

wire 1 and the segment with one of the contacts in the reversing switch, D. The current flows thence to the field magnet of the motor, B', through the wire, F¹—, and returns to the reversing switch through the wire, F¹+, thence through the wire, A' +, to the armature of the motor, B', through the wire, A'—, to the resistance, C', thence back to the spring, 4, of the controller, thence to the spring, F²—, through the reversing switch, wire, F²—, to the field magnet of the motor, B, returning through the wire, F²+, to the reversing switch, thence to the armature of the motor, B, by the wire, A²—, returning by the wire, A²+, to the ground wire, G, which communicates with the ground through the motor box, car truck, car wheels and rails.

Fig. 3 shows the arrangement of the controller and reversing switch when the motors are reversed. The current enters the trolley connection, T, as before, passing to spring, 2, thence to the resistance, C, spring, 1, to the wire, F¹—, thence to the reversing switch, D, and wire, F²+, to the field magnet of the motor, A'; thence back to the switch, D, thence by the wire, A' +, to the armature, B', of the motor, A', thence to the resistance, C', to spring, 4, through the segment of the controller to spring, F²—, thence by the wire, F²—, to the reversing switch, D, thence by the wire, F²+, to the field magnet of motor, A, thence to the switch, D, and back to the armature, B, of the motor, A, thence to the ground connection, C.

It will thus be seen that while the current remains the same in the armatures of the motors, it is reversed in the field magnets; this causes the armatures of the motors to revolve in the opposite direction.

When the controller lever is at the first notch the current is fully on, with both the field magnets, armatures and resistances in series, as shown in Fig. 2. When it is at the second notch the resistance, C, is cut out, as shown in Fig. 4. With the controller lever at the third notch both resistances, C C', are cut out as in Fig. 5. At the fourth notch the motors are in parallel with each other and in series with the resistance (Fig. 6).

When the controller is arranged as shown in Fig. 7, the two motors are in parallel and in series with half the resistance. When the controller is arranged as in Fig. 8, both motors are in parallel, the resistances being cut out. Circuits shown in dotted lines are in parallel with like circuits shown in full lines.

These various changes in the circuit give all the gradations of power required for starting and for running at different speeds.

The heating apparatus, F, which consists of a series of wire coils arranged under the seats behind gratings, is in parallel with the electric lighting apparatus and the motors. Enough current is taken from the supply wire to maintain a comfortable temperature in the car. There are two lamp circuits on the car, each including five 100 volt lamps, the lamps of each set being in series.

At suitable intervals on the various branches of the road there are telephone boxes, shown in Fig. 9, by means of which the engineer or electrician at the power station can be notified of anything occurring on the lines, and by which the dispatcher is informed whenever an emergency arises calling for more than the usual number of cars.

Much of the perfection of this trolley system is due to the efforts of Mr. Francis G. Daniell, electrical engineer for the company, who has kindly furnished us with the data here presented.

Proposed Amendments of the Patent Law.

At the recent Detroit meeting of the American Bar Association the report of the special committee on unification of the patent law was adopted. The committee comprised the following well known lawyers:

Edmund Wetmore, Wilmarth H. Thurston, Charles E. Mitchell, Frederick P. Fish, Francis Rawle, James H. Hoyt, Paul Bakewell, Arthur Stuart, Charles E. Foster, Joseph C. Fraley, E. B. Sherman, James H. Raymond and George H. Lathrop.

In their report they propose five general amendments to the patent law, as follows:

1. At present an applicant for a patent has two years to take action on his application for a patent after he has received notice that the Patent Office has received his application. This accounts for the notice on many devices that "patent has been applied for." It permits the use of devices exclusively for years at times before a patent is issued, and makes abuses possible. The committee recommends that the period be made six months, as that is ample time for any person living in any portion of the country to get his application to the Patent Office at Washington.

2. That the law be amended so that if a patent has been issued or published for two years in any foreign country before application has been made in the United States that patent here be barred. This is urged because an invention may be well known in Europe and be in general use, but may not have been patented here. This may be discovered and some thrifty individual making first claim to discovery can get a patent and get a royalty from an 'old idea.

Foreign inventors, too, having no real conception of the value of their inventions, may come in late and get patents after their device is in general use.

3. To have a statute of limitations for patents, providing that no suit may be begun for an infringement of a patent dating six years or more prior to the commencement of the suit.

4. To so amend the law that the granting of a foreign patent to an American inventor shall not affect the American patent unless the inventor shall have made application for the foreign patent seven months in advance of his application for the home patent.

5. The law requires that assignments of patents shall be in writing, but there is no provision whereby an acknowledgment may afford prima facie proof of the execution of such instruments.

To remedy this the committee propose that a certificate of acknowledgment of these instruments before a proper officer shall be prima facie evidence of execution.

At an evening session of the section on patent laws, an able and exhaustive paper was read by Judge Robert S. Taylor, of Indiana, on "Some Reflections Suggested by the Creation of a Patent Law Section in the American Bar Association."

"It is a respectful form of speech," said the speaker, "to ascribe the wisdom of judicial decisions to the courts, but we know that in fact the judges imbibe most of their wisdom from the bar, and are the most unblushing plagiarists in the world. So that when we get at the final truth, it comes to this, that the despised and rejected fraternity of patent lawyers are in reality the authors of the present system of patent law in America. Whether we consider the magnitude of the interests committed to their keeping, or the

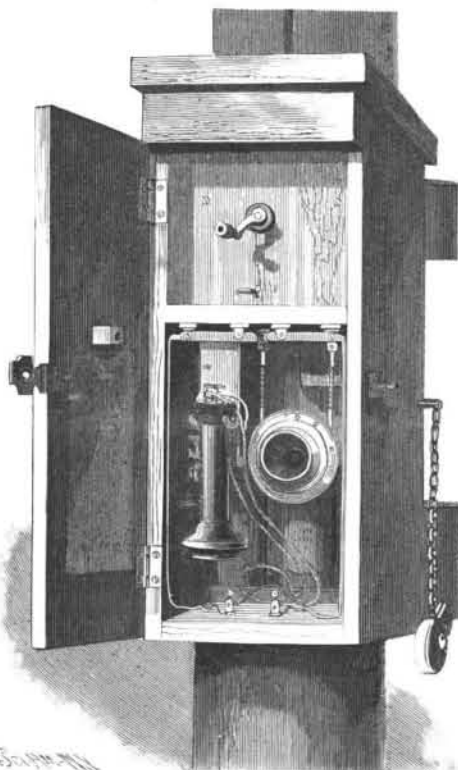


Fig. 9.—TELEPHONE BOX FOR COMMUNICATION WITH THE POWER STATION.

nature of the questions which arise in respect to those interests, it must be affirmed that no department ought to outrank that of the patent law in dignity, honor and usefulness to the public welfare. It is a question whether or no the marvelous development of invention would have been possible without the stimulus of the patent system. The rewards which the patent law offers are of a kind to spur human nature to its best. It is not the manufacturer who has adjusted his machinery, wages and prices to the condition around him, nor the merchant whose interest, his profits, nor prices; nor the customer, who rarely knows the history of the cost of what he buys, or bothers himself with speculation as to whether it could be cheapened or not, that gives to society its labor-saving invention, but the solitary dreamer, looking at the world from his garret window, burning with the thought that to achieve an invention may be wealth, honor to him."

"There are some respects in which the patent practice needs reformation as well as the law, and in which this section will, no doubt, interest itself at the right time. One of these is the length and cost of records. I doubt if the rules of evidence are as grossly disregarded elsewhere as in taking proofs in patent cases.

"Throughout his career the patent lawyer should never cease to be a student of the law at large. Be an all-round lawyer in heart, sympathy and aspiration and as nearly that in fact as the conditions of your life will permit. Buy a new book occasionally, if only to smell the leaves."

A TELEPHONE wire is carried a mile and a half without support over Lake Wallen, between Quinten and Murg, in the canton of St. Gallen, Switzerland.

THE TRANS-SIBERIAN RAILWAY.

A work of prime importance is now being accomplished in Asia, silently and without parade—the construction of the Transsiberian Railway. When finished, this line will exceed in length any of those that exist upon the globe. In fact, its length, from Tcheliabinsk, its initial point, to Vladivostok, its terminus, will be 4,536 miles, while the length of the Transcanadian, which is alone worthy of being compared with it, reaches, between Montreal and Vancouver, but 2,760 miles.

On another hand, the Transsiberian will have a grave influence upon the economical and political relations of the states of Europe, Asia and America. This grand enterprise is worthy of fixing our attention, and the direction line of the road, the work that its construction will necessitate, like the motives that decided the Russian government to undertake it, ought to bespeak instant consideration. Since the year 1579, in which the Cossack Yermak, at the head of 850 adventurers of various origins, Russians, Cossacks, Germans and Poles, advanced victoriously as far as to the Obi, and gave final satisfaction to old Ivan the Terrible, in adding a new kingdom to his preceding conquests, the Russians have gradually seized the whole of Siberia, by a slow but sure march, that was finished only in 1858 by their taking possession of the regions bathed by the River Amoor.

This immense domain was neglected by the government of the czars for a long time. Its situation as a penal colony gave it a sorry reputation among the Russians, and the few free colonists who took the risk of emigrating thither established themselves among the aborigines. Far from raising the population by which they were surrounded to their own level of civilization, they descended to theirs and fell into barbarism. Nevertheless, fifty years ago, this country began to attract more attention, and it soon became evident that the creation of a great way of communication connecting it with Europe was the one condition of its development. The "trakt," that coachable route that unwinds from Perm to Kiakta, upon the Chinese frontier, was already doubtless contributing to the prosperity of Siberia, but it was the opinion of all those who were interesting themselves in the future of the country, Count Moraviev, General Bogdanovitch, Merchant Lioubimor, etc., that this route ought to be replaced or rather doubled by a railway.

Many Transsiberian projects have been put forward within the last thirty years. Finally, on February 21, 1891, Czar Alexander III adopted the direction line that is now being executed. The Transsiberian is connected at Tcheliabinsk with the Russian system of railways. It prolongs the Moscow Riazan-Riajsk-Samara-Oufa line. It runs first directly toward the east in crossing the plains watered by the Tobol, the Irtych and the Obi. Starting from Krasnoïarsk, the line curves toward the southeast to reach Irkutsk (Fig. 1). It is afterward to pass around the southern extremity of Lake Baikal, run for a certain distance along its eastern shore, and then take a northeast direction. It will then follow the valleys of the Ingoda, Chilka and Amoor. But the topography of these regions is as yet too little known to allow of a definite direction line being decided upon. At Khabarovka, the line will leave the valley of the Amoor to ascend that of the Oussouri and reach Vladivostok. It will be remarked that the line does not leave Russian territory. There was some thought of making it run for a certain distance upon Chinese territory. The great curve described toward the north, starting from Lake Baikal, would thus have been avoided. As very friendly relations exist between the court of St. Petersburg and that of Peking, it was thought for a while that the great Asiatic railway would be partially Russian and partially Chinese; but strategical considerations finally prevailed, and as this railway is capable of serving some day for the reinforcing of the Russian garrisons, it was preferred to establish it solely upon Russian territory.

It will be observed, too, that the line does not divide Siberia into two equal parts. It is situated wholly in the southern part. An important section even runs along the Chinese frontier. This direction line was adopted because it is especially in the south of Siberia that the mining districts are met with. But there was still another reason. In the greater part of the country, the ground remains frozen for almost the entire year. In summer, it is true, the upper stratum thaws and the hard and unbreakable crust softens; but it then becomes converted into a muddy mass. To have tried to lay ties upon ground in so poor a physical condition would have constituted a grave imprudence.

It was absolutely necessary to establish the line upon ground that was at once more friable in winter and more solid in summer, that is to say, to the south of the border of the ground perpetually frozen.

Many difficult and costly bridges will be indispensable. The Transcaspian railway necessitated but one very important bridge, that of Tcharadjoui, over the Amou Daria. The construction of the Transsi-

berian will be much more difficult. It will have to cross several large watercourses, the Tobol, Irtych, Obi and Tchoulym. These rivers drain the southern slopes of the Altai and of the Saian Mountains. When the snow melts, heavy freshets ensue, and bridges of large dimensions will therefore be necessary. The crossing of the chains of the Saian Mountains, at right angles with the direction of the line between Krasnoïarsk and Irkutsk, will present many obstacles. The nature of the Chilka and Amoor, whose banks are converted into lagoons over a wide space at the time of freshets, will likewise prove the origin of serious difficulties.

The work was begun at the end of 1891, and was simultaneously undertaken at the two extremities of the line. The western part was finished as far as to Omsk at the end of 1894. The eastern part, between Vladivostok and Grafskaia, is upon the point of being finished.

It is not proposed to continue the construction of these two fragments methodically and push them toward each other; but it is desired to establish provisionally a route half fluvial and half rail. Sections of railway will connect the Siberian rivers at the points where their navigable affluents approach each other more closely. Thus, the section upon which work is being most vigorously pushed is that of Atchinsk, upon the Tchoulym, an affluent of the Obi, at Krasnoïarsk, upon the Iénisseï. The two great rivers will thus be united. Other processes will afterward be employed. From Irkutsk, for example, a line will reach Lake Baikal, and then steamboats will carry passengers and freight along the east shore.

During the four months in which the lake is frozen, a light railway will be established upon the ice.

The Transsiberian line will be a single track one. In a distant future, if the increase in transit requires it, the track will be doubled. The cost is estimated at 350,210,500 rubles, say \$165,105,250. The charges are assumed, not by a private company, but by the government itself.

The motives that decided the Russian government to undertake this colossal work were both political and economical. The Crimean war demonstrated in a general manner the inadequacy of the railways in the empire. Had the regiments going toward the south not been blocked along the roads, the blockade of Sebastopol would probably have been raised. The destruction of the arsenals of Petropaulsk in the peninsula of Kamtschatka, upon the Pacific, by the Franco-English fleets, showed in particular the danger that its isolation caused eastern Siberia to run. The recent events in the far East prove that the Russian statesmen have been well inspired in deciding upon the construction of this railway. For the instant, the Chino-Japanese conflict is terminated; but, if the occasion presents itself, the faculty of rapidly bringing masses of men into eastern Siberia will permit Russia not to figure as a super-numerary in these military pieces, but to play a leading role therein.

Alongside of the strategic reasons, there were also others that pleaded in favor of the construction of the railway. Siberia is one of those still intact countries of which the soil contains resources of every kind. To use a philosophical expression, they are in power therein. It is for man to extract them. From the southern frontier, as far as to 59° of latitude, extend the cereal districts. Beyond, and as far as to the Polar circle, is situated that immense forest of conifers that Nordenskjöld called "the vastest of the globe." Metalliferous deposits are distributed on every side, ores of iron, of argentiferous lead, of copper and of platinum. We know also that a notable part of the gold annually put into circulation upon the globe (about a fifth) comes from the Siberian provinces. The quantity extracted in 1890 amounted to 66,000 pounds. Finally, coal mines have been discovered in several places. One of these is under exploitation in the valley of the Sutchan, situated at fifty miles to the north of Vladivostok. It was discovered in 1888, since which it has been regularly worked. It furnishes fuel for the Russian fleet of the Pacific. The vessel upon which Czarevitch (now Czar)

Nicolas made his grand voyage in 1891 started from Vladivostok with her bunkers full of coal extracted from this mine.

The Transsiberian will infuse life into all these industrial centers. It will permit of the importation of the machines and instruments necessary for the extraction of the ore, and which are now often too greatly lacking. It will also remedy a dearth of population, the great trouble of Siberia, which, as well known, is one of the most thinly peopled countries upon the face of the globe. It possesses the same number of inhabitants as Holland, while its area is three hundred and seventy times greater. Various efforts have already been made to increase the figure of the population. Since 1882, in particular, colonists have been grouped

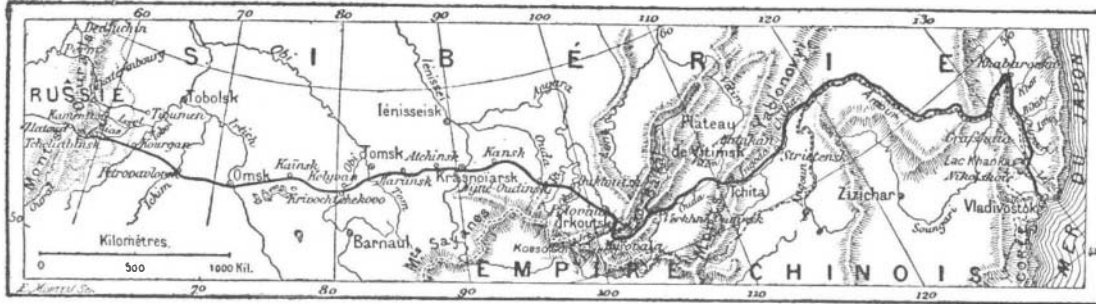


Fig. 1.—MAP OF THE TRANSSIBERIAN RAILWAY.

every year at Odessa by the exertions of the Russian government. They embark with Vladivostok as their destination and are installed in the provinces of Oussouri.

This official colonization has already had good effects, but others still and far better ones are anticipated from the Transsiberian. The two sides of the line will be peopled, and, in a certain measure, there will occur the same phenomena as in the far West of North America, where the establishment of railways in the solitudes of the prairie have caused the sudden springing up of what are called "mushroom cities," to explain in a word the rapidity of their growth. But it will not only contribute to the prosperity of Siberia; its reach will be more general. It may be anticipated that it will transform the conditions of the commerce of the far East. The preponderant situation of the English in China will be menaced. They export silk and tea and import cotton, thread, fabrics and wool. Now, all such merchandise, seeing the small bulk of it and its great value, can easily support carriage by rail. The English also import metals, which will be easily replaced in the Chinese market by those that are extracted from the mines of the Ural and of Siberia. Finally, the Transsiberian will form the shortest route from Europe to the far East. If the trains run at the very moderate speed of 19 miles an hour, Vladivostok will be reached from Tcheliabinsk in ten days, Japan in fifteen, and Shanghai in twenty. With the Trans-

siberian, the route from Vladivostok to the Pacific coast will be shortened to 1,000 miles, and the journey to Europe will be reduced to 1,500 miles.

Military Bicycling.

Lieuts. W. C. Davis, Fifth Artillery, and A. W. Chase, Second Artillery, recently made a very interesting tour of the battlefields of the Army of the Potomac, leaving Fortress Monroe August 1 and returning August 26, having ridden over 1,000 miles on their bicycles. Crossing the James River at Jamestown, they took the old stage route from Surrey Court House to Petersburg, where they visited the old Union forts and the "crater" and examined the Confederate lines of defense. Crossing the Appomattox at Ettrick, they rode through Amelia Court House, Jetersville, Burkeville, and Farmville to Appomattox, where they spent two days on the old "Surrender Grounds." From there they went by way of Lynchburg, the James River Gap, and the Natural Bridge to Lexington, where they visited the homes and tombs of Lee and Jackson, the Washington and Lee University, and the famous Virginia Military Institute. Continuing down the Shenandoah Valley through Staunton and New Market, they rode through Massanutten Gap to Luray, thence to Front Royal and Winchester. They spent two days on the ground of Sheridan's famous victories, visiting Tom's Brook and Fisher's Hill by train. Riding by way of Martinsburg and Shepherdstown, they spent two days at Antietam and then went to Gettysburg by way of Hagerstown and the Monterey Pass. They spent three days on the field of Gettysburg, taking sixty photographs, showing every part of the battlefield and all the surrounding country. The object of the ride was to traverse the routes made famous by war marches and to familiarize themselves with the country fought over. To make after study easier, they took over 300 views en route, showing the terrain and principal features of the fields, the nature of the roads, etc.

Returning home by way of Baltimore and Washington, they visited the battlefields of Manassas, Mine Run, the

Wilderness and Chancellorsville, Fredericksburg, Spottsylvania and the series of fields fought over by Grant in his stubborn advance on Richmond.

By keeping a careful journal of the ride, they have gathered much useful information in regard to the military value of the roads passed over in the four States visited, and their photographs alone will make an interesting study of the battlefields. They rode 35 pound wheels and carried twenty-five pounds of luggage, and although they made no effort to make records, they found it easy to ride eighty miles a day over ordinary country roads.

THERE are seven hundred golf clubs at present in Great Britain, with about 35,000 players.

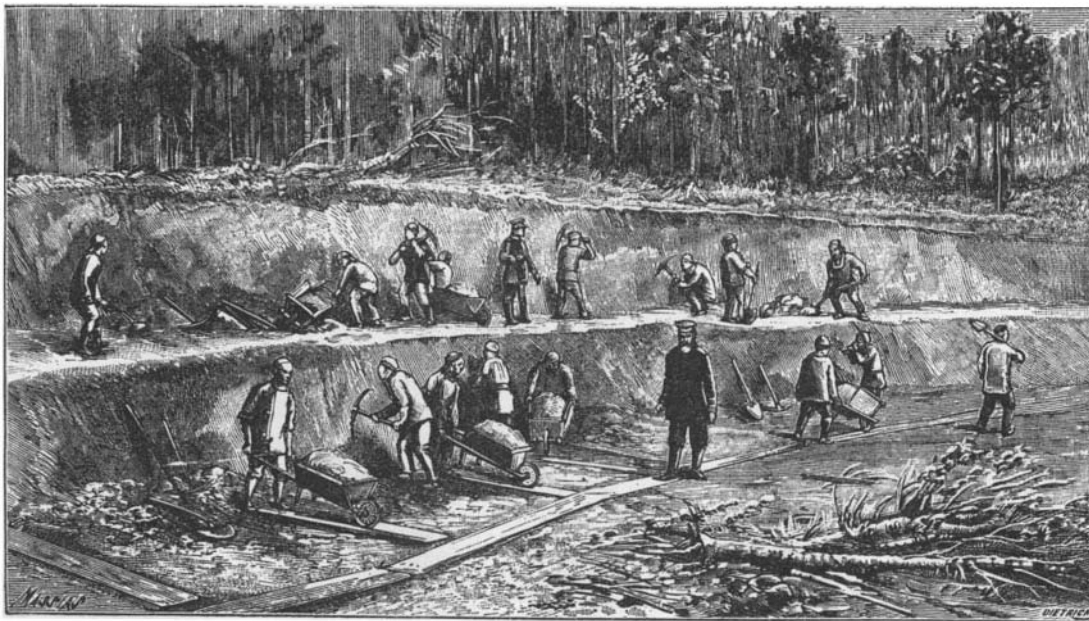


Fig. 2.—CHINESE AT WORK ON THE TRANSSIBERIAN RAILWAY.

canadian, the Transsiberian will complete the iron girdle that surrounds the globe, and will worthily terminate the great works of the century.—La Nature.

Absorbable Tissue for Wounds.

J. Lustok has patented a process in Germany under which the muscular coating of the intestines of animals is divested of both the interior and exterior layers of mucous membrane, and then digested in a pepsin solution until the muscular fibers are half digested. This is then treated with tannin and gallic acid. The result is a tissue which can take the place of the natural skin, and which, when laid on the wound, is entirely absorbed during the healing process.