piping, for steam, water, and air, with the small valves used in their construction, are perfect copies of the large machine. A metallic engineer stands at the throttle. All the parts are beautifully polished and buffed.

The "Mascot" is a model built on the lines of one of the American Line ships. It resembles the "City of Berlin," but is not an exact copy. The crew of the ship were imported from Dresden, Germany. Every line is a faithful reproduction in miniature of an ocean-going ship. Ten lifeboats hang from the davits, each with a block and fall ready for immediate launching. The bridge is connected with the engine room by electric telegraph, the captain and the two mates being posted in their places as though directing the course of the craft. In the chart room, under the bridge, stands the quartermaster holding the spokes of the wheel. Real compasses are at the service of both bridge and wheelroom officials. The sidelights are fitted with two-candle-power electric lamps. The engines are all fashioned in perfect form. The hull is built of copper. The doctor was eight months making his model. A previous effort on the same lines, representing the "City of Paris," was sold to Mr. John Hood, of Buffalo, for $1,000.

Dr. Brandow is an enthusiastic chauffeur, and has made several working models of automobiles, some of which were on view at the recent Automobile Show. His latest work is a model of an airship, which is worked by a machine that enables the propeller to run for an hour. The doctor is now at work on a new Winton automobile, which is about half finished.

## THE AUTOMOBILE AS A PLOW HORSE.

BY W. FRANK M'CLURE.

An interesting experiment was recently tried on the Raser estate at Ashtabula, Ohio, where sparks from a passing train on the Nickel Plate Railroad had set fire to the grass in the adjoining meadows. To cope with the fire plowing was necessary, and the horses not being available at that hour, the owner's automobile was pressed into service. Ropes from the ends of the singletree were attached to the rear axle of the machine. Mr. Raser held the plow-handles, and his brother operated the automobile. Furrows were turned as shown in the picture; but it was found to be impossible to operate the machine slowly enough to get the best results. In order to do this, it would be necessary to gear down the machine to a slower rate of speed. The tendency of the plow was to skim the ground in places, and it was with difficulty that the man at the plow handles could keep up. The automobile, however, served the place of a plow horse sufficiently well for the purpose of breaking up the surface of the ground, and the work was done more rapidly than it could have been in any other way.

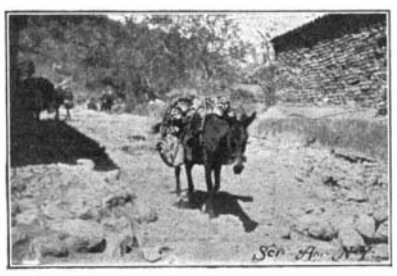
The first test led to another in a few days, when an acre and a half of grass was to be mowed. Here too it was found impossible to operate the machine as slowly as was desirable. However, it was proved that a piece of grass which would require three hours with horses could be mowed in one hour with an automobile as the motive power. On account of this saving of time, the owners will continue to use the automobile for mowing purposes. The machine, which is of the gasoline type, weighs 1,800 pounds, and has a seating capacity for four persons.

The experiment created considerable interest wherever it became known, and raised the question as to whether or not an ordinary automobile can be successfully used for agricultural purposes. There would not seem at first thought to be any inherent difficulties to prevent such use under favorable conditions. The great bearing surface of the tires, the high frictional coefficient of rubber on fairly dry soil or grass, coupled with the weight of the average machine, should render it equal to ordinary plowing or mowing.


Collecting Pulque.

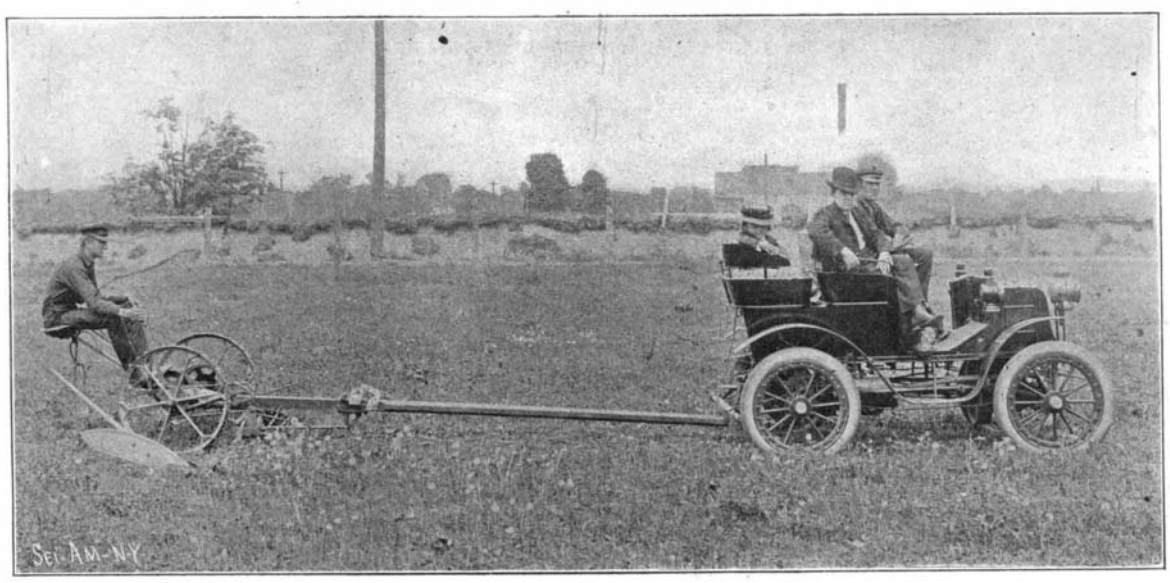

Roasting Agave Hearts Over Baking Pit.

Filling the Fermenting Vats.



Transporting Agave Heads to the Distillery.

THE PULQUE AND MESCAL OF MEXICO.




THE AUTOMOBILE AS A PLOW HORSE.


PLOWING WITH AN AUTOMOBILE.

## THE PULQUE AND MESCAL OF MEXICO.

BY CHARLES RICHARD DODGE.

The American tourist journeying by rail over the plains of Apam, on his way to the city of Mexico, will be surprised to observe the vast plantations of the *maguay* which stretch away on either side as far as the eye can reach. For fifty to one hundred miles, on the different railways, will be seen little else than these Agaves, in all stages of growth from the young plants newly set out—a couple of yards or more apart—to those of mammoth size which are seven or eight years old.

These immense plantations supply the Mexicans of the capital—and of other cities as well—with the drink known as *pulque* (pronounced *pull-key*) which is a national beverage. There are upward of a thousand shops in the city of Mexico where pulque is sold, and hardly a railway station within a hundred miles of the city where the traveler will not be importuned to buy from the boys and women who bring it to the trains in pitchers and jugs of red pottery, dispensing it at a penny or two for a cupful.

On the Mexican Railway, one of the systems connecting the capital with Vera Cruz, a special train is run over the line every morning, laden only with pulque, in barrels and skins, suggesting the milk trains of this country; and it is said that the daily shipments by this train amount to over one thousand dollars. So extensive is the industry that the maguay plantations of the three states of Hidalgo, Tlaxcala, and Puebla are valued at nearly $15,000,000, while the railways have carried over 80,000 tons of pulque in a single year.

Many species of the genus *Agave* produce pulque, these belonging to the *Americana* group of *Agaves*, though two species, *potatorum* and *salmiana*, are the most important, as I was informed by a Mexican botanical authority. The century plant, of our greenhouses, is a *maguay*, and one has only to imagine a century plant, with massive leaves five or six feet in length, to know how these pulque maguays look. They grow to perfection on the high plateau of central Mexico, where the elevation averages about 7,000 feet above the sea level.

When one of these plants reaches maturity its tendency is to flower—throwing up an immense mast or stalk sometimes 25 feet high, upon the branches of which, at the top, the blossoms appear. The pulque operator is always on the alert for indi-

cations of a blossom bud, and when this appears, he knows the proper time has come to prepare to secure the juices of the plant. To "castrate" the plant, as the operation is termed, a long incision is made in the heart, or central thickened portion, and the tender leaves of the unopened leaf-cluster cut away. The opening thus produced is scraped and deepened until a cavity is made, into which the juices of the fully grown expanded leaves slowly filter. This sweetish, slightly acid liquor is known as *aguamiel* (honey water), and in its fresh state might suggest the odor of root beer. It is removed morning and evening, and can be collected from a plant for a month or more, about four quarts being the average daily product. This goes on until the plant is exhausted and the leaves withered.

The liquor is collected by means of a long narrow-necked gourd, hollow of course, and with a small hole at each end. Placing one end in the filled cavity of the plant, and the other to his lips, the collector withdraws the air by inhalation, the pulque filling its place. Then, closing the upper hole with his finger, the gourd and contents are carried to a waiting mule nearby, and the liquor transferred to goatskins or other receptacles secured to the saddle. In this way he goes from plant to plant where the juices are exuding. The larger illustration gives a good idea of the operation. I am indebted to Cox and Carmichael, photographers of Mexico City, for this illustration.

At the depot, or warehouse, the pulque is transferred to the reservoirs, which are often lined with oxhides, and a little sour pulque added to induce fermentation, the fermented liquor becoming cloudy, as though mingled with milk.

Having a wholesome fear of microbes, I did not feel equal to testing the virtues of pulque in any stage. The well-worn gourd with its mouth-hole, and the dark, greasy-looking goatskins, to say nothing of the general appearance of the peons in charge of operations, I think would deter a man with even a stout stomach. It has been stated that the distinguishing characteristic of pulque is the odor of decaying meat, and that in order to lessen this unpleasant smell, orange and lemon peel are thrown into the receptacles while the fermentation is proceeding. Nevertheless, the beverage is universally used, and is considered healthful when taken in moderation, especially in regard to its action on the kidneys. But many pulque drinkers in Mexico do not use it in moderation, and in a certain stage of fermentation it is quite intoxicating.

The earliest use of pulque is said to date back to the latter half of the eleventh century, and to the reign of the eighth Toltec chief, Tepzucoltzin.

Quite a different liquor is *mescal*, although it is the product of a similar plant, but with narrower leaves, for the group of plants called mescals are also *Agaves*. Some writers have stated that the mescal is distilled from pulque, but it is a mistake. The mescal distilleries are found in every portion of Mexico, but the best liquor comes from Tequila, in the state of Jalisco, west of Guadalajara, and is known as Tequila wine—or simply as "Tequila." It is a fearful intoxicant, although, aside from its fiery quality, its taste is not bad, faintly resembling Scotch whisky. The distilleries are for the most part primitive affairs, and, at Tequila especially, are interesting.

Tequila is a place of some 6,000 souls, located twenty miles from the railroad, and for miles in every direction around the city there are plantations of a particular form of *Agave* which sends forth its narrow leaves from a great bulb-like, cellular mass which forms the heart of the plant. This heart, when denuded of its stiff, sword-like leaves, and detached from the root, is cleft in two, and a dozen of these pieces make a fair load for a mule. Trains of mules or burros may be seen all day in the streets of Tequila transporting the Agave heads from the country to the distilleries. One of the small illustrations shows this process.

The first operation that the raw product goes through is the baking or roasting. This is done in pits dug within the distillery inclosure. These are four or five feet deep, and considerably wider. A hot fire is built of mesquite wood, large stones being distributed through the fuel. The cleft heads of the mescal plants are then heaped over the burning mass until a huge mound is formed. This is covered with grass, and finally with earth, and the mass left for several days to cook. When the mound is opened the raw product is found to have changed to a dull brown in color, and the juices to have been converted into sugar. While hot and steaming the material is taken to another pit, stone-paved, on the bottom of which revolves a big stone crusher, driven from a sweep by mule power. Here it is ground into pulp, and the semi-liquid mass transferred in deep trays, borne upon the heads of Indians, to the vats, where it remains until fermented. Then it goes to the still, and finally is run off as mescal.

The finished product is a colorless liquor, sometimes with a slight amber tint, though much of it is like alcohol. Some of the higher grades bear fancy names, such as "Crema-Sauza"—meaning the cream of production of the establishment controlled by the Sauza family—and such names become trade marks designating quality.

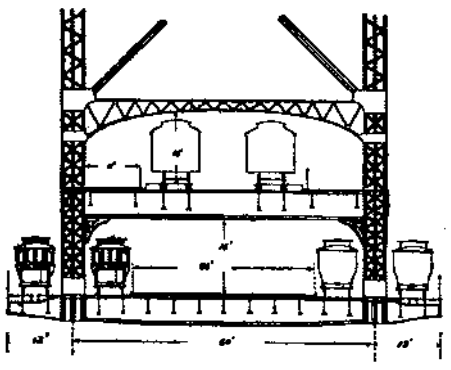
Another Mexican liquor, called *Zotol*, is produced in the more northerly portions of the country. It is likewise produced from the bulbous part of an *Agave*, a small species with extremely narrow leaves, like the true *Dasylirion*. I have not seen this spirit, but was told it is so strong that 95 per cent alcohol is mild in comparison.

Still another fiery liquor is distilled from sugar cane, and is called *aguardiente* (burning water). Why these strong liquors should be so popular with the Mexicans is surprising, but it should be remembered that these people are also fond of such hot substances as "chile" and "tabasco."

## BLACKWELL'S ISLAND BRIDGE.

After a checkered career extending over a period of twenty years, the scheme for the construction of the greatly-needed bridge across the East River at Blackwell's Island has at last taken definite and final shape in the issuance of the plans and specifications for the superstructure from the office of the Commissioner of Bridges.

The first franchise for the bridging of the river in this vicinity was granted to a private individual as far back as 1884, but it was not until the latter part of the year 1898 that plans were drawn up by the Commissioner of Bridges and received the approval of the Board. The site selected has its Manhattan terminus on the block bounded by Fifty-ninth and Sixtieth Streets and Avenues A and B, and the original plan contemplated the erection of a cantilever bridge of five spans, carried on four piers, one pier on each shore of the river, and two intermediate piers on Blackwell's Island. Work was commenced on the piers in the latter part of September, 1901, and was carried forward so slowly that on the first of January, 1902, the value of the completed work was only about $42,000. The original plans were revised by the present Bridge Commissioner, the changes affecting chiefly the superstructure, the alterations in the piers themselves being of minor importance and largely of an architectural character. The revised plans call for two cantilever bridges consisting of the following spans: A shore span on the Manhattan side, 469 feet 6 inches in length; a river span of 1182 feet; a center span across the Island, 630 feet in length, followed by a river span 984 feet long over the easterly channel, and a shore span on Long Island, 459 feet in length. The changes in the piers include a system of elevators and stairways designed to afford access to the bridge from Blackwell's Island.



CROSS SECTION, BLACKWELL'S ISLAND BRIDGE.

On upper deck, two elevated railroad tracks and two 11-foot pathways. On lower deck, two overhead and two underground trolley tracks and a 36-foot roadway.

We present on the front page of this issue a perspective view of the bridge taken from a point on Manhattan Island which affords an excellent idea of the architectural and engineering features of the structure as they will appear when the structure is completed. The bridge will be made up of two lines of trusses, spaced 60 feet from center to center. The top chord, which is the main tension member, will consist of eyebars of nickel steel, which will be made 12 inches to 18 inches in depth and will vary in number according to the stresses that have to be provided for. The bottom chord will be of standard box construction, of the kind that is universally in use in long-span bridges in this country. The floor system will be carried on very heavy transverse floor beams, which will extend beyond the trusses for a sufficient distance to accommodate two lines of underground trolley cars. Between the floor beams will be worked in the usual plate steel stringers, and the whole floor will be covered with buckled plates. It is needless to say that the two great channel spans will take rank among the longest trussed spans in the world. In the United States, the longest bridge of the trussed type is the Wabash Bridge at Pittsburg, which has a clear span of 812 feet. The bridge will be double-decked throughout. On the upper floor provision will be made for two elevated railway tracks, with two foot-walks, each 11 feet wide, carried on the outside of the elevated tracks and between them and the cantilever trusses. On the lower floor, adjoining the trusses, will be two tracks for overhead trolley cars, and on the outside of the trusses will be two tracks for the underground trolley cars. Between the overhead trolley tracks will be a splendid roadway for vehicles, with a clear width of 36 feet.

The towers will consist each of two massive legs of box-section, which will be spaced 93 feet from center to center transversely at the base and 60 feet from center to center at the top of the towers. The height measured from center to center of the chords at the towers will be 185 feet. The two legs of the tower will be heavily sway-braced, and at the top they will be connected by deep lattice trusses and by a blunt arch designed to harmonize architecturally with the general treatment of the whole bridge. Above the towers will extend lofty, ornamental finials of open ironwork.

The tests required of the nickel-steel eyebars call for an ultimate strength, unannealed, of 90,000 pounds to the square inch, an elastic limit of 54,000 pounds to the square inch, and an elongation of 18 per cent in 8 inches, with 35 per cent reduction of area. The annealed specimens must show 85,000 pounds ultimate strength, 50,000 pounds elastic limit, 20 per cent elongation in 8 inches and 40 per cent reduction of area. An annealed test piece of 4 inches width or more must be capable of being bent cold 180 degrees around a pin, whose diameter is twice the thickness of the test piece, while the unannealed specimen must bend 180 degrees around a pin whose diameter is three times the thickness of the test piece.

In addition to its own dead load the bridge is designed to carry live loads of 6,300 pounds per linear foot of bridge, as ordinary traffic, and 12,600 pounds as congested traffic, while unusually heavy, concentrated loads are assumed for the floor system. The foot-walks are to be constructed to carry a maximum load of 100 pounds on every square foot. The under side of the floor of the bridge will have a clear height above mean high water of 118 feet, and the maximum grade will be 3.4 per cent on both the New York and Brooklyn approaches. The total length of the bridge, including the approaches, will be 7,636 feet, and the total estimated cost, including the purchase price of the necessary land, is $12,548,500. It is expected to have the bridge completed by the first of January, 1906.

### Aftermath of the International Wireless Congress.

The United States, Germany, Austria, Spain, France, and Russia have signed the protocol adopted at the recent International Congress for Wireless Telegraphy held in Berlin. Great Britain and Italy have so far withheld their signatures. The protocol provides for the construction of coast stations to allow communication with ships at sea regardless of the particular system of wireless telegraphy which a vessel may happen to use. To facilitate the transmission of messages the protocol also provides for the technical explanations of all systems. A general system of charges is to be introduced. Services are to be so regulated that signal stations will disturb one another as little as possible.

Great Britain thought no system should be used unless a certainty of connection was guaranteed. Italy supported Great Britain, declaring that it could not repudiate its agreement with Marconi.

### Fossil Pollen Grains.

M. B. Renault contributes an article on the occurrence of fossil pollen grains. These may be preserved either in organic media, lignite, bog-head or pit-coal, or in such mineral substances as calcium carbonate and silica. They are found in primary beds, and are generally dispersed or may be located in the pollen sacs or in the interior of pollen chambers. The structure is so well preserved that projections representing the pollen tubes are evident, and in some cases the division of the grain into cells, e. g., the prothallus, may be clearly distinguished. In the case of *Stephanospermum*, which is assigned to the gymnosperms, there is evidence of quite a definite pollen tube, and similar appearances are noted for the genus *Aetheotesta*. In some cases the pollen grain is devoid of the outer layer, the exine, which Renault believes has been shed that the pollen grain may pass through the entrance into the pollen chamber. In the case of *Dolerophyllum*, a genus placed in the Cordaiteæ, part of the wall becomes detached like an operculum to allow the prothallus to grow out or possibly to allow the antherozoids only to escape, and find their way to the archegonium.—Comp. Rend.

It is reported that a hot spring has been struck in the workings of the Simplon Tunnel, and the increased heat is unbearable. About two miles remains to be bored.