constant; but if chloral hydrate is volatile as such, its vapor will be free from water, and on introducing the salt it will give up water, and the volume of vapor will increase till the dissociation tension is reached. The salt used was potassium oxalate, containing one molecule of water. Troost has found that the volume increases on the addition of the oxalate, leading him therefore to the conclusion that chloral hydrate undergoes volatilization without decomposition.

Curious Phenomena in the Oil Regions.

A correspondent of the *Baltimore American* says that at Titusville, Pa., Senator Anderson's beautiful grounds, on the suburbs of the city, present a splendid sight every clear night during summer. The great attraction is the fact that they are brilliantly illuminated by natural gas from the Newtown Well, about four miles distant. This well yields nothing but gas, and when first opened the roar of the escaping gas could be heard, it is said, for a distance of seven miles. The gas has since been confined so as to be conveyed in pipes to the city and is used extensively for cooking and heating purposes. In the house of Senator Anderson not a stick of wood or lump of coal is used during the year either for cooking or heating. He uses the gas in cooking stoves and in open grates in his parlors, sitting rooms, and chambers. It gives too much smoke to be used for light indoors, and simply takes the place of fuel. There are about twenty standards on the lawns and around the fountain and lake in the Senator's grounds, and one magnificent arch, the innumerable jets from the pipe each throwing out a flame about twelve inches long. There are about twenty standards in all, with about thirty jets, each jet throwing out a fierce flame from twelve to eighteen inches long. The portion of the grounds illuminated is to the extent of about four acres, and is as light as day in every part. The fountain is a magnificent work of art, surmounted by a nymph pouring water from an urn into a goblet, and four swans, each throwing

Fig. 1.—VIEW OF THE EARTH FROM MERCURY.

streams into the basin below, while there is a beautiful floral display at the base of the fountain and on the ground surrounding it. The lawn is kept in splendid condition, interspersed with variegated flowers, and the effect of this brilliant illumination may be imagined amid such a scene of floral attractions. The gas is also used for heat in the conservatory, and we are informed by the gardener that the entire cost of the gas used for domestic purposes and illumination of the grounds is but $100 per annum. The force of this gas is so great that recently, in tapping the pipe to put in a service pipe for a dwelling, the particles of iron were forced out with such velocity as to enter the flesh of the plumber's arm. The gas from the Newtown Well is extensively used in Titusville in place of fuel, similar to its use in the mansion of Senator Anderson, and there is some talk of using it for the general lighting of the city.

The *Pittsburgh Despatch* says that situated about four miles southwest of Clintonville, Venango county, is a well which, for volume of production, surpasses anything yet discovered in that county. The well was completed upward of a month ago. No oil was found, but an immense gas vein was encountered at the place where oil was expected. Before abandoning the well the owners resolved to draw out the casing. This was attempted in the usual way, but the casing stuck about a foot above its former resting place. As it was elevated to its present position, the fresh water from the upper part of the hole rushed into the well at the bottom of the casing in great quantity. As it did so, the gas raised it to the surface of the earth after sending it forty feet above the top of the derrick. There it continues to gush, and may for all time. It is estimated that at least twenty thousand barrels of water are thrown out daily. It is truly a remarkable phenomenon.

HOW OUR WORLD LOOKS FROM OTHER WORLDS.

There is no consideration better calculated to exhibit to

Fig. 2.—VIEW OF THE EARTH FROM VENUS.

us how entirely insignificant our earth is as a part of the universe, than that which leads us to realize how our globe would appear to one of its own inhabitants if he could be transported to one after another of the heavenly bodies. The journey of our imaginary celestial traveler need not extend to the fixed stars, for from them the earth is not visible at all. The nearest fixed star is 226,400 times more distant from us than is the sun. Figures convey no idea of this vast interval, for no one can conceive of a trillion, much less of 24 trillions, of miles. A spider thread on that star would blot out the space between sun and earth. Our luminary would appear as a small brilliant dot, our earth, even if it were not lost in the solar effulgence, would be absolutely and mathematically invisible. And this on the nearest fixed star, if we proceeded further into the star depths our sun itself would dwindle smaller and smaller and disappear long before, the stars were reached which now form the limit of our imperfect observations. If any fixed star is inhabited, the inhabitants are not merely ignorant of our earth but of all the other planets of the solar system, all might be swept away by some vast cataclysm and the rest of the universe would be none the wiser.

Restricting ourselves, however, to the planets of the sun's family, it is probable that three are more familiar with our

Fig. 3.—VIEW OF THE EARTH FROM THE MOON.

earth's characteristics than we are with theirs, the other three or the people who live on them if we make that violent assumption, probably see no more of us than do the dwellers on the fixed stars. The excursion we have suggested therefore being restricted to the planets, the starting point will be on Mercury, which moves around the sun at an average distance of 42 millions of miles, its year being 88 days and each of its seasons three weeks. Since the earth travels on an exterior orbit to that of Mercury just as Mars and Jupiter move in orbits exterior to our own, the best epoch for its observation from Mercury is when that planet, the earth and the sun are in a right line. Then the earth's side nearest Mercury is illuminated and our globe appears as a large brilliant star moving as shown by the arrow in Fig. 1, from west to east along the zodiac.

From Venus, the earth presents a far more splendid appearance. Every 584 days it approximates most closely to that planet and is only 180 millions of miles distant. Then it appears as a large bluish white and dazzling star, eclipsing in magnitude every other in the firmament, Fig. 2. The arrow again shows the direction of motion.

From the moon, the earth seems a colossal orb. Sun and planets all pass behind it. It has phases like the moon itself; and in beautiful accord with the needs of the lunar day (equal to fifteen terrestrial days) the earth is full at midnight, in quadrature at sunrise, Fig. 3, new at noon, and in quadrature at sunset. At full earth, the lunar inhabitant can see the seas and continents, the poles white with snow and the cloud banks floating in the air. A light vapor surrounds the earth which, refracting the light of the millions of stars, make it seem as if our globe were bathed in a pale halo. Probably the view of full earth from the moon when our planet seems fourteen times as large as the sun is one of the grandest celestial spectacles that exist in all the universe.

Continuing our voyage through space, we next reach Mars, 168 millions of miles from the sun. The period when the earth is best visible to the Martial inhabitant is just opposite to the similar period in the cases of Mercury and Venus. Since the earth revolves around the sun in an orbit within

Fig. 4.—VIEW OF THE EARTH FROM MARS.

that of Mars, its greatest proximity to the latter occurs when between Mars, and the sun. But then it turns its shaded hemisphere to Mars and is therefore invisible. It is necessary then to find, before and after this position, situations in which the earth shows to Mars a portion of its hemisphere illuminated by the sun. The further it is separated from Mars, the greater will be the phase, but on the other hand the smaller will be the disk. There is however a moment of maximum brilliancy which occurs near quadrature. Then the earth appears to the Martial eye as a bright star and through a telescope as a large crescent. In fact there is an accurate reproduction of the behavior of Venus as regards the earth. As Venus is our morning and evening star, so are we the morning and evening star to Mars. The Martial inhabitant sees the earth as a larger star than Jupiter appears to us, while the brilliancy is such as to render the earth visible in daytime.

To the inhabitants then of Mercury, Venus, the moon, and Mars, the earth stands chief of the heavenly bodies. To those of Jupiter, however, it becomes suddenly of almost total insignificance. The orbit of Jupiter is 576 millions of miles from the sun. Hence the earth in revolving around the sun never appears further from it than 12 degrees. The earth is therefore not visible during the Jovian night, for there the twilight continues some time after sunset, and when twilight has ended, the earth itself has set. Moreover at the only moments when it might be visible from Jupiter the earth is in quadrature, and only half illuminated, and besides, it is too small to be seen by the naked eye. Astronomers on Jupiter could only discover the existence of the earth by telescopes, and at a suitable epoch, as for instance in the east just before sunrise or in the west just after

sunset, and then only for a few minutes. They would class our globe as an insignificant little satellite of the sun lost in his fiery beams. Happily for our astronomical reputation on Jupiter, there are circumstances when if we are not visible as a brilliant star we may at least be seen. Some Jovian astronomer hunting for sun spots might see a little black dot crossing the solar face, that would be a terrestrial transit, and our earth would be the telescopic speck, which we have attempted to indicate in Fig. 5.

The world of Saturn surrounded by its mysterious rings moves at a distance from the sun nine and a half times greater than that separating the sun and earth; or 1,059 millions of miles. From this magnificent planet our globe is a mere point which swings from one side of the sun to the other, thirty times during the Saturnian year, and never distant from the sun more than 6 degrees. The sun itself seems ten times smaller than it does to us. Fig. 6 is an imaginary view on Saturn (the earth of course is invisible), supposed to be taken at 30° latitude at midnight: the epoch when the sun, fully illuminating the vast rings, causes a brilliant ring light night. The satellites which move around this strange world vary by their motions and rapidly changing phases the marvelous spectacle. The inhabitants of Saturn however know nothing of our earth; and even if by the construction of colossal telescopes they discovered us, they never could tell whether we were an independent orb or were fastened to the sun. The best name they would apply to us would be "minute blemish" on the solar disk. From Uranus, nineteen times the earth's distance from the sun, or 2,130 million of miles, the earth's annual orbit is simply a little circle, of 3 degrees on each side of the sun. The sun itself, nineteen times smaller than it appears to us, transmits to the Uranian inhabitants seventy times less light and heat. Even during its transits the earth is not perceptible to people on that world. From Neptune, most distant planet of our system, three thousand million miles away from the sun, the sun seems a huge star, of diameter thirty times less than that seen by us. Here the earth is absolutely invisible; no conceivable instrument could make it seen. Thus, out of the millions of stars which spangle the heavens, out of the vast infinity of worlds there are only five, at most six, to inhabitants on which, if any there be, the existence of this world of ours can be known.

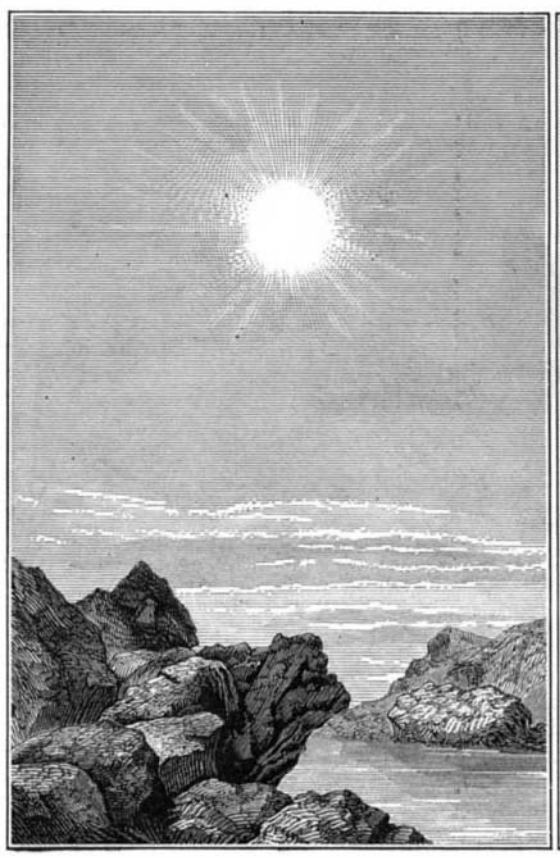

Fig. 5.—VIEW OF THE EARTH FROM JUPITER.

Fig. 6.—VIEW OF THE EARTH FROM SATURN.

Better Times.

The evidences that the hard times have spent their force and that a steady improvement in all branches of business has begun, are now too plainly to be seen on every hand for the most despondent to doubt their existence. The last bugbear of the farmers, the fear that the corn would be ruined by the frost, has now ceased to alarm, as for the most part this crop is too far advanced to be seriously injured, even if cold weather should set in at once, as is not at all probable. As to the harvests generally, they have perhaps never before been equaled; so that the farmers are ensured a good return for their labors, the working masses are afforded food at moderate prices, and the great avenues of transportation are crowded with the eastward flow of the harvests and the return flow of the comforts and luxuries which are sent in exchange. As no small encouragement, we may mention also the fact that our national currency has reached the highest figure it has known—the difference between it and gold having been quoted the other day at less than 3 per cent—so that there is little fear of the terrible results which have been predicted by some in case of specie resumption. One of the very best features of the whole outlook is the fact that the railways have ceased to cut each other's throats, and are all charging reasonably remunerative rates for the immense business which is pouring in upon them. As a consequence, their earnings are showing a marked improvement and afford the cheering hope that the companies will not only be able to pay their employés living wages, but that they will gradually become profitable to their proprietors.—*Railway Age.*

Heat of Combustion of Oxygen and Hydrogen in Closed Vessels.

In a recent number of the *Journal* of the German Chemical Society there are some experiments on the above subject communicated by Than. He has modified Bunsen's ice calorimeter, so as to make it available for heat determinations in chemical action, and by this means he has obtained accurate results of the heat of combustion of electrolytic gases in closed vessels. The terms "heat of combustion," or "total difference of energy," are used by Than to express the quantity of actual energy evolved when the combining gas, in the case of oxygen and hydrogen at 0° and 750 mm., is completely converted in a closed vessel into water. Taking the atom of hydrogen as unity, he finds that a gramme of hydrogen uniting with the requisite quantity of oxygen in a closed vessel to form water, produces 33·982 units of heat, which number agrees closely with that found by Andrews, namely, 33·970.

What Kills the Russians.

The correspondents of the London papers with the Russian armies all speak of the deadly effect of the Turkish fire. It is sickening to read of the slaughter committed on the brave Muscovites in their hopeless assaults on Plevna and the other strongholds of the Turks. No mortal courage, it would seem, could face the pitiless storm of bullets that sweep the slopes up which the assailants press with an ardor carrying the survivors almost over the ramparts and among the unseen foes, until the bugle sounds their recall. The line of these attacks, say the correspondents, is strewn with dead and dying by hundreds from the edge of the glacis back to the point where the troops first ventured upon the open. The Turkish aim is almost sure for 200 or 300 yards. It is only a question of time when the entire Russian army would be melted away in these fruitless rushes. They have now been abandoned, it is said, and the surer and slower system of investment and reduction will be tried, with what success remains to be seen. It adds to the interest with which Americans regard the Russo-Turkish war to know that the whole Ottoman army is or will be furnished with these terrible weapons of our own manufacture. The rifle used in that army is a breechloader, made by the Providence Tool Company, and called the Peabody-Martini. It is a combination of two inventions, one American and the other Italian, uniting the best points of both. It can be fired by an expert hand nearly at the rate of once a second, and the soldier's capacity for killing is therefore only limited by his dexterity and supply of cartridges, of which Turkey, by the way, has an abundance from an American factory also. The Peabody-Martini rifle may or may not be superior in some respects to other arms of precision. There is no occasion for comparing its excellence with that of the Chassepot or the needle gun, or the Gorloff or Berdan rifle (used by most of the Russian troops). It suffices to know that, in the crucial test of war on the large scale, the American weapon does its appointed work, and keeps the Russians at bay wherever the Turks can get behind a cover in strong force. The possession of 500,000 of these rifles—that number having already been supplied by the American contractors, with 100,000 more to be delivered—used by brave men behind defences may not decide the final issues of the war for the Turks, but will protract the conflict, and make it frightfully costly to the Russians. American arms, and the American style of earthworks, which the Turks have copied, will give the Russians even more trouble than that fanaticism and valor which make the Turks foemen worthy of any nation's steel.—*Journal of Commerce.*

Formation of Sulphuretted Hydrogen by Algæ.

From an investigation of those thermal springs which evolve sulphuretted hydrogen, F. Cohn has come to the conclusion that in these waters vegetable algæ are the cause of this evolution of sulphuretted hydrogen, inasmuch as they reduce the sulphates dissolved in the water, some of the separated sulphur staying in their bodies and some being given out to the waters a sulphuretted hydrogen. Further investigations had shown that a number of other microscopic organisms living in bad water have the power of depositing pure sulphur in the form of little grains or crystals. Last year a visit to the Landeck baths gave Mr. Cohn an opportunity to confirm his previous observations. He found that the basin in which the thermal waters are collected was covered on the bottom and sides with a gelatinous mass, which was formed of algæ and thickly filled with numberless little grains of pure sulphur, which strongly refract the light. This separation of sulphur seems at first glance to be a peculiarity without analogy in the vitality of other plants. Hence it must be prominently stated that all plants really have the power of decomposing the sulphates within their cells and liberating sulphur within themselves. It is an established fact that the roots of all plants take up sulphates (gypsum, sulphate of magnesia, of soda, and of potash) in solution in the soil, and that in experiments of cultivation with artificial liquid fertilizers, sulphates must not be omitted if the plants are to exhibit their normal growth. It is no less firmly established that sulphuric acid is reduced in the interior of the plant in an analogous manner to the reduction of carbonic acid in the green cells. For as the carbon liberated from the carbonic acid in the light at once enters into combination with hydrogen and oxygen to form carbo-hydrates, so the sulphur set free by the decomposition of sulphuric acid in the cells at once combines with carbon, hydrogen, oxygen, and nitrogen, to form molecules of albumen or other protein substances contained in the protoplasma. It seems then as if the only peculiarity of the *beggiatoa* in the sulphur springs, and of many purifactive organisms, consists merely in this, that they are able to decompose a far greater quantity of sulphates in their cells, and produce by the reduction of this sulphuric acid a much greater quantity of sulphur than they are able to chemically combine in their cells, and that, consequently, the excess of sulphur is separated in grains.

It may seem somewhat strange that sulphur and carbon are the only elements which plants are able to liberate from their compounds; but it is probable that the list will not stop here, but be filled up by future investigators of plant physiology. Nitric acid and nitrates are reduced by plants, and the nitrogen absorbed. Of the mineral acids these three, carbonic, sulphuric and nitric, are the only abundant ones readily decomposable. Silicic acid is taken up by the plant either as silica or silicates, but silicon is never separated by the plant from its oxygen. It would be interesting to test the power of plants to reduce various other natural and artificial compounds.

Influence of Gaslight upon the Eyes.

The verdict of a scientific deputation for medical purposes has been presented to the Prussian Minister of Education. *Lithographia* extracts the following, which refers to living and study rooms, but is equally applicable to printing offices, factories, etc.:

"According to the previous experiences of oculists no injurious effects of gaslight upon the eyes of pupils has been observed, when it has been used properly, and especially where arrangements are present to protect the eyes from the direct influence of the bright flame. In general, shades and globes serve for this purpose. The dark, totally opaque tin shades are, however, very injurious, and all complaints against the use of gaslight are referable almost universally to these improper contrivances. With these, the eye stays in total darkness, but looks upon a brightly illuminated surface, so that a dazzling and over-irritation or superexcitement of the eye result, with all their attendant injurious results. Very suitable are the globes of milk glass, which diffuse the light more, and the eye is not injuriously affected. Experience shows that more heat is generated by gaslight, hence the gas flames must not be brought too near the head, because the radiant heat which it sends out might cause headache and congestion of the brain. Where several persons are using the same flame, the source of light has to be higher up, so that the unpleasant effect of the radiant heat disappears, especially if the so-called "plate" illumination is used, which consists of a large funnel-shaped globe of milk glass closed beneath by a plate, whereby the descending rays suffer a proper diffusion and loss of intensity, and at the same time the flickering of the flame by breaths of air is avoided and a more steady and quiet source of light is secured. Under special circumstances, where the eyes are particularly sensitive, chimneys of a blackish blue color may be employed. Under such precautions an injurious effect of gaslight upon the eyes is not to be feared in the least.