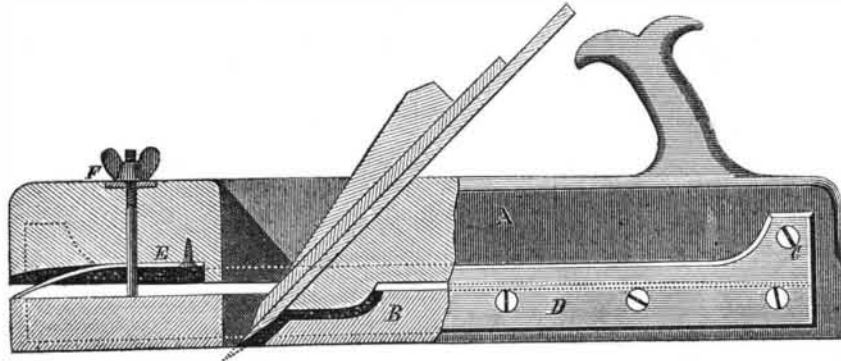


Improvement in Joiners' Planes.

The objects of the invention shown in the accompanying engraving are to give a control over the thickness of the shaving and depth of the cut by the pressure of the hand, and to prevent the drag of the bit on the board when the plane is drawn back. The stock of the plane is made in two parts, the upper portion, A, which holds the bit, being pivoted to the lower part, B, at the rear end by a screw, C, passing through metal guide plates, D, on each side the plane. The front end of the upper portion is raised from the lower portion by means of a spring, E, which, when the pressure of the hand on the front of the plane is withdrawn, lifts the upper portion together with the bit or plane iron. The amount of this movement is governed by the thumb screw, F. From this description and the engraving, which is partly in section, the construction and advantages of this device may be plainly seen.

Patented through the Scientific American Patent Agency, August 25, 1868, by George Buckel, who may be addressed at 17 Prospect street, Detroit, Mich.

**BUCKEL'S ADJUSTING PLANE.****THE PROTUBERANCES ON THE SUN.**

Among the several scientific expeditions sent to the East by the European governments for the purpose of observing the late total eclipse of the sun, was a photographic company under the auspices of the North German States. This party was led by the distinguished scientist and photographer, Dr. Vogel, whose interesting contributions often appear in our paper. A new photometer, or instrument for indicating the actinic power of light at all hours of the day, has been lately patented in this country by him. Dr. Vogel has communicated to the *Philadelphia Photographer*, and also to the *London Photographic News*, some interesting particulars concerning his photographic eclipse experiences, among which are the following:

We were not spared the sufferings generally imposed on the traveler who passes through the Red Sea at the hot time of the year. This sea, inclosed on both sides by deserts, and connected with the Indian Ocean only by a very narrow channel, forms an isolated bay, where, in consequence of the customary calms and want of currents in the water, the temperature increases in the same degree as you advance toward the south. The perspiration flows down your body just as if you were in a steam bath; the whole of the skin is heated and irritated, and happy is he who finds a spot on deck where a slight breeze cools him for a moment. We were glad to reach the more airy ocean, and anchor near Aden on the 2d of August.

The aspect of this town is not in the least an agreeable one. You see a quite bare, savage mass of rocks, interrupted by some works of fortification, warehouses, shops, and coal sheds. The heat was supportable as long as we were not at work, but as soon as we began the slightest exertions the discomfort was very great.

At the day of the eclipse we rose at four o'clock in the morning. It was the task of the North German expedition to make a photographic view of the eclipse during its totality. For this purpose we had a long telescope with a lens of six inches, without difference of focus, and with a focal distance of six feet. This lens, constructed by Steinheil, afforded a solar image of three quarters of an inch in diameter, which was taken upon a photographic plate by means of an ordinary sliding chest for two images.

The totality of the eclipse at Aden was about three minutes long (in India five minutes); nevertheless, we had chosen Aden for our station because there were already photographic observers in India, and because the totality appeared at Aden about an hour earlier than in India. Therefore a comparison of the different results would enable us to decide the question, if the protuberances appearing at a total eclipse of the sun were changing in the course of time or not.

Our task was now to get within these three minutes as many views of the phenomenon as possible. For this purpose we had previously exercised ourselves in the employment of the photographic telescope, like artillerymen with their guns.

Dr. Fritsche prepared the plates in the first tent, Dr. Zenker put the sliding chests into the telescope, Dr. Thiell exposed, and I myself developed in the second tent.

We stated that it was possible in this way to get six images (three plates of two images) during three minutes.

When the decisive moment was fast advancing, the sky, hitherto covered with clouds, showed some openings, through which the sun, already covered partially by the moon, was to be seen. The landscape around was illuminated by the strangest light, a medium between moon and sun light.

The chemical strength of light was exceedingly weak. A proof plate gave a wholly exposed image of the cloud after fifteen seconds. The sun crescent became smaller and smaller, and the opening in the clouds seemed to increase.

The last minutes before the totality (which began at twenty minutes past six o'clock) went rapidly away. Dr. Fritsche and myself crept into the tents, where we remained, consequently we have seen nothing of the totality. Our work be-

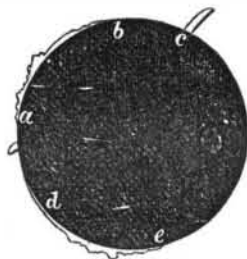
gan; we exposed the first plate five and ten seconds, in order to know what was the just time.

Muhammed, our black servant, brought the first attempt into my tent. I poured the iron developer over the plate, eager to know what was to come. At this moment my light was extinguished. I called for light, but nobody heard me, as all were about their task. I stretched my right hand out of the tent, holding the chest in the left, and happily caught a small oil lamp, which I had previously prepared. And now

I saw the image of the sun appearing on the plate. The dark margin of the sun was surrounded by a series of peculiar elevations, the other side showed a strange hook; the phenomenon being exactly the same in both views. My joy was great, but there was no time for enjoyment. I soon received the second, and, after another minute, the third plate. "The sun is coming forth!" exclaimed Dr. Zenker. The totality was over. All this seemed to have been done in a moment.

When I developed the second plate I perceived only very weak traces of an image. The clouds had veiled the sun at the very moment of the exposure. The third plate gave two brilliant views, with protuberances at the lower margin. Glad to have reached so much, we washed, fixed, and varnished the plates, and immediately took some copies on glass, which were to be dispatched to Europe separately.

I here give you a design of the plate. Over the margin of the sun we see the protuberances, *a b*; on the opposite side we perceive the strange hook already mentioned. Its height was about one-fourteenth of the sun's diameter, and it would therefore in reality be 12,000 miles high. On the third plate we got the protuberances, *d e*, at the lower margin.

**Great and Small—Microscopes.**

A correspondent of the *Boston Journal of Chemistry* says: "There is a curious principle (which may be perhaps called physiological) involved in the terms *great* and *small*. It is this: that one has no conception of magnitude except by comparison of one object with another; and no one has or can have any knowledge of the appearance of magnitude to any other one. That is, I cannot convey to you my idea of the size of any object except by comparing it with my idea of the size of some other object. If I say that a thing appears to me to be one inch long, I merely compare it with an inch rule; but I do not, cannot know, that an inch appears to you as long as a foot does to me, or the reverse. Again, when one looks at an object that is completely isolated (to the vision) from all other objects with which it might be compared, we form an idea of its magnitude entirely arbitrary. For example, the moon in a clear sky must present exactly the same apparent magnitude to every observer. This is determinable mathematically; yet it is notorious, that, of a dozen people who may be asked their idea of the moon's apparent size, no two may agree.

"This same fact comes out in the use of the microscope. Almost all novices in the use of that instrument ask what is the magnifying power, as if the answer to that covered the main value of the instrument, thinking that the more it magnifies the better it must be; when in fact power is a secondary consideration in the value of a microscope, great power of inferior quality being obtainable at very little cost, and that what is called the magnifying power is calculated from an arbitrary standard. The apparent size of any one object in the field of the microscope is by all observers governed by their estimate of the apparent diameter of the illuminated field in which the object is seen. There are modes of determining this by comparison with other objects, but as the instrument is generally used, nothing is presented to the eye but the 'field,' and no other object is compared. Under these circumstances, different persons make widely different estimates of the size of the field. I once tried the experiment of obtaining their estimate of the apparent size from ten individuals, all of them accustomed to the use of the instrument, and they varied from 9½-inch diameter down to 2-inch (my own case). I have since met an individual who estimated it 15 inches. Any one possessed of a microscope can try this experiment, and it will be found to afford a company much amusement, and excite great surprise.

"Now, it is self-evident, that to the one who made the estimate of 15-in., any object of, say 1-1000 of an inch in length, would seem to be seen 7½ times as large as it seemed to me, although we must have seen it exactly alike. Thus, the only conception of magnitude is comparative."

Cook's Telegraph.

We have before us as we write some very beautiful specimens of printing by Cook's improvement of the late Gaetano Bonelli's automatic printing apparatus, just received from Paris. The printing is done in fine bold letters, the words well compacted and spaced, and printed not on a continuous strip, but line under line, as in a printed circular. It is certainly a very admirable result, and indicative of a perfection in telegraphy and a use of the subtle powers of electricity which must enhance the acceptability of the telegraph to the public. The great advantage of the autographic process is that it renders error next to impossible, or rather, that it does not leave to the action of outside causes, or the use of arbitrary characters whose relations to each other may be misunderstood, or to the vagaries of an operator's brain as he manipulates his messages, letter by letter, the opportunity to change their composition. The message is set up and compared before it is transmitted, and if it goes at all, must go exactly as first prepared.

The paragraph before us is one of 35 words, transmitted in 20 seconds, a speed equal to 315 messages of twenty words each per hour. This fact is suggestive of a future in which the entire labor of our offices will be changed, and the operation of transmission become simply mechanical and comparatively unlaborious. We will not be surprised if, in time, parties who prosecute much of their business by telegraph should supply themselves with telegraphic type, arrange their messages for transmission in a case adopted for that purpose, prove them before sending to the telegraph office, and the operator have nothing to do but pass them through the manipulating instrument. By such processes as these only can large quantities of matter be sent over the wires without the fatigue connected therewith, and, what is equally desirable, with the utmost assurance of correctness which mechanism can afford.—*Journal of the Telegraph.*

Editorial Summary.

THE VELOCIPEDE MANIA is beginning to set in, and with the opening of the spring months we may expect to see our parks and highways thronged with this cheap and agreeable substitute for the horse. The two-wheeled velocipede is not exactly the thing wanted for general use, as it will be somewhat difficult for novices to keep upright upon it. A nicely adjusted vehicle with a double hind wheel would be most desirable for all classes. The ladies will need something of the kind, and for obvious reasons; unless they don the Bloomer costume, they will not be able to ride on the two-wheeled machine. It appears to us, judging from the numerous letters we receive on the subject, that there is to be a brisk demand for a good velocipede, and whoever gets into the field first will find it a profitable speculation.

GEOLOGICAL NEGATIVES.—Mr. James Thompson, of Glasgow, Scotland, has contrived a new method of producing photographic negatives of geological specimens. He saws from the stones thin slices containing fossil remains or other specimens; these when polished are so thin and transparent that they may be used as negatives for photographic printing upon the usual sensitive paper. Beautiful prints are thus obtained, having all the fidelity of nature itself. Large numbers of these fossil negatives have been prepared by Mr. Thompson, and he has undertaken to supply the British Museum with duplicates.

It is proposed to remove Yale College from its present site to a more suburban one, thereby securing to the institution an accession of funds from the sale of its property, which, from its central location, is of great value. The value of this property is sufficient, it is said, to purchase and fit up suitable grounds, erect buildings, and leave an endowment of a quarter of a million dollars, should the proposal be acted upon. The removal of the college is also said to be worthy of consideration for sanitary reasons.

THE Powell Scientific Expedition ascended to Longs Peak, in the Rocky Mountain range, on the 23d inst. After making the usual scientific observations a monument was erected as evidence of the visit. In it was placed a tin case containing a record of the observations with date, names of party, etc. A flag was planted and left flying. This peak is a celebrated landmark. Its height however is not remarkable, being only 14,250 feet above the sea level.

THE English scientific papers are criticising severely our new war steamers. They say that the entire new steam machinery of the United States navy is the most costly, most cumbersome, least efficient, and most utterly ridiculous in the world, and that no other power in Christendom would tolerate such blunders in its national engineering practice.

COMETS SELF-LUMINOUS.—The *London Daily News*, says that the special points of interest attaching to the two comets of this year—Borsen's and the new one—is the remarkable discovery that both comets are gaseous and self-luminous, and that the latter consists of volatilized carbon.

CIDER may be preserved sweet for years, by putting it up in air-tight cans after the manner of preserving fruit. The cider should be first settled and racked off from the dregs, but fermentation should not be allowed to commence before canning.

It is stated as a fact worthy of note, that London was recently exempt from accidental or incendiary fires, for a period of twelve hours.

Improvement in the Process of Puddling Iron.

From the London *Mining Journal* we transfer the engraved plan and notice of a new puddling furnace now making considerable stir in England :-

" Mr. John Jones, the able secretary of the Iron Trade Association in the North or England, read a paper at the meeting of the British Association for the Advancement of Science, at Norwich, on the Economical Manufacture of Iron. He there states that, according to information he has gathered, the furnace is being adopted in the Cleveland district, and that the saving of fuel is 20 to 25 per cent., that the consumption is 1,500,000 tons of coals per annum in the production of our finished iron, and that the subject is one of national importance.—

This paper was followed by one by Mr. Siemens, F.R.S., the well-known eminent inventor of the gas-furnace, in which he gives some very interesting details of the working of a puddling-furnace on his system, justly claiming extraordinary merit therefor, on account of it producing a larger quantity of iron than the ordinary system of furnace permits. Mr. Cowper stated that, in his opinion, one great cause of the superior yield, as also quality of the iron, was that the great heat of Mr. Siemens' furnace caused it to run more freely from the cinder than was possible in an ordinary furnace.

" With these preliminary remarks, we will now go into more detail. Messrs. W. Whitwell & Co., the Thornaby Iron Works, Stockton-on-Tees, so well known for their energy, enterprise, and determination to hold a first rank in the Cleveland iron trade, put up their first furnace in January this year; it was very successful, but it had grate bars at the bottom, partly to meet the prejudices of the men, and to overcome them. In the month of March Mr. Wilson persuaded them to allow him to put up a furnace without bars, which he did. Forthwith the success was positive, all difficulties had completely vanished. For a little time minor points of construction had to be met; but for some time every furnace was put up exactly like its neighbor, and at this moment nearly all the furnaces at the above works are on Mr. Wilson's system. Several of the works in the district have trial furnaces at work, the results fully bearing out those of Messrs. Whitwell.

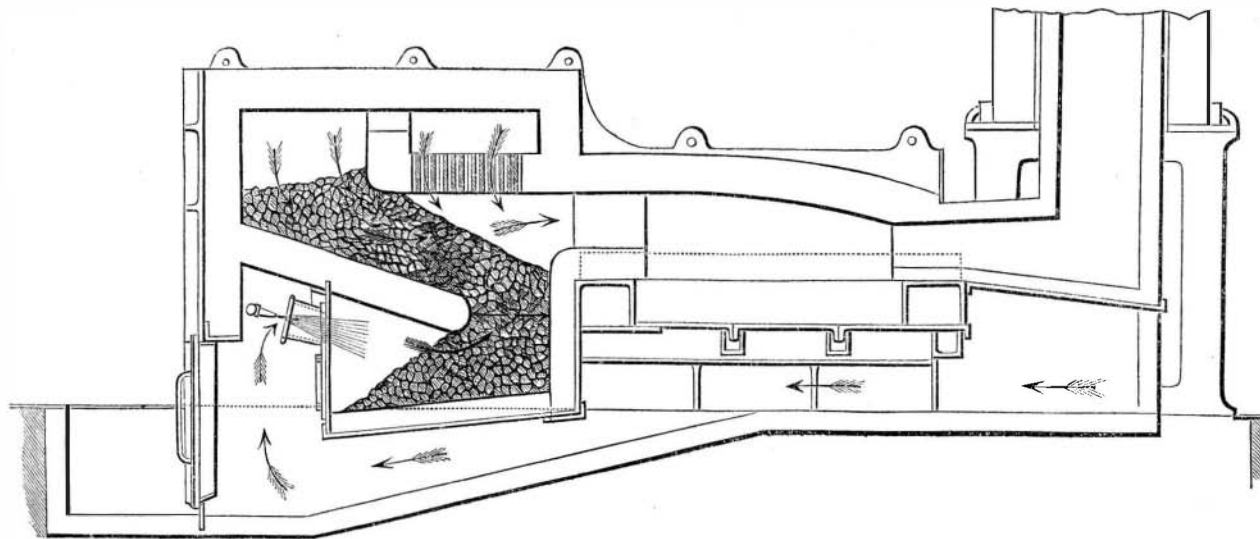
" At a trial made by Messrs. Hopkins, Gilkes & Co. (week 6th to 11th July inclusive), the coals used were 17 cwt. 1 qr. 22 lbs. to the tun of puddled bar; the yield of iron in excess. Another experiment (week ending Aug. 22), the coals used were 16½ cwt. to the tun; 1½ tun of fettling saved—iron charged, 13 tons 16 cwt. 3 qrs. 13 lbs.; iron drawn, 12 tons 18 cwt. 0 qr. 16 lbs.; loss, 18 cwt. 2 qrs. 27 lbs. Messrs. Richardson, Johnson & Co., of the North Yorkshire Iron Works, Stockton, furnish a return (Aug. 31), coals, 18 cwt. to the tun of iron; yield, 13 lbs. average per heat in excess of ordinary furnace. Messrs. Whitwell and Co. are charging all their patent furnaces 4½ cwt. per heat, and they find very little loss of iron; the quality is in all cases superior. We think that these statements justify us in saying that the ironmasters have an opportunity of saving a large amount of money in the manufacture of iron, and we trust such an invention will not be allowed to languish and struggle into notoriety by slow degrees, as most of our inventions have to, no matter how great their benefit to the public.

" We will now point out the improvements in the furnace. Air is forced into the flue-bridge by a steam-jet; it passes into a conduit at the back of the furnace, thence into the flame-bridge and up into a chamber, where it arrives red-hot; it thence passes down into and on to the incandescent fuel.

" By this arrangement much fettling is saved, being the cause of a great economy. Mr. Siemens states that his furnace used an extra quantity of fettling, which reduced the benefit of his good yield of iron. But to obviate this, he adopted water-bridges (these are much used); they absorb much heat from the furnace—this gentleman states equal to 8 or 10 lbs. of coals per heat. We think this a low estimate, as the getting up has to be taken into account. However, it is obvious that, by the arrangement described above, the heat abstracted by the circulating current of air is restored to the furnace; this forms an important feature in the improvement. The fuel is fed at the highest point of the furnace by a slide door on the standing, and there are proper arrangements for shoring up, when required, also on the standing. A current or currents of air are also forced in below into a closed chamber, by which the cinders are most completely burnt up. The steam being decomposed passing through the incandescent fuel, transfers the intense heat into the working chamber. The quantity of refuse produced is very small. The clinkers are readily removed with a light hook, and the men are never occupied more than a few minutes in the operation, generally one minute. Thus, we are justified in saying this is perfect combustion; it appears to us there is no room for further improvement. But to restore the waste heat into the generator, furnaces are now being put up by Messrs. Hannah & Sons, under the superintendence of their manager, Mr. Badon, for-

merly of Jarrow, where pretty nearly all the heat will be re-generated. These furnaces can go to any intensity, and the flame is under perfect control to oxidize or not; or the iron may be drenched with intensely hot air. The cost of alteration to existing furnaces is very small; when erecting new ones about the same price. The advantages obtained are no smoke, no cinders, a large yield of iron, and better in quality. If we assume 25 cwt. of coals used as the Cleveland average for puddling, it appears to be about 8 cwt. to the tun saved. Much fettling is saved, there are less repairs, and no grate bars to replace. We think there is sufficient inducement to ask its adoption." The editor of the *Journal* adds:

" In the supplement to this week's *Mining Journal* will be

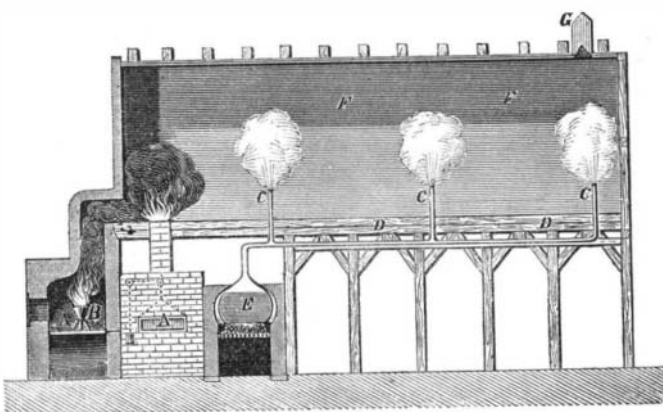


WILSON'S PUDDLING FURNACE.

found an interesting communication from a correspondent who has had considerable experience in iron making, describing the recent improvements introduced by Mr. E. B. Wilson in the construction of his patent furnaces, and which are considered to make the furnace absolutely perfect. We are glad to learn that the increased yield of the Wilson furnace, as compared with that of ordinary construction, averages 13 lbs. per heat, the loss of iron being at the same time much reduced, and the quality being in all cases superior. The new furnaces are now in use at Messrs. Whitwell & Co.'s Thornaby Iron Works, Stockton-on-Tees; at Messrs. Richardson, Johnson & Co.'s North Yorkshire Iron Works, Stockton; at Messrs. Hopkins, Gilkes & Co.'s; and at several other works, and appear in all cases to give great satisfaction. Having had the opportunity of seeing the Wilson furnaces in actual use, our correspondent is, no doubt, in a position to form an opinion of its merits. He states that the perfected furnaces make neither smoke nor cinders, give a large yield of iron, and of better quality; that 8 cwt. of coal is saved per tun of iron puddled; that the first cost of the furnace is no greater than usual; and that there are less repairs, and no grate bars to replace. These recommendations should, it is thought, secure its adoption."

SULPHUR—ITS USES IN THE ARTS.

Every one of our readers is acquainted with the appearance of sulphur. Possibly many of them were made acquainted with its medical properties early in life, like Squeer's school-boys, to whom it was regularly administered, as a measure of economy, in molasses, always before breakfast. It is quite possible that many are not so familiar with its chemical



SULPHURIC ACID CHAMBER.

properties and its extended use in the arts. It is kept for sale everywhere in two forms; roll sulphur, popularly known as brimstone, formed by concretion after fusion, and in a powdered state, obtained by pulverizing the roll sulphur, by sublimation, or precipitation from its solution in limewater by muriatic acid. Sublimation is the heating of any solid substance until it becomes vaporized, and collecting it again when cooled by passing the vapor into a refrigerating chamber. Sulphur thus sublimed can be obtained in a very fine and impalpable state, called flowers of sulphur. When obtained from the solution as described above, it is called lac-sulphur, or milk of sulphur.

Sulphur is an element, that is, it has never been found to be resolvable into other substances. Its affinities or tendencies to unite with other substances are numerous and strong, and under favorable circumstances it will combine with a vast number of simple and complex bodies. Its combinations with simple substances or elements are called sulphurets or sulphides. Such compounds form a large proportion of the ores

of different metals, as they are found in nature. A simple experiment will illustrate the formation of these ores. Mix 21 parts by weight of flowers of sulphur with 30 parts of iron, and put it gradually into a red-hot crucible, waiting until each portion becomes incandescent before adding more. After the whole is put in, cover the crucible and raise the heat until the entire mass is fused. The compound is called the proto-sulphide of iron. There are also other sulphides of iron, which contain more sulphur in proportion to the weight of the mass than the proto-sulphide. Of these the bisulphide may be mentioned. It has a pale yellow metallic luster, and has often been mistaken for gold by the inexpert. In the early settlement of this country an enterprising adventurer

shipped a whole cargo of this substance to England, supposing it to be gold, and that he had, to use a quite modern phrase, "struck oil." His chagrin was great upon finding the value of his venture less than an equal bulk of good garden soil. So many similar mistakes have been made that the substance has been called "fools' gold." The mineralogical name for it is iron pyrites. These sulphides are types of the sulphides of other metals, as found native or artificially produced. The proto-sulphide of iron is used in the laboratory for making hydro sulphuric acid gas, to which the names sulphuric acid and sulphureted hydrogen are also given. Hydrosulphu-

ric acid is a most valuable reagent in analytical chemistry, and therefore deserves some mention here. When fragments of proto-sulphide of iron are thrown into dilute sulphuric acid, a series of reactions take place, which may be described as follows:

Sulphuric acid is a combination of sulphur and oxygen; the proto-sulphide of iron is a combination of sulphur and iron; the water used to dilute the acid is a combination of oxygen and hydrogen. When these couples come together, iron, which loves not sulphur less but oxygen more, deserts its own partner and unites with the faithless oxygen of the water, which leaves fond hydrogen desolate. Sulphur and hydrogen, under these circumstances, mutually sympathizing with each others wrongs, strike up a bargain, and agree to unite their fortunes. The sulphuric acid aids and abets the disruption by providing for the protoxide of iron as fast as it is formed by the union of iron and oxygen, and uniting with it, forms the sulphate of iron. The sulphureted hydrogen formed by the union of the sulphur and hydrogen not being so fortunate, goes off in exceedingly bad odor. The smell of this gas is discernable in the decay of all organic substances which contain sulphur, as turnips, cabbages, eggs, etc. The smell of rotten eggs is its most prominent characteristic, and is the principal test for its presence. The most minute quantities, imperceptible to smell, may be detected by moistening a bit of paper with a solution of acetate of lead. Paper so prepared is turned black by the action of the gas. The reason for this change of color will give the clue to the value of this reagent in chemical analysis. Metallic salts are formed by the union of their oxides with acids. When sulphuric acid comes in contact with solutions of these salts, a mutual

decomposition takes place, the hydrogen of the sulphuric acid unites with the oxygen in the metallic base, and forms water, while the sulphur combines with the metal itself, to form a sulphide which generally falls to the bottom as a bulky precipitate. The conditions under which these reactions take place vary for different metals. Thus, the metals capable of being precipitated may be classed into groups. The alkalies are not precipitated by it under any circumstances, neither are the alkaline earths. A third group, comprising the salts of alumina and the sesquioxide of chromium, and a number of others of very rare occurrence, are not precipitated by sulphuric acid but by sulphide of ammonium. The metals of the third group and the remaining metals are precipitated under certain conditions, either by sulphide of ammonium or by sulphureted hydrogen, the precipitate being in the third group a hydrated oxide, that is, an oxide combined with water, and in all other cases a sulphide, or the mixed sulphides of all the metals precipitable by these reagents. Suppose now a chemist wishes to determine whether sodium is a constituent of a very complex solution under examination. By passing a sufficient quantity of sulphureted hydrogen through the solution under the proper conditions, he can eliminate all the metals, except the groups above specified not precipitable by this reagent. The field of research is thus greatly narrowed, and a very long step is taken toward the complete isolation of the substance sought. This brief description will give a correct idea of the great value of this reagent in chemical analysis.

Sulphur forms acids by combination with oxygen, the most important of which is sulphuric acid, more popularly known as oil of vitriol. This substance may be called the Goliath of chemistry. No other substance known has such extended and diversified applications. There is scarcely a department of the arts that does not directly or indirectly involve its use.