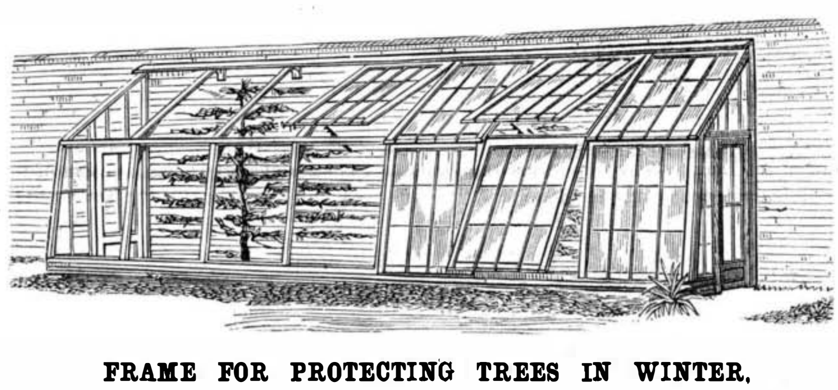
THE EQUATORIAL OF THE PARIS OBSERVATORY.

(*Continued from first page.*)

it possible for the observer to quickly move the instrument into any position by revolving the winch placed at his right. The toothed arc, L, revolves upon the horary axis and slides upon the bronze limb of a circle which is likewise fixed to the axis. A lever, M, renders the arc immovable at will, so that the latter need not be freed from the tangential screw when it is desired to free the instrument itself. The weight that actuates the wheelwork is wound up on a rod by means of a winch that may be removed at will. The back motion in right ascension is given by a button, and the tangential screw is disengaged with a key by acting upon a button. The clockwork movement is capable of being stopped when in motion, and *vice versa*. The steel sleeve, R, which is adjusted by slight friction on the cast iron tube of the telescope, is provided with two toothed circles. With the first of these gears the pinion, Y, which transmits motion to the divided circle placed near the ocular. With the second gears another pinion, which causes the revolution of the sleeve, through the winch placed within reach of the observer. The sleeve is carried and held at its base by three double rollers, R', fixed to the telescope tube. The counterpoise, O, is fixed to jointed levers, E, which pivot upon studs, O', and act upon the four rollers upon which the sleeve rests. At the upper part of the latter is fixed the mounting of the mirror, S, of 40 centimeters. This mirror is adjusted in a cast iron cylinder, in which it rests upon a layer of flannel. The bottom of the cylinder, which contains apertures 40 millimeters square, is movable, and gives a means also of regulating the pressure. The cylinder is held in its mounting by two trunnions, and is regulated by an adjusting screw. The mirror is inclosed in a square metallic box having in each end an opening that is closed by hinged covers. Upon the sides of this box are placed two comet seekers, T. The objective is fixed to the tube of the telescope, and the small mirror, V, which is placed in the square box, rests also on a layer of flannel in a cast iron cylinder carried by an adjustable mounting. A gas lamp, Q, serves for lighting up the interior of the telescope, and makes the black threads show upon a brilliant field, and the bright threads upon a dark background. The threads are accurately brought into the focus of the objective by revolving the small sleeve to the right or left.—*La Nature.*

SIMPLE GARDEN IMPROVEMENT FOR PROMOTING WINTER GROWTH.

The accompanying engraving so well shows the idea of the sort of half hothouse proposed that it cannot fail to be at once understood. The winters over a large portion of the United States have so few extremely cold days and nights that, with a cheap and simple protector like this, many plants and shrubs might live through the year, when they would not otherwise do so. It will be seen from the illustration that the frame which holds the glass is designed to be attached to a wall or high fence on one side, and may be put up in sections small and light enough to be easily moved from one place to another. A similar device, or one on the same principle, might, we should think, be useful in the way of encouraging the lay ing of fowls during the winter months.



FRAME FOR PROTECTING TREES IN WINTER.

The Northern Pacific as seen by an Englishman.

At a recent meeting of the Institution of Civil Engineers, Mr. G. B. Bruce, Vice-President, gave an account of his recent visit to the United States of America as the representative of the Institution, on the occasion of the opening of the through line of the Northern Pacific Railroad.

The railroad is based upon a concession from the government, the company making the road, and the government giving 25,000 acres of land per mile of road constructed, in alternate sections, the government holding one block and the company the next. The railroad lies mainly between the 46th and 47th parallels of north latitude, about 200 miles ~~south from the boundary between Canada~~ and the States, and 300 miles south of the Canadian Pacific Railway. The distance between the termini, Lake Superior and Puget Sound, was about 2,200 miles. Besides this, there was a branch from Brainerd on the main line to St. Paul on the Mississippi, which would probably be the chief route for traffic between the Northern Pacific towns and the Eastern ports.

Proceeding northwestward from St. Paul, the country at first was chiefly under wheat; some distance after passing the Missouri it was mainly devoted to raising cattle. Mr. Bruce was particularly struck with the bridges on the line. The crossing of the Missouri at Bismarck was effected by an iron bridge 1,450 feet long, having three spans of 400 feet each and two spans of 113 feet each, and was 50 feet above the highest level of summer floods. The large girders were 50 feet deep. The majority of the bridges throughout the road were of timber, the most remarkable being among the Rocky Mountains. Here, too, were the steepest gradients on the line, the maximum being 116 feet to the mile. The crossing of the summits of the two ranges would be by two tunnels, each 1,200 yards long; at present temporary roads had been laid over the mountains. Mr. Bruce considered the passage of the Columbia River through the Cascade Range the most imposing feature of the line.

The road at this point, for a considerable distance, is carried along a ledge made by blasting away the almost perpendicular hillside into the river below. The rails were of steel, 56 pounds to the yard; the road was well sleepered and reasonably ballasted; and there were all the elements of a good and substantial road, which in time will rank doubtless among the best in the United States. There was no signaling apparatus, but great use was made of the telegraph. In one feature the American engineers seemed to be particularly distinguished—namely, in the arrangement of their work, and in the strictly systematic manner in which they carried it forward under very difficult and trying circumstances. The visitors were conducted in four trains of about ten Pullman carriages each. They all left New York, and were ready to start from Chicago on the 1st of September.

They met with a hearty reception at the cities of St. Paul and Minneapolis, which, though not forty years old, each contain a population of between 80,000 and 90,000, and are the centers of large industries. Notwithstanding the lack of timber over many hundreds of miles in the center, the discovery of coal in that very locality would make it easy to supply the engines with fuel. The Westinghouse brake seemed to be in general use in America. The whole trip was carried out with very few mishaps; one or two slight accidents were the outcome of the running together of carriages from different lines, the couplings of which did not correspond. The great ceremony of the occasion was driving the last spike at the "Garrison" Station, at the foot of the eastern side of the Rocky Mountains, when about half a mile of track was laid in about half an hour.

Mr. Bruce then alluded briefly to some things not connected with the Northern Pacific Railroad. He was struck with the much greater use made of the electric light in America than in England. In many little cities in the prairies, a high pole in the middle of the town with a light on it illuminated the whole place. He very much admired the steamboat accommodation in the United States, and remarked that the arrangements for landing in Liverpool, in a steam tug without even a covering to keep off the rain, contrasted most unfavorably therewith, and were a disgrace to England and to the companies which perpetuated them. While at Chicago, Mr. Bruce went to see the new works of the Pullman Car Company. There was now there a town of 7,000 inhabitants, where three years ago there was nothing but an unoccupied stretch of country. The chief feature was in the surroundings of the works; everything had been done for the welfare and comfort of the workmen, and the whole had been a great financial as well as moral success.

Gutta-Percha Stopping.*

CHAS. E. FRANCIS, D.D.S., NEW YORK.

Among the various preparations for filling carious teeth, gutta-percha stopping holds an exceedingly important place.

Cases are commonly presented where defective teeth can be better preserved if filled with this material than with any other substance. Owing to its nice adaptability to the dentinal walls, together with its slightly expansive nature, it can be made to seal cavities in which it is packed, with a remarkable degree of thoroughness.

For bucco-cervical cavities of second and third molars, it will stand for years, and prove exceedingly effective in preventing renewed decay.

It is frequently and advantageously used for packing against cervical walls of large buccal or approximal cavities, prior to introducing fillings of oxyphosphate of zinc or amalgam; also for repairing large gold fillings with cervical borders slightly undermined.

As a stopping for deciduous teeth, it can be quickly introduced, and in most cases answers admirably; also for impoverished or poorly calcified teeth when attacked by caries, and is peculiarly well adapted in cases of white decay or where the tooth structure is undergoing rapid decalcification.

As a temporary stopping for early decay in permanent teeth, nothing can surpass or perhaps equal it for safety. It holds good until the dentine becomes more dense, and the patient older and better able to tolerate the introduction of compact gold fillings.

In cases where the dental pulp is nearly or quite exposed, protection should be afforded by a covering of oxyphosphate of zinc to prevent pulpitis, which might be occasioned by the expansion and consequent pressure of gutta-percha stoppings. Similar care should also be observed where the enamel walls are so exceedingly frail as to become easily fractured.

Although these stoppings are liable to wear away when much exposed to attrition, the surrounding cavity walls usually remain well preserved. They are, moreover, easily repaired or renewed, and with no loss to the tooth structure.

For large stoppings, much exposed to wear, caps of gold plate can be fitted to cover them accurately, on the cavity surface of which may be soldered small loops or "T" shaped anchors. Such a cap, warmed over a spirit lamp, can be embedded in or united with the fillings, leaving a firm gold surface on which to masticate.

With a degree of tact and experience, gutta-percha stoppings can be manipulated readily and with comparatively little trouble. Cavities should be prepared as nicely as possible, and kept dry while filling is introduced.

Small pellets of the stopping heated to a plastic condition can be carried to the cavity on the point of a small curved and flattened instrument. Gentle pressure against the walls packs it securely. The excess can be trimmed away with flat heated instruments, and the surface rubbed with burnishers. A bit of cotton or spunk moistened with chloroform, held with tweezers and passed over the filling, will also aid in smoothing it.

Great care is requisite to avoid over-heating the material. If warmed over a spirit lamp it must be held considerably above the flame. It is safer to place bits of the stopping on a piece of heated porcelain or a small covered vessel of boiling water, preparatory to use.

Gutta-percha stoppings, if well impacted in properly prepared cavities, seldom prove treacherous, but as a rule are exceedingly safe and reliable.

* Frequent inquiries concerning the practical value of this material and the method of manipulating it, the writer states to be his excuse for printing the following communication, which we copy from the *Independent Practitioner.*

Analysis of Luminous Rays.

A means of isolating the heat rays from any luminous source, intercepting the illuminating and chemical rays, has been communicated to the Academie des Sciences by M. Van Assche. Upon a piece of glass he lets fall a drop of melted and sublimated selenium, which is immediately covered by a thin glass; and the melted material is then squeezed gently until it is extended into a very thin, homogeneous sheet. The glass is then placed under pressure and gradually cooled. It is necessary that the selenium should not boil on the glass, or otherwise cells are ~~formed by means~~ of the vapor, which interfere with the action of the material. When properly made the cell is of uniform thickness, and is free from bubbles and striations. Cells so constructed, when placed in the path of a ray of light, reflect the chemical rays, and convert the luminous ones into electrical energy. Only the calorific rays pass through the cell; being at the same time subjected to a definite refraction. The transmitted light is monochromatic, of a ruby-vermilion tint, only showing one luminous band in the spectroscope. If the light of burning sodium is passed through this form of cell, there is annihilation of luminosity. The author contends that an arrangement of this kind will form a considerable addition to the apparatus used for analyzing light and determining the constituents of flames.

Purification of Sewage.

Experimental trials of the Andrews-Parker process for deodorizing and purifying the sewage of London have been in operation since last May. The 90,000,000 of gallons daily and nightly flows into subterranean reservoirs located beyond Beckton. By the action of water and repeated pumping before the last station is reached all the fecal matter in the sewage is reduced to a liquid having a grayish-black appearance and an extremely offensive odor. The sewage, after having been drawn into a tank, is subjected to a powerful stream of water, under heavy pressure, charged with ground clay, caustic soda, hydrochloric acid, and sulphate of iron. The mixture is then turned into large tanks, where it is allowed to remain until the action of the precipitates has thrown all the sediment to the bottom, when the liquid is drawn off into the Thames, it being a pure, colorless, and odorless water. The sediment is kiln dried and pulverized, and makes a fertilizer which chemical analysis has shown to contain a large proportion of ammonia and phosphates, and to be of much commercial value.

Underground Cables.

Considering the interest which attaches now to the question of overhead *v.* underground cables, it may be useful to give the figures of the underground cables in existence at the end of 1881. They were as follows:

Countries.	Length in kilometers of cables.	of wires.
1 in Germany	5,500	37,605
2 in Austro-Hungary	29½	511
3 in Belgium	11	232
4 in Denmark	3	79
5 in France (including colonies)	851	11,880
6 in Great Britain and Ireland	771	17,700
7 in The Netherlands	96	591
8 in Roumania	11	56
9 in Russia	202	250
10 in Switzerland	45	327
	7,519½	69,231