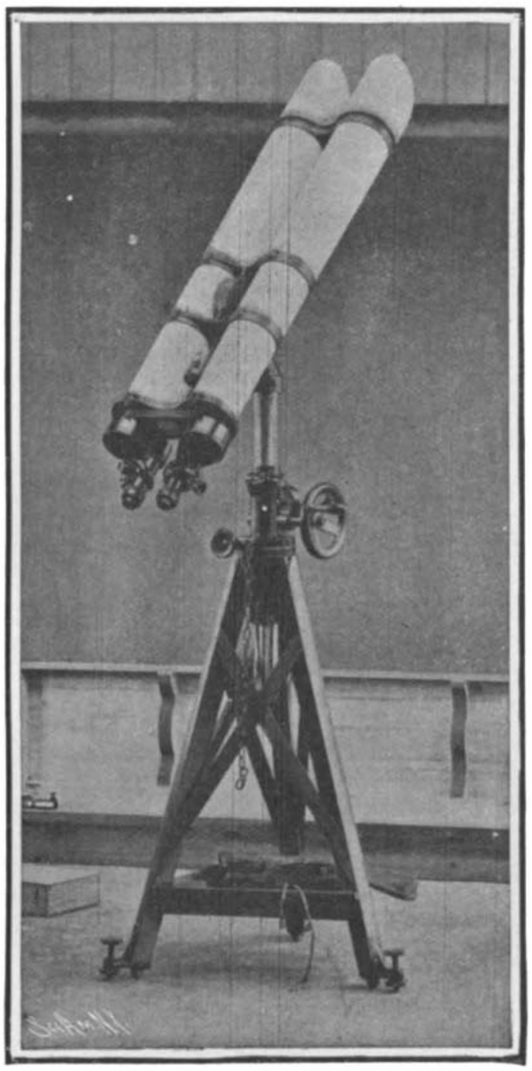
THE MOUNTAIN TELESCOPES OF SWITZERLAND.

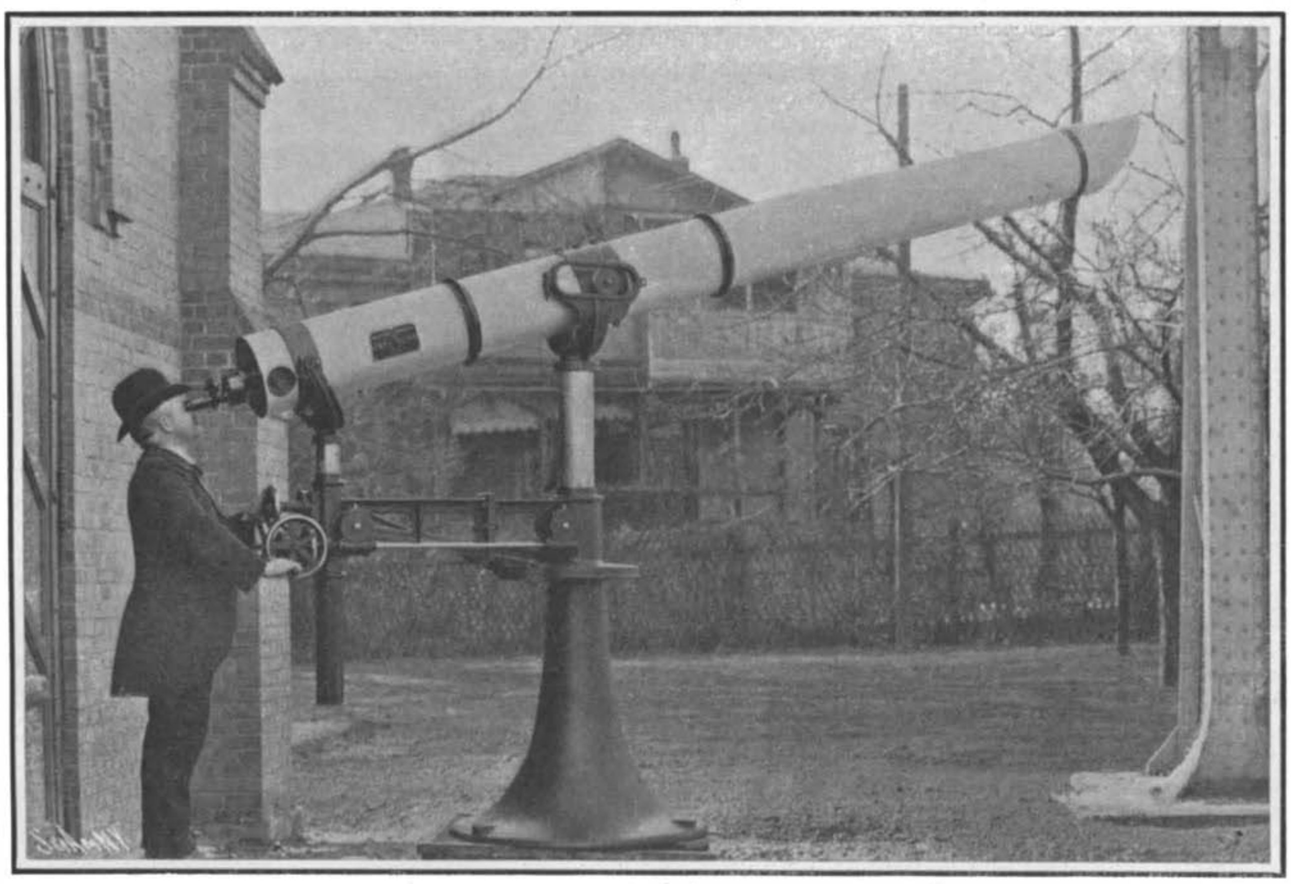
BY HAROLD J. SHEPSTONE.

During the last few years there have been erected at the termini of the mountain railroads of Switzerland and at other suitable lookout stations some exceedingly powerful long-range observing telescopes. They are at once rendered conspicuous by their construction and size, and have rightly become very popular among tourists for the reason of the splendid panorama views of the mountains obtained through them. Indeed, the ordinary traveler is often dumfounded with the wonderful detail that is brought out through these high-power glasses.



A Stereoscopic telescope which preserves perspective values.

Watching a climber on the Matterhorn through a 5 1/8-inch telescope on the Riffelalp, Zermatt.



The long-range observing telescope. Object glass, 7 7/8 inches. When the weather permits, objects 120 miles distant can be seen clearly.

THE MOUNTAIN TELESCOPES OF SWITZERLAND.

The idea of establishing telescopes on the mountains of Switzerland was indeed a happy one. Not everybody has the inclination or the necessary physical strength to undertake arduous climbs in this mountainous land, and so obtain a close glimpse of this wonderful world of ice and snow. True, there are now a number of mountain railroads penetrating right into the heart of the Alps, but even these are not accessible to all. Many lack the time or even the means of availing themselves of these ingenious railroads up the hillsides; but the tourist can now study the rocks and glaciers, and note the formation of the summit of Europe's most famous range of mountains, by the simple operation of viewing them through a telescope.

Naturally, the variety of mountain scenery in Switzerland offered a unique field for the introduction of a telescope suitable for long-range observation. It was necessary, of course, to turn out a glass which could be used by the general public without difficulty. What was demanded was an instrument free from chromatic aberrations, one offering a large field of vision, through which one could observe with ease a bright and clear section of the landscape. All these conditions are more than fulfilled in the telescopes which have been specially constructed for use in the Swiss mountains by the well-known optical firm of Carl Zeiss of Jena. It was in these instruments that the new Jena glass was practically used for the first time.

This new type of telescope may be roughly divided into two classes, monocular and binocular; i. e. those through which the observation is made with one eye only, and those through which it is made with two. The former are mostly fitted with a revolving appliance, the simple turning of which allows of rapid change of magnifying power. The telescopes seen in our photographs possess object glasses 5⅛ inches in diameter, and magnify 35, 58, and 116 times respectively. The binocular instruments are contrivances astonishing in their effect. It is well known that our power of perspective rapidly decreases as the distance from the object increases. The reason for this is that the optic angle at which objects appear decreases with the distance, and finally becomes so slight that we lose all power of estimating it. We can, however, enlarge this angle by approaching the object, or by bringing the object apparently nearer to us, or ultimately by increasing the distance between the eyes. The optic angle is the angle formed by two straight lines from our eyes to a given or observed point. It is quite clear that to extend the distance between the eyes an artificial medium is necessary, and this train of ideas is realized in the binocular telescope under notice. Imagine, for instance, the two object glasses of an opera glass 25 times farther apart than the normal distance (about 2½ inches) between the eyes, that is 5 feet, and the projected image again reduced to normal distance by inserting prisms; the object would then appear at an optic angle 25 times as great. Now suppose we view a landscape two miles distant; the separate objects—houses, trees, people, etc.—would appear to us as if only 140 yards away. Now apply, in completion of the instrument so constructed, ocular glass of tenfold magnifying power, and we raise the plastic or stereoscopic effect proportionally, we achieve a 250-fold plasticity, and the objects appear as if they were only eighteen yards away. This is the principle of the latest mountain telescope. Upon everyone who is able to see stereoscopically it produces a most striking effect; mountain chains, precipices, etc., which, when seen through an ordinary telescope, are apparently on the same plane, separate from one another in a most surprising manner. The observer sees before him a living stereoscopic picture, sharp cut, clear, and in glowing natural colors. He sees the trees stand forth, the rocks recede; the foreground appears pushed quite up to the front, and the observer is made to believe that he is looking into the country from an elevation. Especially in the mountains does this panoramic effect exercise its magic.

At both the objective and eyepiece ends of the telescope are cap arrangements for protection against rain or wind. The telescope rests in a forked cradle, is well balanced, and can be clamped in any position by tightening thumb screws. The elevating gear is a simple but very complete contrivance. By means of hand wheels the eyepiece can be so adjusted as to remain focused on objects of varying altitude above the horizon. Indeed, the instruments are the envy of many an observatory. Their magnifying power, which is adapted only for landscape observations, not for astronomical observation, ranges from 35 to 116 diameters; even the lowest of these, the one mostly employed, gives extraordinary results.

Through the instrument at Uetliberg near Zürich, for instance, climbers on the Titlis, 40 miles distant, can be seen on a clear day, the atmospheric conditions being favorable. The hotel on the Faulhorn, 60 miles distant, can be recognized with this instrument, and in very fine weather the small trigonometrical signal itself, as well as visitors on the Rigi, the crevasses in all visible parts of the Alpine chain, and one of the church clocks in Shaffhausen, may be seen. Through the instrument on the Riffelalp above Zermatt, the movements of the Matterhorn climbers may be as clearly followed as if they were within hailing distance. One sees them cutting steps in the ice, carefully placing their feet therein, and paying out the rope. On such a day the telescope is much frequented. Through the instrument on the Schynige Platte near Interlaken, the timid chamois may be observed on the precipices miles distant, as they are otherwise never to be seen, and persons on the four miles distant Faulhorn are easily distinguishable. All the great ascents are now watched through the telescopes, and anxious relatives can follow their friends' progress up the mountains. Then again these wonderful instruments have often been the means of saving life. Accidents have been witnessed through them, and help dispatched to those in danger. The signals of distress from the Alpine guides are invariably first seen by the watchers through these powerful glasses.

Similar instruments are to be found on the Rigi, the Weissenstein near Solothurn, the Wengeralp (Scheidegg), and on the Jungfrau railway; in Bern, Grindelwald, Zermatt, and other places. The object glass in almost every instance is 5⅛ inches in diameter. Naturally, such instruments are expensive, as they represent the very best and latest of their kind. The telescope on the Schynige Platte, for instance, cost $460. It is interesting to note that the Carl Zeiss firm is now turning out a long-range observing telescope with a 7⅞-inch object glass. This will magnify objects 60, 100, and 200 times respectively, and in the clear atmosphere of the Swiss mountains, one should be able to see an exceptionally long distance with it.

Tapping the Earth for Electricity.

BY PRIVY COUNCILOR OF MINES TECKLENBURG.

As pure water, mineral waters, petroleum, gas, and heat can be obtained from deep borings it appears worth while to make an attempt to obtain electrical energy from the interior of the earth by the same means.

I have already published numerous instances of the magnetization of driven well tubes. Some tubes, driven less than a thousand feet into the earth, became magnetized strongly enough to sustain the weight of large iron keys placed in contact with the protruding tops of the tubes.

We know, furthermore, that a measurable electric current is generated when two electrodes, connected by a wire, are immersed in solutions of different temperatures or different degrees of concentration. Now the earth contains various liquids, the pressure and temperature of which increase according to their depth below the surface. This distribution must produce electric currents and these may possibly be the most available subterranean source of electric energy, for to every depth corresponds a certain constant pressure and when this pressure is removed (as by a boring) the temperature immediately rises.

In the universe in general, very great electrical tensions are produced, in all probability, by various periodic cosmical influences. In the atmosphere we observe a continuous variation of electric charge and potential, and as the electric charge of the earth depends chiefly on the electricity of the air, it should undergo violent, though momentary, disturbance in thunder storms, especially near the striking point of a discharge. It is well known, also, that the electrical state of the ground always differs from that of the air.

There are, no doubt, electrical currents in the earth, caused by local differences in electrification, as winds are caused by differences in atmospheric pressure. If the interchange of electricity represented by these earth currents could be made to take place through suitable apparatus it would become an available source of energy. The regular alternation of solar illumination probably generates earth currents of unvarying direction, analogous to the trade winds and other constant air currents produced by the same cause. Certain solar phenomena, including increase in the number, size, and variability of sun spots and faculæ, and the formation of protuberances and eruptive columns of incandescent gas, strongly affect the electrical and magnetic condition of the earth. The aurora borealis is undoubtedly of electrical origin. The earth currents due to solar influences and the rotation of the magnetized earth must be influenced by variations in the electrical state of the atmosphere. Telegraph and other electrical circuits, both overground and underground, are affected by earth currents, especially during auroral displays, when it is often impossible to telegraph for hours.

The considerations set forth above suggested to me the following experiments, which were conducted in borings miles distant from underground electric circuits.

The first boring was unlined, had a depth of only 46 feet and was filled to a depth of 11½ feet with water. The second boring was 184 feet deep, contained 131 feet of water and was lined with iron pipes to a depth of 151 feet. The apparatus consisted of a brass rod, a lead cylinder 6 inches long and 2 inches in diameter, about 300 feet of insulated copper wire, and an amperemeter and a voltmeter, which were placed in a building near the shaft.

When the lead cylinder was lowered into the shallow and unlined boring, the brass rod driven into damp ground 150 feet from the mouth, and the two connected through the galvanometers by means of the insulated wire, the instruments indicated 0.06 volt and 0.001 ampere. The substitution of a number of brass screws for the lead cylinder raised the voltage to 0.16, and the substitution of an iron pipe for the brass rod raised it to 0.24 volt, but in both cases the current remained equal to 0.001 ampere. Experiments made in the deep boring gave substantially the same results when the suspended electrode was sunk to depths of 130 and 160 feet, though distinctly greater deflections were obtained at the full depth of 184 feet. Depths of several thousand feet may, of course, give very different results.

It would be an easy matter to lower electrodes to various depths in wells, mine shafts, and other borings and excavations. Unfortunately I cannot do this myself, as I do not control the shafts, but contractors and mining companies might well take up the problem. It would only be necessary to place a hollow copper cylinder, 60 feet or more in length, at the bottom of a boring of 3,000 feet and to connect it by a well-insulated copper wire with a similar cylinder buried in moist earth at the surface in the vicinity of the mouth, intercalating a voltmeter and an amperemeter at any convenient points.• Possibly a current strong enough to charge an accumulator might thus be obtained. Perhaps a strong current can be obtained merely by connecting an electrode buried in moist earth with the top of an iron well pipe of great length. The simple expedient of connecting two neighboring pipes at mineral springs might conceivably furnish a current, and is well worth trying. If the pipes are of different metals, iron and copper, further experiments should be made with pipes of the same metal in order to distinguish the galvanic from the earth current.

Experiments of many kinds, indeed, should be made in deep borings, if only for the sake of the possible utilization of many costly borings that have been abandoned. No doubt other and better methods than I have suggested will be found for obtaining electrical energy from the interior of the earth. I merely wish to induce others to repeat these experiments in deep borings and mine shafts and I shall be glad to assist in the work.

What is to be expected of such experiments? In the most favorable case we may find in the depths of the earth sources of heat, light, and power of vast importance to all mankind, and in the most unfavorable case we shall lose a few thousand dollars. The horizontal intensity, declination, and inclination of the earth's magnetism are measured daily with great precision in many places. Why is not the same interest shown in the more important electrical state of the earth? This should also be a matter for governmental investigation.—Translated for the Scientific American from Umschau.

The Harmful Effects of Ultra-Violet Rays on the Human Eye.

The action of ultra-violet rays on the human eye has been much discussed ever since Doctors F. Schanz and K. Stockhausen at the Congress of German Naturalists held at Dresden drew attention to the matter. Another interesting contribution toward a definite solution of the question was given by the same men in a lecture delivered before the sixteenth annual meeting of the Association of German Electricians, at Erfurt.

Many experimenters have investigated the influence of ultra-violet rays on the human organism, and their work has resulted in the therapeutical use of the rays, some affections of the skin being cured by an artificial inflammation due to their action. Ultra-violet rays of short wave length were found to act very intensely on the surface, whereas those of greater wave length penetrated to some depth. The action of the rays on the eye has likewise formed the subject of research.

Investigations carried out by Schanz and Stockhausen show that *ophthalmia electrica* is due to ultra-violet rays. The same disease, though in a less characteristic form, is produced also by many other illuminants containing a large percentage of ultra-violet rays. Snow blindness is similar in its symptoms to electrical ophthalmia and is likewise produced by ultra-violet rays contained in reflected sunlight.

That the action of ultra-violet rays, so far from being confined to the external eye, also affects its deeper parts, is evidenced by the intense fluorescence of the lens which they are able to produce. The lens thus converts the short-wave invisible rays into visible rays, acting, as it were, as a safeguard to the retina. Persons whose lenses have been extirpated are accordingly subject to attacks of erythropsia ("red visions"), especially in the case of intense lighting effects. This trouble can be observed at high altitudes even in normal eyes. As a slight turbidness is further produced in the lens by an intense lighting with ultra-violet rays, it may be said that the cataract of old age is possibly due to a progressive alteration of the lens.

Though an increase in the percentage of ultra-violet rays with increasing temperatures of the illuminant could be anticipated, Schanz and Stockhausen examined the usual lamps by means of a quartz spectrograph, the results of which are as follows:

The spectrum of crude oil lamps and candles hardly exceeds the region of visible rays. The ultra-violet range, however, extends as soon as a chimney is added. The same result is observed if the temperature of the flame be raised by means of an air blast, and an even more extensive spectrum is produced by using an incandescent mantle; but the longest ultra-violet spectra are found in electric illuminants, of which the mercury vapor lamp with quartz globe and arc lamps are found to come foremost. Nernst lamps likewise radiate a considerable percentage of ultra-violet rays. In all electric lamps fitted with a glass cover of any kind, the short wave lengths are absorbed by the glass.

The authors draw attention to the fact that blue protective spectacles afford no protection against ultra-violet rays, and that smoke-gray spectacles weaken the whole spectrum, for which reason they are not suitable for practical purposes. Because of the special importance of the question, they have undertaken the production of a new kind of protective glass which is now brought on the market under the name of "euphos" glass. This glass, which is of a light greenish-yellow hue, owes its remarkable power of absorbing ultra-violet rays to its special composition rather than to its color. The composition can be adapted to each kind of lamp.

With a very slight loss of light (3 to 5 per cent) this glass screens off entirely any ultra-violet rays. Special experiments made on animals show that it really affords an efficient protection to the eye.

Prizes for Essays on Street Cars.

To the senior students of the technical schools of the United States who will be graduated in 1909, the J. G. Brill Company, of Philadelphia, manufacturers of cars and trucks, offer $500 for theses on the subject, "Design of an Electric Railway Car for City Service." The authors of the three theses which in the estimation of a jury shall be considered most meritorious of those submitted, shall receive respectively in order of merit of their work prizes of $250, $150, and $100. The subject may be considered from any standpoint the student may elect or from all, i. e., from the standpoint of the construction of the car body, the standpoint of the truck, the standpoint of the electrical equipment and its arrangement, etc. Each thesis will be judged: 1. On its technical merit; 2, on the manner in which the subject is presented. A jury of three whose decision shall determine the winners of the respective prizes will be appointed to consider the relative merits of the theses submitted. The jury will include an electric railway official of prominence who is thoroughly conversant with the features and requirements of electric railway car construction; a member of the editorial staff of one of the technical journals in the electric railway field; and an expert in car construction.

The Current Supplement.

An interesting and novel application of concrete has recently been carried out in the erection of a new lighthouse in the Straits of Malacca. This the English correspondent of the Scientific American describes at length in the current issue of the Supplement, No. 1712. James Hatch's paper on the development of the electric railway, in which he traces its marvelous growth, is concluded. The Action of Radium Emanation on Copper Salts is the title of an article in which Mme. Curie describes her experiments, and in which she fails to confirm Ramsay and Cameron's announcement of the degradation of copper to lithium by means of radium emanation. Francis Hyndman contributes an article on the absolute zero of temperature, which has been inspired by Prof. Onnes's recent achievement in liquefying helium. The British battleship "St. Vincent," the eighth of the "Dreadnought" type to be built for the British navy, is described and illustrated. The faked and the forged antique are made the subject of an amusing article by Mr. Tighe Hopkins.

The United States Forest Service will reforest about 3,000 acres of cut-over long leaf pine lands in South Florida, about twenty-five miles southwest of Ocala. After a careful study of the soil and forest-growing conditions here, the service has decided that the most practical method of doing this will be the planting of pine seed on the areas to be covered with trees, for starting the trees in a nursery and transplanting the seedlings in the field is not considered feasible because of the long tap roots produced by this species of pine, these roots rendering transplanting difficult. The experimental planting of the mesquite and several species of eucalyptus on these lands has been suggested also in this reforestation work. These will be the most extensive operations yet undertaken in the South.