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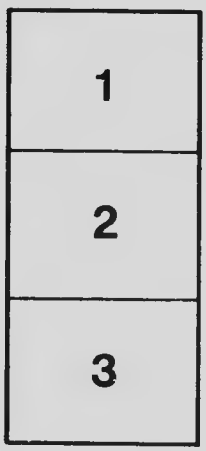

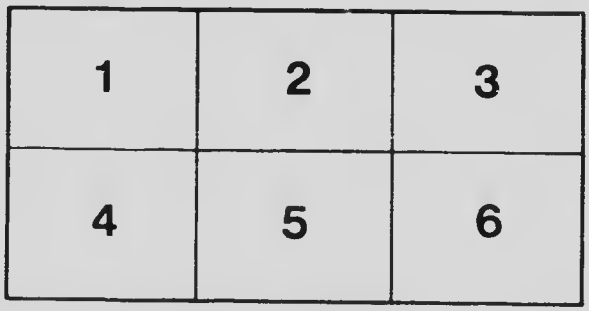

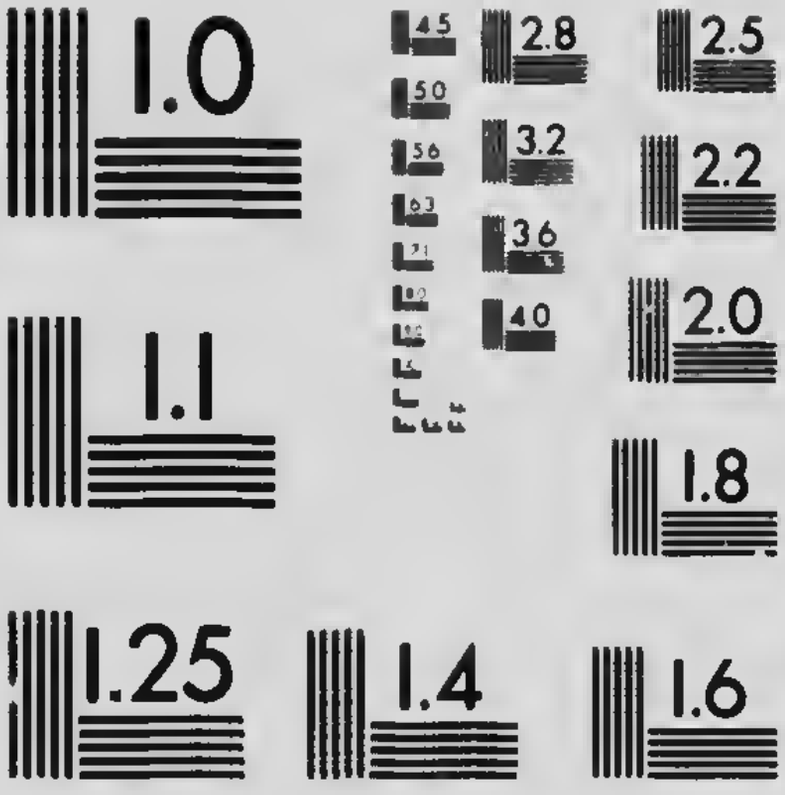

ADDRESS

OF

EDWARD H. KEATING,

PRESIDENT

OF

The Canadian Society of Civil Engineers.

JANUARY, 1902.

PRESIDENT'S ADDRESS.

By Edward H. Keating.

The By-laws of this Society contain nothing requiring the President on vacating the Chair to inflict an address upon the members, but the practice has been so generally followed since its inception, that it has come to be regarded as a law which cannot be broken with impunity.

Annual addresses of past presidents in this and in the parent institution have touched upon such a variety of engineering subjects that it seems hopeless, under existing conditions, to look for a new one which would be likely to prove of general interest, or to find an old one which has not previously been ably treated or not already worn [illegible].

The [illegible] of the Institution of Civil Engineers is expected, on taking the chair for the first time after his election, to deliver an address on some engineering topic, though he is under no obligation so far as I know to do so, other than common custom. An interval of several months, however, elapses between his election and his inauguration, so that he is given time to reflect.

In the American Society of Civil Engineers, the Presidents were, until recently, allowed no choice, but were required, upon retirement, to make an address upon the progress of Engineering during the preceding year. As this progress has within the past quarter of a century been remarkably rapid, the duty became so difficult of fulfilment, that the by-law was amended not long ago to read, "He shall deliver an address at the Annual Convention," leaving the subject as well as the length of the discourse to the judgment of the occupant of the office. A further amendment has been suggested, for the relief of the unfortunate president, to substitute the word "may" for "shall," but it does not appear to have been favourably considered.

With this preface allow me to venture a few rambling thoughts on

The Antiquity and Progress of Engineering.

Although the calling of the engineer has only within recent times been recognized as a distinct profession, or even as a profession at all, it may be justly claimed and will, I think, be generally admitted on investigation, that it is the pioneer of civilization and the first of all professions, as well as the noblest and most useful occupation to which man could devote his attention. The human race would still be clothing itself with the skins of animals, using stone implements and dwelling in caves or wigwams, but for the services of observant,

intelligent men who studied the ways of nature and the necessities of their fellow beings and who put their knowledge to practical use. As these are expressly the functions of the engineer, these men may be termed the world's earliest engineers. The first step in advancement could not have been made without them, and in succeeding ages, as the wants of mankind increased, the services of the Engineer became still more indispensable. The Arts, Sciences and Manufactures could not thrive without his assistance, and progress and the spread of enlightment and Christianity throughout the world are due chiefly to his exertions.

The universe, of which this planet forms but an atom, is planned and governed on sound engineering principles under laws which are immutable, and these laws are the same which guide the Engineer and upon which he places his dependence and bases his calculations. When he is ignorant of them, or is so bold as to disregard or depart from them, disaster follows, involving, not only himself, but countless others who are dependent upon his judgment.

It is not usual in an address of this kind to refer to Scripture, but the Book of Books contains so much of interest to engineers and so many references to engineering undertakings that I trust a slight digression may be pardoned.

When God answered Job out of the whirlwind, He said, "Where wast thou when I laid the foundation of the earth? Declare, if thou hast understanding. Who determined the measures thereof, if thou knowest? Or who stretched the line upon it? Whereupon were the foundations thereof fastened? Or who laid the corner stone thereof; when the morning stars sang together, and all the Sons of God shouted for joy? Or who shut up the sea with doors, when it brake forth, as if it had issued out of the womb?"

This is the first authentic account we have of the beginning of engineering. At this interview we find the great Engineer of the Universe conversing with man on purely engineering subjects relating to the stability of structures, the determination of quantities, surveying and the science of hydrology. It seems evident, therefore, that in Job's time mankind must have made considerable advancement both in the theory and practice of Engineering.

The term "Engineer" meaning literally "one who makes or uses an engine" was first applied "exclusively to military men charged with the construction and use of artillery and siege trains." In later years, and as other engines than those required for the purposes of war came into more general use, the term came to be applied indiscriminately to men in different stations in life, whose occupations require them in some way or other to direct or utilize the great sources of power in nature for the service of man. Thus we find men of high scientific attainments and refinement, and men

with no pretensions to either, and often of limited education, classed under the same common title. The Engineer entrusted with the responsible charge of gigantic undertakings and the expenditure of millions, and the man whose only responsibility is to attend to the machinery of his tug boat, are each known and designated by common consent as "engineers." Each in his way "makes or uses an engine." The difference is entirely one of degree. It lies in their training and in the use which they have made of the opportunities which chance or providence throws in the way of every man at some time or other in the course of his career. The engine driver may have had and often has had more and better opportunities than the man who has risen, in spite of poverty and adverse circumstances, to the top of the professional ladder. The difference here rests with the men themselves. Integrity, observation and pluck and that most uncommon qualification, common sense, are the lower rungs upon which the Engineer must depend, if he expects to rise in his profession. If he misses his footing on this ladder, he cannot hope to succeed, to attain a position of trust or even hold his own in life's struggle, unless he is so fortunate as to command political, religious or other equally baneful influence the improper use of which has done much in other callings as well as in engineering to discourage deserving men, to retard progress and to promote the survival of the unfit.

Long centuries before the advent of the Military Engineer and before either law or medicine was thought of as a science, or the priesthood as a profession, the Engineer plied his calling, though under perhaps a different designation, and worked and toiled for the advantage and improvement of mankind. His profession is essentially one which makes and works for peace, happiness and advancement; prosperity is entirely dependent upon his assistance and you cannot find on the face of the earth an enlightened or a progressive community where his services and advice have been ignored or disregarded.

The first reputed inhabitant of the earth was a horticulturist, who, owing to an unfortunate circumstance with which everyone is familiar, relinquished that occupation and devoted his attention to agriculture. The situation of the garden, or as we should now probably call it "the Park," of which he was originally the keeper, is not definitely known. It is supposed by some to have been in the mythical island of Atlantis, now buried fathoms under the sea, and by others in the Mesopotamian valley, or elsewhere. Wherever its position may have been, it is clear from Biblical records that it was scientifically designed and laid out, special attention having been devoted to irrigation and to drainage as adapted to the wants of man. What useful lessons might have been learned from a study of its plan and surroundings, and what our additional information

on these important branches of Engineering might have been if our first parent had only exhibited a little more prudence, it is of course impossible now to tell. It is quite certain, however, that the profession has suffered greatly from the blunder he committed, apart altogether from the other heavy disabilities under which mankind has laboured, from the same cause, to which it would be irrelevant for me to refer.

The first man recorded as having been connected with any engineering undertaking is Cain, who "builded a city, and called the name of the city after the name of his son Enoch"; for it is evident that before he could have planned and built a city he must at least have had some rudimentary knowledge of surveying and municipal engineering.

We also have the early cases of Tubal-Cain, "an instructor of every artificer in brass and iron" and of his younger brother Noah, who though famous as a preacher, subsequently acquired greater fame as the constructor of a craft vastly exceeding in size the Great Eastern or our largest ocean liners. According to Bishop Wilkins, the measurement of the Ark was 72,625 tons, or just three and a half times the gross tonnage of the White Star steamer, "Celtic," which is the largest modern vessel yet constructed.

The Pyramids of Egypt date back, according to different authorities, from 2,700 to 3,700 years B.C., and are sometimes referred to as the earliest structures upon which the services of Engineers were engaged. This, however, is a mistake. While it must be admitted that they are the most stupendous masses of building in stone that human labour has been known to erect, they are not the earliest post-diluvian examples of the work of Engineers. There was a greater edifice than the largest of them erected centuries before the time of Khufu, the builder of the oldest and greatest of the pyramids, or of the legendary King Sesostris, who is credited with having conquered the world and built the chief temples and early canals in Egypt. Nimrod (possibly identical with the god Bel or Baal, a great-grandson of Noah, who is described as a hunter, a rebel and "a mighty one in the earth" as well as a tyrant, began his kingdom in Babel or Babylon, where, as you know, the erection of a very large tower was commenced, but owing to circumstances over which its Chief Engineer, Etanna, had no control, it was never entirely completed. Babylon was a very large, prosperous and wealthy city, and although a commercial centre and some of the people were inclined to science and devotion, the structure does not appear to have been intended either for commercial or for entirely scientific or religious purposes. Its promotors had greater ambitions, they contemplated scaling the very heavens. Everyone knows how their designs came to be frustrated. This is the first engineering failure

of which we have any record, but as [illegible] failure did not arise from any defects in design or construction, it would be out of place here to make further reference to the cause. This edifice was of gigantic proportions, and although covering less ground, vastly exceeded in size the greatest of the pyramids. The date of its commencement is unknown, but the work of construction ceased for the time and the workmen were dispersed in the year that Peleg was born, which was 101 years after the flood. The time seems incredibly short for mankind to have increased sufficiently either in numbers or in wealth to undertake such a prodigious enterprise, but following the example of our law courts, we are left no alternative but to accept the evidence as we find it. As there was no building stone available in the country, bricks were used throughout its construction. The bricks were baked in furnaces, hot bitumen was used to cement them together, and reeds were used apparently for bonding purposes at regular intervals in every few courses. The structure was not circular as usually supposed or as shown in pictures, but was rectangular, the base being square, each side measuring about 600 feet. Herodatus says that "the going up to it was by stairs on the outside round it," from which the conclusion has been drawn "that the whole ascent to it was by the benching-in drawn in a sloping line from the bottom to the top eight times round it," and this gave it the appearance of eight towers one above another. Its altitude when work ceased is stated to have been over 600 feet, or about double the height of the tallest "sky scrapers" of New York or Chicago. It is improbable that this huge structure could have possessed any extensive or high class architectural embellishments, as it would be somewhat difficult to do much with such a combination as vitrified bricks, reeds and bitumen. Midway in the ascent, there was "a spacious place with seats where those who ascended might rest themselves." In the uppermost tower there was a large chamber dedicated to Belus or Baal, furnished with a magnificent couch and a table of gold beside it, but there was no image of the god there, as he was supposed to occupy it himself. The temple was also adorned with many statues of gold, the estimated value of which has been placed on high authority at over $100,000,000.

As the city in which this remarkable tower was erected, was well laid out and contained other engineering works of magnitude, a brief reference to it may not be entirely without interest. Dean Prideaux says "by whomsoever it was first founded, it was Nebuch-"adnezzar that made it one of the wonders of the world. The most "famous works therein were: the walls of the city; the temple of "Belus; his palace and the hanging gardens in it; the banks of the "river, the artificial lake and artificial canals made for the drain-"ing of that river. In the magnificence and expense of these works, "he much exceeded all that had been done by any king before him."

"An hundred gates
Of polished brass led to that central point,
Where, through the midst, bridged o'er with wondrous art,
Euphrates leads a navigable stream,
Branched from the current of his roaring flood."

The city was situated on the river Euphrates, about fifty miles south of Bagdad. It was in the form of an exact square, each side being 15 miles in length and was surrounded by a prodigious wall built of large bricks laid in bitumen, which is described as a glutinous slime arising out of the earth of that country, which binds in building much stronger and firmer than lime, and soon grows much harder than the bricks or stones themselves which it cements together. "These walls were surrounded on the outside with a vast "ditch filled with water, and lined with bricks on both sides, after "the manner of a scarp or counterscarp, and the earth which was "dug out of it made the bricks wherewith the walls were built; and, "therefore, from the vast height and breadth of the walls, way be "inferred the greatness of the ditch. In every side of this great "square were twenty-five gates, that is, an hundred in all, which "were all made of solid brass; and hence it is, that when God pro- "mised to Cyrus the conquest of Babylon, He tells him that He "would break in pieces before him the gates of brass.. "From "the twenty-five gates of this great square, went twenty-five streets "in staight lines to the gates which were directly over against them "in the other side opposite to it; so that the whole number of the "streets was fifty, each fifteen miles long, whereof twenty-five went "one way and twenty-five the other, directly crossing each other "at right angles. And beside these, there were also four half "streets, which were built but of one side, as having the wall on "the other These went round the four sides of the city next the "walls, and were each of them 200 feet broad; the rest were about "150 feet. By these streets thus crossing each other, the whole city "was cut into 676 squares, each of which was four furlongs and a "half on every side, that is, two miles and a quarter in compass."

The houses were built around these squares facing the streets and were all from three to four stories in height. The spaces within the squares were left open and were cultivated or used as parks and gardens or places of recreation. The houses were all detached with a considerable space between them, an arrangement which it is claimed was adopted for sanitary reasons and not for the prevention of the spread of fire as has sometimes been supposed. There are no census returns now available, so that the number of its inhabitants cannot be stated, and although it exceeded all other ancient cities in magnificence, it does not appear to have been as populous as Nineveh which covered less area, but did not contain so many

vacant spaces. From all I have been able to gather, the services of the architect do not appear to have been appreciated or in great demand, as the public edifices are described as being more remarkable for vastness of dimensions than elegance of design. A German traveller who visited the spot in 1574 says "By the old bridge over the Euphrates there are yet remaining portions of arches built of burnt brick, so strong that it is admirable," and a more recent visitor in describing the ruins of the King's Palace, states that the walls were eight feet in thickness, ornamented with niches, strengthened by pilasters and buttresses, all built of fine burnt brick still perfectly clean and sharp, laid in lime cement of such tenacity that those whose business it is to find bricks, have given up working on account of the extreme difficulty of extracting them whole. I can scarcely drop this subject without a short allusion to the so-called hanging gardens which were perhaps the greatest engineering wonder of the city.

"For Nebasser's queen,
Fatigued with Babylonia's level plains,
Sighed for her Median home, where nature's hand.
Had scooped the vale, and clothed the mountain's side
With many a verdant wood; nor long she pined
Till that uxorious monarch called on art
To rival nature's sweet variety.
Forthwith two hundred thousand slaves uprear'd
This hill—egregious work—rich fruits o'erhang
The sloping vales, and odorous shrubs entwine
Their undulating branches."

These gardens were laid out in terraces one above another, supported on immense arches and surrounded by walls twenty-two feet in thickness. "On the top of the arches were laid large flat stones, "sixteen feet long and four broad; over these was a layer of weeds "mixed and cemented with a large quantity of bitumen, on which "were two rows of bricks closely cemented together with the same "material. The whole was covered with thick sheets of lead, on "which lay the mould of the garden. And all this floorage was so "contrived as to keep the moisture of the mould from running "away through the arches." The terraces were arranged in rows so that at a distance the whole had the appearance of an immense pyramid covered with woods. In the spaces between the arches there were magnificent apartments, and it is said that in the upper terrace there was an hydraulic engine for raising the water from the river for the purposes of watering the garden and for the supply of fountains and reservoirs.

I will not weary you by attempting to describe any of the other engineering wonders of this doomed city.

"The Lord of Hosts hath swept it with the besom of destruction." Its magnificent works have been destroyed or have perished from negiect and age and its mightiness, its grandeur and its glory have long ages ago passed away for ever.

Ancient Engineering works in India, Egypt, Greece and Italy have already been referred to in addresses of this kind and in papers read at meetings of Engineers.

Mr. Mansergh in addressing the Institution of Civil Engineers in 1900, devoted special attention to some of the most important, ancient waterworks, canals and irrigation works in those countries and elsewhere, and gave as full particulars of several of them as it is in all probability possible now to obtain.

The oldest work in Great Britain upon which Engineers were employed, of which there is any trace left, was probably the famous temple of Apollo of the Hyberboreans. All that now remains to mark the supposed site is a group of gigantic stones at Stonehenge. From recent discoveries it would seem that the original of this temple was much older than has hitherto been supposed. It has been reported within the past few months that workmen engaged in making excavations to raise one of the monoliths, found portions of numerous neolithic implements broken off and embedded in the joints. If this report is true, there would be good grounds for the conclusion that the structure was erected anterior to the dawn of the bronze age in England. However, this may be, there are still to be seen throughout the British Islands and Europe, remnants of engineering works constructed long before the Christian era. Embankments for the prevention of encroachments of the sea and of damage by floods and storms are probably amongst the oldest and best known of these works, while the roads and causeways of the ancient Romans need only be referred to as of later origin.

The earliest society of Engineers of which I have been able to obtain any information, was a clerical order of bridge builders or pontiffs, instituted by Numa Pompilius, the second king of Rome, who lived about 700 B.C. I think I am safe in saying it was one of those institutions, if not the principal one, to which Rome owed her greatness. The original institution consisted of five members, the head of the order being styled "Pontifex Maximus" or Engineer-in-Chief. About the year 300 B.C., the number of pontiffs or pontifices was increased to nine. Sulla, in 81 B.C., further increased the number to fifteen and Julius Caesar made it 16. During the Empire the functions of the Pontifex Maximus, whom we may term the President of this "Society of Civil Engineers" were discharged by the Emperors personally, and this order of things continued for some time after the establishment of Christianity, when in lapse of time the title was dropped by the Emperor and assumed by the Christian Bishops of Rome.

Prince Henry, in "The Golden Legend" says,

"God's blessings on the architects who build
The bridges o'er swift rivers and abysses.
Before impassable to human feet,
No less than on the builders of Cathedrals,
Whose massive walls are bridges thrown across
The dark and terrible abyss of Death.
Well has the name of Pontifex been given
Unto the Church's head, as the chief builder
And architect of the invisible bridge
That leads from earth to heaven.

As Engineers have more to learn from failures than from successes, a reference to the earliest disaster due to faulty design or construction that has come to my notice, may not be out of place. This occurred on the 28th October, A.D. 312, when a bridge crossing the Tiber, about two miles from Rome, broke down under the weight of a surging body of men. The "Pontifex" charged with its construction, evidently had not allowed a sufficient factor of safety for live loads. The circumstances were as follows:—Constantine the Great, having defeated the Emperor Maxentius, was pursuing his army across this bridge which proved too weak to stand the unequal strains to which it was subjected. The result was that Maxentius and a part of his army perished in the collapse, while the remnant thus cut off from retreat, shared the usual fate of captives.

Engineering is a progressive science. It cannot remain stationary or lag without producing detrimental effects upon humanity. When it ceases to advance, the world goes backwards, but when fostered and encouraged, prosperity and wealth are the results. It would be well if governing bodies would bear this in mind when considering the grants and privileges for our Engineering colleges, schools of practical science and technical training schools.

J. G. Schurman, President of Cornell University, in an address in 1897 at the opening of the new house of the American Society of Civil Engineers, stated that he had never heard of such a person as a "Stationary Engineer." He was, of course, speaking to Civil Engineers, and had no reference to that large body of mechanical men under that name to whom the world owes a deep debt of gratitude. He also said. "If I were asked what the desiderata of the Engineering profession, as we see it at the present day, are, I should answer, "first of all, you need, as all the learned professions need, to know "more. Nature spreads out around us with infinite mystery. We "have dipped in here and there and made shallow soundings: but "the dimensions of attained knowledge, even if we take the knowledge of the race, are ludicrously small in comparison with the

"great ocean of mystery that stretches beyond." I think all Engineers will agree with these views. No matter what their opportunities and attainments, or their age and experience, Engineers are always finding out something new and sometimes they find to their sorrow that they have very much more to learn than they had previously supposed.

Mr. Schurman, is or rather was, a Canadian, of whom we all feel justly proud. He has, however, changed his flag and is one of a few prominent men who hold and preach that the ultimate destiny of this country is annexation. As this question has long since died, perhaps it had better remain buried. but as far as Mr. Schurman's prediction is concerned, I think I should be voicing the views not only of this Canadian Society of Civil Engineers, but of all true Canadians from the Atlantic to the Pacific, and from the great Lakes to the Arctic Ocean, by offering up the fervent prayer "God forbid."

During the middle ages, a period of a thousand years, which may be taken as extending from about the time of the downfall of the Western Empire of Rome almost to the discovery of America, the science of Engineering does not appear to have received much attention or encouragement in Europe. Is it any wonder therefore that this period is considered as steeped in darkness? It could not. under such circumstances, be anything else. The dykes, embankments, roadways and other works which Engineers had constructed for the benefit and advancement of mankind, were neglected and allowed to fall into decay and shared the same disastrous fate that befel civilization generally in those benighted times.

In the eighth century, Charlemagne revived the "Ancient laws and customs" in some districts by which the people were required, under well devised regulations to construct necessary roads and causeways, but it was not until nearly four hundred years afterwards, when the need of bridges became indispensible, that some pious monks undertook their construction as an act of charity. About that time St. Benezet is said to have founded a new monastic order of "Monk-Engineers," the recognized title of the members of this order, as in the earlier society, being "Pontifex." It is stated that the order continued in existence and carried on their charitable work of bridge building for some hundreds of years, raising the necessary funds by soliciting subscriptions and by begging. This brings us down to comparatively modern times.

John Smeaton, who lived from 1724 to 1792, has been called the father of modern civil Engineering. He was, I believe, the first engineer to adopt the prefix "civil." Before his time Great Britain may be said to have been almost devoid of public works. There were no canals, railways, artificial harbours or machinery which we would now consider worthy of the name. The public roads of

the country were mere tracks, probabi, little better than Indian trails and certainly much worse in wet weather. Inland commerce was carried on chiefly by means of pack horses, and communication between towns and cities was difficult and expensive. In 1759 when he was 35 years of age, Smeaton having just completed the Eddystone Lighthouse, presented a paper to the Royal Society, entitled "An Experimental Inquiry concerning the Native Powers of Water and Wind to turn mills and other machines depending on Circular Motion." From this time his reputation and fame as an Engineer was thoroughly established and he was called in consultation on all kinds of engineering projects. It is stated that "he was an incessant experimenter" and James Watt, his contemporary, said of him: "His example and precepts have made us all engineers." In referring to England's eminent Civil Engineers of the 18th Century, mention should not be omitted of James Brindley, who was also contemporary with Smeaton. He was an enthusiast in canal construction and has been styled "the father of inland canal navigation in England." His answer when asked what was the use of navigable rivers—"To feed canals," is said to have been characteristic of the man and will always remain historic. It is unnecessary that I should dwell at any length upon the debt which the profession and humanity owe to Watt. It has been said that "Smeaton knew how to improve, but Watt knew how to create." An eminent Frenchman once wrote. "The part which he played "in the mechanical application of the force of steam can only be "compared to that of Newton in astronomy, and of Shakespeare "in poetry. And is not invention the poetry of Science." This tribute, eloquent as it is, conveys but a faint conception of his true worth, for he was a far greater benefactor than either Newton or Shakespeare. "It is a great thing" he once observed, "to find out what will not do." "Give me facts, I am sick of theory, give me actual facts." In 1784 he wrote to Boulton, "I have started a new "hare. I have got a glimpse of a method of causing a piston-rod "to move up and down perpendicularly by only fixing it to a piece "of iron upon the beam, without chains or perpendicular guides "or untowardly friction, arch heads, or other pieces of clumsiness' "by which contrivance it answers fully to expectation." A few day later he wrote: "I have made a very large model of the new sub- "stitute for racks and sectors, which seems to bid fair to answer" ....."However, don't pride yourself on 't--it is not fairly tried "y", and may have unknown faults." This was only 118 years ago. Previous to that time the steam engine had been used almost exclusively for pumping water in mining operations. Watt made it a powerful, automatic and economical machine capable of application in the manufactory and for the purpose of commerce by land and sea, as well as for the various other purposes to which it

has been adapted to lessen the labours and to minister to the wants of mankind. He was a keen observer and "was always on the "watch for facts, noting and comparing them. He took nothing "for granted; and accepted no conclusions, save on experimental "evidence." "Nature can be conquered, he said, if we can but find "out her weak side. His patience was inexhaustible. He was "never baffled by failure, from which he declared he learnt more "than from success." When complimented on the greatness of his "achievements he is reported to have said: "The public only look "at my success, and not at the intermediate failures and uncouth "construction which have served as steps to enable me to climb "to the top of the ladder." He died only 83 years ago. The monument by Chantry erected to his memory in Westminister Abbey, bears the following inscription written by Lord Brougham, which Smiles calls the finest lapidary inscription in the English language, and adds, as if it were something singular, that "forty as is the eulogy every word is true."

Not to perpetuate a name
Which must endure while Peaceful Arts flourish,
But to show,
That Mankind has learned to honour those
Who best deserve their gratitude,
The King,
His Ministers, and many of the Nobles
and Commoners of the Realm
Raised this Monument to
JAMES WATT,
Who directing the Force of an Original Genius
Early exercised in Philosophic Research
To the improvement of
The Steam Engine,
Enlarged the Resources of his Country,
Increased the Power of Man,
And rose to an Eminent place
Among the most Illustrious Followers of Science
And the real Benefactors of the World.

Any Engineer who has been brought much in contact with theorists will readily understand why Watt expressed himself as "sick of theory." The faculty of theorizing is one which some people, placed in positions of brief authority, especially municipal councillors, occasionally possess in a very marked degree; as a rule it makes no difference what their previous training or occupation may have been, but woe betide the unfortunate Engineer who is so situated as to be dependent upon their caprices for his living.

We all know that in the present advanced state of the science of engineering, theory and practice must go together and that one without the other, like "faith without works," is of little profit. It is the combination of both that makes the successful engineer. This was equally true in Watts' time, and if we regard theory as "the fruit of reflection" or simply as "thought," we know that Watt had the genius or the talent of uniting the two in a remarkable manner. The poet Wordsworth, twenty years after his death, said: "I look upon him, considering both the magnitude and the universality of his genius, as perhaps the most extraordinary man that this country ever produced," while Sir James Macintosh, places him "at the head of all inventors, in all ages and nations."

To follow the progress of Engineering through the past century would be a much greater and more difficult task than to trace it back for thousands of years previously, and even if I felt equal to the attempt, it would be an impossibility in the course of a single address. At the commencement, I promised you only a few rambling remarks on the antiquity and progress of our profession and have already far exceeded the limit, I intended as well as having by this time probably exhausted your patience, while I have barely touched upon the second part of my subject. I have wandered over scores of centuries and might perhaps be permitted to omit any reference to the comparatively insignificant portion of time which has elapsed since the days of Brindley, Smeaton and Watt, were it not for the fact that the science of Engineering has made infinitely greater advancement since their time than in all the preceding ages combined.

Within this period, engineering has risen from being a craft to the dignity of a profession. New fields have opened out; many new and distinct branches have sprung into existence. Gigantic works and undertakings of various kinds, both public and private, have been inaugurated and carried to successful completion in almost all quarters of the globe, while others of equal or greater magnitude and of vast importance are in course of construction and in contemplation. New and startling inventions and discoveries have followed each other in rapid succession and new machinery, devices and processes are so constantly being brought to notice that the situation has become almost bewildering. No living man could attempt to master all the details of this truly wonderful progression. There seems, in fact, to be hardly any limit or bounds to the accomplishment of any design or the attainment of any desired ends where brains, pluck and capital meet together and unite their forces for a common purpose. The words of our venerated first president, Thomas C. Keefer, C.M.G., would seem appropriate here. Mr. Keefer, in the first presidential address

to this Society, just fourteen years ago, said: "When we reflect "that steamboat navigation began less than eighty years ago, and "railway construction less than sixty years ago, the telegraph forty, "and the Atlantic cable less than thirty years ago, and that the "telephone, electric lights, and motors are yet in their infancy, and "then look at their position and work of to-day, we have reason "to be proud of a profession to which the world owes so much; "and, having regard to the great interests committed to us, we have "need to take counsel together, for we cannot say of each other no "more than the foot to the hand 'I have no need of thee.' "

It is unnecessary for me to refer to the vast improvements that have since been effected in all of these branches of engineering, especially as many of you are quite as familiar with them as I am in the year just closed, the first of the new century upon which we have entered, two wonderful achievements have to be recorded. In aero-navigation, Santos-Dumont has apparently solved the problem of guiding air ships in any direction independently of atmospheric conditions, and scarcely more than a month ago Signor Marconi succeeded in transmitting signals by wireless telegraphy across the Atlantic, from Cornwall in England to St. John's Newfoundland, a distance of about 1,700 miles. Such exploits can only be characterized as marvellous in the extreme. They would seem to indicate that we have entered upon a new era and the far reaching results, it would be presumptuous for mortal man to predict.

The progress of this Society, which is only fifteen years old, has been eminently satisfactory. In that short time it has grown from a body of 252 members of all classes, and 83 students, to a membership of 688 and 204 students. There are few Civil Engineers within the borders of the Dominion, whose names are not upon our roll, while some of our members are professionally engaged in different parts of the world, under the British flag and in foreign countries.

I fully appreciate the high compliment you have paid me by placing me in the presidential chair. I feel it to be the most conspicuous mark of confidence and the greatest honour which my brother Engineers could have bestowed upon me. My chief regret is that I have been so situated that I have been unable to do as much as I desired, or perhaps as I should have done, for the advancement of the interests of the Society.