

THE TRANS-SIBERIAN RAILROAD.

BY HENRY MICHELSEN, SECRETARY NATIONAL IRRIGATION CONGRESS.

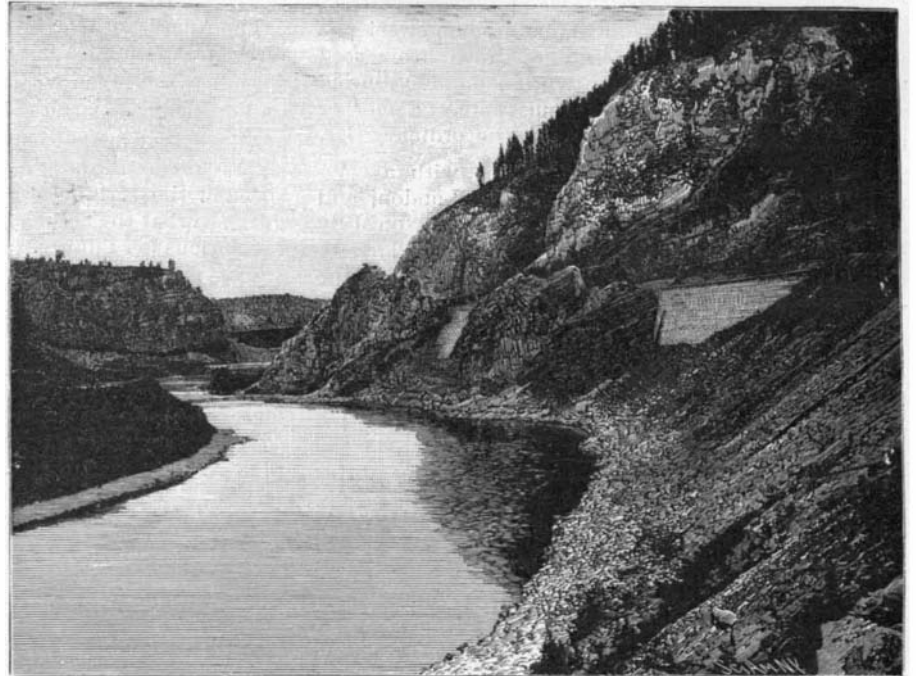
The results of the operations of the Trans-Siberian Railroad for the year 1898 are said to be encouraging to the Russian government. In its present unfinished state the traffic must be strictly local. An analysis of the government report shows that the country through which the line runs, though at present undeveloped and subject to the rigors of the climate on a prairie sloping to the Arctic Sea under the fifty-first degree of latitude, is still capable of producing great crops of grain; that it has fine forest resources, that live stock may flourish in it, and that coal has been found sufficient for the purposes of the railway and the population which may settle on the lands contiguous to it. Therefore, the railway may be expected, when finished, to become a factor in the commercial business of the world, even if its through traffic is not considered, by the opening up of the riches of the hitherto unknown continent which it is destined to make accessible.

The length of the road with its projected extensions is so great that even Americans, who are accustomed to deal with large distances, will have some difficulty in comprehending the scope of this undertaking. The longest continuous line on the North American continent is the Canadian Pacific Railway. Its main line from Montreal to Victoria is 2,990 miles in length. The located line of the Siberian railway, from Cheljabinsk to Vladivostok, is 4,776 miles; the branch through the recently acquired territory of Manchuria to Port Arthur will be 1,273 miles; so that the system will commence, before any feeders are built, with 6,000 miles of track. The distance from Vladivostok to St. Petersburg will be nearly 6,700 miles. The distance from Port Arthur to the harbors of the North Sea, on the estuaries of which the European trade with Eastern

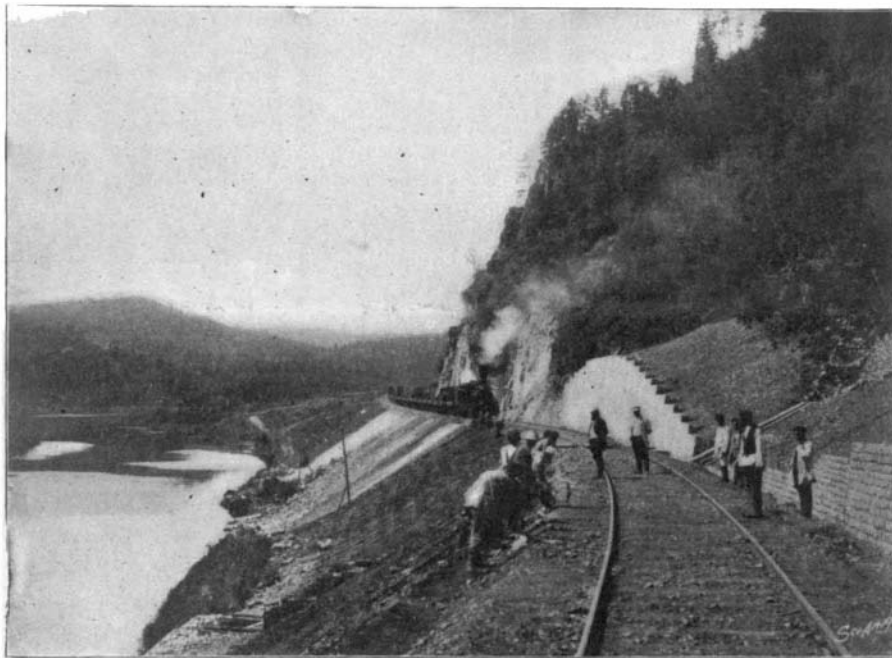
For fully 600 miles the line traverses an excellent agricultural country, producing all kinds of grain in abundance. The 300 miles west of Tomsk run through a fine stock country containing many small lakes of slightly brackish or alkaline water; 200 miles east of the main stream of the Obi River the country is hilly, heavily timbered, and cut up by many small streams. The central division commences at Tomsk and extends to Irkutsk, through a barren upland, climate and soil alike forbidding settlement. The third section crosses the Baikal Lake, and extends to Misorskaia. From this point to the Amoor section, the road passes its summit to drop down into the Pacific slope, running along the old Chinese frontier, touching Kiahta—the emporium of Russo-Chinese overland trade—through a country rich in gold, silver, copper, and iron, producing even now, with antiquated machinery, some fifteen millions of dollars worth of gold annually. The Amoor section extends eastward toward the Pacific, approximately 1,600 miles. This is the district from which the greatest returns may be expected agriculturally. It is well timbered, contains large bodies of alluvial lands and its climate is tempered by the proximity of the Pacific Ocean. The next, the Ossoori section, extending southward to the terminus at Vladivostok, runs through a hilly country fit for agricultural and stock raising purposes, and rich in excellent bituminous coal. The branch which runs through Manchuria passes through a thickly settled farming country; it leaves the Khingan Mountains to the west and crosses the many streams flowing into the Soongaree River, reaching the fine harbor of Port Arthur, which, being ice free the year around, will, it is safe to say, rival Hong Kong at no distant day. Port Arthur is destined to become the great city of Siberia. The fertile territory tributary to the Siberian Railway proper is equal in size to Germany, Austria, Belgium, the Netherlands, and Denmark combined. This territory is capable, if once peopled, of sustaining a railroad out of the local traffic it will produce. The long stretch of 1,500 miles extending from Tomsk to the head waters of the Amoor is perhaps the only distance on the line of the road which a Western railway man would consider difficult to handle successfully as regards revenue. But this upland country has not been explored, and there is a possibility of its becoming a mining country of great importance.

The transportation problem of the Trans-Siberian Railway is a peculiar one. The products which it may expect to carry are what Americans would call low-grade freight—grain, ore, live stock, and timber. To transport these articles from the interior of Asia to the markets of the world must entail too long a railroad haul. It may be pointed out that California wheat is carried from San Francisco to

Liverpool via Cape Horn, not all rail by way of New York. In general it may be held that agricultural staples cannot stand a railroad haul of over 2,500 miles. The greater part of the import and export trade of Eastern Asia is in the hands of the western European nations, taking its way through the Suez Canal. The schedule time of the North German Lloyd's steamers between Bremen and Shanghai is 46 days. Its tariff rates are less than \$6 per ton or cubic meter of room to Shanghai or Port Arthur, \$6.25 to \$8.75 to Yokohama and Hiogo, and \$8.75 to \$11.87½ to Nagasaki. Between London, Liverpool, and other English harbors and Asiatic points, the freights are a little less than is charged to and from German ports. This means, practically, that in the competition for through freights, the Trans-Siberian Railway may not cope with the steamship lines to Europe, either in rates or time. For, assuming the adoption of the European classification, with its tariffs running from 0.47 to 2.35 cents per 1,000 kilogrammes per kilometer, we have a rate per ton of the lowest grade of freight for 7,000 miles of over \$200, which is prohibitory. As to the time, we must consider the necessity of a transfer from the Russian five-foot gage cars to the standard gage cars at the European frontier, and also the physical condition of Russian railways in general. Railroad men will concede that on crowded, single-track Asiatic railways a freight train will do well if it makes 240 kilometers, or 150 miles, a day, for many consecutive days, taking into consideration the liability to accidents, delays by reason of accumulated traffic from opposite directions, and the uncertainties incident to an Arctic climate. At any rate, this is the standard adopted by other Russian roads, of which Mr. Poultney Bigelow says that "an express train means a train that does not carry cattle and occasionally attains a speed of 25 miles an hour," and where the adaptability of the inferior administrative officials to the requirements of modern railway service has not, as yet, been demonstrated. The time, therefore, between Vladivostok and Hamburg, under present conditions, will be about the same either by rail or steamer, with the advantage of uninterrupted passage and fragmentary rates in favor of the latter. For east bound freights from the interior of Asia to the United States or Canada there will be but little



The Railroad Along the River Zouriazan.



On the Banks of the River Simm, near the Miniar.

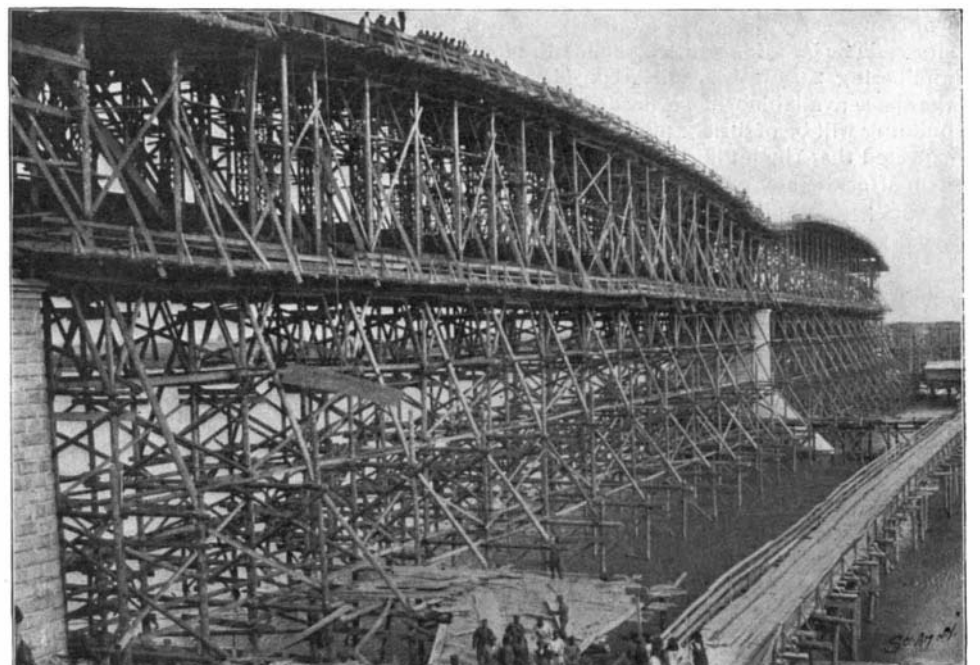
Asia is centered, is, approximately, 6,900 miles by the nearest route.

The Siberian Railway is, like all Russian roads, of a five foot gage. It is constructed after the manner of American Western railways, single-tracked, gravel-ballasted, where ballasted at all, with Howe truss bridges over the smaller waterways, and steel bridges across the large rivers. The watershed of the country east of the Ural Mountains is from south to north for more than 3,000 miles, which means a northern exposure entailing more severity of climate than is known on the railways of the United States and Canada. The rivers here are deep, full flowing streams, the alluvial bottoms of which necessitate large spans and make it desirable to have as few bridge piers as possible. Floating ice is in the rivers for about seven months of the year. The bridge at the Ishim has openings amounting to 700 feet, that at the Tobal 1,400 feet, that at the Irtysh 2,100 feet; and the bridge over the Yenesei has a total length of just under 3,000 feet. Lake Baikal is traversed by a steam ferry for a distance of some forty miles. Forty bridges, each over 200 feet long, cross the tributaries of the Obi River between Omsk and Irkutsk. East of Baikal the road passes into the valley of the Amoor River, bridging waterways running from north to south. After spanning the Amoor at Khabarovka by a steel bridge some 5,000 feet in length, it turns abruptly to the south toward Vladivostok, running to the east of the rivers skirting the Khenden-a-Lin Mountains. The total length of water crossings between Cheljabinsk and Vladivostok is given at 30.1 miles exclusive of the forty miles of ferry; the snow sheds and fences at 565 miles.

The western section extends from Cheljabinsk on the European frontier to Pochitanka, 1,080 miles. It runs for 880 miles over a highland plane so level that the distance exceeds an air line by only 2½ per cent. There are tangents on this division of 50, 62, and 86 miles.

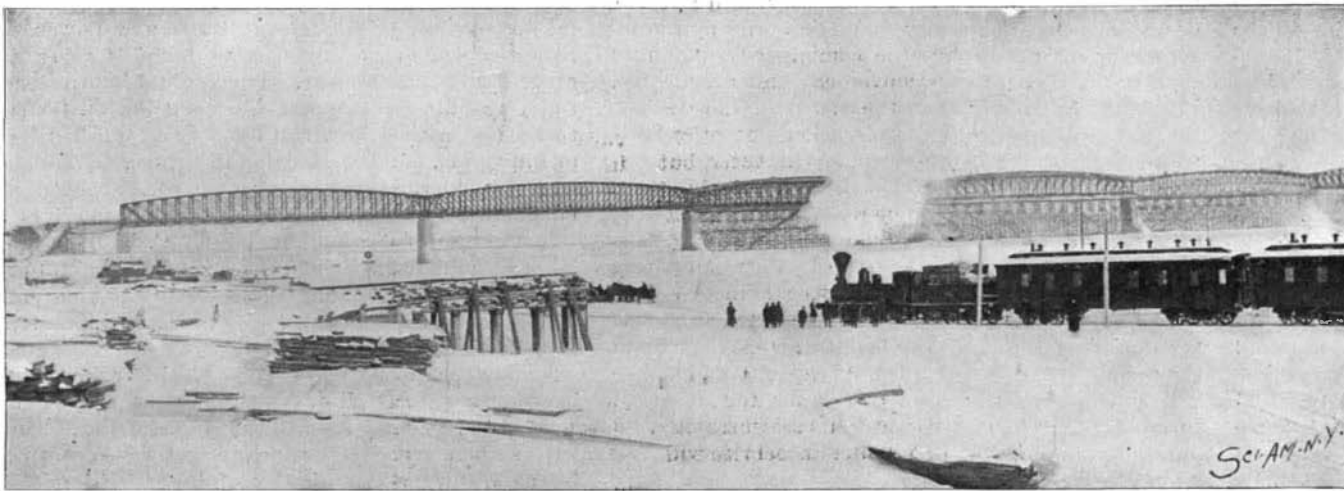
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West Siberia Railway--Bridge Over the Irtysh.

THE TRANS-SIBERIAN RAILROAD.



Movement of Trains on the Ice near the Bridge over the River Irtysh.

The mere construction of a line of railway extending communication between the ports of the Pacific and those of European Russia would have been comparatively an easy achievement. The builders of the road had immeasurably more than this to accomplish. They had to make a scientific exploration of half a continent, to drain swamps, utilize peat bogs for fuel, lay out irrigation ditches, dig wells, provide for the housing, feeding, and health of incoming settlers and their animals, to erect school houses, bring in agricultural teachers to show the immigrants how to plant, water, and raise crops fitted for soil and climate, make country roads and bridges, arrange rural mail facilities, and a multiplicity of other things about which an American railroad man has not to think. The construction of

demand. Siberia, Canada, and the States of the Union raise products of the same kind, making an interchange unlikely to occur. We are therefore bound to assume that if the Siberian Railway is to earn its expenses at all, it must rely upon its local traffic almost exclusively. This can only be made possible by the introduction and establishment of a new population, both agricultural and manufacturing, originating beyond the old limits of the empire into the territory traversed by the road. Now this population is close at hand. It does not have to cross broad seas, as did the immigrants that built up the United States. The time is big with events in the Far East. The close of the century witnesses the breaking up of the greatest of old world industrial nations, the empire of China, and Russia will fall heir to whatever it may choose to take, both as to Chinese population and territory. So far from imitating American anti-Chinese legislation, Russia favors the immigration of its newly acquired subjects into the Siberian provinces.

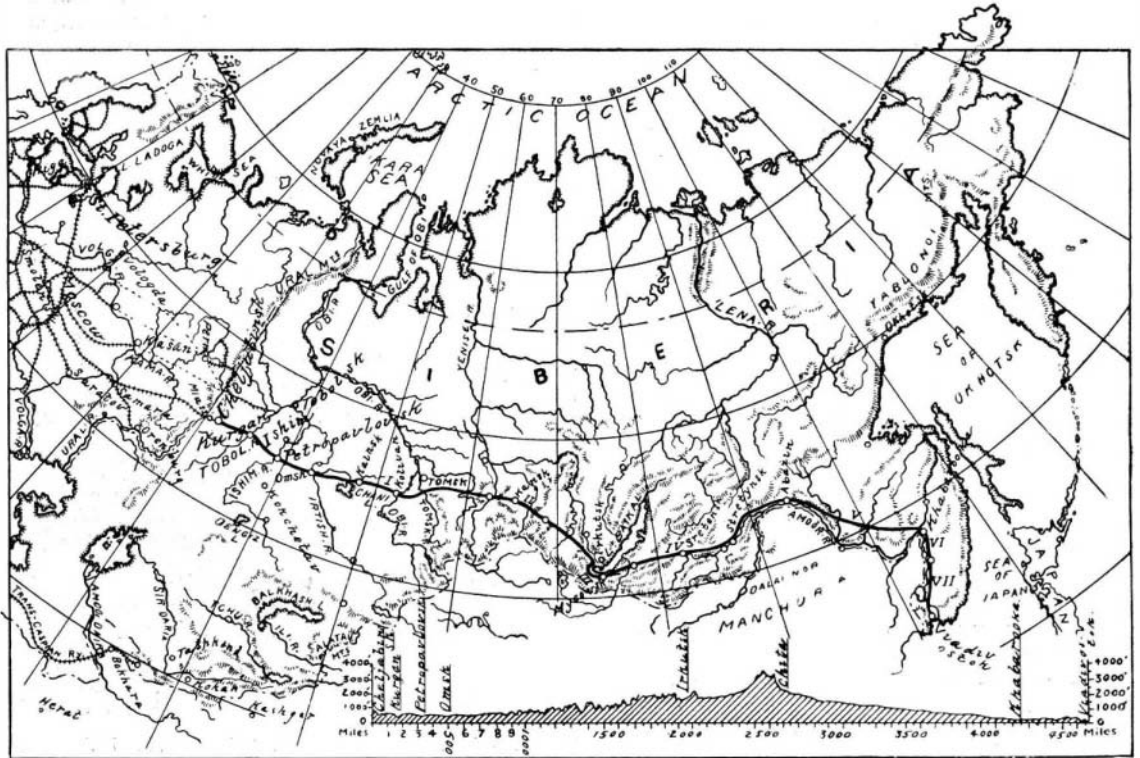
The "spheres of interest" in China, at present, stand thus:

ITALY.	
Tokien and Che Kiang	72,630 square miles.
GERMANY.	
Shantung	65,104 square miles.
FRANCE.	
Kwang Se	78,250 square miles.
Kwang Tung	79,456 " "
Quei Chow	64,554 " "
Yunnan	107,969 " "
	330,229 square miles.
GREAT BRITAIN.	
Kiang Su	44,500 square miles.
Kiang Se	72,176 " "
Ngan Hoc	48,461 " "
Honan	74,320 " "
Hoo Peh	70,450 " "
Sgetchuen	166,800 " "
	476,707 square miles.
RUSSIA.	
Mongolia	1,500,000 square miles.
Manchuria	400,000 " "
Pe Chili	58,949 " "
Kansuh	86,608 " "
	2,045,567 square miles.

The Chinese, as known to the citizens of the United States, are a frugal, intelligent, hardworking race. As

irrigators and fruit farmers they are unequalled; as miners, both in placer and fissure mining, wherever they have been permitted to work, they have excelled. For the development of such a country as Southern Siberia they will be found eminently adapted. They

the railway led to the rectification of navigable streams for the shipment of material, to the sinking of shafts to obtain iron and coal, the laying out of villages for the workmen, the erection of machine shops, plants for the manufacture of cement, and technical schools for



Map Showing Route of the Trans-Siberian Railroad.

are imitative to a degree, docile and obedient, and will make excellent factory hands. We conclude, therefore, that a railroad having farming, mining, and manufacturing prospects like those enumerated above may be supposed to have reasons for anticipating a successful issue of its financial affairs.

railway employes. For purposes of construction it was necessary to examine the mouths of the great rivers flowing into the Arctic Sea, to explore Lake Baikal and place buoys in its channels. The "volunteer fleet" was increased by three great ocean steamers, and railway connection was built to the port of Archangel on the White Sea.

In the Trans-Siberian Railway we have a magnificent exposition of well considered and ordered human endeavor. No one will want to contend that in the accomplishment of so stupendous an enterprise all mistakes have been avoided; but the effort is a noble one, and worthy of the great nation which has undertaken the task.

The above is a resume of a lengthy article, the full text of which will be found in the current issue of the SUPPLEMENT.

DURING the administration of the receivers of the Baltimore and Ohio Railway, 15,350 box cars, 6,750 wooden gondola cars, 6,000 pressed steel cars, 310 miscellaneous cars, postal, express and dining cars, were purchased, at a total cost of \$17,000,000. Two hundred and sixteen locomotives were purchased at a cost of nearly \$2,500,000. The steel rail purchases amounted to 123,010 tons, costing \$2,142,000, an average of about \$17.50 per ton. The number of cross ties purchased was 3,000,000 at a cost of \$1,200,000, and the number of cubic yards of ballast 750,000, at a cost of \$525,000. The cost of new steel bridges was \$750,000, and the cost of improving terminals, erecting new buildings, reducing grades and changing alignment, about the same amount. The maintenance of way department expended, as wages, for improvements, nearly \$12,000,000. The total of all the expenditures was about \$35,600,000.—Railway Review.

THE celebrated French sculptor M. Rodin has obtained permission to make an individual exhibit at the coming Paris Exposition. The works of M. Rodin have been the subject of so much controversy recently that he wishes to present them as completely as possible, and for this reason the municipality has allowed him to have a site for a special exhibition.



Ironworks of Miniar.

THE TRANS-SIBERIAN RAILROAD.

The Pollok Memorial Prize.

The Department of State has given notice to the various governments of the "Anthony Pollok Memorial Prize," to which we have already referred on two occasions. According to this notification, Mr. Pollok's name is prominently connected with many of the most important inventions of the last half of the nineteenth century, and he will always be remembered as a potent factor in the development of the patent system. The document states:

"He cherished a dream of universal patent practice embracing all nations of the world, and inspired in France the first step toward its realization in the International Convention for the Protection of Industrial Property, of which he was vice-president. When the United States at first withheld its adherence, he aroused the interest of manufacturers, and appeared twice before the Committee on Foreign Affairs of the United States House of Representatives, answering objections and advocating the measure in printed briefs and oral arguments, finally attained the object of his efforts.

"With sorrowing hearts and profound regret those who loved him, and deplored his loss, have founded this prize in sacred remembrance of their affection, and as a crowning monument to honor and perpetuate the memory of Anthony Pollok."

The prize consists of one hundred thousand (100,000) francs (\$20,000) and is to be awarded to the inventor of the best apparatus for the saving of life in case of maritime disaster and is to be open to universal competition. This sum is on deposit with the American Security and Trust Company, of Washington, D. C., and will be paid over to the successful competitor when the decision shall have been rendered by the appointed jury and formally communicated to the Secretary of State of the United States through the Commissioner-General of the United States to the International Exposition of 1900. The juror selected on behalf of the government of the United States is Lieut. William S. Sims, U. S. N., Naval Attaché of the Embassy of the United States at Paris.

The Committee of the Pollok Memorial Prize has formulated rules and regulations which will be subject to revision by the Jury of Award in Paris, but it is not anticipated that any material change will be made, and should such changes be made, notice will be given to the applicants.

We give below full text of the rules as issued, and for further information our readers are requested to address William Ker, Secretary, 1405 G Street, Washington, D. C.:

"The jury shall have power to dispose of the prize in the following manner:

"First. It may award the entire amount of 100,000 francs to one person submitting the best original apparatus or device for the saving of life in cases of disaster at sea, provided it is, in the opinion of the commission, of sufficient value to the world to justify the award.

"Second. In case two or more persons shall submit devices which seem to the jury to be of equal or nearly equal value, there may be awarded to the several inventors thereof such a ratable proportion of the entire sum as the commission may deem just; or

"Third. In case none of the devices presented shall be deemed by the jury of sufficient value to justify the giving thereof of the prize offered, the jury may reject all, but may reimburse any competing inventor for his expenses, wholly, or in such part as it may judge proper.

"The jury will make all necessary rules and regulations for its government and procedure not inconsistent with the conditions herein stated.

"Instructions to Competitors.—Persons desiring to compete must comply with the following instructions:

"Each competitor shall submit a working model of his apparatus or device, together with accurate scale drawings, full size when practicable being preferred, but drawings to a large scale will be accepted. These must be accompanied with a statement in writing containing the following information concerning the apparatus or device:

"First. Name. Second. Detailed description. Third. Nomenclature of each separate part, stated in list form with reference letters corresponding to letters on accompanying drawing. Fourth. Construction, stating method of manufacture or fabrication in detail. Fifth. Kinds and quantities of materials used in construction. Sixth. Dimensions of all parts. Seventh. Weights of principal parts, and total weight of apparatus or device. Eighth. Description of method of using. Ninth. Claims of inventor for device, set forth specifically, in full, and in numerical order. Tenth. Whether device or any of its parts is covered by letters patent or caveat in any country. If patented, in what country or countries, giving registered number or numbers of patent or patents. Eleventh. Estimated cost at which it may be furnished. Twelfth. Whether it has ever been actually used or tried? If so, when, where, and with what results? Thirteenth. All devices submitted must be delivered at the expense of the inventor or agent at the time and place appointed, and returned at the expense of said inventor or agent when no longer required by the jury. Fourteenth. All expenses connected with

the trial and testing of the apparatus or device, if trial or test be deemed necessary, shall be borne by the inventor or his agent, but the commission will afford such facilities as may be convenient and practicable. Fifteenth. In passing upon the merits of the devices, the jury will take into consideration not only their values as preservers of life when once in the water, but in case of appliances which depend upon the aid of persons other than those to be rescued (such as boats, rafts, etc., as distinguished from life preservers and the like), it will take into account the facility and safety with which they may be detached or launched from the vessel under any conditions. The extra weight of the device or apparatus, its facility for carriage upon the vessel, the space occupied, its capacity and adaptability for carrying numbers of persons, the means of sustaining life when in the water, its seaworthiness, its durability, and its cost of maintenance in service will all be considered.

"The competition will also include devices designed to save life by preventing a vessel from sinking at sea as the result of collision with another vessel, an iceberg, or other object. The foregoing requirements, so far as applicable, must be complied with by competitors."

A TOKEN OF APPRECIATION.

From time to time we receive kind words from our subscribers relative to the SCIENTIFIC AMERICAN, and we highly appreciate all such tokens of interest. We were indeed greatly surprised to receive, a few days ago, a gold medal, which was presented to us by Mr. T. R. Bowman, of "Waverley," South Terrace, Adelaide, South Australia. His letter is as gratifying in itself as is the handsome medal.

He says: "I forward this trifle to the Editors of the SCIENTIFIC AMERICAN as a souvenir of thanks for the many favors, information, and instruction I have derived from the perusal of the SCIENTIFIC AMERICAN for the last twenty-seven years; also for your kindness in giving me at different times information by letters."

The medal itself measures 1 3/8 inches in diameter, and consists of a plain gold ring, which circumscribes another gold ring of a differently colored gold. The

**MEDAL PRESENTED TO SCIENTIFIC AMERICAN.**

second ring is deeply chased; then comes the medal itself, which was executed by F. Basse, jeweler to His Excellency the Governor. The obverse has a heraldic design bearing the words "Advance Australia," and the date, "1899. On the reverse are the words "Messrs. Munn & Co., SCIENTIFIC AMERICAN, New York, from T. R. Bowman, South Australia."

Kind words are always encouraging, and Mr. Bowman's thoughtfulness in sending the medal is much appreciated.

Royal Letters from Babylon.

Under the auspices of the British Museum, Mr. King, of the Department of Oriental Antiquities, has collected a series of ancient documents which have been published under the title of "The Letters and Inscriptions of Khammurabi, King of Babylon, about B. C. 2200." A few years ago the dark hiding place of Dier-el-Bahri yielded up the bodies of the greatest of the Egyptian Pharaohs, and in February of this year some more of these august rulers of Nile land were recovered at Thebes. But it is in the field of Oriental literature that the greatest of our recent discoveries have been made. Nothing has been so astonishing as the universality of the literary remains. It is not only royal records, or a few votive inscriptions, telling us, in grandiloquent terms, the mighty deeds of some Babylonian or Egyptian ruler, that have been brought to light. The literature of these records of the past is far more extensive and wide-embracing in its character, and the astonishing fact is revealed that more than twenty centuries before the Christian era the art of writing was not confined to the classes, but had been acquired by a large portion of the masses. Formerly the earliest record of letter writing was the treacherous missive sent to Joab by the hand of Uriah the Hittite, which may approximately be placed about B. C. 1000. Still there was little indication that the attainment of this power was general at this period, or in the later age of Solomon.

Some ten years ago a most important find of tablets was made by native diggers in Babylonia. The site from which they were obtained was the mound of Tel-Sifr, the site of the ancient city of Larsa—the Ellasar of Genesis xiv. This city, about B. C. 2300, was of great importance. The whole of the land had been swept by a terrible invasion of the Elamites, and,

both Erech and Ur being destroyed, a temporary capital was established at Larsa. But a new power was rising, which eventually was to found forever the great Babylonian Empire. The gradual infiltration of the Arabs into Babylonia had been going on for centuries, and at last an Arab dynasty established itself in Babylonia, making Babylon its center. Gradually, by the wonderful organizing power which the Semites have always shown, they established themselves as rulers of the whole land, and in B. C. 2280 the great King Khammurabi—whom there is much reason to regard as the Amraphel of Genesis xiv.—was king paramount over all Babylonia, and claimed for himself the title of "builder of the empire."

Among the inscriptions found at Tel-Sifr are a number of letters, forty-six of which are written by Khammurabi to the petty ruler of the city of Larsa. These letters, then, carry us back more than seven centuries in the history and antiquity of letter writing. The importance of this discovery, now developed by Mr. Leonard King, is very great, as they come as contemporary and confirmatory records of this most important period in Oriental history. Written on little clay tablets about three inches long and two wide, they are certainly the oldest letters in the world. Their value is much enhanced by the fact that they belong to a period to which there is every reason to assign the date of the migration of Abram. To the subject of Biblical historical criticism they are of great importance.

On the first examination of the tablets, Mr. King was struck with the resemblance which the name copied by Scheil presented to the name of a Babylonian general mentioned in the Museum letters. A copy of the Constantinople letter being obtained by photographs, it was shown that the name of Kuderlagamar did not exist, but that of Inukh Samar, a Babylonian general, instead. It is now found that there are three tablets which form a series relating to an important war with Elam, probably late in the reign of Khammurabi. One of them refers to the capture of certain Elamite statues of goddesses, and the Babylonian king writes to his subordinate requesting them to be sent to Babylon.

In this letter we read: "To Sin-iddina thus speaks Khammurabi (the King) Zikha-ili-su, and Khammurabi-bani the Vizier in regard to the goddesses as messengers I send. As in a temple the goddesses in barks (sacred ships) cause them to ride. To Babylon may they bring them. The female bodyguard after them let them be brought. For the offerings of the goddesses let four fat rams be provided. Appoint a bodyguard. The goddesses to Babylon may they bring in safety; let them not delay. Quickly in Babylon may they arrive." The next tablet in the series is the one published by Icheil. The statues having arrived in Babylon, some evil appears to have happened, which was attributed to their anger, and so the king desires to return them to their native shrines. But this must be done in such a way as not to display weakness—and thus the king's orders are as follows:

"To Sin-iddina speaks thus Khammurabi (the King): The goddesses of Elam which are intrusted to thee, the troops under the command of Inukh-Samar will bring safely to thee, with the troops that are in thy hands attack the people (Elamites), and the goddesses to their shrines let them go in safety." It is evident that force had to be employed to restore the divinities to their shrine. The military genius of this ancient king is well shown in these letters. In one he writes that certain men who were sent guards of the great gate had not gone to their posts: "Send," he says, "and let them bring these men to them and place a guard over them, and send them to Babylon." In another letter he writes: "For the troops of Imgur Bel and under the command of Rimmanirisu. Sent teams, let them be brought, and a march make. Let them arrive in two days."—London Standard.

A Western View of Our Canals.

"Expert engineers all agree that the usefulness of the Erie Canal as a highway of commerce is practically ended," says The Detroit News-Tribune. "Traffic is falling off so rapidly that soon it will be of insignificant proportions. The State has recently thrown away \$9,000,000 in work which does not afford a penny in return. The proposed expenditure of \$15,000,000 more to complete a 9-foot channel is regarded as a useless waste of money, because no waterway which requires a breaking of bulk and transfer of freight from lake shipping at Buffalo can hope to compete with the railroads. On the other hand, it is the universal opinion that through traffic from the lake ports to New York by means of a ship canal will always hold its own against railroad competition. The Erie Canal, once the main avenue of travel and commerce between the East and the West, has passed its day of usefulness like the old stage coach. It has become a source of great inconvenience in the cities of Rochester, Syracuse, and other large towns. The lake route would enable the State to abandon the unused portions of the big ditch, and wherever it is in the way it could be filled up and the ground occupied for other purposes."