CARRYING 100,000 VOLTS OVER THE ROCKIES

THE electrical engineer is every day achieving what seemed impossible the day before, says a writer who tells how a Colorado power company is carrying an enormous current over the Rocky Mountains, exposed to wind, snow, hail, and lightning. This plant, it appears, transmits energy at 100,000 volts for a distance of 150 miles over altitudes that run up to a maximum of 13,700 feet. In *The Electrical World* (New York, January 27) we read:

"The lines are exposed, not only to the ordinary contingencies of wind and snow, but to sleet conditions which are exceptionally severe. The sleet recorded in the region has reached a diameter as high as 6 inches, a condition quite unheard of in most sections of the country. Success has been obtained by very thorough and skilful tower construction, together with the use of suspension insulators, which are undoubtedly a very considerable factor in the success of the installation. The average spacing of the towers is about 750 feet and they carry three hemp-core cables . . . supported on a single top cross-arm in a horizontal plane, the distance between the conductors being 10 feet 4 inches. The insulators are four suspension disks, each of which is rated at 25,000 volts working-pressure. The suspension insulator has the greatest recent improvement in the electrical transmission of energy, and this line, subjected as it is to enormous strains, is an admirable example of the success of the device. The towers are not high, the normal height of the conductors at the tower being only 40 feet. This gives unusual stability to the line, a stability which is greatly needed in winter. The lightning protection consists of a galvanized steel-stranded cable, or sometimes a pair of them, carried at the level of the upper cross-arm and supported directly on the tower structures. This protection runs over a considerable part of the route, especially the portions most exposed from their situation to the danger of lightning. The results have been satisfactory, altho no lightning arresters were installed, and no damage was caused to the line or apparatus by lightning during the entire summer service. . . . Altogether, the results of eight months' operation at from 86,000 to 100,000 volts has been highly successful. Here is another proof of the fact we have often noted, that engineers have been in the past more scared than hurt in the matter of high voltage. As each forward step has been taken, dangers seriously feared have generally proved to be mythical, which is a good augury for further improvements."

EFFECT OF THUNDER ON RAIN

IT is often noticed, during a thunder-storm, that a heavy discharge of lightning is followed at once by a downrush of rain. This is usually ascribed to coalescence and consequent enlargement of the drops due to loss of their electrical charge. According to Laine, of Finland, the phenomenon is due, not to electricity, but to the sound of the thunder, and he supports this view by observations made upon rainbows during storms. Says a writer in *Cosmos* (Paris, January 15):

"Laine made his observations of thunder-storms on August 3, 1908, at Alahaerma, not far from the city of Vasa. A storm was approaching from the east, while the western sky was at first quite clear. The thunder was heard for the first time at 5:50 P.M. and ceased at 6:24. The rain, at the same place of observation, lasted from 6:33 to 7:25. From 6:05 to about 6:30, a double rainbow was seen in the east, extending uninterruptedly from horizon to horizon. It is well known that the double rainbow consists of two concentric bows, the inside one having the red toward the center, the outer one with the red outside. The sunlight enters the raindrops and is first refracted therein and then reflected from the inner surface, once for the interior bow and twice for the outer bow, being afterward sent back to the spectator's eye after another refraction.

"Now at each roll of thunder, the colors of the two bows, especially those of the outer bow, were seen to be displaced, so that the boundaries of the colors and the edges of the bows were effaced completely; at the same time the colors became blurred and rapid undulations ran along the bows.

"Here, surely, was no effect produced by the lightning. The disturbances began always at nearly the same instant at which the thunder was heard. Laine thinks that the phenomenon confirms the Airy-Peruter theory of the rainbow; the thunder occasions a variation in the size of the drops, whose radii, normally less than 0.1 millimeter [0.004 inch], assume during the thunder a value between 0.5 and 1 millimeter [0.02 and 0.04 inch].

"We may conclude from this phenomenon that artificial acoustic disturbances may be able to bring about an agglomeration and an enlargement of rain-drops. Here is a chance for experimental verification, which might increase our knowledge of the production of thunder-storms."—*Translation made for* THE LITERARY DIGEST.

MAKING WASTE PRODUCTS USEFUL

THE complete utilization of all residues in industrial processes, so that there shall be no waste at all, is a commercial ideal. Formerly no effort at all was made to go any further in any process of manufacture than to turn out the product directly aimed at, all incidental or by-products being thrown away. At present the secondary product often assumes greater importance than the primary, but there is still much to be done before all waste is abolished. A recent address by Otto Witt, a celebrated German chemist, is thus paraphrased and commented upon in *La Nature* (Paris, January 8):

"It is easy to see that simply to do away with or remove an annoying accumulation of material is an appreciable advantage. But very often these residues are injurious, and by utilizing them we render unnecessary costly treatment imposed upon the manufacturer by the sanitary authorities—for example, purification of residual water, or the suppresson of smoke. Finally, the use of these materials gives them a certain value that may sometimes be very appreciable.

"We do not generally realize, in fact, what a total may be attained by the value of the useful elements lost too often in the residues of factories. The powerful modern industries have a very intensive production, and the smallest figure is so greatly multiplied that it changes into millions. Interesting facts on this subject have been published recently by Mr. J. Effront, director of the Institute of Fermentation at Brussels, and Mr. A. Aulard, the well-known sugar chemist. The figures relate to the value of principles contained in the residues of sugar-making and distilling which are theoretically utilizable, but in most cases practically unutilized."

First mentioned among these residues is the "mash" from which spirituous liquors are distilled. This contains salts of potash and soda and various nitrogenous compounds. Sometimes the potash is saved by evaporation and calcination, but generally the whole mash is thrown away, and in any case all the nitrogen is lost. In grain-distillation about a pound of nitrogen is thus thrown away for every ten gallons of alcohol produced. It has been calculated that the equivalent of 100,000 tons of ammonium sulfate, worth about $4,000,000, is thus annually lost in Europe. Instead of using this as a fertilizer, Chile saltpeter is imported at great expense. Processes for saving this valuable nitrogenous fertilizer have been devised and are beginning to be used. In the beet-sugar industry, likewise, juice is thrown away containing various albuminoids and hydrocarbons, besides considerable waste sugar. In Europe alone, more than 50,000,000 tons of beet sugar are made annually, and this manufacture involves a loss of $12,000,000 worth of nutritious substances. Some of these, also, are shortly to be recovered and used. We read further:

"It would be easy to multiply examples. Prof. F. Fischer, of Göttingen, for instance, estimates at $30,000,000 the annual saving in Germany from the rational utilization of the heat produced in the furnaces of steam-boilers. In a recent work on 'Industrial Combustion,' the value of the easily-usable heat that passes up factory chimneys and is wasted is estimated at $20,000,000.

"So we are beginning to use industrial residues of all kinds. A large number of secondary industries have thus been annexed to the oldest technologies and sometimes assume more importance than their elders. The manufacture of soda by the Leblanc process, for example, has had as a corollary the production of hydrochloric acid and of bleaching-powder.

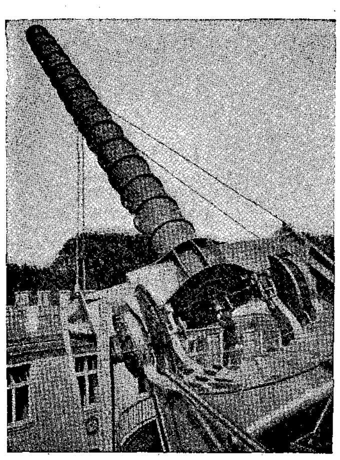
"Among the new industries thus created, we may mention that of lime-silica bricks, . . . of cement obtained by calcination of the lime-precipitates of sugar refineries, the numerous processes for utilizing the fatty matters extracted from wool, the manufacture of glycerin by the Barbet process, and of propionic acid from the refuse of distilleries. Mixtures of residues of various food industries, such as the refining of sugar, make excellent food for cattle."—*Translation made for* THE LITERARY DIGEST.

A GREAT OPEN-AIR TELESCOPE

UNDER this title the great popular telescope erected recently at Treptow, near Berlin, Germany, is described in *The Scientific American* (New York, January 29) by Prof. S. A. Mitchell, of Columbia University. This telescope is intended to make astronomy popular through public exhibitions. Professor Mitchell contrasts it with the Yerkes telescope, the highest development of American manufacture. He says:

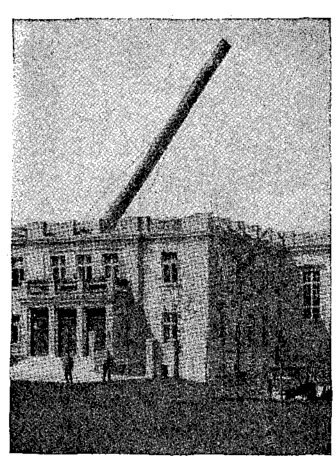
"In the Yerkes telescope we have a great instrument given over to exact research, handled by a corps of expert astronomers, leaders in their special lines of work. Prof. E. E. Barnard is there with his keen eye for the measurement of the positions of comets, star clusters, etc., for the depicting of slight planetary details, or with the help of the photographic plate for the portrayal of Mars on a large scale. The greatest living authority on double stars, Prof. S. W. Burnham, spends two nights each week with the great 40-inch refractor. The director, Prof. E. B. Frost, takes care of the spectroscopic side of astronomy by photographing the spectra of stars for the determining of their motions in the line of sight, and by daytime the telescope is made use of to learn of interesting phenomena about the sun. This great telescope is a model of engineering perfection with its great tube and massive parts, rising floor, and rotating dome. It is mounted in what is known as the equatorial form.

"But how different is the Treptow telescope! Erected with other purposes in view, it is not necessary to have expert scientists to keep the telescope employed almost every hour during the day and night; constructed under a different plan, it is unnecessary to have a great elevating floor inside of a huge rotating dome, for, in fact, the dome is done away with and the telescope is used in the open air! This, then, brings something radically new into the old science of astronomy, something entirely different in the construction of a great telescope. And this new form of instrument has many points in its favor that make it a most interesting telescope."



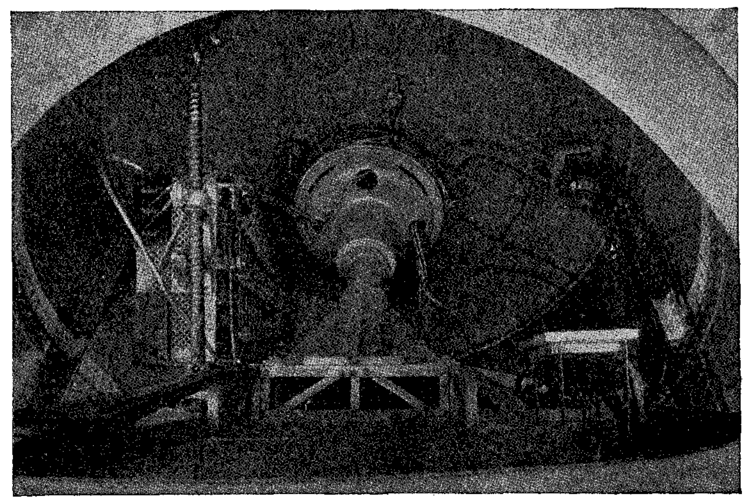
From "The Scientific American," New York.

HOW THE GREAT TUBE IS BALANCED.



"THE DOME IS DONE AWAY WITH AND THE TELESCOPE IS USED IN THE OPEN AIR!"

German astronomers, the writer goes on to say, ridiculed Dr. Archenhold, director of the Treptow Observatory, for his radical idea of placing in the open air with no protection from the wind a great tube $68\frac{9}{10}$ feet in length, 7 feet longer than the Yerkes telescope, and it was with difficulty that funds for its erection were secured. Professor Mitchell goes on to say:



From "The Scientific American," New York.

VIEW TAKEN UNDER THE MOUNTING,
Showing the electric motors for driving the telescope.

"The old equatorial form of mounting was departed from, for this requires that the eye-end of the telescope be raised through a vertical distance approximately half the length of the telescope tube in viewing a star overhead and one near the horizon. This necessitated a very expensive elevating floor run by electric motors. By swinging the telescope tube in a great fork, and employing suitable counterpoises, Dr. Archenhold was able to have the eyepiece near the center of motion, and run the telescope tube upward into the air. . . . This eliminated the rising floor and saved many thousands of dollars. . . . As the whole construction had no great height, it became possible to house the telescope by turning the long telescope tube into a horizontal position and pulling over it a cheap portable house. By using the telescope in the open air it became possible to entirely eliminate the great dome, and thereby save again more thousands of dollars. The result of these plans was that Dr. Archenhold was able to build the completed instrument for . . . $62,500 [of which] $11,500 was spent for the lens. . . . . . .

"The radical departure from old-established forms in eliminating the dome has many points in its favor besides the mere saving of money, and also many drawbacks. As is well known to astronomers, the temperature of the night air is continually falling (especially in the early part of the night), and it is impossible to have the air in the interior of the dome at the same temperature as the outside air. This causes the heated air to pour out through the slit of the dome, and also produces currents of air in the interior of the telescope tube itself. All of this makes 'bad seeing,' and a distortion of the telescopic image—the bane of the existence of the professional astronomer. Dr. Archenhold's plan of doing without a dome eliminates most of the effects of air currents, for there is no 'dome effect,' as astronomers call it, and the air in the telescope tube quickly takes the temperature of that outside. Here, then, is a decided advantage. But unfortunately the telescope being in the open air makes it the sport of every passing wind, and even a slight wind is apt to set up a vibration."