Correspondence.

LEAKAGE OF BICYCLE TIRES.

To the Editor of the SCIENTIFIC AMERICAN:

In view of the extensive use of the bicycle, it may be of interest to some of your readers to know how the porosity of the rubber in the pneumatic tire may be easily demonstrated. This porosity, rendering the rubber pervious to air, accounts for the necessity of frequently pumping up the tire, which labor, unavoidably associated with the use of pneumatic tires, is very often attributed to a leaky or an imperfect valve; whereas, in fact, there is a perfect stream of air continually passing through every tire throughout its length in the shape of exceedingly fine bubbles, so long as the pressure of air inside the tube is much in excess of the atmospheric pressure on the outside, as it always is when the tire is properly inflated.

This flow of air can be easily shown by stretching a sheet of rubber, such as is used in the inside tube of the bicycle tire, over the slightly flanged end of a glass tube and winding a stout twine tightly about the rubber in several turns, as shown in Fig. 2. By filling the tube with any transparent oil and connecting the top of the glass tube to a vacuum pump capable of producing a fairly good vacuum, a continuous stream of bubbles will be seen to rise through the oil, which will continue so long as the vacuum is maintained above the oil. With a vacuum of about 28 inches by the mercury gage, the bubbles will be from $\frac{1}{32}$ to $\frac{1}{16}$ inch in diameter, and even larger as they near the surface of the oil. This large size of the bubbles—enabling them to be seen so distinctly—is due to their being relieved from atmospheric pressure, and therefore greatly expanding as soon as they reach the inside of the rubber wall, the only pressure at that point being that due to the weight of the oil and the slight remnant of air remaining above the oil. If the top of the tube is suddenly opened to admit atmospheric pressure, the bubbles are seen to suddenly disappear, being compressed into the finest specks, and, owing to their diminutive size, they remain practically stationary in the oil. When the vacuum is again produced, they suddenly expand to their former size and continue their journey toward the top of the oil.

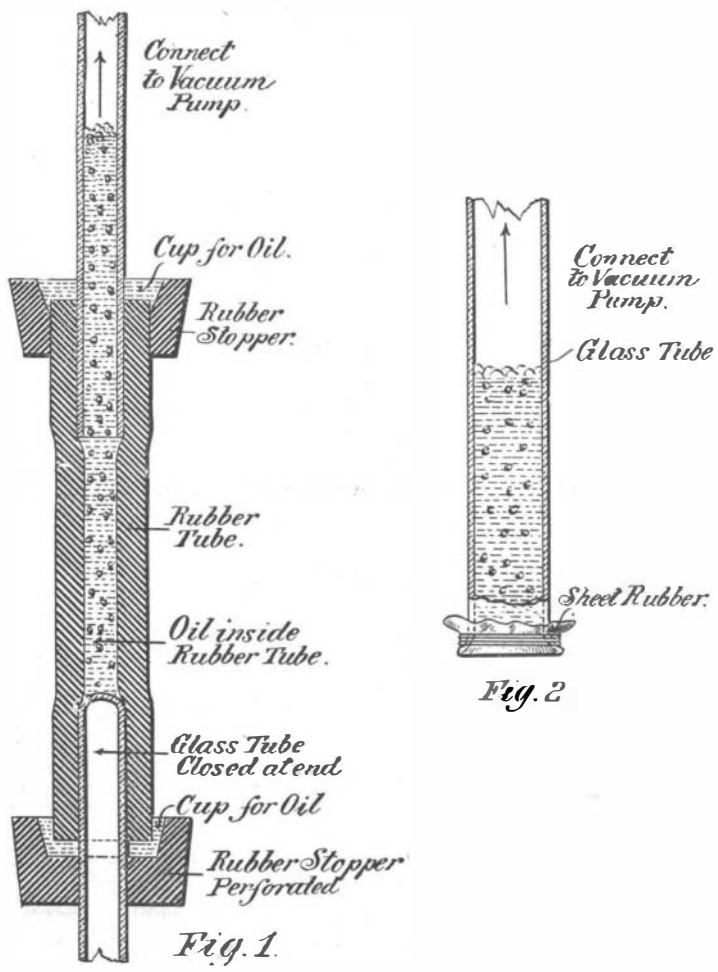
By means of the arrangement shown in Fig. 1, the writer has tested samples of several different qualities and makes of rubber tube up to ¼ inch thickness of wall, and has been unable to find any that would not allow the air to pass through it freely.

Fig. 1 shows in section a rubber tube of nearly pure gum with ¼ inch wall. Near the ends were attached perforated rubber stoppers cupped out to hold castor oil, in which the ends of the rubber tube were kept immersed to prevent any air passing between the glass and the rubber. The lower end of the rubber tube was closed by a sealed glass tube fitting tightly.

The pump was allowed to work sufficiently long in every test to exhaust all gas from the oil and the inside surface of the rubber. The stream of air bubbles would continue to pass after the pump had been working for several hours.

Immersing the entire tube in castor oil would cause the passage of air to cease but as soon as the tube was removed from the oil the flow of air would be resumed, although in smaller quantity. Wiping off the oil from the outer surface or bending the tube would cause the air bubbles to greatly increase in number.

Peterborough, Ontario. HENRY D. BURNETT.



METHOD OF TESTING LEAKAGE IN BICYCLE TIRES.

Long Distance Railroad Runs Without Stop.

To the Editor of the SCIENTIFIC AMERICAN:

I have studied with great interest the valuable article in your issue of September 3 on the subject of the two fastest long distance railroad runs without stop, and congratulate you on the completeness of the engineering data contained therein. I wish, however, in this connection, to call your attention to the ocean express trains on the London & Northwestern Railway, which make the run from London to Liverpool without a stop, the distance being exactly 200 miles, or 6 miles greater than that covered by the Great Western train. These trains also owe their existence to the keen competition between the Liverpool and Southampton steamship routes, and run every Wednesday and Saturday, in connection with the White Star and Cunard boats. The time for the 200 miles is 3¾ hours, giving a booked speed for the entire run of 53⅓ miles per hour, approximately the same as that of the two trains described in your article. I should say that I have no data for these trains more recent than last December, but, as the competition is as keen as ever, I presume the speed is still maintained. An article on these trains would doubtless be very acceptable to your readers. You do not seem to take account, either, of the run from London to Crewe, made twice daily by the same company, without stop. The distance is 158 miles, or 15 miles longer than the New York and Albany run, and the time is 3 hours 5 minutes, giving a booked speed of approximately 51 miles per hour.

In this country, the California Limited (run semi-weekly during the winter months), on the Santa Fé route, is scheduled to run the 202 miles from La Junta, Col., to Dodge City, Kan. (on an average descending grade of about 7½ feet to the mile), without stop, in the very creditable time of 4½ hours, but presumably there are stops not shown on the official time card.

No doubt your attention has already been called to what is presumably a slip in the first paragraph of your article. You state, or imply, that the Empire State Express was inaugurated during the year of the World's Fair, that is, 1893, and that the length of its run is nearly 1,000 miles. Doubtless you refer to the "Exposition Flier," which was run distinctly from the Empire State Express. The run of the latter is, of course, 440 miles, and the date of its inauguration was 1891.

Hoping this long epistle has not exhausted your patience, and that you will publish the same if you think it of general interest, I am,

Santa Cruz, Cal. HUGH S. GORDON.

[The run on the London & Northwestern Railway to which our correspondent calls attention is a good performance, but its exact merit can only be known when the weight of the train is given. It would scarcely come into the comparison instituted in our article of September 3, for the reason that it is not a regular daily train running on schedule time, as is the case with the Empire State Express and the Cornishman. The facts given in the letter are of considerable interest, especially the run on the Santa Fé route, the account of which will, no doubt, be news to a considerable number of our readers.—ED.]

Plants of Hawaii.

Since it has been determined, says The Independent, that the Hawaiian Islands may immediately come under the dominion of the United States, its natural products must deeply interest our people. A tropical flora is always attractive, but that of these islands is peculiarly so.

It is well known that they are very remote from any other land. From our own country the distance is 2,040 geographical miles, to the Marquesas group 1,060, and to Tahiti 2,190. It will thus be seen that it occupies a singularly isolated position, and, from a natural history point of view, has been left to work out its own salvation. Anyone who has given attention to the distribution of animals and plants over the earth knows how profoundly a fauna or flora may be affected by such entire independence of other lands. Once established in such a situation, uninfluenced by continental struggles, the creatures in the course of ages assume peculiar and marked characteristics.

There are reasons for supposing that this group of islands has always been thus separated from the influences of other lands. While in a northwesterly direction, according to Hillebrande, there is a succession of reefs and low uninhabited islets extending for a distance of thirty degrees of longitude about half way to Japan, the depth of water is less than a thousand fathoms, and reveals a narrow band of raised sea bottom. This line of reefs and islets exactly follows the trend of the fissure in the earth's crust on which the Hawaiian volcanoes have been erected. There is, too, abundant evidence to show that the age of the different islands of the group increases from east to west. Hence it is fair to conclude that these islets, rocks, and reefs lie in the same fissure and are only the coral-covered peaks of submerged volcanoes; in other words, that the volcanic action began at the northwest extremity, thirty degrees of longitude northwest from the island of Kauai. Thence it gradually moved on to the island of Hawaii, with subsidence of the older formations while it progressed.

But the western extremity of this varied sea bottom is separated by a great distance and enormous depths of sounding from the nearest high land, Japan, and the circumstance that the present flora of the Hawaiian Islands has less affinity to that of Japan than to any other warm or temperate country on the borders of the Pacific forbids altogether the assumption that this submerged chain of islands can at any time have formed a road for the migration of plants.

The soundings between Hawaii and California reveal one of the profoundest oceanic depressions on the globe. This, considered alone, would prove almost a total bar to the migration of plants from the northern portions of America. But, in considering the problem of distribution, one has to take into account the presence, direction, and force of ocean currents. These may carry on their surface seeds or even parts of living plants. Darwin proved by actual experiment that many seeds will long survive exposure to sea water.

Almost an infinitesimal number of Hawaiian plants, and these mostly on the high mountains, are North American in origin. However, a current deflecting from the coast of Mexico, or even further south, bathes the shores of the Sandwich Islands, and thus gives a marked American character to the Andean regions of the country. Other, and especially equatorial, currents have also had their effect. Long after their establishment in a new region, plants may retain traces of their origin. On the other hand, under new conditions, and disturbance of native systems of check and balance, they may vary widely.

It is said that Hawaii contains, and we would expect this from the circumstances above indicated, more endemic plants than any other known country; i. e., plants peculiar to itself. Great differences of elevation are found in the islands, from the palm-fringed lowlands to the sparsely clad heights of the volcanic peaks.

In one day a traveler may proceed from tropical jungles to a region of perpetual snow, and from a climate with an annual average of 180 inches of rainfall to one of 30 inches, or even less.

It will pay the reader who may be interested in lovely flowers to consult the royal folio of colored plates of Hawaiian plants prepared by Mrs. Francis Sinclair, Jr., and published by Houghton, Mifflin & Company, in 1889. One is impressed especially by the prevalence of elegant types of hibiscus, convolvulus, and pealike flowers. Of course this volume, issued solely for esthetic reasons, neglects many plants that a collector would delight to see. Many of these he will find figured in the superb atlas of the United States Exploring Expedition under Captain Wilson. Miss Isabella Bird, now Mrs. Bishop, in her charming volume, gives us some pleasant pictures. Here is one of them:

"Without exception the men and women wore wreaths and garlands of flowers, carmine, orange, or pure white, twined round their hats and thrown carelessly round their throats—flowers unknown to me, but redolent of the tropics in fragrance and color. Many of the young beauties wore the gorgeous bloom of the red hibiscus among their abundant, unconfined black hair, and many, besides the garlands, wore festoons of a sweet-scented vine, or of an exquisitely beautiful fern, knotted behind and hanging half way down their dresses. Their adornments of natural flowers are most attractive."

It may be said in closing that Hawaii, like all tropical islands, abounds in ferns. They are infinite, varied, and beautiful.

Spontaneous Combustion of Red Lead.

At some works in Germany a caskful of minium or red lead had become hardened, and in order to work up the mass again a commencement was made of breaking it into pieces, the whole being left for the night covered with a few sacks. The oxygen of the air soon acted upon the fresh fractures, raising the temperature of the mass, while reducing and igniting the resinous substances that had served to agglomerate the red lead cement, and a fire was only prevented by the fortunate arrival of the watchman.