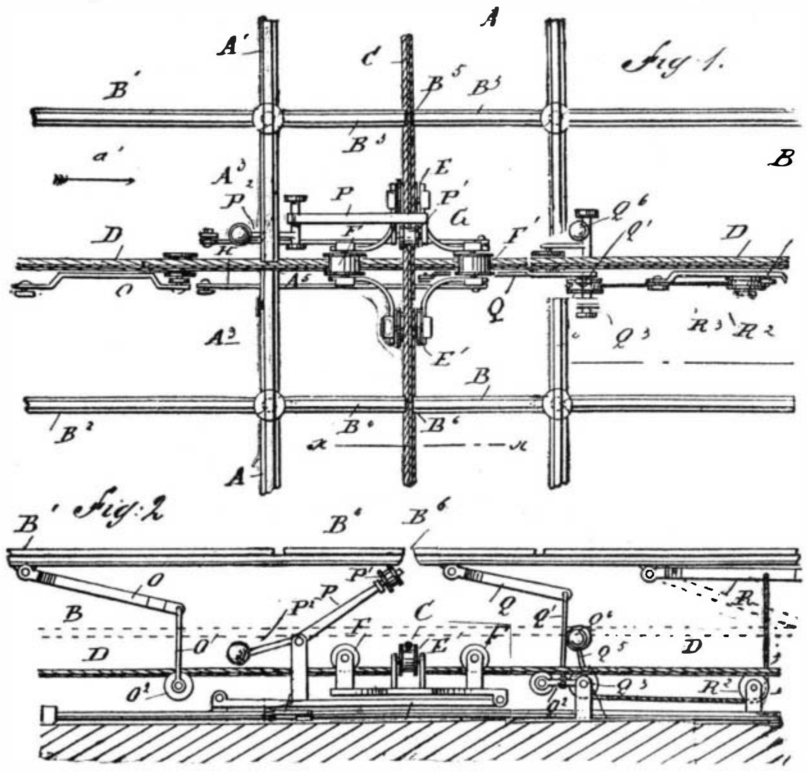
AN IMPROVED CABLE RAILWAY CROSSING.

The illustration shows plan and sectional views of a cable railway crossing so arranged as to bring the crossing cables near each other, while preventing the cables from coming in contact. The main track, A, is crossed at right angles by the track, B, C being the main cable and D the crossing cable. Two pulleys, E E', are arranged in line at right angles with pulleys, F F', to turn in the frame, G, which is held in position by a lever, H, extending in the direction of cable, D. The pulleys, F F', are supported by cable, D, and a counterpoised lever, not shown, but similar to lever, P. Cable, C, passes over the pulleys, E E', which are so arranged with pulleys, F F', to frame, G, that the cables are prevented from coming in contact with each other. When the crossing cable is elevated by a grip car approaching in the direction of arrow, a', the grip carries the cable to the height shown by the dotted lines in Fig. 2. A pulley attached to the grip, but not shown, then engages the under surface of lever, O, which is raised to a horizontal position, its pulley, O^2, supporting the cable until the grip is swung to the left by a curve in the slot, when the mechanism swings down to allow the grip to pass over cable, C. In the path of the grip over cable, C, is a counterpoised broad lever, P, having mounted on its free end a pulley, P', to engage cable, C, and prevent it from swinging upward as the crossing cable grip is passing over it. The grip next engages lever, Q, in the same manner as lever, O, the mechanism permitting the necessary upward motion of the cables as a car approaches the crossing, and, without bending either cable over the pulleys, preventing them from coming in contact with each other.

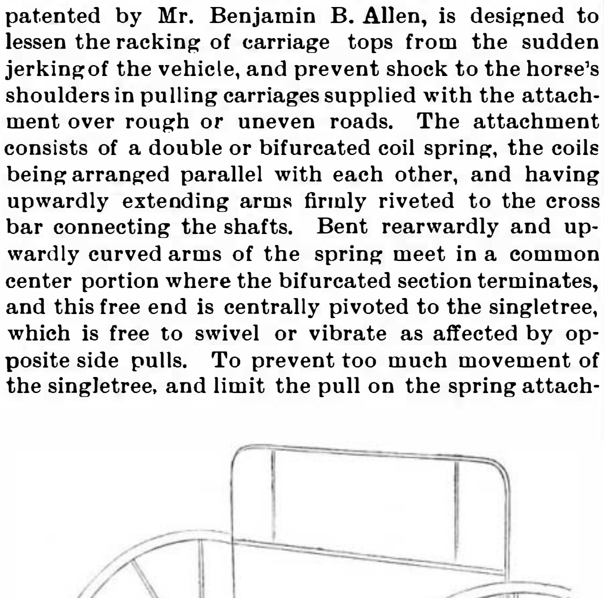
Further information relative to this invention may be obtained of the patentee, Dr. James P. Orr, No. 638 Fifth Avenue, Pittsburg, Pa.



ORR'S CABLE RAILWAY CROSSING IMPROVEMENT.

A SPRING DEVICE FOR SINGLETREES.

The device shown in the illustration, which has been patented by Mr. Benjamin B. Allen, is designed to lessen the racking of carriage tops from the sudden jerking of the vehicle, and prevent shock to the horse's shoulders in pulling carriages supplied with the attachment over rough or uneven roads. The attachment consists of a double or bifurcated coil spring, the coils being arranged parallel with each other, and having upwardly extending arms firmly riveted to the cross bar connecting the shafts. Bent rearwardly and upwardly curved arms of the spring meet in a common center portion where the bifurcated section terminates, and this free end is centrally pivoted to the singletree, which is free to swivel or vibrate as affected by opposite side pulls. To prevent too much movement of the singletree, and limit the pull on the spring attachment, the ends of the singletree are loosely held by flexible loops or straps fastened to the cross bar.



ALLEN'S SPRING-ATTACHED WHIFFLETREE.

Further information relative to this invention may be obtained of Messrs. Weisbaum & Wilson, P. O. box No. 186, Hanford, Cal.

IT is said the largest mass of granite ever quarried was taken out by the Bodwell Granite Company, in Vinalhaven, Me. It exceeds in length any of the Egyptian obelisks, the tallest of which was brought from Heliopolis and subsequently taken to Rome, where it now stands. This monument is 105 feet high. The Vinalhaven shaft will be 115 feet high, 10 feet square at the base and weighs 850 tons. This would, perhaps, form a good monument to the memory of General Sherman.

Discovery of Chaldean Monuments in the City of London.

BY PROFESSOR DOUGLAS.

If the house of Mr. Augustus Franks or of any other well known collector of Oriental porcelain were overwhelmed and destroyed by a sudden catastrophe—which Heaven forbid !—and if, after two or three centuries, the old foundations were dug up, it is more than probable that the workmen would find such specimens of crackled china and blue and white porcelain as would rejoice the hearts of the frequenters of the Christie & Manson's sale room of the day. An analogous case to this has lately occurred in Knightrider Street, in the neighborhood of St. Paul's Churchyard.

In the reign of the Merry Monarch this quarter of the town was the favorite business haunt of Dutch merchants. During the fire of London the then existing tenements were gutted and overthrown, and, though houses have since risen on the site, many of the old foundations have never been stirred to their depths. A few weeks ago, however, the workmen employed in laying the foundations of a new house discovered in the rubbish which they were compelled to remove some old Dutch tiles and three black diorite stones bearing figures and characters which suggested to them that they were of more than ordinary interest.

This surmise was, on investigation, fully borne out, and on the stones being removed to the British Museum it was discovered that two of them bore inscriptions in the Accadian language, the pre-Semitic language of Chaldea, and that on the third were traced the usual grotesque animals and astrological signs commonly found on Chaldean boundary stones of the twelfth or thirteenth century B. C.

That these stones should have been found in the foundations of a Dutch merchant's house is to be accounted for by the facts that in the seventeenth century, and, indeed, before that period, the Dutch flag was well known in the Persian Gulf, and that Dutch merchants had extensive mercantile relations with the traders of Bussorah. What more natural, therefore, than that these stones should have been shipped on board the ship of some Dutch captain and brought to the house of the consignee in London ?

Unfortunately the inscriptions are, as is so often the case, purely religious, and do not add materially to our knowledge of the history of the country. In both cases they are dedicatory and contain the dedication of the objects—a door socket and a fragment of a basin for holy water "to the god Nina, the supreme Lord, the Lord of the written tablet." The only point of historical interest in the inscription on the basin is the mention of E-anna-du, who, according to a tablet in the Berlin Museum, was a son of A-kur-gal, who is mentioned on the well known Vulture stela at the Louvre, and who is recognized as the son of Ur-Nina.

The real importance of the inscriptions, however, consists in the forms of the characters employed. The script on the door socket is in the cuneiform character of the period of Gudea ; and the mention of that king's name in connection with the dedications has enabled Mr. Evetts, of the British Museum, to fix the date approximately at 4000 B. C. But, far-reaching as this date is, the inscription on the basin is still older. Before the adoption of clay as a writing material, and before, therefore, the introduction of the cuneiform character, the writing of the country was linear, and it is this form which appears on the basin. This characteristic guides us to a date about 4500 B. C., and we may therefore congratulate the British Museum on having acquired, by a happy chance, one of the oldest Chaldean monuments ever brought to Europe.—*Illustrated London News.*

Copper Sulphate.

An establishment for the manufacture of copper sulphate was set up by M. Defrance (Societe des mines et usines de cuivres de Vigsnais Annus), at the beginning of the year 1890, to meet the wants of the vine growers, who use a large amount of this product to prevent mildew. In this works the sulphate is prepared from metallic copper, which is heated to redness with sulphur in a series of reverberatory furnaces, the subsulphide thus obtained being then roasted in order to form a basic sulphate. This sulphate is next brought into large vats, in which it is dissolved in dilute sulphuric acid, the liquid being maintained at the proper temperature.

The solution obtained is run into four series of twenty large leaden vessels, where the sulphate crystallizes out as the solution cools, the crystals being deposited on sheets of lead which dip into the liquid, and are supported by cross pieces of wood. When the crystallization is complete, the liquors are run off, and the crystals removed from the walls and the leaden sheets.

After removal from the crystallizing vat, the crystals are placed on an inclined table, and sorted according to size and color by workmen. They afterward are passed down to the lower story to the driers.

These consist of large inclined tables which allow the water to drain away. The crystals are spread on these in thin layers, and moved about from time to time. The temperature of the room is kept sufficiently high to dry them. After drying, the sulphate is packed and sent off.

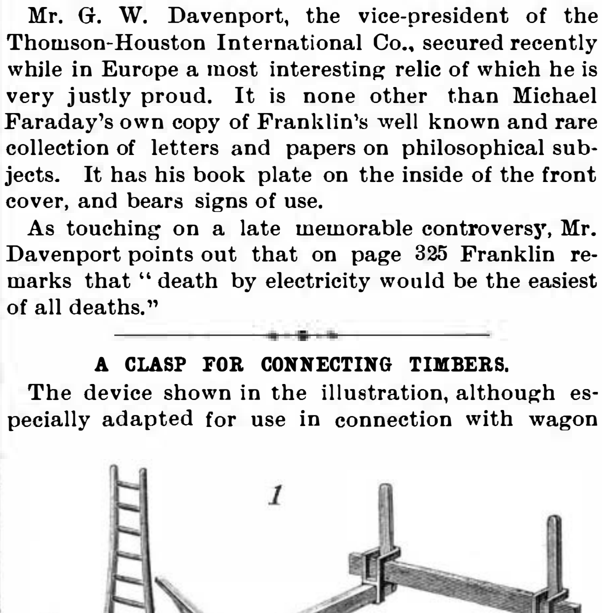
An Interesting Literary Relic.

Mr. G. W. Davenport, the vice-president of the Thomson-Houston International Co., secured recently while in Europe a most interesting relic of which he is very justly proud. It is none other than Michael Faraday's own copy of Franklin's well known and rare collection of letters and papers on philosophical subjects. It has his book plate on the inside of the front cover, and bears signs of use.

As touching on a late memorable controversy, Mr. Davenport points out that on page 325 Franklin remarks that "death by electricity would be the easiest of all deaths."

A CLASP FOR CONNECTING TIMBERS.

The device shown in the illustration, although especially adapted for use in connection with wagon racks, is also applicable where two or more timbers running at an angle to other timbers and parallel with each other are to be spliced or connected. It has been patented by Mr. Harold A. Salisbury, of Vinson, Oregon. Fig. 3 shows the device in perspective and Fig. 2 represents a form of clasp to be employed for securing a ladder or side extension to a wagon rack, the application of both forms of the improvement being shown in Fig. 1. By this means the timbers may be quickly and conveniently joined without mortising or otherwise disturbing the wood in a manner to weaken it.



SALISBURY'S CLASP FOR WAGON RACKS, ETC.

THE national museum of Brazil has come into possession of an enormous aerolite. It weighs 11,800 pounds.

Belgian Food Adulteration Law.

On the 15th of January regulations fixed by the Belgian Legislature, having for their object the prevention of the adulteration of food products, were to come into force in Belgium.

The first relates to the sale of artificial butters, otherwise called margarine, and stipulates that warehouses, shops, depots, as well as market stalls where margarine is exposed for sale, must present to the public view, in distinct and indelible characters, the inscription, *Sale of margarine.*

Casks, covers, and receptacles in which margarine is placed for sale by a shop keeper, or which are employed by the makers, wholesale dealers, importers, exporters, consignors and consignees of this product, must also bear, in distinct and indelible characters, the word *Margarine.* Further, if the margarine intended for sale is contained in cases, casks, or receptacles not opened, the inscription will mention the name or description of the maker.

Articles and wrappers in which margarine is delivered to the purchaser by a retail dealer must bear, in distinct and indelible characters, the word *Margarine,* and the statement of the name or description of the seller must in the inscription immediately precede or follow the word *Margarine.*

As regards consignments, the makers, merchants, consignors or consignees of the margarine must state on the invoices and way-bills or bills of lading for each individual consignment that the merchandise dispatched is sold as margarine.

If the margarine is sold or exposed for sale in the form of cakes or loaves, these must take the form of a cube. They must be marked, moreover, with an imprint bearing the word *Margarine,* as well as the name or description of the maker, unless the receptacles themselves bear these indications.

The second of these regulations relates to the sale of food products containing saccharin. It provides as follows:

1. Under the name of products in which saccharin enters (*produits saccharines*) is understood any commodity sweetened by the aid of matters of which the chemical composition and physiological properties differ entirely from those of common sugar or sugars derived from amylaceous substances (maltose, glucose).

2. Proprietors of breweries, glucose factories, confectionery establishments, factories of liquors, chocolates, and other food products, who use saccharin in their manufacture, are obliged to have the following words painted in large characters: *Saccharin products* (*produits sacchariné*) on the outside of the principal entrance to their works and warehouses.

Warehouses, shops, depots, as well as stalls and all places of sale where saccharin products are exposed for sale, must exhibit in a conspicuous place, in distinct and indelible characters, the words *Saccharin products.*

3. Casks, covers, or any receptacles in which saccharin products are placed for sale by a dealer, or which are used by the makers, wholesale merchants, importers, exporters, consignors and consignees of these products, must also bear, in distinct and indelible characters, the word saccharin.

Further, if the product containing saccharin intended for sale is contained in cases, casks, or receptacles not opened, the inscription will mention the name or social position of maker.

4. Receptacles in which the product containing saccharin is delivered to the purchaser by a retail trader must bear, in distinct and indelible characters, the word saccharinated (sacchariné), as well as the name or social position of the trader or retailer.

5. As regards consignments, the makers, merchants, exporters, or consignees of the products containing saccharin must indicate on the invoices and way-bills or bills of lading, for each individual consignment, that the merchandise exported is sold as a product containing saccharin.

Two other sets of regulations, which come into force on the 1st October, 1891, deal with the artificial coloring of food products and with the utensils, etc., used in the industry and trade in food products.

The first stipulates as follows:

It is forbidden to use for the coloring of food products, such as bonbons, pastilles, sweetmeats, pastries, food pastes, confections, marmalades, sirups, liqueurs, wines, fruits, vegetables, etc., intended for sale, any poisonous coloring matter.

A list of harmless coloring matters, and a list of colors considered as injurious, will be published by the ministry of agriculture, industry, and public works.

It is forbidden to sell, to expose for sale, to detain or to transport for sale any food product manufactured or prepared contrary to the above regulations.

The receptacles or wrappers in which colored or artificially colored food products are contained for sale, either wholesale or retail, must bear, in plain characters, the name and description as well as the address of the seller.

The second set of regulations prohibits the use, for the preparation, preservation, or packing of food products, intended for the sale of these commodities, of any utensils, receptacles, or different objects containing any properties which by contact with the substance they contain become poisonous or injurious to health.

Lead and zinc, as well as alloys, platings, solderings, and enamels containing these metals, arsenic, antimony, or their compounds, must especially be considered as poisonous or injurious to health in the sense of the present regulations.

The above regulations are not applicable to preserve boxes of iron plated with pure tin, of which the solderings are external and are made of an alloy of tin and lead in the proportion of a maximum of 10 per cent of the latter.

It is forbidden to sell, to expose for sale, to detain, or transport for sale prepared food substances, preserved or packed in any way contrary to the disposition of the present regulations.

It is forbidden to sell, to expose for sale, to detain, or transport for sale apparatus, utensils, or articles intended for the preparation, preservation, packing, sale, or manipulation of food products, of which the use is forbidden by the preceding articles.

Any apparatus, utensil, receptacle, or article, of which the parts placed or likely to be placed in contact with food products in a factory, warehouse, or store of the commodities contain tin, metallic alloys, enamels, or coloring materials, must bear, in legible characters, the name or position as well as the address of the maker.

Contraventions of the law will be punishable with fines prescribed by the law of the 4th of August, without prejudice to the application of the penalties prescribed by the penal code.

Talc or Soapstone.

The following was originally addressed to the Atlanta Talc, Mining, and Manufacturing Company, whose sample was analyzed and reported on by Prof. John M. McCandless:

As the general impression is that talc is used mainly for purposes of adulteration, I will give in detail some of the uses to which it may be applied. Talc possesses properties which adapt it to a great variety of economic uses. It is a highly infusible substance, resisting perfectly the greatest extremes of temperature reached in industrial processes. Slabs of it are, therefore, used as fire stones in hearths, stoves, and for register borders and pipe holes, also in tips for gas jets. A very extensive application of the material is opened up in the manufacture of linings for stoves and ranges; in short, wherever an excellent non-conducting and heat-resisting material is needed, there talc would be applicable. The fine varieties are also used in the manufacture of porcelain.

Talc is readily cut with a knife, and is reduced to the condition of a white powder with the greatest ease. This powder has a greasy, soapy feel, hence the name soapstone has been applied to the mineral. These qualities, it is evident, render it suitable for diminishing friction, and when ground it is largely used as a lubricant on the bearings of heavy wheels where the friction is great, lubricating and at the same time, by excellent non-conducting, preventing overheating.

The various other uses to which it may be put, both small and great, are almost numberless. It may be used as a filler in the manufacture of paper, especially in the manufacture of wall paper and shades of the best qualities, where a handsome surface is desired. It is very largely consumed in England, especially as a make-weight in the manufacture of cotton goods exported to China and other foreign countries. It is also very largely consumed in the manufacture of soaps, not only as filler, but also as having no mean cleansing properties of its own. It is also the base of nearly all the face powders and tooth powders, costing scarcely anything, and sold at high prices. Talc is also made into dustless crayons, being far superior to ordinary chalk where a fine line is needed. Tailors use it under the names of "French chalk," "Briancon chalk," and "Venice talc," in marking cloth before cutting. It writes readily on glass, and is used by glaziers for marking glass before cutting with the diamond. It readily absorbs oil and grease, and is used in powder for extracting such spots from silk and woolen goods. It is also used in dressing skins and leather in boots and shoes, and forms a large percentage of the composition of various patent greases, as axle greases. It is also used in imitating engraved stones, being easily cut and afterward hardened by heat, when it may be changed to any desired color by the use of metallic solutions. This is also the same stone known as the "figure stone" of the Chinese, from which exquisite figures and ornaments may be carved. This mineral is also very largely used in adulterations, though this use of it is to be deprecated. Still it is better that an inert, harmless material, such as this, should be used than many substances which are poisonous. As a proof of its harmless nature, it is a species of earth eaten by many savage tribes. It is consumed in the manufacture of candy, and is added to flour, pulverized sugar, baking powder, etc., as a make-weight and diluent, doing no other harm to the purchaser than the harm it does to his pocketbook.

I have examined the sample of talc or steatite received from you. . . . The sample has the following chemical composition:

Silica	63·60 per cent.
Magnesia	33·75 "
Protoxide of iron	1·46 "
Alumina	0·42 "
Moisture	0·48 "
Loss	0·29 "
Total	100·00 per cent.

The analyses of the best Italian talcs only vary slightly from these figures, the essential constituents being silica and magnesia.

Horse Breeding in New South Wales.

Mr. Coghlan, New South Wales Government Statistician, in his report on the wealth and progress of that colony, says that New South Wales is eminently fitted for the breeding of most descriptions of horses, and attention has long been directed to this industry. At an early period of its history the colony was enriched by the importation of some excellent thoroughbred Arabians from India; and the high name which was acquired by the horses of Australia was largely due to this cause. The abundance of good pasture everywhere obtainable also contributed to this result. The native kangaroo grass, especially when in seed, is full of saccharine matter, and young stock thrive exceedingly upon it. This abundance of natural provender allowed a large increase in the stock of the settlers, which would have been a great advantage, had it not been that the general cheapness of horses led to a neglect of the rules of breeding. In consequence of the discovery of gold, horses became very high priced. Under ordinary conditions this circumstance would have been unfavorable to the breed of horses, and such was the case in Victoria; in New South Wales it was far otherwise. The best of the stock of that colony, including a large proportion of the most valuable breeding mares, was taken by Victoria, with the result that, for twenty years after the gold rush, the horses of the colony greatly deteriorated. One class of stock only escaped. The thoroughbred racer was probably improved both by the importation of fresh stock from England and by the judicious selection of mares. The period of deterioration ended about the year 1870, since which year there has been a perceptible improvement in all classes of horses. As regards the actual number of horses in the colony, this shows but little increase for the last sixteen years, the figures for 1874 being 346,691; 1880, 395,984; 1885, 344,697; and in 1889 there were 430,777. The annual increase in the number of horses has not been more than 1·45 per cent during the whole period covered by these sixteen years, while the increase of population has been at the rate of 4·56 per cent. For purposes of classification, the horses of the colony have been divided into draught, light harness, and saddle horses, the number of each particular kind being as follows: Draught horses, 139,378; light harness horses, 109,659; and saddle horses, 181,740.

New South Wales is, says the government statistician, specially adapted for the breeding of saddle and light harness horses, and it is doubtful whether these particular breeds of Australian horses are anywhere surpassed. The bush horse is hardy and swift, and capable of making very long and rapid journeys, when fed only on the ordinary herbage of the country; and in times of drought, when the grass and water have become scanty, these animals often perform astonishing feats of endurance. Generally speaking, the breed of horses is improving, owing to the introduction of superior stud horses and the breeding from good mares. When there has been a deterioration in the stock, this has been due, it is stated, to breeding from weedy mares for racing purposes, and from the effect of the drought. The principal foreign markets for horses are the Indian and Chinese. The total number of horses leaving the colony for markets outside Australia during 1889 was only 668. Although the demand for horses in India is considerable, and Australia is a natural market from which supplies may be derived, there is no one, according to Mr. Coghlan, employed by the Indian government to make himself acquainted with the resources of the various colonies, or to furnish information to intending shippers. The speculation of sending horses to India is one open to many risks, as, apart from the dangers of the voyage, there is always an uncertainty as to the stock being accepted. It is stated that the number of horses in the Australian colonies in the year 1889 was as follows: New South Wales, 430,777; Victoria, 329,335; Queensland, 352,364; South Australia, 170,515; Western Australia, 42,816; Tasmania, 29,778; and New Zealand, 187,382; making a total for Australia of 1,542,957.

IMPORTANT seams of smokeless coal exist in the hills fringing the Gulf of Tonquin. According to Mr. William Warren, an engineer, one of the seams is 152 feet thick. The coal is an anthracite smokeless, and containing 87 per cent of carbon. The steamer Fatshan, making 14 knots, has been successfully tried with it, and the gulf will be of great service to the French as a coaling station in the far East.

Another Underground Electric Railway for London.

In the SCIENTIFIC AMERICAN of November 29, 1890, and in our SUPPLEMENT, No. 771, we gave descriptions and illustrations of the underground electric railway which was lately opened for traffic in London. This road, known as the City and South London Railway, is 3¼ miles in length and consists of two tunnels, each 11¼ ft. exterior diameter, made of iron plates, extending from near the Monument in King William Street, thence under the Thames River to Binfield Road, Clapham. The operations of the road so far have been highly satisfactory; so much so that the parties interested have applied to Parliament for the privilege of building another line of railways, on the same general plan. These tunnels were built very economically and expeditiously by the use of an American invention known as the Beach hydraulic shield for tunneling. The new tunnels are to extend from Shepherd's Bush to Cornhill, and pass through or rather under some of the most important sections of the great city, namely, Cheapside, Newgate Street, Holborn, Oxford Street, Bayswater, and Notting Hill, with stations about half a mile apart at Lansdowne Road, Notting Hill Gate, Queen's Road, Wesbourne Road, Marble Arch, Davies Street, Oxford Circus, Tottenham Court Road, Bloomsbury, Chancery Lane, Newgate Street, and finally Cornhill. Total length six miles, and on an average about 50 ft. below the surface of the ground, rising to a nearer point in some places, but in other places being from 70 ft. to 80 ft. below the surface in the London clay. The proposed capital of the company is $15,000,000.

It was represented to the Parliamentary committee that this railway would do precisely what the existing underground lines did, viz., tap great business thoroughfares; but there would be no such nuisance as that which rose from smoke and steam on the present underground systems; and at the same time the proposed level would avoid any disfigurement of the streets. The sites for the thirteen stations would be excavated first; then the borings would begin, and the excavated material would be carried to the surface and carted away. There would be neither noise nor vibration nor blow holes. The two tunnels, one up and one down, would be perfectly distinct, and consequently each train as it passed through would make its own ventilation. Each tunnel would be 11 ft. 6 in. in internal diameter. The stations being about 50 ft. beneath the surface, special approaches were required. There would, therefore, be at the stations hydraulic lifts, and also stairs for those who preferred them, though it was believed that the majority of passengers would use the lifts, which would be at once easy, speedy, and comfortable.

With respect to speed, Mr. Pember stated that the company would get a maximum of 25 miles an hour, but, including stoppages, the rate would be about 15 miles an hour, and they expect to do the whole journey in 25 minutes, which was 25 per cent better than on the Inner Circle Railway.

Mr. J. H. Greathead, C.E., was the first witness called, and explained that he was jointly, with Sir John Fowler and Sir Benjamin Baker, engineer to this scheme, the object of which was to increase the traveling facilities between the western portion of London and the City.

The main line was nearly straight from end to end, the worst curve being at the junction of Cheapside and Newgate Street, and that was not more than half as bad as the worst curve on the City and South London Railway. The worst gradient would be 1 in 100. He stated that the surface would not be disturbed at all except at the stations.

The whole railway was to be made by boring, and the tunnels would be constructed of iron, as was the City and South London Railway. They would be made of cast iron, and composed in segments bolted together, forming rings of cast iron. In that way a continuous tube of iron would be formed.

In the construction of the tunnels the Beach hydraulic shields are to be used, similar in general make to that employed under Broadway, New York, in 1869–70. The method was described by Mr. Greathead as follows:

A "shield," composed of steel plates, smooth inside and out, fitting over the mouth of the tunnel, and having in front an opening and a cutting edge, and inside a number of hydraulic presses was fixed; this pressed against the end of the tunnel, and as the hydraulic pressure was increased, the shield was forced forward and drew out the clay to the outside diameter of the shield. The material brought out was thrown back to the opening of the tunnel in the front of the shield, and then taken up the shaft. When the tunnel had been advanced to the length of one ring, the segments were brought down and placed inside the shield and bolted together until the last ring was completed. When that was done the machine was ready to go forward again, but there was one other important feature. The space which was left by the advance of the shield—which was equal to the thickness of the plate of the shield—about 1 in., had to be filled up. That was done by "grouting," which forced some fluid cement through holes left for the purpose in such a way as to fill up the space left by the advance of the shield, and thus all chance of a sediment was prevented.

Mr. Greathead stated that on the City and South London line, after a little practice, they were able, by means of a shield of this kind, to tunnel 16 feet a day at one facing, and for several weeks together the rate was 15 feet 6 inches per day; while at one time they did over 100 feet of tunneling a day. The progress in six months was equal to 2¼ miles of completed tunnel, and the tunnels, when once completed in that way, were perfectly stable and safe.

To prevent corrosion in the iron in the proposed work, the iron would be dipped into a composition of tar while hot, and that, partly entering into the iron, formed a skin on the surface. The grouting was thus protected, and there was no chance of corrosion. The iron would be about an inch thick, and the flanges about four inches deep, the space being filled up with cement. This was the system adopted on the South London Railway, except at the stations, where, after the iron tunnels had been driven forward, larger tunnels of brickwork were constructed for the platform. That method enabled them to see how the grout had acted, and in all cases they found the space entirely filled up. In constructing the line, besides working in clay, they had in some places to go through water-bearing strata. He did not think in the new work it would be necessary to use compressed air (Haskins American system), but they would have the machinery ready if it should be required. At Stockwell, where they had to pass through gravel, there were overhead sewers, large water mains, tramways, and houses on each side, but there had been absolutely no subsidence even where they had to go through gravel. At Swan Lane, within 50 feet of the Thames, they passed from clay to gravel and the water entered, but they stopped it by bulkheads and then applied compressed air. The line passed close to and under warehouses, but he was not aware of any vibration being felt in those buildings, and no complaints had been made. Neither had there been any noise during or since construction. The stations had been constructed of brickwork, and some little damage had been done near the stations.

With respect to having two separate tunnels, Mr. Greathead explained that there was a great advantage in that arrangement, as a matter of ventilation, for by the mere movement of the trains perfect ventilation was secured. As the train entered a station it forced the air out, and as it left the station it drew air after it. The tunnel and train really formed a sort of tight-fitting cylinder, and in this case there would be no smoke or steam to vitiate the atmosphere. There would also be no soil vibration. The South London tunnels were perfectly free from moisture. The carriages would be entered at the ends, one reason for this being that it would be impossible to have side doors, because the Board of Trade required that there should be a sufficient space to allow of the doors being open, and in this case that would involve a tunnel 15 ft. or 16 ft. in diameter.

It was also found on the elevated railways in America that end entrances were most convenient, and the carriages on this new line would be very similar to those on the railways in New York. Each train would carry 336 passengers, and it was intended to have two classes. The motive power was to be electricity generated at Shepherd's Bush for the whole line, carried by a main conductor throughout the whole length of the two tunnels. The depot or generating station would be above ground. In addition to the main conductor there would be a working conductor, which was a naked conductor from which the locomotive drew the current as it proceeded. That might be laid between the rails or above. The direct current system would be adopted with a comparatively low tension, such as the Board of Trade had approved of on the South London line. He had no doubt whatever that electricity would prove as efficient in this case as it had on the South London line. It was not intended to erect any temporary shafts, but to make them so that they could afterward be used for hydraulic lifts giving access to the trains. The hydraulic power for working the lifts would be provided at Shepherd's Bush and conveyed through pipes to the various stations. After the water had done its work, it would be returned and used again.

AT a recent meeting of the Cambridge Philosophical Society, a paper was read by Professor J. J. Thomson, on the electric discharge through rarefied gases without electrodes. A vacuum tube was exhibited, in which an electric discharge was induced by passing the discharge of Leyden jars through a thread of mercury contained in a glass tube coiled four times along it. The induced discharge was found to be confined to the part of the vacuum tube which was close to the primary discharge, and it did not show striæ. It was also demonstrated that an ordinary striated discharge is strikingly impeded by the presence of a strong field of magnetic force.

Overrated Aluminum.

If any one ought to know what aluminum is, and what it is good for, it should be one of the leading manufacturers of this metal; and if such leading manufacturer deliberately and publicly says that aluminum is not the extraordinarily good metal that it is popularly believed to be, then we have good reason to suspect that he is right and that popular belief in the matter is wrong. These remarks are suggested by a lecture delivered by Alfred E. Hunt, president of the Pittsburg Reduction Company, before the Boston Society of Arts, on February 12, on "The Properties, Uses, and Processes of Production of Aluminum." He states that the two chief difficulties which his company has met with in selling aluminum and introducing it into the arts and manufactures of the country during the past two years have been, first, the extravagant, erroneous and, in many cases, mischievously misleading claims which have been made concerning the properties of the metal; and second, the equally wide-spread, extravagant, and misleading claims by inventors of processes for the manufacture of aluminum at remarkably low prices.

We have been so surfeited lately with statements to the effect that aluminum is going to revolutionize the world that it is interesting to learn from such a source that it has some bad qualities. Among them are the following:

For many purposes the pure metal cannot be so advantageously used as that containing three or four per cent of impurity. The pure metal is very soft, and not so strong as the impure. The thin coat of oxide which it gains on exposure gives it a pewtery appearance, which makes it undesirable for table ware. It becomes pasty at a temperature as low as 1,000 degrees F., melts at 1,300 degrees F., and loses its tensile strength and much of its rigidity as low as 400 or 500 degrees. It is inferior to copper as a conductor of heat and electricity; in fact, being only half as good. Its lack of rigidity and hardness is an obstacle to its use for many purposes, such as castings. In rolling it, not nearly as much draught can be given to the rolls as in the case of steel.

In cold rolling it requires to be annealed oftener than steel. Alloys of the metal increase in brittleness more than they do in hardness. Its tensile strength per square inch is not greater than that of common cast iron, and only about one-third that of structural steel, while its compressive strength is less than one-sixth that of cast iron. Under transverse test, a 1 inch square bar of cast iron, 4 feet 6 inches between supports, will sustain a load of 500 pounds with a deflection of 2 inches, while a similar bar of aluminum would deflect over 2 inches with a load of 250 pounds. The modulus of elasticity of cast aluminum is about 11,000,000, being only about one-half that of cast iron and one-third that of steel. It combines with iron in all proportions, but none of its alloys with that metal are of value, except those with very small percentages of aluminum. Other elements than aluminum can be better employed to harden iron, and its presence in iron is to be regarded as deleterious, and to be avoided if possible. The addition of aluminum does not lower the melting point of steel, as has been claimed, nor does it increase its fluidity.

One of the most important statements made by Mr. Hunt concerning aluminum is that of its cost. It is not a cheap metal, as now manufactured in the works of the Pittsburg Reduction Company at the rate of 375 pounds per day and selling at about $2 per pound, but he gives what may be called a theoretical estimate of its probable cost when made in great quantities in the future as follows: Two pounds alumina (Al_2O_3 contains 52·94 per cent Al), 6 cents; one pound of carbon electrode, 2 cents; chemicals, carbon dust, and pots, 1 cent; 22 electrical horse power exerted an hour, water power being used, 5 cents; labor and superintendence, 3 cents; general expense, interest, and repairs, 2 cents; cost of a pound of aluminum, 20 cents.

The above statements are made simply as an antidote to the extraordinary claims which have been made regarding the value of aluminum as a metal of construction, and are by no means intended to disparage the value of the metal for the uses to which it is well adapted. These uses are very numerous, and are constantly increasing, and there are great possibilities yet remaining for the metal, especially in the shape of its alloys with other metals, the properties of which alloys are now being made a subject of research. Mr. Hunt's paper treats largely of the uses of aluminum and of its good qualities which recommend it for these uses. He also tells us that the difficulty which has hitherto been found in soldering aluminum has at last been overcome, and that it can now be soldered by the use of the blowpipe with ordinary hard or soft solder, or with pure zinc, or with an alloy of zinc and aluminum as the soldering metal. The novelty, which has just been covered by letters patent, is in the soldering salt, which allows the solder to flow freely on the surfaces to be united. The difficulty of the softness of aluminum is also now overcome by the method of alloying pure aluminum with a few per cent of hardening metal, and by cold rolling, hammering, or drop forging.—*Engineering and Mining Journal.*