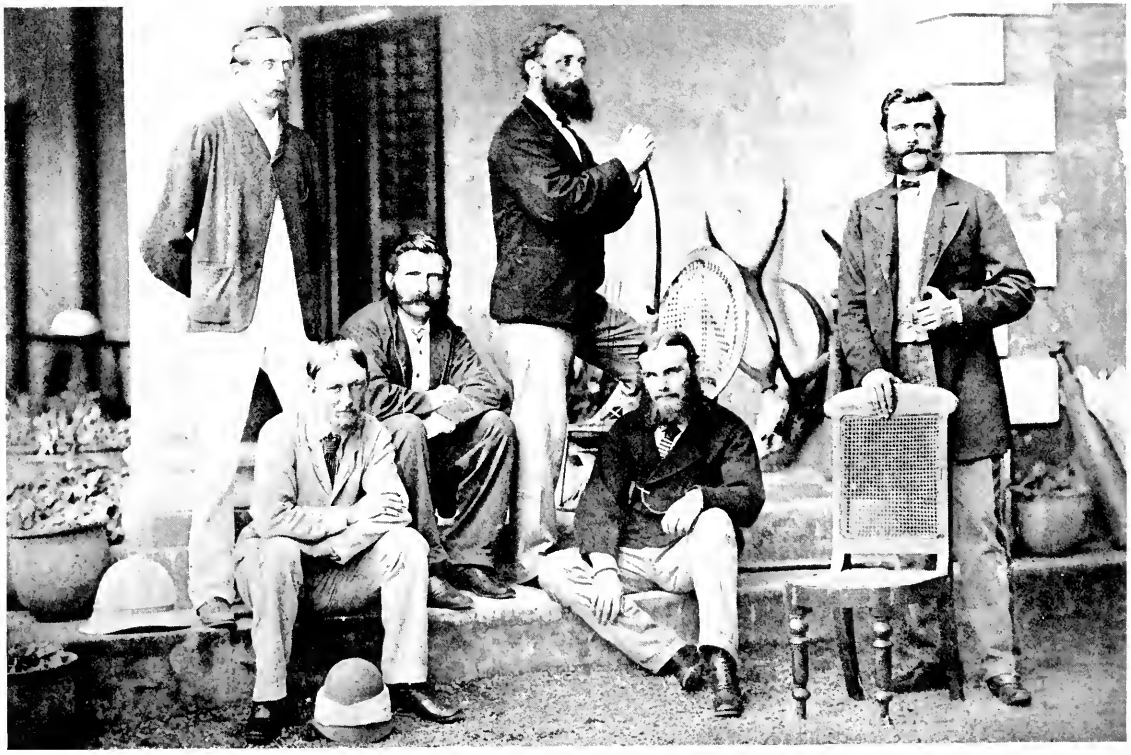
Some Evidence of the Engineer Staff's Appreciation of R. M. Brereton, Who Had Worked in Harmony With Them During a Period of Fourteen Years in the Staking Out and Construction of the Greatest Portion of the G. I. P. Railway System.

Bombay, September 6, 1870.

Dear Brereton:

The staff are anxious to meet you at dinner before you go home. Monday next, the twelfth, is fixed, and we hope that it will be a convenient evening to yourself. All of the staff, engineering and otherwise, who can in any way get to Bombay will not fail to be





R. M. B.'s Brother Engineers and Assistants on the construction and completion of the line from Bhosawell to Jubbulpore, 1868-70.

present. Dinner will be served at eight p. m., and we have taken the bungalow lately occupied by the Nawab of Surat, Nesbit Lane, Byculla, for the occasion. Sincerely yours,

(Signed) J. H. ABBOTT,
HENRY CONDER,
C. WARD,
C. W. HAWKINS,
Dinner Committee.

Bombay, September 6, 1870.

My Dear Brereton:

I hope you will keep yourself disengaged for Monday next, as a few of your old friends on the line of all departments want to see you at a dinner that evening to wish you farewell on leaving the line and your departure from India. We have arranged for a bungalow to have the dinner in. You cannot think how glad I am that we shall have an opportunity of expressing amongst ourselves our regard for you and estimation of what you have done for the line.

Sincerely yours,

(Signed) J. H. ABBOTT.

Akola, Berar, August 31, 1870.

My Dear Sir:

I have to acknowledge with great regret the receipt of your letter informing me that you are about to leave the service of the company. I am sure that the staff employed on this branch will readily and gratefully acknowledge in how great a measure the success which has attended our efforts is due to the high example set by yourself in unflinching and self-sacrificing devotion to duty, and in the interests and honor of the company. We are proud to have served under your able leadership, and our highest respect and esteem will follow you when you lay down the authority you have exercised with so much kindness and consideration to us and so great advantage to the company. In the names of the officers of this (Nagpore) branch, I thank you for your kindly acknowledgment of our services and bid you farewell.

(Signed) T. W. PEARSON.

The Following Inscription Is on a Solid Silver Inkstand Which the Staff Presented to R. M. Brereton on His Leaving India:

PRESENTED

TO

ROBERT MAITLAND BRERETON, ESQ.,

BY THE MEMBERS OF THE ENGINEERING STAFF OF THE

GREAT INDIAN PENINSULAR RAILWAY.

As a tribute of their regard and esteem, and in recognition of the personal kindness and cordial good will that existed during the many years he labored with them as a member of the same staff in carrying out the extensive works of the railway and which on the Northeastern Division established through communication between Bombay and Calcutta, when he held

THE APPOINTMENT OF THEIR CHIEF ENGINEER,

September, 1870.

The Late Sir Richard Temple, When Chief Commissioner of the Central Provinces From 1862 to 1864, and When Minister at Hyderabad, Was Intimately Acquainted With R. M. Brereton's Services on the Nagpore Branch and on the Deccan Branch of the G. I. P. Railway During the Sixtieth Decade of the Last Century. Also Sir Bartle Frere Had the Same Acquaintance While He Was Governor of Bombay During the Same Period.

London, February 1st, 1877.

My Dear Brereton:

Your letter dated from San Francisco, January 10, 1877, arrived here yesterday morning. You will perhaps have seen in the newspapers that I am going out to the Cape of Good Hope as Governor and High Commissioner, with some hopes of getting, a portion at least of, the South African colonies to enter a confederation. I am not, at present, in a position to offer you government employment, but the Cape appears to me to offer so fine a field for your talents and experience, in irrigation especially, that I am induced to ask what amount of salary would tempt you to come out there. I have directed Messrs. Stanford, Charing Cross, to send you a copy of Silver's "Handbook of South Africa," in which there is much information; and if there is any other which I can give, I

hope you will ask me for it. My departure for the Cape will probably take place early in March, after which my direction will be either direct to the Cape, or "to care of Under-Secretary of State, Colonial Office, London, to be forwarded."

Believe me, ever sincerely yours,

(Signed) H. B. E. FRERE.

Heath Brow, Hampstead, N. W.

My Dear Brereton:

I have the pleasure to acknowledge your letter. I have not yet received any enquiries about you, as apparently contemplated. But if I do, I will very gladly testify to your professional ability and to your experience both large and long. With best regards,

Yours very sincerely,

(Signed) RICHARD TEMPLE.

The Late Duke of Edinburgh, Who Greatly Appreciated His Visit to India in 1870, Made Application to the India Office for the C. S. I. Honor Being Given to R. M. Brereton for His Services in India. The Following Was the Reply Given:

From Horace Walpole, Esq., Private Secretary to Lord Salisbury, Secretary of State for India, to the Hon. W. J. Colville, Equerry to H. R. H. Duke of Edinburgh.

India Office, February 9, 1876.

Dear Sir:

I have shown your letter of the third instant about Mr. Brereton to Lord Salisbury and he desires me to tell you in reply that he regrets that, for the present at any rate, it is impossible to take into consideration the claims of any one for the Star of India. The appointments recently made by the Prince of Wales in India have created three C. S. I.'s in excess of the numbers laid down, and until these are absorbed by vacancies occurring it will be impossible to make any new appointments to the Order. Very truly yours,

(Signed) HORACE WALPOLE.

On June 18, 1871, the private secretary to the Duke of Argyll, then Secretary of State for India, wrote: "His Grace desires me to tell you that all the recent vacancies in the Star of India appointments have just been filled up, and that the new nominations were gazetted on the Queen's birthday. A note has, however, been made of your name for future consideration. He fully appreciates the valuable services which you rendered to railway enterprise in India."

On February 28, 1882, the private secretary to Lord Kimberley wrote: "Lord Kimberley desires me to inform you that he has brought your name before Lord Hartington for the honor of Companion of the Star of India, and that he has been informed that your name has been noted, and that your claim will be considered with those of others on the occasion of a distribution of honors."

On the same date the private secretary to Lord Hartington wrote to R. T. Gurdon, M. P., and Senior Chairman of Quarter Sessions, County of Norfolk, as follows: "I will with pleasure show your strong letter of recommendation and its important enclosures to Lord Hartington, and will take care that Mr. Brereton's claims are brought under His Lordship's consideration when a distribution of these honors is made."

Letters From the Honorary Secretary of the Institution of Civil Engineers, Introducing R. M. Brereton to the Civil Engineers of the United States and Canada, March, 1871.

Mr. R. M. Brereton, M. Inst. C. E., who will present this, has, among other works, especially distinguished himself in the execution of part of the Great Indian Peninsular Railway, on the termination of which he returned to Europe to recruit his health. He takes advantage of the vacation to pay a visit to the United States, and I beg to introduce him very specially not only to the members of the Institution who he may meet, but also to our professional brethren in the States, asking them to kindly further his views and to aid him by good introductions and by affording him the information he may require.

(Signed) CHARLES MANBY,
Honorary Secretary.

February 10, 1871.

This will be presented by Mr. R. M. Brereton, a member of this Institution of some years standing, and lately chief engineer of one of the most important lines of railways in India. He is about to visit the United States in order to make himself personally acquainted with the system of making and working the railways and tramways of that country. I shall be greatly indebted if the engineers and officials connected with the principal railways will afford the necessary facilities to enable Mr. Brereton to carry out the object of his trip. (Signed) JAMES FORREST,

Secretary of the Institution, C. E.

Foreign Office, April 14, 1871.

To Sir Edward Thornton, H. B. M.'s Ambassador, Washington, U. S. A.

Sir:

This letter will be delivered to you by Mr. Robert Maitland Brereton. I beg leave to introduce him to your acquaintance, and to commend him to your protection and good offices.

(Signed) GRANVILLE.

From Lord Kimberley, Secretary of State for India, to Hon. Lionel S. Sackville West, Ambassador, Washington.

Dear Mr. West:

I want to introduce Mr. Brereton, an able engineer formerly in the Indian service, and till lately surveyor of roads, bridges, etc., in our county (Norfolk). He is a very capable and intelligent man and much liked by all who know him.

Yours sincerely,

April 16, 1885. (Signed) KIMBERLEY.

From Sir Henry Mortimer Durand to Mr. E. A. Hitchcock, Secretary of the Interior Department.

British Embassy, Washington, March 10, 1906.

Dear Mr. Secretary:

May I introduce to you Mr. Robt. M. Brereton, residing in this country? Mr. Brereton is a civil engineer and has done much work in India and on the Pacific Coast. He is anxious to meet the head of your Geological Survey. Mr. Brereton's family and antecedents are well known to me, and I shall be grateful if you can introduce him to the gentleman in question.

Yours sincerely,

(Signed) H. M. DURAND.

Letters From Dr. William Pole, M. I. C. E., F. R. S., Consulting Engineer to the Government of Japan, Imperial Railway Department, in London, to Mr. James Forrest, Secretary, and to Mr. Charles Manby, Honorary Secretary, of the Institution of Civil Engineers, in the Matter of the Appointment of an English Chief Engineer for the Railways of Japan.

3 Storey's Gate, Westminster, April 18, 187—.

My Dear Forrest:

Since you were good enough to give me the telegram from Mr. Brereton, I have been to Mr. Ward, Mr. Berkley and the India Office, and have reported what I have heard of Mr. Brereton to my clients, the representatives of the Japan Government in this city. They are so far impressed with Mr. Brereton's qualifications that they wish to give him the opportunity of making personal application for the appointment, and I learn from Mr. Ward that it was Mr. Brereton's intention, independently of this matter, to come to England immediately. I am authorized to ask you to be good enough to telegraph to him as follows: "Ward says you purpose coming immediately, if so, Japan kept open till 1st June; answer telegraph."

Yours faithfully

(Signed) WILLIAM POLE.

3 Storey's Gate, Westminster, April 20, 1872.

My Dear Manby:

I return Brereton's letter with thanks. Forrest will tell you what has passed in the matter. It is, in a word, that my clients are so well impressed with what I have told them of him, that they have consented to keep the appointment open till 1st June, if he likes to come and offer himself for it. I have seen his cousin (R. P. Brereton), Ward, Turnbull and Berkley, and they all confirm your recommendation of him.

Ever Sincerely yours,

(Signed) W. POLE.

Irrigation Work in California

1871-1876

Letter Appointing R. M. Brereton Chief Consulting Engineer.

San Francisco, September 28, 1871.

Dear Sir:

I have the honor to notify you that at the regular meeting of the board of trustees of the San Joaquin and Kings River Canal and Irrigation Company, held this day, you were unanimously appointed chief consulting engineer of said company, at a monthly salary of one thousand dollars (gold), commencing with this date; and you were authorized to make such preliminary explorations and surveys as may in your judgment be necessary. Assuring you of the fullest support upon the part of the board, and hoping you may accept the appointment, I remain,

Yours very truly,

(Signed) SAMUEL J. C. SWEEZY,
Secretary.

Letter From Wm. C. Ralston, Cashier of the Bank of California, to His Excellency the Governor of California (Newton Booth), Who at That Time Was Opposed to Irrigation Enterprise by Capitalists, and Wanted the Settlers to do the Work Themselves, and Who Was Prejudiced Against the Employment of an English Engineer.

San Francisco, January 18, 1872.

My Dear Sir:

I have this moment received your note of sixteenth instant, and must confess that it has given me some surprise, after the verbal explanation I made to you, which, however, in the pressure of business you may have forgotten. Mr. Brereton is no adventurer, but a man of established reputation, who comes to us with the highest credentials for actual service and large experience in such matters; he speaks of what he has seen and knows.

He came at first merely as a visitor to this country and has been induced to remain and aid in this enterprise contrary to his

original design. A number of gentlemen who have very large interests at stake on this coast, and therefore seek to promote the common welfare, have thought themselves fortunate in securing the services of Mr. Brereton, with the influence he can bring to bear in Europe, where he is well known and appreciated.

It was not doubted that the Governor of the State would allow his name to be used in behalf of an enterprise of so great and manifest public utility. It has not been used and will certainly be omitted if you so desire.

(Signed) W. C. RALSTON.

First Act of Congress in Regard to Irrigation in the United States, Which Was Obtained Through Mr. Brereton's Personal Efforts in 1872-3.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President be, and he is hereby, authorized to assign two engineers of the army and one officer of the Coast Survey now stationed on the Pacific Coast, for the purpose of examining and reporting on a system of irrigation in the San Joaquin, Tulare and Sacramento Valleys of the State of California; and for that purpose the officers so assigned may associate with themselves the Chief of the Geological Survey of California and also one other civilian distinguished for his knowledge of the subject.

Sec. 2. That these five persons shall constitute a board, with power to fill vacancies, whose duty it shall be to make a full report to the President on the best system of irrigation for said valleys, with all necessary plans, details, engineering, statistical and otherwise, which report the President shall transmit to Congress at its next session, with such recommendations as he shall think proper.

Sec. 3. That the Secretary of War shall furnish subsistance and transportation for the board while in the field, and the compensation of the members of the board who are not in the service of the United States shall not exceed two thousand dollars each, but the other member of the board shall receive no additional compensation for their services.

Approved March 3, 1873.

Message From the President of the United States, Transmitting the Report of the Commissioners on the Irrigation of the San Joaquin, Tulare and Sacramento Valleys, in the State of California.

To the Senate and House of Representatives:

I have the honor to transmit herewith the report of the Board of Commissioners on the irrigation of the San Joaquin, Tulare and Sacramento Valleys of the State of California, and also the original maps accompanying said report.

(Signed) U. S. GRANT.

Executive Mansion, March 23, 1874.

Letter From Lieut.-Colonel B. S. Alexander, Corps of Engineers, President of the Commission, Inviting Mr. Brereton to Join the Commission as a Member of the Board.

San Francisco, May 6, 1873.

Sir:

At a meeting of the board of commissioners of irrigation today it was unanimously resolved to ask you to join the commission as a member of the board, in accordance with Section 1 of the Act of Congress organizing the commission. Will you please inform me of your acceptance or non-acceptance of this appointment?

(Signed) B. S. ALEXANDER,

Lt.-Col. Engineers, President of the Commission.

Note by R. M. Brereton.

By order of General A. A. Humphreys, Chief of Engineers, Washington, the board of commissioners was confined to an expenditure not to exceed five thousand dollars; so, in order to afford the board the entire disposal of this authorized expenditure for its expenses, I declined the seat on the board, but rendered the commissioners my entire services in the field and in the furnishing of the fullest information regarding irrigation works in India and in Europe, without making any charge for such services.

Letters From Senator William M. Stewart, Senator From Nevada, to Mr. Brereton.

San Francisco, July 8, 1889.

Friend Brereton:

Your favor of the sixteenth ultimo is received. The subject of irrigation is now at last attracting considerable attention in the United States. It is a great work and the people are just beginning to appreciate its importance. The Committee on Irrigation and the Reclamation of Arid Lands, of which I am chairman, will travel over most of the arid region during August and September of this year. The purpose of the trip is to obtain object lessons which will be useful to the framing of legislation to meet the wants of irrigation. I wish it were possible for you to appear before the committee and give it a short history of your experience in India and in the United States in the matter of hydraulic engineering. You could be of great service if you could meet us somewhere on the trip. Let me hear from you. Very truly yours,

(Signed) WM. M. STEWART.

Washington, D. C., April 26, 1889.

Friend Brereton:

I should be very much pleased if your services could be procured by the United States in connection with irrigation. The people are now taking more interest in that question than they did when you were here. The public land which can be cultivated without irrigation is very nearly exhausted, leaving only the arid lands for new farms. Surveys similar to the ones you made in San Joaquin Valley are now being made and will be continued until the whole arid country is surveyed, reservoir sites and lines of canals for the purpose of irrigation marked out, and the cost of reclamation of each district estimated. If you were here you would be a most valuable assistant in this business. If you decide to come, let me know and I will try to prepare the way for your employment.

Very truly yours,

(Signed) WM. M. STEWART.

Washington, D. C., January 25, 1889.

My Dear Brereton:

The irrigation matter dropped out after I left the Senate in 1875. On my return to this body last year I again commenced to agitate the question and Congress is beginning to understand that it is a matter of paramount importance, and I think we will get such legislation as will enable the people to reclaim many millions of acres of land regarded as desert. The report you made in connection with the San Joaquin Valley Commission is a very valuable document. I have used it to good advantage. I would dislike very much to have you go to South Africa for mines and not be able to invest in this country, and hope that we shall get the bill through and that I will see you soon in Washington. Very truly yours,

(Signed) WM. M. STEWART.

Extract From Government Report of Irrigation Investigations in California, Contained in Bulletin 100, U. S. Department of Agriculture, Washington, 1901, pp. 282-3, About "The San Joaquin and King's River Canal" Enterprise, Designed by R. M. Brereton, 1871.

"The most comprehensive project for the utilization of King's River water of the early days of irrigation development in this region, was that of the San Joaquin and King's River Canal Company, which proposed not only to divert the San Joaquin River water upon the west side of the valley, a project which has been carried out, but who were far-seeing enough to recognize the value to their enterprise of controlling also the waters of King's River and other streams to the south, as well as the overflow from Tulare Lake. Their project was on too stupendous a scale to be carried out in its entirety with the means at command, but it indicates that the value of effecting a control of the water available for irrigation was early appreciated. The records also indicate that their intention to dam up Tulare Lake, using the same as a reservoir, and availing themselves of the flow of King's River sloughs, the Mussel Slough, Four Creeks, Deer and Elk Creeks, Bayou River, Tule River, White River, Peso Creek, Kern River sloughs, Goose Lake, Buena Vista and Kern Lakes and Buena Vista slough. It was also proposed by

the same company to utilize by appropriation the waters of Summit Lake and its tributaries; also to convert a fifteen-mile stretch of King's River, near the point where it leaves the foothills, into a reservoir for storage purposes."

The Following Are Extracts From the San Francisco Papers of That Period of the Early Enterprise of the Company, During 1871-5.

From the *Chronicle,* November, 1875:

"We place a special value upon the opinions of Mr. Brereton, who was in India for fourteen years and was acquainted with the government irrigation system in that country. He states in his reports that the expense of irrigating 500,000 acres in the San Joaquin Valley by means of permanent works would be at least $25 per acre, and upon that statement we made the calculation that the whole cost would be no less than $12,500,000. Who has thus far succeeded in showing that these figures are not approximately correct? A brief extract from Mr. Brereton's report to the president of the company will show that he at least fully understands the greatness of the work and weighs the obstacles that are to be encountered. While admitting the feasibility and desirableness of a grand general scheme of irrigation, he holds this language: 'I stated that what I believe to be the *future* of these central plains of California as regards the facilities for irrigation and the great advantages pertaining to the same. These statement were made almost entirely in the *future sense,* because population is yet so small in the valley and irrigation so new to Californians. I wish you very clearly to understand that a complete system of irrigation canals throughout these immense plains must be the work of time and a large increase in population. It may take fifty years or more to develop fully such a system of canals for irrigation and navigation, such as I have contemplated. Though the cost of a complete and perfect system of irrigation may fall on several generations, it certainly rests with the present Californians to introduce a system that shall be capable of future expansion and at the same time be beneficial to the present occupiers of the soil. Canals that may cost $15,000 or more per mile need not for present requirements cost more than $5000 per mile, and it is to the present requirements that your attention should be directed.

" 'Another most important matter for your consideration is the fact that most of the land under the influence of the present canal and in its extension is held by a few individuals. Miller and Lux alone are said to own over 300,000 acres, and if they thought proper to place 50,000 acres of this area under alfalfa they would use all the present supply of water in the canal. I do not know what terms of contract the company has made with these parties, but it seems to me that great care and foresight on the part of the company should be exercised; otherwise the company would be making the rapid fortunes of other parties without receiving for their enterprise a fair *quid pro quo*. My firm conviction is that in irrigation enterprises on any extensive scale, whether carried out by private capital or by the state or by the federal government, the proper principle should be adopted, namely: that of combining the water and the land to be irrigated so that the revenue derived from the products shall pay off the capital invested in providing the irrigation system, plus a fair interest on the capital expended. In other words, if Miller and Lux lands, now worth from $1 to $2 only per acre, become worth, through irrigation, $100 and more per acre, the company should get one-half of the increase, because the land is of no higher value without the water, and the water is without value unless used on the land. It thus becomes an equitable partnership concern; Miller and Lux provide the land and the company provides the necessary water. You cannot raise public or private capital on your bonds sufficient for the enterprise unless the bonds are secured on land and water combined, and such lands must lie below the canals to be capable of being irrigated. Another point you need to consider very carefully, that is, the question of riparian rights, which I understand is secured under the constitution. This is why in this extensive irrigation enterprise I have embraced in my scheme the appropriation of all the water flow from the Sierras south of King's River for the purpose of covering all the land through which the streams flow to the west into Tulare and other lakes.' "

From the *Evening Bulletin,* May 18, 1874:

"The party of capitalists that accompanied Mr. Brereton on the recent excursion into the San Joaquin Valley returned this evening to the city. The engineer of the irrigation works, believing that sufficient progress had been made to demonstrate the success of the

enterprise, planned the excursion in order to show what had been done, and claim for it recognition as an accomplished fact. With this idea in view, he issued his invitations, selecting such gentlemen of capital as he believed likely to become interested in the work. It is due to the intelligence and foresight of Mr. Brereton that this early practical demonstration of the capabilities of soil and water thus artificially brought together has been so speedily had. That gentleman perceived that in this portion of the state, settled as it is by a class of farmers from the Western states, to whom irrigation is unknown, a practical showing of the effect of the system was more important than even the system itself. Nothing like it has been seen in this state upon soil not irrigated artificially. Forty bushels to the acre is a low estimate of the production, and there are spots where sixty and even seventy-five bushels will be yielded. Of the canal itself, Mr. Brereton has fully justified the confidence of his friends in his ability as an engineer and constructor. The canal is thirty feet wide on the bottom and sixty-eight feet on the top, and is finished with a skill, care and precision more like the manner in which such works are done in England and in Europe than these American engineering works are generally performed. The gates, sluices, discharge and supply openings are all substantial, and evidently arranged with a thorough knowledge of what is expected of them. The canal carries a depth of seven feet of water. The canal is more than a success; it is a grand triumph of genius and perseverance."

Letters From Sir Arthur Cotton, Sir Louis Mallet, Secretary to the Government of India, India Office, and Sir Douglas Forsyth, Who Was Formerly Commissioner of the Punjaub.

Dorking, February 16, 1877.

My Dear Sir:

Could you not call at the India Office and see Mr. Thornton, the head of the irrigation department there? Mr. Cassels, one of the members of council, is a very kindly man, and would help you in any way he could. If you could call upon him, you might, if you pleased, use my name in introducing yourself. There is not the slightest difficulty in reducing the number of laborers in India; they are always wanting more men than they can get. Though the offi-

cials are determined to prevent any great extension of irrigation and navigation, if they can, I am in great hopes that the present spirit in the country will be too much for them. I beg to send you some of my late pamphlets. I am in the midst of a great fight and am wonderfully prepared for it in respect of strength, being better than I have been for twenty years. I hope your great work is going on satisfactorily. Yours sincerely,

(Signed) ARTHUR COTTON.

Dorking, March 18, 1877.

My Dear Sir:

I have written to Colonel Haig to ask him to try and get you appointed to introduce machines into the works in India, if you are willing to go. It will be a capital excuse for getting you into the service, where you would be ready if, as I confidently hope, they set about the prevention of famines in India. I should like exceedingly to see you established there. I have a great set of works in my head, being quite certain that India can be made a garden from the Himalayas to Comorin. I sent Colonel Haig your last letter. I think it would be well for you to write to him, using my name if you please. They are now planning a complete line of waterway from Havre to Marseilles for vessels of 350 tons, part of the works being already in hand, the whole system to cost eight million pounds sterling. They reckon a saving on the present traffic of two millions a year, but the traffic would be increased two or three-fold by the reduction of the rate one-half. I have two volumes of reports and evidence of a commission in the States on the complete establishment of effective water carriage throughout the Union. They have already so reduced the cost of transport that the extent of traffic has become far beyond what all their present means will accommodate. In fact, it is now becoming generally perceived that railways cannot carry the great traffic of a big country. If they are compelled in America to fall back on water-carriage, where they have five months of frost, how much more are waterways desirable in India, where we have no such drawback. Yours sincerely,

(Signed) ARTHUR COTTON.

Dorking, November 26, 1877.

My Dear Sir:

I am greatly obliged for your letter informing me of the excavating machines, which are so grand a desideratum in India. I should be most obliged to you for all particulars of them, their cost and weight, where they could be obtained, how they could be sent to India, etc. I have written to the India Office, telling them what you have told me about your use of them. Could you send the same information that you send me to C. Fouracres, Esq., Dehree, Calcutta, to whom I will write about it? Suppose if they had such machines at work on the Sirhind Canal connecting the Sutledge and the Jumna, where they have a deep excavation of forty miles, in the middle of which they have to cut 100 yards broad at the bottom by seventeen feet deep in sheer earth. The present famine in India will cost the government some twenty millions in actual expenditure and loss of revenue for years to come, but the loss to the people is beyond computation. I hope you are getting on well with your great undertakings. With many thanks for your very valuable information, which will most likely have a powerful effect on the future of India,

Yours sincerely,

(Signed) ARTHUR COTTON.

76 Onslow Gardens, London, May 3, 1878.

My Dear Mr. Brereton:

I am much obliged to you for a copy of the notes of American and English locomotives. I have shown it to Sir R. M. Stephenson, and at his suggestion have written to India to make some statistical enquiries with reference to the subject. On receiving a reply I shall communicate with you. There is, as you doubtless are aware, considerable prejudice to be overcome before American improvements are adopted by English engineers. Yours sincerely,

(Signed) T. DOUGLAS FORSYTH.

India Office, March 6, 1878.

Sir:

I am desired by the secretary of state for India to thank you for your letter of the first instant, regarding the Wauchope and Slusser machines for excavating and moving earthwork. The question of

the employment of these machines in India would be best discussed in a personal interview, and Lord Salisbury would be obliged if you could conveniently call on Colonel Hyde of this office, to whom the papers on the subject have been referred for report.

(Signed) LOUIS MALLET,
Secretary to the Government of India.

Letters Regarding Investment in Some of the Rich Lands of California, and English Settlers Thereon.

From Mr. D. Meinertzhagen, Partner of Messrs. Frederick Huth & Co.

12 Tokenhouse Yard, London, August 4, 1875.

My Dear Brereton:

Pray excuse me for having delayed so long to answer your letter. The reason is that I was waiting to ask my father-in-law about the matter, as he knows a good deal of affairs connected with America and would be able to give useful advice on the subject. I certainly think your scheme a very reasonable and also probably a feasible one, but it is difficult to create a tide of emigration without an agency here, and in that respect I fear I am unable to advise you. I do not know how far you have already been successful during your stay in England in securing good representatives, but that no doubt will be your first difficulty. As to estates properly managed in California, I can only cite my own experience as to their success. The property in which I am interested is in the Salinas Valley. It has now yielded back all the money that has been put into it (the speculation was commenced in 1859) with five per cent interest, and there remain about 4000 to 5000 acres net profit. Should I hear of anything that would interest you in connection with the undertaking you have embarked upon, I shall not fail to let you know. With best wishes, I remain, Sincerely yours,

(Signed) D. MEINERTZHAGEN.

(Note: Mr. Theodore Kearney—an old California friend of the seventies—who I had inspired in 1874 to start a colony, called

the Central Colony, near Fresno, for fruit and alfalfa (clover) raising, had succeeded in establishing his beautiful Fruit Vale Estate. He had made a magnificent avenue several miles in length, 140 feet in width; containing three distinct driveways, separated and bordered by a splendid growth of palms, magnolias, acacias, deodara cedar from the Himalayas, oleanders and other semi-tropical trees and plants, which is known as the Chateau Fresno Avenue. This estate then contained about 7,000 acres in Big Dry Creek. He had 1,000 acres in raisin vineyard and 4,000 acres in alfalfa, and had expended $100,000 in irrigation works. In 1887-8 he came to London and sought my aid in obtaining further capital for the development of the property. I introduced him to my friends, Stephen Williamson, M. P., and A. Guthrie, of the firm of Balfour, Williamson & Co., of Liverpool, and Sir Julian Goldsmid, M. P.; from these he obtained the aid he needed. When, during 1871-5, I was surveying this east side of the San Joaquin Valley for irrigation, the whole of this district was semi-desert. In 1903 President Roosevelt visited these irrigated regions of California, and his admiration thereof he expressed in the following terms:

"I have enjoyed to the full getting into your beautiful state. Here I am in the pioneer community of irrigated fruit raising in California. In many other parts of the country I have had to preach irrigation; here you practice it. Throughout the portions I have visited it is literally astounding to see how the land yields a hundred and a thousand fold when water is put upon it. I have been traveling through what is literally a garden of the Lord, in sight of the majestic and wonderful scenery of the mountains, going over these great plains tilled by the hand of man as you have tilled it, that has blossomed like the rose—blossomed as I have never dreamed in my life that the rose could blossom until I came here. No small part of the prosperity of California in the hotter and drier agricultural regions depends upon the preservation of the water supply; and the water supply can not be preserved UNLESS THE FORESTS ARE PRESERVED. I earnestly ask you that you see to it that your resources, by use, are perpetuated for the use of the peoples yet unborn. Keep the waters; keep the forests; use your lands as you use your bays, your harbors, so that by the very fact of the use they will become more valuable as possessions." R. M. B.)

Extract From Wm. C. Ralston's Letter, Dated June 18, 1872, to Governor Booth, Regarding Colonies in California.

As regards colonization from the middle classes of England, we most certainly want just that class of population. I know of no country in the world better adapted to it than this or where the inducements offered are greater, or where that class of people would reap greater benefit from the change. Colonies upon the very same plan suggested by Mr. Brereton have been eminently successful in Colorado, Iowa and other parts of the world. I see nothing visionary about it in the lights of facts now patent. What has been done can be repeated. If the scheme is Utopian, then I fear my views of the resources and capabilities of this state are Utopian also. Time will show whether your hasty criticism is just or not.

(Signed) W. C. RALSTON.

Extract From Letter by Mr. Ralston to R. M. Brereton, Referring to One of His Canal Enterprises for the Great Valleys of California.

May 9, 1872.

We learn with great pleasure that the company you represent has finally determined upon the construction of a canal to extend from Tulare Lake, along the foothills of the San Joaquin Valley, to tide water at Antioch on Suisun Bay, a distance of 180 miles; also that this canal is to convey a volume of water sufficient for purposes of irrigation and navigation and mill-power; that the supply of water, according to the most careful estimates and surveys is quite ample and that the country to be passed through presents no serious obstacles to the work, but is, on the contrary, favorable in nearly all respects. This is, without doubt, an enterprise of great magnitude, involving a large outlay of money, but at the same time, in our judgment, promising results the most satisfactory and in every way desirable to the state, the company and, indeed, to all concerned. Throughout the region of country to be traversed by your canal are large tracts of land, the value of which would be immensely enhanced by the facilities for irrigation thereby afforded. At present these lands, though naturally fertile, are uncertain and capricious in their production, owing to the prolonged drought of our summers

and the sometimes scanty rainfall of the winter months, and they are therefore very sparsely populated. In wet seasons such of them as are cultivated yield abundantly, even with very imperfect tillage, thus showing the great capabilities of the soil, so there can be no doubt that with assured means of irrigation they would be speedily settled up and the entire region become one of the most productive in the world. In climate, as well as soil, and in adaptibility to all the varied pursuits of agriculture, viniculture, horticulture, fruit growing and stock raising no country, we believe, surpasses it. The only natural want is water in sufficient quantity, and this being supplied by your great work, an extraordinary development of wealth must surely follow, which would yield large revenues to your company. Of this we have no doubt whatever.

(Signed) W. C. RALSTON,
Cashier of the Bank of California.

Norfolk Experience

We, the principal land-owners and rate-payers of Norfolk, desire to record our hearty appreciation of the useful manner in which, during the past six years, our County Surveyor of Roads and Bridges, Mr. Robert Maitland Brereton, C. E., has performed his county duties.

We consider that by the energy, ability, patience and tact he has displayed during this period he has fairly earned this testimonial.

We are sorry that the county is about to lose his services, and we trust that this testimonial may assist him to obtain an appointment wherever he may go.

Signed in following rotation by

Harvey Mason, High Sheriff of the County.
Leicester, Lord-Lieutenant of the County.
Albert Edward, Prince of Wales, Sandringham, Norfolk.
D. M. Probyn, Lt.-Col., Comptroller and Treasurer to H. R. H. the Prince of Wales.
John Norwich, Bishop of the Diocese of Norfolk.
Kimberley, Secretary of State for India.
Wodehouse (heir to the Earl of Kimberley).
Albemarle, Quiddenham Hall (Sixth Earl of Albemarle).
Walsingham, Merton Hall, Chairman of Quarter Sessions.
Rosebery, Postwick Hall (Earl of Rosebery).
Suffield, Gunton Park (Lord in Waiting to H. R. H.).
Robert Gurdon, M. P., J. P., D. L., Senior Chairman of Quarter Sessions.
Waveney, Flixton Hall, Chairman of Quarter Sessions.
Orford, Mannington Hall.
Francis G. M. Boileau, Bt., J. P., D. L., Ketteringham Park.
R. Harvey Mason, J. P., Chairman of the Highways Committee.
Hastings, Melton Constable Hall.
Clare, Sewell Read, M. P., J. P.
William M. Haggard, J. P., D. L., Senior Chairman of Quarter Sessions, West Norfolk.
Robert J. Buxton, Bt., M. P., J. P., D. L., Shadwell Court.
Thomas Beever, Bt., Chairman of the County Finance Committee.
J. J. Colman, M. P. for Norwich, J. P., D. L.

W. Amhurst T. Amherst, M. P., Didlington Hall.
John Hetblack, Mayor of Norwich.
James Bowker, Mayor of Lynn.
Henry Birkbeck, Senior Partner Gurneys' Bank.
Charles Foster, Clerk of the Peace of Norfolk.
Robert Fellows, J. P., D. L., Shottesham Hall.
Edmund Beck, Agent to H. R. H., The Prince of Wales, Sandringham.
Edward Muskett, Agent for The Duke of Norfolk.
Dennis Wells, Agent for the Marchioness of Lothian.
Henry W. B. Edwards, J. P., D. L., Hardingham Hall.
H. F. Custance, K. C. B., J. P., D. L., Weston House.
Richard England, J. P., Binham Abbey.
George Forrester, Agent to the Earl of Kimberley,

And over two hundred other signatures, among which are all the chairmen of the Board of Guardians in every union of the county.

Motion of Recognition at the Quarter Sessions, January 11, 1885.

It was moved by the Right Honorable Thomas Lord Walsingham, the chairman of the court, and seconded by the Reverend Henry Milne, and carried unanimously, "That this court regret to learn the intended resignation of Mr. Brereton, the County Bridge and Road Surveyor, and desire to express their acknowledgment of the completeness and great usefulness of his report upon the bridges of the county and the high value of his services generally during the past six years. By the Court."

(Signed) CHARLES FOSTER,
Clerk of the Peace.

Report of the Proceedings of the Court of Quarter Sessions Held at the Shirehouse, Norwich, January 10, 1885.

Mr. Harvey Mason, Chairman of the County Highways Act Committee, said that the committee regretted extremely that Mr. Brereton had thought it necessary for his own sake to resign the office of County Bridge and Road Surveyor. The county would lose the most active, intelligent and capable officer that had ever served the county. The amount of good work that Mr. Brereton

had done, and the saving he had effected for the county in various things, had become very apparent to the committee, and they only hoped the county might succeed, if possible, in getting another officer who would serve them as well. During his term of office Mr. Brereton had submitted some very excellent reports to the court, including the last, as to the breakdown of the audit system in the county. One able report gave them a most complete history of the roads with schedules as to the expense of them, and another contained most valuable information regarding all the bridges in the county, without which they could not have proceeded on their way at all. He would also remind the court that Mr. Brereton had foreshadowed all the roads that would probably be included in the main road system in a valuable schedule to his third report. Then with regard to his last report, on the audit system, whether any action could be taken by the court or not, it afforded them most valuable information, because without such information, setting forth the defects of the present system, they would not be able to effect a reform.

The Earl of Kimberley said that "As a member of the Highways Act Committee he desired to express his own feeling as to the loss the court would sustain by the resignation of Mr. Brereton. In having to inaugurate, as they had done, a new system, it certainly has been extraordinarily fortunate for this county to have had an officer of such singularly striking experience, knowledge and energy; and whatever might be the defects of the present system, which he believed were very great, they would have derived immense advantages for the future, in any measures they might wish to take, from the light which Mr. Brereton had thrown upon the whole system. He thought he was not wrong in saying that there is no magistrate in the county who thoroughly understood the condition of the roads and the system on which they were worked until they had read the admirable report which Mr. Brereton had laid before them, and every magistrate would feel regret at losing his services."

Mr. R. Gurdon, M. P., Senior Chairman of Quarter Sessions, said: "He must be permitted to say how thoroughly he agreed with all that has been said, as to the loss to the county by the resignation of Mr. Brereton. He would be borne out by Mr. Brereton in stating that he had worked hard to prevent it. The court would remember that Mr. Brereton had to work at the first an unpopular and difficult act, and had it fallen into other hands they would have had a terrible amount of trouble. Wherever Mr. Brereton went he would

carry with him not only the good wishes of this court, but of all sorts and conditions of men."

Lord Walsingham, Chairman of Quarter Sessions held at Swaffham, said: "I am quite sure that this court will endorse everything that was said at Norwich as to the great regret which the county feels at Mr. Brereton's resignation. The county was extremely fortunate in having secured the services of Mr. Brereton at a time when a great change was made in the system of carrying out the management of our roads, and the manner in which he has discharged his duties has been, in my opinion, and I believe in the opinion of the magistrates of this county, very creditable to himself. Mr. Brereton has shown an immense amount of ability, tact and good judgment in what has been for a long time rather a thankless and unpopular office. I wish Mr. Brereton every success in his future life. I hope that wherever he goes he will find his services as highly appreciated as they have been by ourselves."

Mr. Wm. M. Haggard said: "As chairman of this court during the whole of Mr. Brereton's tenure of office, I can confirm all that the noble lord has said with respect to the services which he has rendered to this county, and also to his courtesy, thought and earnest endeavors to save the rate-payers' money in every possible way; and I also agree with the remarks of Mr. Mason, the Chairman of the Highways Act Committee, that it was a great pity and much to be regretted that just at the moment when a longer continuance of his experience and courtesy and all those other good qualities which he possesses would have been very likely to have cleared away the prejudices which seemed to exist in certain quarters, he felt himself called upon to resign his office."

Letter From Mr. Charles Magniac, M. P., Partner of Messrs. Matheson & Co., Referring on Mr. Brereton's Reports to the Highways Act Committee.

Lombard Street, March 1, 1885.

My Dear Sir:

I never saw such splendid reports upon a subject, much less on county business matters, which, so far as my experience goes, are a sealed book to those who ought to transact them.

Very truly yours,

(Signed) C. MAGNIAC.

From Mr. E. W. Harcourt, M. P. for Oxfordshire.

Nuneham Park, Abingdon, February 18, 1885.

Dear Mr. Brereton:

I read your letter with great regret. The old country can ill afford to lose good men like yourself, who do honest work for conscience sake. Personally, I must thank you for the valuable information you have at various times given me. The "Far West" will be a gainer by your determination, and I only hope your new employment will be less thankless than your present one has been. I have often felt the discouragement you describe, but we cannot all run away—"the real property" ties us by the leg, and if Mr. Chamberlain is to have his way, why, good-bye to the economy in the rates forever! I shall always be very glad to hear of you and to learn that your energy and capability is crowned with the reward it deserves.

Yours very truly,

(Signed) E. W. HARCOURT.

From Sir Slater Booth, Bart., M. P., President of the Board of Trade.

The Priory, Odiham, February 9, 1885.

My Dear Sir:

I learn with much regret and surprise that you are leaving Norfolk in despair of seeing the introduction of a more satisfactory road management in that county. I can quite appreciate the worry and trouble of endeavoring to administer the Highway Act parochially. I was disappointed that the present government did not give a lift or helping hand to such counties as yours, by declining to administer the subvention in aid of highways except through a county authority. Very truly yours,

(Signed) SLATER BOOTH.

From Sir Stafford Northcote, Bart., M. P., Late Earl Iddesleigh.

Dynes, Exeter, December 31, 1884.

Dear Mr. Brereton:

Your letter of the thirteenth has been lying on my table until I should have read your report. I must not let the year close without

thanking you for it. Your experience makes the report very valuable and shows how necessary a careful revision of the whole system of county audit has become. I hope next year, or, at all event, the year following, will furnish opportunity for taking the whole question of county administration in hand. Very truly yours,

(Signed) STAFFORD H. NORTHCOTE.

From Hon. Edward Thesiger, Clerk to the Highways Acts Committee of the House of Lords, March 18, 1881.

Sir:

I am desired by the Lords Committee on the Highway Acts to inform you that they are anxious to have the benefit of your evidence on this subject, and to request you to attend their Lordships on Tuesday, next twenty-ninth instant.

(Signed) EDWARD THESIGER.

Scotland

Recognition of Services When Commissioner to the Late Duke and Duchess of Sutherland in Sutherland and Rossshire, 1886-89—

From Sir Arnold Kemball, K. C. B., ex-Commissioner to the Duke.

Stafford House, May 31, 1886.

Dear Sir:

The Duke returned home today, and I have much satisfaction in informing you that His Grace has been pleased to prefer for you the office of Commissioner for His Grace's Estates in Scotland, with the command of your services when required in all matters concerning his interests. The salary of the office is £1500 per annum, with house at Uppat and the use of two horses in the execution of your duties in Sutherland. The condition is the obligation on either side to give six months' notice of its termination.

Yours very truly,

(Signed) A. B. KEMBALL.

From the Late Duke of Sutherland to Mr. Brereton.

Hotel Bristol, Paris, June 5, 1888.

Dear Brereton:

Many thanks for your letter. I was sure you would take my letter in good part, and trust and believe you will not find much difficulty in finding fresh work. I am afraid you have been up partly to see me. I ought to have told you that I was going abroad again for a time. Of course, I shall be only too happy if I can be of any use to you, and I repeat how sorry I am that we should part. I find Stafford is very anxious to get into harness again, and, of course, he is the natural man and would have always been my right hand if it had not been for that unfortunate election.

Yours sincerely,

(Signed) SUTHERLAND.

Testimonial From the Duke.

Mr. Brereton acted as my commissioner for two years in Sutherland, and I always found him full of energy and anxious to fulfill his duty under very difficult circumstances. I need not mention his engineering qualities; his past services in England, India and America speak for themselves.

(Signed) SUTHERLAND.

From the Late Duchess of Sutherland.

Sutherland Tower, Torquay, November 9, 1888.

My Dear Mr. Brereton:

Do ask the Duke to see you before he starts for Florida on Wednesday next. He must and ought to give you a testimonial. I would say more, but am in the middle of an attack of low fever, which makes me very weak and suffering.

Yours very sincerely,

(Signed) A. SUTHERLAND.

From the Late Duke of Argyll.

Argyll Lodge, Kensington, June 19, 1888.

Dear Mr. Brereton:

I was extremely surprised and equally sorry to hear of the change which the Duke has made in the management. * * * * * I sincerely hope you may get other employment worthy of your abilities. Yours truly,

(Signed) ARGYLL.

From the Late Duke of Westminster.

Cliveden, June 22, 1888.

My Dear Brereton:

I am obliged for your letter of twentieth, and regret that all the circumstances of the case surrounding the conclusion of your term of engagement with the Duke should have been of so unsatisfactory a character to yourself, and I am bound to say that, from my knowledge of you, that it is a matter of regret that the Duke is losing your valuable services. Yours very truly,

(Signed) WESTMINSTER.

Eaton, October 21, 1888.

My Dear Brereton:

I now have your address in London from Cecil Parker, of which I take advantage. The Duke of Rutland, I heard some little time ago, is in want of an agent, and in the possible event of the place being likely to suit you, I mentioned your name and have also written to the Duke in the same sense, but have no idea that you would think of the place. I have not been well for some time and had in consequence to leave the forest sooner than we had intended. Kylestrome and its surroundings are as delightful as they are most beautiful, and the greater part of the new ground was fairly covered with deer. Yours very truly,

(Signed) WESTMINSTER.

From Lord Ronald Gower, Brother of the Late Duke of Sutherland.

Stafford House, June 11, 1888.

Dear Mr. Brereton:

Thanks for yours just received. I need hardly tell you how much I regret that you are giving up the place you held in Sutherland. I can well understand the great difficulties of that situation. * * * * Yours very truly,

(Signed) RONALD GOWER.

From William Houston, One of the Duke's Oldest Sheep-Farm and Shootings Tenants in Sutherland.

Strathpeffer, June 21, 1888.

My Dear Mr. Brereton:

I need not say how truly sorry both my wife and I feel at losing such very kind and genial neighbors as you and Mrs. Brereton have been to us, and we shall miss you more than enough. At the same time, I am quite sure that owing to the painful combination of crofters and other difficulties in Sutherland, you have taken the proper course. I can assure you that we shall ever cherish the kindest regards for you and Mrs. Brereton, wherever you may next take

up your abode, and with our kindest wishes for you and yours, believe me, my dear Mr. Brereton,

Yours very sincerely,

(Signed) WILLIAM HOUSTON.

From Major Weston, Another Old Tenant.

Morvich, Rogart, June 22, 1888.

My Dear Brereton:

I am sincerely sorry at the change matters have taken in the management of the Sutherland estate, as I think you were the right man to bring things round into a satisfactory state. Your suave and conciliative manner, your kind sympathy and great benevolence of heart, strong common sense, added to your intelligent grasp of your work, and varied experience of human nature, would soon have made you a very popular man and one in whom all men have confidence, provided always the management of the estate had been left to you alone without any outside interference. Selfishly speaking, I am very sorry to lose you as a neighbor and friend in these parts. Your experience in India must have taught you that the great secret of the ability of our men there, viz: to place men in responsible positions and leave the management of affairs very much to their own judgment, but it is all very well to have theories—these may all be false conclusions of mine—there is, however, the sad and too patent fact left, viz: you are going away, and we are all very sorry for it.

Yours very truly,

(Signed) CHARLES WESTON.

Extract From a Letter Received From Mr. Gurney Buxton, Senior Partner of Messrs. Gurneys, Bankers, Norwich, Norfolk, and One of the Duke's Salmon-Fishing Tenants in Sutherland.

Catton Hall, Norwich, Dec. 22, 1888.

"I met the Duke of Westminster at Holkham last week; he spoke very warmly of you and said that you were a great loss to Sutherland. I only wish that you were back again."

Letters From Some of the Ministers of the Free Church of Scotland in Sutherland, Who Represented the Crofter Community.

From Reverend Donald Mackenzie.

Free Church Manse, Farr, July 4, 1888.

My Dear Sir:

It is with much surprise and unfeigned regret that we all heard of your going away and leaving us so soon, and when we were only beginning to know you and appreciate your services. Your last visit to Farr was a red letter day in our history and in that of the Sutherland management; the inauguration, as we hoped, of a new era of hopefulness and helpfulness. Your lecture did much, your patient hearing of our grievances did more, but your visiting us from house to house did most of all avail to allay the spirit of mischief, to encourage self-reliance, and to have confidence in the management which you represented. That the Lord be with you and bless you always and everywhere is the prayer of, my dear sir,

Yours sincerely,

(Signed) DONALD MACKENZIE.

From Reverend Neil Taylor.

Free Church Manse, Dorneck, June 28, 1888.

Dear Mr. Brereton:

I may say in good faith that I regret the fact of your departure, as I believe that you sincerely sought the well-being of the people while seeking to serve your superior, and that the people generally felt this and were learning to confide in your policy. The time allowed you and required to carry out a policy of conciliation such as is required in this county has been too short. I hope and pray that you and your family may have the way opened up for entrance upon some sphere which shall afford opportunities of usefulness similar to that which you have occupied in Sutherland.

Yours very sincerely,

(Signed) NEIL TAYLOR.

From Reverend Gilbert McMillan.

Manse of Loth, June 29, 1888.

Dear Mr. Brereton:

I am very sorry indeed to hear that you are leaving us. I am so on our own account and also because I feel sure that if the views you entertain with regard to the management of His Grace's estate were carried out great good would be the result. In saying good-bye, I beg to thank you for all the kindness I have received from you, and to express our united best wishes for the welfare of Mrs. Brereton, yourself, and all the children. Yours very faithfully,

(Signed) GILBERT M'MILLAN.

Mr. Brereton received similar letters of appreciation from several other crofter representatives.

From Sheriff Mackenzie.

Tain, June 26, 1888.

My Dear Sir:

I presume I may take the paragraph in today's *Courier,* which announces your resignation as commissioner, to be authentic, and I now write to say how sorry I feel at this severance of your connection with the county of Sutherland. It is some satisfaction to think that our business relations have been uniformly so harmonious, and I can look back with pleasure on the frankness and openness which characterizes our intercourse. I am indebted to you for many acts of private kindness, and of these I shall cherish a pleasant remembrance. In leaving Sutherland you will carry with you my best wishes for the future welfare and happiness of "you and yours," and I hope, before you leave, to have the opportunity of expressing to you in person my sincere regret for your departure.

Yours very truly,

(Signed) THOMAS MACKENZIE.

From John Cheyne, High Sheriff for Sutherland and Rossshire.

13 Chester Street, Edinburgh, June 22, 1888.

My Dear Mr. Brereton:

Our intercourse has been so uniformly pleasant that I much regret to hear of the step you have taken, but no one can appreciate better than I do the worry and anxiety which, owing to the deplorable state of feeling in the county, you must have had during the last two years, and if your difficulties were increased by other circumstances, unknown to outsiders, I cannot be surprised at your action, but, on the contrary, can believe that it is a great relief to you to be rid of the commissionership. Personally, I shall always retain a grateful sense of your kindness and courtesy to me, and, although our official relationship is now terminated, I hope that we may occasionally meet and that you will not fail, when you happen to be in Edinburgh, to look me up. My wife joins me in kind regards to Mrs. Brereton and yourself, and with every good wish for your prosperity and happiness, I am,

Yours very sincerely,

(Signed) JOHN CHEYNE.

From Sir William Fraser, the Historian of the Noble Families of Scotland.

32 South Castle Street, Edinburgh, June 22, 1888.

Dear Mr. Brereton:

Your letter gives me great concern, and I sincerely regret that you have found it necessary to resign your commissionership. As I formerly mentioned to you, I have, during a long professional life, seen much of commissioners and chamberlains on large estates, and from what I saw of you personally, as well as through correspondence, I felt that you were well qualified to discharge the duties of the office with marked ability. I looked forward to the pleasure of satisfactory intercourse with you during the progress of the Sutherland family history. I sincerely hope that the change may turn out for your benefit, and I will always be happy to hear of your well-being. Believe me, with many thanks for your courtesy,

Yours very faithfully,

(Signed) WM. FRASER.

Letter From Sir Donald Smith (Lord Strathcona), on Mr. R. M. Brereton's Visit to Canada in 1888, for the Object of Seeing the Crofter Settlements in the Northwest Provinces, and for the Settlement of Other Crofters From the Sutherland Estate.

Canadian Pacific Railway Company,
88 Cannon Street, London, June 18, 1888.

Dear Mr. Brereton:

I send you a line to say that it will give me pleasure to meet you here at the time you suggest, shortly before noon on Saturday of this week, and to be of use to you in any way I can in connection with the intended visit of yourself and Mrs. Brereton to Canada.

Very truly yours,

(Signed) DONALD A. SMITH.

Sir Donald Smith kindly furnished Mr. Brereton with several letters to his friends and officials in Canada; as also did Mr. Peacock Edwards, the Managing Director of the Canada Northwest Land Company.

Professional Notes Made by R. M. Brereton on American Systems of Locomotive and Bridge Construction and on Labor-Saving Excavation Machinery, as Likely to Prove Useful in India and in the British Colonies. Copies of These were Given to Lieut.-General Sir Richard Strachey, R. E., and to Sir Douglas Forsyth of the India Office, and to the Officials of the Colonial Office, and to Colonel E. C. G. Williams, R. E., Secretary to the Government of India, Public Works Department, and to the Institution of Civil Engineers, in October, 1878.

Design and Duty of American Locomotives Compared with Same of English Locomotives.

Having studied during the past eight years the working results of 77,400 miles of railways in the United States, I have compared

these with my own personal experiences during the past twenty years in England and in India. In regard to locomotives, it seems to me that the Americans obtain from 8,000 to 10,000 train-miles greater duty per annum from their locomotives than we do in England or in India, and this, too, under the following disadvantages: Inferior roadway, steeper gradients, sharper curves, more severe climatic conditions and less speed in running. This greater duty obtained in America cannot be due to better workmanship and the use of superior materials, because it is well known that the English mechanic in skill cannot be excelled, and the very best materials are employed by our English builders, and the hours of work in both countries are the same. Hence, it would seem to me that this greater duty done by the American motor is due to the better design and better system of working the locomotives. The American builder excels in his system of framing and counterbalancing, and in the design of the crank-axles, &c., so that the engine may run remarkably easy and without jar around sharp curves, and can work not only over the lightly constructed road-beds, but also diminish the wear and tear on the more solidly constructed roads, and at the same time increase the effective tractive-force. I have ridden hundreds of miles on locomotives in England, India, France and in the United States, and have always found the American engine the most easy to ride on, more steady and with less fatiguing jar to the drivers.

As an evidence of my criticism in this matter, I may quote the following statements from the Railway Gazette re "Narrow Gauge Engines in India":—"The speed on all narrow gauge lines in India is restricted to 15 miles an hour, and to run trains on our metre gauge railways at a much higher speed is not safe, owing chiefly to the unsteadiness of the locomotives employed; the wheels being too rigid, the whole engine is stiff, and the weight not being equalized: through these and other causes they are very unsteady, the oscillation is very great, and the rigid wheel-base jars going round the sharp curves of the metre-gauge. It is also almost impossible to give these engines their full hauling power, simply because the greater portion of the weight cannot be on the driving-wheel." Another note I have made is in the mistake we make in adhering so obstinately to our old-fashioned system of running each engine with one crew. Herein we limit the power of the motor to the physical endurance of the individual driver. Every one who understands the construction and

power of the engine must see that it is capable of doing a far greater duty than 16,000 to 20,000 train-miles per annum. On the American system the object is to avoid the wear and tear due to expansion and contraction which ensue from frequent withdrawal of the fires. The more continuous running system saves considerably consumption in fuel in getting up steam so frequently. In America they do not find that the double-crew system involves any greater cost in repairs and renewals; in fact, the costs in these is found to be less than they are in this country and the engines are as long-lived. The duty of the driver is to run his engine and to keep her in order on his daily trip from depot to depot. He has nothing to do with her in the engine-house: there she is cleaned and repaired and got in steam by a staff employed for these purposes. As soon as one crew has driven the engine over their daily run another crew is ready to drive her over the next run, and so she oscillates to and fro. Mr. Juland Danvers's report for 1876-7 shows (on page 11) the number of engines on the whole of the Guaranteed Railways in India to be 1425; and (on page 31) that the train-miles were 21,609,411, which gives an average of only 15,164 miles per engine per annum. Deducting as much as 33 per cent. from the days of the year for the monsoon season and for repairing days, there remain 240 days in which the engine should be capable of running 100 to 200 miles per 24 hours, or from 24,000 to 36,000 train-miles per annum. Mr. Danvers' report, however, shows that the average mileage per engine was only about 60 miles per 24 hours for 240-day year. The official returns of the New York Central Railroad show that 13 engines, in 1877, made combined monthly average of 6,238 train-miles for the entire year; four of their engines ranging from 7,104 to 7,218 miles per month; while the average for the year of all the 97 engines in service was 38,422 train-miles per engine. One of their engines during 15 months averaged 7,858 miles per month, or over 255 miles daily for 461 consecutive days, including Sundays. The cost of repairs of these engines per mile run was 2 7-10th cents, which is less than 1 4-10 pence per mile. Mr. Ely, the locomotive superintendent of the Pennsylvania Railroad, gives the following data regarding 20 of their engines on the heaviest portion of their road—over the Alleghany Mountains—for the year 1877: Average annual mileage of 10 passenger engines was 45,554½, and the cost of repairs per mile run was 3.48 cents; 10 of their goods (freight) engines had an average annual mileage of 32,574½; the cost of repairs was 3.65 cents per mile run. The

average of all 20 engines was 39,065½ miles per engine, and the cost of repairs per mile run was 3.56 cents. One of their passenger engines, No. 133, on this Alleghany division averaged 237½ miles daily for the entire year, in 1872. This engine ran 44,616 miles in 1869; 42,900 miles in 1870; 54,139 miles in 1871; 86,724 miles in 1872; 41,979 miles in 1873; and during nine years' service it averaged 47,528 train-miles per annum. Another of their passenger engines, No. 914, ran 60,604 train-miles in 1874; 58,344 miles in 1875; 57,225 miles in 1876; 49,257 miles in 1877. One of their goods engines, No. 447, ran 41,184 train-miles in 1870; 44,108 miles in 1871; 42,537 miles in 1872; 36,877 miles in 1873; 35,580 miles in 1874; 36,508 miles in 1875; 45,529 miles in 1876; 39,193 miles in 1877. This gives an average of 40,189 train-miles for each of the eight years this engine had been running. Mr. H. J. Jewett, the Locomotive Superintendent of the Erie Railroad, in an official letter, dated April 8, 1878, gives the following train-mileages of four of his engines, which were built by the Rogers Locomotive Works of Paterson, New Jersey:

Engine No. 201—mileage 635,169—placed in service June 9, 1854.
Engine No. 202—mileage 632,122—placed in service June 26, 1854.
Engine No. 203—mileage 658,548—placed in service July 15, 1854.
Engine No. 204—mileage 539,186—placed in service July 29, 1854.

These engines had new boilers applied in 1871: the original boilers were running 17 years. He reports these engines good for eight years more service at least. He also reports that two other engines, Nos. 313 and 327, built by the same company, as running with their original fire-boxes since 1865 or 13 consecutive years. I note that these locomotives in service on the above railroads must have been well constructed; that they could not have been long in the repairing shops; that they must have been kept in good running order, to have performed the high rate of duty they actually did. This, too, is the more remarkable when one considers the very severe winters, the heavy snow-falls and how the frost breaks up the road-bed in the spring. In order to arrive at a fair comparison with the cost of repairs in England, there are a number of points to be equated, such as cost of labor and materials; effects of climate; steeper gradients and sharper curves; and heavier train-loads hauled; for in all these the American engine labors under greater disadvantage than do engines in England or in India. Americans economize by adopting

a system of interchangeability of parts as much as possible, and by limiting the number of types or classes of engines. They consider that for all the ordinary traffic requirements of a railroad three types of engines are sufficient: these are known as C, D, and E. Class C is for passenger service and for level lines or where the gradients are easy; Class D, known as the "Mogul," is for goods or freight traffic and for heavy grades: Class E, known as the "Consolidation," is for very steep gradients and a very large and heavy traffic. The passenger engine has a four-wheel truck, which not only swivels, but can move laterally under the front end of the engine by means of a swinging bolster; thus it can adapt itself to the shortest curves in use and to the greatest inequalities in the road-bed: the four driving-wheels are equalized together, as also are the four truck-wheels. In the goods or freight engine the same arrangement for swinging truck pertains: the truck is composed of only one pair of wheels and is equalized with the front driving wheels. On the Lehigh Valley Railroad, on which there is a very heavy coal traffic, Class E works over a maximum gradient of 126 feet to the mile, with a maximum load of 329 gross tons of wagons (cars) and lading: the average load is 235 gross tons. On a gradient of 76 feet to the mile, one of these engines hauls a maximum train of 140 empty four-wheel wagons (476 gross tons) at a speed of eight miles per hour. The usual train is 100 empty wagons (340 gross tons). On an incline, 12 miles in length, with a gradient of 96 feet to the mile, combined with frequent curves of 8 and 10 degrees radius, and with only two tangents, each less than a mile long, engines of the Class E take 40 loaded four-wheel coal wagons: the usual train is 35 of such wagons, which are hauled at a speed of 12 miles per hour. The wagons weigh 3 tons 8 cwt. each; the load is 6 gross tons of coal per wagon: thus these engines haul up this incline a train weighing from 329 to 376 gross tons: they consume 3.75 tons of coal daily. On the Denver & Rio Grande Railroad, five-feet gauge, on which the maximum gradient is 4 per cent. or 211 feet to the mile, and the sharpest curve is 30 degrees, or 193 feet radius, and on which the rise in 14.7 miles in 2,370 feet, and in 10.2 miles 1,136 feet, Class E engine hauls one luggage or baggage car and seven passenger cars containing 160 passengers; weighing 100 tons, stretched over a length of 360 feet. The following comparative schedules show the working results on English, American and Indian railroads during the year 1876-7:

ENGLISH.

	No. of Engines.	Miles Operated.	Train Miles per Engine
Great Eastern	505	907	20,600
Midland	1326	1588	18,219
Great Western	1478	2274	17,397
London & N. W.	2058	2158	15,800
Totals	5367	6927	72,016
Average of all			18,004

AMERICAN.

	No. of Engines.	Miles Operated.	Train Miles per Engine
Pennsylvania	515	1071	32,627
New York Central	602	1000	30,870
Michigan Central	219	804	30,812
Erie	468	956	26,900
Totals	1804	3831	121,209
Average of all			30,302

INDIAN.

	No. of Engines.	Miles Operated.	Train Miles per Engine
East Indian	450	1504	14,737
G. I. P.	331	1288	17,000
Madras	100	858	23,334
Bombay and Baroda	64	417	19,149
Totals	945	4067	74,220
Average of all			18,555

On the Pennsylvania Railroad, including double and third track, the aggregate number of miles operated by the 515 engines was 2,881. On the New York Central the same was 2,433 by 602 engines. This shows 12,298 more train-miles per engine on the American roads than on the English, and 11,747 more miles than on the Indian roads. The following statement shows the average first cost of the locomotives placed on the English roads:

Midland	£2,648	=	$13,240
Great Eastern	2,271	=	11,355
Great Western	1,767	=	8,835
London & N. W.....	1,617	=	8,085
Average of all.....	2,076	=	10,380

AMERICAN.

First Class C Passenger	$ 8,600
First Class D Goods (Freight)	9,000
First Class E Goods (extra power).....	11,500
Total	$29,100
Average of all.....	$ 9,700 pr engine

Mr. Danvers' report does not furnish the cost of the English engine erected ready for service in India. The freight rate from New York to Calcutta, Bombay and Madras is about 40 s=$10. per ton, the same as from Liverpool.

AMERICAN LOCOMOTIVES IN AUSTRALIA.

The latest official reports of the Colony of Victoria show that the American locomotives built for the Government Railways by the Rogers Locomotive Works of Paterson, New Jersey, cost erected in Melbourne, £2,132=$10,660 each; the English built ones cost from £2,352 to £3,032=$11,760 to $15,160 each; those built and erected in the Colony itself cost from £2,939 to £3,571=$14,695 to $17,855 each. The American locomotives supplied to the Colony of Victoria and to the New Zealand Government were ordered through Mr. W. W. Evans, C. E., of New York; they were built and shipped under his personal supervision. Mr. A. Morris, Executive Commissioner from the Colony of New South Wales to the Philadelphia International Exhibition of 1876, reported to his government that American locomotives of the very best quality could be laid down in Sydney for £2,000=$10,000 or £1,000=$5,000, less than for those built in England. Mr. Allison D. Smith, the Locomotive Superintendent of the Government Railways of New Zealand, reported, on March 29, 1878, as follows: "The engines, or 'yankees,' as they are called here, are working splendidly; they have given great satisfaction. I have picked out our best men for them, and they are great favorites. When I let it be known that six more were coming the drivers and firemen all commenced to vie with each other in

trying who should be best man in order to get one. The engines being new are somewhat stiff, but I can plainly see that they will be economical in stores and light in repairs." Though these American engines seem clearly to be cheaper than English-built engines, costing less in repairs per mile run; running easier and with greater steadiness, and causing less strain and damage to the permanent-way; it would be bad policy to place them in the hands of any prejudiced or narrow-minded English superintendent, who would wish to injure them and so give them a bad record: this I have known to have occurred in South America. The two leading and most reliable locomotive firms in the United States are the Rogers Locomotive & Machine Works at Paterson, New Jersey, and the Baldwin Works of Philadelphia. Both have immense establishments and facilities for turning out with the greatest expedition a large number of engines; far surpassing any similar works in Great Britain or in Europe. Mr. W. S. Hudson, the superintendent of the Rogers Works, is an Englishman by birth, and was brought up in the Stephenson's Works at Newcastle: he is justly recognized as the ablest locomotive designer and builder in the United States; and he is as good a master of natural and mechanical sciences as can be found in America, although almost entirely self-taught.

THE WESTINGHOUSE AUTOMATIC BRAKE.

The United States deserves great credit for the general adoption of this most important safety brake on all passenger trains. The marvel is that its value and importance have not been appreciated and adopted in England, India and in the Colonies. Then there is another great safety improvement to the style of rolling stock in use on American railways; this is the Miller's coupling and buffer, which entirely prevents telescoping of the cars. Another improvement in the rolling stock is found in the use of the cast-iron chilled wheel made from the Salisbury iron of Connecticut. All these safety improvements have been in use on 74,000 miles of the railway system of America; so that these appliances are no longer mere experiments. The safety of the traveling public and the value of the traffic in general on railways throughout the British Empire forbid the slow and ultra-conservative progress of our companies and governments in the way of adopting such safety measures. A great economical saving could be effected through the use of the cast-iron chilled wheel. The

Americans have proved that these have a life of 100,000 miles, and cost only $17, as against $40, the cost of the English steel-tired wheel. The weight of these American wheels is about 525 pound: the metal is charcoal iron, having a tensile strength of fourteen tons per square inch.

THE CORCORAN WIND-MOTOR FOR PUMPING.

This is another American useful and handy machine largely in use throughout the Western Plains. It is used in connection with cedar or redwood tanks, holding from 50,000 to 150,000 gallons, for supplying the railway locomotives, and for farm purposes. These machines are entirely automatic in their action; they set themselves to the wind, and turn their faces from it when it blows too hard; they can be regulated to any strength of wind and will operate with the lightest zephyr. The cedar tanks, if properly covered, will last fifty years and over. By soaking the staves in silicate of soda and then in chloride of calcium they will last for a very long period.

AMERICAN MECHANICAL EXCAVATORS FOR EARTHWORK.

In the construction of railways and canals through valleys and plains where alluvial soil prevails and in which ploughs will operate, and where horse, mule or bullock-power is available, a great economy may be obtained through the use of the American "Wauchope" and the "Slusser" earth-excavating and movable machines; also with the Chicago self-revolving scraper; all of these are extensively in use throughout the United States. I have employed them on large canal works in California, where labor was $3 per day and the hire of horses and mules was $2 per team per day. With the "Wauchope" machine I have moved earth from side-cutting into embankment at the rate of 1,000 cubic yards a day at a cost of less than one penny or two cents per cubic yard. Many people think that human labor is cheap in India because they compare it with the cost of similar labor in England. Judging from results in my own large experience in India, the rate of labor in India is not cheap when one thinks of the limited wants and the frugal fare and habits of the people, as well as the vast amount of earthwork required to be done with the greatest possible expedition in the construction of railways and canals, and also the limited financial resources of the Government.

AMERICAN BRIDGE CONSTRUCTION.

In America they have effected great economy in time and cost of bridge construction through the general adoption of the "Whipple Truss" system for iron superstructure. The English engineers of Canada have gone to the United States for their bridges of large spans, because they found that they could not get the iron-work so good or so cheap elsewhere, or so quickly; yet, the American iron-work has to pay a duty of 17½ per cent. in entering Canada. Messrs. Clarke, Reeves & Co. of Philahelphia are one of the largest bridge firms in America. They have constructed over three miles in length of their "Whipple Truss" bridges on the Canadian railroads, besides nearly nine miles of the same in the States and in South America. The facility and rapidity with which these American bridges are erected seem almost incredible to English engineers, who are acquainted only with the English style of riveted girder-work. In America I have known and seen spans of 150 feet erected in a single day. As a matter of fact, the riveted work takes just as many weeks to erect as the pin-connected work takes days. The advantage of pin-connection—besides being the most scientific and suitable—lies in all the skilled labor being done in the shops, and none is required on the scaffolding during erection; so that the work of erection proceeds with a facility and rapidity quite impossible in a riveted structure. The pin-connected girder is cheaper than the riveted, because the amount of metal in it is less. In proportioning the different parts, the strength of each part is increased in proportion to its nearness to its work; so that in carrying out the principle of "uniformity of strains" the American structure is of the strongest combined with the lightest, and there is no useless weight of iron to be paid for. These bridge structures in America have undergone the test of years under the heaviest traffic, and have been found safe and efficient. All the parts in each successive similar span are of exact uniform dimensions, and are, therefore, perfectly interchangeable; this, of course, greatly facilitates the erection and the rebuilding of these girder bridges.

COMPARATIVE FIRST COST OF RAILROADS.

In India, in 1878, there are about 7,000 miles of railway to over 250,000,000 of people. In the United States of America there are 77,470 miles to a population of 45,000,000. The American railways

have cost, on the average, for construction and equipment £12,000= $60,000 per mile. Some of the principal roads, such as the New York Central, cost only £9,000=$45,000 per mile. The narrow-gauge lines—3 to 3½ feet gauge—(of which there are over 3,000 miles in operation) have cost from £5,000=$25,000 to £6,000= $30,000 per mile. In England the cost has averaged about £37,433 =$187,165 per mile. In India the average cost has been £15,760 =$78,800 per mile. The East Indian has cost about £20,365= $101,825 per mile, and the Great Indian Peninsula £18,000= $90,000. In India the English plan of constructing the railways as perfectly as possible from the start has been followed, hence the delay in opening up the country to railway communication. In America the object has been to open up the vast unsettled continent as fast as possible for the furtherance of settlement, and to perfect the roads hereafter as population and traffic demanded.

R. M. BRERETON, M. Inst. C. E.