mining and ordinary machinery points of view, are not fitted to examine and overhaul electrical plant. The question arises as to what constitutes a "competent person" within the meaning of the Mines Act (Rule 11), and the sooner this is made quite clear and insisted upon the better it will be for all concerned in electrical mining work. In the present case, the engineer of the colliery and the "overman" were entrusted with the machinery in question, and the evidence proves clearly that they were only expected to see that outside and surface connections were all right, and also to open up switch boxes, but any internal faults and so on were not considered to be within their responsibility. Colliery managers must be made to realise that technically trained men should be employed to undertake electrical work in the colliery, and until they do so accidents are bound to occur—the only wonder being that they are not more frequent.

PROF. R. W. WOOD has sent us a description of a series of interesting experiments he has made in the direction of the optical intensification of paintings. One of the difficulties an artist has to contend with in depicting scenes in which great contrasts of luminosity occur is the narrow range of luminosity obtainable on canvas with pigments. Aubert states that the whitest paper is but fifty-seven times as luminous as the blackest, and this probably represents about the range obtainable in paintings. The problem is, therefore, how to produce a strong illumination on all high lights of the picture and a feeble illumination on all the shadows. Prof. Wood has obtained good results by taking a photograph of the painting on an orthochromatic plate, preferably a red sensitive plate with a suitable ray filter. A lantern-slide is then made from the negative, and the picture projected in a dark room, not on a white screen, but on the original painting. Any desired effect can be secured by local reduction or intensification of the negative or lantern-slide. If the negative itself is projected upon the painting a most curious effect is obtained. The contrast is lessened, and if the negative is a dense one the contrast may be almost destroyed, making the painting appear a flat wash of chocolate. In taking the negative, care must be taken to have the painting vertical and the camera lens directly in front of the centre of the picture. If after looking for a few minutes at a painting illuminated in the way described the lantern-slide is removed and a uniform illumination allowed to fall on the picture, it appears as if it had not been dusted for ten years; the sunlight leaves it, and everything looks flat. Prof. Wood finds that the effects are very different according to whether the negative is taken on an ordinary or an orthochromatic plate, especially if there is much blue in the painting. He thinks, too, that if the values are correct in the original painting, they will hold under the graded illumination produced by the lantern-slide; if they are not right, the errors will be glaringly magnified.

No. 95 of the Communications from the Physical Laboratory of the University of Leyden contains an account of a series of investigations on the measurement of very low temperatures carried out under the superintendence of Dr. Kamerlingh Onnes, the director of the laboratory. Mr. C. A. Crommelin has compared the readings obtained by a thermoelement of constantin-steel with those given by the hydrogen thermometer. Mr. J. Clay has measured the coefficient of expansion of Jena glass and of platinum between $+16°$ C. and $-182°$ C., and compared the platinum resistance thermometer with the hydrogen and the gold resistance thermometer, whilst M. C. Braak has made a detailed investigation of the hydrogen thermometer as a means of measuring low temperatures.

THE transformation, which was first observed by Lallemand in 1870, of orthorhombic sulphur, dissolved in carbon disulphide, into a less soluble amorphous variety under the influence of light, forms the subject of a paper by Mr. G. A. Rankin in the *Journal of Physical Chemistry* (vol. xi., No. 1). The transformation is brought about by the violet and ultra-violet rays, and is reversible, the conversion of the amorphous form into the orthorhombic crystalline variety taking place when it is kept in darkness. The presence of ammonia or hydrogen sulphide accelerates the latter change and tends to prevent precipitation from a carbon disulphide solution even in bright sunlight. Conditions of equilibrium depending on the intensity of the light can be established between the two forms of sulphur present in solution at a constant temperature.

A SECOND edition of Mr. Mervyn O'Gorman's "Motor Pocket Book" has been published by Messrs. A. Constable and Co., Ltd. The book has been revised and enlarged, and its price is 7*s*. 6*d*. net.

THE writer of the article on the "Treatment of Cancer" in NATURE of December 20, 1906, writes to say that he was in error in believing that the injections of the pancreatic enzymes have to be made in the neighbourhood of the growth (January 10, p. 247). He understands that this is not the case, so an objection he raised to the trypsin treatment is removed.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN MARCH:—

March 1. 11h. 42m. Minimum of Algol (β Persei).
,, 14h. Mercury at greatest elongation, 18° 9′ E.
4. 8h. 31m. Minimum of Algol (β Persei).
6. 22h. 26m. Conjunction of Mars with the moon, Mars 3° 13′ S.
12. Venus. Illuminated portion of disc=0·639.
16. 3h. Conjunction of Vesta with the moon, Vesta, 0° 7′ N.
21. 6h. Sun enters Aries, Spring commences.
,, 7h. 16m. to 8h. 30m. Moon occults χ^1 Orionis, (mag. 4·7).
,, 12h. 30m. to 13h. 25m. Moon occults χ^4 Orionis, mag. 4·8).
,, 16h. 38m. Conjunction of Jupiter with the moon, Jupiter 2° 32′ N.
24. 10h. 14m. Minimum of Algol (β Persei).
27. 7h. 3m. Minimum of Algol (β Persei).

A NEW FORM OF CŒLOSTAT TELESCOPE.—One of the chief difficulties encountered in the work of the Mount Wilson Solar Observatory has been the deformation and poor definition of the sun's image, caused by the distortion of the mirrors and by the unsteadiness of the heated atmosphere through which the horizontally projected beams have to pass when reflected from the cœlostat to the spectroheliograph or spectrograph.

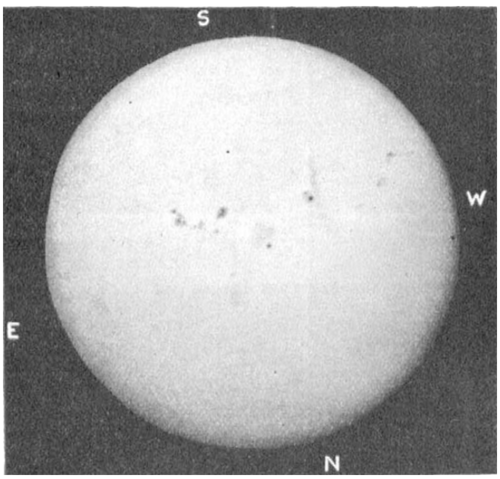
Prof. Hale now proposes to obviate some of the difficulties by having the whole instrument vertical, and in No. 1, vol. xxv. (January), of the *Astrophysical Journal* he describes and illustrates the form of the proposed instrument. The cœlostat mirror (diameter 17 inches) is to be mounted on a steel tower some 60 feet high in such a manner that it can be moved to follow the sun without disturbing its adjustments. A second mirror, elliptical in form, will again reflect the beam on to a 12-inch object-glass (60 feet focal length) mounted directly below it, and this will focus the image on to the slit of the 30-feet spectroheliograph or that of the Littrow spectrograph; both these instruments will be underground, and will therefore be preserved at a fairly even temperature.

To prevent its distortion, each mirror is to be 12 inches thick, and will be silvered on both sides, and, if necessary, heated on the back by reflected or direct sunlight. An electric motor will drive the photographic plate across the secondary slit of the spectroheliograph, and will by means of a vertical shaft impart a synchronous motion to the 12-inch lens, and hence to the sun's image.

The Littrow spectrograph is to be fitted with an 8-inch plane grating, and will be employed in the study of the solar rotation and in the photography of sun-spot spectra.

THE RECENT LARGE GROUP OF SUN-SPOTS.—Another large group of sun-spots visible to the naked eye—of which the solar maximum through which we have just passed has furnished an abnormal number—was observed during the former half of the present month.

The first signs of this group appeared on February 6, when two small nuclei were seen on the eastern limb about 15° south of the equator, and these were followed by two similar spots on February 8. On February 9 a larger spot brought up the rear of the group, which then contained a large number of small umbræ. In London,



Photograph of sun taken ch. 47m. February 11, 1907.

bad weather prevented the daily observation of the development of the group, but on February 11 it was easily visible to the naked eye, and was seen to have developed a second fairly large spot at its preceding extremity. The accompanying reproduction is from a photograph taken at oh. 47m. on that date, and it may be seen that the preceding spot was then the largest in the group, and had a peculiar kidney-like shape. The total affected area was then roughly rectangular, with a length of about 115,000 miles and a breadth of about 55,000 miles. Naked-eye observations of two groups were possible on February 14. The larger group formed a striking spectacle on the western limb on February 18, but had disappeared from view when the sun was observed on the following day.

THE SPECTROSCOPIC BINARY λ ANDROMEDÆ.—From a number of spectrograms of λ Andromedæ, taken with the Mills spectrograph, 1897–8–9, a set of elements for the orbit of the binary has been computed by Mr. Burns, of the Lick Observatory. On comparing these elements with those determined from more recent spectrograms, taken with the re-mounted Mills spectrograph, it is seen that there are material differences which can only be reasonably accounted for by the supposition that the orbit itself has been modified. The discrepancy, if established, will probably be found to be due to a third body in the system of this star (Lick Observatory Bulletin, No. 105).

THE GROWTH OF MICRO-ORGANISMS.[1]

THE author, early in the past year, began to make experiments on the origin-of-life question, with various saline solutions containing ammoniacal salts. After a time he found the best results were to be obtained with one or other of two solutions, one of which contained small quantities of sodium silicate, ammonium phosphate, and dilute phosphoric acid in distilled water, and the other a simple solution of sodium silicate with liquor ferri pernitratis in distilled water. It was found, also, that with the use of these saline solutions exposure of the experimental vessels to diffuse daylight, with even a mean temperature of only 60° F. to 65° F., favoured the appearance of microorganisms quite as much as, or even more than, darkness associated with an incubator temperature of 95° F.

The solutions were placed in previously superheated tubes, which, after being hermetically sealed, were heated again in a calcium chloride bath to 239° F. (115° C.), 248° F., 257° F., or 266° F. (130° C.), for ten to twenty minutes. In all these tubes, after the process of heating, a small deposit, either of silica alone or of silicate of iron, was thrown down. The tubes were subsequently exposed either to diffuse daylight or else in the incubator, and mostly for periods varying from five weeks to four months. When opened, the tubes were found to contain, in varying abundance, one or more kinds of micro-organisms, photographs of which were shown.

One point of much interest in connection with these experiments is the fact that no carbon was ostensibly contained in the solutions, though its close chemical ally, silicon, was always present.

It had previously been determined that such solutions proved excellent nourishing media for the growth of micro-organisms, and this fact led to trials whether any evidence was to be obtained tending to show that such solutions could also actually engender living units. On examination of the contents of the tubes after their prolonged periods of exposure to light or in the incubator, the organisms were always found, after careful search, on or within the substance of the flakes of silica, while the fluid above remained perfectly clear.

Many organic compounds have been discovered by chemists in which silicon wholly or in part replaces carbon, and it is contended that there is good *primâ facie* evidence from these experiments tending to show that silicon is capable of entering into the composition of protoplasm itself—that is, wholly or in part taking the place of carbon.

In regard to the major question, concerning the origin of life itself, the facts to be borne in mind are these:—If a few hours after the heating of the tubes one or more of them be opened as "control" experiments and the sediment carefully examined, no organisms of any kind are to be found, but, after suitable periods of exposure, organisms may be found, in more or less abundance, in the sediment taken from other similar tubes. Here, then, is evidence that *the organisms are living*; they have appeared and multiplied within sealed tubes, though at earlier dates none is to be found.

Then again, it is important to bear in mind (1) that, apart from "spores" of bacilli, no micro-organisms can resist an exposure of two or three minutes in boiling water, this being lethal for bacteria, vibriones, micrococci, torulæ, and moulds; and (2) that all ordinary spores of bacilli are killed by a similar exposure for a minute or two to 115° C. (239° F.).

It is concluded, therefore, that the bacteria, bacilli, vibriones, micrococci, torulæ, and moulds which have been taken from hermetically-sealed tubes previously heated to 115° C., 120° C., 125° C., and 130° C. for ten to twenty minutes must have been engendered *de novo* within these vessels.

The organisms that arise *de novo* are presumed by the author to assume well-known forms, for precisely the same reason that the various representatives of the crystalline world, *when they originate*, invariably fall into their own specific shapes, and with surfaces always inclined to one

[1] "On the de-novo Origin of Bacteria, Bacilli, Vibriones, Micrococci, Torulæ and Moulds in certain previously superheated Saline Solutions contained within hermetically sealed Tubes." By Dr. H. Charlton Bastian, F.R.S. Read before the Royal Medical and Chirurgical Society on January 22.