

sired, to two minutes. The electrical equipment has been duplicated, so that in case of accident or necessary repairs traffic will not be blocked.

In order to give the whole structure of the road longitudinal stability, rigid double A-frames, with a broad fixed base, are introduced at intervals of about 900 feet, the intermediate A-frames being provided with ball-and-socket joints. By reason of this arrangement, the intermediate posts, or A-frames, as the case may be, are free to move in a longitudinal direction, and accommodate themselves to the expansion and contraction of the supported spans.

In that portion of the line which is built above the river, the total weight of the structure, including the supporting struts or piers, is less than 850 pounds to the foot, while the weight of the portion above the roadways, where inverted U-posts are used, is 785 pounds. When it is considered that the length of the spans average about 100 feet it will be seen that the structure has been designed with a due regard for economy of material. The road cost between \$200,000 and \$225,000 per mile, including the foundations and the stations. If the equipment be included, the cost may be placed at about \$265,000 per mile.

The Charleston Exposition.

BY GEORGE E. WALSH.

The Winter Exposition is something unique and novel even in this age of exposition-making, and probably few cities can offer the climate favorable enough to make such an enterprise successful. Charleston has the peculiar geographical location which makes it accessible to Northern and Southern cities, and with a winter climate that can be described neither as hot nor cold. It approximates that "happy medium" between our extremes of temperature which most people desire.

Situated not far distant from the temperate and tropic zones, the historical city by the sea which appeals this winter to those who love expositions, furnishes an opportunity to learn about the products and habits of life of a tropical and semi-tropical part of our western hemisphere that is rarely accorded to any people. The city is practically a key to the great commercial life which pulsates among the islands of the tropics off our South Atlantic coast, and which each year is becoming more important to us. Charleston is a seaport that has no superior for stimulating the growth and development of the trade with the West Indies and this country; and while our Southern States produce many of the articles of a tropical and semi-tropical nature, there is less rivalry than mutual advantages obtained through exchanging of products with the islands of our coast. Only in an accidental way do we appreciate the importance of this West India trade; yet we sell more merchandise to the West Indies than to all the fifteen republics of South and Central America. Our Pan-American Exposition and Pan-American Congresses are all intended to stimulate a future trade with South America; but here with the West Indies is a trade already in our possession, and yet not half developed. The islands to-day are looking to us to supply them with most of their manufactured goods, and in exchange they offer to send to us the tropical products of their fields and orchards.

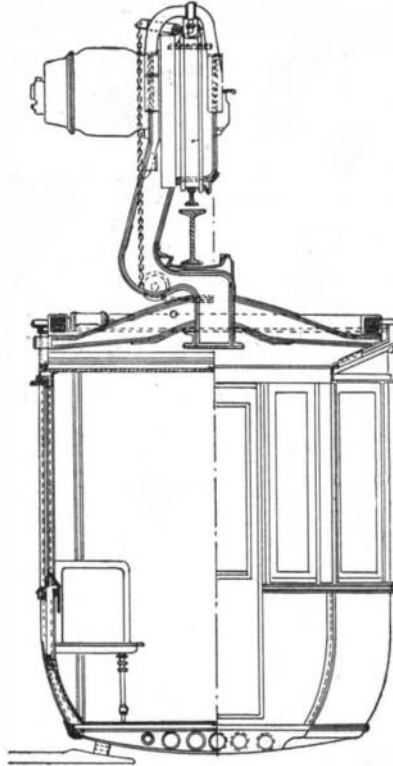
In the year 1900 we sold to the West Indies goods to the amount of \$47,436,677. Compared with the value of our products sold to some other countries which have received far more advertising one may find food for interesting study. In the same year our trade with the South American republics reached a total valuation of \$42,373,255; with China, Japan and Asiatic Russia combined, \$47,396,744; and with the combined countries of Greece, Turkey, Switzerland, Norway and Sweden, Spain, Portugal, Russia and Austria-Hungary, only \$45,089,368. Our trade with the comparatively little-talked-about West Indies suddenly looms up in true proportions when such comparisons are made, and we manage to find more enthusiasm on the subject. Charleston in holding its Winter Exposition for the purpose of exhibiting the products of these islands, as well as those of the South, intends to draw into closer union the interests of the West Indies and those of this country. As a factor in the American expansion of our commerce these islands of the Atlantic must prove of the greatest importance to the South.

The display of the products of the West Indies at the Winter Exposition is of the finest, and the visitor there is enabled to get a very comprehensive idea of the resources of the island. Likewise the exhibits of the American products which the average West Indian will need are made with singular simplicity of aim and desire. The West Indian trader can study what he needs and find suggestions for his own improvement.

Naturally in such an exposition the chief exhibits are of products which the group of South Atlantic States are most interested in. These include cotton, sugar, tea, rice and tobacco. These products, from one of the oldest and richest of our agricultural sections, are in constant demand in the West Indies in

one form or another. Most of the cotton raised in this country comes from a group of the States on the southern Atlantic seaboard most interested in this exposition; and since cotton mills have become almost as numerous there as in New England, manufactured goods of this product will figure as important factors in the future development of that section. It is not without good reason, therefore, that the Charleston Exposition endeavors to draw the West Indian traders to a seaport which aspires to control a trade that is bound to expand as time goes on.

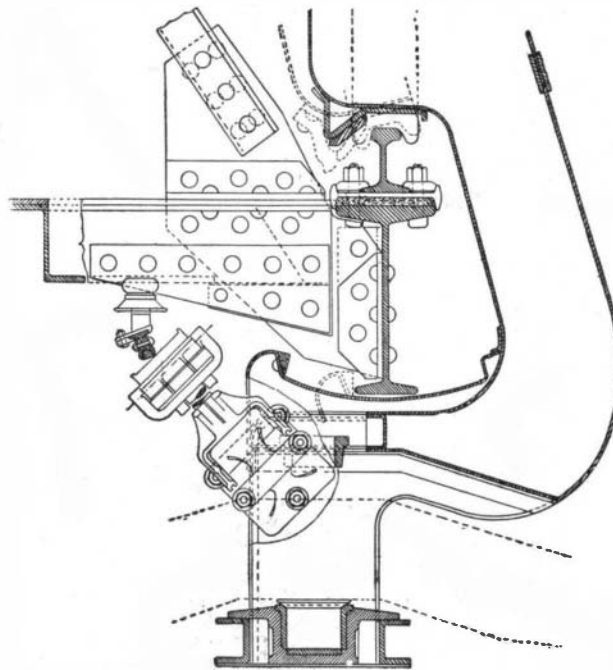
The fact that most of these islands off our coast



PARTIAL CROSS-SECTION AND REAR-END ELEVATION OF CAR.

are owned by European nations, who merely use and exploit them as colonies, makes the trade relations between them and this country all the more interesting and valuable. Great Britain's flag waves over fifty-six of the islands, the Netherlands over five, France's over three, and Denmark's over three. By their geographical position and natural trade conditions they should either belong to this country or be independent and commercially bound to us; but political rulings have arbitrarily changed their destinies, though not their actual trade development.

Trade conditions between this country and the West Indies are further emphasized by a comparison of the consumption of our goods according to the population of the islands. Thus during the year 1900 the people



METHOD OF SUSPENDING THE TRUCKS.

of the islands imported from this country our surplus goods, per capita, to the extent of \$7.90. The imports, per capita, in China of our goods amounted to 3 cents. The same proportion existed between the people of the Philippines and our exports to the islands, while the South American republics imported goods, per capita, from us to the extent of \$1.13. Considered from any point of view the trade with the West Indies is one of the most important we have, and anything to encourage and stimulate it must be of general benefit to the whole country.

An egg of the great auk was recently sold in London for 240 guineas.

Correspondence.

Power from Rivers.

To the Editor of the SCIENTIFIC AMERICAN:

How to utilize the water power in navigable rivers is a problem which has received but little attention from engineers. In these days of big accomplishments, when capital seeks investments in the largest enterprises, it is strange that an attempt has not been made to wrest power from the big, sluggish rivers which have played so important a part in the development of our country.

To stimulate thought on this subject I submit a plan for using this wasted power.

Supposing it is decided to take power from the Missouri River at Omaha, Neb., the power to be used for traction and lighting purposes. We will say that the average fall of the river for ten miles is seven feet to the mile, or seventy feet to the ten miles. We lay a dozen lines of pipes, each two feet in diameter, on the river bed from Omaha to a point ten miles up the river.

By having the upper ends of the lines of pipes terminate at a foot below the surface and near the bank, so as to leave the river clear, we would have a power at the lower end which would raise twelve columns of water, in pipes, sixty-nine feet above the surface of the river. The power which could be thus utilized would be limited by the number and strength of the lines of pipes, which could extend any distance up the river.

The first cost of a plant constructed on this plan would be large, while the maintenance and operating expenses would be comparatively small.

EDWARD P. SHARP.

Lincoln, Neb., December 31, 1901.

[There are plants erected on this system in various parts of the country.—Ed.]

An Esquimau Arrow.

To the Editor of the SCIENTIFIC AMERICAN:

A few days ago a very large wild goose, weighing 16 pounds, was shot and killed by a hunter on the shores of Lake Liberty. This body of water is located in the Spokane Valley, about 12 miles from the city of Spokane, Wash.

The hunter was standing near the lake, when a flock of geese came winging their way from the north and settled in the tall hedge. He shot and brought one down.

As he picked up the big honker, he was surprised to see a piece of polished ivory protruding from the breast of the goose. The ivory projected about two inches. With great difficulty the man pulled the stick out, for the flesh had grown tightly around it, and the wound had entirely healed.

He then saw that it was the long, sharp point of an arrow, which was made of ivory, about eight inches long, and as large as an ordinary lead pencil.

There are some queer, delicate carvings on the ivory where it had been attached to the arrow-stick. No such arrow has ever been seen in this part of the country, and it could not have belonged to any of the Indian tribes. The Indians in all these regions have, for many years, discarded the use of bows and arrows.

Evidently, the bird has borne the arrowpoint for thousands upon thousands of miles from the far Arctic regions where it had been shot by some Esquimau hunter. The point was deeply embedded in the flesh of the breast, and had touched no vital spot. In the bird's long flight, the arrowstick had doubtless been broken off. The goose was a full-grown male, and had probably received the wound a long time ago.

Some returned Cape Nome miners pronounce the arrowhead of Esquimau manufacture. It will be preserved in the State Museum.

J. MAYNE BALTIMORE.

Bossburg, Wash., December 30, 1901.

The Current Supplement.

The current SUPPLEMENT, No. 1360, has for its first page engraving a portrait of Mr. Marconi, and in the article his recent address before the American Institute of Electrical Engineers is given. "The Need of Direct Steamship Service to Africa" describes conditions which warrant the opening of an American line. "Locomotive Steam Carriage" gives a detailed drawing showing a full section of the carriage. The Meeting of the Geological Society of America is specially reported for the SUPPLEMENT by E. O. Hovey. The Annual Report of the Secretary of Agriculture is continued.

In the course of two years, a thriving town, known as Deferiet, and a gigantic paper mill have been built and put into operation on the Black River, New York. The mill is that of the St. Regis Company and it has a capacity of one hundred tons per day. An investment of two millions is represented in the company's holdings at this point.

Automobile News.

For the purpose of overcoming the inexplicable prejudice of many of the provincial county councilors of Great Britain to the motor car, the Automobile Club of London proposes to inaugurate a series of trials, for the purpose of obtaining accurate and incontestable information as to the length within which motor vehicles may be stopped when traveling at various speeds. The trials will also afford an excellent opportunity of demonstrating how impossible it is for bystanders to gage accurately the speed of motor vehicles, as most of the aversion to motor cars is based on ignorance of their capabilities, especially in the matter of stopping suddenly when going at a high rate of speed.

Although electrically-propelled vehicles have proved a failure in London, they have proved successful in other parts of Great Britain. During the trials of automobiles at Glasgow, during the exhibition, one electric motor car accomplished a very satisfactory performance by traveling 1,000 miles without an accident. The car first ran from London to Glasgow, a distance of 486 miles, climbing several steep hills, including a severe gradient up a mountain in Cumberland, ten miles long, rising to a height of 1,250 feet above the level of the main road. The accumulator used, although of special design, was only special in that it was a special development of the line upon which all inventors are advancing in this matter. After being driven to Glasgow the car participated in the trial runs around the city and the neighborhood, covering 285 miles in all. It was then conveyed to Liverpool by ship, and ran a further 386 miles, by Birmingham, Bristol and Salisbury, back to London. The day's runs were such as any motor car might take, stopping at convenient places en route, the distances between stops measuring from 40 miles to 84 miles. The total costs of the run 1,172 miles worked out to 5 cents per mile.

The government of Cape Colony are having constructed in England a number of motor "quads," or light four-wheeled machines, for use on the Cape lines which need protection against rebels and Boers. Mr. Donald Menzies, a well-known colonial engineer, is responsible for the idea, and has prepared the specifications of the machines. Each vehicle is to have a carrying capacity for six men and is to travel at a speed of 30 miles per hour. The weight of each motor quad is not to exceed 135 pounds. Several of these vehicles are already in use, and have given the greatest satisfaction in patrolling the line. The vehicle is built with tubing and is pneumatic-tired. Flanges attached to the wheels prevent the "quad" from leaving the line, and by its means rapid scouting on the railways is possible. It carries sufficient oil for a three days' journey. The "quad" is eminently adapted to scouting, since it affords a much less conspicuous target to the enemy's fire than a railway engine, and it can be lifted off the track by a couple of men should a break in the line render it necessary. Moreover, it can travel at a greater pace than would be safe for an engine on some parts of the Cape lines. It is proposed to supply every section of the Cape Colony railroads with these motor vehicles.

Visitors to the Paris Automobile and Cycle Show will no doubt be surprised at the great advance which has been made in the application of alcohol as a motive power. In France this is an especially interesting question, as alcohol is a home product, while the petroleum used in so many machines is imported from America or Russia. Consequently every effort is being made to develop this branch of the industry and the Minister of Agriculture is especially interested in the subject. The basement of the Grand Palais will contain some novel exhibits devoted to alcohol production and different types of motors and automobiles will be well represented. The large vault will be handsomely fitted up and lighted by electric or the new alcohol lamps. The main wall is covered by an exceptionally fine decorative design by Jambon, representing the Production of Alcohol. A model farm will be shown which is operated entirely by alcohol motors, including reapers, thrashing machines, mowers, etc. The center is reserved for a large exhibit of automobiles which use either pure alcohol, or a mixture of gasoline and alcohol. The De Dion-Bouton Company are to have a unique exhibit to show their new type of small alcohol motor applied to domestic operations such as wood-sawing, corking of bottles, and butter making, as well as for different industrial purposes. The immense hall of the Grand Palais will be devoted, as last February, to the main exhibit of automobiles and motors of the regular types and will also include many novelties. One of the "clous" of the Automobile Show will be the famous balloon No. 6 of Santos-Dumont, which gained the Henri Deutsch Prize. The aeronaut had dismounted the balloon and intended to take it with him to Nice where he is to continue his experiments with a view of passing across the Mediterranean, first to Corsica, then to Africa. However, he was prevailed upon to send it instead to the Automobile Show, and will use instead the No. 7 which he is now constructing.

Engineering Notes.

The British Admiralty proposes to remove the cowls and other ventilating apparatus from the decks of warships, experts having decided that they retard the speed of vessels.

The Pennsylvania Railroad is now experimenting with ties imported from Demerara, British Guiana. The ties are hardwood and are expected to last a long time while in service. It is said that they will last about fifty years. The ties will be used on the main line and several places in the vicinity of Philadelphia, and will cost about \$1.50 each delivered in Philadelphia.

An incident showing the value of quick wit in taking advantage of the situation in an emergency occurred on the coast of England, where a number of pilot-boats and fishermen, having been caught in a storm, ran for the harbor, but failing to get quite into safety made for the end of a long pier which was being erected where there was a "Titan" crane. The boats were run under it and hitched on to the tackle, when five boats and fifteen men in them were lifted bodily into port.

American street railway promoters have invaded St. Petersburg, and have, according to a dispatch to The London Standard, submitted a proposal to take over the entire tramway system of that city under a twenty-five years' contract, the lines to be relaid and extended in all directions, and horse cars to be replaced by electric cars. The scheme includes the building of a substantial bridge across the River Neva to replace the existing wooden structure. The capital, to be raised in the United States, will be 100,000,000 rubles, half of which will be in ordinary shares and the remainder in guaranteed.

The English railway managers who came to this country a few weeks ago to investigate our systems in their specialties were treated to a run on a fast train, which must have enlightened them somewhat as to the speed possibilities of American locomotives. The train weighed 210 tons behind the tender (without engine and tender) and consisted of five cars. A run of 55½ miles was made at the rate of 71.6 miles per hour, including three checks. During this run 35 miles were covered at 81½ miles per hour, and one mile at 85.7 miles per hour. The last two miles were run to a dead standstill in 120½ seconds.

The thoroughfares of Paris, like those of London, suffer severely from congested traffic, which considerably retards business. The Parisian municipal authorities are contemplating the construction of underground methods of rapid communication. M. Cassalonga, the well-known engineer, has prepared a scheme for relieving the congested state of the street traffic in various parts of Paris, by means of a subterranean moving platform, similar to the traveling footway which was one of the novelties of the last Paris exhibition. The revolving footway, which is to have perpetual motion, would be divided into four sections, the fastest traveling at the rate of thirteen miles an hour.

In view of the magnitude of British interest in the petroleum industry, a Petroleum Institute has been founded in London for the purpose of affording technical and scientific instruction in relation to the industry, and to serve as a central bureau for the dissemination of information concerning it. The project has met with the approval of many of the leading companies interested in petroleum, and arrangements have been made for a number of their engineers and managers to deliver lectures at the new institution. Courses of addresses will be delivered dealing with the historical, geographical and geological aspects of the industry. The extent of the British interests in petroleum may be gathered from the fact that upward of \$125,000,000 capital is invested in the industry, while the value of the tank steamers engaged in the distribution and carriage of the oil flying the British flag, represents another \$50,000,000.

A serious blow has been struck at the export trade of British sewing machines to Germany by the levy of a prohibitive tariff upon this domestic article, whether it be of English or foreign manufacture. The new duty on cast-iron stands with machine will vary from \$1.25 to \$5, and on hand-power sewing machines it will run as high as from \$6 to \$9. Last year Germany imported 83,916 hundredweight of sewing machines with stands. Of this large amount, 66,866 hundredweight came direct from England either as of British make or transhipped from England, equivalent to a value of more than \$900,000. This new tariff will affect our sewing machine export trade as well as that of England. Last year Germany bought from us sewing machines of the value of \$1,125,000. It is anticipated that the levying of this new tariff will considerably assist the home manufacture of Germany, and will also increase the export trade of that country in this connection to an appreciable extent. Last year the German export trade in sewing machines increased by 40,000 hundredweight.

Electrical Notes.

The gross earnings of the summer parlor-car service of the Brooklyn Rapid Transit Company to Coney Island were \$4,812.

The Milan-Turin-Paris telephone line is now being finished and will soon be ready for service. This will be the first international telephone communication of Italy. A second line from Milan to Zurich will be completed in a few months, as it only remains to finish the section from Como to Chiasso on the Swiss frontier. The line from Milan to Paris will connect the Italian telephone system with London, and the Zurich line with Berlin. It is expected, however, that a direct line will be run from Milan to Berlin.

The Athens-Piræus railroad is soon to be transformed to the electric system, using the overhead trolley, and bids have been asked from leading electric companies. It is expected to thus have the trains circulate 15 to 30 minutes apart, according to the season. The trains will be provided with freight cars, but there will be besides a regular system of freight trains. These latter will be drawn by electric locomotives, while the ordinary trains will use motor cars. This line has a continuous grade of 1.4 per cent.

The Earl of Crawford has devised a means of manipulating a vessel's rudder by means of electricity from any part of the ship. A practical demonstration of the invention was recently given upon the inventor's steam yacht "Valhalla" in the Solent before several representatives of the British and Japanese navies, who were considerably impressed with the device. It is stated that the British Admiralty proposes to give the invention a thorough trial upon one of the battleships. The most prominent feature of the device is that it is not so liable to accident as the steam gear, and it is much easier to manipulate.

The boats on the Miami and Erie Canal from Cincinnati to Toledo will shortly be towed by electric locomotives, says the Mechanical Engineer. These locomotives will each be equipped with two 125 horse power alternating-current motors of the Westinghouse type. In the city the current will be delivered at 380 volts and in the country at 1,100 volts. Along the first section of the line, from Cincinnati to Dayton, there will be four transformer stations, and current will be delivered from lighting plants in the various towns at 33,000 volts. When towing boats the locomotives will have a speed of about three miles an hour, but by cutting out one of the motors this can be increased to six miles an hour, when it is desired to cut loose from the boats.

A detonator for dynamite has been invented by M. Aubert, of St. Etienne, France, says The Engineer. It is intended for use in coal mines where gas is present in dangerous volume and it is operated without the use of electricity. A copper tube receives the end of the fuse for several inches; and at the other end of this tube is a percussion cap similar to those used in toy pistols. This cap lies against the side of the tube, which is there pierced by a small hole, and the fuse end is only 0.07 inch from the cap. The end of the tube containing the cap is inserted into another copper cylinder containing the firing mechanism. To operate the apparatus the outer tube is held in the hand and a smart blow on a button explodes the cap; the gas from the burning fuse fills the cylinder, but is prevented from escaping outside by the metallic gauze which covers all openings in it.

The directors of the Mersey Tunnel Railway hope, in January, 1903, to run their system by electricity, says The Mechanical Engineer. The desirability of this reform, both on the score of speed and cleanliness, has long been recognized by the directorate, but monetary difficulties have until now prevented its initiation. The three-rail system, similar to the one employed on the Liverpool Overhead Railway, will be adopted. There will, however, be a slight difference in arrangement, to meet the special requirements of the Board of Trade. On the Overhead Railway the positive, or working, electric rail is in the center of the track, and the running rails are utilized as the negatives. In the Mersey Tunnel the "positive" will be just outside the metals, and, to keep the running rails entirely free from electric current, a "return" rail will be laid in the middle of the track. Electric motors, and not engines, will be used, and the cars will be 60 feet in length, capable of seating 60 passengers, "first" and "third" class only. All preparations for commencing the work of conversion are now complete, and the various sub-contracts have been let. Already the foundations of the generating station, which will stand in Shore Road, Birkenhead, adjoining Hamilton Square Station, are being made, and the building proper is to be commenced in the coming spring. To meet the anticipated increase of traffic the lifts at James Street will be fitted with two sets of doors—one for entrance, the other for egress only. The lifts themselves will still be worked hydraulically, but the necessary power will be supplied by electricity instead of by steam, as at present.