carry the disturbing magnet to two positions that are symmetrical with respect to the magnetic meridian and to the center of rotation of the compass needle, and in the same horizontal plane. In order to fulfill these conditions in a simple manner, Mr. Ragona uses the following precautions: He assures himself, by means of a small telescope and leveling rod, that the two copper rods divided into centimeters (one of them to the right and the other to the left of the compass) are well in a line with each other. The bar to the right that carries the scale is provided with an adjusting screw, which permits of establishing an exact coincidence. He assures himself of the horizontality of the rods by means of a level—the slight motions necessary for this purpose being executed by an adjusting screw; he makes sure of the perfect equidistance of the marks corresponding to the right and left, by means of a carriage which serves as a gauge and which he carries successively to each side; and, finally, he assures himself of the perfect perpendicularity of the line of the two copper rods relatively to the magnetic meridian, by means of a small apparatus which consists of two circular plates, each containing a very small aperture. The axis of the compass needle should be in the direction of these apertures. In order to obtain such a coincidence, there is a special adjusting screw that permits of giving each instrument a proper rotary motion around its axis.

In the central part of the apparatus, and behind the compass-support, there is a square column designed for holding the tent when the apparatus is set up in the field. The same column is designed to support the posterior part of the apparatus (which is also covered in the field by a special tent), in which the meteorological instruments are exposed. The portable observatory, as regards these latter, includes only those of which the observation is useful and possible, taking into consideration the duration of the exhibition and the conformation of the apparatus. We find therein the Fortin barometer, the dry and wet thermometer, with the ventilation apparatus moved by clockwork, such as is employed in Italy. This apparatus is much more practical than that which sets in motion the thermometer itself. To these instruments it is important to add the maximum thermometer, the minimum thermometer, and the weather cock.

This movable observatory when taken apart occupies but little space. On the road it is inclosed in a cart of peculiar form that one man can easily push before him, and to which, for long excursions, a horse is harnessed. In mounting the apparatus in the field the theodolite is placed to the south of the compass in such a way that the theodolite, the compass, and the square column are in the line of the magnetic meridian, and the two apparatus for inclinations and variations in a line perpendicular to the latter.—*La Lumiere Electrique.*

The Heating Power of Gas.

M. Lefebvre, engineer to the Paris Gas Company, has recently been lecturing at Rouen upon heating by coal gas. Among other things, the lecturer explained to his audience the characteristics and performances of atmospheric as compared with lighting burners. Theoretically, with the gas under examination, 16 liters would raise a liter of water from freezing to boiling point. With a common steatite fish tail burner the mean of 26 experiments conducted by M. Lefebvre showed a practical consumption of 31·844 liters of gas to perform the same work. An atmospheric burner, composed of a vertical copper tube provided with a copper mushroom top, pierced with lateral holes, gave 39·60 liters as the mean of 13 experiments. By diminishing the air supply, the consumption of gas in the same burner was reduced to 35·32 liters. By means of a gasholder in which were made successively mixtures of 10, 15, 20, 25, and 30 per cent of air with the same gas, the calorific effect of the various mixtures of air and gas was shown as follows:

Percentage of air	0·0	10	15	20	25	30
Gas consumption	31·84	37·40	39·20	40·40	45·60	48·00

Going on from this point, M. Lefebvre showed the effect of adding hydrogen to gas. Having first determined the calorific power of a given burner with the normal gas to be 32·05, the lecturer successively added hydrogen in progressive increments of 10 per cent up to 60 per cent. The addition of the first 10 per cent of hydrogen lowered the efficiency of the burner—*i. e.*, increased the consumption of gas to perform the same work—from 32·05 to 34·40, and the figures corresponding to the higher increments of hydrogen are 36·80, 37·56, 40·24, 42·40, and 44·52. Thus it was shown that the more hydrogen is contained in a coal gas, the poorer is its heating effect. On the other hand, progressive additions of bicarbureted hydrogen (C_4H_4) resulted in a notable reduction of the bulk of gas consumed by the burner. The object of these tests was to expose the illusions as to the supply of "heating gas of low illuminating but high fuel value" fostered by partisans of water gas schemes.

Accident at the Mersey Tunnel Works.

An alarming occurrence lately took place in Birkenhead in connection with the Mersey Tunnel Works. A considerable portion of the roadway in Hamilton Street, under which the tunnel is bored, collapsed without the slightest warning just after a tramcar and a cab had passed over the place. A gang of men were employed below, but fortunately none suffered any injury. It is stated that an extensive bed of quicklime which lies near the tunnel works has been the cause of the collapse. In consequence of the accident, tramway and other vehicular traffic through the principal street in the town is suspended.

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NEW YORK, SATURDAY, SEPTEMBER 6, 1884.

REMOVAL.

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Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 458,

For the Week ending September 6, 1884.

Price 10 cents. For sale by all newsdealers.

RUFUS PORTER, FOUNDER OF THE SCIENTIFIC AMERICAN.

Rufus Porter, the original founder of the SCIENTIFIC AMERICAN, died recently at New Haven, Conn., in the 93d year of his age. Up to within three days of his decease his health was good, he was in the full possession of his faculties, and enjoyed considerable bodily vigor. He succumbed to a severe attack of diarrhœa. He was born at West Boxford, Mass., on the 1st of May, 1792. He was a remarkable natural genius. He showed a taste for mechanics while in the cradle; was in school learning Noah Webster's spelling book at the age of four; spent six months at Fryburg Academy when twelve years old; beyond this he had no educational advantages. By this time he had become quite an adept in the making of all sorts of mechanism, such as water wheels, windmills, lathes, etc. He was also something of a musician; he played the fife and the violin, and wrote poetry. In 1807 his family concluded it would be best for him not to fiddle any longer with life, but to settle down to something solid and useful, in short, become a shoemaker, like his elder brother. So, in 1807 he walked from Portland to West Boxford, 106 miles, and undertook the honest calling of the cobbler. But it was soon seen that he was not cut out for that species of industry; he gave it up, went back to Portland, played fife for military companies and the violin for dancing parties until 1810, when at the age of 18 he was apprenticed to a house painter, including sign painting, and he soon became proficient in the business. The breaking out of the war with Great Britain in 1812 gave him constant occupation in painting gun boats; also as fifer to the Portland Light Infantry.

In 1813 he painted sleighs at Denmark, Me.; beat the drum for the soldiers, taught others to do the same, and wrote a book on the art of drumming. This probably was his first book publication. In 1814 he was enrolled in the militia for the defense of the country, and was for several months in actual service; after this he taught school at Baldwin, married at Portland, taught at Waterford, made wind grist mills at Portland, painted in Boston, the same on through New York and New Jersey to Baltimore and Alexandria Va. A peculiarity which he developed about this time, and which continued through life, was a frequent change of place and occupation. Although he might be doing well at the business which for the time engaged his attention, he would sell out and abandon it the moment a new idea came into his mind. He could not hold fast to one thing or to one place for any considerable length of time. His brain was an overflowing fountain of new ideas and active projects. One of his most profitable businesses at this time was portrait painting. At Alexandria, in 1820, he made a camera obscura—a dark box fitted with a lens and mirror and containing a place for a sheet of paper.

With the lens placed in front of the sitter the image was focused on the paper, and he was enabled very rapidly to sketch the outlines of his subject with correctness, and to produce a satisfactory portrait in fifteen minutes, for which his customers readily paid a dollar. He adorned his camera box with bright colors, bought a light handcart for locomotion, planted a flag on his vehicle, and with this attractive establishment started on foot for Harrisonburg Hot Springs. He was welcomed in every town and village, his little show attracted attention, and his portraits were greatly in demand. He did very well in a pecuniary sense; but he was possessed with the desire of finding a substance that was capable of yielding perpetual heat. He was certain he could do wonders if he could make this discovery. It would be for him the lamp of Aladdin. Arrived at the Hot Springs he bored the earth with an auger having a five foot shank, in search of his hot substance, but found nothing more than a hydrate of lime; and much to his regret was obliged to resume portrait painting and trudge behind his gay camera and cart. Northward he wends his way, painting portraits from village to village, and at odd hours inventing mechanisms of various kinds.

He invented a revolving almanac, and suddenly stopped painting to make and introduce it, which he did with considerable profit and success; but at the moment when attention was needed for this new enterprise, a sudden and violent ambition seized him to make a twin boat to be propelled by horse power, and to run on the Connecticut River. This project brought him, in 1823, to Hartford, Conn. But nothing came of it; and he took up his old profession again of portrait painting, traveling once more from town to village with camera, cart, flag, and now accompanied by "Joe," a lad, a relative. In the course of his wanderings he spent some time in New York painting portraits as usual. One morning he was out strolling with Joe, when he saw some people who were about to start in the stage for Philadelphia. An impulse instantly seized him to go along. So he joined the party, directing Joe to get the camera and send it by next stage. But the box failed to come, and he was obliged to foot it back to New York, earning his meals by cutting people's portraits out of paper with scissors.

In 1824 he adopted the profession of landscape painter. That is to say, he painted landscapes on the walls of dwelling houses, public buildings, halls, etc., as a substitute for ornamental papers. His work was greatly admired, and proved profitable. He went from town to town on this business, carrying his apparatus on a hand cart. In the midst of his prosperity another boat fever came over him. He dropped everything and built a horse flat boat, 35 feet long, with cabin. He worked the boat on the Connecticut

River for a few weeks, sold it for a song, and returned to portrait painting.

In 1825, at Billerica, Mass., he invented a successful cord making machine. He also wrote a book entitled "Curious Arts," which had a good sale; but his lack of business habits and inability to continue long at one thing or in one place caused the loss of these enterprises and his return to portrait and landscape painting. From this time on to 1840 he figures very often as an inventor, producing among other things a wonderful clock, a steam carriage, a portable horse power, a corn sheller, churn, washing machine, signal telegraph, fire alarm, and numbers of other inventions. For shares in some of these he received small sums. The making and selling of his inventions alternated with his painting, in the manner we have before described.

In 1840, in New York, he was offered an interest in a newspaper called the New York *Mechanic*, and at once decided to become an editor. He made it ostensibly a scientific newspaper, the first of its kind in the country. In the following year he changed the title to the *American Mechanic*. The paper prospered; the office was removed to Boston; but now his attention was as usual suddenly diverted to something else, and in a few months' time the publication was stopped. He next learned the then new art of electroplating, and did profitable work. About this time, 1844, the religious mania of the Millerite people struck him, and he was among the most ardent believers who hourly expected the second advent of the Messiah. He now invented a revolving rifle, which he subsequently sold for one hundred dollars to Col. Colt; he also invented a box machine, but somehow lost it.

In 1845 he was again in New York, doing electroplating. Here he wrote a prospectus for a new paper, which he entitled the SCIENTIFIC AMERICAN, and began its issue weekly, with a cash capital of one hundred dollars, and contemplated indebtedness for a few hundreds more. The first number of the SCIENTIFIC AMERICAN bears date August 28, 1845.

The typography of the new paper was poor, but was the best the author could afford. The prospectus stated in very clear terms the intended scope and nature of the work; and the SCIENTIFIC AMERICAN of to-day is conducted substantially upon the plan originally marked out by its founder. He did not, however, continue long in charge of the publication. After running it for six months, the desire and necessity for a change came over him, and he decided to stop the issue and return to New England. At this juncture, just before the last number or two were to be published, he gladly arranged with the present proprietors, then very young men, to continue the publication, and on receipt of a very satisfactory compensation he transferred to them all his interests, consisting of the title, a subscription list of about two hundred names, some old types, and cuts. The first half century of Mr. Porter's life practically closed with the foundation of the SCIENTIFIC AMERICAN.

During the remaining half century, nearly, of his life, he was chiefly occupied with his inventions, and moved from place to place, but did not so often recur to his old profession of portrait painting. He was now very prolific with inventions. The moment a new thing occurred to him, he made a drawing and description and sold the whole or a share for a small sum; and then worked out some other idea, to be sold in the same manner. The mere catalogue of his inventions would be tedious. Among them were a flying ship, an air blower, punching press, trip hammer, pocket lamp, pocket chair, fog whistle, wire cutter, engine lathe, clothes drier, grain weigher, camera obscura, spring pistol, engine cut off, balanced valve, revolvidal boat, rotary plow, reaction wind wheel, portable house, paint mill, water lifter, odometer, thermo engine, rotary engine, and scores of other inventions. During this period of his life he also did some business as a writer of patent specifications for inventors. This brief sketch will perhaps give some idea of the wonderful fertility of his genius. He possessed in a high degree the gift of contentment. He cared little for place or outward surroundings. So long as he was at liberty to do whatever happened to come into his head, he was perfectly happy. Few men comparatively have lived so long as Rufus Porter; fewer still have studied out and produced so vast a variety of useful inventions. But the most celebrated of all his works was that done on the memorable day in 1845, when with a flash of his peculiar genius he wrote out the prospectus and commenced the establishment of the SCIENTIFIC AMERICAN. This title, we think, was one of the most felicitous ever given to a periodical; and so long as it endures the memory of Rufus Porter, its originator, will be held in grateful remembrance.

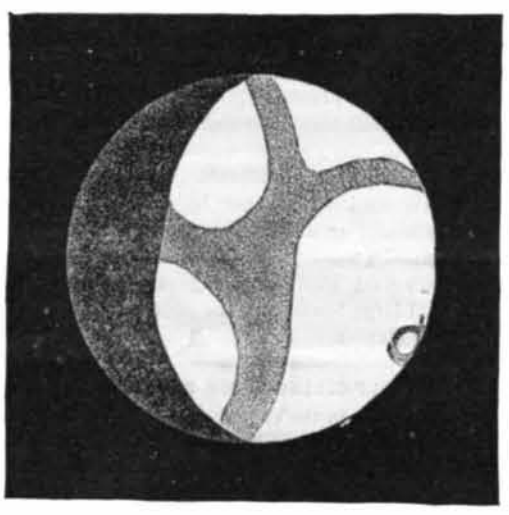
MECHANICS IN EDUCATION.

Seeing and feeling are two senses which are more important in aiding to a knowledge of our surroundings than any others, and yet their education is generally neglected until the possessor begins to learn something of mechanics. By mechanics in this connection is intended any attempt to contrive, put together, manufacture, or change by manipulation, so that a woman who contrives and fashions a dress out of the unformed and plain material may be a mechanic. The use of mechanical tools cannot be begun too early in life, whether the pupil is to be a practical mechanic or to follow some other calling—there are few vocations that do not demand for success some practical knowledge of mechanics. "The whittling Yankees" possibly owe much of their undisputed position as inventors and good mechanics to the habit of using a pocket knife. A very prominent inventor and superior mechanic recently remarked that the bent of his taste as a mechanic was undoubtedly given by his schoolmaster, who was a carpenter and joiner, and who worked at his trade in summer and taught the district school in winter. If a boy did not possess a foot rule, he made one for him from a shingle, or constructed an inch scale. The foot rule and a pocket knife he considered necessary to a schoolboy's outfit, and he encouraged his pupils to estimate dimensions by the eye and then verify them by measurement. Wind wheels and water mills were parts of the pedagogue's training, and the click-clack of one or the other could be heard all about the school house and on the borders of the brook in an adjoining field. Vanes cut from pine boards, toy ships, bird houses, bows and arrows, pudding sticks, and most of the toys used by boys forty years ago were made by the schoolmaster's boys under his direction. To-day, besides the prolific inventor named, there are one superintendent of a railroad company, one bridge builder, one superintendent of a large manufactory, and two architects to be counted from memory who probably received their bent for mechanics from the carpenter schoolmaster.

All these lead lives of usefulness—they are producers, adding to the wealth and comfort of the country and the people; and nothing in their observation education makes them less valuable as members of society. One of our most distinguished pulpit orators was a blacksmith, and many men who are noted for their eminence in literature, divinity, law, medicine, and as educators have had a mechanical training.

THE PROBELMATIC PLANET NEITH.

It is not impossible that a new planet has been discovered, a very small member of the solar system, revolving outside of the orbit of Venus, and near her domain. M. Houzeau, the Director of the new observatory at Brussels, an astronomer and writer of renown, contributes to the columns of *Ciel et Terre* an article on the subject that will awaken a widespread interest, not only from the ingenious theory it



A drawing of Venus, with the bright point on her disk as seen by M. Stuyvaert on the 8d of February, 1884.

presents, but also will be entitled to careful consideration as coming from the pen of a distinguished man of science.

There was formerly a general belief that our fair neighbor was, like the earth, accompanied by a satellite, and one of the first objects looked for, after the invention of the telescope, was the moon of Venus.

Seven times at least since that important event, a small object has been seen near Venus, presenting a similar phase, and bearing evidence of being a satellite of the bright planet. The first observation was made in 1740, and the last in 1764. During the 120 years that have passed since, though diligent search has been unremitting, no vestige of the mythical moon has been found.

It is easy to say that the observers were deceived, and that the visionary moon was a "ghost" due to the imperfection of the instruments then in use. But the observations were made, two of them, certainly, by the renowned Cassini, and the others by practiced astronomers who would be as little likely to be deceived in the reality of what they saw as Galileo was when he detected the moons of Jupiter or the phases of Venus.

More than a century has now elapsed without a passing glimpse of the supposed satellite, and the probability of its existence grows fainter as the years roll on, though the hope of eventually picking up the celestial will o' the wisp has never been entirely abandoned by zealous astronomers. There the case rests. Astronomers whose opinions are most worthy of weight discredit the earlier observations, while other members of the fraternity still trust that at some time not far distant a tiny point of light may be seen following in the wake of the most brilliant star that adorns the heavens.

M. Houzeau has revived the theme by the presentation of a curious and somewhat startling theory upon the following basis: A planet revolves around the sun, outside of Venus and near to her. It is very small in dimensions, and is possibly an escaped satellite. Neith is the name given to the little planet, in honor of the mysterious goddess Sais, whose veil no mortal has raised.

These assumptions are the result of a critical examination of the recorded data of six appearances of the supposed satellite. The shortest interval between any two appearances is 2·90 years. Taking this as the duration of the period between the nearest approach of the two bodies, the Belgian astronomer finds the longer intervals to be almost exact multiples of this number, and the consequent duration of the periods to correspond very nearly, the average being 2·96 years.

Therefore two bodies, the one relatively large, the other small, are found side by side at fixed intervals. As they are not seen between these intervals, the smaller cannot be a satellite, but the orbits are near each other in their whole extent, for conjunctions have been observed in different parts of the orbit of Venus, beyond, and on this side, on the east, and on the west of the sun. Hence Venus and Neith move in concentric orbits, near each other, and are in apparent conjunction in 2·96 years, or about 1,080 days.

As Venus revolves around the sun in 225 days, she makes 4 revolutions + 290° in 1,080 days. If we assume that in this time Neith makes 3 revolutions + 290°, Neith will then revolve around the sun 283 days; her mean distance from the sun, that of the earth being 1, will be 0·84, and her greatest elongation will be 57°.

This result leads to a still more remarkable coincidence, for 5 revolutions of Venus—1,125 days—nearly equal 4 revolutions of Neith—1,132 days. The time approximates, at least, to the interval from conjunction to conjunction, or 1,080 days, the figures harmonizing within the limits of the errors of the numbers used, and the results of the perturbations that the smaller planet must receive from the larger.

There is one more point in this curious combination. M. Houzeau found that 40 or 41 periods of 2·96 years had elapsed since 1764, the last recorded appearance of the two bodies, and that a conjunction was due about February, 1884. After these calculations were made an event occurred of which he knew nothing at the time, though it must have been as welcome as it was unexpected.

On the 3d of February, at 6 o'clock in the evening, M. Stuyvaert, of the Brussels Observatory, observed on the disk of Venus, near the illumined border, an extremely brilliant point, that recalled the aspect of the satellites of Jupiter as they transit the planet. The interest of this observation is increased by another made a few days later, on the 12th of the same month, at 8 o'clock in the evening. M. Niesten then saw, a little south of Venus, a small star that seemed to be composed of a nucleus and a very faint nebulosity. He looked in vain for the star on the succeeding evenings. Has Neith, the problematic planet, deigned to reappear after an absence of more than a century?

M. Houzeau gives in these calculations the results of his observations. He calls them "conjectural reflections," interwoven with singular coincidences that appear when taken together to pass beyond the bounds of mere chance. He makes no effort to explain the reason for the long-continued disappearance of the supposed satellite. Neither does he seem to discern that his figures make Neith almost as near to the earth as she is to Venus, and greatly complicate the perturbations to which the little wanderer is subjected. He simply throws out his theory as a study, and earnestly solicits observers to multiply researches, and explore day by day the disk of Venus and her surroundings.

If the moon were removed farther from the earth, and placed at a given moment in opposition, she would no longer revolve around our globe, but would, like the earth, revolve around the sun. This condition of affairs may have prevailed on Venus, and Neith may be an escaped satellite removed beyond her power of attraction, and henceforth, like her primary, revolving around the sun.

The illustration is from *Ceil et Terre*.

Patents Industrially Classified.

A table prepared by Commissioner Butterworth shows that of the nearly 300,000 patents issued by the Government, the various lines of machinery and industries have received the following number:

	No. Patents.		No. Patents.
Applications of electricity	5,872	Metaling	3,814
Arteeian wells	500	Metal working machines	10,203
Beds	2,150	Methods of tanning hides	1,219
Boots and shoes	5,060	Mills and thrashing	6,740
Bread and cracker machinery	440	Nut and bolt locks	734
Chairs	1,580	Plows	6,889
Corset patterns	969	Pumps	3,156
Dairy utensils	2,429	Railways	3,508
Fences	2,888	Railway cars	3,505
Fire engines	567	Seeders and planters	3,568
Fire escapes	884	Steam engines	5,111
Harvesters	6,606	Stoves and furnaces	8,288
Lamps and gas fixtures	5,254	Vegetable cutters	450
Laundry utensils	4,993	Water distributers	3,719
Machines for knitting	754	Wearing apparel	2,417

These aggregate 104,217, or a little over one-third of the entire number of patents issued.

Hydraulic Pumping.

At the Dahlbusch colliery, Gelsenkirchen, Germany, a Korting ejector is used for lifting 125 liters of water a minute from a new level started 30 meters below the deepest force pump. The peculiarity of the arrangement is, that water under pressure is used instead of steam. The apparatus is mounted in the shaft, and is connected with the discharge pipe of the lowest force pump by a 39 millimeter pipe. The ejector has a 124 millimeter discharge pipe leading to the pump tank 30 meters above it. When using from 60 to 90 liters of water under a pressure of 14 atmospheres, the apparatus will lift 370 liters of water.