THE CULTIVATION OF COCOA IN THE WEST INDIA ISLANDS.

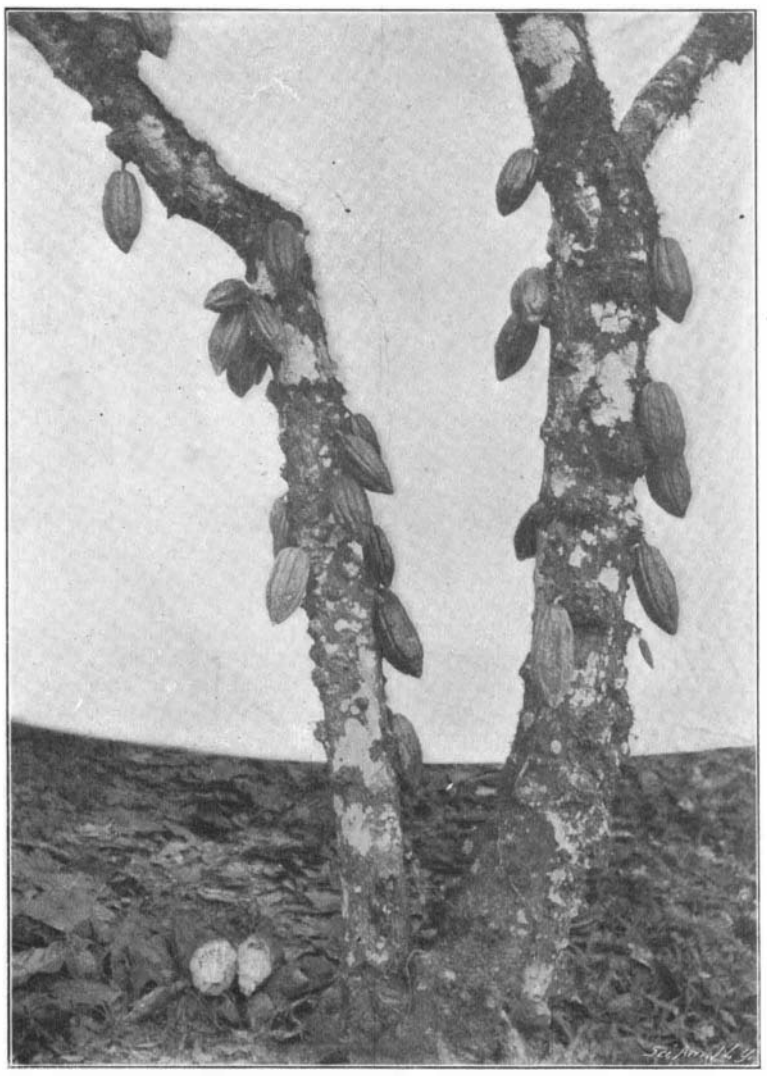
To the active young man possessed of a limited amount of capital, who is looking for an occupation as well as investment, in the Lesser Antilles or in many parts of Venezuela, the cultivation of cocoa is at the present time the most inviting of the agricultural pursuits. The island of Trinidad, which is the one most familiar to the writer, produces cocoa of a quality second to none, and only equaled by that grown in the vicinity of Caracas, and always brings the highest price in the London market. Considerable patience is required to grow it from the seedlings, as it takes five or six years of cultivation before there is a harvest worth mentioning, and seven or eight years before a full crop can be realized, but when the trees are once full grown they will continue to bear fruit for an almost indefinite time.

Cocoa has been grown on this island, as early as 1700, in considerable quantities, and there is so much of its area under cocoa cultivation that it is always possible to purchase bearing plantations at a price that would make a paying investment for the man who will give his own time to the management. Want of proper care seems to be the cause of more failures than the lack of the trees to produce paying quantities, or the market price of the product.

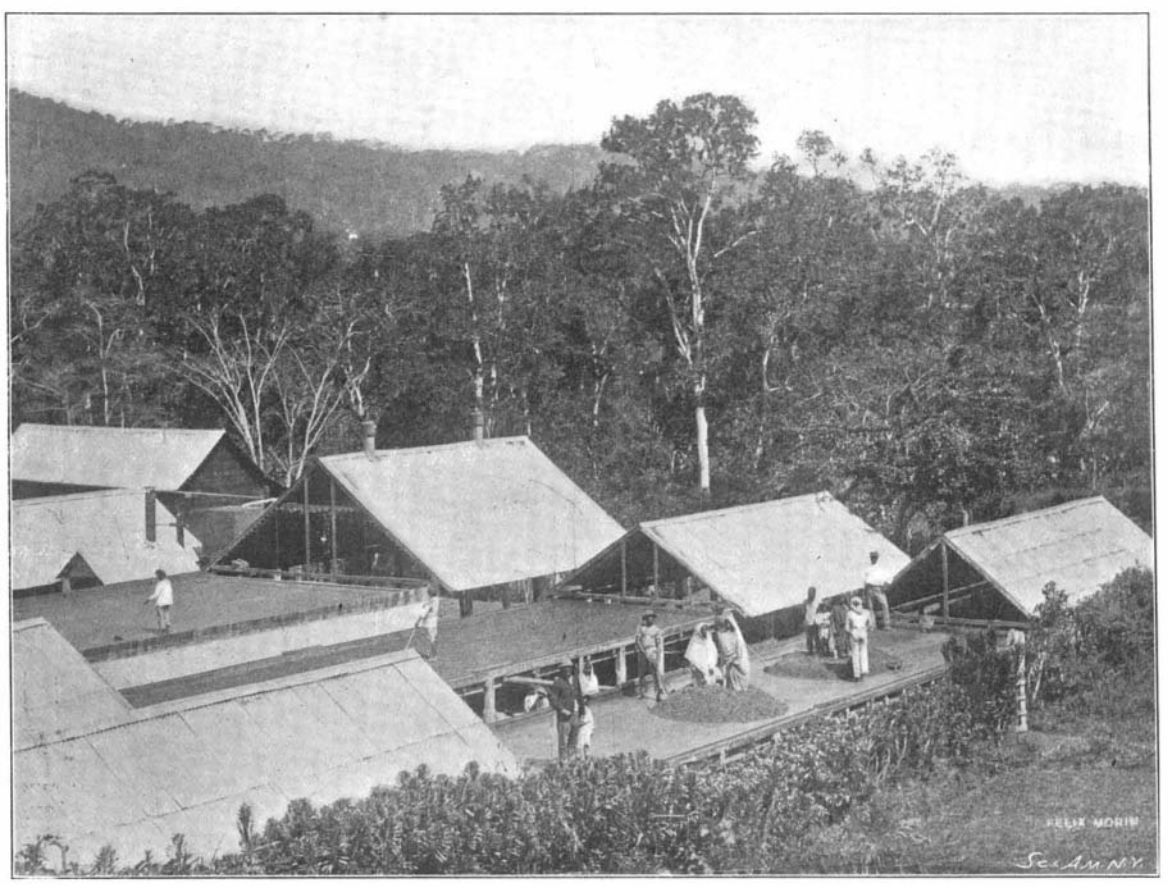
The cocoa tree seems to flourish best in the rich and well-watered soil along the banks of the many ravines that traverse the uplands of the island, where they are more or less protected from the violent storms. The small plants are reared in nursery grounds until they are ten or twelve inches high, when they are planted in rows like a northern fruit orchard. The cocoa tree must always be protected from the powerful rays of the tropical sun, that seems to blast the fruit. When young, they are shaded by growing bananas or plantains adjacent to the young tree; these grow very rapidly and furnish the required protection, as well as a source of some profit, while the cocoa is too small to bear. But it is necessary to provide for a future shade—for the cocoa after three or four years outgrows the banana—and for this purpose a tree known as the "Bois Immortel" (sometimes called the "Mother of the Cocoa") is planted at the same time as the cocoa tree; this is a tall tree with high and spreading branches that form a sort of canopy over the entire cocoa plantation and give it the required shade, making it resemble an open forest. The Immortels are shown in the illustration immediately behind the dry-houses, with the smaller cocoa trees underneath. The coffee tree, which is much smaller than the cocoa, is often grown in small quantities among the cocoa.

The cultivation of cocoa consists largely of draining the land, keeping down the undergrowth of bush and weeds, and trimming the trees. The flowers occur in clusters on the main branches and on the trunk of the trees, usually only one of each cluster reaching maturity. The fruit, which is seen in the illustration, is a hard pod six or seven inches long, resembling a cucumber, growing from the trunk or large branches, and looks very much as though it were artificially attached. Buds, blossoms and fruit, in all stages, occur side by side, and ripened fruit is harvested at all times of the year. The main crop, however, matures in the dry season and is usually harvested in February; only small quantities ripening during the remainder of the year.

The pods each contain five rows of seeds or beans, quite similar to a large, thick Lima bean, embedded in a pink, acid pulp. These seeds are the cocoa beans of commerce. The harvesting consists of cutting off the mature pods by means of a knife on a long bamboo pole, gathering them into heaps on the ground, where they are allowed to lie for about twenty-four hours. They are then cut open with a cutlass, the seeds and pulp coming out in a mass; these are carried to the dry-house. The dry-house consists of a smooth, tight floor, or platform, set on posts at a height of four or five feet above the ground to allow a free circulation of air underneath. A light iron T-rail is spiked on each side near the edge and extending one-half the length of the floor beyond each end; a corrugated iron roof, with its eaves level with the floor, covers the platform. This is carried on a frame, divided in the middle of the floor, mounted on small car wheels traveling on the rails. The drying of the beans is accomplished on this floor by spreading them over it and exposing them to the sun. The roofs are to protect them from the rain and dews, and are kept wheeled back on the extended tracks when the sun is shining. As soon as the beans reach the dry-house, they are placed in the "sweat box" or pit, where they are closed up tight and allowed to ferment for some time. This process requires very careful attention to prevent the temperature from getting too high and to stop the fermentation at the proper time to insure the proper flavor, as well as the fitness for the preservation of the beans.



COCOA PODS ON THE TREE.



COCOA DRY-HOUSES IN TRINIDAD—MIXING THE BEANS.

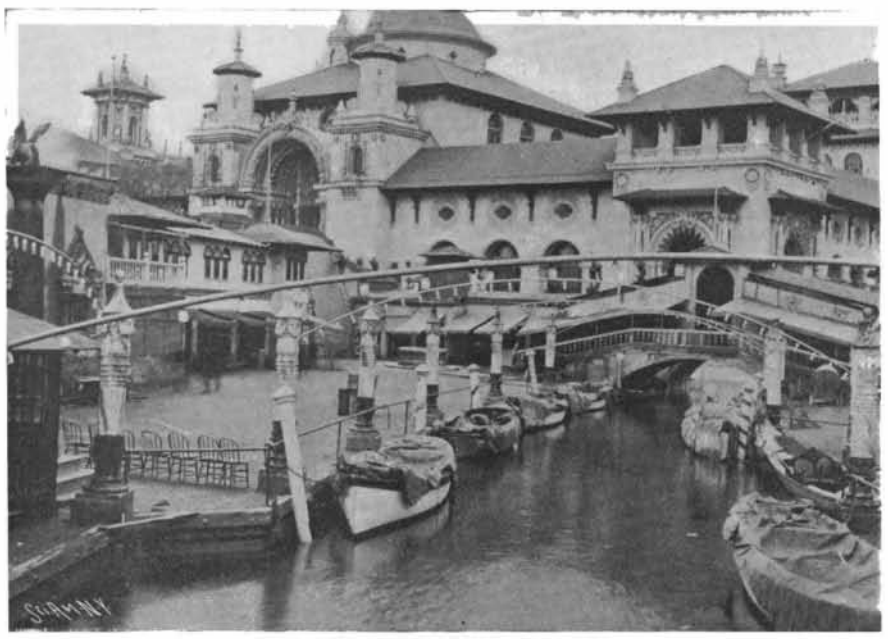
The next process is the drying, which is accomplished by spreading the beans in a layer over the platform and drying them in the sun. Laborers are kept constantly stirring them, while exposed to the sun, with a wooden rake, so that they will dry evenly. Each morning, during the early stages of the drying process, the beans are gathered into a heap in the middle of the floor and given a thorough mixing. This is sometimes accomplished by the laborers mixing and kneading them by treading them with their bare feet, as shown in the illustration. This is known as "dancing the cocoa" and renders the beans smooth and uniform in color. It usually requires ten days or two weeks to finish the drying, depending on the weather; a great many attempts have been made to dry the beans artificially with more or less satisfactory results, but no generally satisfactory drier has yet been designed, and the open dry-houses are in general use throughout the island. It only remains, however, for some ingenious mind to make a careful study of the requirements. The most difficult problem seems to be to get an artificial drier that will give the proper color to the dried beans—the brick-red color, and the property of retaining it is a very important feature in the cocoa market. The dried beans, when ready for market, are put in canvas bags holding about 150 pounds, and the name of the plantation stenciled on the bags, these names or brands at times becoming very prominent in the market for the quality of cocoa the plantation is reputed to produce.

The manufacturing, which is invariably done in northern factories, consists of roasting the beans in a revolving cylinder; this develops the aroma and fits them for crushing. After the beans are crushed they are screened to separate the "nibs," or crushed nuts, from the shells. The nibs are then ground to a fine meal; this is put in sacks and put in a powerful press, where it is subjected to heat and pressure, and the fat, known as "cocoa butter," is squeezed out, and the hard substance left in the sack has only to be broken or powdered to became the pure chocolate, and this more or less adulterated is the chocolate of commerce.

THE PAN-AMERICAN EXPOSITION.

The Pan-American Exposition is rapidly nearing completion. There still remains considerable work for the gardeners, and a number of exhibits are yet to be installed. All of the principal buildings are entirely finished, and only a few minor structures are in a state of incompleteness. A notable exception, however, is the Art Building, which will not be opened for some weeks. We present a number of engravings prepared from photographs taken by the staff-photographer of the SCIENTIFIC AMERICAN. They embrace a number of new views and subjects which have not before been photographed. The current issue of our SUPPLEMENT is largely devoted to the Exposition and contains a large number of engravings of the various buildings and groups of statuary, and is accompanied by an extended article.

The pictures which we publish this week are intended, as far as possible, to give an idea of the attention which has been given, not to the buildings proper, but to what might be considered special features of the Exposition, such as the effects produced by the aid of canals, bridges and landscape gardening. The mall which connects the two most important entrances, which are most used by visitors, is spanned and decorated with orna-



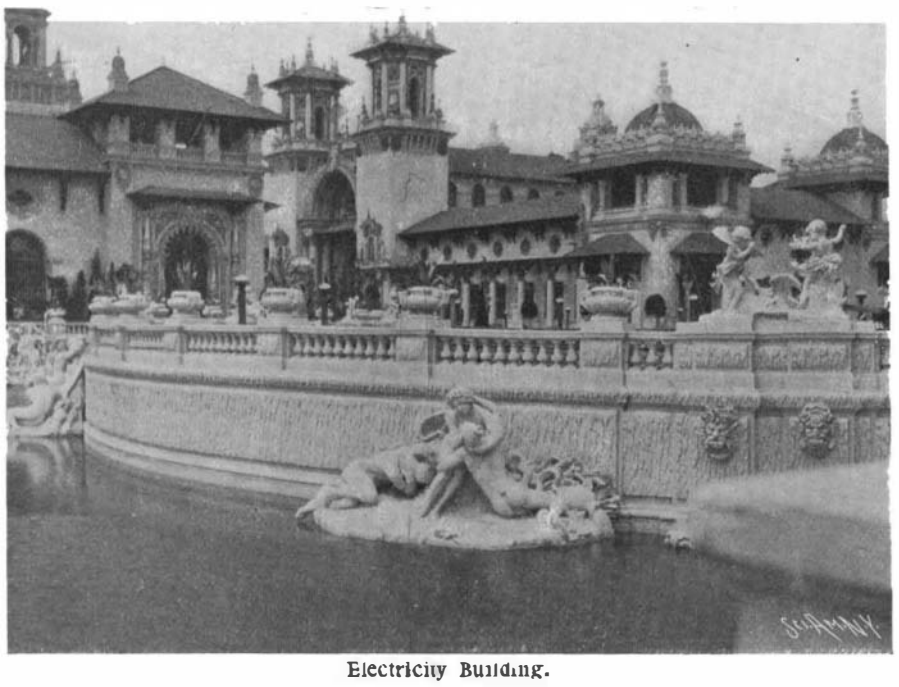
Venice in America, from the Rialto.

One of the Small Canals.

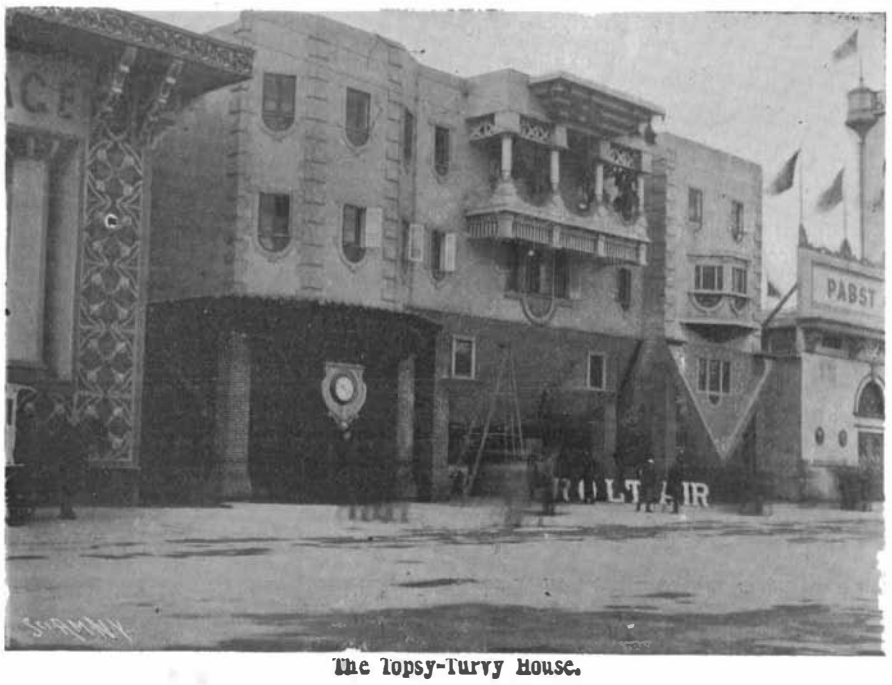
The Horticultural Building.

The Mall.

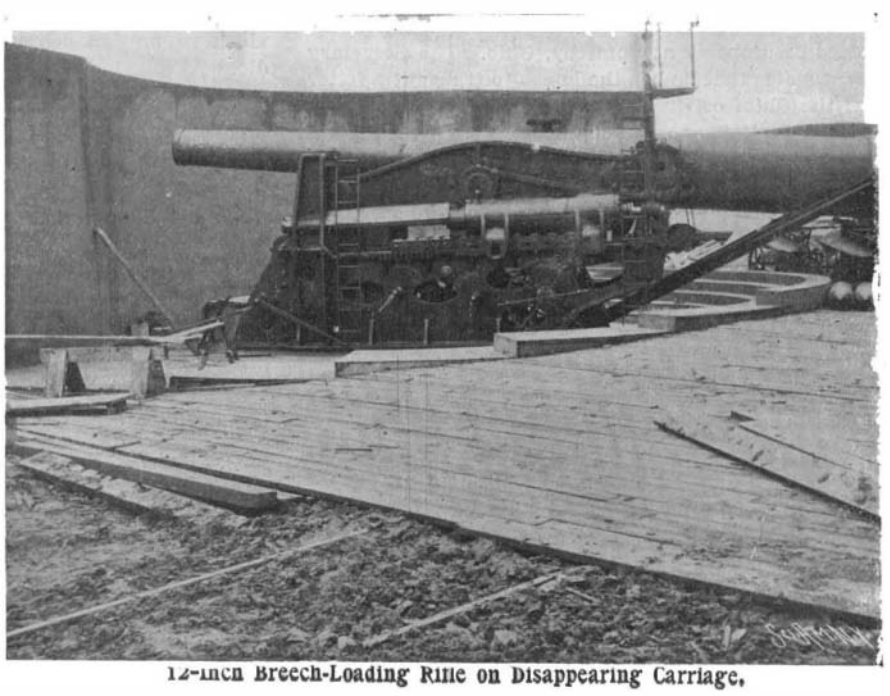
Fountain and Agricultural Building.



Electricity Building.



The Topsy-Turvy House.



12-inch Breech-Loading Rifle on Disappearing Carriage.

BITS OF THE PAN-AMERICAN EXPOSITION.

mental trees and shrubbery. It is embellished by statues, and is lighted at night by posts, the top of each being a mass of small incandescent lights, for the arc light is banished from the grounds except for illuminating outskirts of the reservation, the result being there are no excessively bright points to strike and offend the eye. The Grand Canal, which is over a mile in length, extends around the central group of large buildings, and is shown in several of our engravings. The outer bank of the Canal and the banks of the lagoons are sodded and set with trees and flowers, producing vistas of great beauty. The canals are crossed by many bridges, and statues, groups of statuary and fountains are distributed with a lavish hand. The buildings with their polychromatic decoration compose admirably with the water, bridges, statuary, trees and flowers.

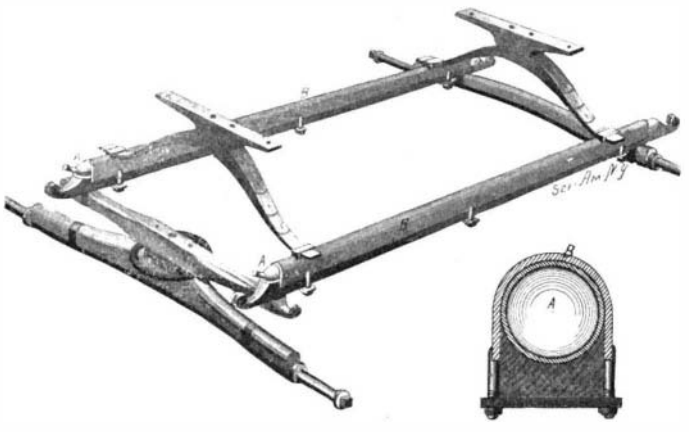
Even the attractions of the Midway in many cases fit in admirably with the architecture of the buildings. This is especially the case with "Venice in America," which is composed of a number of replicas of Venetian palaces, shops, bridges and canals, and gondolas, with real gondoliers, can be engaged to make the circuit of the Canal. The "Topsy-Turvy House" is one of the oddest attractions on the grounds. It represents a house standing on its roof. The visitor enters through the roof and after going up or rather down several flights of stairs, he reaches the cellar, which is converted into a roof garden. Even the flower-pots on the balcony are upside-down. One of the most interesting exhibits is the 12-inch breech-loading rifle on a disappearing carriage, which is in the rear of the Government Building. The government exhibit, as a whole, is remarkable for its completeness, and the visitors are sure to appreciate this fine example of American ordnance manufacture.

A PNEUMATIC SPRING FOR VEHICLES.

The shocks to which a vehicle is subjected as it travels over an uneven road are absorbed in a novel way in an invention patented by William W. Humphreys, of Sheffield, Ill.

The two parallel reach-bars, connecting the front and rear axles, are concaved to receive two long pneumatic cushions, *A*, each closed at one end and provided with an air-valve at the other end. Curved saddle-plates, *B*, are carried by the cushion-springs to support the vehicle-body, and are prevented from being accidentally displaced by means of bolts.

When the cushions are inflated, the jolting of the vehicle is so thoroughly absorbed, that only a gentle rocking motion is felt by the occupants. Automobiles



PNEUMATIC CUSHION FOR VEHICLES.

and two-wheeled vehicles can also be fitted with the pneumatic cushion.

Document 384 of the Fifty-sixth Congress.

We have received Document No. 384 of the Second Session of the Fifty-sixth Congress, dealing with the damage to property at Pomeroy, Ohio. The Secretary of War states that he has the honor to transmit a letter from the Chief of Engineers, U. S. A., submitting certain facts relative to the claim of Mrs. B. N. Reuter, amounting to $1, for damages to a window and curtain in her residence, caused by a fragment of rock thrown by a blast by government employes while removing rock from the river bed and banks of the Ohio River, at Pomeroy, Ohio. The Chief Engineer considers that damages inflicted by the torts of the government officers or agents are in the nature of unliquidated damages which no executive officer has authority to settle. He therefore recommended that Congress be asked to insert the following amount in the next general deficiency bill:

POMEROY, OHIO, November 5, 1900.

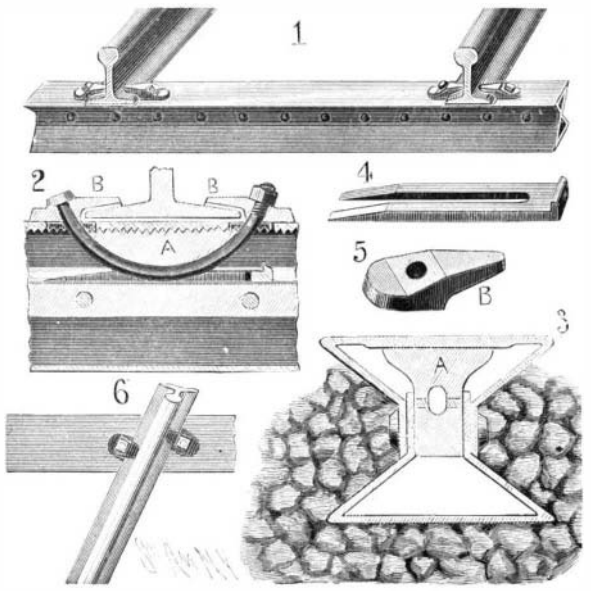
U. S. Government to Mrs. B. N. Reuter, *Dr.*

To one 14 x 32 double-strength glass	$ .50
Glazing same	.25
One curtain damaged	.25
Total	$1.00

The estimated number of telephone exchange connections in the United States is 1,825,000,000 annually.

A NEW METAL RAILWAY TIE.

Perhaps no railway appliance contains so much promise for the future as the metallic tie; for the time will soon come when our fast-disappearing forests must necessitate the abandonment of the wooden sleeper for the more durable and stronger metal tie. The illustration which we present herewith pictures one of the latest attempts which have been made to provide a metal tie which will answer the needs of the modern railway. The inventor of the tie is Mr. Chester Rabert, Coalburg, W. Va. Fig. 1 is a general view of the tie; Fig. 2 is an enlarged sectional view; Fig. 3 is an enlarged cross



A NEW METAL RAILWAY TIE.

section of the tie; Fig. 4 shows a split-wedge employed; Fig. 5 represents a novel washer serving to hold the rail in place; and Fig. 6 shows a method of securing the rail at any angle and at any point on the tie.

The tie is composed of interlocking upper and lower sheet-metal sections. The sections are so bent that the general outline of the tie in cross section, as shown in Fig. 3, shows a wide flat base and top, sharply re-entrant sides and corresponding vertical parallel side portions. Interposed between the side portions is a reinforcing block of metal, extending the entire length of the tie. The vertical portions and the block are firmly bolted or riveted together. By reason of the peculiar hollow form this construction combines great strength and lightness. Downward strains upon the upper section of the tie are concentrated upon the reinforcing block.

Each rail, as shown in Fig. 2, is secured to the tie by a curved bolt extending through openings in the top of the tie and seated in a saddle, *A* (Fig. 2); the ends of the bolt pass through washers, *B*, overlapping and securing the base of the rail. The rail is seated upon a piece of hard felt or other sound-deadening material. As shown in Fig. 5 the washers have a circular body portion designed to rest upon the upper face of the tie, and an extended lug or projection overlapping the edge of the rail-base. The under surface of each washer is cut away beneath the lug portion to form a shoulder or abutment bearing against the edge of the rail-base.

The curved bolt connecting the washers is seated in a groove formed in the under surface of the saddle, *A*, and in a recess extending throughout the entire length of the reinforcing-block. The saddle, *A*, and the lower opposing face of the top of the tie are both toothed, so that a firm interlocking connection is provided to prevent longitudinal movement of the saddle. A split-wedge of the form shown in Fig. 4 is used to straddle the bolt and to pass between the central reinforcing-block and the saddle.

As shown in Fig. 5, the rail may cross the tie and be secured to it at any angle and at any point. It is necessary merely to make two openings in the top of the tie at the proper point for the passage of the curved bolt—a construction clearly serviceable for sidings and switches.

By reason of the serrated connection of the saddle and tie the rails may be transversely adjusted to the proper gage while the parts are loose. Upon tightening the bolt the saddle and rail are positively locked against movement transversely to the rail. This done, the wedge shown in Fig. 4 is driven home. It will be seen that Mr. Rabert has invented a metallic tie which combines with the lightness of a tubular structure, unusual stiffness, and provides an unyielding bearing at the point of greatest stress. The track gage can be simply and accurately adjusted by means which obviate the spreading of the rails and yet permit readjustment without removing the rails.

Alcohol Motors.

In an address recently made by M. Oelers, a prominent engineer, before the German Distillers' Association upon the subject of alcohol motors, he brings out the following figures to show the cost per horse power hour for motors using gasoline, petroleum, illuminating gas, or alcohol, the figures being an average for several motors of each type, of the systems most used in Germany. According to these data, the gasoline motor consumes 0.77 pound per horse power hour, representing a cost of $0.031; a motor using ordinary petroleum, 0.88 pound, or $0.025; an average gas motor costs $0.021 per horse power hour; the alcohol motor uses 0.98 pound, or $0.026. The conclusions brought out by M. Oelers are that the alcohol motor runs at a less cost than the gasoline motor, at about the same cost as the petroleum motor, but at a somewhat greater cost than the gas motor. He concludes that alcohol will no doubt render great services in agriculture for engines and tractors, as well as for automobiles.

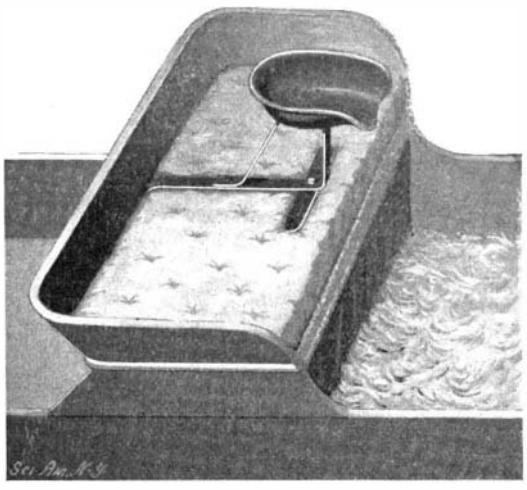
Education of German Children in Foreign Countries.

Consul Hill, of Amsterdam, March 19, 1901, reports that, in a recent German appropriation bill, provision has been made for subventions for 125 schools for the German education of German children in foreign countries. For a school at Constantinople, $7,140 is allowed; for three schools at Buenos Ayres, $4,284; for one at Galatz, $2,665; and $2,380 for a high burghal school and $238 for a deacon school at Antwerp. A high school for girls at Brussels also receives $2,380. Four schools at Bucharest together receive $2,380. A school at Pretoria is granted $1,428 and one at Johannesburg, $2,522.80. There are 29 German schools in Brazil, 12 in China, 12 in the British colonies, 12 in Roumania, 11 in Egypt, etc.

A SUPPLEMENTAL SEAT FOR VEHICLES.

Among the patents lately issued in the United States is a third seat for two-seated vehicles, the invention of Nelson Marsh, of Bernardston, Mass. The seat is bolted to a detachable skeleton-frame constructed with a horizontal part resting on the seat-cushion. A downwardly-extending hook part receives the rear end of the cushion. A firm support is provided by a cross-bar resting on the cushion.

As shown in our illustration, the supplemental seat is placed in the middle of the main seat in an elevated position so that it will interfere but little with the occupants of the main seat.



A DETACHABLE THIRD SEAT FOR VEHICLES.

The Current Supplement.

The current SUPPLEMENT, No. 1327, might be called a Pan-American number, as the Buffalo Fair occupies a considerable portion of the paper, and is illustrated by nine engravings showing many of the principal buildings and the remarkable decorative sculpture. The article was prepared after a recent visit to Buffalo by one of our staff especially for this purpose. "Signaling to Mars" is by Sir Robert Ball. "Syntonic Wireless Telegraphy" is a *resume* of Marconi's recent lecture on the subject. "The Distribution and Conversion of Received Currents" is by Henry Gordon Stott, and is accompanied by eleven engravings. "The Citizen: His Schools, His Industries, His Life," is by Prof. R. H. Thurston. "Blackfoot Amusements" is by John McLean.

Contents.

(Illustrated articles are marked with an asterisk.)