poses is simple, but interesting. In stations where Morse instruments are "cut in" to the circuit, these instruments are bridged with dead non-inductive resistance. The relays of the Morse instruments are wound for 100 or 150 ohms inductive resistance. The high resistance of the shunt is, on the contrary, a non-conductive. It is so constructed as to eliminate the factor of impedance when the high-frequency telephone current is superposed on the line. Thus the high shunt resistance prevents the passage of the Morse current, but in accordance with the well-known law, it will offer a free path for the talking waves. The shunt resistance being non-inductive, does not impede or interrrupt the high-frequency telephonic current. The initial call is made by means of a direct, slowly-pulsating signal by a special magnet with two segments on its armature, one only of which is alive, thus giving direct, pulsating waves. If by means of the plug and jacks in the train instruments, this direct, pulsating current is given one polarity, the pulsating current will affect the Morse relays in the circuit to its polarity. On the side of the temporary connection, where the line is in direct polarity with the superposed pulsating current from the special magneto generator, the latter will strengthen the battery on the part of the line, and will not annunciate the emergency signal on that part of the line. On the other side of the temporary connection, over which it is desired to communicate, however, the pulsating magneto current is in opposition to the force of the line battery on that part of the circuit which is a reverse polarity. As a result, all relays on that part of the line which are in reverse polarity are caused to give the brief pulsating call. If it be desired to give the signal on the opposite side of the temporary connection, the plug is inserted in the other jack, reversing the polarity of the magnet. It will be understood that the magnet circuit is normally open, except when the brief emergency signal is being given. A condenser connected into the secondary of the telephone prevents the Morse current from grounding, while at the same time permitting the passage of the talking waves of the telephone current.

One of the most interesting trials of the telegraphone recently occurred on the line of the Rome, Watertown & Ogdensburg Railroad, under the supervision of Mr. John Dennis, of Rochester, N. Y., the inventor. A locomotive and tool car were dispatched from Rochester toward Oswego under the orders of the dispatcher at Oswego. The trip was made over a busy single-track railway, but it was understood that a stop could be made between stations at discretion. A heavy rain was falling, electrical conditions thus lending themselves to the breakdown test which had been determined upon. Between Windsor Beach and Sea Breeze stations, the wrecking outfit came to a halt on the main line. One of the crew attached the wire from the reel of the train instrument to an extension pole, with a clamp on its extremity, and hooked it over a commercial wire which was crowded with messages. A call was made through the relays on the line on the side toward Oswego, and within thirty seconds from the time the special had halted, communication was established with the train dispatcher at Oswego, seventy miles distant, and the train was placed under his orders. After calling Trainmaster Halleran, in his office at Oswego, to the telephone, and exchanging condolences on the weather, by simply changing the jack in the caboose instrument the agent at the Rochester office was called in turn in a similar manner. The Rochester operator jacked the telegraphone in with the Rochester Telephone Company's exchange, at Rochester, and a conversation was held from the wrecking outfit, otherwise isolated between stations, with the superintendent of that company. Then Mr. Dennis's home telephone was called, and he talked with his family. The Oswego dispatcher, who had been constantly in touch with the isolated train, was called, and orders for the movement of the special were taken by the trainmen. One of the men removed the pole, the wire was reeled in, and the special started on its return trip.

THE BRITISH QUEST FOR AN EIGHTEENPENNY SAFETY LAMP.

In no way discouraged by their previous failures to find a table-lamp which may reasonably be regarded as "safe," and which can be retailed at a fair profit at 1s. 6d., the promoters of the Grocers' Exhibition have again this year invited inventors and manufacturers to send in designs embodying the conditions laid down, and, as a further stimulus to competition, have increased the monetary value of the prize from £50 to £120. This sum itself is well worth having, but Mr. A. J. Giles, the secretary to the committee which has the matter in hand, stoutly maintains that, when put to practical use, the successful design would probably be worth twenty times the amount of the prize to the inventor. In the conditions laid down the committee stipulated that the design, to be successful, must be satisfactory from a mechanical, a scientific, and a commercial point of view—that is to say, (*a*) the lamp must be made of thoroughly sound and durable materials, and be of reliable workmanship; (*b*) it must be adapted to burn any brand of petroleum; and (*c*) it must be possible for oilmen or grocers who possess no special acquaintance with lamp-construction to handle and sell it at a profit. Whether all, or indeed any, of these conditions are to be found in the designs sent in this year will not be known until the judges have made their report (which may not be for some weeks yet), but so far as a superficial examination of the selected patterns and a demonstration of their capabilities, carried out in the presence of members of the trade press on September 24, enable one to form an opinion, it seems quite within the range of possibility that a solution of the problem has been found.

For obvious reasons, continues the Ironmonger, from which paper these remarks are republished, no detailed inspection of the internal construction of the competitive designs was permitted at the demonstration, nor will the names of the judges be divulged, for the present at all events. We were, however, assured by the secretary that the committee are being advised by gentlemen who are experts in lamp-construction, and upon whose decision the competitors and the public alike may place implicit confidence.

The preliminary tests on September 24 were open to the public, and were carried out in a roped-off portion of the Minor Hall at Islington, the lamps (of which some eighty-four had been sent in, as against fifty-three last year) being arranged on trestles placed against the wall. As a precaution against fire, a heap of wet sand in charge of some workmen was provided, and one of the firemen attached to the place was also in attendance. About half a dozen of the more promising lamps having been lighted and turned up fully, the attendants proceeded to tip them upside down, the operation almost invariably bringing the various extinguishing devices into play and promptly putting out the light. In several instances, however, the oil followed the example of the flame, and also "went out" of the container in rather an unpleasant and disconcerting fashion. Indeed, one fantastically devised light-giver, formed with an inner oil-container swinging upon the outer shell, gimbal fashion, completely emptied itself of oil upon being inverted. Among the little knot of privileged spectators who were admitted inside the ropes were Mr. Alfred Spencer, of the L. C. C. Public Control Department, and Dr. Paul Dvorkovitch, of the Petroleum Institute, both of whom, although for different reasons, are deeply interested in the subject of safety-lamp construction.

The bulk of the lamps on view were of British make, but there were a few designs from Germany, Austria, and France, and one or two from British colonies. The patterns adhered in the main to the familiar table-lamp style, viz., square or circular base, with vase-shaped container, and the orthodox basket, gallery, cone, and winder. Several radical, and even daring departures from the conventional outline were, however, to be seen. One of these monstrosities was shaped something like a "duck" or "torch" lamp, the only point which redeemed its unspeakable ugliness being the impossibility of the flame ever heating the container or of raising the temperature of the oil to flashing-point. Another freak was so arranged that, when it stood on a table by itself, an extinguishing-cap was "on," and only by holding the base firmly down by both hands could the wick be lighted and kept alight. Such a lamp might be suitable as a punishment device for convict prisons, but it would hardly be the sort of thing to introduce into happy British homes. Another funny pattern embodied a container with a water-jacket, the idea being to keep the oil cool while the lamp was alight and to "douse the glim" in the event of the structure being upset. With this device the inventor had considerately sent two small enameled mugs—one, as he was good enough to explain, being for pouring in the oil and the other for pouring in the water. Most of the lamps were fitted with flat-wick burners, but a few had a round wick and flame-spreader.

Metal predominated in the construction, some of the cast-iron bases being very poor specimens of the founders' art, while the attempts at decoration were equally unsatisfactory. Many of the bases, moreover, were too small for security, a point which lamp-designers frequently overlook. Glass containers were but sparingly adopted, and, so far as one could see, even the few on show were not sufficiently stout to render them reasonably safe against breakage if overturned or dropped onto the ground.

All the designs appeared to be provided with chimneys, and nothing of a freak character had been attempted in this direction, the committee having been emphatic on the point that the lamp galleries and burners should follow the accepted shapes, so as to put no difficulties in the way of the purchasers of the approved pattern obtaining refills of wick and new glasses.

After the conclusion of the testing the judges and committee adjourned to the restaurant in the hall for lunch.

Replying to the toast of his health, Mr. A. J. Giles, who is the organizer of the lamp competition, mentioned that his committee, undeterred by previous failures, were determined to persevere in the attempt to find a lamp answering their requirements. The fact that from 300 to 500 fires were caused in the metropolis each year, in addition to much loss of life, from the use of insecure lamps, was, he contended, ample justification for the efforts they were making. The committee had been greatly encouraged by the expert assistance and advice which had been placed at their disposal, and they were confident that ere long success would be achieved.

NEW GERMAN RED PHOSPHORUS MATCH.

By a law of May 10, 1903, Germany forbade the use of white phosphorus in the making of matches. A new material, made of non-poisonous red phosphorus and potassium chlorate, has been bought by the government and is to be substituted in its works for the deleterious and oftentimes more dangerous white phosphorus. A commission of experts appointed by the government to consider the matter of allowing or forbidding the use of white phosphorus and of buying the right to manufacture the new material defends itself against the claim that the new material, which lights at a point about 100 deg. (160 to 180 deg. Cel.) Réaumur, is of little more value than the white phosphorus match-making material, which lights at 50 to 80 deg. Cel. In spite of its high igniting point, the new material may be lighted by scratching on almost any material—sandpaper, bricks, boards, soles of shoes, rough clothing, etc. Great gain attaches to the fact that it does not ignite easily, hence removing or minimizing the danger from fire. How important this is appears when one is reminded of fires caused by the ignition of white phosphorus matches by the sun's rays. In regard to danger to employes, the commission says explosions are practically impossible with the new material.

Then, again, the fact that the new material contains only 15 per cent of lead, while all others contain from 18 to 45 per cent, is in its favor. Matches made of the new material in 1898, when the government first bought the rights thereto, were found to be as good in 1903 as they were when made. The prices of production are interesting. The new kind cost 6.3 marks ($1.50) per 100,000 for the cheapest, and the dearest, 8.10 marks ($1.93). The prices of the others run between 60.50 and 68.20 marks ($14.40 and $16.23).

THE CURRENT SUPPLEMENT.

The rapid increase in the number of agricultural colleges throughout the country is partly responsible for the remarkable improvement which has been noted in the farming methods of those States which are fortunate enough to possess such institutions. Day Allen Willey, in the current SUPPLEMENT, No. 1451, discusses the Agricultural College of the Ohio State University, a typical institution of its kind, and shows just how the instruction fits the student for scientific farming. Mr. Charles J. Sullivan shows how it is possible to produce a battery of sufficient power to perform the many practical experiments requiring a voltage of at least fifty. His outfit requires the care of only five gravity cells. Prof. Robert H. Thurston presents an instructive paper entitled "Functions of Technical Science in Education for Business and the Professions." Of interest to automobilists are the articles on the Ossant muffler and the Lohner-Porsche electric automobile. Mr. Albert Ladd Colby in a valuable article presents a *resumé* of the properties and applications of nickel steel. The usual Selected Formulæ, Trade Notes and Recipes and Consular Notes are also published.

ALUMINIUM IN FLOWERING PLANTS.

Hitherto aluminium has not been found in phanerogamic plants, or at most only in minute traces, although cryptogams appear to use it as a food material. Mr. H. G. Smith, of Sydney, however, has recently found it in one tree belonging to the Proteaceæ, viz., *Orites excelsa*, R.Br., in even greater abundance than it is found in any of the cryptogams. In a paper read before the meeting of the Royal Society of New South Wales, Mr. Smith showed that this tree uses aluminium almost to the exclusion of other mineral elements, and that the aluminium is deposited in cavities and natural fissures as a basic succinate.

SUN SPOTS PHOTOGRAPHED.

Two photographs of spots on the sun have been taken at the Naval Observatory. The photographs show a group of spots, the largest observable for many years, capable of being seen with the naked eye protected by smoked glass.