be procured whereby no sacrifice would be entailed for lightness.

The race for the Vanderbilt cup will be run this year on Long Island on October 6, and will be the only real international race of the year. At least four countries—France, Germany, Italy, and America—will be represented by five cars each. The rules governing the race will be practically the same as heretofore, and the course will be nearly the same as that of last year.

In contrast to the races just mentioned, thər is now being conducted in this country and Canada the third annual tour of the American Automobile Association, which includes the contest for the Glidden trophy. This trophy is awarded annually to the touring car which makes the best performance in a 1,000-mile tour. Contrary to what was the case last year, the present contest is being conducted with some resemblan reliability run. The cars are required to make an average speed of nearly 20 miles an hour, and checking stations are located every 25 or 30 miles apart. No repairs, adjustments, or replenishments are allowed in the garage, but these must all be made during the cars' running time. While such a rule does very well for a high-speed race, in the present instance it tends to incite racing. This is not what is desired. Furthermore, the penalization of all cars that do not pass the checkers and arrive each day at the specified times, has not had the effect of stopping racing on the part of the contestants. This was shown on the first day's run of 135 miles from Buffalo to Auburn, New York. The contestants invariably reached the vicinity of the checking stations a considerable length of time in advance. They would then wait until the exact minute when they were due before they would pass the checker. From the working of this system during the first day's run, it would seem that a better way to attain uniform speed on the part of the contestants would be to oblige them to follow a pacemaker provided with an accurate speedometer. This would effectually stop all racing, save on the part of cars which broke down, and were obliged to make up time, if possible. A test of this character should be made to give all the information possible to be obtained from the actual running of cars under touring conditions. Official observers should be provided, and an accurate record kept of all stops, breakdowns, repairs, fuel and oil consumption, tire trouble, etc. With a loss of a specified number of points for all such happenings, it would be an easy matter to pick out the winning car. Besides this there would be considerable valuable information obtained regarding the different makes of cars, both domestic and foreign. In the present event but five foreign cars figure. While light cars are not excluded, they are decidedly in the minority. Almost all of the cars are of the four-cylinder type, and there is one new six-cylinder model of a type which will be marketed next year.

The result of the first day's run was the disablement of three of the cars, owing, it is said, to the roughness of the course. One of these broke its rear axle, another broke a spring, and the third gave out from some cause not as yet recorded. One of the steam cars of a well-known make was burned, owing to its catching fire while the gasoline tank was being filled. This accident was no doubt due to gross carelessness, as the make of car in question is well known for its reliability. Of the 69 starters, only 8 were absent at the end of the second day's run. Out of 51 contestants, 20 had perfect scores.

AN ELECTRIC EXAMINATION OF EUROPEAN MINERAL WATER.

An electrical method of estimating the proportion of mineral matter contained in spring water has been devised by M. F. Dienert, of Paris, and presented to the Académie des Sciences. The subterranean water encounters soluble elements in the soil, and the solubility is increased by the presence of carbonic acid. Thus carbonate of lime and silica, which are but slightly soluble in pure water, are much more so in presence of the gas. In a given soil and for a certain pressure of carbonic acid gas, the underground waters contain a determined proportion of dissolved bodies, and we may estimate the average amount by means of the electric conductivity, using for this purpose the Kohlrausch method, which has already been used here. For several years past M. Dienert has been employing this method in order to follow the daily variations in the composition of the springs which supply the city of Paris. Thus we have a good check upon the variations in the mineral matter, and if these are great, we afterward seek the causes. The electric method is much more sensitive than chemical analysis. In cases where we find 50 ohms variation in electrical resistance, this being very clearly shown in the Kohlrausch apparatus, for the same water chemical analysis gives uncertain results, seeing that they fall within the limit of error. As an example, we may mention the values of the resistances of some of the springs which supply the city. The Breuil spring, for instance, has had about a uniform value, except in times of freshets, during the last three years, and its resistance is maintained very closely between 2,695 and 2,720 ohms. The Dhuys spring keeps between 2,120 and 2,140 ohms, while the Lunain spring lies between 2,350 and 2,375 ohms. Thus we find that some springs have a very constant mineral value. It is to be remarked that all these springs are very pure and usually contain colon bacilli when their resistance remains constant. Variations of the latter may be traced to different causes, such as were observed for several years past. These causes are due either to changes in the underground condition or again to the infiltration of surface water.

A KEROSENE-OIL LAMP.

Experiments with a new lighting system have been carried out in Scotland, in which kerosene oil is used. The oil is stored in a tank, which is accommodated in the base of the standard carrying the lamp. In the top of this reservoir is a cylinder filled with compressed carbonic-acid gas, with a small oil container at the bottom holding from one-half to two gallons of oil, which automatically flows thereto from the larger receptacle. A reducing valve connects the oil container with the carbonic acid gas cylinder, and a fine tube leads to the burner, which has a vaporizer consisting of a jet and an air-mixing chamber, while the burner is fitted with an incandescent gas mantle. The oil is forced from the oil container to the vaporizer through the fine tube by the pressure of the carbonic-acid gas. On reaching the vaporizer the oil is converted into gas and passes through the flame spreader, where it combines with the air, and thence to the incandescent mantle. The lamp is economical in consumption, a light of 200 candle-power being obtained for 45 hours with a consumption of one gallon of oil, and the light is clear, bright, and of great penetrative power.

INDUSTRIAL ALCOHOL: HOW IT IS MADE AND HOW IT IS USED.

The development of the use of denaturized alcohol for industrial purposes has probably reached a higher plane in the German Empire than in any other country. It took its rise from the fact that Germany is dependent upon outside sources for its supply of petroleum and petroleum products. When the explosive motor came into general use for governmental and military purposes, the German government realized that in case of war it might be shut off from these sources of supply, and that, therefore, it was advisable to procure a substitute for the mineral hydrocarbon fuel. With the active co-operation of the German Emperor, the growth of the alcohol industry for commercial purposes was both rapid and widespread. The government encouraged the invention and manufacture of alcohol motors for stationary and automobile purposes, of illuminating devices, cooking utensils, and other apparatus employing alcohol as a fuel. Extensive laws regulate the production and use of denaturized alcohol, and for several years it could be obtained in large quantities and at low cost. Unfortunately, the alcohol industry in Germany to-day has gradually come under the control of a trust and, in consequence, the prices have risen so rapidly that many of the benefits arising from the untaxed alcohol system have been lost. In France, England, Austria, Belgium, and other countries, the use of denaturized alcohol is extensive and it is employed in thriving and valuable industries, regulated by wise laws to safeguard the public and to prevent fraud. The passage of the free-alcohol bill in this country promises much good, and as very little is known regarding the subject on this side of the Atlantic, we must draw from the knowledge of the European manufacturers and users for information upon the product.

During the height of the interest aroused among the public in the earlier phases of the denaturized alcohol propaganda in Germany, the press of many countries was full of accounts concerning the sources from which alcohol might be derived, and an apparently authentic account was at one time circulated, in which it was stated that large quantities were produced from such substances as peat and garbage. It appears, however, that alcohol is not made on an industrial scale in Germany from peat or from garbage of any kind. Aside from the small amount that is produced for drinking and medicinal purposes from prunes, grapes, cherries, and other fruits, the great sources of alcohol for industrial and other uses are potatoes, grain, and the molasses derived as a secondary product from the manufacture of beet sugar. The crude molasses left as a refuse product of the raw beet-sugar manufacture contains from 40 to 50 per cent of sugar which cannot be crystallized, and this can also be utilized as a material for the production of alcohol. The spirits distilled from grain and molasses and the small quantities made from cherries, grape-must, plums, etc., are used mainly for drinking and the manufacture of medicines, perfumes, vinegar, and various other food preparations. The great source of industrial alcohol is from potatoes, and it is used for heating, lighting, and motor purposes, and for a vast number of applications in chemical and industrial manufactures. An interesting consular report from Maracaibo states that successful attempts have recently been made to produce alcohol from the hitherto useless bulb or husk inclosing the coffee bean. Should this report prove true, the alcohol industry will have received a new and vast source of supply, which will prove of great value, especially in coffee-growing countries.

Alcohol may be produced from substances containing sugar, or from those containing starch which may be converted into sugar. It may be similarly derived from cellulose, for instance, in the destructive distillation of wood, which results in the production of wood alcohol and various other substances. It can be obtained by distillation or by fermentation, but usually results from a combination of both. In making spirit from beets, sulphuric acid is used during the fermentative process, which is effected by adding yeast to the *wort*. The latter is the result of a process of saccharifying the starch in the substance undergoing distillation. The alcohol results from the decomposition of sugar, which by the process of fermentation is resolved into carbonic acid and alcohol. Sugar is, therefore, the direct source of alcohol, and for this reason sweet vegetables and fruits may be converted into spirits. The starch is readily converted into sugar by means of the substance called *diastase*, which is found in malt and in germinating seeds generally. It is for this reason that starchy vegetables, such as potatoes, as well as sweet vegetables, may be used in the manufacture of spirits. In using starchy vegetables, however, the intermediate process mentioned above of saccharifying the starch, technically known as *mashing*, is necessary. This consists in mixing the raw grain, or other substance, properly ground, with malt and with water at a temperature of about 150 deg. F. In using potatoes these are usually steamed before the malt is applied, for they contain a much smaller proportion of starch than the cereals, and by steaming the starch cells are thoroughly broken and the starch is reduced to a conditioı in which it is easily acted upon. The saccharine infısion resulting from the *mashing* is that technically known as the *wort*.

The fermentation is effected by adding either brewer's or compressed yeast to the *wort*, or to a saccharine liquid obtained from molasses, beets, or other sugar-producing fruits or vegetables. The fermentation process is carried to its furthest limit in order to produce the greatest amount of alcohol, and the liquid thus prepared for distillation is technically known as the *wash*. The *still* is the apparatus in which the wash is reduced to vapor and then condensed. Essentially and in its oldest form, the *still* consists of a copper vessel provided with a closed head and connected with a spiral tube called the *worm*. The latter is cooled by means of circulating water or refrigeration, and when the heat is applied at the still the spirit begins to rise in vapor along with more or less steam, and passes through the worm, where it becomes condensed by the cold, and trickles down into the *receiver*. The product of the first distillation is impure, and redistillation at a lower temperature is necessary to deprive it of the water and of the oils which have passed with the alcohol. To-day, by means of fractional stills the process has been greatly improved, and the alcohol may be obtained cheaply and of a high grade.

The industrial uses of alcohol are many and varied, as was demonstrated by an exhibition in Germany a few years ago, which was devoted exclusively to alcohol, its production and its uses for industrial purposes. While the general use of alcohol for industrial purposes, heating, lighting, and a vast range of chemical and other manufacturing purposes has steadily increased in Germany, the percentage of the whole product that is used for motor purposes is relatively small and, so far from increasing, is said to be rather diminishing, though to just what extent it would be difficult to prove. A few Germans, from patriotic motives, use alcohol for driving automobiles, freight wagons, motor boats, and farming machinery. It has been found by elaborate tests that the economy of alcohol as a fuel for gas motors is largely increased by its being carbureted through admixture with a certain percentage of benzole or other product of mineral oil. For a time it was believed that this admixture of benzole could not be safely carried beyond 20 per cent, but more recent experience has shown that a mixture of equal parts of alcohol and benzole can be used, especially in large motors, with entire safety and economical results. For automobile purposes the usual proportion is now about 30 per cent of benzole or gasoline, but at the previous cost of alcohol it could not compete on the score of economy with mineral hydrocarbons in a country where they were either produced or imported free of duty.

The industrial applications of alcohol are numerous; the chemical industries lead. Of these, the manufacture of vinegar from alcohol and acetic acid is one of the most important. This industry is mainly the growth of the period since 1887, and its extent may be

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