tree. Unlike many parasitic growths the cynips do not seem to interfere with the health of the leaves or plants, those so studded being quite as thrifty in appearance as the others.

RAILROADS IN CUBA.

BY WALDON FAWCETT.

The railway systems, existent and prospective, in the Island of Cuba constitute one of the most important factors in the promised development of the new republic. To a neglect in the past to comprehend the full value of transportation facilities must be attributed, in a measure, the retardation of the commercial and industrial advance of the country; but nevertheless the dawn of the new era in Cuba has found ready to hand a very fair foundation equipment of rail lines, steam or electrically operated. Moreover, the inauguration of American military control was coincident with the promulgation of an enterprise for the construction of a great trunk line through the center of the island—a long-awaited and sorely needed undertaking of pre-eminent importance; and finally, other projects of only slightly lesser importance but awaited the establishment of a stable government to take definite shape.

The railroads of Cuba are divided into two general classes: the public railways and the private or plantation railways, the latter being designed, of course for marketing the products and aiding in the distribution of supplies on the large estates on the island. The public railways comprise seventeen separate systems, although nearly all are owned and operated by five companies, and their aggregate length is in the neighborhood of 1,225 miles. There are 107 plantation or private systems totaling 872 miles in length, and thus the total railway mileage amounts to 2,097 miles.

In view of the fact that these lines have been built in a tropical island, where it is necessary to exercise great care in the construction of tracks and bridges that they may withstand the exactions of the rainy seasons when water in torrents descends upon the road-beds, the cost of construction constitutes an interesting phase in their history. The 124 railroads of all kinds represent a cost of $68,474,407 in gold. Of this sum $57,164,715 was expended for the public railways and $11,309,692 for the private lines. Two of the public railroads have been operated at a slight loss for some time past; but all the others have proven profitable in a greater or less degree. During the last calendar year for which the operating companies have submitted statements the profits of all the lines, if pooled, would have amounted to about $2,120,000. The existing railways in Cuba are owned largely by British capitalists and the headquarters for a majority of the various operating companies are in London.

In order to convey an idea of the conditions obtaining in the case of a thoroughly representative Cuban railroad, it may be well to direct momentary attention to the Puerto Principe and Nuevitas Railroad, one of the oldest and best-paying lines on the island. The line extends from the seaport of Nuevitas for a distance of 45 miles to the important inland city of Puerto Principe, through a level region principally adapted to cattle raising, but in which a number of large sugar plantations are situated. One of the reasons why this system constitutes so valuable a property is that it has no bonded indebtedness and pays handsome dividends to its few shareholders—it being a close corporation, composed of less than a dozen stockholders.

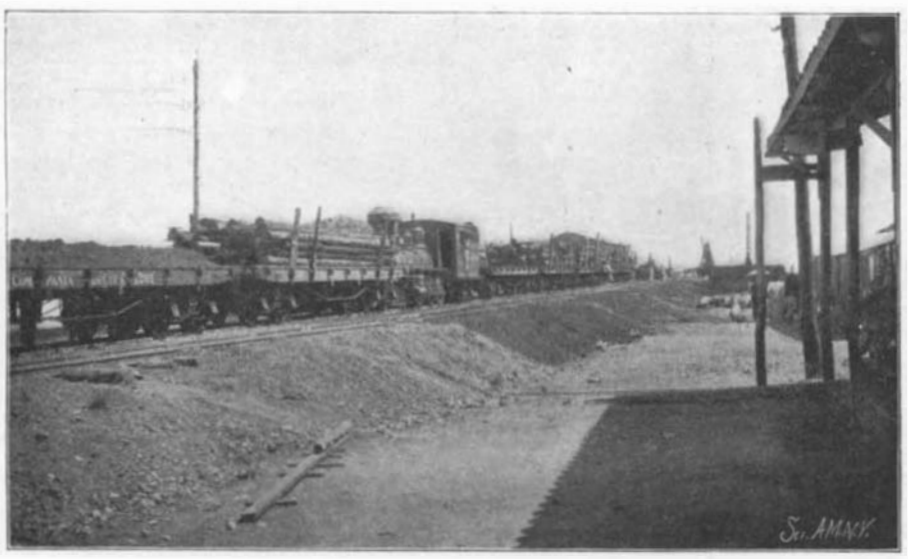
The operating company is virtually a private corporation, with a capital stock of $1,000,000 and eight stockholders, each of whom holds one share of stock. The government and administration of the affairs of the company are in charge of a committee composed of three stockholders, elected annually by the others by a plurality of votes and who are not eligible to reelection. They perform their duties gratuitously. The line has twenty bridges and seven pontoons with walls and pillars of masonry and trusses of steel and a large number of culverts also of masonry. The stations are of lumber and tile, and the rails are of American steel, weighing fifty-six pounds a yard. The rolling stock consists of five passenger and five freight locomotives, the heaviest weighing sixty tons, eleven passenger coaches and 137 freight cars. The telegraph line in connection with this system was constructed in co-operation with the Spanish government, the cost being shared equally. There are two wires extending the entire length of the road, the upper wire being for government use and the lower for the use of the railroad company.

Several of the smaller and less important railway lines in Cuba belong to the new government as an inheritance from Spanish sovereignty. One of these, the Jucaro-Moron system, cost the Spanish government $1,152,800 in gold. Private parties are willing to purchase at least one of these railroads, reimbursing the government for the full amount of the first cost, and it is probable that ultimately all the lines under governmental control will be either sold or leased to private corporations, following the example of the Mexican government, which, after expending millions of dollars on the Tehuantepec Railroad, finally leased it to an English firm.

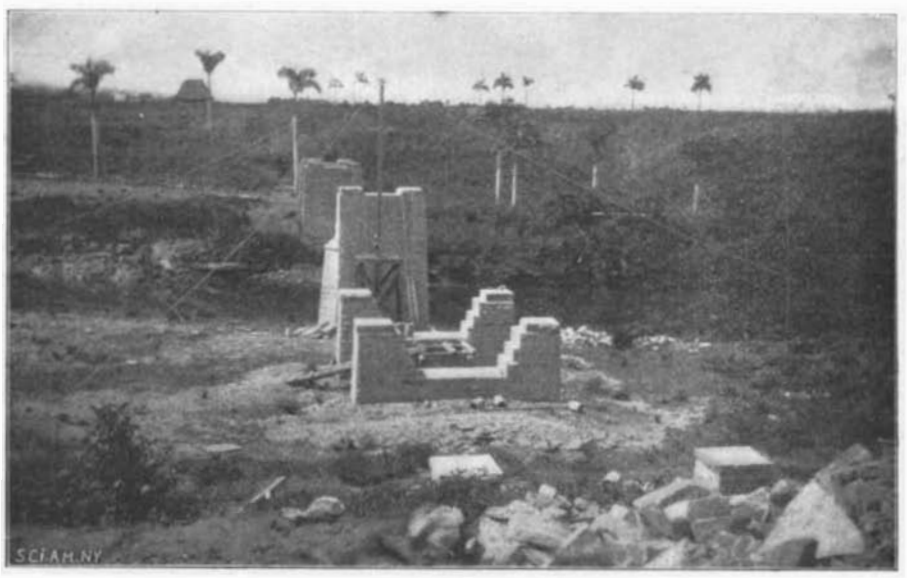
As indicative of the equipment available for the development of the mineral resources of Cuba it may be noted that several of the corporations operating iron mines on the island control their own rail lines. This is the case with the Spanish-American Iron Company, the Juragua Iron Company, the Cuban Steel Ore Company and the Sigua Iron Company. The Spanish-American Iron Company owns five freight locomotives and sixty ore cars and has transported as high as 30,000 tons of iron ore a month.

The deepest interest in the Cuban railway field naturally centers in the new operations having for their object the extension of the transportation facilities of the island. Prominent among these is the project of the Havana Electric Railway Company, which has undertaken to reconstruct and extend the street railway system of Havana, giving the Cuban metropolis a thoroughly modern urban system. The new 7-inch girder rail weighs ninety pounds per yard; the steel ties are spaced every ten feet, and the roadbed is of concrete 7½ inches thick, with vitrified brick and asphalt block paving. When completed there will be thirty-six miles of single track, and the cost of reconstruction will exceed $3,000,000. There will be 110 motor cars with two 25 horse power motors on each car, and the power house will represent when all machinery is in place an investment of about $480,000.

However, the enterprise of supreme importance in the transportation field, if not indeed in the entire range of activities on the island, is found in the project being carried out by Sir William Van Horne, the builder of the Canadian Pacific Railroad, and the capitalists associated with him in the construction of a central line of railroad throughout the length of the island. This "backbone railway," as it has been aptly termed, and which will exert a more powerful influence for the general development of the island and all its resources than any other one undertaking, was an objective institution with foreign capitalists for half a century prior to the Spanish-American war; but all their schemes failed of consummation. The main line from Santa Clara to Santiago, to be completed this spring, is about 350 miles in length; but there will be feeders to the north and south coasts which will bring the aggregate length of the system to approximately 1,000 miles. The branches or



Raising the Tracks at Jucaro.



Masonry Piers for Bridge Across Guaninicum River.

Pile Trestle Bridge on the Eastern Division.

Railway Headquarters at Ciego.

RAILROAD CONSTRUCTION IN CUBA.

feeders will reach such ports as Nipe, Baracoa, Gibara and Manzanillo, connecting them with the interior and affording an outlet to deep water shipping points for the plantations along the lines.

The Cuba Company, as the Van Horne syndicate is known, has carried on its construction work in the face of many difficulties, not the least of which was found in an inability to secure a governmental franchise or even a permit for construction, and the consequent necessity of purchasing outright a private right of way. However, the same energetic tactics which characterized the construction of the Canadian Pacific Railroad were adopted, a working force which at times exceeded 6,000 men was employed, and at certain portions of the route the line was carried forward at a rate considerably in excess of a mile a day. The construction of this new railroad has been thoroughly in accord with the latest approved modern practice in every respect. Although it has been necessary to provide an immense number of bridges, owing to the volume of water which falls during the rainy season, steel construction has been employed exclusively, and the rolling stock and equipment is identical with that to be found on the most important railroads in the United States.

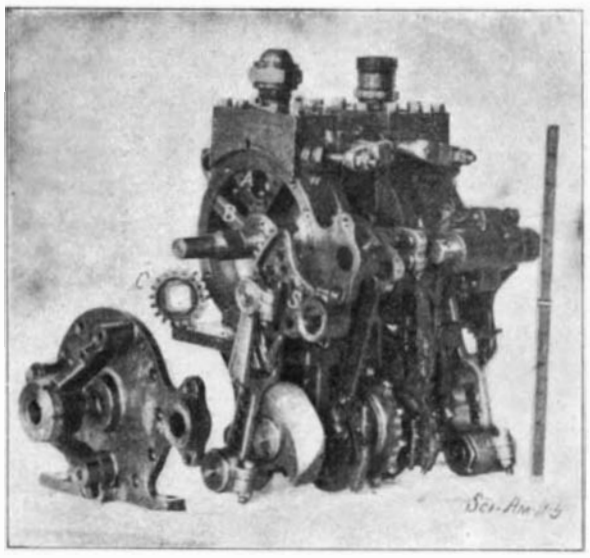
THE NICE-TURBIE RACE.

BY OUR PARIS CORRESPONDENT.

After the suppression of the Nice-Abbazia race, which was to have been the main event of the season at Nice, the chauffeurs had to fall back on the Nice-Turbie hill-climb and the Rothschild Cup to try their new racing machines which had cost so much labor in the preparation. The Turbie hill-climb is a severe test for the machines in more ways than one. The road starts from Nice and winds up the mountain side to the village of La Turbie, situated at the summit. Not only is the grade very steep but the route is unprotected by curbing on the outer side and is on this account quite dangerous. Several racing-cars met with accidents here, and one was smashed to pieces; however, no one was seriously hurt. The race took place in a heavy fog, which was a disadvantage, as it prevented the racers from making their best time. At the top were assembled a large party of chauffeurs about the chronometer station. The heavy-weight caravan had already climbed up the slope and the vehicles were drawn up in line to await the finish before descending to Monte Carlo. The start was chronometered by M. Tampier and the racers started at 3-minute intervals. The record was made by Mr. Stead on a 40-horse power Mercedes machine, which covered the distance of 15.5 kilometers (9.6 miles) in 16 min. 37 3-5 sec. Next came Gabriel on a 30-horse power Darracq, in 16 min. 50 3-5 sec. One of the engravings shows the Mercedes racing machine, mounted by Mr. Stead and in the second will be seen Gabriel in his light weight racer. The Mercedes and Darracq machines carried off the honors of the race, as three of the former made the best time in the automobile class, and six of the latter came first in the light vehicle class. Osmont, on a De Dion motocycle, held a very good place. The Mercedes machines are built at the Daimler works at Canstatt (Alsace), and these powerful racers continue to be formidable competitors to the French machines. The same holds good in the heavy weight class, where a Daimler hauling wagon made one of the best records in the Paris-Nice concourse. At La Turbie was noted a novel type of electric automobile made by Lohner & Porsche, of Vienna, which will be described later.

AN OSCILLATING COMPOUND STEAM ENGINE OF NOVEL DESIGN.

The compactness of the engine shown below is readily seen by comparing it with the foot rule standing beside it. Occupying as it does, less than one cubic foot, it nevertheless has abundant power to pull a 1,000-pound automobile out of a mud hole or send it quickly up a steep ascent; for although normally the engine develops but 4 horse power, by a simple changing of valves accomplished instantly by the movement of a special handle, the cylinders may both be made to take high pressure steam, thus more than doubling the power and enabling the engine to develop 9 horse power.



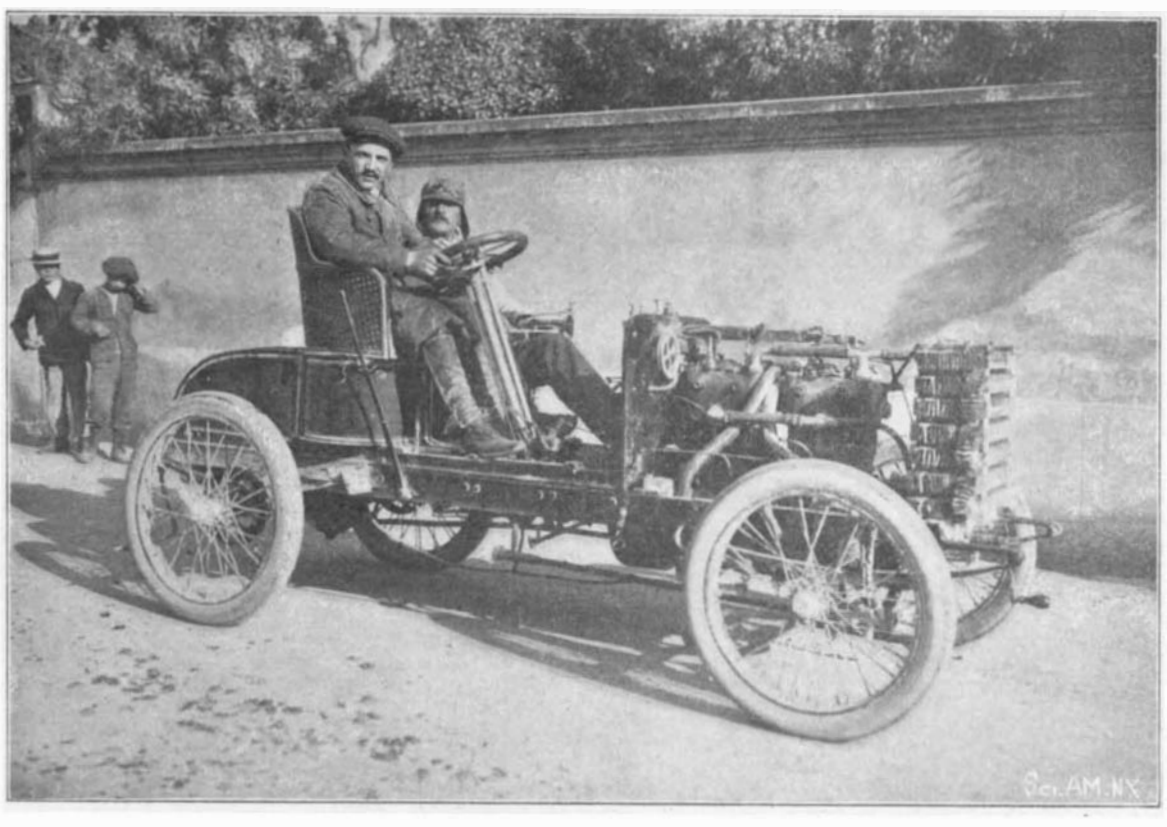
THE STOWELL OSCILLATING COMPOUND STEAM CARRIAGE ENGINE.

The illustration shows plainly the piston and cylinder construction. The engine is built on similar lines to most rotary engines as far as these parts are concerned. The piston consists of a flat blade, *B*, secured to the shaft and adapted to oscillate between the faces of the abutment, *A*, through five-sixths of a revolution. The steam enters through ports in the abutment not shown in the cut, which direct the jet upon the outer end of the blade, thus obtaining the greatest leverage possible from the initial pressure. The inlet and outlet of the steam is controlled through ordinary slide-valves, links and eccentrics. A special packing is employed on the valve stems, which causes little or no wear and assures a tight joint. The engine is protected against steam leakage at all points where such leakage could possibly occur, by spring-pressed metal packing strips. The blade, *B*, has two pairs of L-shaped packing strips, spring-pressed both sidewise and endwise; the abutment, *A*, holds a packing-strip in its lower face, which is pressed downward against the shaft; and two rings on the ends of the latter within the cylinder, make a tight joint between it and the cylinder walls. It will be seen, therefore, that steam leakage is effectually guarded against, even after the engine has been in use for some time and the parts have become worn.

The long stroke—8 inches—obtained in this engine is one of the main points gained by the use of the rotative principle followed in its design. It will be observed, also, that with this construction the amount of steam required to fill the exceedingly short ports is greatly reduced as compared with other slide valve engines of corresponding length of stroke, and the waste of steam is thus brought to a minimum. The 8-inch stroke of the piston is reduced to a 3-inch stroke on the crankshaft by means of the pinion, *C*, and segment, *S*, which are made of harveyized steel and phosphor bronze respectively. The pinion, as is seen, is squared on the shaft, while the segment and connecting rod are heavy and substantial, and abundantly able to transmit the power for which they were designed. Suitable counterweights on the cranks balance the piston, connecting rods and segments. The segments are pivoted on eccentric studs so that any wear of the gears may be taken up. The low-pressure cylinder is of the same diameter as the high-pressure one—5 inches—but is twice as wide, having a cross-section of 2 inches. The steam exhausts from the high pressure cylinder through the large hole in the center of abutment, *A*, whence it passes to the low-pressure cylinder. By means of the afore-mentioned transforming device for which patents are now pending, the low pressure cylinder is instantly available for high-pressure steam by a simple turn of a handle, thus giving a steam carriage equipped with this engine an advantage similar to that employed by using two gears, without the corresponding complications.

The compactness of the engine is such that it can be completely housed in the carriage body; and while on the road, should it be necessary to take it apart for examination or repair, the entire crank-

40-Horse Power Mercedes Machine (Daimler System)—Winner in Automobile Class.



30-Horse Power Darracq Machine—Winner in Light Vehicle Class.

NICE-TURBIE HILL-CLIMBING CONTEST.