BIOGRAPHICAL SKETCH OF A. P. LOW

The Dominion Geological Survey

If one were to accept the views advocated by certain Canadian papers not at present enjoying the patronage of the government, one would be disposed to believe that all positions in the civil service are filled by "pull," and that the recipients of such promotion have one common end in view—graft. So writes the editor of the Geological Survey in the Canadian Mining Journal.

The department of the geological survey—now officially designated the department of mines—has happily been practically free from political patronage, and the minister, the nominal head of the department, has honestly endeavored to appoint as director that man best fitted to fill the position.

Fortunately for the survey, there have been few opportunities for the minister to exercise his discretion. Logan created the Canadian survey and raised it to a standard difficult for even such men as Selwyn and Dawson to maintain. After Dawson's death the government determined that future directors of the Canadian geological survey should themselves be Canadians. The time had gone by when we needed to send to England or Australia to find a competent director. Scientists, Canada could supply in plenty, and scientists who, by reason of their special knowledge of Canadian conditions, were more fitted for the position than any stranger could possibly be. But a scientist—especially in these days when scientists adopt specialties—is not necessarily an administrator; indeed, it is more often the case that a scientist cannot administrate at all. When it is taken into consideration that the director of the survey is expected to successfully control fifty or sixty men, each of whom believes that his own brand of science ranks higher in importance than any other; and that one of the director's principal duties is to so apportion their work over this huge Dominion as to extract the greatest benefit, both scientific and economic, while not clashing with the work being accomplished by the provincial surveys, it can be readily understood that a first class director must be not only a first class scientist, but, above all, an able administrator.

Researches in Labrador

Those who read Mr. Low's reports on his researches in Labrador or his voyage in the Neptune, were prepared to hear of his appointment to the directorship. No one who has read these reports can fail to appreciate that Mr. Low has the two requisites that combine to make an able director—a thorough knowledge of geology and a fine power of administration.

Mr. Low was born in Montreal on May 24, 1861, and is believed to have succeeded in getting into more scrapes as a youngster than would make a good record for any two average Canadian school boys—which is a sufficiently large order. He was educated at the public schools, and soon evinced so decided a taste for applied science that he was allowed to make it his specialty. He entered the applied science faculty of McGill in 1878 and passed with first rank honors in natural science in 1882.

With his inborn love of knowledge was interwoven—as is so frequently the case—an inborn love of sports. Many of the director's staunchest friends today were his friends or foes of the football field and hockey rink of many years ago. Indeed, hockey was not played at all in Ottawa until introduced by Mr. Low, and some of the most strenuous football matches ever witnessed in that town were won and lost by the Ottawa Football club, which Mr. Low captained for many years.

In 1881 Mr. Low was appointed as a "student assistant" to an exploration party sent by the geological survey to the Gaspe peninsula, and from that time to the present day his work may be followed in the survey's reports. His work—but not his life—for it has ever been an unwritten law with the survey officers that as little as possible should be made of difficulties overcome or danger averted. In this respect Mr. Low has followed the survey traditions with almost irritating fidelity, and only those who know the conditions of northern travel can read between the lines or suspect, from perusing Mr. Low's geological reports, what risks have been run, or what suffering has been endured. His reports, like poets, "... lose half the praise they should have got, could it be known what they discreetly blot."

Field Geologists Scarce

A "student assistant" on his first expedition is very carefully watched; the survey is always on the lookout for new material. Good field geologists are scarce, for the first essential in a budding field officer is observation, and the power of observation in this age of cram is becoming, as is well known, rarer and more rare. But in this Dominion, mostly unsurveyed—except in a very superficial manner—the field geologist is practically useless unless he combine with his knowledge and faculty for observation, a splendid constitution, large powers of endurance and a spirit of determination that, when it fails, is called pig-headed obstinacy, or, when it succeeds, unswerving persistency.

That in Mr. Low these unusual factors were combined became apparent during his first field work in Gaspe, and, on the recommendation of Dr. Ells, who was in charge of the party, he was offered and accepted a permanent position on the survey staff.

From that time it has always been recognized that Mr. Low was in the running for the directorship, and it was pretty generally known that to be director became, in after years, his chief ambition. So well was this recognized that, one Christmas, some wag on the staff brought out a Christmas card containing "quotations" for the geological survey, and apportioned the following lines to "A. P. 55":

Hard on Shakespeare

"Low was his name, but great was his desire."—Shakespeare.

The hit was a fair one, though it was rather unkind to ascribe the lines to our national poet, who never perpetrated anything like them.

In 1884 an expedition was sent by the Quebec government and the geological survey to make a report on the Mistassini district, and especially to survey those portions of Mistassini lake that had been left uncompleted by McEwart and Richardson. A Quebec land surveyor was in charge of the party, to which Mr. Low was attached as a geologist. The methods employed by the expedition were not such as would recommend themselves to any officer of the geological survey, to whom "hustle" becomes the first essential directly the flight of winter makes field-work possible. Kicking his heels in Quebec, waiting for the expedition to move, was not Mr. Low's ideal of geological research, and he started on his own account up the Bersimis river, supposing that the main party—unhampered by field work—would soon overtake him.

He reached Lake Pipmuakin, but no main party appeared and he was compelled to return for food. Delay after delay occurred, and it was actually not until late August that the expedition at last got away. The natural consequences ensued. Blizzards caused frozen hands, frozen feet, food ran short and the game that had been counted on failed to appear. The party lived for some time on starvation rations, eked out with an occasional beaver but for which the entire expedition would have suffered the same fate as befell the unfortunate Indians last month, whose skeleton bodies lined the same route, and whose fate was made known by one of the survivors, John Bastian, who acted as Mr. Low's guide on three trips in Labrador.

The exhausted expedition eventually reached the Hudson's Bay company's post on Mistassini lake, where they arranged to winter. From Mr. Low's point of view, everything had been disappointment. Nearly a year gone by and practically nothing done. There was, however, time to think—weeks of leisure—and Mr. Low employed it in coming to a noteworthy decision. He left the post in February, arrived in Ottawa the first of March, and interviewed Dr. Selwyn, the director. What passed is known only to Dr. Selwyn, Mr. Low and the minister, but in a few days Mr. Low—with J. M. Macoun as assistant—set out once more for Lake Mistassinia, armed with a letter giving him complete charge of the expedition. But it was more by good luck than good management that these two officers ever reached the lake. Untaught by previous experience, they counted on making the average number of miles per day and on living largely on the country. Soft weather made travel terribly slow, the game perversely refused to be accommodating, even the beavers kept away—and the two white men, with six Indians, found themselves half starved and fearfully weak at Lake Chibougamau, sixty miles from the nearest post.

It became evident that for the whole party to make a forced march meant death to some of them, and Mr. Low called for a couple of volunteers to hurry to the post with news of their plight. At the same time it was arranged that the pary should move as quickly as possible along the trail, in the endeavor to save a few hours. The volunteers accomplished their mission admirably, but the starving party missed the trail when they had followed it for some twenty miles, and were obliged to camp, in view of the danger of missing the rescuers with food. Mr. Low describes the first twenty-four hours of absolute starvation as very painful, but adds, strangely enough, that during the subsequent four days he and the men suffered very little.

Arrival of Food

What was worse than the starvation was the anxiety as to whether the volunteers would be able to reach the post. On the fifth day, food, supplied by the H. B. company, arrived. It was only flour and lard, but to the starving men it was beefsteak and onions. They made a meal that Mr. Low describes as "an elegant sufficiency," and immediately afterwards started for Lake Wakonichi, but soon encountered more food—bacon this time—sent from the same source—and encompassed another meal, whose proportions did not seem in the least handicapped by the previous Gargantuan repast.

Crossing Lake Wakonichi the party met with its first piece of good luck. In a net set by some trapper they found a lake trout weighing nearly twenty pounds, and it can be imagined what a meal this made, cooked with flour and bacon.

Early in May the Mistassini post was reached, and Mr. Low took over charge, the first of the many that have been entrusted to him, from which time he has been regarded as the standard authority on the geology of that huge tract commonly known as the Labrador peninsula.

Paddling Ice-blocks

Of his observations and experiences in the Mistassini district Mr. Low could fill a goodly sized book and still leave much untold. In the space of this short sketch it is impossible to do more than allude to the incidents of his travels, but one fact regarding Lake Mistassini it is difficult to refrain from mentioning. On May 24, an Indian attached to Cleary's trading camp, left the post and crossed the lake on his heavily laden sled. At noon Low and Macoun were paddling ice-blocks in the lake, and in the afternoon A. P. celebrated his birthday by enjoying quite a long swim. The temperature was 84 degrees in the shade, and proved to be the highest recorded that summer.

The survey of the lake was completed in July, after which the party surveyed the Rupert river to Rupert house, journeyed to Moose Fatcory, ascended the Moose river, and eventually reached Missinabie, where the Canadian Pacific railway was in course of construction.

In 1886 Mr. Low was instructed to find the outlet of Favorable lake, in Keewatin, to survey the Severn river, and to return via Oxford lake and Norway house. Prof. Macoun's son was again appointed as assistant, and together they journeyed up the Berens river from Lake Winnipeg. They found the outlet of Favorable lake, though, if the truth must be told, they found it by accident, and followed it to Severn lake. The season was exceptionally dry; no rain fell for six weeks, forest fires obscured the atmosphere, taking sights became difficult, and sometimes impossible, and the travelers once more found themselves on starvation rations. For 300 miles no human being was met nor any game near enough to be shot. At last an Indian and his squaw were sighted in a canoe trying to escape notice. When called upon they endeavored to outdistance the party, and a long chase ensued, ending, after ten miles' hard paddling, in the couple being caught.

No Food to Spare

They had no food to spare—scarcely sufficient indeed, to take them to Trout Lake, the nearest H.B.C. post. They were, however, induced to act as guides, and, with their help, the party arrived at Trout Lake before the want of nourishment had caused any serious harm. The Hudson Bay agent was only able to supply them with fish pemmican, which, for the uninitiated, it may be explained consists of boiled fish, dried and pounded, stored in birch-bark baskets, with, generally, a rabbit-skin holding fish oil in which to cook the appetizing concoction. Furnished with what, after their privations, seemed to be luxury, the party continued down the Severn River, but in a reach of the stream what they thought was a rapid turned out to be a fall eight feet high, and trouble ensued. The first canoe actually rode the crest and fell into the river below without upsetting or sustaining any harm. It, however, displaced some loose rocks just before taking the plunge, and the second canoe, striking these, never had a fair chance. The canoe was so badly damaged that only with great difficulty did the party succeed in nursing it to Fort Severn, but the precious pemmican was unharmed, and in comparison to that, the rest mattered little.

At Fort Severn unsuccessful efforts were made to obtain another canoe. It was decided to repair the boat as much as was feasible, and coast westward to York factory. During this westward trip, camp was pitched at night on the dreary mud flats that characterize this portion of Hudson Bay. On the second night a storm arose that played havoc not only with Mr. Low's tent, but with his intentions.

Vagaries of the Wind

The wind picked up one of the canoes—they had been staked down as usual—blew it across the tent, which it tore down, and damaged both tent and boat beyond repair. Macoun returned to Fort Severn with instructions to procure a boat of some sort—honestly if he could, but to procure a boat. Here again good luck intervened, for, after some days, Macoun was sighted with four Indians in a flat-bottomed boat lent by the H. B. C. The boat had been made at Fort Churchill, had drifted away and had turned up at Severn post just in time to loan to Macoun.

Though the boat made good way before a fair wind, tacking with her was a tedious business, so much so indeed that when Mr. Low shot a polar bear he was unable to capture the prize owing to the difficulty of beating against the wind. Game, however, was plentiful. Ducks, geese and caribou were easily obtained, so that the loss of the bear was not a serious matter.

York Factory was safely reached, and a river boat was obtained. Mr. Low reached Norway House just as W. H. Glider and his party were setting out on their search for the North Pole.

From 1887 to 1891 Mr. Low continued to add to our knowledge of Canadian geology. At first in James Bay and afterwards in the country north of the St. Lawrence he made extensive surveys, the results of which, are they not written in the chronicles of the Geological survey?

Quebec Northern Boundary

In 1892 it was determined to map the new northern boundary of the Province of Quebec. It seemed taken as granted that the officer in charge would be Mr. Low, and Mr. Low was duly appointed. He travelled north from Lake St. John to Mistassini, crossed from the Rupert river to the Eastmain river, and made the first instrumental survey on record of the western portion of that large stream. In the following year he traveled by the same route to the Eastmain river, which he surveyed to its head. Afterwards he began a series of geological explorations in Ungava, the results of which are embodied in a report officially known as Part L. volume VIII. This publication has remained ever since, and seems likely to remain for some time, the standard geological work on the Labrador peninsula.

The party portaged to the head waters of Big River, and down it to Lake Nichikun. Thence a traverse was made to Kanlapiskau lake; the Kaniapiskau river was followed, and subsequently the Larch and Koksoak rivers, to Chimo on the coast.

No fuss was made about this journey, no bombast displayed, no magazines published illustrated articles with lurid head lines. Had Mr. Low or his assistant (Captain—now Major—Easton) died from privation, the newspaper reporters would have craved for copy and fought for photos, but as the exploring party happened to be in charge of an officer who understood the conditions, realized the difficulties, who went prepared for emergency and was fortified with experience, no lives were lost, no pathetic diaries were written, and the newspapers were too wise to fill their columns with dry geological details.

Natives Die of Hunger

Mr. Low had intended wintering at Chimo, but a severe famine—to which nearly one hundred natives succumbed—induced him to alter his plans, and the party were conveyed by the H. B. Co.'s steamer to Rigolet. In the following March the survey of the Hamilton river was commenced. Twelve extra natives had been engaged, and each man—white and native—drew 200 pounds on a sled. Progress was necessarily slow, but after some days the spot to which canoes had been sent was reached, and the extra men were sent home. Though the Grand Falls are not the largest or the most powerful in the world, they run the Victoria Nyanza a close second, and, compared to them, Niagara is but a baby waterfall. Mr. Low first saw this magnificent accident of nature from a cliff nearly 500 feet high. He had been warned of the irresistible desire the spectator feels to throw himself into the gorge, and had laughed. He describes his feeling, however, not as if he had any desire to throw himself over the cliff, but as if someone behind was pushing him, and, as happens to all who view this extraordinary sight, it was with difficulty he was prevented from precipating himself into the gorge, under the belief that he was being violently shoved. The water has a sheer drop of 312 feet, but the total fall of the river here is over 700 feet, and it is estimated to give nine million horsepower. Mr. Low has pointed out the vast possibilities of this neglected power, which, there is little doubt, will some day supply the greater part of the province of Quebec.

Excellent Iron Ore

It was after having mapped the head waters of Hamilton river that Mr. Low reported large quantities of excellent iron ore along the valley of the Ashuanipi river and deposits of labradorite in Lake Nichikum. Labradorite is probably the most perfect and certainly the most beautiful building stone of which we have any knowledge, and in the days to come, when the valley of the Hamilton river is being worked for iron, this wonderfully streaked feldspar will be quarried in enormous quantities.

The expedition returned by way of the Romaine and St. John rivers, having accomplished what was probably the most interesting survey ever made by the Canadian or any other government.

By this time Mr. Low had come to be recognized as the right man in the right place—the right place being Labrador—and he spent most of the following five years in mapping the least known portions of Ungava. As a welcome break in these desolate surveys he was sent in 1900 to the Paris exhibition to superintend the Canadian mineral exhibit.

The continual mention in the geological survey reports of first-class magnetite and hematite in Labrador and on the islands of Hudson Bay had attracted the attention of American capitalists, and on Mr. Low's return from Paris he was approached by a Philadelphian syndicate who endeavored to procure his services in prospecting the Nastapoka islands. Many years ago, that sage observer, Hudibras, referred to

"... the evils that do environ
The man that meddles with cold iron."

In this case the evils were complicated for difficult as it is to join the geological survey, it is almost impossible once you play the prodigal, to be again embraced by those stony arms.

Expedition to Polar Regions

Mr. Low, however, took chances and made a detailed report on the iron deposits—he located 8,000 acres—of the Nastapoka islands. His report has never been made public, but it is understood that though the ore was both plentiful and of first class quality, he considered the economic conditions too unfavorable for profitable mining. Nothing, perhaps, is more to Mr. Low's credit than the fact that the geological survey jumped at his offer to rejoin the service, and he was immediately marked as one of the few possible candidates that could be put in charge of the expedition the government intended to despatch to the polar regions. Eventually Mr. Low received his commission as commander of the Neptune, and his report of the work performed by the expedition has become an Arctic classic.

It was in connection with that report that the present chronicler first met Mr. Low, and thereby hangs a tale so good that, though Rome fall, it must be told.

Mr. Low had made certain statements which the writer in his capacity as editor—and after having consulted the Encyclopedia Britannica—queried and altered. The Arctic explorer, exceedingly wroth, interviewed the editor and told him that he might alter the expression as much as he d— pleased, but he must not alter the facts. "Anyway," said the irate geologist, "where did you get your information?" The editor meekly explained. "Oh, great heavens!" said Mr. Low, "why go to the Encyclopedia, why not consult a specialist?" The editor brooded over this melancholy incident for some days and then wrote the editor of the Times, asking why the information was not up-to-date. He received a letter to the effect that though the Times was not responsible for every sentence written, it endeavored to ensure accuracy by inducing specialists to write, and in this case the article was supplied by the well-known Labrador explorer, Mr. A. P. Low.

Voyage of the Neptune

The report of the voyage of the Neptune, blue book though it was, differed so materially in style and manner from most other blue books that the government decided to publish it in an edition de luxe. Seven thousand copies were issued, but the demand was so great that before the wholesale booksellers could be supplied the entire edition had run out.

Among the many conclusions arrived at in the "Voyage of the Neptune" the following are probably the most important, and the reasons that led to their adoption are very forcibly argued by the author:

1. The discovery of the north pole, except as a matter of sentiment, is absolutely useless.
2. With plenty of good luck, the Northwest passage can be made, but will never be a commercial route.
3. The Hudson bay route for wheat to Europe is not only practicable, but is bound to be adopted in the near future.
4. Unless the government take strong measures, the Eskimos are a doomed race.

In 1905 the Quebec government requested the Dominion government to instruct the geological survey to make a report upon the mineral areas in the Lake Chibougamau district. Accompanying the request was a rider to the effect that of all the field officers in the survey, Mr. Low would be the most acceptable. Mr. Low, accordingly, was sent. His report could scarcely be considered a very comforting document for those deeply interested in Chibaugamau mining, but the author expressed the opinion that further prospecting and cheaper transport may develop something really profitable in copper and asbestos.

In April, 1906, Mr. Low was appointed director of the survey, and immediately started on a stretch of hard work that came near to being his undoing, both physically and mentally. Late hours at the office and an attack of "grip" were the cause of the evil, and in January last Mr. Low was reported dying. But the constitution of a giant and the pluck that had pulled him through so many narrow escapes came to his rescue and after a month's anxious waiting the survey heaved one big sigh of relief when the daily bulletin read "out of danger."

The illness has left its mark. The remarkably youthful appearance that characterized the director is no longer seen—

"... middle age
Has slightly pressed its signet sage."

But, fortunately, this is all. The clearness of thought is still there, the ability to decide quickly what line to take, and the determination to take it and stick to it are still there; above all he still retains the friendship and respect of the staff—who, as one of them remarked the other day—would "work their fingers to the bone to do old Low a turn."

Robert Fulton and the Introduction of Steam Navigation

The centenary, which takes place during this month, of the introduction by Robert Fulton of navigation by steam as a commercial means of transport in a form that has proved permanent, deserves more than a passing mention. Indeed, the fact that our neighbors across the channel are celebrating the event—for the Maritime exhibition now being held at Bordeaux is ostensibly with this aim—may be our excuse in this country, which contributed so much to that consummation, for giving a brief account of the circumstances leading up to and connected with what may well be called an epoch in material development.

It will be impossible in the limits of this short article to refer to all the experiments in navigation by steam that have taken place, but reference to the claims of two individuals which have been put forward very prominently may be briefly made. They are de Garay and Papin. Blasco de Garay, a Spanish ship captain, is stated to have used steam in 1543 in experiments on ships in the port of Barcelona, but a scrutiny of the documents preserved in the national archives of Simancas has revealed the fact that there is no mention therein of steam at all, and that actually the experiments were with paddle-wheels turned by men only.

A stronger claim, and one that, curiously enough, if substantiated, would antedate Fulton's success almost exactly 100 years, necessitating therefore that we should be celebrating the bicentenary instead of the centenary, is that attributed to Denis Papin in 1707. After a very exhaustive examination of all the documents, Prof. E. Gerland, Ph. D., in a paper given before the International Congress of Naval Architects, at Bordeaux this July, conclusively shows that Papin had not got beyond the stage of paddle-wheels actuated by muscular power. It is true that he intended applying steam power to his boat, and was even setting out for England, where he hoped to further his ideas, when his little craft was broken up as an infringement of their privileges by irate boatmen on the Fulda at the end of September, 1707. When it is remembered that the only way known at the time in which steam could be utilized, was to raise water by pressure or suction upon its surface in a closed vessel, we can see that it would have been necessary to have used the water so raised on a water-wheel in order to have obtained rotative motion. Papin was before his time; indeed every inventor is more or less, and while it is necessary to progress that it should be so, every engineer knows how cheap ideas are, but how difficult it is to reduce them to practical form.

In experiments which led to definite results of some value, several inventors in New England seem to have attacked the problem simultaneously. The need for greater facilities of transit on their extensive inland waterways must always have been felt. The impetus may have been given by the removal of trade restrictions by the War of Independence, 1775-83; what the nature of these restrictions had been is shown by the fact that the art of constructing engines was totally unknown in that country. A fact not less pregnant is that in the years beween 1775 and 1782 great developments, exceeding those at any other period of its history, had taken place in the steam engine at the hands of Watt, transforming it from the simple pump of Newcomen into the rotative engine, which was available for general power purposes.

John Fitch, of Connecticut, commenced his experiments in 1785, and having obtained from the State of New Jersey a privilege for 14 years "for making and using all kinds of steamboats," induced several gentlemen to assist him financially and share in his enterprise. In 1786 he moved a skiff on the Deleware river by means of paddles on either side, the idea being obviously borrowed from the Indian and his canoe. The engine he employed seems to have been one resembling Watt's construction; the paddles that it put in motion were four sets acting alternately, three on either side. Curiously enough, had Fitch known it, a period of 20 years almost to a day was to elapse before permanent success was finally achieved.

James Rumsey, who commenced his experiments if anything earlier than Fitch, revived an old idea—that of hydraulic propulsion—and was the first to reduce it to a practical form. As this only needed a pump to draw water in at the bow and eject it at the stern, the mechanical arrangements did not involve anything novel. In 1787 and again in 1788 Rumsey succeeded in propelling a vessel on the Potomac at the rate of four miles an hour. He proceeded to this country and, in 1788, obtained a patent over here. Having interested an American gentleman financially in his undertaking, his system was tried on the Thames in 1793, but as his death had occurred on the eve of success the matter was allowed to drop. The plan has since been exhaustively tried by the Admiralty and others, but has not been found more economical than other modes of propulsion. It has, however, received some little application in circumstances requiring exceptional arrangements—e.g., in lifeboats.

Almost too well known to need more than a passing mention are the experiments of the Edinburgh banker Patrick Miller. In 1788, having been supplied by William Symington with an engine of the form that the latter had patented in the preceding year Miller had the satisfaction of attaining a speed of five miles per hour with a small double pleasure boat on Dalswinton Loch, in his estate in Dumfriesshire. This machinery has been preserved and is now in the National Museum at South Kensington. A trial on a larger scale was decided upon; one of Miller's double boats was brought round from Leith to Grangemouth and was supplied with an engine of similar design to the last, built at Carron Iron Works; the result of the trials, which took place on the Forth and Cylde Canal, was even more gratifying than before, for a speed of seven miles per hour was attained. Miller hardly seems to have realized the importance of his experiments; the feasibility of any other application than that to inland navigation does not seem to have occurred to him. The engine was not at all suitable for everyday work even in smooth water, since it relied on ratchets for obtaining rotative motion, much in the same way as had been proposed by Jonathan Hulls in 1736. Miller had met with but little encouragement from the government of his day in his public-spirited efforts for the improvements of the arts, in which it is stated that he had expended as much as £30,000, and perhaps it is not surprising that he prosecuted these experiments no further.

John Fitch, with the help of his friends, built a third boat with which they realized in 1788 a speed of over six miles an hour; in this boat the paddles were all placed at the stern. A fourth and similar boat gave an even higher speed—i.e., eight miles an hour, when tried at Philadelphia in 1790 before members of the Legislature of Pennsylvania. The same summer the boat was put upon the Delaware and ran a passenger and freight service between Philadelphia and Bordentown, but failed to pay expenses. Possibly the weight and size of the engine was out of proportion to the power developed, leaving little displacement for freight and passengers. Fitch was sent to France by his partners in 1791 for the purpose of introducing steamboats there, but owing to the disorganized state of the country following upon the revolution, he was unable to obtain workmen and he returned to the states. In 1798 he died in poverty and disappointment. It would take up too much time more than to mention the names of Read, Evans and Morey, none of whom, however, appear to have advanced a solution of the problem in any way.

A most decisive step in advance was, however, taken in 1801 by William Symington. Lord Dundas of Kerse, governor of the Forth and Clyde canal, conceiving that the power of both horses and the wind could be replaced on the canal, employed Symington to make an engine for a vessel specially built for the purpose, and named the "Charlotte Dundas," after his lordship's daughter. At a time when the beam engine and other indirect types were the established practice, Symington patented and designed a horizontal condensing engine directly actuating the paddle-wheel, which was placed in a recess in the stern. This tugboat was tried in 1802 and was a complete success. The canal proprietors were not, however, of the same opinion as their chairman; on the contrary they were convinced that damage would result to the banks of the canal from the wash of the paddles. As nothing could be done to remove their prejudices, the boat was laid up at the drawbridge at Bainsford, near Carron Ironworks, where it gradually went to decay. Lord Dundas, however, gave Symington an introduction to the Duke of Bridgewater, who was with difficulty convinced, by the aid of a model, of the utility of the invention, but finally gave Symington an order for eight boats of similar construction to the "Charlotte Dundas." The death of that nobleman, however, occurred in 1803, and the order was never executed.

Returning across the Atlantic, Col. John Stevens, of Hoboken, N.J., in 1804 struck out in quite an original direction and had constructed a boat propelled by submerged twin screws. The machinery was remarkable, for besides a double-acting high-pressure cylinder driving the two shafts geared together, he had also made a fairly efficient water-tube boiler. To speed attained was four miles an hour, and it appears to have been only that he was ahead of the state of the mechanical arts of his day that prevented him prosecuting his experiments further in that direction. The machinery is preserved in working order at the Stevens Institute of Technology, at Hoboken, N. J.

The final phase in the evolution of the steamboat, the centenary of which is now being celebrated, was the immediate origin of the fleets of palatial steamers that are such striking objects on the rivers of the North American Continent. Robert Fulton, of Pennsylvania, had had unusual opportunities, by travel and by intercourse with distinguished men of science, for acquiring information. Having a natural bent towards mechanics he seems to have turned his attention while in Paris in 1802 to nautical propulsion by mechanical means. In 1803 he met a kindred spirit in Chancellor Robert R. Livingston, the U. S. representative to the French Government. In 1798, before this appointment, Livingston himself had been interested in steamboat projects, and had obtained an exclusive privilege for navigating the waters of the State of New York. With Livingston's financial assistance, Fulton conducted experiments on a large scale on the Seine, which so satisfied Livingston that he obtained a renewal of his privilege. Fulton ordered an engine from Boulton, Watt and Co., and made further experiments on the Seine in 1804. Later in that year he visited this country, calling at Soho to explain his requirements in greater detail, and also visited Symington in Scotland, when he had a trip on the "Charlotte Dundas," and was generously given complete information about her. Fulton returned to the States in 1806, his engine having arrived before him. He lost no time in ordering a vessel to be built, and in the spring of 1807 Charles Brown launched for Fulton from his yard on the East (Hudson) river the "Clermont," named after the country residence of his associate, Chancellor Livingston, who had also recently returned home. Fulton planned and executed the paddle-wheel and the parts connecting it with the engine, which was of the bell-crank type lately introduced by Boulton, Watt, and Co.; the boiler was of the ordinary land type, set in masonry. With the boat only partially decked over and with no guards to the paddle-wheels, the "Clermont" ran her trial trip on August 17, 1807, from New York to Clermont, proceeding thence the next day to Albany. The return voyage was commenced the day following, the round trip of about 300 miles being accomplished at the rate of nearly five miles per hour. During the winter of 1807-8 the Clermont was lengthened and the paddle-wheels were boxed in; she was flush-decked from stem to stern and fitted with cabins and berths. Before the end of the season she proved too small for the number of people who thronged to take passage in her. The tide had turned, prejudice had been overcome, and the new method of transportation had come to stay. Fulton and Livingston lost no time in building other boats, each one of greater displacement and better found than the preceding. In spite of their monopoly on the Hudson which had been extended to 20 years from 1807, they did not derive much profit from their enterprise, for they were quickly assailed by unscrupulous persons both by running foul of their boats on the river and also in the Law Courts, where their opponents eventually succeeded in annulling their exclusive privilege.

Even if Fulton had not succeeded the event would be celebrated just the same, for the indefatigable Colonel Stevens had turned his attention from high-pressure steam and screws to low-pressure steam and paddle-wheels, and succeeded, only a few days after Fulton, in achieving a similar result with a boat named the "Phoenix." Debarred from the Hudson by the latter's monopoly, Robert L. Stevens, the son of Colonel Stevens, in 1809 took the boat from New York to Philadelphia, where she plied for many years; he thus has the credit of being the first to navigate the open sea by steam. All this happened several years before steam navigation was achieved in Europe, for it was not till 1812 that Henry Bell commenced running the "Comet" on the Clyde.

Fulton was busy with the construction of a coast defence battery—the first warship propelled by steam—at the time of his death, which took place in 1815 at the early age of 50 years. He had the satisfaction of having lived to see steam navigation successfully established in nearly every civilized part of the globe.

It is not difficult at this distance of time with the above facts to come to the conclusion that Fulton was not, as has been so often claimed, especially by his own countrymen, the inventor of the steamboat any more than was Stephenson in this country the inventor of the locomotive engine. Rather should they be regarded as master minds who focus the knowledge of their time and had an intuitive perception of what are the elements necessary for success. Thus one was successful in establishing a new method of transport by water and the other by land.

New York an Electric City

"Did you ever consider," began the young man who lived very far north in Harlem, "what a really electric city New York is? Take my case.

"Each morning I am awakened by an electric bell, pushed five flights down by a kindly janitor. That starts the day.

"I hop into an electric subway train and get downtown quickly as things will permit. I buy two cigars and light them at an electric cigar lighter.

"Then I march into an elevator which is propelled upward by electricity and I scurry into my office. If I am the first man in I turn on an electric fan as a matter of habit.

"Maybe I get a call from the only girl on an electric telephone during the morning. If the day is an unusual one I may get a message wired to me by electricity.

"At noon I go to lunch and use the same electric elevator. I ride a few blocks on an electric surface car, and after reaching my underground cafe I seat myself under a cluster of electric incandescen lights. As it happens there is an electric piano in my particular restaurant which plays solemnly during the lunch hour, though there are times when I wish it wouldn't.

"In the evening I dine hurriedly at another place downtown, surrounded by the commonplace electric affairs that no one ever notices, and then I hasten uptown to a friend's house, where I make my presence known by jabbing his bell four times. Of course it is an electric bell.

"My friend and I go somewhere and if the money affairs are in good shape we may ride in an electric cab before the evening wanes. I reach my own home at a late hour, and before going to my apartment I throw on an electric switch which lights the lamps in front of my mail box.

"All I am waiting for now is to have some ingenious chap invent something better so that by turning on a clever little electric device I can hold my job without leaving home at all."—New York Sun.