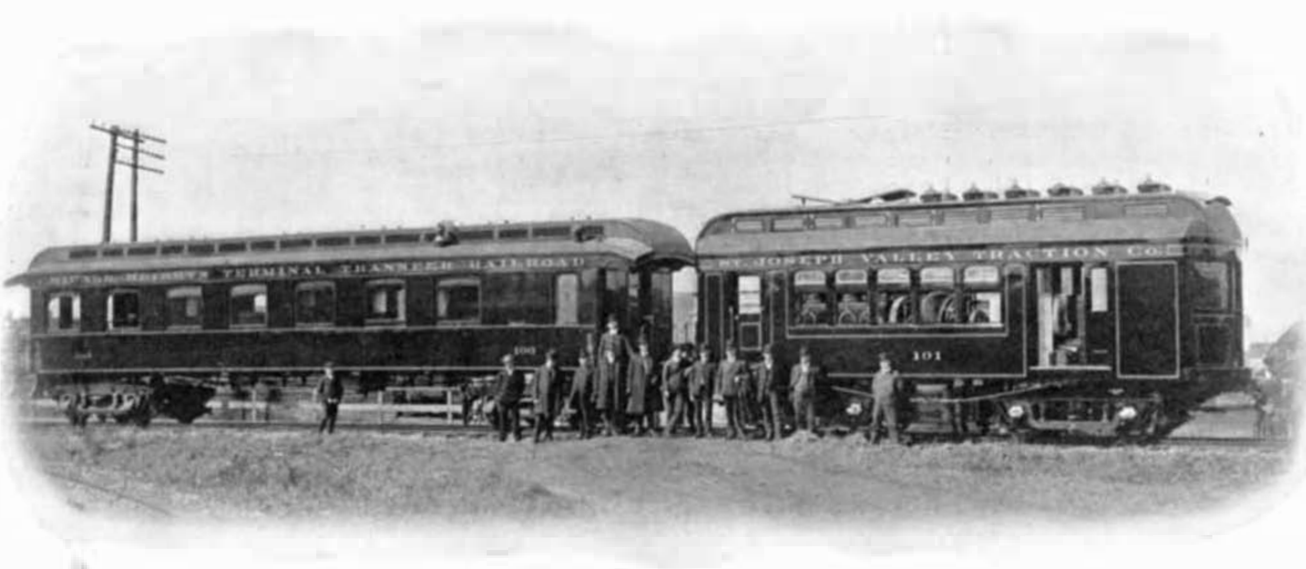
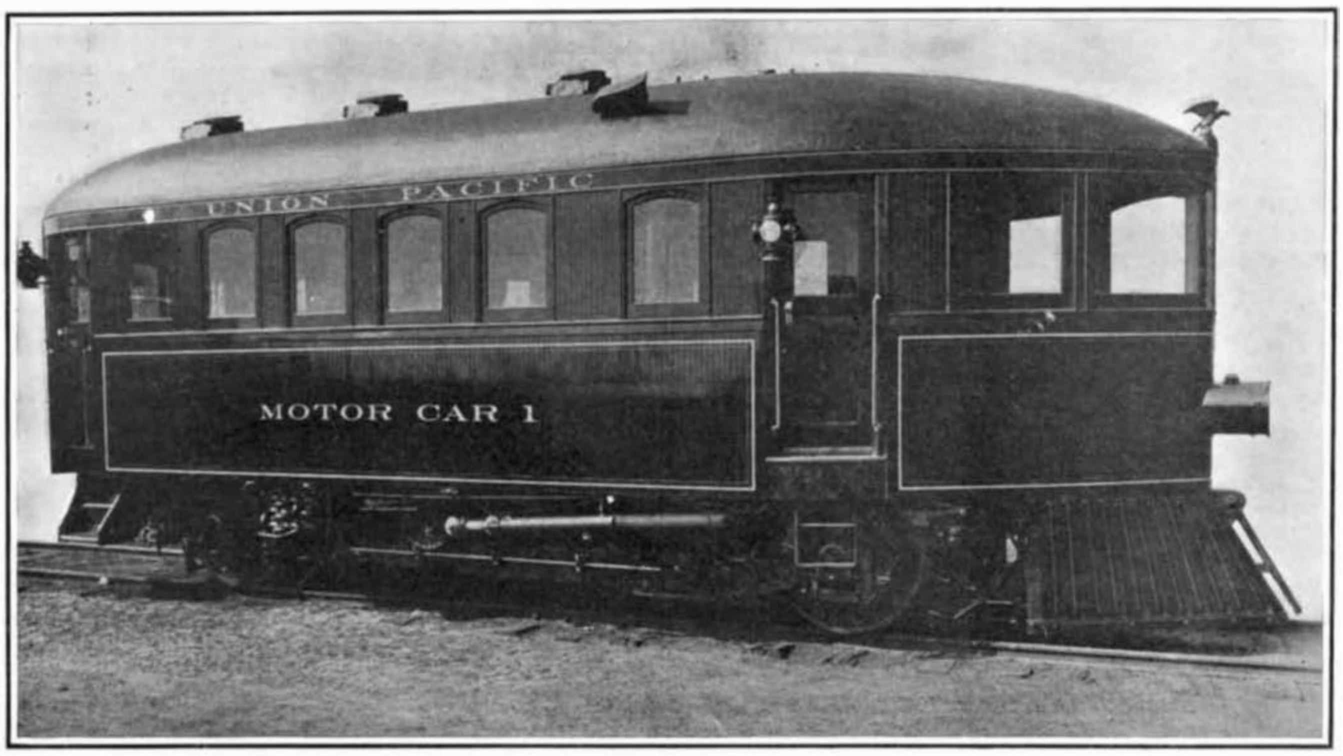
AMERICAN GASOLINE RAILWAY MOTOR CARS.

The application of the gasoline motor to a railway car, which was first experimented with and put into actual use a year or so ago in England, has recently been taken up in this country; and there are now several motor cars in operation here, which are giving the greatest degree of satisfaction.

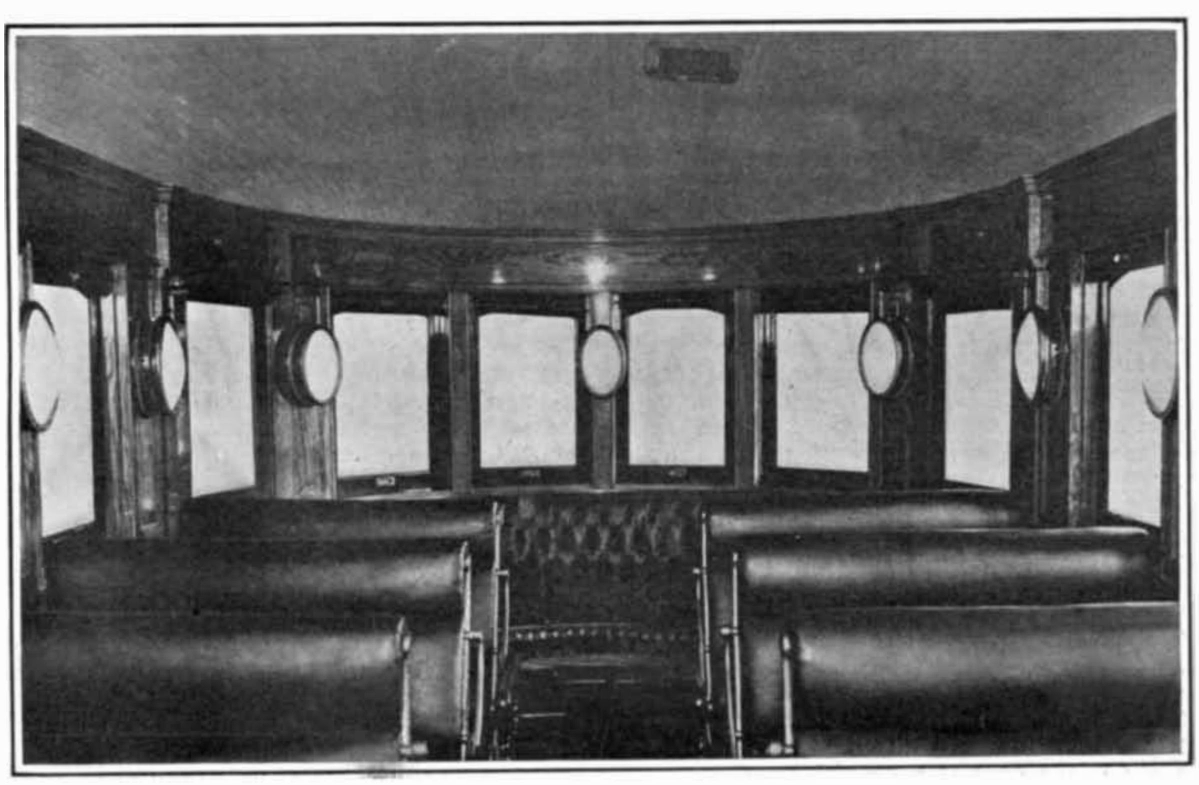
In solving this problem there are two methods of attack. Either the gasoline motor is arranged to drive the axles of the car through a transmission which gives two or three speeds ahead and a reverse, on the principle of a gasoline automobile, or the engine is direct - connected to an electrical generator which supplies current to electric motors at the car axles. A very successful car of the first type was constructed, last winter, in the shops of the Union Pacific Railroad Company. This car is of the single-truck, four-wheel type, and is designed for light branch and interurban passenger service. It has a seating capacity of twenty-five people. Its weight, complete, is a little over 20 tons. The car is 31 feet in length and mounted on 42-inch wheels. The design of the body is similar to that of a racing yacht, the front end of the car being tapered to a sharp point, and the roof rounded off from the top so as to present no flat surface to the resistance of the atmosphere. The rear of the car is rounded off so as to avoid the vacuum produced by cars of the square-end type. This shape tends to reduce wind resistance to a minimum. The car is thoroughly ventilated by means of roof ventilators which exhaust, by suction, the air inside of the car, while fresh air is drawn in from the front part of the car roof. The air in the car can be completely changed every four minutes, if desired. The floor of the car is entirely watertight and can be easily and thoroughly cleansed by flushing with hot water, which tends to destroy all germs and keeps the car in a thoroughly sanitary condition. In winter the car is heated by hot water from the engine cylinder jackets, which is circulated through radiating coils on the sides of the car. In summer this water is sent through radiating coils beneath the car. It can be directed through either set of coils, as desired, and the temperature of the car in cool weather can thus be regulated to a nicety. The car is lighted by acetylene lights placed behind opalescent panels, and a powerful acetylene headlight is also provided. The acetylene gas is generated in two Adlake generators shown in one of the illustrations. The air-brake system is supplied by means of an air-pump driven from the motor crankshaft, and which maintains 100 pounds per square inch air pressure in two reservoirs each of 13 cubic feet capacity. Tests at a speed of twenty miles per hour have demonstrated that the car can be stopped in from 112 to 115 feet without inconvenience to the passengers. The air-brakes are of the direct type and are applied on all four wheels. The car is also equipped with a ratchet lever hand-brake for emergency use. The construction of the whole car is very substantial in character, which assures the greatest possible safety to the passengers in the case of an accident or wreck, as the strength of the car is such as to almost entirely preclude the possibility of telescoping. The car is driven by a six-cylinder "Standard" gasoline motor of 100 horse-power, and having 8 x 10-inch cylinders. The engine is a vertical one, very similar in construction to the well-known "Standard" marine motor. The six cylinders are arranged in sets of three each, connected together, with the result that three impulses are obtained for every revolution of the crankshaft. The engine has a wide range of control, which affords great



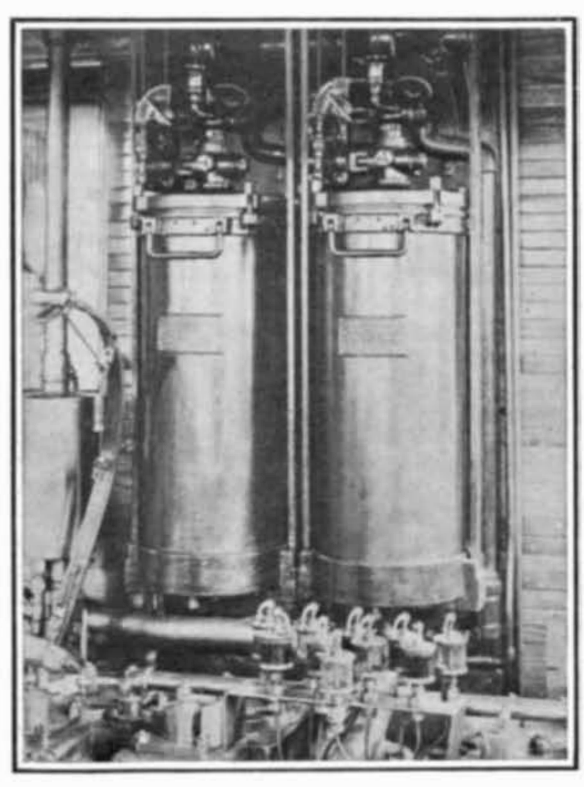
The Twenty Horse-Power Gasoline-Electric Car of the St. Joseph Valley Co.



The Union Pacific's Gasoline Car.



Interior of the Union Pacific Gasoline Car.

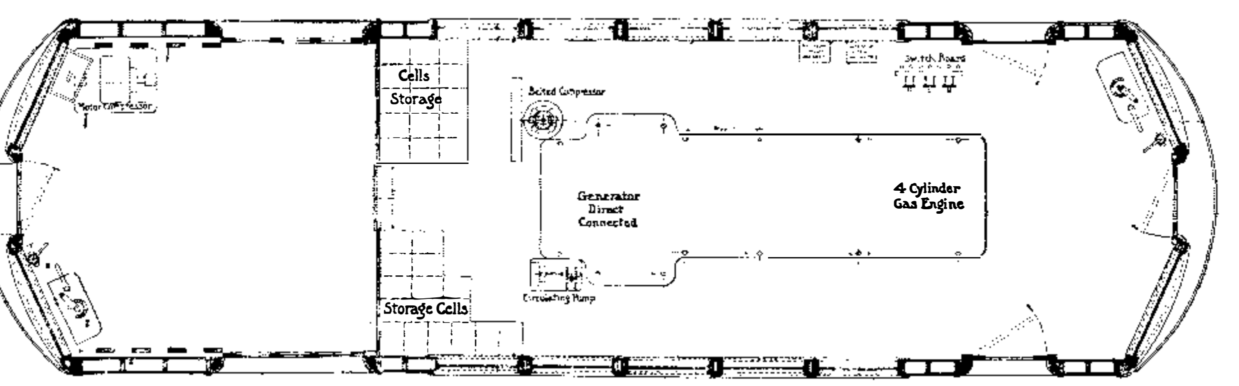


The Acetylene Generators.

THE GASOLINE-DRIVEN SUBURBAN CAR OF THE UNION PACIFIC RAILROAD.

economy under variation of loads. A synchronizer facilitates and simplifies the variation of speed, while the reverse, throttle, and spark levers are all conveniently located within easy reach of the operator. On the high speed the engine is geared direct to the driving axle of the car by means of a special form of chain. The engine is reversed by admitting compressed air into three of the cylinders after the valve cams have been changed for running in the opposite direction. This arrangement makes the engine almost instantly reversible and does away with any complicated reversing gear. A sliding gear transmission furnishes three positive speeds, and, because of the reversibility of the motor, these may be had in either direction. The car is geared to make a speed of thirty-five miles per hour at the regulation speed of the motor. Its acceleration when starting from a standstill to 300 feet is superior to that of an electric car of the same horse-power; for, while the acceleration for the first fifty feet is much slower than that of the electric car (there being, however, no uncomfortable jerk in starting), from 100 feet on the acceleration is very rapid. The car can be started on the high gear on a level or one-half per cent grade; but on anything over a half per cent grade, or when pulling a heavy trailer, it is necessary to resort to the positive gears for starting. The vibration and noise of the engine have been almost entirely eliminated. The exhaust is thoroughly muffled, and is scarcely perceptible.

This car, which is designated as motor car No. 1, was put on the rails the latter part of March. Before being used in actual road service, it was thoroughly tested in the vicinity of Omaha. During these tests the car was coupled to two cars—a standard mail car, weighing 52,100 pounds, and a standard coach, weighing 60,000 pounds. These cars were successfully started and accelerated on a one-third per cent ascending grade, the motor thus starting a total load of 152,100 pounds. The standard mail car was drawn to South Omaha and back, up a 1.6 per cent grade, which was ascended at a speed of eleven miles an hour. The total load pulled in this instance was 94,000 pounds. In another test the car successfully ascended a 7.8 per cent grade, of about 400 feet to the mile, and it was stopped and started repeatedly on this grade. After receiving its preliminary testing, the car was started, on April 2, on its first long-distance run, which was made to Valley, 34.8 miles distant. On April 10 a second test run was made to the same place, the car running the whole distance both ways on the high speed. On April 16, the car went to Grand Island, Neb., and made the entire run of 154 miles in a very satisfactory manner. From the 17th to the 22d of April it was in regular service on the branch line between Grand Island and St. Paul, Neb., making two round trips, or 89 miles, each day. On the 23d, it made 137 miles from Grand Island to North Platte, while the following day a run of 278 miles was made to Denver without delay. The car afterward was run to the Pacific coast. It has been under test since on the heaviest mountain grades of the company's system, and has been found to operate very satisfactorily.



PLAN VIEW OF THE UNION PACIFIC GASOLINE CAR SHOWING ARRANGEMENT OF DRIVING AND ILLUMINATING APPARATUS.

Some time ago, in Supplement No. 1481, we illustrated an English gasoline-electric railway car which has been in service for over a year in that country.

Recently, in this country, the St. Joseph Valley Traction Company has had built by F. M. Hicks & Co., locomotive and car builders, of Chicago, a gasoline-electric car of 70 horse-power fitted with a "Walrath" four-cylinder, marine type gasoline engine direct-connected to a 50-kilowatt, 250-volt, direct-current generator, which supplies current to four 35-horse-power motors mounted on the trucks. A "Chloride" battery of 120 cells supplies the extra current needed when starting and rapidly accelerating the car. The cells are placed in two compartments, one on each side of the car at about its center, as can be seen from the diagram. Any gas given off by the battery is drawn from the compartments by special ventilating fans.

The wires from the battery and generator terminate at a special switchboard, where they are connected in parallel to the main controller leads. Consequently, when the generator voltage drops below that of the battery owing to a heavy load, the latter supplies the extra current needed for the moment; while when the generator voltage is greater than the battery voltage (as it is normally), the generator charges the battery at the same time as it runs the car. The generator also supplies current for the lights and feeds a 4-horse-power electric motor which works the air compressor for supplying the air-brake system. This is of 5.9 cubic feet capacity, capable of maintaining a pressure of 200 pounds per square inch. It is connected to two storage reservoirs which in turn are connected to the air-brake cylinders through reducing valves which bring down the pressure to 90 pounds per square inch. The National Electric Company's automatic type of brake is used, and the car is provided with emergency hand brakes as well. Mounted on the switchboard are circuit breakers adjustable for different amperages, and these take the place of fuses.

The engine can be started either by the dynamo running as a motor on current from the batteries, or by compressed air. The former method is ordinarily used. The engine develops 70 brake-horse-power at 325 revolutions per minute on a fuel consumption of one pint of gasoline per horse-power hour. The gasoline is pumped from the 125-gallon tank to the carbureter by a small reciprocating pump. The cooling water is rapidly circulated through 800 feet of radiating pipe by a rotary pump, and the radiation of heat is aided by two large fans which exhaust through the roof of the car. The cylinders of the engine can be taken out through the ventilating doors in the car roof if it is ever necessary to dismount them. The engine runs very quietly and without undue vibration. It is of the standard four-cycle type made by the Marinette Gas Engine Company. The car frame upon which it is mounted is of composite steel and wood construction designed especially to stand severe strains. Its length is 34 feet, and width 9 2-3 feet, while the height of the car is 14 feet. There are two compartments, one forming the engine room and the other being for baggage. The large engine and dynamo can be seen through the windows of the car in our illustration. The propelling machinery and the car body and trucks each weigh 20 tons, which, besides 5 tons for miscellaneous fixtures, makes a total weight of 45 tons. During a test run of ten miles the car hauled a 45-ton trailer loaded with over seventy passengers this distance on 6½ gallons of gasoline at a cost of seventy-eight cents for fuel, and this despite the fact that the roadbed was in poor condition and there was a heavy ascending grade. The speed maintained was over thirty miles an hour. From this it can be seen that the car has an abundance of power, and it can doubtless be made to draw two or three trailers if necessary.

These two cars are typical examples of the application of the gasoline motor to a railway car, and it is probable that in a short time there will be a considerable number of similar cars in use upon the branch lines throughout the country.

The Current Supplement.

The Paleontological Department of the Paris Museum of Natural History has recently mounted an important collection of Quaternary animals. These are described and illustrated by the Paris correspondent of the Scientific American in the current Supplement, No. 1547. Prof. G. Lippmann writes instructively on the Progress of Astronomy. The dangers of the domestic use of illuminating gas and the means of avoiding them are discussed by Dr. Henry Leffmann. The first installment of a series of two articles on reinforced concrete is published. The article will review very exhaustively the existing methods of the use of iron and Portland cement in combination. Casehardening is fully discussed by David Flather. F. C. Perkins writes on a new system of air brake which has recently been brought out in Berlin, which is electrically controlled and is said to have advantages over electric brakes, pneumatic brakes, and mechanical brakes now in operation on steam railways and electric roads. Prof. Otto N. Witt writes one of his highly interesting articles, his subject this time being the origin of coal and of carbonated spring waters. By far the most important contribution that has appeared in the columns of the Supplement for months is one on "Chemical Affinity" by no less an authority than Sir Oliver Lodge. Excellently illustrated and lucidly written, the article deals in a most simple way with a subject that presents not a little difficulty to electrical and chemical students.

The Track of the Approaching Total Solar Eclipse

On August 30 the sun rises totally eclipsed just to the south of Lake Winnipeg, in Canada; then the shadow track crosses James' Bay, passing into Ungava and Labrador, entering the Atlantic Ocean near Sandwich Bay and the Hudson's Bay Company's post of Cartwright. Two expeditions will be stationed in this region—the first, the official expedition of the Canadian government, under the leadership of Dr. W. L. King, chief astronomer of the Canadian government observatory at Ottawa, which will be encamped near the Hudson's Bay post of Northwest River on Lake Melville, at the head of Hamilton Inlet, the longest of the many fjords by which the coast of Labrador is indented. A strong party from the Lick Observatory, under the leadership of Mr. C. Perrine, will be stationed on the coast of Labrador, or on one of the small islands off it. These two parties will have their eclipse at about eight o'clock in the morning, local time.

The next observers will not have their eclipse until noon is past, for the shadow track next meets land in Spain, the whole of the north coast of Spain, from Corunna almost to Santander, being involved in the shadow of the moon. The chief astronomical expeditions will not be placed on the north coast, however, but on the highlands inland, or else upon the Mediterranean coast. The fine old cathedral city of Burgos, at a height of nearly 3,000 feet above the level of the sea, will be the chief center to which observers and sightseers will direct their steps. Here the chief Spanish official party, under Señor Iniguez, director of the Madrid Observatory, the first of five parties sent out by the permanent eclipse committee of the Royal and Royal Astronomical Societies, under Mr. John Evershed, and two parties of amateur astronomers organized by the British Astronomical Association under Mr. C. Thwaites and Mr. H. Krauss Nield respectively, will all take up their positions. On the Mediterranean coast of Spain, near Oropesa, or Castellon de Plana, will be the second expedition of the permanent committee, with Prof. Callendar, Prof. A. Fowler, and Mr. W. Shackleton as its chief members, and a party from the naval observatory, Washington, U. S. A. A little group of rocks, the Columbretes, lying almost exactly on the central line, will be the headquarters of a third American party, and also of the official German expedition. Both of these expeditions will be supported by cruisers of the navies of their respective countries. An English cruiser will similarly act as basis for the third expedition of the permanent committee, under Sir Norman Lockyer, at Palma, in Majorca. Prof. Porro, from Turin, will lead an Italian party here; and the fourth expedition arranged by the British Astronomical Association, under its president, Mr. A. C. D. Crommelin, will also come to Palma.

The shadow track now leaves Spanish ground for French territory, Philippeville, in Algeria, and Sfax, in Tunis, marking respectively the points where the central line enters and leaves the country. A number of French parties, official and private, will find their way to Philippeville; while M. Trépied, the director of the Algiers observatory, has installed a very complete equipment at Guelma, in the interior, where he will be joined by Mr. H. F. Newall, of the fourth party of the permanent committee. The official party of the Royal observatory, Greenwich, under the direction of the astronomer-royal, Sir W. H. M. Christie, will be stationed at Sfax.

The last observing party, the fifth, sent out by the permanent committee, under Prof. H. H. Turner, Savilian professor of astronomy at Oxford, will have their post on the Nile at Assouan. Here the eclipse will be total about half-past four in the afternoon, and will last two minutes and a half. The path of the shadow will sweep eastward across the Red Sea into Arabia, and the sun will set totally eclipsed near the coast of Hadramaut, in South Arabia.

It is well known that during active growth special foods may be taken out of circulation and stored up. The stimulus to such storage is not easily determined. In many instances it is apparently the protoplasm which is decomposed in order that these storage products may be formed; therefore, so far as possible a study of all protoplasmic decomposition phenomena is especially necessary. The deposition of the cell plate and the storage of reserve cellulose are especially interesting. It will be extremely difficult to follow the succession of changes involved, yet some information will undoubtedly be gained.