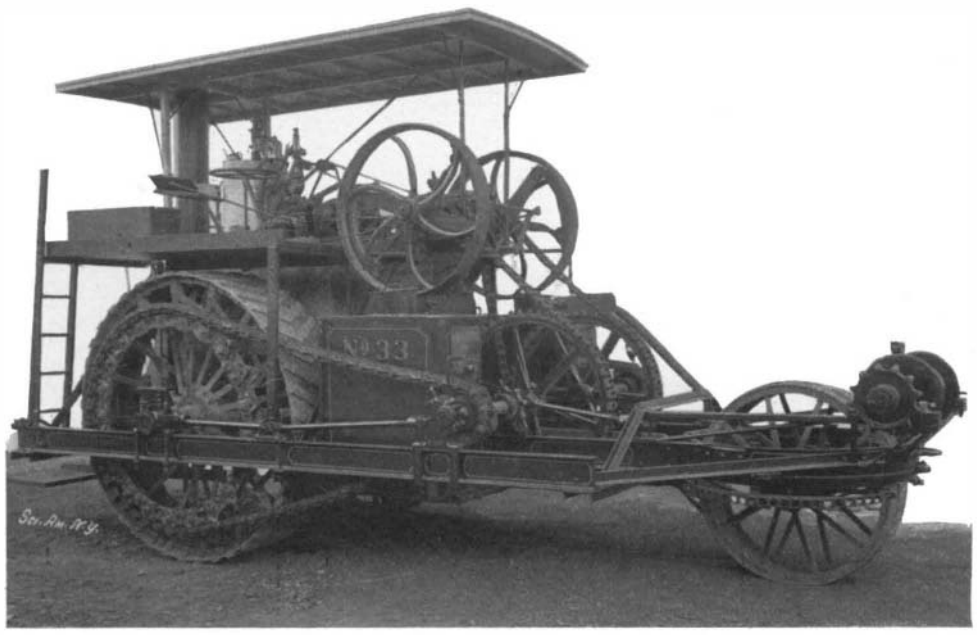
THE TRACTOR IN LUMBERING OPERATIONS.

The success which has attended the use of steam power in farming operations on the Pacific coast, has resulted in the use of the traction engine in lumbering and other industries where extensive horse power is required. The roads in the hill country of California, Oregon and Washington, where are located the principal lumber camps, are in a very crude condition, most of them having no paved surface, while the grades are extremely steep in many instances. Much of the formation is of a red clay, which in wet weather is turned into liquid mud, through which an ordinary wagon can scarcely be forced, although three or four horses or mules may be attached to it. Loose stones falling from the hillsides increase the difficulty of travel over these mountain highways, so that where animal power is used, double and treble the ordinary number of teams are required to "freight" lumber or other material from the woods to the mills or the railroad stations.

For the purpose of substituting steam power for animals, the Holt Brothers, of Stockton, the inventors of the farm tractor, have designed a very powerful engine, which accomplishes remarkable results where it has been placed in service. The sizes range from 40 to 60 horse power, and the plan of construction followed is similar to that of the farm engine which has already been described in the SCIENTIFIC AMERICAN. The driving wheels, however, have narrower tires, although they range from 18 to 24 inches in width, with corrugated or roughened surface, in order to give them more traction upon the highways. Power is communicated to the driving wheels by roller chains on each side of the truck, which revolve about an axle which is driven by two sprocket wheels, also connected by roller chains with the engine. The tractor is guided or steered by a smaller front wheel, which is connected with a hand-wheel by a sprocket chain, so that the motorman can turn it in any direction desired, merely by using the strength of one hand. Most of the engines are provided with a steel drum upon the forward end of the truck frame. Upon this is reeled a wire rope or heavy manila cable kept for the purpose of hauling when the tractor may be detached from the cars of logs or material to be transported.

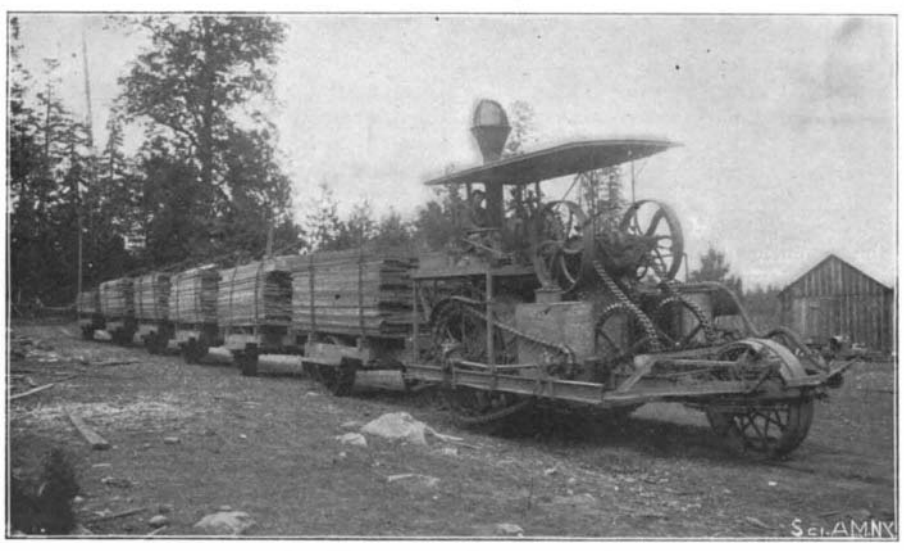
On a level surface, the motor will readily pull a train of trucks loaded with lumber weighing from 200 to 250 tons, without difficulty. On the highway it can attain a speed of from 8 to 10 miles an hour if desired. It is used, however, in the forests, where no highways exist for transporting logs from the stump lots to the mills or the railroad stations. In this case, the logs are usually chained together, sometimes mounted upon rollers, and then attached to the tractor, which pulls them to their destination by the most convenient route. Such is the strength exerted that it can actually be forced through bushes and over young trees five and six feet in height; while being able to turn in a circle of 150 feet, it can be guided in and out among the trees. It will haul in this way a dozen large trunks, a single one of which would require the strength of ten or twelve horses or mules to move ordinarily.



General View of the Freighting Engine.

The ordinary highways have such steep ascents, that frequently the tractor can reach the summit only by being separated from the trucks or cars which it is drawing. To haul its load to the top of the hill is the object of the drum and cable. The latter is unwound, fastened to the cars or trucks at the bottom, and the tractor converted into a stationary engine, exerting all its power upon the rope. In this way trips can be made over routes which are literally impassable for wagons. Another great difficulty encountered, especially in California, is sand. This is partly overcome also by the broadness of the tires, which prevent the engine, in spite of its weight, from sinking into the surface of the road to such an extent as to become stalled.

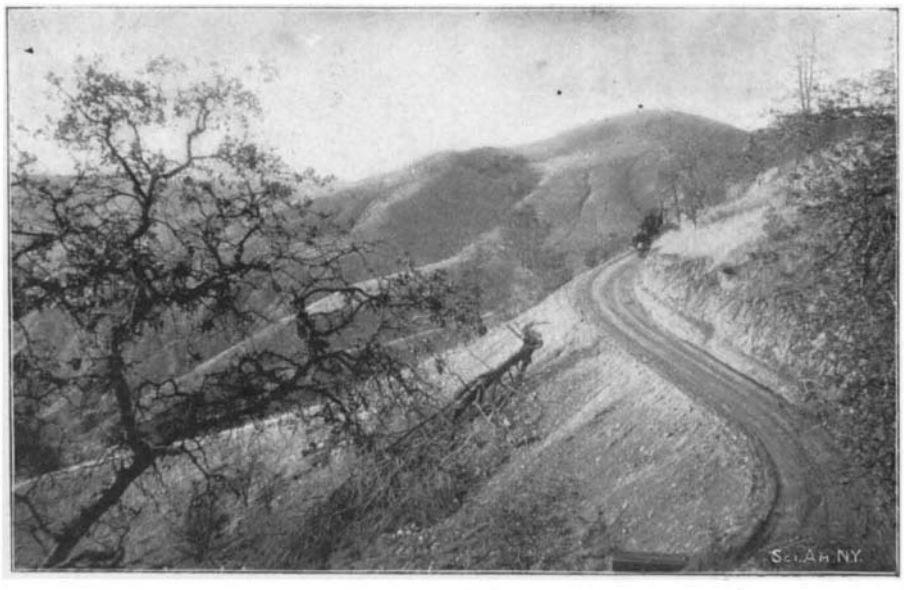
The type of tractor used especially in lumbering and mining operations is what is termed the freighting engine, and weighs from 14 to 21 tons when equipped and ready for service. It will consume about 225 pounds of coal an hour when working at its full capacity, or about one ton daily, while its consumption of water is about 300 gallons an hour. Since the use of oil in industries on the Pacific coast has extended into Oregon and Washington, some of the tractors have been fitted with apparatus for burning oil in place of coal. It is calculated that one will utilize about 28 gallons of the ordinary oil hourly when in service. The boilers furnished are of two types—corrugated-flue and water-leg. In freighting outfits a smaller force of hands is required than in farming operations with the tractor. The larger types have an engineer and fireman, if coal is used. The latter may also act as "trainman," coupling and uncoupling the cars and trucks when necessary, so that really only two men are required to transport the material. The photographs which show the tractor hauling lumber on the level, also ascending steep grades and going over sandy roads, include a view showing the manner in which it is employed in duty on the farm. As a substitute for horse drills, in planting seed, the motor has been very successful, accomplishing from twenty to thirty times as much at a time as two or three teams of the heaviest draft horses. In fact, calculations made of the economy of operating with the tractor show that it will plow and harrow, seed and harvest a certain area at about one-sixth of what it costs when men and horses are



The Freighting Engine with a Small Load.

The Freighting Engine in the Field.

Hauling a Load up a Heavy Grade.



The Freighting Engine Descending a Hill.

THE TRACTOR IN LUMBERING OPERATIONS.

used. Lumbermen who have tested it for freighting purposes estimate that the cost is about one-third of the sum expended when teams are employed. In these estimates the fuel and water and repairs are all carefully estimated and deducted.

FIJI AND THE FIJIANS.

A TRAVELER'S OBSERVATIONS IN THE PARADISE OF THE PACIFIC.

BY SIDNEY DICKINSON, M.A., F.R.G.S., BOSTON.

Few travelers, comparatively, have penetrated the mysterious regions of the Southern Seas. Many have, indeed, wandered as far as the Hawaiian Islands, and returned enraptured with the mingled beauty and grandeur of these, our new possessions—but even there the traveler stands merely upon the threshold of the Sub-Tropical Wonderland.

Far below his horizon roll immeasurable leagues of iridescent seas; his ear cannot hear the roar of distant surf upon the coral reefs; the melting skies, the amethystine mountains, the vales "with verdure clad," lie far beyond his ken. There is perpetual summer; beauty that never fades; a year whose cycle knows no blight of frost or shroud of snow; flowers that bloom in never-fading generations; days of unbroken sunshine; nights in whose violet depths strange constellations glisten, and from whose bosom subtle perfumes emanate and intoxicate the air. Here nature wears her native and immaculate garb—virgin as she appeared on creation's morning, when the Spirit moved upon the waters, and from the womb of primeval Night brought forth these Islands of Eternal Day. Audacious the tongue that attempts to utter, the pen to record, the brush to paint the wonders of these happy archipelagoes—yet will I try to lift a corner of the veil that hides their beauties, confident of indulgence if I fail in my endeavor to describe the indescribable.

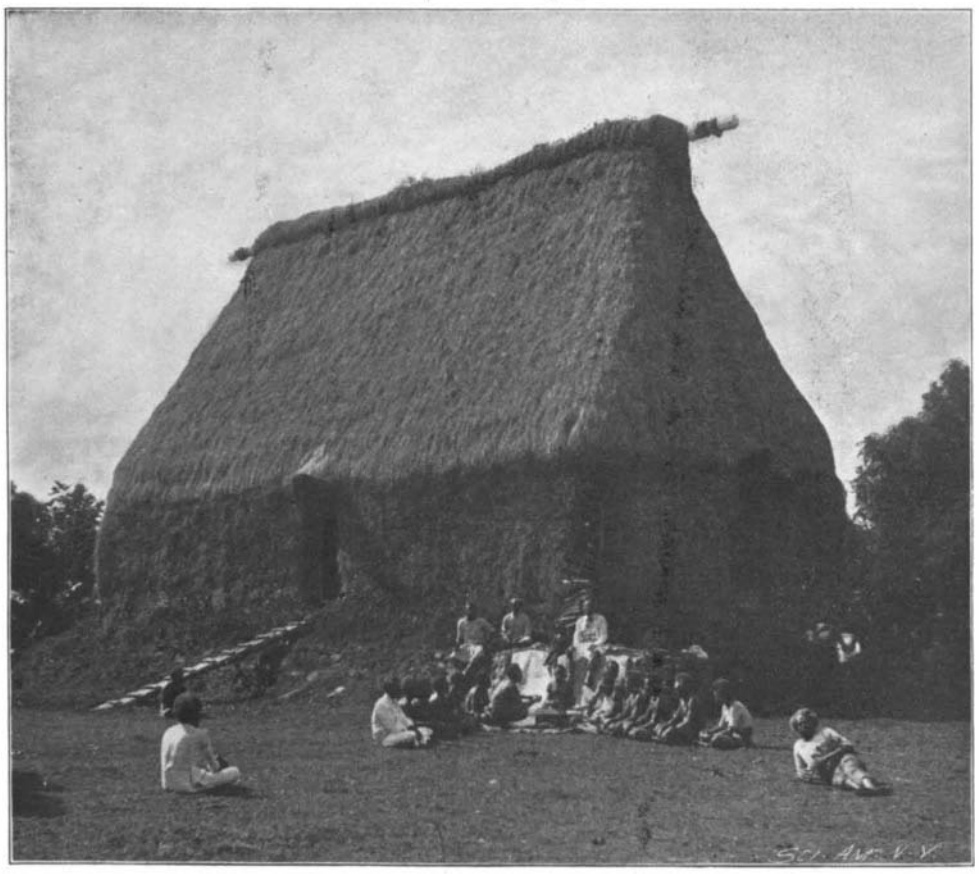
Most interesting, perhaps, of all these lands of the Southern Seas in natural charm, strange and somber history, and present importance as illustrating the work of civilization in that part of the globe, are the Fiji Islands. Upon the chart of the world they appear as mere pin-pricks amid the vast expanses of ocean that surround them—a small galaxy among the thousand systems that form that Milky Way of the Pacific known to geographers as "Oceanica." A vast continent, ages ago, may have existed here, and, subsiding slowly, have left its loftiest peaks and table-lands to stand above the waves as monuments to mark its place of burial. Cyclopean remains upon certain of the groups, whose builder no man knows, and present languages and customs seem to refer to some mighty and long-buried past. The glamor of mystery that broods about those seas is fascinating—all the more so that their secrets seem likely to be preserved inviolate until eternity solves the riddles of time.

The Fiji group, lying south of the equator at about the distance that the Hawaiian Islands lie north of it, covers five degrees of latitude and three of longitude. Forty of the islands are of considerable size, while some two hundred more are of decreasing importance, the tale dwindling to barren and uninhabited rocks hardly large enough to be christened. These islands lie in an irregular oval—300 miles in longest, and 120 miles in shortest diameter, around the Koro Sea, and, like our own West Indies, are composed of two groups, known as the "Greater" and "Lesser Fijis."

"Fiji" is a corruption of the native "Viti," which appears in the name of the largest land of the group—"Viti Levu," or "Big Fiji"—which contains an area of 4112 square miles; "Vanua Levu," or "Big Land," coming next with 2432 square miles. Roughly speaking, the total land area of the Fiji Islands about equals that of the State of Connecticut, and the population is estimated at a quarter of a million.

Travel to this land of the whilom cannibals is to-day a commonplace matter. Steamers from San Francisco make regular calls, and at least two lines from Australia convey the voyager in luxurious comfort. My own approach to Fiji from Melbourne was by the "Taviuni" of the New Zealand Union Line—a boat which was then making her first trip after steaming from her birthplace in Scotland to Melbourne around the Cape of Good Hope—a trifle of 12,000 miles—without once stopping her engines. As to one's treatment by the sea—that is a matter of luck and temperament. The Pacific has its whims, and, despite its name, I have never encountered worse weather or heavier seas than around Australia and New Zealand. When the discoverer of this sea, looking from the hills at Panama, saw its languid swell and the lazy break of its surf on the shore, he might well have thought he was looking upon the waters in their constant mood, and have had reason for calling the ocean the "Pacific." If, however, he had set sail upon it, and made test of its capricious temper, we can fancy him looking over the side of his caravel with a face of anguish, and declaring between his qualms that he was the biggest failure that ever lived in the matter of christening large bodies of water.

Early on the morning of the seventh day from Melbourne, a patch of misty blue appears upon the horizon, and by degrees the verdant shores of Fiji rise into view. Passing through the opening in the coral reef, we enter the placid harbor of Levuka—lying, like Honolulu, under precipitous hills, sprinkled with the white bungalows of the European residents. There is a strange sense of unreality in coming, in our present fashion, to the Land of the Cannibals, and the air of peace and serenity which broods over the beautiful harbor and town afford a striking contrast to the conditions that one has imagined after reading Fijian history. The former things, however, have passed away, and the stranger may now wander pretty freely over the islands, without fortifying himself with the hope that Sydney Smith urged upon his departing missionary friend—"that he would disagree with the man who ate him."



Example of Fiji Architecture—A Thatched Hut.

As we approach the shore, a flotilla of boats puts out to meet us—catamarans made of cocoanut logs hollowed out, pointed at each end, and rendered stable by wide outriggers. Natives, clad only in loin cloths, or *sulus*, of calico or snowy *tappa* cloth, paddle these craft rapidly toward us, and swarm aboard to sell their cargoes of fruit and curios—somewhat to the consternation of our lady passengers who precipitately flee to the cabin at sight of these brawny savages; but soon return, for it is not in feminine breasts to resist the fascinations of the bargain counter.

These Fijians are a stalwart race; very tall and muscular, for the most part, their skins soft as velvet from anointings of cocoanut oil, their countenances strong and in most cases pleasing, rather than forbidding. A thing that at once impresses the visitor is the varied and striking manner in which both men and women—the former especially—arrange their hair. Here a man is seen whose pate seems covered with a thick coating of whitewash; there another, whose locks, radiating in every direction from his skull as if they were electrified, could hardly be inserted in a bushel basket. The former state is but a preliminary to the second. The natives plaster their hair with a kind of paste made of powdered coral mixed with water, which, after hardening and then being broken up, stiffens the hair and bleaches it from its natural black to odd shades of red and dull yellow—thus producing strange effects in combination with the dark-brown skins of the people. Each form of head dressing has its meaning—the chiefs wear one, famous warriors another, men of counsel a third, yet all with variations at the caprice of individuals, which give great picturesqueness to a native gathering. Married men are distinguished from bachelors by the cut of their hair; the latter are of little account in Fiji, and by the way, are barbered, to announce to a scornful population their independent and degraded condition.

Both sexes are attired in the airy and simple manner which residence in a climate where the sun is hot, and the rainfall from eight to twelve feet a year, would naturally suggest. An elaborate female costume is shown in the picture of a chief's daughter, who is arrayed as to her trunk with a necklace of "trade" beads, and from her waist downward with a mantle of beautifully decorated "*tappa*" cloth, of creamy white ground relieved by designs of dull reds and browns. This "*tappa*" cloth is a characteristic product of Fiji, and is made from the inner bark of the paper-mulberry tree, which is macerated in water and the pulp beaten out upon hard ground with heavy wooden mallets, making a sort of vegetable felt of varying thickness—some as heavy as a blanket, others as light and thin as gossamer. The average female dress, however, is less elaborate—consisting simply of a fringe of cocoanut husk or hibiscus fiber dyed black and hanging from the waist to the knees. This adapts itself to every movement of the wearer, and is at once a sensible and decent dress.

Chiefs Drinking Kava.

FIJI AND THE FIJIANS.

The interior of a native house illustrates another use of the omnipresent "*tappa*" in wall