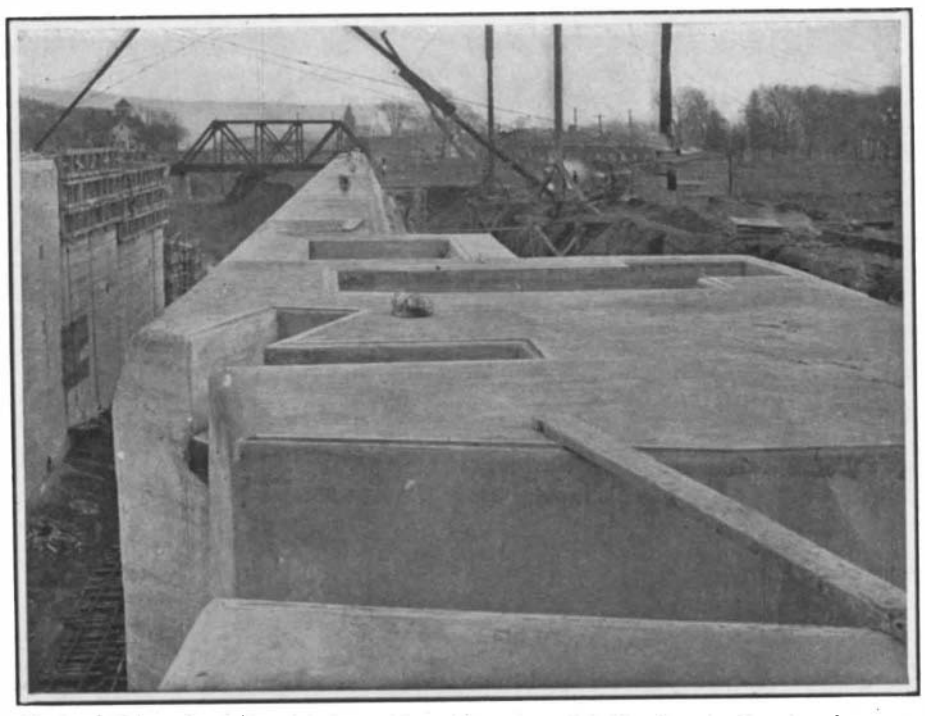
THE NEW YORK STATE BARGE CANAL.

Nature has provided two natural outlets from the Great Lakes to the Atlantic, one by way of the St. Lawrence River, and the other through the Mohawk and Hudson valleys. The first presents the great natural obstruction of the Niagara Falls; the second is intercepted by a range of hills and mountains, broken by a low depression at the junction of the Mohawk with the Hudson. As far back as the days of the Indian occupation, the Mohawk and Hudson valleys formed the main line of communication for the various tribes, and, with the coming of the white races, the importance of this route was emphasized, the tide of pioneer advance flowing steadily up the Hudson and Mohawk valleys to spread out ultimately on the prairies of the then Far West. As this route of travel grew in importance, it was utilized by every means of conveyance known to those early days, from the canoe and the packhorse to the lumbering stage coach. Ultimately, and inevitably, the government found itself confronted with the demand for improved means of transit; and as far back as 1793 the improvement of facilities for transit by water were begun by the construction at Little Falls of a canal about 3½ feet in depth by three-quarters of a mile in length containing five locks, which served to carry the water-borne traffic around the rapids. Shortly afterward similar improvements were undertaken at Rome and other places, and finally, in response to the rapidly increasing demands of traffic, the government undertook the construction of the Erie Canal, extending from the Hudson River near Albany to Buffalo—a really stupendous work for that early day. The canal was opened in the year 1825. It was 4 feet deep, its least width on the bottom was 28 feet, and its total length was 363 miles. It contained 83 locks and 18 aqueducts, the total cost of the work being about $7,000,000. Between the years 1836 and 1862 the canal was enlarged to a depth of 7 feet, and a least width on the bottom of 52 feet. The total number of locks was reduced from 83 to 72 and their size was increased from 15 feet by 90 feet to 18 feet by 110 feet. The total cost of the work was $32,000,000.

Meanwhile the railroad system of the country was developing by leaps and bounds, and entering into keen competition with the waterway. The steady decrease in railroad rates, coupled with the shorter time of transit, was bound to tell heavily in their favor; and there was a steady transfer of traffic from the old to the new system of transportation. Practically no effort was made by the State authorities to meet this competition, and there was a constant heavy fall in the total amount of traffic, which decreased from a maximum 4,600,000 tons in 1880 to 2,000,000 tons in 1904. The only serious effort to alter conditions was the abolishing in 1882 of the tolls on the canal, which had amounted in the sixty years from 1820 to 1882, to a total of $120,700,000. In spite of the encouragement afforded by this step, it failed to win back the traffic from the railroads. In 1895 an inadequate attempt was made to rehabilitate the fortunes of the canal by an appropriation of $9,000,000 for reconstruction; but this amount was quite inadequate to enable work to be undertaken on a scale of any magnitude. In 1903 it was decided to put the question of reconstruction to the vote of the people, who by a large majority authorized the expenditure of $101,000,000 in the enlargement of the canal. The new plans called for a least depth of 12 feet and a least bottom width of 75 feet, dimensions which will accommodate barges of 1,000 tons capacity. The locks were to be 28 feet in width, with a depth of 11 feet on the sill. Subsequently, and very wisely, the locks, in anticipation of a future widening of the canal prism, were increased to 45 feet width and 12 feet depth over the sill. With a view to this possible enlargement, the present embankments are being built so as to make it possible to widen the canal with as little expense as possible to 110 feet; and in canalizing the rivers, the channels are being dredged to a width of 200 feet.



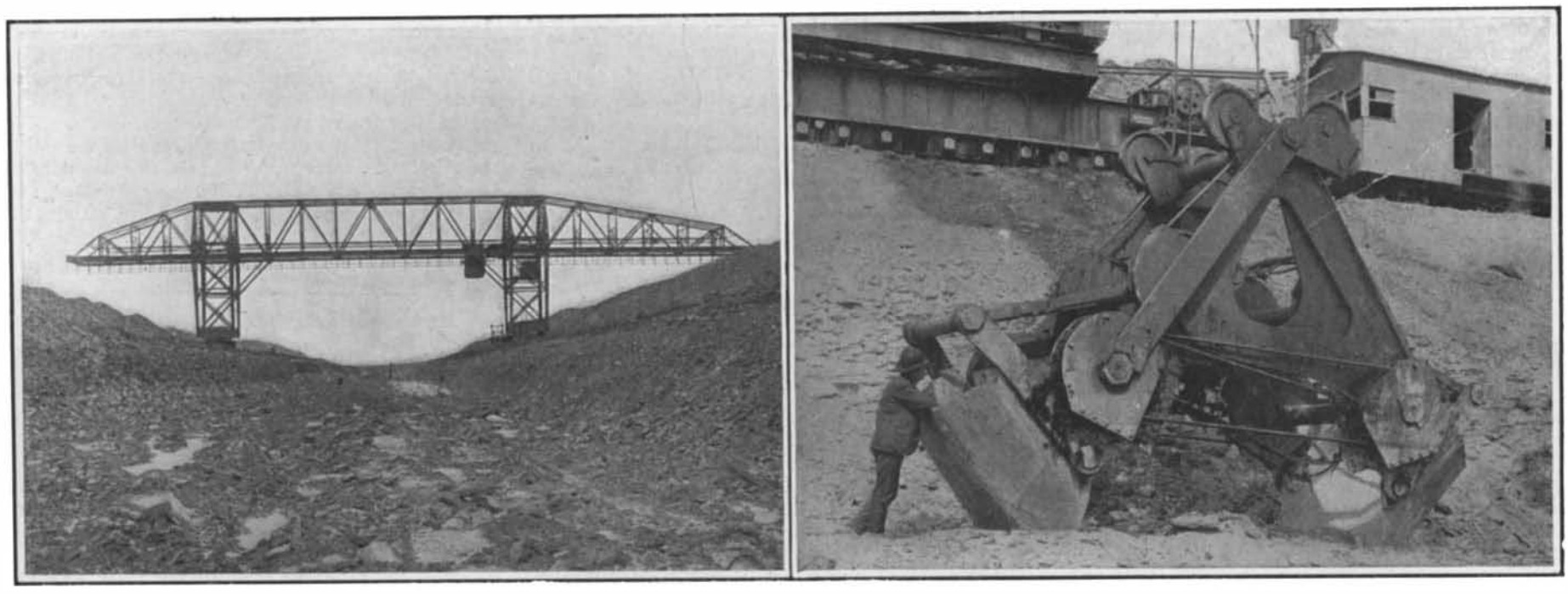
The successive openings will contain the machinery for opening and shutting the gate; the gate anchorage; the machinery for filling and emptying valves; and the capstan machinery.

Upper End of Dock Wall.

The new canal, on leaving Lake Erie at Buffalo at an elevation of 565.6 feet above sea level, follows the Niagara River to Tonawanda Creek, and thence runs in an easterly direction, and generally parallel with the shore line of Lake Ontario, until the Oswego River is entered, from which point it continues in a generally easterly direction to a junction with the Hudson River at Waterford. After entering Tonawanda Creek, it follows the course of this stream until, at Lockport, it descends by a flight of two locks whose lift will vary from 49 to 54 feet, the lift being dependent upon the level of Lake Erie. From Lockport to Rochester the canal extends for a distance of 60 miles in a single level, crossing the Genesee River before reaching the city. At the Genesee River, harbor accommodation will be afforded by means of a pool formed in the river. Beyond Rochester the new canal coincides with the old canal until it enters the River Clyde near Lyons. Up to this point, the location of the old and new canals is practically identical; but beyond Lyons the old canal route is abandoned, and the new location has been laid so as to take advantage of the various river channels encountered, the change of location carrying the new canal as much as 20 miles to the north of the old work. The Clyde River is followed to the Seneca River, which, in its turn, will be utilized as far as Three Rivers, where the Seneca and Oneida unite to form the Oswego River. At this point, a new stretch of canal will be formed in the bed of the Oswego River, north to Lake Ontario, the depth of the river being increased by the use of fixed dams. From Oswego River the canal continues easterly, following the Oneida River, to Oneida Lake, through which it passes, leaving the easterly end of the lake through the valley of Wood Creek, through which it is located to the city of Rome. At Rome the canal is carried by locks and across the divide, and enters the valley of the Mohawk River.

In the valley of the Mohawk between Utica and Schenectady, the canal will be provided with nine movable and two fixed dams. Eight of the movable dams will be of the bridge-and-gate type. They will have a maximum lift of 15 feet, and a maximum depth on the sills of 20 feet. By the use of these dams it will be possible to control the high floods to which the Mohawk is subjected, and operate the canal with as little inconvenience to the thickly-settled valley as possible. In order to avoid the big drop in elevation, which occurs at the discharge of the Mohawk into the Hudson River, the location of the new canal has been changed so as to enter the Hudson at Waterford by a series of five locks, in which the canal is brought down from an elevation of plus 151 feet to tide level. At Waterford the important branch known as the Champlain Canal starts north to its connection with the lake. From Waterford to Fort Edward the location will lie in the Hudson River, and the new route will take the place of the old land line located along the base of the foothills. Beyond Fort Edward, also, the line will be on a new location, and its final entry into Lake Champlain will be through Wood Creek, which will be canalized by the use of fixed dams. In this connection it is interesting to note that the Canadian government has prepared plans for the construction of a 12-foot depth of water along the present route, from the mouth of the new canal through Lake Champlain to Montreal.

An important feature, which should be remembered in judging of the magnitude of the work being done, is that the mere excavation represents but forty per cent of the total cost of the canal; the other sixty per cent covers the unusually large amount of constructional work, in the way of fixed and movable dams, locks, bridges, and other masonry and steel work. Thus, there will be a total number of no less than fifty-four locks, whose lift will vary from 6 feet to a maximum of 40½ feet; and of these, thirty-four will be built along the line of the Erie Canal proper. As showing the improved character of the new canal, it should be mentioned that on the present Erie Canal there are no less than seventy-two locks. All of the locks will be 45 feet in width, with a workable length of from 300 to 310 feet, according to the character of the boats. Throughout the canal the masonry will be of concrete, composed of 1 part of Portland cement

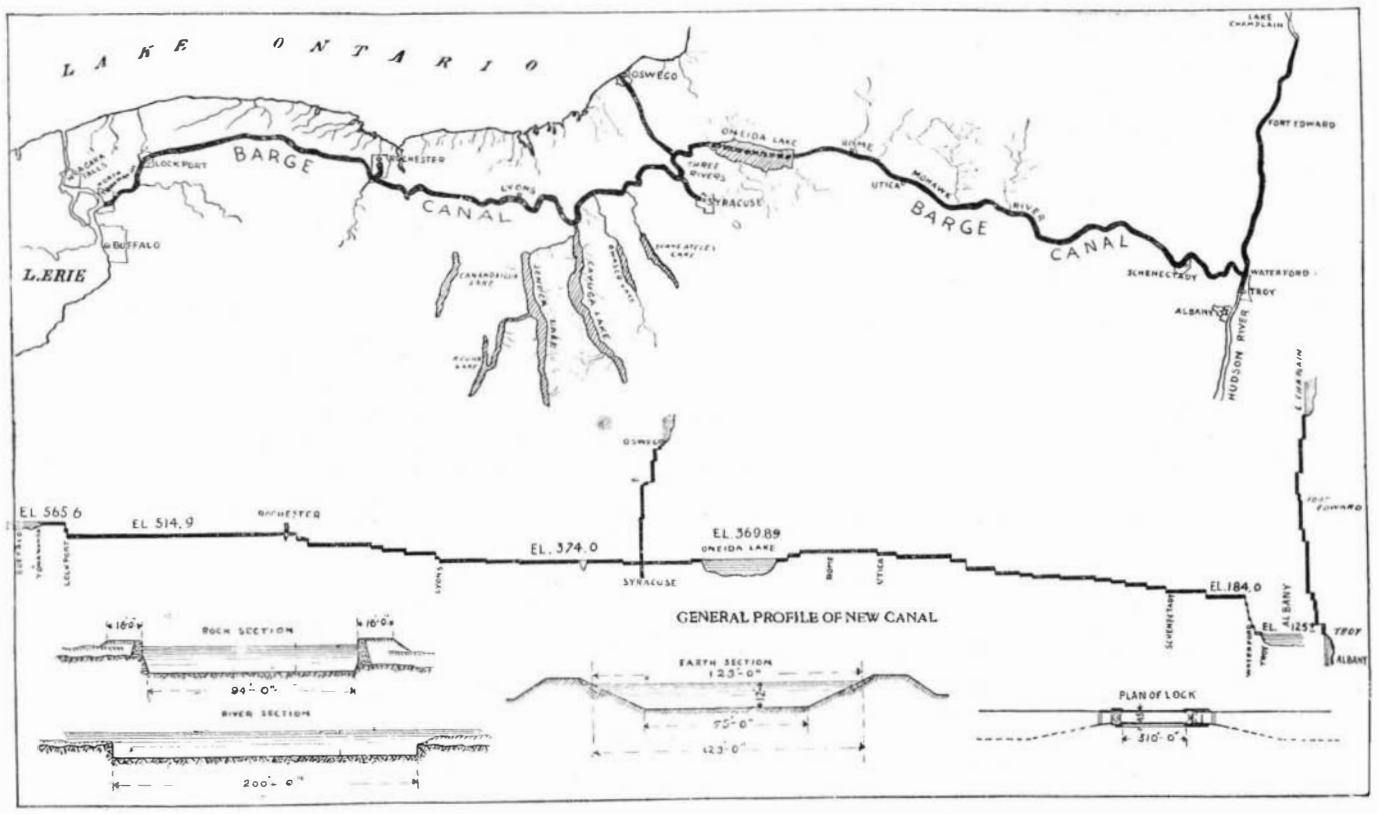


This Cantilever Excavating Machine Spans the Entire Width of the Canal.

The Bucket Grab of Machine Shown in Adjoining Cut.

THE NEW YORK STATE BARGE CANAL.

and from 7½ to 9 parts broken stone, gravel, etc. All lock gates will be built of steel; and they will be operated by electric motors, the power being generally developed by turbo-generator plants located at the locks. For the control of rivers and streams and the impounding of water for summit supply, thirty-five dams will be required, of both the fixed and movable types. The statement of the total amount of excavation and construction to be executed gives an impressive idea of the magnitude of the work.



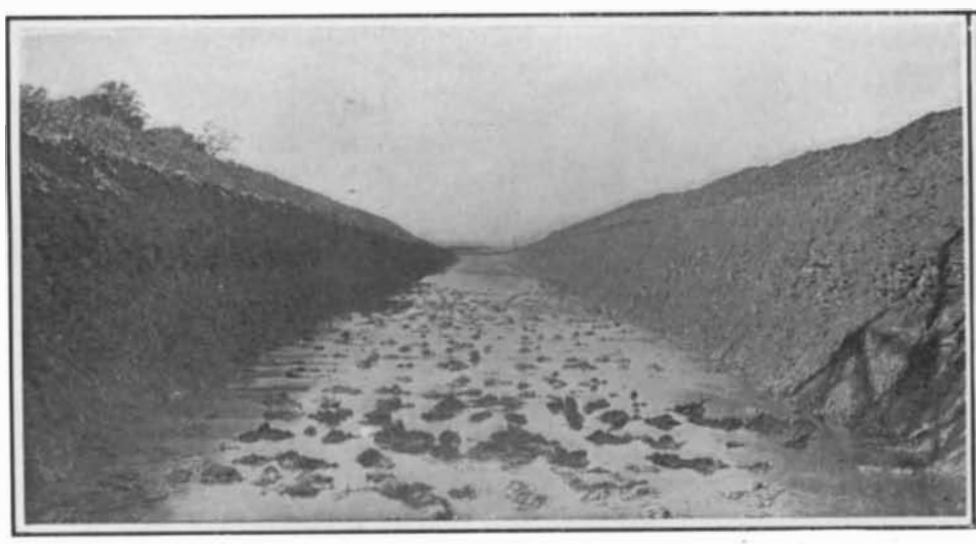
Plan, Profile, and Sections of the New York State Barge Canal.

QUANTITIES OF EXCAVATION AND CONSTRUCTION FOR NEW YORK STATE BARGE CANAL.

Dredging	57,676,700	cubic yards.
Earth excavation	54,989,000	" "
Rock excavation	10,806,000	" "
Embankment and back filling.	9,454,300	" "
	132,927,000	" "
Concrete	4,243,105	" "
Cut stone	9,787	cubic yards.
Iron and steel	82,500	tons.
Sawed timber	93,756,000	feet B.M.
Piling and round timber	4,230,000	lineal feet.
Rip-rap	1,628,967	cubic yards.
Number of locks	54	
Number of dams	35	
Total length of canal	442	miles.
Total estimated cost	$101,000,000	

Active construction of the canal was commenced over three years ago, but on account of the extended surveys, comparative studies, and preparation of contract drawings, the work could not be attacked on any considerable scale until the present year. On the first of August contracts had been made to the total amount of $26,265,158, covering 152½ miles of canal; and on the same date, plans had been completed covering an additional amount of 98⅛ miles of canal and a large storage reservoir, which represented an estimated cost of $11,760,612. Work on the canal is now in full swing; the total excavation on all contracts during July amounting to 1,067,111 cubic yards, which is 99 per cent of the amount taken out at Panama for July, 1907.

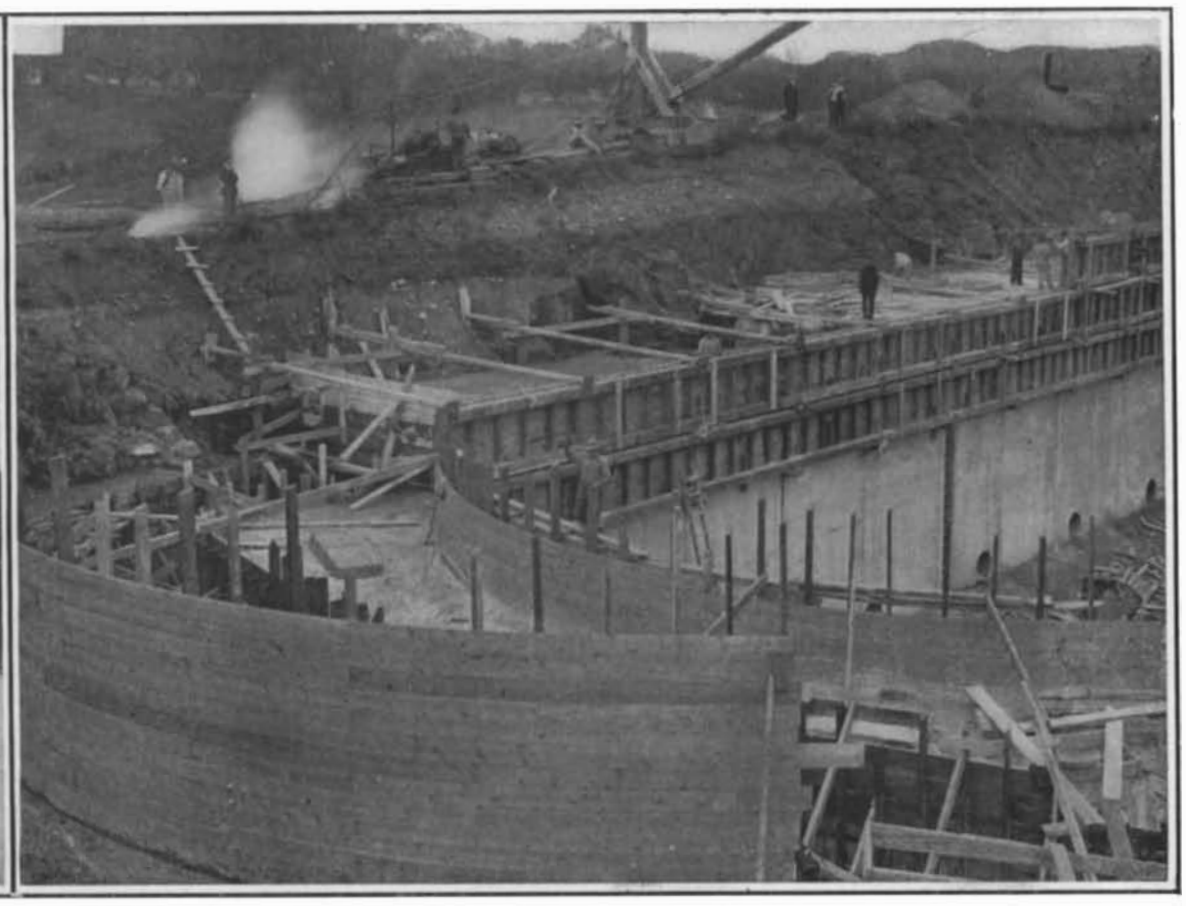
Air-pump displacement should be one-seventy-fifth of the low-pressure piston displacement on a compound engine.



Section of Canal Excavated in Soft Material. The Material Dredged Out and the Earth Excavation Amount to on the Whole Canal 112,665,700 Yards.

Lubecker Excavator. The Material is Dug from the Left-Hand Side of Machine, Emptied onto a Conveyer, and Deposited in Dump at Right.

Loenitz Rock Breaker. Operated by Lifting and Letting Fall the 16-Ton Iron Hammer Seen Below the Derrick.



Constructing the Concrete Walls of No. 2 Lock at Waterford. This Will be One of a Series of Five Locks.

THE NEW YORK STATE BARGE CANAL.

The Sixth Tuberculosis Congress.

If there be any gatherings of more merit and endowed with more beneficent influence in shaping the future of our race than even peace congresses, they are the series of congresses on hygiene and demography, and principally those on tuberculosis, which have met during the last two decades. The present Congress on Tuberculosis now convened in this country is the sixth of its kind. It has never been surpassed in the wealth of material offered, and its deliberations will give a vast impetus to the great work of eradicating a terrible plague. Some idea of the magnitude of this Sixth International Congress and its exposition and our own share in fighting consumption may be gleaned from the fact that of the 438 contributors to the exposition, 312 reside within the limits of the United States; 126 without. Two hundred and twenty-two of the number are collective contributions, that is, from associations, societies and other corporate bodies, and 216 from individual members of the Congress. Of the 222 collective contributors, those from the United States number 170; those from Europe or from other parts of America, 52. Of the 216 individual exhibits we are indebted to the United States for 142; to European and American countries outside of the United States, for 74.

The economical necessity of stamping out tuberculosis and thereby increasing national efficiency can not be more graphically presented than by condensing the able paper prepared for the Congress by Prof. Irving Fisher of Yale University. According to Prof. Fisher, tuberculosis costs, in hard cash, over one billion dollars a year. Consumption kills 138,000 every year in the United States. This is equal to the deaths from typhoid fever, scarlet fever, diphtheria, appendicitis, meningitis, diabetes, smallpox, and cancer all put together. The scourge picks out its victims when they are young men and young women, at the very time they are beginning to earn money. The minimum cost of such items as doctors' bills, medicines, nursing and loss of earnings before death amounts to over $2,400 in each case, while the earning power which "might have been" if death had not come brings the total cost to at least $8,000. If this is multiplied by the 138,000 deaths, we find the cost is bigger than the almost incalculable sum of $1,000,000,000. Prof. Fisher estimates that over half of this cost generally falls on the luckless victim himself, but the cost to others than the consumptive is over $440,000,000 a year. As a matter of self-defense it would be worth while to the community, in order to save merely a quarter of the lives now lost by consumption, to invest $5,500,000,000. At present only a fraction of one per cent of this money is being used to fight the disease. Five million people now living in the United States are doomed to fill consumptives' graves unless something is done to save them. As each death means anxiety and grief for a whole family, Prof. Fisher estimated that there will be over 20,000,000 persons rendered miserable by these deaths.

Government control of some kind seems an obvious necessity. In this country we are hampered by the constitutional requirement of respecting State rights. As Dr. H. M. Bracken pointed out to the Congress, there are interstate regulations relating to the shipping of hogs, cattle, and commercial products, but when the question of national legislation for the protection of human beings is raised, the question of States rights is brought forward and the proposed legislative measure is promptly killed. In a recent article Dr. C. Harrington drew attention to the remarkable difference which may exist under conditions fundamentally alike, in the matter of States rights, citing as illustrations the fact that while States rights prevented legislation for national quarantine covering a period of about a century, no strong objections were made to the passage of national laws relating to pure food, packing house products, etc. The question of States rights is easily thrust aside when it interferes with interstate commercial problems—another illustration of the greater value of the dollar than of human life. This very Congress has reserved a whole section to the consideration of State and municipal control of tuberculosis, and of laws and ordinances relating to it. The time is approaching when the people will insist upon having their health safeguarded. We have in this country a cabinet with special members for law, for war, for the navy, for foreign politics, for internal political and economic improvements. We have a special department for agriculture, which supplies the people with rare and common seeds, and prevents and cures the diseases of their cattle. We even begin to make an end to our dereliction in allowing our forests to be burned or stolen. We have, however, no central representation of the forces that make for the physical welfare of the people, and no United States board of health. Above all, the poorer classes should be enlightened on the dangers of consumption, a subject which Sherman C. Kingsley brought to the attention of the Congress. He showed that the necessities of life exhaust the earnings of a man earning from nine to eighteen dollars a week, leaving no margin for emergencies. A call from the doctor means the price of a day's wages and a cut from the rent or the savings for shoes and clothing. For this and many similar reasons tuberculosis is far advanced when discovered among these people. The only hope of recovery depends upon early diagnosis. They live in the least favorable parts of the city, in tenement houses, in neighborhoods where milk and food supplies are inferior. In a recent examination of 150 families by Dr. Theodore B. Sachs, 25 to 30 per cent of all the children in these families showed signs of infection. The disease forces children out of school at the earliest possible age, exhausts family resources and vitality and fastens itself on the weakened members. The obvious needs suggested are more hospitals for advanced cases—hospitals that will gain the confidence of the people themselves and also satisfy the conscience of the community. We need more sanatoria for incipient cases, more funds to save fathers and mothers still in incipient stages, a wide increase of tuberculosis clinics, day camps, and church classes as adjuncts to the home care of patients.

The present movement is guided by the endeavor to put every personal consideration aside, and to bring before the Congress the newer and more recent means of grappling with the tuberculosis question. It would be impossible not to express gratification that the Congress has brought to our shores many who are of international reputation.

Encke's Comet.

Encke's comet was reported from the Cape Town Observatory on May 28 last, about one month later than the time calculated by Prof. Backlynd. The discrepancy is easily accounted for by the perturbations which the body naturally undergoes as it travels among the planets. Next to Halley's comet, which will probably be photographically picked up in a month, and which will reach perihelion in 1910, Encke's comet is the most famous body of its kind. In the first place, it is periodical, and therefore belongs to a class numbering comparatively few comets. In the second place it has been made the subject of as much mathematical calculation as Halley's comet itself. As it now appears, Encke's comet seems dismembered, the tail being separated from the nucleus. It is rarely that any comet presents the same aspect twice in succession, for which reason this mutilation is not extraordinary. On some of its previous visits it has appeared almost tailless; on others it was a perfect comet of its kind. Unfortunately, the comet is south of the equator, for which reason it cannot be very well observed by many observatories of the world.

Funeral of Lieut. Selfridge.

Lieut. Thomas E. Selfridge, the promising young army officer who fell to his death with Orville Wright in the latter's aeroplane on September 17, was buried with military honors in the Arlington National Cemetery, which adjoins Fort Myer, on the 25th ultimo. The loss of this brilliant officer will be keenly felt, particularly in aeronautic circles, for he was thoroughly informed in the new science, and, as the secretary of the Aerial Experiment Association, he had had much to do with the development of aeronautics in America. The various aeroplanes built by this association, all of which flew successfully, were designed by him, and the third of these, the "June Bug," on July 4 last won for the first time the Scientific American Trophy. Lieut. Selfridge is the first martyr to flight by a self-propelled heavier-than-air flying machine, and it seems but fitting that a suitable monument should be erected on the spot where he fell.

Mr. Orville Wright is slowly recovering from the injuries he sustained in the fall of the aeroplane. His broken thigh is slowly knitting, and his ultimate recovery is only a matter of time.

Melting Silica.

A German firm has brought out a new process for melting silica and for molding it in various forms, using the principle of the electric furnace. The silica (quartz, etc.) is fused in a special type of furnace, and to this end it is placed in a carbon tube which is mounted horizontally or vertically as desired. This tube forms one of the electrodes of the furnace, and it is inserted in a larger tube which is used as the second electrode. In the space between the tubes is placed carbon powder or other conducting substance. One end of the inner tube is closed by a removable stopper. The outside of the large tube is closed by a cover which has such shape that it can be inserted more or less in the melted matter of the inner tube. A suitable housing of firebrick incloses the whole. The current is passed between the two carbon pieces and the heat causes the melting of the silica in the best manner. When the silica is entirely fused it can be taken from the mold in the form of a solid block. On the other hand it can be molded by using an inner core which is placed inside the above-mentioned tube, so as to compress the silica within the latter. Steam or compressed air can be used to give the needed pressure for the molding process. At the conclusion of the process the end of the mold is removed and the silica is driven out by means of the movable piece.

Wilbur Wright's Latest Aeroplane Records in France.

On September 21, only four days after the accident to Orville Wright's aeroplane at Fort Myer, his brother, Wilbur Wright, surpassed all previous records by remaining in the air 1 hour, 31 minutes, and 20 seconds, during which he flew 98 kilometers (60.85 miles) in a circular course above the military field at Auvours. The average height of the aeroplane above the ground during this flight was about 25 feet, though at times Mr. Wright sent it up to an elevation three or four times as great. The machine flew with great steadiness, and only alighted at the starting point when it became too dark for the aviator to see. The start of this record-breaking flight (which surpassed that made by Orville Wright by 16 minutes and 56 seconds) was delayed until afternoon on account of a brisk breeze. At 4 P. M. three unsuccessful attempts to launch the machine were made. The trouble was found to be that one of the rollers of the car which carries the aeroplane on the starting rail was damaged. This was repaired, and at the next attempt the machine was started readily. A large and enthusiastic crowd witnessed this flight, which dispelled all doubts abroad as to the complete practicability of the Wright aeroplane and the possibility of making extended flights with it. A few days later, on September 24, Mr. Wright demonstrated that he could fly in an 18-mile wind. He remained aloft 54 minutes and 35 seconds, and flew a distance of 39 kilometers (24.21 miles) in a circular course. When the aeroplane turned into the wind it slowed down perceptibly, while when it flew with the wind it traveled very fast. The following morning a flight of 36 minutes and 14 seconds duration was accomplished. After fitting division partitions in the new large gasoline tank in order to check the movement of the fuel from one end of the tank to the other (which tended to affect the equilibrium), Mr. Wright made a 5-minute test flight. This was followed by a 9-minute 1-second flight with M. Paul Zens as passenger, which was but 5 seconds shorter than the record one made by Orville Wright at Fort Myer when he carried Major Squier as passenger.

The Current Supplement.

The current Supplement, No. 1709, opens with an article by our English correspondent on some highly interesting discoveries which afford conclusive evidence of a connecting link between the Greek art and the art of the Far East. Dr. Francis Darwin's striking paper on the movement of plants is continued. Prof. Harold Jacoby explains popularly the meaning of gravitation. Armor-bearing animals are described and illustrated. Inventors will read with interest some striking statistics on occupational mortality, which tend to show how much the inventor can do to ameliorate conditions in the factory and workshop. Dr. W. Donsell contributes an article on the preparation of tobacco. Very few people have ever heard of Count Francisco Zambeccari, yet he was the Zeppelin of his day. In the Scientific American Supplement will be found a description of his dirigible airship which sailed the air in the early part of the nineteenth century. A new gas locomotive embodying some novel features in its construction is described and illustrated. One of the latest developments in the application of armored concrete is the construction of poles and masts for the support of telephone and telegraph lines. An excellent article describes their manufacture. Wilson E. Symons writes on the future of the electric locomotive. The measurement of ocean waves is the subject of an article by J. B. Van Brussel, in which he describes a method of measuring waves, a method based on comparative measurements of spectroscopic photographs. A primer of wood preservation is presented by W. F. Sherfesee. The usual electrical notes and trade notes and formulæ will be found in their accustomed places.

Visitors to California will have access to a third forest of giant redwoods when the counties of Tulare and Fresno complete construction of twenty-five miles of highway between Visalia and Redwood Canyon, in the Kings River country, where there is a grove of over fifteen thousand magnificent specimens of the *Sequoia gigantea*, many of which are said to compare in size and beauty with the trees of the Mariposa and Calaveras groups. It is probable that the property, which is as yet untouched by lumbermen, will be recommended to Congress for purchase as a national park. One tree in the redwood grove, recently measured by a government ranger, is 110 feet in circumference and is estimated to contain 800,000 feet of lumber. A claim is made that a fallen giant in the region is the largest in the country. Located at an altitude of less than six thousand feet, the canyon would be accessible for a longer period than the other giant groves in the State.