A RUSSIAN PACIFIC RAILROAD.

THE question of a rail connection of the Baltic with the Pacific Ocean through Russia and Siberia has frequently been discussed, and recently steps have been taken to carry out part of this great enterprise. Political as well as economic reasons make the establishment of a better connection between Siberia and Russia appear very desirable. The remoteness of the Amur Province from the mother-country makes the security of this possession appear doubtful, and the immense distance of Siberia from any market renders its produce almost valueless.

The experience of American railroads shows that there is no better means of developing the productive capacity of a country than by the establishment of railroads. Siberia is capable of becoming a highly productive country, and the limits of its productiveness can hardly be conceived. The history of the settlement of the American and Canadian North-West Territories shows that an excessively continental climate is not a serious drawback to the development of a country. Southern Siberia has great agricultural resources; large tracts of land are well adapted for stock-raising; and its forests and mineral resources are of great value. While precious metals yield even now a considerable income, its rich coal and iron deposits have hardly been explored. The abundant supply of furs and fish needs only to be mentioned. At present a large portion of the grain grown in this country is used for distilling alcohol, as there is no market for it.

The only thing needed is better means of communication. The large rivers of Siberia, which flow into the Arctic Ocean, are not available for this purpose, as their mouths cannot be reached regularly from Europe, and as they are frozen during the greater part of the year. Numerous attempts have been made to ascertain the feasibility of a regular intercourse between the Atlantic ports and the mouths of the Siberian rivers; and, from the experience of Captain Wiggins, it would seem that the route is not so impracticable as it appeared to be. He succeeded eleven times in making the journey from England to the mouth of the Yenissei, and up to Krasnoyarsk, and proved that this trade may become of some importance, although the difficulties are so formidable that only the remoteness of central Siberia makes its use practicable. Another project of making the great rivers of Siberia more useful is that of a railroad from the Obi to a point west of the Strait of Kara. Although this plan might help to develop to a certain extent the resources of western Siberia, it would hardly prove adequate to opening the most productive parts of this vast country.

In summer the rivers afford a good means of intercourse, and plans have been made to improve them. The most important of them is the connection of the Obi and Yenissei by means of a canal, work on which is in progress. When this canal is completed, the following line will be open to commerce,— from Tyumen, the terminus of the Perm-Tyumen Railroad, down to Tobolsk,— and, following the Irtish, vessels will reach the Obi at Samarovsk. From here they will ascend the latter to the point where it approaches nearest to the Yenissei. Following the canal, they will reach the Yenissei, which is descended down to the confluence of the Upper Tunguska, which comes from Lake Baikal. In East Siberia the Amur affords good means of communication. The route follows the Chilka, and its tributary the Ingoda, as far as Chita. The distance between this point and Lake Baikal is not very long.

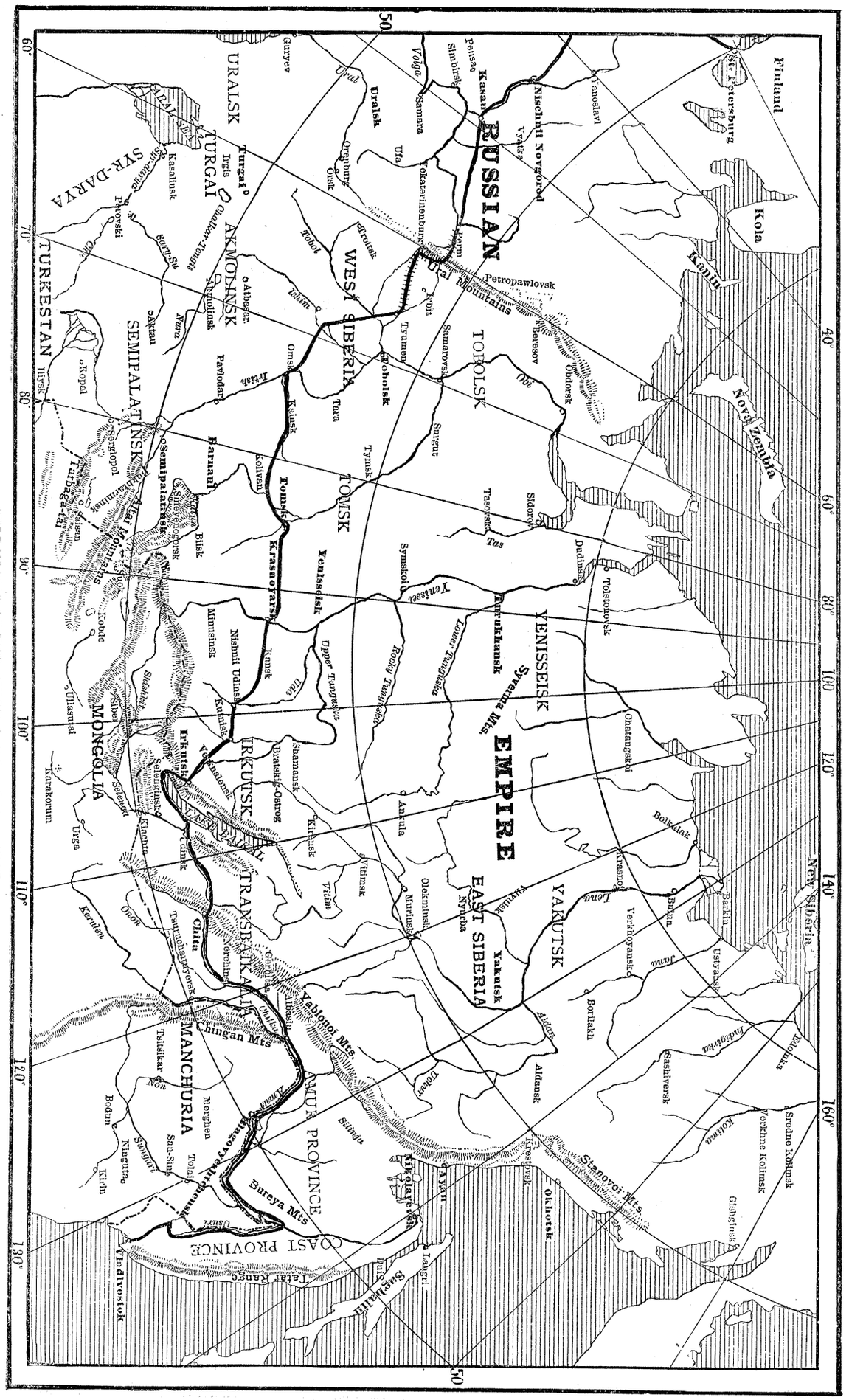
It seems that it has been decided to build first those portions of the Pacific Railroad which will supplement those sections which are open to river-navigation. This requires the building of the sections from Vladivostok to the mouth of the Usuri, from Chita to the Selenga, and from Irkutsk to Tomsk. The last is necessary, as the Upper Tunguska would require very expensive regulation. Should these works be completed, and reasonably fast-going steamers be put upon the rivers, the development of Siberia will receive a strong stimulus.

The effect of this improved inland connection upon the development of manufactures and industries will be great. At present eighty per cent of the total manufactures of Siberia belong to the territories Tobolsk and Tomsk. According to the reports of the Bureau of Statistics, there are 2,300 factories, which employ 12,500 men, and produce 14,000,000 rubles' worth of goods annually. The principal manufactures are those which use raw animal material: 500 tanneries produce goods valued at 3,000,000 rubles, and 150 tallow-factories have an annual output of 2,000,000 rubles in value. Next in importance are manufactures based on raw vegetable material. The rich mineral deposits of Siberia are not yet opened to any great extent. The industrial development of this region does not date back farther than about fifteen years. It was only then that modern machinery was introduced; and the subsequent improvement in the quality of Siberian manufactures has secured for them an extensive sale in Asia. The slow progress of these manufactures will be greatly accelerated as soon as cheaper and more rapid communication with Europe has become possible.

One of the principal considerations which recommend the construction of the Siberian Pacific Railroad is the remoteness and isolation of the Amur and Coast Provinces. At present there exist hardly any roads in this region. Communication is possible only on rivers which are navigable in spring and autumn, while in summer and winter intercourse is interrupted. In winter, sledges are used for travelling, while it is impossible to transport freight. What little trade there is, is almost exclusively in the hands of Americans and Chinese. The whole Russian population of Transbaikalia, the Amur Province, and the Coast Province, amounts at present to twenty thousand, while immigration from Manchuria is of considerable importance: therefore the Russian Government attempts to promote the Russian colonization of this region. The country is rich, but it is too remote to become a Russian colony until better communication with Transbaikalia has been established.

It must not be expected, that, even after the completion of the road, the settlement of Siberia will make as rapid strides as that of the American North-West. It is true, the Russian peasant is inclined to leave his home, and to look for a more prosperous life east of the Ural; but it must be remembered that no foreign immigration is possible, or would be allowed, the political aims of the Russian Empire being to Russianize the whole of its territory. As European Russia is not very populous compared to its area, a Siberian emigration will retard its progress in many respects, as its effect will be to produce a lack of the workers necessary to develop its resources.

The proposed railway, if completed, will be of importance not only for the development of the resources of Siberia, but also for the Eastern trade. At present a considerable amount of Chinese goods, among which tea is the most important, is sent overland. The cost of transportation is, of course, enormous, and will be greatly cheapened by the railroad. The present state of this trade may be seen from the following data given by the commissioner of Chinese customs at Tientsin. In 1887 this trade increased by 5,400,000 pounds, or nearly half as much again as in the year before; while the quantity of brick tea carried by the same route increased 7,300,000 pounds. This remarkable growth of the overland tea-trade was due to the unusual luxuriance of the Mongolian pastures, which, providing as they do the only sustenance for the enormous herds of dromedaries almost exclusively used as beasts of burden in these regions, exercise a very great influence on the prosperity of this branch of trade. It was owing to the failure of the grass-crop in 1885 that the transport of tea by that route fell so low, great numbers of dromedaries having died of starvation. The uncertainty of the grass-supply, and consequently of the means of transport, has led some Russian merchants to project a Decanville portable railway across the plains of Mongolia from Kalgan to Urga. The motive power would still be supplied by camels; but, whereas fifty thousand of these animals are now employed, it is calculated that ten thousand only would be required to do the same work on the railway, and that with these increased facilities the trade would in all probability be doubled. As in case of failure of the grass-supply a sufficient quantity could easily be brought from Siberia by the returning trains, the additional advantage would be gained of more certainty in the means of transport. The carriage of the tea over the mountainous district between Urga and Kiachta would still be effected by camels. An alternative scheme is a railway from Stretinsk to Veringukunsk, on the Amur. A fleet of seventy steamers is running on the Amur, and goods can be conveyed from Veringukunsk to Kiachta by one of the affluents of the Selenga River. Russian steamers would convey the tea from Hankow to the Amur. This route would be entirely under the control of Russia. It would



SKETCH-MAP OF THE RUSSIAN PACIFIC RAILROAD.

bring the whole profits of the trade into Russian hands, and offer greater financial facilities.

This route, although more expensive than the transport by sea through the Suez Canal, is preferred, as the quality of the tea thus transported is better.

One of the important considerations which induce the Russians to urge the building of the Pacific road is purely political. The Chinese boundary is at present almost unprotected, and it would be extremely difficult to concentrate an army of considerable strength anywhere east of Semipalatinsk. It is true that the boundary as far east as Manchuria is guarded by the best of protections, — a vast desert. Still greater weight is attributed to the connection with Vladivostok, the only harbor Russia possesses on the open ocean. Without the railroad, Vladivostok is of very little value, as the Coast Province is not able to furnish provisions for the garrison and fleet. It is hoped that its value will be greatly enhanced by the construction of the railway. A glance at the map will show that the latter follows for a long distance the boundary: therefore, in case of war with China, its safety appears very doubtful, and, indeed, it has been proposed by military authorities that it would be more advisable to build the road farther north.

From an engineering point of view, there are no serious obstacles to the building of the road, except the bridging of the large rivers of West Siberia, and the passing of the enormous swamps of that region, which would probably make the road far more costly than the Transcaspian Railway. There are no steep grades that would present serious difficulties.

The distances of the several sections of the line are given as follows: —

	Miles.
Tyumen to Tomsk	800
Tomsk to Irkutsk	1,050
Irkutsk to Stryelka	800
Stryelka to Usuri	1,000
Usuri to Vladivostok	300
Total	3,950

The cost of construction is estimated at from five to seven hundred million rubles. The whole distance from St. Petersburg to Vladivostok is estimated at six thousand miles; and the time necessary for accomplishing this distance, at from sixteen to seventeen days. To this must be added a few days for the journey from Japan and China to Vladivostok, and from St. Petersburg to western Europe. Thus the journey from eastern Asia to Europe might be made in from twenty to twenty-two days instead of from thirty to thirty-five days, which it takes steamers to run from China to England.

It seems improbable that the effect of this road upon the trade of the world will be as important as that of the American Pacific roads. The political condition of Siberia is not favorable to an energetic development of its resources and to an extensive immigration; and, the length of the road being so great, it is doubtful whether it would be able to divert the carrying-trade to any great extent from the steamers using the Suez Canal route.

SCIENTIFIC NEWS IN WASHINGTON.

Do Solids act Chemically upon Each Other? Mr. Spring's Experiments do not prove it. — The Transit of Venus and the Solar Parallax. — An Eighth Sternum Rib. — Measurements of Crania. — Adulteration of Condiments. — A New Fibre from the Stalk of the Cotton-Plant.

Chemical Action between Solids.

ONE of the most interesting papers read before the Washington Philosophical Society last spring was one by Mr. William Hallock on the formation of alloys at lower temperatures than the melting-points of either of their constituents. An abstract of the paper was published in *Science* (xi. No. 265) at the time. Mr. Spring, a distinguished chemist of Belgium, has been pursuing researches in the same field as Mr. Hallock, and has criticised some of the latter's work. At the last meeting of the Philosophical Society Mr. Hallock turned the tables on Mr. Spring by examining some experiments, a description of which had been published, to prove that chemical action takes place between solids.

Mr. Hallock began by mentioning one or two experiments illustrative of his theory of the formation of alloys, as referred to above. He placed potassium and sodium in contact, arranging a thermometer to register the temperature. As they united, the temperature fell 2°.4 C. below that of the room. A block of ice and one of rock-salt, the temperature of each being reduced 10° or 12° C. below the melting-point of the ice, when brought into contact, began immediately the formation of the solution of salt.

One of Mr. Spring's experiments to show chemical action between solids consisted of placing copper filings and sulphur in contact. The sulphur attacked the copper. Mr. Hallock doubted that this was a case of chemical action between solids, and prepared the following described experiment to satisfy himself. A piece of bright copper and a small mass of sulphur were placed near, but not in contact with each other. After a time the face of the copper was blackened by the sulphur. Thinking it barely possible that particles of copper might fly across the space between them, Mr. Hallock then varied the experiment as follows: The copper and sulphur were placed in a glass tube, with a wad of absorbent cotton an inch thick between them. The experiment was varied in several ways, in one case the tube being filled with dry air, in another the air exhausted, and in a third the tube being filled with oxygen, etc. In every case the copper was affected by the sulphur, although in some more than in others. Mr. Hallock's conclusion was that the chemical action did not take place between the copper and the sulphur *as a solid*, but that the active agent was the vapor of sulphur. In the same manner re-action took place between copper and mercuric chloride, the vapor of the latter passing through absorbent cotton.

Mr. Hallock does not deny that chemical action may take place between solids, — indeed, he is inclined to think that it does, — but he holds that Mr. Spring's experiments do not prove it.

The Solar Parallax.

Prof. William Harkness, a member of the United States commission to observe the transit of Venus, in a long paper read before the Philosophical Society at its last meeting, gave a very interesting description of the instruments used in observing the transit and in photographing the sun. Great labor, much of it very perplexing and occupying many weeks, was required to measure lenses used, and determine their focal distances, to ascertain the peculiarities of mirrors, etc., as preliminary to the observations. Professor Harkness described this work. About sixteen hundred photographs were secured, most of which have already been finished. The methods of reduction were also explained.

In the latter part of his paper, Professor Harkness spoke of the solar parallax and its related constants, introducing a series of intricate calculations which he has made to determine the latter. Among them may be mentioned the sun's distance from the earth as found by his calculations, 92,385,000 miles; as computed from data furnished by the transit of Venus, 92,521,000 miles; the moon's distance from the earth, 238,852.4 miles; the moon's mass, $\frac{1}{81\frac{5}{9}\frac{1}{9}}$; the velocity of light, 186,298.4 miles per second; sun's parallax, $8867'' \pm .0012''$.

An Eighth Sternum Rib.

At one of the meetings of the Anatomical Society during the late Medical Congress in Washington, Dr. Lamb of the Army Medical Museum spoke briefly of a singular phenomenon he had observed in his examination of human breast-bones. It was the occurrence, in a number of specimens, of an eighth rib, the cartilage that is usually found below the seventh rib being fully developed into a rib. Dr. Lamb first saw a specimen of this kind about ten years ago. While teaching, he had occasion to observe the subject he had before the class with great care, and was surprised on one occasion, on counting the ribs, to find that there were eight. He made no further investigation at the time, presuming that the phenomenon might be of comparatively frequent occurrence.

More recently Dr. Lamb has given the subject more attention, and now has in his own collection four specimens, while in the Army Medical Museum there are eight more. In all these cases the phenomenon occurs in negroes, but one additional specimen is that of an Indian.

Dr. Lamb has made a thorough search of anatomical literature