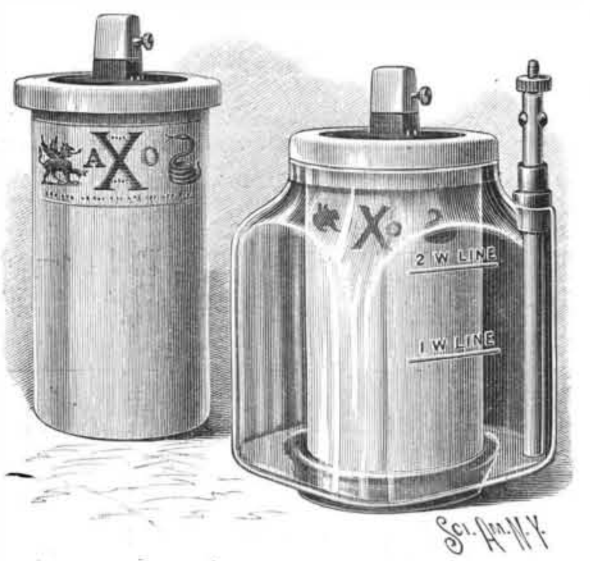
AN IMPROVED POROUS CUP BATTERY.

The Axo battery, illustrated herewith, meets and overcomes nearly all the recognized defects in open circuit batteries of the porous cup class. The porous cup has a flange which rests on the rim of the jar and forms of itself a cover for the cell. The zinc passes through an independent aperture of its own in the shoulder of the jar. The carbon conductor has inclined sides, increasing in size from the top to the bottom. By gravitation, therefore, the particles of the surrounding mixture are always in perfect and continuous electrical contact with its surface. The carbon it-



BREWER'S IMPROVED POROUS CUP BATTERY.

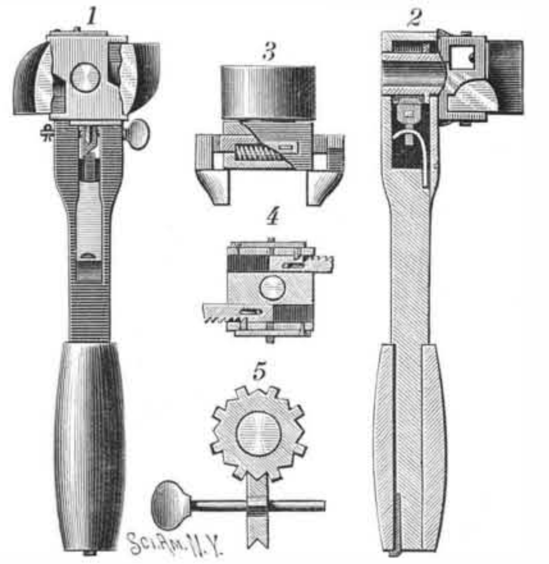
self is provided with ventilating grooves extending along its sides, by which it is much more readily relieved of the bubbles of gas which form on its surface, and retard the electric action, than by the holes usually run through the seal and into the mixture. The well known lead cap of the carbon is dispensed with, and in its place is used a thimble, with thumbscrew, which can be slipped off and replaced in a moment. The battery wire passes through a small hole in the top of the thimble and into a recess in the carbon, against which it is clamped by the thumbscrew. The jar is square in form, but the bottom is decreased in size, and is round, thus serving three different purposes: to hold the bottom of the porous cell in place, to keep it and the zinc separate at the bottom, and to raise the body of the jar above accumulations of dirt and mould in damp locations. A convenient method of setting up a battery of these cells is to set the bottoms of the jars in corresponding holes in a piece of board. The whole battery can then be taken up and removed without disconnecting the cells from each other.

This battery, which is covered by no less than six different patents, is put upon the market by the Leclanche Battery Co., the manufacturers of the celebrated Leclanche Gonda batteries.

THE present series of experiments with ordinary live shells and shells charged with melinite and gun cotton against the Resistance, armorclad, have been concluded. The topsides and interior of the hulk are very much torn and rent, but the comparative values of the several explosives will not be determined until after a careful examination of the results has been made on board by a committee of experts. But the mere fact that it was possible to tow the ship into harbor immediately after the firing goes far to prove that the hull was not fatally damaged.

AN IMPROVED WRENCH.

A wrench which can be readily changed to operate as a ratchet wrench or plain wrench, and the jaws of which can be easily adjusted to and released from a nut, has been patented by Mr. Jonathan M. Silvis, of Kittanning, Pa., and is illustrated herewith, Figs. 1 and 2 showing a vertical section, Fig. 3 a plan view and Fig. 4 a horizontal section of the head of the wrench, Fig. 5 being one view of the pawl and ratchet mechanism. Sliding jaws are mounted in a support having a tubular shank, the latter, located in a shank of the handle, and extending across the upper end of a chamber therein, the tubular shank being formed with a ratchet with which a pawl is held in engagement by means of a spring, the pawl being mounted on a rod having an operating thumb screw. The pawl is made with two oppositely beveled sides and two oppositely V-shaped notches, and by rotating a quarter of a turn the rod on which it is mounted, a notched side is brought into engagement with a projection, as shown in Fig. 5, or a beveled side is projected into the path of the ratchet, in the former case locking the ratchet and preventing the wrench from acting as a ratchet wrench, and in the latter case permitting it to so act. The sliding jaws are adjustable on their support for different sized nuts, being automatically moved into extended position. The handle is shown in shortened position, but the construction is such that it can be conveniently lengthened by disengaging a spring and extending the handle on the square end of the shank of the wrench. This wrench is designed to work between bars, or in close quarters, where other forms of wrench cannot be used, and the tubular shank of the jaw support allows the head of the wrench to go over the end of the bolt.



SILVIS' WRENCH.

THE LUCIGEN.

The new system of lighting known as lucigen permits of obtaining an intense light of great brilliancy under very remarkable conditions. This system, which was devised by two English engineers, Messrs. Hannay & Lyle, is based upon the atomizing of combustible liquids by means of a current of compressed air. We shall describe it with sufficient completeness to allow our readers to appreciate the interest of it.

Let us first describe the oil reservoir, which is represented in Fig. 1. The lucigen employs the most diverse oils--crude and rectified petroleum, naphthas, oils of tar, vegetable oils, waste lubricating oil, etc. It can burn all of these, but the luminous intensity varies with the amount of carbon contained in the oil used. It is indispensable that the oil be anhydrous, and that it contain no solid particle large enough to stop up the orifices of the burner.

The oil is poured into the reservoir through the sieve, E, which retains the solid particles, if there are any. It collects in a compartment, F, which communicates with the lower part, D, through a tube provided with a cock shown to the right of the engraving. The compressed air enters through the pipe, A, descends through the tube, B, into the air chamber, C, and causes the oil to ascend in the tube, D, which leads to the burner. The oil reservoir has a double bottom that forms a feed chamber that can be filled during the operation of the system.

Fig. 2 will allow the operation of the burner to be understood. The oil enters the tube, A, under pressure, and makes its exit through a cylindrico-conic ajutage placed within the lamp. This ajutage is capped by a second ajutage, B, serving for the passage of the air and the atomized oil. The air enters through a conduit, C, parallel with the tube that leads the oil, circulates and becomes heated in the worm, D, placed in contact with the flame in the combustion chamber, K, and returns to the annular chamber, E, crowned by the exit ajutage. Here it heats the oil in a certain measure, thus rendering its division easier and surer, and finally seizes it between the two ajutages and carries it to the exterior under the form of extremely small drops. The outflow of oil and air is regulated by a double cock, R (Fig. 3), placed at some distance from the burner.

To complete the description of the burner, it is necessary to mention the role of an accessory oil tube, F, placed at the side and provided with a regulating cock, G (Fig. 2). The oil, on making its exit from this cock, enters a vertical tube, H, that debouches below in the combustion chamber. It here impregnates an asbestos wick, which, during the operation of the lamp, burns constantly, so as to light the burner automatically, in case the flame should become extinguished through any cause.

The apparatus here described is the one constructed and improved by Messrs. Rouart Bros., grantees of the Hannay system for France. It furnishes a broad, thick flame, which might aptly be called a "plume" of fire (Fig. 3, A). The denticulations, observed along the edges of the flame are produced by the shock of the gases in combustion against the surrounding air, which, although carried along in an ascending motion by the ignited, vapor, has an incomparably less velocity.

Messrs. Rouart have devised a series of apparatus designed for the various possible applications of this new mode of lighting. Where the apparatus are to be stationary, the burners are arranged at proper distances upon supports of various heights, according to their

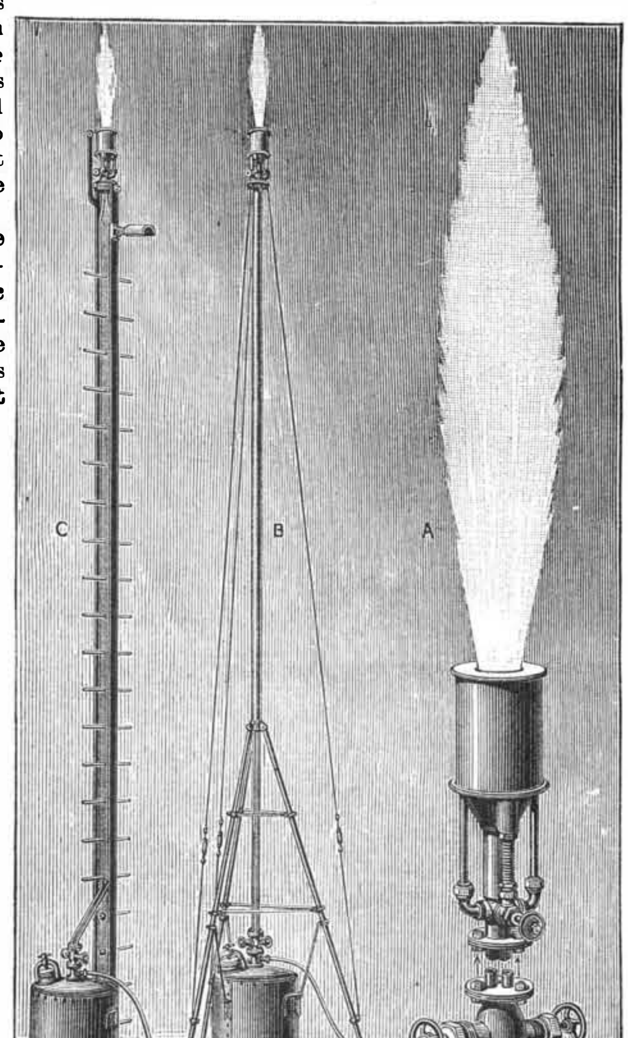


Fig. 3.—A, APPEARANCE OF THE LUCIGEN FLAME. B, MOVABLE SUPPORT. C STATIONARY SUPPORT.

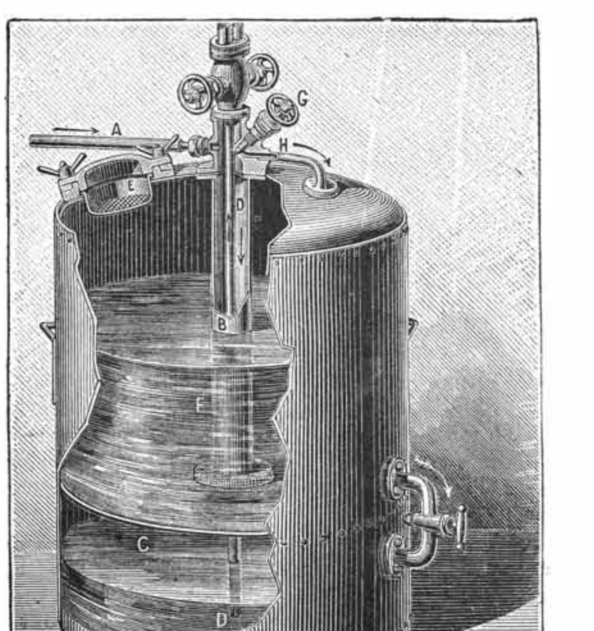


Fig. 1.—OIL RESERVOIR.

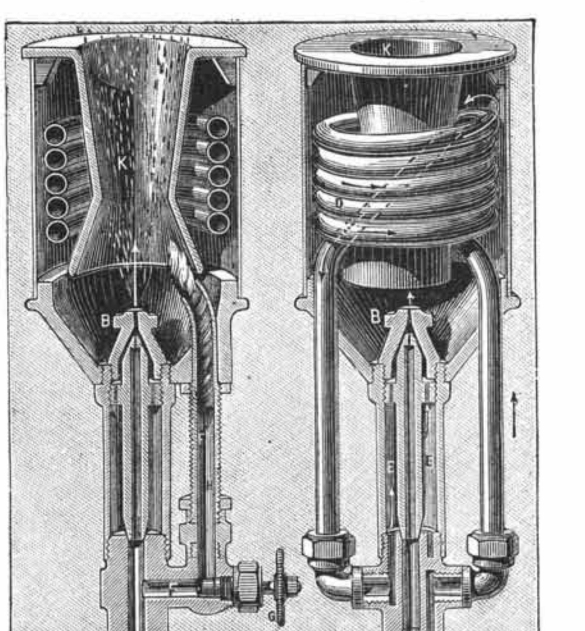


Fig. 2.—DETAILS OF THE BURNER.

intensity and the conformation of the ground. Thus, a 2,000 candle burner would, on level ground, be placed at a height of about twenty-five feet. The support used in such a case consists either of a cast iron column or, more simply, of an iron upright provided with rounds so as to form a ladder (Fig. 3, C). It is indispensable, in fact, to be able to reach the burner from time to time in order to clean it, change the asbestos wick, etc. At the base of the support is placed the oil reservoir that we have described.

The regulating cocks of the burner are upon the reservoir, within easy reach, and the lighting is effected, as in the case of gas, by means of a torch. A system of underground pipes leads the compressed air to the different burners. This air is compressed to about one kilogramme by a stationary compressor, which may be operated by a steam, gas, or any other kind of motor.

If a temporary field of work is to be lighted, either a stationary installation like the preceding can be employed, or movable apparatus may be used if the duration of the lighting is not sufficient to permit of so complete an installation. The piping will be simply placed upon the ground, or be buried in a trench not deeper than 4 inches at the most. The supports will be movable and easily carried to the spot to be lighted. For this purpose, these supports (Fig. 3, B) consist of a tripod surmounted by an iron column of small diameter. The legs are hinged so that they can be bent back parallel with the column, thus making the support easily handled. Two men suffice to maneuver it.

One of the most interesting applications of the lucigen apparatus seems to us to be the one that was studied with a view to their application to ambulance cars. A small petroleum motor directly actuates a compressor, and the base of the motor is utilized as a reservoir of compressed air. The supports and the oil reservoirs are those described above. The conduits consist of 30 or 40 tubes twenty feet in length, the mean length of a car. In case of accidents that do not need the presence of an ambulance car, or where there is need of a light that is not to last long (as, for example, in the examination of tunnels), the apparatus differs a little from the preceding. The burner is here fixed directly to its oil reservoir, and the compressor is so arranged as to be operated by manual labor. Two men suffice to supply a 2,000 candle lamp.

The lucigen, which is not yet well known in France, is already in extensive use in England, where it originated, and where it is employed on a large number of railway lines. It serves likewise for lighting important working stations, especially those of the Forth bridge.

With a few modifications, the apparatus may also be employed for heating purposes in a large number of cases. For this purpose, Messrs. Rouart have devised a portable apparatus called the lucigen blowpipe. This consists of a table carrying two burners opposite each other. The oil and air reservoirs are placed beneath the table, and the compression pump with its pulleys is fixed at the side. It therefore suffices to connect this apparatus with any transmission whatever in a shop to obtain immediately two jets of a high temperature, that may be used for soldering, heating rivets, brazing, etc.—*La Nature.*

The Vagaries of the Law.

A decision has been reached in the suit in the United States Circuit Court for the Southern District of New York, entitled Webster Loom Company against E. S. Higgins & Co., of this city, which practically involves the interests of the whole carpet industry of the country. The suit was begun in June, 1874, and is for the infringement of a patent on the wire motion employed in producing the pile of tapestry carpet. The suit in 1878 was decided for the defendants by Judge Wheeler, on the ground that the patent was invalid. Subsequently this decision was reversed by the Supreme Court of the United States, the patent being sustained and E. S. Higgins & Co. being declared infringers. It was then referred to John A. Shields, as master, to ascertain the amount to be recovered by the complainant. The matter has been pending before the master since 1882. The complainant claimed as damages and profits enormous sums, varying from $7,000,000 to $30,000,000, and voluminous testimony was taken from all parts of the United States and England. The master now reports, in an elaborate written opinion, that the complainant has failed to establish any substantial claim, and the decree will be for six cents. The counsel for the complainant were E. N. Dickerson and Edward Stephens; for the defendant, Livingston Gifford and W. K. Griffen.

THE fastest armed cruiser in the world is said to be the German vessel Greif, which has a displacement of 2,000 tons, and is fitted with engines of 5,400 indicated horse power. On the voyage from Kiel to Wilhelmshafen a speed of 23 knots, or almost 27 miles, an hour was obtained. What is the reason our Navy Department does not build some fast vessels like this? Every one of the new ships so far ordered is to be a slow tub compared with the Greif. Why does not the Secretary of the Navy use his influence to have some fast vessels constructed?

Speed of Passenger Trains.

The accompanying table gives the speed of the fastest passenger trains and the average speed of all passenger trains between most of the principal cities of the United States. The times and distances are taken from the *Traveler's Official Guide* for July, 1888. The average distance between the stations at which the fastest train is timed to stop is also given where possible. The time on which the speed is calculated includes all stoppages, and no allowance or deduction is made for ferries, etc. It is believed that in every train given in the table, through cars of some description are run between the termini given, though in some cases no sleepers are run, and in others the sleepers only are run through.

The trains given in the table either run between or pass through 36 of the principal cities in the United States, and it is believed that Denver and Indianapolis are the only important omissions. The case of Brooklyn is of course exceptional. Care has been taken to make the table as accurate and representative as possible, but some errors are unavoidable.—*Railroad Gazette.*

SPEED OF PASSENGER TRAINS BETWEEN PRINCIPAL CITIES, JULY, 1888.

Whence—Whither.	Route.	Fastest Train. Distance. Miles.	Time. Hrs.	Min.	Speed. Miles per hour.	Average distance between stopping stations. Miles.	Mo. of trains each way per day.	Average speed of all trains.
New York—Philadelphia	Philadelphia & Reading	90·4	2	9	42·0	12·9	10	32·6
" "	Pennsylvania	90·8	2	5	43·6	22 7	23	34 5
" —Washington	"	226	5	32	40·8	?	9	34 5
" —Pittsburg	"	444	11	30	38·6	89	4	31·6
" —Chicago	"	912	25	0	36 5	102	4	29·9
" "	N. Y. Central & LakeShore	981	25	0	39·1	109	4	32·7
" "	" & Mich. Central	977	28	30	34·3	28·7	3	30 9
" —Buffalo	New York Central	441	10	45	41 0	110	5	34·8
" "	Erie	423	13	0	32·5	21	3	31·3
" "	Lackawanna	409	12	40	32·3	16	2	29·9
" —Boston	Boston & Albany	234	6	0	39·0	33·5	4	35 4
" "	New York & New England	213	6	0	35 5	53	5	31·1
" "	Shore Line	229	6	0	38·2	32·7	4	32 7
Baltimore—Chicago	Baltimore & Ohio	853	25	40	33·2	25	*2	29·5
" "	Pennsylvania	801	23	15	34·4	33	4	28·5
Chicago—Minneapolis	C., M. & St. Paul	420	14	40	28·6	15·0	3	27 0
" "	C. & Northwestern	419	14	33	28·8	18·0	2	27·5
" "	Wisconsin Central	472	15	5	31·3	26·0	2	28·7
" "	C., St. Paul & Kansas City	431	15	0	28·7	22·7	2	26·8
" "	C., Burlington & Northern	442	14	37	30·2	19	2	28·3
" —Kansas City	C., Burlington & Quincy	487	15	40	31·1	24 3	2	26·3
" "	Chicago & Alton	488	15	30	31·5	30·5	3	25 0
" "	C., Rock Island & Pacific	521	16	35	31·5	....	2	27·3
" "	C., Santa Fe & California	458	20	25	22·4	24·1	2	21·7
" —Omaha	C., Burlington & Quincy	508	16	20	31·1	30	3	28·5
" "	C., Milwaukee & St. Paul	490	18	45	26·1	9·4	2	25·0
" "	C., Rock Island & Pacific†	500	16	0	31·2	18·5	3	26·5
" —St. Louis	Chicago & Alton	283	10	35	26·7	?	3	26·1
" "	Wabash	286	9	50	29·1	8	2	28·3
" "	Illinois Central	299	10	30	28 5	?	2	28 0
" —New Orleans	" "	915	35	0	26·1	10	2	25·0
Cincinnati— "	Cin., N. O. & Texas Pacific	826	25	35	32·3	50	2	27·5
Louisville— "	Louisville & Nashville	811	25	0	32·4	25·3	2	29·0
Savannah—Atlanta	Central of Georgia	295	10	20	28·5	10·5	2	28·8
St. Louis—Galveston	Missouri Pacific	1014	46	55	21·4	10·4	1	21·4
" "	Iron Mountain	869	35	55	24·2	13·6	1	24·2
Omaha—Ogden	Union Pacific	1031	36	10	28·5	38	2	24·7
Ogden—San Francisco	Central Pacific	834	37	45	22·9	12	2	21·5
San Francisco—New Orleans	Southern Pacific	2495	113	25	22·0	?	1	22·0
St. Paul—Portland	Northern Pacific	1913	74	20	25·7	31	2	22 8

* Via different routes. † To Council Bluffs Transfer.

Fast Trains.

The term high speed is used somewhat indiscriminately, and to most has a very indefinite meaning. If the difficulty of running a train regularly at a high speed is taken to increase approximately as the cube of the speed, a train run at 30 miles per hour requires fully 50 per cent more care, skill, and attention to detail than one run at 25 miles per hour, while the task of running at 40 miles per hour involves fourfold the difficulties experienced in running at 25 miles. These proportions are merely speculative, but they have sufficient basis of fact to render important an increase of a few miles per hour in the speed of a train. The higher the speed, the greater the difficulty of attaining an additional mile per hour.

The table which will be found herewith contains some interesting information as to speed of passenger trains between the chief cities of the United States. The table has been carefully compiled, so as to represent as fairly as possible all sections of the country, and the rule of selecting as termini important cities indicates fairly the speeds at which passengers are conveyed between the principal centers of business. As it is practically impossible to make any fair allowance for the time lost in stopping at stations, or at level crossings, drawbridges, etc., the time given includes all stops. It is equally impossible to make any allowance for ferries, and the time given is always, as far as possible, that from city to city, and includes the time lost by any ferries, etc., between the terminal points. The average distance between the stopping stations as marked in the time tables is given, and indicates the frequency with which stops are made for traffic purposes. On the great majority of roads many other stops are made for water, grade crossings, drawbridges, and other causes, both permanent and temporary. The Ramsbottom water trough and scoop renders it unnecessary to stop for water, and efficient interlocking signals can be used, which obviate all necessity of stopping at grade crossings. The fact that the famous Jarrett & Palmer special train was run for 439·5 miles without a stop over a road with such numerous curves and heavy grades as the main line of the Pennsylvania shows what can be done in long runs without stopping, and should encourage railroad managers to minimize the time wasted in stopping at points where no money can be earned and where traffic is delayed rather than accommodated.

The table shows very clearly that the train service between New York and Philadelphia stands out preeminent both for speed and frequency of trains, while that between New York and Washington, Boston and Chicago respectively is not far behind. The average speed of all trains between New York and these cities is over 30 miles per hour, which is a higher average rate than obtains elsewhere, and is exceeded only by a few of the fastest trains in the West and South.

The table shows that the fast trains between Chicago and Kansas City, which are said to have been such expensive luxuries, are, after all, run at a very moderate pace, and their speed of 30 to 31·5 miles per hour is exceeded by two Southern roads, one of which has the disadvantage of worse gradients, while neither serves such enterprising Western cities as Omaha, Minneapolis, St. Paul, or Kansas City.

An unwillingness to run a through train at over 30 miles per hour, including a few stops, is a confession of weakness. Going south again, the table shows that a very cheaply constructed road, the Central of Georgia, actually attains a higher average speed between two comparatively small Southern cities than the great competing companies of the West attain between Chicago and Kansas City.

Even when the fastest trains between Chicago and Kansas City are compared with the fastest train between Savannah and Atlanta, the former come out only three miles per hour ahead. The stopping stations are nearly three times as frequent on the Southern road, and an allowance of only three minutes a stop makes the running speed equal.

The train between San Francisco and New Orleans is noticeable for the fact that it has the longest through car service of any line in the world, and in fact it would be impossible to find a continuous line of rail of this length on any other continent. The Canadian Pacific runs through trains from Montreal to Vancouver, 2,906 miles, but we believe sleepers are not run through for the whole distance.

The table shows that east of Chicago the speed of the fastest trains between the largest cities is about 40 miles per hour, including stops, while the average speed of all through trains is about 32 miles per hour. West of Chicago and in the South the speed of the fastest trains is about 30 miles per hour, while the average speed of all through trains is about 27 miles per hour. In the Southwest the speed of the principal through trains is about 23 miles per hour. These figures in all cases include all stoppages.—*Railroad Gazette.*

A LONG trestle has been built by the Portland & Vancouver Railroad to get across the bottom land of the Columbia and reach deep water. The trestle is 8,000 ft. long, with two truss spans across arms of the stream, and extends 700 ft. into the stream. The river is crossed by ferry from the end of the trestle, in about ten minutes.