with uranium, he investigated the matter himself, and found his incredulity justified; for the gas he obtained in his receiver contained no nitrogen whatever, but was a new gas which he was utterly unable to identify with any known terrestrial substance. Now new elements do not hang on every bush in the days when keen-eyed science searches through every nook and cranny of creation; and so its discovery, even though there were nothing more, was a very wonderful thing.

We have said the new gas could be identified with no known terrestrial element; but it was identified, and that very quickly, with the mysterious element in the outer layer of the sun's atmosphere called helium. Before considering the remarkable consequences of the discovery, let us ask how Ramsay could know that the colorless gas which he held in his test tube was identical with a substance 93,000,000 of miles away, which no man had ever seen. Briefly, it was by the light which it emitted on being heated to incandescence. That different substances on being heated give out lights of different colors, may be seen in every display of fireworks; that every known substance, on being heated to an incandescent condition, gives out a light peculiarly and characteristically its own, is a broader statement, but just as true. The light may not look characteristic to the unaided eye; but when it passes through the triangular prisms of a spectroscope, the original ray is dispersed into a broad band, or spectrum, whose vari-colored lines declare in an unyielding voice the nature of its constituents. Moreover, the spectroscope's decisions cannot be invalidated by distance. Its jurisdiction extends to the walls of the universe.

In 1868 J. Norman Lockyer, by means of this most remarkable of all instruments of precision, discovered certain lines in the solar spectrum which could only be accounted for on the hypothesis of a new element, which he named helium.

The most prominent of these lines was one marked D_3, close to the yellow line of sodium. The first thing which struck Ramsay in examining the gas from uraninite was the D_3 line of the solar spectrum. Amazed, and half doubting his own senses, he sent the tube to Professor Crookes, of London, the world-famed authority on the spectra of the elements, who fully confirmed Professor Ramsay's discovery. Since then helium has been prepared by Lockyer, Cleve of Upsala, and others; and its existence can no longer be doubted. The gas, however, obtained from cleveite is not pure helium, but contains other elemental gases hitherto unknown, whose investigation and separation will tax all the powers of chemical ingenuity. The presence of these other curious gases, the simplicity of the helium spectrum, the obstinate pertinacity with which it refuses to be classed with any of the "happy families" into which the other elements have arranged themselves, together with the enormous quantities in which it exists in the hottest part of the sun's atmosphere, lead us to think that we are on "the ragged edge" of solving that burning question of physico-chemical science, the genesis of the elements themselves. It is very probable that the atoms of our so-called elements are but different combinations and aggregations of the atoms of one primordial element; and it is possible indeed that this primordial element is helium or one of the strange elements associated with it.

The late Professor Huxley says that the "idea that atoms are absolutely ungenerable and immutable 'manufactured articles' stands on the same sort of foundation as the idea that biological species are 'manufactured articles' stood thirty years ago;" and Professor Richter, of Breslau, stated in 1891 that "the various properties of the elementary atoms may be explained by the supposition of yet simpler primordial substances." These "simpler primordial substances" have very probably come upon the stage with helium within the last three months.

Hail to them! We may now realize the dream of the alchemist—the transmutation of metals. But outside of these considerations there are others of a somewhat different nature. The gas nitrogen, so lazy and inert that it is useful in the atmosphere merely as a diluent, when in combination with other elements, gives us our most valued medicines, poisons, explosives, and industrial products. Its useful compounds may be numbered by the thousand. The gas helium holds out the same promise. When made to combine with other elements, we may look for compounds having properties a conception of which we have as yet not the shadow of a dream.

ELECTRICAL ITEMS WORTH REMEMBERING.

An accumulator should never be short-circuited.

The loss in a converter does not exceed five per cent.

To maintain an electric arc 1 inch long requires about 118 volts.

A well charged cell of storage battery has about one-half the resistance of a discharged one.

A secondary battery of 800 elements will illuminate a vacuum tube of high resistance for 3½ hours without recharging.

The electrical resistance of German silver is, in round numbers, 13 times that of copper, and the resistance of iron is 6 times that of copper.

The discharge of small storage cells should be limited to 1¼ amperes per plate; of large cells, 2½ amperes per plate. A battery should not be allowed to remain discharged longer than two days.

In an arc light produced by alternating currents, both carbons are consumed at the same rate and both remain pointed. Carbons burn faster with the alternating current than with the direct.

The electrolytic fluid used in different storage batteries varies. In some it is a 20 per cent solution of sulphuric acid in water: in others it is much stronger, the proportion of acid being as high as 36 per cent.

For a pole finder take two clean lead electrodes and dip them in dilute sulphuric acid; connect them with the circuit to be tested. One electrode soon becomes brown and the other gray. The brown electrode indicates the positive pole.

In mixing the acid solution for a storage cell, care is required to avoid accident. The acid must be very slowly added to the water, to avoid splashes and the too sudden rise of temperature. The water must never be poured into the acid.

The internal resistance of a cell of storage battery is from 0·001 to 0·005 of an ohm. The average electromotive force is 2 volts, and the working capacity of a good sized cell is 350 ampere hours, that is, it will economically deliver a 35 ampere current for ten hours.

Where no coil is used it requires a battery having an electro-motive force of 1,080 volts to produce a spark 0·005 inch long in air. Sir William Thomson said "greater electro-motive force per unit length of air is required to produce a spark at short distances than at long."

To find the direction of a current, arrange the wire conveying the current in the meridian so that it will be north and south. Place a common compass under the wire. If the N. pole of the needle turns west, the current is flowing from south to north.

In charging storage batteries, the electro-motive force of the charging current should be 2·3 volts for each accumulator in series, and the charging current should not exceed 1 ampere per plate for small cells, composed of say 6″ × 8″ plates, or 2 amperes per plate for large cells, composed of say 10″ × 12″ plates.

It requires a potential difference of 10,000 volts to produce a spark $\frac{1}{10}$ inch long between two metal balls. As this proportion practically holds good for longer distances, it would of course require 100,000 volts to produce a spark 1 inch long, the striking distance between a point and a plate being at the rate of 1 inch for 23,400 volts.

Trouvé's bichromate of potash battery solution is as follows: Water, 9 quarts; pulverized bichromate of potash, 2·6 pounds; sulphuric acid, 7½ pounds. It is prepared as follows: The powdered bichromate of potash is dissolved as far as possible in the water, and the sulphuric acid is added, very slowly, stirring continually with a glass rod. The mixture heats by degrees and the bichromate becomes completely dissolved, and when once dissolved the solution remains clear, and crystallization does not take place on cooling.

How Electricity Sets Fires.

William McDevitt, chief of the electrical department of the Philadelphia Underwriters' Association, recently gave a demonstration of some of the ways in which fires may be caused by electricity. The first danger was that arising from the common practice of grounding telephone wires on gas pipe. A bad connection is generally made—quite sufficient for telephone purposes—and then if the telephone wire becomes crossed with an electric light wire, the larger current meeting resistance at the ground connection heats the joint, punches a hole in the gas pipe, and the arc formed lights the gas. Mr. McDevitt gave a complete demonstration of the gas and insulation on the wire burning simultaneously. He also exhibited a section of gas pipe that had caused a fire in just this way. The wires in the sockets of electric lamps are liable to touch the casing, when an arc may be formed. For this reason, no drapery should be used around the lamp sockets. The advantage of using metal conduits with insulated lining through which to run the wire was demonstrated, a wire outside being dangerously heated, while from that inside the conduit there was no risk. A caution was given against the rough handling of flexible cords used for electric lights as a common cause of short circuits and fire. There are other dangers due to ignorance on the part of the general public of the character of the electric current. In one case on record, the walls of a room were upholstered with stuff in which were interwoven a great number of metal threads. These were in contact with the electric light wires, and when the current was turned on, the whole room was set ablaze. An obscure danger from frictional electricity has been traced. Sparks may be caused by shuffling the feet on carpet or by the rubbing of silk. Where benzine is used to clean such materials, a spark thus caused may give rise to a dangerous fire. It is believed that some benzine fires have been caused in this way. Another cause of fires is the unreliability of fuses. They are put in the line to be burned out when an excessive current is turned on, but, like safety valves, they do not always work. If they fail to fuse, a dangerous current may be carried along the line. To obviate this danger, a standard should be adopted.—Boston Transcript.

Cycle Notes.

A well known New York firm has introduced what is termed the folding bicycle. The wheel differs slightly from the ordinary style except that the upper and lower bars of the frame are crossed by a light bar that works on a pivot, so that when a person has finished a ride and wishes to convert his bicycle into a shape suitable for transportation, he merely unscrews a bolt and the bicycle folds up, turning by the cross bar. The durability of this type is not lessened by the fact that the bar is interchangeable. The advantages of this folding bicycle are evident to all who have occasion to transport wheels on railroad trains. There are a few in use, by reason of the fact that the demand for the ordinary type of machine this year has been so great that the manufacturers are able to devote little time to novelties.

A twenty-four hour bicycle race occurred at Putney, England, June 22-23. Mr. A. C. Fountaine made 474 miles 1,296 yards in the twenty-four hours.

In France the bicycle is called the "pneu."

Bicycling for Women.—In the Boston Medical and Surgical Journal for June 13 Dr. Charles W. Townsend has an article on this subject in which he states that he sent a list of questions to eighteen women physicians in Boston and throughout the State in regard to the value of bicycling for women. The replies, he says, seem to him to cover the field of bicycling for women very satisfactorily, showing that the bicycle is of great value to the average woman, even to the woman with various forms of uterine disease. They also show that the bicycle when improperly used may do harm. Outdoor exercise, he says, is of great value to every one, and women, as a class, suffer greatly from the lack of it. Another thing from which women suffer is too heavy and too tight clothing. Both of these ills the average woman is entirely unconscious of, and will deny the need of more exercise on the one hand, or the existence of heavy and tight clothing on the other. No amount of dress-reform preaching or of calisthenic exercises will remedy these evils or awaken the woman to a knowledge of the possibilities of the enjoyment of life. This is what the bicycle is doing, and is destined to do in the future. The bicycle provides not only an agreeable method of exercise in the open air, but also demands a comfortable loose and light costume. Whether it will change woman's dress so far as to discard the skirt and substitute the divided garment or loose knickerbockers remains to be seen. Patients who have substituted the comfortable loose health waists for corsets while they were riding have found that corsets were unnecessary for their everyday dress and decidedly uncomfortable. Like all forms of exercise, the bicycle, he says, can do harm by excessive use. Too great speed or too long rides are exhausting and may injure some delicate point. The exercise is so agreeable and inspiriting that there is more danger of excess than in many outdoor sports, especially if a spirit of ambition and rivalry is allowed. The long rides on time—even "century" runs are indulged in by women—accomplish no useful purpose and often result in great harm. Dr. Townsend thinks that bicycling is beneficial to women, not from any special effect on the pelvic organs, but because it is an agreeable, healthful form of exercise in the open air, a form which exercises the whole body and indirectly benefits special conditions. And the converse of this holds true, that as a general exercise bicycling is not hurtful to the pelvic organs even when these are affected, unless the disease is so acute that any exercise as great as this is contraindicated. In the same journal Dr. James R. Chadwick publishes an article entitled Bicycle Saddles for Women, in which he remarks that he finds no serious attempt has as yet been made to produce a saddle that shall be adapted to a woman's anatomy. His inquiries have not enabled him to form definite conclusions, but have made evident the fact that the saddles in most use require many adjustments to be comfortable to the generality of female riders; that some of the saddles are absolutely unfitted for the use of women; and that the teachers have no definite ideas by which they can adapt the saddle to the use of women.

IF half of the million of dollars expended annually in New York City for charity, says the Texas Sanitarian, were invested in Western lands and the rising generation of the pauper element in that city were placed thereon and made self-sustaining, the ratio of defective population would be wonderfully decreased, and the opprobrium of our civilization would be materially softened. Verily here is a field for the philanthropist.