RESULTS OF THE AMERICAN AUTOMOBILE ASSOCIATION'S FOURTH ANNUAL TOUR FOR THE GLIDDEN AND HOWER TROPHIES.

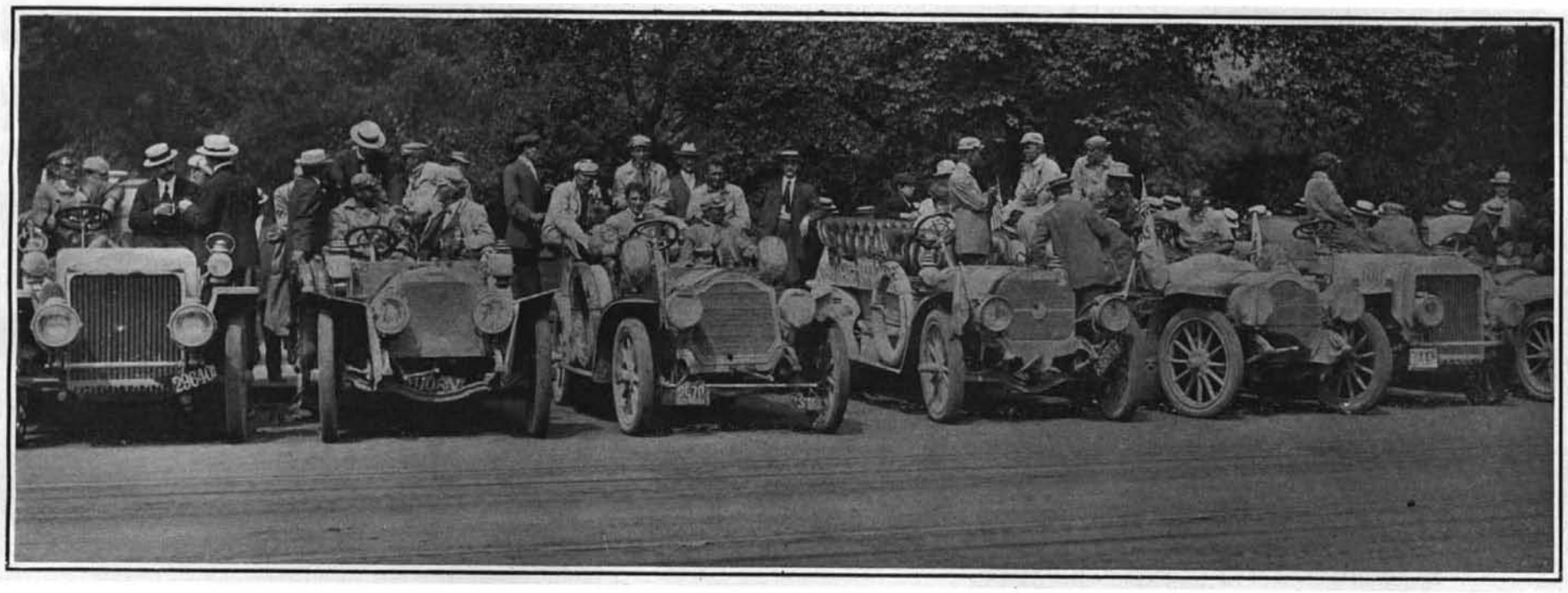
On Wednesday, the 24th ultimo, by the arrival in New York of 55 mud-covered and travel-worn automobiles, and the assemblage of most of these cars along the south side of Central Park on 59th Street, the fourth annual tour of the American Automobile Association was brought to a successful termination. The tour was the longest and the most strenuous test of ordinary touring automobiles that has ever been held either here or abroad, and that no less than 21 machines should have competed with perfect scores under the rules, is indeed remarkable, and is a clear indication of the degree of perfection to which the modern automobile has come, in America.

In our last issue, we described the progress of the tour as far as Pittsburg. The ninth day's run of 97 miles, from Pittsburg to Bedford Springs, Pa., was not so difficult as had been anticipated. There was plenty of hill climbing and coasting, the longest climb being 4 miles in length up Laurel Ridge. When the summit was reached, the cars were enveloped in the fog. The roads were rough in places, and the roadbed was largely of clay. Overheated engines and burnt-out brakes were the chief troubles experienced during this day, and many of the contestants had a great deal of tire trouble as well. The runabouts in the Hower trophy were the chief machines to suffer from the rough roads and high hills. A 6-cylinder Pierce runabout lost 6 points through a delay due to tire and other troubles, and a Dragon runabout was delayed by transmission trouble, and withdrawn so repairs could be made. The Pennsylvania runabout broke the steering-lever arm. The Premier runabout did not start from Pittsburg, owing to illness of its driver. At the end of this day's run, but two runabouts remained with perfect scores. These were the 30-horse-power White steamer and the 35-horse-power Stoddard-Dayton. Both these cars completed the remaining three days' run with perfect scores, and it has been found necessary to give them a supplementary test run from New York to Cleveland, in order to determine which will be the winner of the Hower trophy. By the delay of Pierce car No. 21, due to tire trouble and to the bouncing out of the owner's boy on one of the "thank-you-ma'ams" encountered, the Pittsburg Club, which previously had a perfect score, lost 22½ points, and dropped behind the Buffalo Club, which lost 18 1-5 points on the seventh day. As neither of these clubs had any further penalization, the Buffalo Club was declared the winner at the completion of the tour. The cars which made up the Buffalo team consisted of two Pierce, two Thomas, and one Packard touring car. The Glidden trophy was won by a Pierce machine in the last two tours, so that this makes three times in succession that Pierce cars have won, or have been instrumental in winning, this trophy. Among other cars which had trouble in the ninth day's run were the Columbia gasoline-electric machine (which is said to have had trouble with its transmission), the Deere car, No. 51 (which stripped its intermediate gear), Acme No. 43 (which damaged the rear axle), and Mitchell car No. 24 (which broke both front springs). The Thomas 40-horse-power runabout (No. 102) also arrived with a broken front spring.

In the tenth day's run of 140 miles, which was made at an average speed of 14 miles an hour, from Bedford Springs to Baltimore, Md., better roads were encountered, and, except for the water breaks and toll gates, better time could have been made. One more Glidden contestant lost its perfect score. This was the Stoddard-Dayton car No. 38, which was penalized 142 points on account of the delay due to transmission trouble. Ranier car No. 26, which was driven throughout the entire tour by Mrs. A. Cuneo, ran off the road and into a fence, owing to a front tire coming off. This car already had a broken front spring, and in the accident thus mentioned, the front axle was damaged and had to be repaired at a nearby blacksmith's shop. As the result of this trouble, the Ranier car received a further penalization.

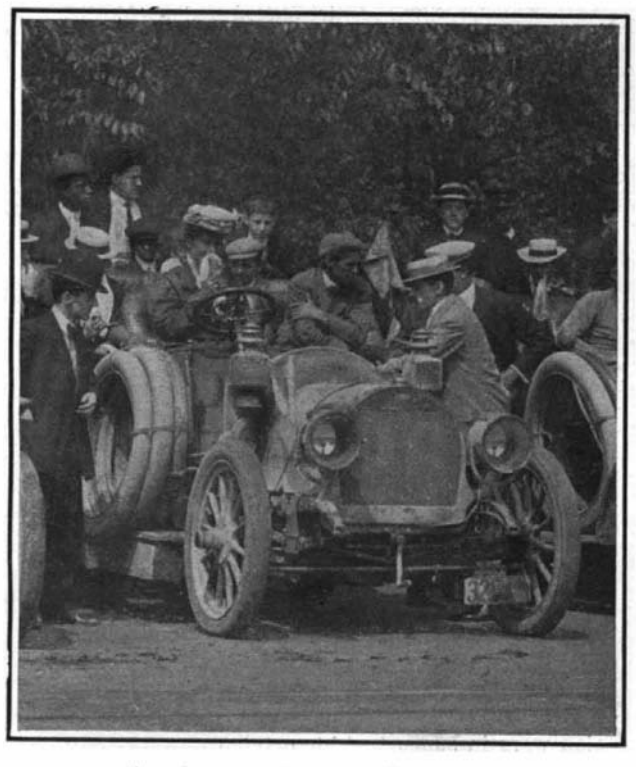
The eleventh day's run of 174 miles, from Baltimore to Philadelphia, resulted in a broken rear axle for Haynes car No. 55, which for nine days had kept a perfect score. Welch car No. 7, which had been penalized 12 points on the first day only, for delay caused by hitting a bridge when trying to avoid striking a boy, and which on all subsequent days had a perfect score, was put out of the running by a broken crankshaft, though its mate, No. 29, was one of the perfect-score cars at the finish.

The final day's run, from Philadelphia to New York, a distance of 98 miles, was completed in 5 1-5 hours' running time, at the Court House in Jersey City. After being checked in, the cars crossed the ferry to 23d Street, New York, and paraded up Broadway to Central Park. A more mud-bespattered, dust-begrimed set of men and automobiles has seldom, if ever, been seen than the 55 cars which finally finished in New York city. Our illustrations show some of the perfect-score machines as they appeared in the line-up at Central Park, but these pictures, of course, give no idea of the hardships and terrible roads which were encountered and successfully overcome in this 1,570-mile tour. Several of the most marvelous performances were made by the small double-opposed-cylinder Reo and Maxwell machines, of 16 to 20 horse-power. That these little cars did successfully maintain the same fast schedule that was maintained by machines of more than double their horse-power, is



White Steamer. Pierce Arrow Packard Welch Thomas White

Some of the Perfect-Score Cars as They Appeared in the Line-up at the End of the Tour.



The Only Lady Driver, At the Wheel of Her 30-35 Horse-Power Rainier.

Mrs. Cuneo, despite the breakage of the springs and front axle of her car, brought it through to the finish.

View Showing Sprung Front Axle of One of the White Steamers.

No. 42 is the Royal Tourist which made a perfect score. Another car of this make completed the run on "filled" tires.

SOME OF THE WINNING CARS IN THE A. A. A.'S FOURTH ANNUAL TOUR AND CONTEST FOR THE GLIDDEN TROPHY.

indeed a high tribute to the perfection of the simple light-weight American car.

In going over the results of the tour, one is struck by the fact that there was relatively very little engine trouble on any of the cars. The same can be said of the radiators, which, with the exception of a few that were damaged in collision, did not spring any leaks. Structural weaknesses were the main weaknesses developed, and the ones which chiefly hampered the continuance of the cars in the run. The Autocar, for instance, first strained and then cracked its frame, while several cars broke their rear axles, and a considerable number encountered broken springs. No less than five cars stripped their gears, and the one gearless car, the Columbia gasoline-electric, as noted above, also had its transmission give out. One of our photographs shows a White steamer whose front axle was sprung. Notwithstanding such damage, three of these cars finished with a perfect score. Many of the drivers wished to equip their cars with shock absorbers after the first day's run, but this was not permitted. Several of the winners had these devices.

The 21 cars which finished with a perfect score consisted of four Pierce machines (three 40-45 4-cylinder cars and one 60-65 6-cylinder), two 60 horse-power Thomas Flyers, two 30-horse-power Peerless cars, two White steamers (a 30 and a 20-horse-power), and one each of the following: 50-horse-power Haynes, 50-horse-power Welch, 40-horse-power Walter, 40-horse-power Berliet, 45-horse-power Royal Tourist, 24-horse-power Premier, 25-horse-power American Mors, while a 30-horse-power White steam runabout and a 35-horse-power Stoddard-Dayton runabout were tied for the Hower trophy. A 6-cylinder Pierce runabout lost but 6 points on the ninth day. Three other contestants, a 35-horse-power Gaeth, a 40-horse-power Oldsmobile, and a 16-20-horse-power Maxwell, lost only 3 points throughout the entire test. When these facts are taken into consideration, it will be seen that fully half the cars that contested for the Glidden trophy finished with practically perfect scores. This was indeed a splendid showing, in view of the extremely difficult roads that had to be traversed in many places at the high average speed of about 18 miles an hour. In all probability, the tour will be more popular than ever another year; for, despite all the hardships which they went through, the tourists all expressed themselves as eager and willing to compete again. It is safe to say that no other form of competition gives a modern automobile such a terrible racking as a tour or endurance run of the character of this last Glidden tour, and only by such a test can the weak points of their machines be forcibly brought out and demonstrated to the automobile manufacturers.

A PRACTICAL GLIDING CRAFT WITH SUBMERGED HYDROPLANES.

(*Continued from page* 76.)

the quantity of water pumped into the tank, the cooling water is kept at the proper temperature. On account of the high compression, the best results are obtained with the water at a temperature below 180 deg. F. As each pair of opposed cylinders are in the same vertical plane, a four-throw crankshaft is used, the connecting rods of each pair of pistons being suitably jointed together at the crank. One of the rods is forked and attached to the crankpin bushing, while the other fits in between the fork of its mate and reciprocates upon the bushing. The engine is placed horizontal and oiled by splash lubrication.

A representative of the Scientific American recently witnessed a demonstration of Cooper Hewitt's gliding craft. As soon as the motor was started and the clutch thrown in, the craft shot forward, accelerating very rapidly until, after two or three seconds, the large planes left the water and the boat was entirely raised. It then ran on the four sets of lower planes at high speed and without any commotion, except when the upper planes happened to strike a wave, when the spray would be thrown in sheets, as shown in the photograph.

The force of the waves striking the emerged planes must necessarily have a decided retarding action upon the boat, and, as was explained to our representative, for rough water the craft should be designed to lift them higher above the water. The pressure of the waves when striking the emerged planes, while the boat is traveling at 30 miles an hour, is estimated to be 300 pounds to the square foot, which is also equivalent to the lift pressure on the submerged planes at the same speed. The blows received by the hull itself from the crests of the waves were sufficient to open seams, and drive water and spray into the boat. Of course, all this can be obviated by placing the step-like sets of planes farther below the hull, so that both it and the large upper planes will be lifted a foot or more above the surface instead of 3 or 4 inches, as at present. Such development will undoubtedly occur in the next craft that Mr. Hewitt builds.

According to the generally accepted formulas of Froude and others, the lift of a hydroplane increases or decreases as the square of the speed. Consequently, since the weight is constant, much less plane surface (about ¾ less) is required at 30 miles an hour than at 15, for example. Either that, or else a lesser angle of the planes can be used to accomplish the same purpose. To avoid complications and to obtain as accurate results as possible, Mr. Hewitt chose the former method and arranged to diminish the surface of the planes progressively by causing them to emerge step by step as the speed increased. As the lift per horse-power is better with large planes, such planes would be chosen were it not for the fact that the skin friction increases with the surface, and when large planes are used this becomes very great. Consequently a small or moderate-sized plane is preferable. The angle of the plane is another important factor. As the angle decreases, the surface of the plane (and consequently the skin friction) increases for any given lift. Naturally, there is a certain best angle with relation to the horse-power in each particular case. This angle is modified by the coefficient of friction of the material of which the plane is formed, and it must be such as to cause the minimum expenditure of energy for the required lift. It of course differs according to the material used in constructing the planes. In any case, the angle is relatively small, practically between 1 in 8 and 1 in 20 for the materials ordinarily used. An angle of 1 in 12 would probably prove to be about the right one in most instances. As the angle is relatively a small one, a small variation in it will produce a large variation in lift. In each experiment Mr. Hewitt preferred to keep the angle practically constant after the planes had been once set. This was done for purposes of level and equilibrium, and instead of changing the angle, the area of the planes was varied in the manner mentioned above. It would be feasible to vary the area of the planes mechanically if this were necessary, but it is simpler to take advantage of the surface of the water and to vary the surface of the hydroplanes by causing them to emerge step by step. Mr. Hewitt believes that varying the surface of the planes is essential, especially when it is desired to leave and return to the original supporting medium at such speeds as will be found safe in practice. Of course it is doubtless also practical to vary the angle of inclination of the planes if this is found necessary.

The weight of the Hewitt boat, together with the planes which emerge at full speed, is about 2,500 pounds. With two men and some 300 pounds of water aboard, the boat was lifted above the surface of the water at a speed of about 16 miles per hour, and a speed of over 30 miles an hour was readily attained, while the inventor believes that he has attained a speed of over 38 miles per hour. As the boat raised above the surface and the top of the propeller blades came within a foot thereof, the thrust was seriously affected and rapidly fell off. When the tips of the blades came close enough to the surface the engine would race for a moment till the boat slowed down and settled. This can be overcome by placing the propeller lower.

As the conditions were such that accurate observations were difficult to obtain, one could not tell with absolute accuracy by looking over the side of the craft at the various speeds just how far out the hydroplanes emerged, but Mr. Hewitt says that as far as he was able to judge, the craft was supported upon the four bottom planes when it was traveling at full speed, and that the other planes were above the surface. The combined surface of these four planes was about 8 square feet, so that the weight lifted per square foot was over 300 pounds. As no tests have been made of the horse-power the engine develops at the speed it was running, Mr. Hewitt does not state the horse-power that was required, though it is safe to say that this was slight in comparison with that which would be required to propel an ordinary boat at such speed.

As already stated, the lift of the planes tends to increase as the square of the speed, and the skin friction also tends to increase in the same ratio. At very high speeds, however, it is thought to be probable that the lift tends to increase in a greater ratio and the skin friction in a lesser one. If this is so, the increase in air resistance would be counterbalanced by this effect, and the horse-power required would tend to increase directly as the speed. Whether this is so or not cannot be determined until these very high speeds are actually attained.

The question naturally arises as to whether such a boat, supported as it is on four small planes, is stable. This can be answered in the affirmative, for, since each step in the system of hydroplanes is only a few inches in height, if the boat sinks at one corner due to any of its occupants changing their position, for example, it can only sink a few inches before another plane is lowered into action, and this, with the increased surface it affords, will quickly counterbalance the added local weight.

Comparing the usual surface hydroplane with the submerged type, it can readily be seen that although the supporting area of the former diminishes as the boat's speed increases, whereby only the rear third of the plane is made to carry the weight, nevertheless the front plane especially is subjected to terrific retarding blows when struck by a wave, and there is also trouble from interference of the planes. All this is obviated with submerged planes. It is also a well-known fact that the front third of a plane supports about one-half of the weight. The submerged hydroplane can be made so small, thin, and light that the resistance to advance of such a plane through the water is probably less than that of the large, cumbersome plane used on the surface, while the lifting power is far superior. As can be seen from the photograph, the planes that support Mr. Hewitt's 1½-ton craft are surprisingly small, which makes it seem probable that submerged hydroplanes suitable for large boats would not be unwieldy nor unpractical, while the hull required could be built strong and light and would serve simply as a means of flotation when the craft was at rest. It would certainly seem as if a great stride had been made in marine navigation by the successful demonstration recently made with Cooper Hewitt's novel craft.

The Use of Hydrolith for the Inflation of Balloons.

BY DR. G. F. JAUBERT.

All the chemical processes for the production of hydrogen which are at all suitable for use in the field are rather complicated. This is true both of the wet method, in which metallic iron or zinc is employed to displace and evolve hydrogen from dilute sulphuric or hydrochloric acid, and the dry method, in which calcium hydroxide (slaked lime) is decomposed by pulverized zinc at a high temperature. In practice the wet process is always used for the inflation of hydrogen balloons.

The reaction between the metal and the acid is affected by a number of conditions of diverse nature, and as the composition of the metal filings employed is far from uniform, it is found that, while some specimens act quickly upon the dilute acid, others remain almost passive, so that the disengagement of gas is extremely slow.

These objections, in addition to the consideration of weight, which is of paramount importance in field operations, led me to seek a chemical compound which would evolve pure hydrogen on simple contact with water, as calcium carbide evolves acetylene and oxylith evolves oxygen.

After long study of the question I turned to the hydrogen compounds of calcium, and in particular to calcium hydride, CaH_2, to which I have given the name of hydrolith. In marked contrast to oxylith, which yields only 150 liters of oxygen per kilogramme (2.4 cubic feet per pound) and calcium carbide, which produces from 280 to 300 liters of acetylene (4.6 to 4.8 cubic feet per pound), hydrolith gives a copious flow of hydrogen, amounting, if the compound is chemically pure, to 1,143 liters per kilogramme (18.3 cubic feet per pound).

The commercial hydrolith which we are now making and delivering to various governments for use in military ballooning, contains about 10 per cent of impurities and furnishes about 1,000 liters or one cubic meter of hydrogen per kilogramme (16 cubic feet per pound).

The large quantity of hydrogen produced by a small weight of transported material and the promptness with which the gas is disengaged make hydrolith preeminently suitable for the use of military ballooning, both for the initial inflation on the ground and for replacing lost gas without landing—a thing hitherto impossible.

Three types of military balloon have been adopted by the French central aeronautic station at Chalais-Meudon: The colonial balloon of a capacity of 350 cubic meters (12,350 cubic feet), the field balloon of 500 cubic meters (17,650 cubic feet), and the siege balloon of 800 cubic meters (28,250 cubic feet).

For the conveyance of compressed hydrogen for the inflation of colonial and field balloons (siege balloons being filled by stationary apparatus) the military authorities have adopted wagons, each of which carries 180 cu. m. (6,356 cu. ft.) of hydrogen compressed to 135 atmospheres in eight or ten steel tubes. The loaded wagon weighs 3½ tons and is drawn by six horses. Three wagons and eighteen horses are therefore required for the service of a field balloon.

It may be doubted whether this heavy and cumbrous equipment would render the service expected of it on the battlefield.

Gen. Langlois, in a recent excellent article on the German heavy artillery, asserts that even 2 tons is an excessive weight for a field vehicle, and cites experiences of the Austrian-Prussian and Franco-Prussian wars in support of his opinion.

What, then, can be accomplished with wagons weighing 3½ tons in the service of a field balloon station, which is essentially a portable observatory and should possess the same maneuvering qualities of lightness and mobility that are now demanded of field artillery?