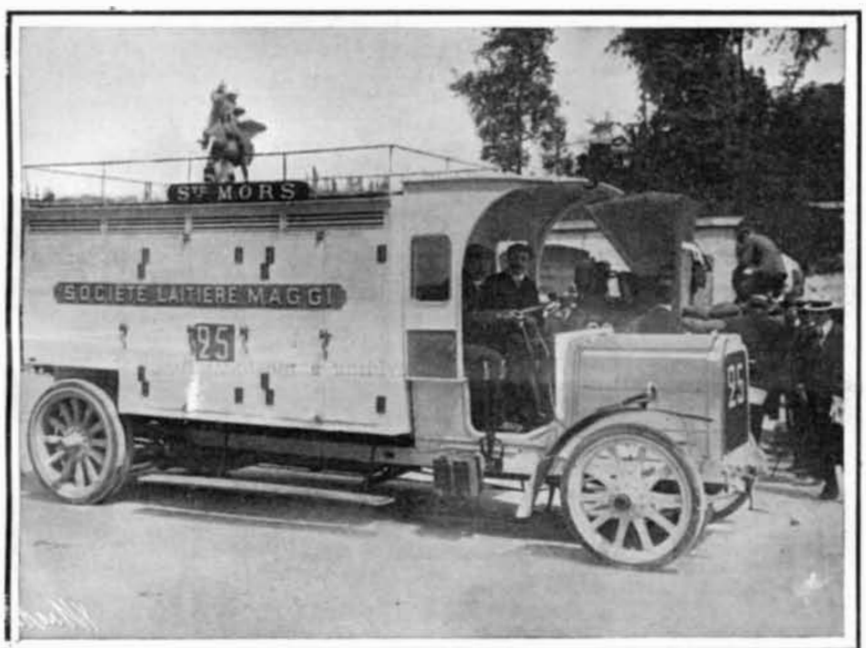
NOVEL COMMERCIAL VEHICLES IN THE RECENT FRENCH TEST.

The automobiles shown in the accompanying illustration are some of the most novel types which participated recently in a contest for commercial vehicles organized by the Automobile Club of France. The Latil fore-carriage seen at the top of the page shows the latest attempt of the French designer to perfect an attachment for converting an ordinary horse-drawn delivery wagon into a motor-propelled vehicle by removing the regular front axle and substituting one with motor-propelled wheels. In the present instance these wheels are shod with peculiar sectional solid rubber tires. The fore-carriage has a two-cylinder, 12-horse-power, gasoline motor of 3.464 inches bore by 5.118 inches stroke, the normal speed of which is 1,000 revolutions per minute. The weight of the wagon, empty, was 3,946 pounds, and the load carried was 3,086 pounds. An average speed of 9.32 miles an hour was made throughout the 267-mile test, while the gasoline consumption for the last day's run of 40.4 miles (during which the consumption of all the vehicles was tested) was the least of any in its class, being

The 1½-Ton, 12-Horse-Power Latil Fore-Carriage Delivery Wagon.

A new form of solid sectional tire is shown on the front wheel.



A 28-Horse-Power Mors Refrigerator Milk Wagon. Weight of Wagon, 5 Tons. Capacity, 2 Tons.

Note the twin solid rubber tires on the rear wheels, for carrying the exceedingly heavy weight.

The 3-Cylinder, 24-Horse-Power Janvier Truck, Fitted with Novel Steering Bogie.

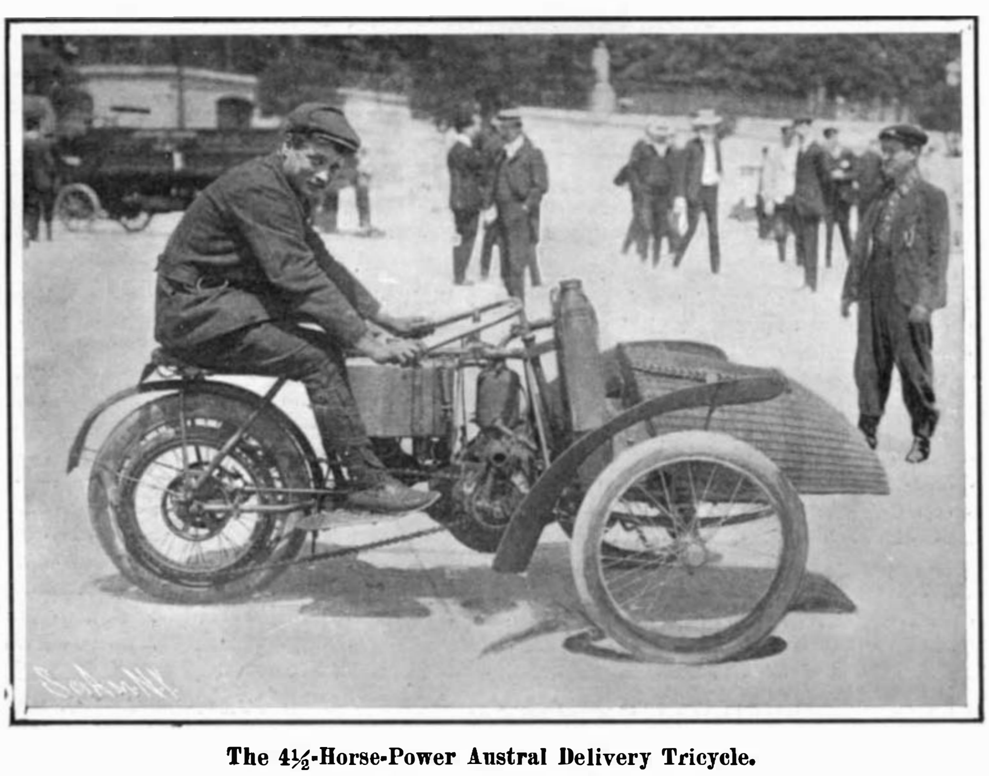
A peculiar form of hub brake is to be noted on the rear wheel. Loaded as shown the machine weighed over 14 tons.

but 0.146 liter per ton-kilometer of useful load (or 0.06 of a gallon per ton-mile). Besides the delivery wagon shown there were two still larger Latil fore-carriage trucks which weighed 9,766 and 13,448 pounds respectively, including their loads of 4,532 and 8,140 pounds. These vehicles averaged 7.61 and 6.93 miles an hour. These vehicles also were at the head of their respective classes (that for a useful load of from 4,409 to 7,716 pounds and that for vehicles carrying more than 7,716 pounds) as far as gasoline consumption was concerned, as the former consumed only 0.168 liter per ton-kilometer (0.071 gallon per ton-mile) of useful load, while the latter consumed only 0.095 liter of gasoline per ton-kilometer (0.04 gallon per ton-mile) of useful load. The best previous record is that made about a year ago by a German Daimler truck which consumed 0.028 gallon per ton-kilometer as against the heavy Latil's 0.025. All three fore-carriages were fitted with two-cylinder motors, the horse-powers being respectively 12, 14, and 28. The demonstration showed the remarkable efficiency of this type of vehicle in which the horse is replaced directly by the motor.

Two other interesting vehicles are the Janvier six-wheeled truck and the Mors refrigerator milk wagon. The former vehicle has a four-wheeled bogie at the front. This bogie is arranged to turn like that of a locomotive. The rear wheels, which are chain-driven from a countershaft, are fitted with a peculiar type of double-band brake, which is applied to the wheel hub. The Janvier truck has a three-cylinder, 24-horse-power motor, having a bore of 5.511 inches and a stroke of 5.905 inches and fitted with low-tension magneto ignition. The truck shown weighed, loaded, 28,660 pounds. Its average speed was 5.06 miles an hour. The Mors refrigerator car is a huge vehicle intended for the transportation of milk. Its total weight empty is 10,350 pounds, the refrigerating box alone weighing over 1 1-3 tons. The useful load carried was 4,409 pounds, and the total weight was 14,759 pounds. A 28-horse-power four-cylinder motor, having a normal speed of 1,000 revolutions per minute, was employed. The vehicle made an average speed of 6.21 miles an hour.

The Austral motor-tricycle, or tri-car, shown at the bottom of the page, is the same machine and driver that recently won the Tour de France. Three of these little machines were at the head of their class. They are fitted with single-cylinder motors of 4½ horse-power and have a chain-drive to the rear wheel, in the hub of which is placed a two-speed gear. The radiator in front of the handle bar serves to remove the heat from the cooling water used around the engine cylinder. The basket in front is used as a package carrier. These machines are found very useful by small dealers for delivering packages. Their average net weight was 760 pounds, and their average speed 16½ miles an hour. The average load carried was 114 pounds, and the average weight, loaded, 874 pounds. A similar machine, the Contal, the weight of which loaded was 769.4 pounds and the load carried 132¼, used alcohol for fuel and showed a consumption of 0.839 liter per ton-kilometer (0.35 gallon per ton-mile) of useful load.

Besides the trucks and other freight-carrying vehicles, there were no less than four omnibuses entered in this test. Two of these, the 40-horse-power Brillié and the 35-horse-power Clement, had a carrying capacity of thirty persons, weighed loaded 14,164 and 11,177 pounds, and made an average speed of 14.66 and 13.42 miles an hour. Two others, the Clement I. and the Delahaye, with a carrying capacity of from twelve to twenty-four persons and a total weight, loaded, of 7,495 and 7,319 pounds, made average speeds of 16.22 and 13.04 miles an hour. The large Brillié omnibus, which is similar to those now being run on the streets of Paris, used alcohol for fuel, and in the test consumed 0.2 liter per ton-kilometer (0.085 gallon per ton-mile) of passengers carried. The live load amounted to 4,684 pounds. The 24-horse-power Brillié delivery wagon, weighing, loaded, 11,034 pounds, of which 5,780 represented the load, also used alcohol and showed a consumption of 0.177 liter per ton-kilometer (0.05 gallon per ton-mile) of useful load



The 4½-Horse-Power Austral Delivery Tricycle.

Three of these machines made an excellent showing.

NOVEL TYPES OF FRENCH COMMERCIAL AUTOMOBILES.

carried. A still larger Brillié truck, which was run on gasoline at an average speed of 10.37 miles an hour, had a consumption of 0.11 liter per ton-kilometer (0.046 gallon per ton-mile) of load carried. The consumption of alcohol was thus shown to be somewhat greater per ton-kilometer of useful load carried than when gasoline was used.

HOW ECLIPSES OCCUR.

BY PROF. FREDERIC R. HONEY, TRINITY COLLEGE.

In the endeavor to obtain a clear understanding of how eclipses occur, it is necessary to know the form of the moon's path in space, which is the resultant of two motions, viz., that of her orbital motion round the earth, and of the revolution of the latter round the sun.

The popular conceptions of this path are frequently erroneous, and are illustrated in Figs. 1 and 2. The piece *a* rotating about the fixed center *S*, which represents the sun, carries a disk *b* which rotates round the center *E*, representing the earth.

On the periphery of this disk is a point *M*, representing the moon, which revolves round *E*, and describes the moon's path. In Fig. 2 this curve forms a loop, due to the rapid rotation of the disk as compared with the angular motion of *a*.

Fig. 1 represents the curve when the disk rotates more slowly; and *M* describes a sinuous path which crosses and recrosses the earth's orbit. This approaches more nearly the form of the moon's path; but it differs very widely from the true one, because in the illustration the radii of the orbits, and the relative orbital velocities of the earth and moon, are not correctly represented. The mean radii are respectively 92,900,000 and 238,840 miles. Dividing one by the other, $\frac{92,900,000}{238,840} = 389$; i.e., the earth's mean orbit radius is three hundred and eighty-nine times as long as the moon's. They are correctly proportioned in Fig. 3, which is a plot of the earth's orbit for about one-half of the month of August, 1906.

The position of the earth on August 4 and the dates that follow is the center of the circle the circumference of which represents the moon's orbit drawn to the same scale. The moon *M* is situated at the extremity of the radius of the circle. The earth, moving at the rate of eighteen and a half miles a second, travels each day a distance of about one million six hundred thousand miles, or three and a third times the diameter of the moon's orbit, while the latter, moving in her orbit at the rate of about five-eighths of a mile a second, revolves round the earth daily at an average of a little over 13 deg.

The relative positions of the sun, the earth, and the moon are shown for August 4, the date of a total eclipse of the moon. The sun is situated in the direction of the arrow, the earth at the center of the circle, and the moon at *M*. They are in the same straight line. If we place this page in a horizontal position, and regard it as representing the plane of the ecliptic—i.e., the plane which passes through the centers of the sun and earth—the moon must be in or near the plane of the ecliptic, that it may be possible for an eclipse to occur.

This will be evident by referring to Fig. 4, which shows the plane of the ecliptic, the plane of the moon's orbit, and the earth and the moon *M*. *M′* and *M″* represent two views when the center of the moon is in the plane of the ecliptic, i.e., when she is at one of her nodes. The earth and moon are shown at *M′* by concentric circles; while the distance from *M′* to *M″* measures the mean radius of the moon's orbit. The shadow area is inclosed by the dotted lines drawn from the circumference of the sun's disk tangent to the earth, and indicates the limit within which a total or partial eclipse may occur.

When the moon is at or near *M″*, the eclipse is total; when at *M‴*, partial; and at *M⁗* no eclipse occurs.

The moon at each of the dates August 4 to 20 (Fig. 3) is at the extremity of the radius of the circle representing her orbit, and her revolution round the earth is shown until she reaches her position on August 20. Connecting these points, the dotted line represents her path which is below the plane of the ecliptic.

A partial eclipse of the sun occurs on August 19, when the earth, the moon, and the sun (Fig. 3) are again in the same straight line.

The diameter of the sun is 866,400 miles; dividing this by 389—the length of the earth's mean distance in terms of the moon's mean orbit radius—$\frac{866400}{389} =$ 2,227.

A disk 2,227 miles in diameter would eclipse the sun. The moon's diameter is 2,162 miles. Therefore, under these conditions, if the three bodies were in the same straight line, we should have an "annular" eclipse of the sun, shown at Fig. 5; the larger circle representing the sun, and the smaller one the moon.

If the sun should be at his minimum distance from the earth, and the moon at her maximum distance, Fig. 6 would represent their apparent relative diameters—a more pronounced annular eclipse.

If the moon were at her minimum distance, and the sun at his maximum distance, Fig. 7 would show their apparent dimensions; the larger circle representing the moon, and the smaller one the sun—a total eclipse of the sun.

The moon's center will be in the plane of the ecliptic on August 18 (the ascending node) before the three bodies are in the same straight line as shown at *M* on the 19th.

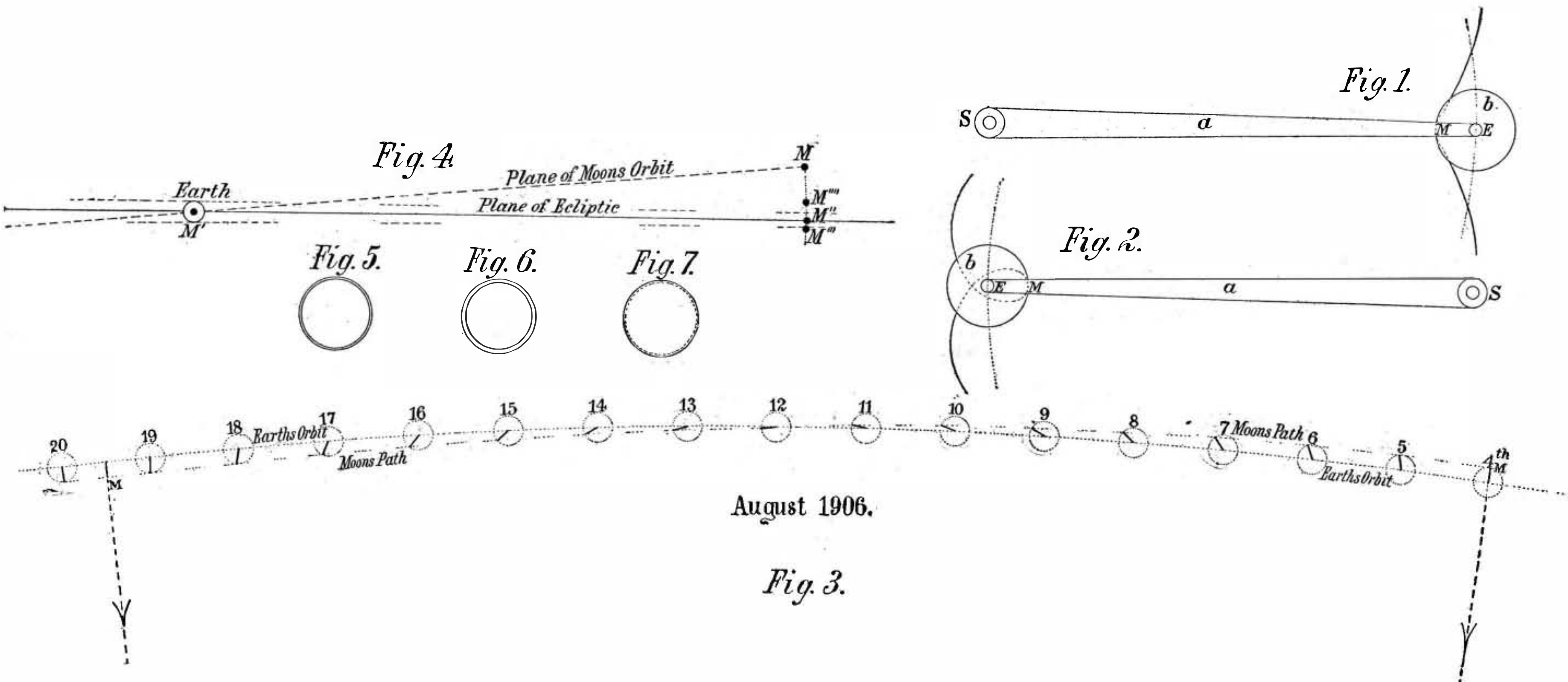
Therefore it cannot be a "central" eclipse on that day. If the earth's orbit were plotted to include the date July 21, when another partial eclipse of the sun occurred, we should have an exhibit of the moon's path somewhat similar to that of Fig. 3. This has been omitted for lack of space.

The sun subtends on the average an angle of about thirty-two minutes, with a variation of about half a minute during the year. This is due to the varying distance between the earth and the sun, which amounts to about three million miles.

The moon subtends an average angle of about thirty-one and a half minutes, with a variation of about two minutes. These variations are exhibited in Figs. 5, 6, and 7.

To obtain some conception of the relative dimensions of the sun, the earth, and the moon, and the distances that separate them, it should be noted that the diameter of the sun—which is one hundred and nine times that of the earth—if drawn to the same scale as Fig. 4, would be equal to three and five-eighths times the distance between the earth and the moon ($= M'\ M''$); and the sun's distance would be represented by a measurement equal to three hundred and eighty-nine times this unit.

The sine of 32 deg. = 0.0093. If we multiply this by 108, $0.0093 \times 108 = 1.00$, we discover that a circular disk of one inch diameter placed 108 inches (= 9 feet) from the eye will eclipse the sun or the moon.



HOW ECLIPSES OF THE SUN AND MOON WILL OCCUR IN THE MONTH OF AUGUST.

Another Alpine Tunnel.

Consul Edward Higgins, of Berne, reports that the legislature of the Canton Berne has accepted the project for a trunk line called the "Lötschberg," with electricity as motor power, to pass through the Bernese Alps and connect at Brig with the Simplon.

This new road will require five and one-half years to build, and necessitates a tunnel 13½ kilometers (kilometer = 0.62137 mile) long out of an entire length of 56 kilometers. The cost will be about $17,100,000. The steepest gradient will be twenty-seven one-thousandths. It will serve as the most direct means of communication between northern Italy (Milan and Genoa) and the vast district lying to the north and northwest of Switzerland. It will shorten the approach to the Simplon, that now must be reached *via* Lausanne, and will compete with the Gothard tunnel railroad. In addition to its value as an international trunk line it will prove of vast commercial importance to central Switzerland, and particularly to the Canton and city of Berne, by affording a direct line with the south that now has to be reached by means of the Gothard on the east or through the Simplon, which requires a roundabout deviation *via* Lausanne on the west. The road that has to be constructed will commence at Frutigen, a town near Spiez, a few miles from the lake of Thun, which is in direct communication with the towns of Thun and Pontarlier and with the cities of Berne and Basel. It will merge into the Simplon at Brig and virtually form the completion of that great project. The distance from Frutigen to Brig will be 56 kilometers, from Spiez to Brig 71 kilometers, and from Berne to Brig 113 kilometers. From an international standpoint Paris will be 15 miles nearer the cities of Italy than *via* the new Lausanne-Simplon tunnel route and about 100 miles nearer than *via* Gothard. From Calais northern Italy can be reached with 52 miles less travel than by Lausanne, through the Simplon.

A federal concession was granted covering the Lötschberg in 1891 and amended in 1897. The Canton has turned over its concession to a syndicate, and the cost will be borne by issuing subvention shares, $4,000,000; preferred shares, $4,600,000; 4 per cent first-mortgage bonds, $5,600,000; and 4½ per cent second mortgage bonds, $2,900,000, or a total of $17,100,000. The subvention shares will receive no interest until the road is in working order, but the preferred shares will be paid 4 per cent interest during the period of construction. The Canton Berne participates by the purchase of $3,300,000 subvention shares. The syndicate is composed of Swiss and French banks. It is expected that ultimately the Swiss federal railways will buy the Lötschberg. The work will commence at once.

A 12-horse-power four-cylindered petrol motor in America recently ran 87 miles on two gallons of petrol. The weight of the car was 1,500 pounds. Another car identically the same only ran 57 miles on the same allowance of fuel.