AUTOGRAPH OF A THUNDERBOLT.

BY PROF. R. W. WOOD.

On the afternoon of June 23rd a flash of lightning struck on the lawn behind our summer home at East Hampton, Long Island, not fifty feet from the house and some tall trees which overshadow it. I was about to cross the lawn at the time, but had been detained for a few seconds to reply to a question, and was looking in the direction of the flash when it came.

There was a blaze of light at the surface of the ground where the bolt struck, and a column of smoke

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or steam seven or eight feet high. The report was not deafening, resembling the explosion of one of the so-called dynamite cannon crackers of medium size. As lightning goes, I suppose it was a mild discharge, but I felt quite thankful for the detaining question nevertheless. On examining the spot struck, I found three small patches of withered clover in a straight line about eighteen inches apart. At the center of the larger one was a hole in the ground perhaps an inch in diameter; a smaller hole about one-quarter of an inch across marked the center of the next patch, while the third showed no perforation of the soil. A closer examination showed that the sides of the hole were

blackened, and covered with small white patches of grains of sand fused together. It seemed worth while to make a study of what had happened below ground, and I accordingly melted about fifteen pounds of solder in an iron pot, heating the metal considerably above its fusing point, and poured it into the hole until it overflowed. We then excavated the cast thus formed, taking great care not to bend or scratch it with the spade. We found a small lateral tube several inches below the surface, which joined the two holes, with a long rusty nail partially fused and polished lying in it. The presence of the nail in the soil probably caused the lateral discharge to bridge across between the two main ones. In digging out the cast we found a lateral tube branching out from the large one, running down in the same general direction, into which the solder had not penetrated.

The cast was nearly four feet in length, and over an inch in diameter at the center, tapering off in both directions. What was especially interesting was the fact that it was *distinctly spiral*, a circumstance which has frequently been noticed in the case of fulgurites, or the tubes of fused sand formed when a heavy discharge of lightning strikes in a sand bank. Very little seems to be known as to the cause of this spiral structure, and this method of making casts of the tunnels formed by lightning may add in no small degree to our knowledge of the subject. On the day after the storm another and much larger hole was found on the golf links, where a very heavy discharge had struck a box of sand on one of the tees, so they are doubtless of very frequent occurrence. It is my hope that others will repeat the experiment; the services of the local plumber and his furnace can always be invoked in case one has not the facilities for melting the solder. It is important to find out whether the spiral form is the rule or the exception, whether the direction of the spiral remains the same throughout the entire length of the tube, and whether the twist is always the same. In the present case the direction of the twist was clock-wise looking downward, that is the fulgurite resembled a corkscrew driven down into the ground. The spiral form can be distinctly seen in the accom-

panying photograph of the cast, and is especially noticeable at the bottom. The entire surface of this cast is covered with small buds, arranged in straight lines along its length, some of these lines being seven or eight inches long. These may be due to cracks in the walls of the tube, due to the explosive action of the steam generated by the heat of the discharge.

Denatured Alcohol from Cacti.

BY P. E. MCLENAHAN.

If the great Southwest is ever reclaimed and made to produce vegetation that will be profitable, it must be done by developing the native plants instead of attempting to introduce new species and trying to acclimate them. With this idea in view, the United States Department of Agriculture has been directing the experiment stations and encouraging work upon the cacti.

For more than six years the experiment station at Las Cruces, New Mexico, has been experimenting with the prickly pear and other cacti. This species has been planted, and it was found that by throwing it upon the ground 85 per cent of the pieces grew, while only 91 per cent of the parts planted in a furrow grew. The rows were planted ten feet apart, and then left without cultivation, irrigation, or attention for three, four and five years. By this time the rows had spread until they were from six to eight feet wide, and only left a small path between them.

Then began a large series of experiments. The fruit of the cactus (tunas) was gathered. It is almost as large as an egg, of a dark red color, and filled with seeds. The coloring matter was first extracted, and found to make an excellent fruit coloring for jellies and confectionery. Then the sugars were examined and six kinds were found, and after long, tedious processes, each sugar was fermented and in time turned into alcohol. Then came careful weighing and mathematical calculations to determine the amount of denatured alcohol that could be produced from an acre, and the minimum of cost.

Final deductions gave most satisfactory results, and it was proven that \$150 worth of denatured alcohol could be produced per acre after an average growth of four years for the plants. At this rate a quarter section of now arid land could be made to yield a gross income of \$24,000, and this would be almost a perpetual yield, as the fruit is borne annually, and the plants need no replanting, cultivation, or irrigation, and grow upon the poorest soil in the arid regions.

A NOVEL WIND WAGON.

At the Indianapolis Motor Speedway aviation meet, held last June, an Overland Wind Wagon was exhibited which attracted a good deal of attention. The car was one taken from a stock of sixty-seven others, produced at the factory on one day, immediately after they had returned from their road test and before they were painted and groomed. Everything was removed from the chassis back of the clutch. Instead of an ordinary rear axle with a differential, a plain, straight axle was substituted. A wooden propeller eight feet long was mounted in position. The driving shaft instead of running back to the differential on the rear axle, was extended straight back until it protruded about six inches beyond the seat. Here a silent chain, which ran upward about 2½ feet, connected it with another short driving shaft, the upper driving shaft extending back in the rear of the car and holding the propeller. The propeller made 750 revolutions per minute. Its pitch and diameter were about 9 feet. The weight of the car was 1,800 pounds, and the motor was of 40 horse-power.

At the Indianapolis Motor Speedway, in competition with Walter Brookins in a Wright aeroplane, this wind wagon, driven entirely by the propeller, with Carl Baumhofer at the wheel, made the new time for 5 miles of 5 minutes and 20 seconds. The driving

A NOVEL WIND WAGON WHICH HAS A SPEED OF NEARLY 60 MILES AN HOUR.

sprocket has 17 teeth and the driven sprocket has 31 teeth.

A TUBULAR HIGH-SPEED CATAMARAN MOTOR BOAT.

BY FRANK C. PERKINS.

A novel tubular power boat, which draws only two inches without load and three inches with several passengers, has been constructed by William S. Reed, of Janesville, Wis. It has a speed of 18 miles per hour when operated by a gasoline motor of only 6 horsepower capacity.

The boat consists of two cigar-shaped tubes measuring a trifle less than one foot in diameter. On the tubes a platform 14 feet long is mounted, which has a railing of tubing with paraffin-coated canvas sides

A TUBULAR HIGH-SPEED CATAMARAN MOTOR BOAT.

and ends, secured by a molding at the bottom and hooks on the railing.

The platform on which the engine is mounted is 3½ feet wide, and is made of matched flooring. The boat measures about 30 feet in length over all. The galvanized-iron cylinders or tubes are divided into three chambers, an air pump keeping a moderate pressure constantly within them.

The rudder is located at the bow between the tubes. By this arrangement the boat is steered with little loss of speed in turning, the usual result when the rudder is placed at the stern. The boat attains its highest speed in a remarkably short space of time.

It is said that this novel motor boat leaves hardly any wake and that it throws only a three-inch wave, for this construction gives the propeller an undisturbed body of water to pass through at all times.

It is maintained that the stern does not settle down in the water, even when running at full speed. The skin friction is small.

In a paper entitled "Reinforced Concrete Trestles," which was read some time ago, it is stated that as yet, no soil has been encountered in which wooden piles could be driven, in which it has not been possible to drive the concrete piles. In some soils it is expedient to employ a jet; in others, an ordinary drop hammer, a steam hammer, or a combination of the jet with one or the other forms of hammer. It is necessary to lift the drop hammer somewhat more slowly for the concrete pile than for the wooden pile, in order not to set the driver into vibration. A cushion of some elastic material must be placed between the hammer and the pile, and with this precaution very little damage to the head of the pile results, even after long continued driving. As a matter of fact, it is surprising how much punishment a well-seasoned pile will stand. When it is necessary to drive the pile below the leads, as is generally the case, the follower is placed on top of the cushion. As the loads on these piles are great it is necessary to drive them to refusal, so that accurate knowledge of the required length is necessary. In case it is found that the piles so driven do not reach the elevation called for on the plans, the depth of the cap is increased accordingly. If it is found impossible or impractical to drive the piles to the depth anticipated, they can be cut off without difficulty. The cut need not be a smooth one, as the casting of the cap will take care of irregularities of the head of the pile.