SCIENTIFIC AMERICAN

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RAGONA'S PORTABLE ASTRONOMICAL, MAGNETIC, AND METEOROLOGICAL OBSERVATORY.

Our correspondent at the Turin Exhibition recently called attention to Mr. Ragona's portable observatory, which permits of making observations upon terrestrial magnetism with as much facility in the field as in a permanent observatory. We give an engraving of this apparatus, along with a few details concerning the different parts thereof.

In the front part of the apparatus there is a theodolite for astronomical observations, for the determination of the instrumental azimuth of the magnetic needle, and for the measurement of deflections and of the duration of oscillations. The method of determining the absolute magnetic the needle is at rest, and then levels upon the vertical line of the cross projected upon a blue field. But in his apparatus observations can be made, even when the needle has a strong oscillatory motion. To this end, there is a small mirror, perpendicular to the direction of the needle, arranged upon the latter's mounting. The image of a scale graduated in millimeters (a scale which is found upon the support of the theodolite) is seen reflected upon the mirror, and the leveling is done upon the mean of the extreme excursions of the cross. The upper part of the compass carries an apparatus for torsion observations. Moreover, the compass is provided with an arrangement which permits, each time, of suppressing the observations upon the torsion division of the second rod, can carry the value of the absolute declination to any instant whatever of the day or night. The second telescope permits of observations upon variations with a precision nearly double that that can be obtained with the first, which is merely designed for leveling the cross.

The determination of the declination needle's variation is a point upon which Mr. Ragona has particularly dwelt. In fact, he has discovered some very interesting laws, which he made known to the Meteorological Section of the Rouen meeting of the French Association for the Advancement of Sciences (1883). A large sized tablet containing diagrams relative to these laws is now at the Turin Exhibition, in the same compartment with the portable observatory.

RAGONA'S PORTABLE ASTRONOMICAL, MAGNETIC, AND METEOROLOGICAL OBSERVATORY.

declination is one of Mr. Ragona's own invention. It is entirely independent of a knowledge of the hour and of the latitude of the place of observation. Mr. Ragona has given the mathematical formulas that permit of determining the absolute declination, when the instrumental azimuth of the needle is known, by the aid of the height of the instrumental azimuth of the needle, and by aid of the height of three of the fundamental stars of the ephemeris. We must refer those who are curious to search into these details to Mr. Ragona's memoir entitled, "Determinazione della declinazione magnetica in viaggio," and to the "Repertorium fur experimental Physik", von Dr. Ph. Carl, vol. xvii.

In the central part of the apparatus there is a declination compass, which is also of Mr. Ragona's invention. The needle is a small steel tube, which carries at the front extremity a cross engraved upon a very thin plate of glass. The needle is susceptible of two different suspensions for observations, and the passage from one to the other may be readily effected. One of these arrangements is a suspension from a very slender thread, without torsion, and the other is a resting upon a small plane of agate by means of a very fine steel point. As the observations have to be made at night, the compass carries a lantern provided with a blue light. For making his declination observations, Mr. Ragona waits until of the thread. The operation is performed once, at the beginning of the voyage, and before starting thereon. In fact, the thread is not only fastened above, but also below (on a voyage), so that it is firmly held and can no longer get out of order unless the apparatus be broken.

The needle of Mr. Ragona's compass carries a second mirror, almost perpendicular to the other, which is observed with a second telescope, and which reflects the divisions of a second leveling rod. This second telescope and second rod (a scale divided into millimeters) are upon a lateral support to the right of the observer, who has his eye to the telescope of the theodolite, and the support is capable of revolving upon its plane by means of a peculiar arrangement of its base. This lateral apparatus is very easily maneuvered, and is perfectly adapted for determining the variations of declination, and also for ascertaining its absolute value at any instant whatever during the entire duration of the exposure of the apparatus in the same place, without having need of making observations every time upon the absolute magnetic declination. In fact, the observer of the second telescope, having noted the division of the second leveling rod that corresponds to the moment at which the observer of the theodolite telescope has determined the absolute declination, and knowing the expression in arcs of the unit of

The determination of inclination is effected by means of an apparatus analogous to those already known; but, as the operations of reversing the needle and magnetization in the opposite direction are delicate ones, and the excessively delicate axis may not be true, Mr. Ragona adds to his apparatus a lever that permits not only of reversing the needle, but also of placing it in the interior of a bobbin fixed to the lower part. The magnetization in opposite direction is effected by means of a pile of two elements and a commutator, without there being any necessity of causing the needle to leave the interior of the apparatus, and in avoiding the danger of twisting the needle and dulling its axis. The reversals of the needle and its magnetization in opposite direction are effected with the greatest facility by means of the lever and a corresponding rack. The inclination apparatus is placed upon a lateral support to the left of the observer, who has his eye to the telescope of the theodolite, and in the same line (perpendicular to that of the magnetic meridian) in which stands to the right the lateral support for the variation apparatus.

The determination of the horizontal intensity is effected by means of an apparatus that permits of employing the Gauss method, which Mr. Ragona has modified and improved. In order that it shall succeed, it is necessary to 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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(Illustrated articles are marked with an asterisk.)

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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.

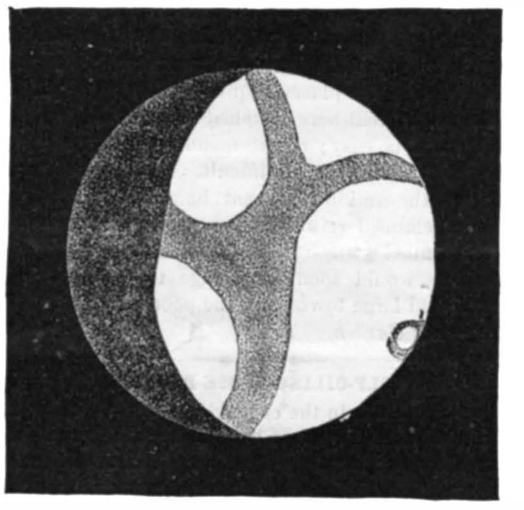
MECHANICS IN EDUCATION.

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 3d 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
Artesian 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	8,238
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

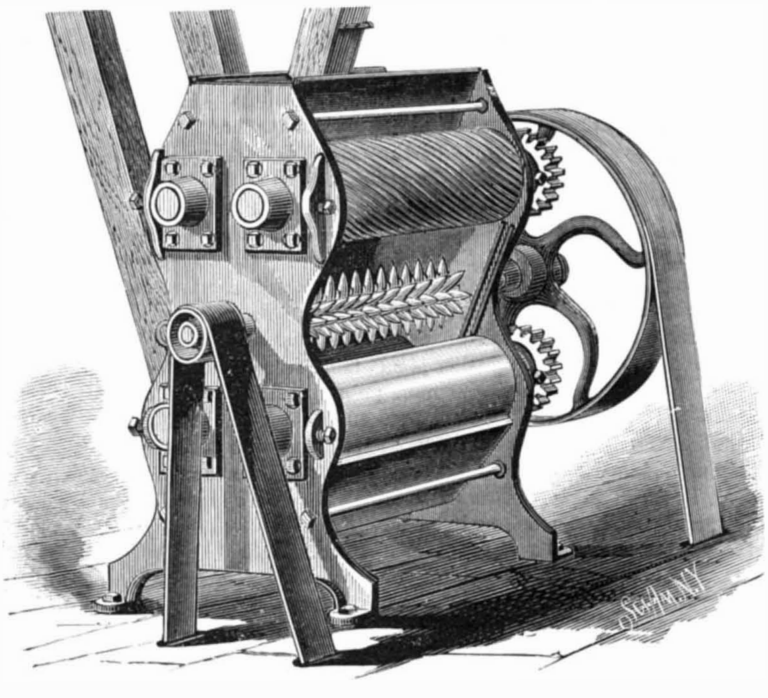
These aggregate 104,217, or a little over one-third of the entire number of patents issued.

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.

GRAIN CRUSHER AND DISINTEGRATOR.

The machine herewith illustrated thoroughly crushes and reduces the grain before it goes to the millstones, thereby making the work of the stones very light and materially decreasing the wear. The upper and lower sets of crushing rollers are mounted in bearings attached to the end plates by bolts; the upper set being made with spiral corrugations to cause the grain to feed more freely, and the lower set being smooth. The bearings of one roller of each set are adjustable by means of set screws, so that they can be spaced so as to crush the grain coarse or fine, as desired. The cylinder carrying the blades is revolved rapidly, the blades passing between the ribs or bars of a diaphragm above the blades, thus disintegrating the crushed grain after it has passed through the upper rollers. An inclined apron, placed in



JONES' GRAIN CRUSHER AND DISINTEGRATOR.

grooves in the end plates, rests in front of the blades to conduct the grain to the center. A pipe conveys the grain to the hopper, and elevator boxes take the crushed grain from the bottom of the machine up to bins, from which it is distributed to the millstones.

A mill superintendent who has used one of these crushers states that with one of these machines and two sets of stones, all using thirty-five horse power, fully as much meal can be made per day as with three sets of stones using forty-five horse power. By using the machine on wheat, in connection with burrs, about one-fourth more flour per day can be made with the same use of power, and a larger percentage of high grade flour than with stones alone. The meal is not heated by this as by the old process, and is of a more uniform and better quality. The machine is also used for preparing grain for stock food.

For further particulars the patentee, Mr. J. A. Jones, of Raleigh, N. C., may be addressed.

The Radiating Power of Metals.

M. Walter Meunier has, according to the *Revue Industrielle*, been experimenting on the comparative loss of heat from cast iron, wrought iron, and copper tubes. The experiments were carried out in a room having a uniform temperature, and were made simultaneously with the three materials in question. The tubes were all 2·5 meters long, and 150 mm. in diameter, connected at one end with a steam supply, and at the other end with a worm condenser in water. Observations showed that the weight of water condensed, per square meter of heating surface per hour, was, with naked pipes, 3·484 kilos for the cast iron, 3·906 kilos for the wrought iron, and 2·816 kilos for the copper. The non-radiating power of copper, in comparison with iron is thus manifest. It is not stated, however, whether the pipes were all of equal thickness, and similarly polished, or left with their natural surfaces. It is to be understood, perhaps, that identical conditions were, as far as possible, preserved.

Railway Embankment Gardens.

Whatever blessings we derive from our railways (and they are many), they certainly absorb something like 182 square miles, or 116,480 acres, of good land. There is always one and sometimes two sunny sides to railway embankments, and on these strawberries enough to supply the whole country might be grown, besides such low growing fruit trees as gooseberries and currants, while, on the margins of cuttings, cherries, plums, apples, and pears might be advantageously cultivated. The waste land on the sides of the levels should be utilized for vegetables. How all this is to be profitably done is the difficulty. An infinitesimal portion of this scheme is now being carried out at country stations and crossings.

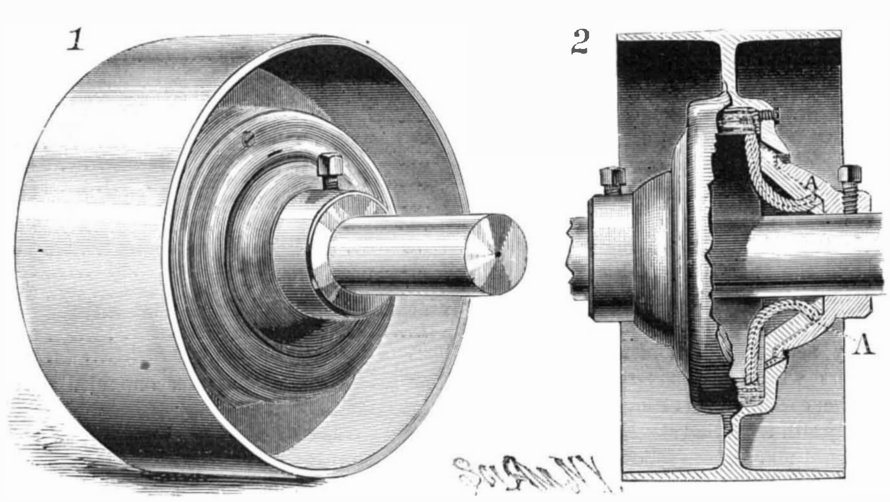
Nearly all railway men are gardeners, and all praise to them for the roses and hardy flowers in which their huts and houses are frequently embowered. They get land near home from their employers at little or no rent, and on that the off duty hours are spent. In a scheme for the conversion of railway banks into fruit gardens, directors and managers would have to be appealed to, and it would be necessary almost in the first instance to supplement each platelayer's gang of men by one who knew something about fruit tree management—one who could utilize his time when not fully occupied by railway duty (as is now done by platelayers in hedging and ditching) in attending to the fruit trees. It is not generally known that just as our coast is perambulated every night by coast guardsmen, so the whole 16,000 miles which we have of railways, mostly consisting of double lines, are walked over each morning by platelayers.

One or two garden inspectors would be required on each railway on somewhat the same scale as telegraph inspectors now are; these would have to superintend the laying out of nurseries on such suitable lands as are to be found on every line, and to direct the transport of the trees to the places required to be planted. After such a plan as that here sketched had been fairly started, the rest would be easy; replacements, pruning, and gathering the fruit would not be difficult. Fruit hampers might lie empty at the stations as meat hampers do now, and of never-to-be claimed returned empty packages there is no lack; these filled with fruit, a few basketfuls daily from each station, would soon so change the markets of our metropolis and large towns that the poor could eat and have to spare.—*The Garden.*

SELF-OILING LOOSE PULLEY.

The pulley shown in the engraving—Fig. 1 being a perspective view, and Fig. 2 an elevation with parts broken away to show the interior—is made with a central chamber for the reception of oil. It makes no connection whatever with the shaft. The hub of the pulley has a conical form, and upon these portions bearings are formed by the collars, which are fastened to the shaft in the usual manner by set screws. The oil being introduced into the chamber through the supply hole, which is afterward closed by a screw, it is distributed by the rotary motion evenly around the periphery of the pulley, and is drawn by wicks through oil holes, A, at the lowest point of the bearing—point nearest the shaft.

The oil works along to the outer point of the bearing, and is then thrown by the centrifugal force into annular drip cups, E, formed by annular projecting rings on the outer surface of the oil chamber, through the return oil holes, of which there are several around the circumference of the drip cup, back into the oil chamber. The oil is then ready to make the circuit again, through the wicks, bearings, and return oil holes, and so on until it is worn out or becomes gummy; there is no appreciable waste. This pulley requires but little attention, there is no annoyance from dripping, and as the bearings are conical all wear can be taken up by setting the collars close to the pulley. It is simple in construction, and the bearing surface is about equal to that of a common pulley of the same size.



SELF-OILING LOOSE PULLEY

The manufacturers, the Eureka Pulley Company, of 297 South Street, Boston, Mass., had a pulley running ten hours a day for three and a half months, with one oiling, and there was scarcely any diminution of oil in the chamber. These pulleys will be shown in operation at the Charitable Mechanics' Fair, to be held in Boston this month.

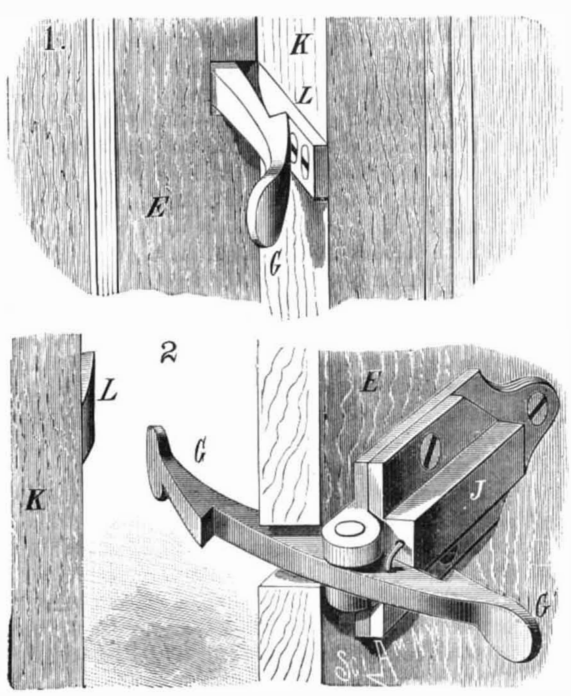
IF you want to preserve your strength, work. If you prefer to be weak and feel tired, do nothing.

Fun in a Horse.

Rather a regular series of interruptions occurred on the train due here on a Saturday morning from the West. When leaving Syracuse, a car laden with horses en route from the west to Saratoga was connected with the train. The train had scarcely got under way when the bell cord was jerked, and the engineer warned to stop. The brakes were shut down, and inquiry made along the train as to what was the matter. The trainmen all denied pulling the cord, and after an examination as to the cause, without result, the train got under way. Scarcely 500 yards had been gone over, however, before the bell cord was again pulled and the train brought to a stop. Another inquiry and examination along the line failed to reveal the cause, and another start was made, when, for a third time, the mysterious signal was sounded. This time another thorough investigation was made, which was equally fruitless. Once more was the train started up, and again the warning signal was sent to the engine. This time, when a stop was made, it was determined to ascertain whether any other than human agency was responsible for the signal, and the train was carefully gone over. When the car containing the horses was reached, a jerking of the bell rope was noticeable, and on further examination it was found that one of the animals in the car, finding that the bell rope was within reach, had amused himself by seizing it with his teeth and jerking it to and fro. The mystery of the signals being thus satisfactorily explained, the bell rope was hitched up out of the animal's reach, and the train continued on its way.—*Albany Journal.*

DOOR AND GATE LATCH.

At one end of a plate is a fork between the prongs of which is pivoted a lever which passes through a notch in the edges of the door, E, to which the plate is secured. The lever is formed at each end with a finger plate, G G', and with a prong forming a shoulder; the hook prong, G, on



WORMUTH'S DOOR AND GATE LATCH.

the end of the lever inside the door projecting toward the free edge of the door, and the prong, G', projecting in the opposite direction. The inner end of the lever is pressed against the door frame by a spring in a casing, J, secured to the plate. On the door frame, K, is a shouldered catch, L, with which the prong, G, engages to hold the door closed; and on the wall of the building is a catch with which the prong, G', engages to keep the door opened. By pressing upon the finger plate the door may be opened or closed as the case may be. The latch is fastened to the door by the same screws that secure the spring casing, and may be applied on a right or left hand swinging door. Fig. 1 shows the door closed; Fig. 2 shows it partly opened.

This invention has been patented by Mr. Charles Wormuth, of Little Falls, N. Y.

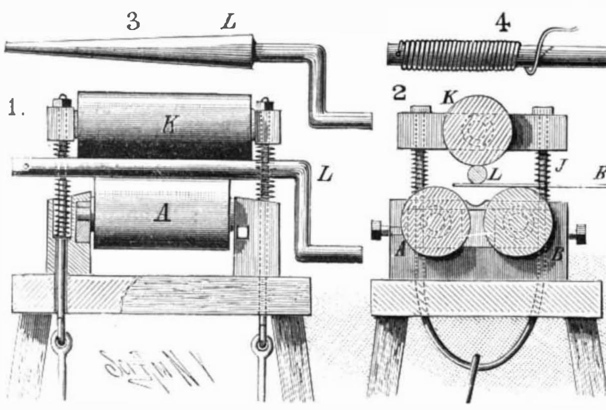
The Channel Tunnel.

A party of gentlemen, mainly connected with the Society of Arts, lately visited the Channel Tunnel works, accompanied by Sir E. W. Watkin, M.P., and by Mr. Myles Fenton, Mr. John Shaw, and Mr. Charles Sheath, of the South-eastern Railway Company. Among the visitors were the Duke of Buckingham and Chandos, Lord Alfred Churchill, Sir F. Abel, Sir Robert Rawlinson, C.B., Sir Frederick Bramwell, Sir Joseph Bazalgette, Captain Douglas Galton, Admiral Sir E. Inglefield, Captain J. B. Eads, C.B., and Col. J. F. Donelly. The visitors were received by Mr. Francis Brady, C.E., the engineer. They at once descended the shaft, in parties of five, by means of an iron cage, and were conveyed by a kind of tramway through the tunnel, the heading being distant about a mile and a quarter from the shaft. Mr. Brady explained the working of the Beaumont cutting machine, the arrangements for ventilation, etc. Mr. Brady stated that if they were allowed to go on with the work they could easily join the French heading in about two years. The works on the French side are suspended.

TINSMITH'S ROLLER.

The two lower rollers are journaled in boxes held adjustably in blocks on a platform supported by legs. A U-shaped frame passes up through each block and the platform and through blocks held above the rollers, and upon the upper ends of the prongs nuts are screwed. A roller, K, is journaled in the upper blocks, which are pressed upward by springs coiled around the prongs. Held loosely between the rollers is a mandrel, L, made either tapering or of a uniform thickness, and provided at one end with a crank handle. When the mandrel is pressed down, it enters notches formed in the center of the lower blocks. The bent frames are joined to levers, forming a treadle by which the roller, K, can be brought down.

The piece of sheet metal, B, to form the tube is placed on



BEALS' TINSMITH'S ROLLER.

the front roller, and the mandrel is inserted between the metal and the upper roller, when the treadle is depressed. This movement presses the mandrel down between the rollers, bending the metal. By turning the mandrel the rollers will be revolved and the piece of metal will be fed into the machine, and in its passage will be rolled around the mandrel. Tubes of different sizes are formed by using mandrels of greater or less diameter, and adjusting the rollers, A B, to or from each other as the case may be. When the tapered mandrel is used, the rollers are inclined to each other by means of the set screws. When spring wire is to be made, one end of the wire is passed through the hole in the mandrel (Fig. 4) and the wire wound on by turning the mandrel. This invention—recently patented by Mr. L. F. Beals, of Marquette, Michigan—can be applied to the ordinary tinsmith's rollers.

Glucosed Leather.

The fact that glucose is extensively employed in the adulteration of sugar, candy, and sirups has been well known for some time; we have even been told that the bee has been cheated out of the products of its honest labor, by substituting glucose for honey in the markets. While we fully admit that the number of applications of glucose in the adulteration line is almost unlimited, we are rather surprised to hear that tanners have used it to give additional weight to their leather. According to a circular recently received by the *American Tanner*, Louisville appears to be the headquarters for such fraudulent practice, and in order to save the reputation of the oak-tanned leather of that city a number of tanners sent out a challenge to find such adulterations in any of their products; by thus publicly denouncing any departure from ancient honest methods, under their full names, these firms hope to open the eyes of purchasers as to those who dare not join the protest, and are unable to sell their leather under a guarantee that it has not had its weight increased by any fraudulent means. The names of the firms who have signed the circular are as follows: Wedekind, Hallenberg & Co.; Louisville Leather Company; D. Frantz & Sons; Phœnix Tanning Company; Mantle & Cowan.

Speaking about the above subject, the *Shoe and Leather Reporter* says: "An effort is being made by the manufacturers of grape sugar to induce tanners to make use of this substance as a means of giving additional weight to leather, and it is even claimed that some tanners have been foolish enough to yield to such temptations. Glucose is a fraud, however used. It is even a greater fraud when used on leather than when used in adulterating sirup or sugar."

When we are told that some samples of leather have been found which had as much as 30 to 40 per cent of extra weight, it seems that something should be done in this matter. There are numerous tests for glucose, but the most of them require a number of more or less expensive apparatus, while the following recommends itself by its simplicity and cheapness, as the complete outfit, consisting of a small test tube and two small bottles, one containing cupric sulphate and the other caustic potash, may be obtained anywhere, and can be carried with ease in a vest pocket.

A little scrap of the suspected leather is soaked in pure water; to this liquid, enough to fill about one-quarter of the test tube, we add a few drops of a solution of cupric sulphate and half as much of a caustic potash solution as the liquid contained in the test tube; shake well and boil over a flame. If glucose is present, a yellow or red precipitate is formed in the tube.

Cupric sulphate, or blue vitriol, readily dissolves in water, and enough of it must be added to the sample to produce a faint blue coloring. The caustic potash solution is made by dissolving 58 grammes of the potash in 1 liter of water.

The principle upon which the test is based is as follows: The boiling alkali converts the glucose into glucic and melassic acids, substances which oxidize rapidly. The cupric sulphate is then converted into cuprous sulphate, and this again is decomposed, forming a deposit of cuprous oxide. Of course it is only a rough test, because we are told that under normal conditions leather contains a trace of glucose; but if the test has been performed once or twice on good leather, any excess of glucose in other samples can easily be detected by the deeper color of the more copious deposit in the test tube.—*American Tanner*.

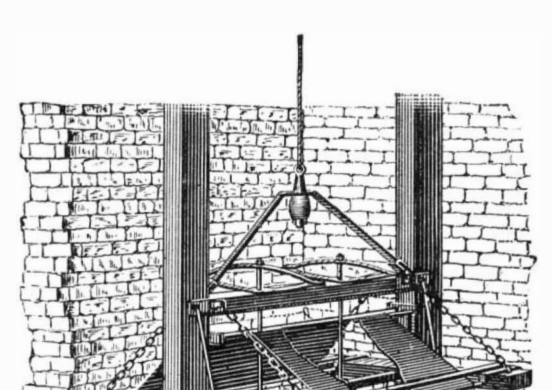
A Foot Fog Horn.

A new fog horn, invented by Mr. Bryceson, has recently been tried on the Thames by the representatives of the Admiralty. It is in the form of a pump, and is worked by a strap fastened to the signalman's foot, and so worked as to produce short or long sounds, as required. The advantages of the invention are, the length of time to which the sound can be drawn out, its cheapness, and the fact that it can be heard for three-quarters of a nautical mile in stormy weather.

SAFETY CATCH FOR ELEVATORS.

From opposite sides of the cage floor rise two standards, whose upper ends are united by a beam. To each standard near its upper end is secured a cross beam, at the ends of which are vertical rods which have their lower ends attached to the corners of the floor. The standards have forked clips at the top and bottom, which embrace the two side guide beams in the elevator shaft. Hung on the ends of the cross beams are stirrup rods, on which rest the free ends of sheet iron tops, which are hinged on rods connecting the upper ends of the standards. Resting upon a rubber spring secured to the lower end of the hoisting cable is a V-shaped inverted hanger, upon the ends of which are pivoted the ends of a bar carrying a beam. Between the ends of the beam and the bar are held clips which embrace the guide beams, and which are formed with outwardly projecting lugs. Chains are attached to clips upon the ends of this beam and to the upper ends of the corner rods. Passing through apertures in this beam are rods secured to the beam uniting the tops of the two standards; upon the upper ends of the rods are held elliptic springs. On each end of the floor a lever is pivoted, at each side of the standard, to the outer ends of which are pivoted rods whose upper ends are joined to the clips. To the inner ends of the levers are pivoted rods which pass through holes in wedge shaped blocks having transverse teeth formed in the faces toward the sides of the guide beams. Blocks are secured to the ends of the floor in such a manner that their beveled edges face the beveled edges of the lever blocks.

It will be seen that the cage is suspended from the spring rods, the springs being compressed. The beam carrying the springs keeps the outer ends of the levers raised, and the blocks are held a short distance from the guide beams.



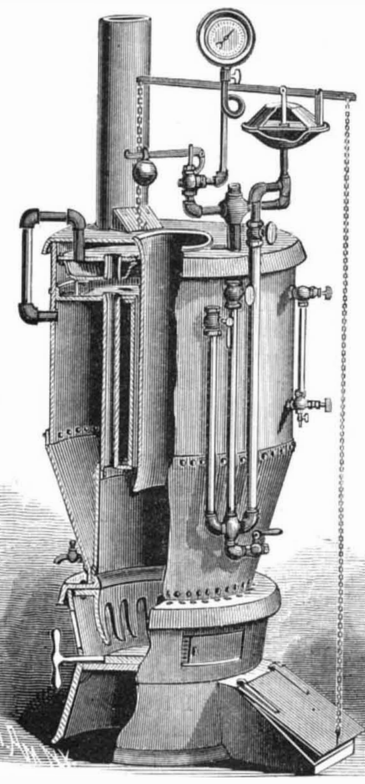
GILES' SAFETY CATCH FOR ELEVATORS.

When the cable breaks, the springs exert a downward pressure, thereby forcing the beam downward, and through the rods and levers pressing the blocks against the sides of the guide beams, firmly locking the car in place.

Further information concerning this invention may be obtained from the patentee, Mr. William Giles, of Mount Olive, Ill.

IMPROVED STEAM HEATER.

Near the middle of the circular cast metal base, having a double conical form, is a shaking and dumping grate, and resting upon its upper edge is a ring shaped plate, to the lower side of which is bolted a ring having downwardly projecting fingers forming the lower portion of the fire pot. The lower edge of the fire pot wall and the boiler shell, which is made conical at its lower end and cylindrical above, rest against an inner flange on the ring plate. In the upper



BOYER'S IMPROVED STEAM HEATER.

portion of the base are openings with sliding doors, through which access may be had to the fire. Between the crown sheet and the top of the boiler are a number of tubes for the passage of the products of combustion; the inside wall of the boiler connects the crown sheet and the fire box.

The top plate of the heater closes in the smoke space and sustains the central magazine, through which coal is fed to the fire pot. Between the crown sheet and the cover is an annular space in which is located an annular steam superheating chamber, which is connected with the steam space of the boiler by an elbow pipe, and from which the steam issues through a pipe to the radiators. Through this chamber there are short tube sections so arranged as to register with the flues below. Connected with the steam pipe there are a steam gauge and a safety valve; a regulator, within which is a flexible diaphragm of soft rubber, is supported by a plugged pipe attached to the delivery pipe. A glass water gauge, a feed water pipe, and a return water pipe are arranged upon the outside of the boiler.

A pipe communicates with the boiler below the water line, and with the under side of the diaphragm in the regulator. A damper in the smoke pipe and a draught damper for the fire pot are respectively connected by chains to the opposite ends of a lever united by a rod with the diaphragm. These parts are so arranged that when the fire burns too freely the increased pressure on the diaphragm moves the lever, closing the draught damper and opening the smoke pipe damper; when the heat and pressure are reduced, the diaphragm falls and the movements are reversed. This insures an automatic regulation of the heat and pressure and the most economical use of fuel.

This invention has been patented by Mr. J. L. Boyer, of Reading, Pa.

The Black Snake Cure for Rheumatism.

The patient is Mrs. H. W. Stevens, wife of the Chief Engineer of the Danbury, Conn., Fire Department. The mode of treatment is to take the snake, which is about five feet long, and wind it about the patient's leg. After remaining for twenty minutes he is taken off and put in a box. This is done two and sometimes three times a day. A month ago Mrs. Stevens could walk only with the aid of crutches. She is now able to walk with a cane, and entertains strong hopes of ultimate recovery. At times the snake will bring his restrictive powers into play, and give a painful squeeze to the leg. A pin thrust into him cures him of this. Several times he has bitten his handlers, but no harm has followed.

We are inclined to think a thin rubber tube filled with warm water might replace the snake, and prove to be more advantageous as a cure.

Aerial Navigation.

M. Herve Mangon has lately presented a report to the Academy of Sciences concerning a recent balloon ascension at Meudon. The balloon was under the direction of Capt. Renards, and, although it moved against the wind, it easily followed the course along which it was steered. It was then veered around and brought back to the point from which it started.

Killing Food Animals without Pain.

Dr. B. W. Richardson's experiments and studies to find the best way of mitigating the cruelties of the slaughter house are well known. His earliest attempts were with electricity; but the use of carbonic oxide gas he now finds is the best.

In the last number of the *Asclepiad*, he says: Respecting the method of killing by the electrical discharge, I reported on the experiments I had made in 1869 with the large induction coil of the Royal Polytechnic Institute, with which I put to full test the practical value of electricity for the painless killing of animals.

I used, in these inquiries, twelve large Leyden jars, the whole representing ninety-six square feet of surface. In some cases the discharge was made in the ordinary direct way; in other instances the jars were set out in cascade on the plan devised by Benjamin Franklin. The results, as many who saw them will remember, were most striking. It was proved that the shock "in cascade" was the most fatal, but by both methods small animals, rabbits, and birds, were killed so instantaneously that they actually remained in the exact position they had assumed at the moment the shock was given, so that it required careful examination to prove that they were really dead. In these small animals the bodies were left, after the shock, in a state of complete rigidity; but in a short time the rigidity subsided, and the flesh ate tender.

The common idea that after death from electrical shock rapid decomposition ensues was disproved, for in all cases the bodies of the animals remained for several days free from decomposition. In another series of experiments, larger animals, sheep, were subjected to the shock, and in every instance unconsciousness immediately followed the application of the shock, the current being passed from the heads of the animals through the body to the hind extremities. The method proved very difficult to carry out in practice, for two reasons. First, it was found that if the shock was so decisive that death took place absolutely, the animal would not afterward bleed; while, if the shock were not completely decisive, the animal, during the flow of blood, evinced certain signs of returning consciousness, a phenomenon as remarkable as it was unexpected. Secondly, it was found that the administration of the shock was dangerous to the operators unless they took such care as could not be expected from all the men who are employed in the duties of the slaughter house.

CARBONIC OXIDE GAS AS THE NARCOTIZER.

Some researches on anæsthesia led me to an exposition of the anæsthetic action of the fumes of the Lycoperdon giganteum, or common puff ball.

These fumes were found to be most actively narcotic, and on analysis of them by two independent observers, the late Dr. John Snow and Mr. Thornton Herepath, it was found that the narcotic present was carbonic oxide—CO. On this being determined I commenced to follow up the study of carbonic oxide, and in course of time employed it as one of the cheapest and readiest of the lethal gases for the painless extinction of life in the lower creation, using it frequently for narcotizing sheep, birds, and dogs.

In 1878 I constructed, for the first time, a lethal chamber, in which sheep were introduced in order to be rendered insensible by this gas before being subjected to the slaughterer. The chamber was capable of receiving two sheep at once, and the carbonic oxide was made by passing common air in a simply constructed stove over charcoal. The gas diffused through the chamber was sufficiently effective in its action to render the animals insensible to pain in a period of from one minute and a half to two minutes. When entirely unconscious they were removed from the chamber, and finally killed by the butcher in the usual way.

These animals had no sense whatever of the violent death to which they were subjected. They felt no more of the slaughterer's knife than the patient under chloroform who is about to have a limb amputated feels the knife of the surgeon. When they had lost the quantity of blood that is required to produce the phenomenon, the usual death convulsion incident to loss of blood occurred, but it was painless and very short in its duration.

The flesh of the animals—eight in number—killed in this painless manner was entirely unchanged. The gas combines harmlessly with the tissues, it communicates neither odor nor taste to them, and is, in short, entirely innocuous to the flesh as food.

In the painless slaughter of animals intended for food there need be no hesitation in the selection of the narcotic. Carbonic oxide is the right agent in every respect.

The painless death of animals to be used as food might be put into operation at once in a properly constructed abattoir in the case of sheep, lambs, calves, fowls, rabbits, and other game, pigs, and perhaps oxen. Of the oxen I am not sure, the pole ax being so very speedy and effective when it is properly used.

For sheep the narcotic is specially appropriate. Sheep come under the influence of the narcotic with singular facility, and are saved from what is to them a very painful death.

Through the generosity of one benevolent man, Mr. Kennet, I have constructed at the Dog's Home at Battersea a large lethal chamber in which from fifty to one hundred dogs can be narcotized at once, and can be allowed, without awakening, to pass from sleep into death.

On May 15 of this year, I put the chamber, for the first time, into practice, by passing into it thirty-eight dogs which had to be killed. The animals were quickly asleep, and when removed from the chamber were all lying precisely as if asleep, but every one dead.

On the 21st of May fifty-four dogs were submitted to the same mode of death in the lethal chamber. They fell asleep in the most direct and easy way; and on removal from the chamber were all found lying as if asleep, but quite dead.

The same process has now been repeated many times on batches of dogs varying from fifty-three to eighty-four at one time. On the whole, five hundred dogs have been in this way made to sleep into death—have been submitted, that is to say, to death, with no more sense of pain than is felt by every human being who goes to sleep from the hand of the administrator of an anæsthetic vapor. The death is the easiest it is possible by any art to devise. First sleep, then death sleep, then death.

The lethal chamber is an air tight chamber built of wood, with double walls holding a layer of sawdust between them, so as to sustain an equable temperature, and secure an equable diffusion of the lethal air within the chamber at different seasons. The chamber is capable of holding two hundred cubic feet of lethal air, and is constructed to receive a cage having a capacity of one hundred and forty cubic feet.

The cage runs easily on wheels into and out of what may be called the central nave of the chamber. As it enters it pushes before it a valve screen, which prevents the escape of lethal air; it also pushes before it, at the further end, a movable screen to allow for the displacement of the air caused by its entrance.

When the lethal chamber is required for use, the carbonic oxide is generated freely in the stove condenser, one pound of charcoal being used for the production, excluding loss, of every twenty-five cubic feet of gas. For three hours the gas is diffused into the chamber at a temperature of about 75° F., and at the rate of one hundred cubic feet per hour. The chamber is thus well filled with a lethal atmosphere, through which finally the methylated vapor is rapidly diffused.

The chamber ready, the animals are put into the cage outside of it. The first doors of the chamber are then thrown open, and the cage, pushing before it the valved screen spoken of above, is run in. Its own end closes up the entrance; but to make all perfectly air tight, the outer door of the chamber is immediately closed. The animals are now immersed in the lethal or narcotic atmosphere. The whole time of introduction of the cage and closing of the chamber is less than half a minute.

At first the animals are, as a rule, completely quiet; then they seem, one by one, rapidly to fall into deep sleep, often with heavy snoring; finally, with a series of short, sharp barks, in some cases, they fall into death, the perfect placidity in which they are discovered after death indicating that they have passed imperceptibly from sleep into death.

It is important, however, for me to record that all animals after they have fallen into sleep under the lethal vapor do not pass into death with equal rapidity. About 3 per cent of animals, after the narcotism is fully established in them, show such a peculiar tenacity of life that they may continue to breathe for some time after the rest of their comrades are dead. In these instances it would seem that the animals, brought down to the very lowest possible ebb of life, retain a sufficient reserve of oxygen to keep the flame of life alive.

They are like animals hibernating in the extreme cold. The same phenomenon has been observed in the human subject in cases of exposure to lethal vapors in mines.

The idea that an atmosphere charged with 5 per cent of carbonic oxide is instantly fatal to all warm blooded animals is an entire fallacy. Some animals may be as rapidly affected, but others may continue to live a long time in an atmosphere containing at least five times that proportion of the gas.

These experiences have led me to increase the intensity of the lethal atmosphere far beyond what would, up to the present time, have been considered necessary.

The atmosphere of the lethal chamber is not merely anæsthetic; it is also antiseptic. The dead animals can, therefore, be preserved in it, if required, while awaiting removal.

Horse Breeding in Russia.

An interesting account is given in Consul-General Stanton's last report of horse breeding in Russia. He says that the horse has played an important *role* among the inhabitants of the steppes from the eariest period of the history of the Slavonic breeds. Oley, and succeeding princes, took measures to improve the breeds, and Yaroslaff punished horse stealing by loss of liberty and fortune; but until the middle of the 13th century the Russian Government was lukewarm in the matter of encouraging the breeding or improving their breed of horses. From the time of Ivan III., government measures became more systematic, imperial studs were established, thoroughbreds purchased, and stallions were lent to boyars and monasteries for breeding purposes.

At the present time there are six imperial studs: The Orloff, where English thoroughbreds, trotters, and saddle horses are reared; the Novo-Alexandrofsk, for English halfbreds and large horses; the Strelitz, for Oriental saddle horses; the Derkulsk, for farm and carriage horses; the Tanoff, for large saddle horses and English halfbreds; besides these there was, until 1881, a stud at Orenburg for breeding steppe horses.

There are fifteen covering stations, which are open to all. The stallions are distributed each year from February 15 to June 15 among these stations, and here mares are served by thoroughbred stallions at a fixed rate. In 1881 there were 1,077 stallions at the 15 stations, and 39 stallions were placed at the disposal of the agricultural establishments at separate stations. The imperial studs, after replenishing their stock, dispose of their increase by auction every four years. The thoroughbred Orloff colts are, however, sold each year. In 1880, 555 horses and 15 foals were sold for £11,480; and in 1881, 687 horses realized £10,064. Three thoroughbred English and two Arabian stallions were added in 1880, and eight English thoroughbreds in 1881. The department receives annually about £11,450, to be spent in encouraging private breeding establishments. At present there are eight jockey clubs and twenty-seven trotting establishments. There are 3,430 private studs, with 9,560 stallions and 92,971 mares. Besides these, a large number of horses are bred in herds on the steppes, chiefly in the governments of Semipalitinsk and Akmolinsk. The total number of horses in European Russia, exclusive of Poland, is 17,785,975. In the Caucasus there are about 500,000, in Siberia about 2,500,000, and about the same number in Central Asia.

In consequence of the varied elements from which the modern Russian horse has been developed, and the manifold character of the climate, topography, etc., in Russia, the horses are of very different types, viz.: Mountain horses, to which group belong horses of Oriental extraction, and bred in Caucasia; they are characterized by medium size and great beauty, and on account of their speed and sure footedness they are especially adapted for riding and driving in mountainous districts. Steppe horses, which are the horses of the Don, Calmuck, and Bashkinian races; they are characterized by leanness, great powers of endurance, and a contented disposition. Forest horses; to this group belong the Smudish, Obrimian, Viatkan, and Kasan horses, which are bred in the northern forest regions. And, finally, horses of the Blackearth districts, which are large and powerful cart horses. Besides these breeds there are also the Polish and Little Russian breeds.

Horse dealing is concentrated in the yearly markets, of which there are about 1,090 in European Russia, and the total number of horses sold in these markets averages about 360,000 annually. A considerable sale of horses is also carried out throughout the Empire, irrespective of these markets, and 15,000 are annually sold in Moscow alone, at prices ranging from £8 to £9, and a number of Orloff horses, which command from £400 to £500 each. The total value of the horses annually sold in Russia is estimated at £1,000,000. Prices vary considerably, according to season, age, and race, the average price of a common horse being £5, that of a good cart horse from £10 to £30, a good trotting horse from £400 to £600, and of a good cavalry horse from £8 to £15.

A New Metallurgical and Gas Process.

A new system of iron and steel making has been devised by M. Louis de Soulages, who has constructed works at Montjean for the purpose of developing his designs. The general idea of the process, as stated in the *Revue Industrielle*, is divisible under two heads—the preparation of the ore, and its reduction by a flame of carbonic oxide. In the first place, M. De Soulages holds that the connection of a mineral with its *gangue* is due to the presence of one or more molecules of water of crystallization or combination, which, if evaporated, will permit of the easy separation of the two substances. Upon this hypothesis, therefore, the first step is to pulverize and dry the mineral, which is afterward subjected, while in the form of anhydrous dust, to the intimate action of carbonic oxide. In practice the mineral is first broken small by a Blake machine; and it is then ground by cylinders into grains of from 1 to 3 millimeters in diameter. After this it is dried and screened into three sizes by volume; and it is then separated according to gravity. In this way the raw material is collected free from dross, perfectly dry, and ready for the chemical operations of reduction and melting. For this purpose the gaseous fuel is prepared in a peculiar manner. Retorts (vertical ?), heated by coal, contain carbonate of lime in their lower portion, and wood charcoal above. The heat disengages the carbonic acid, which becomes transformed into carbonic oxide by traversing the wood charcoal, and the gas is then collected in a gasholder for use in the reducing furnaces.

After being used in this way the carbonic oxide becomes carbonic acid; and it is then conducted to other retorts which are divided into two parts, and heated by the carbonic oxide from the gasholder. The upper parts of these retorts contain wood charcoal; and the conversion back to carbonic oxide is performed as easily as in the first operation, but without the necessity for extracting carbonic acid from carbonate of lime.

For the successful working of the reducing process it is essential that the hearth where the operation is carried out should be kept free from the admission of air; but to raise the temperature by the combustion of the carbonic oxide, a regulated supply of air is admitted from a suitable reservoir. After the heat has thus been raised to about 1,500° C., the combination of the carbonic oxide with the molecule of oxygen contained in the metallic oxide under reduction will keep up the temperature without further aerial combustion. No results of the application of this system have been given; but while the fact that it depends wholly upon theoretical data is admitted, it is pointed out that all the remarkable metallurgical advances of modern times have equally been based upon pure theory.

Correspondence.

The Tarantula.

To the Editor of the Scientific American:

I have noticed in your issue of July 19 (page 39) a brief account of the "Tarantula of California," with an illustration. As my attention has been specially called to this subject, I write to inform you of a popular error which you unwittingly perpetuate.

The tarantula proper, of California (called Mygale Hentzii), builds no nest as depicted in the illustration, possesses very prominent and numerous black hairs (as is peculiar to the genus), and is quite large, often six or more inches across—in fact, usually with a *body larger than the entrance of the so-called "tarantula nests,"* which nests belong instead to much smaller, hairless spiders, with shorter and fewer hairs, and properly called trap door spiders. Of these there are several species in California; the more common species known to me is Cteniza Californica, which is almost destitute of hairs, and whose nests are much sought after by dealers in curiosities, who are very particular to displace the rightful owner and substitute by its side a large tarantula—causing a more ready sale.

The spider in the illustration is perhaps an unpublished species of Antrodiætus, one of our California trap doors, and to which (as also to C. Californica) the name Mygale Hentzii has often been erroneously applied; but it is plainly neither a true Mygale nor Cteniza. A note in *Science* (see Cteniza, in vol. iii.) mentions the facts upon this subject, which however seem little known.

It is not strange that the occupants of so-called tarantula nests should be considered tarantulas, and as such they have been largely collected and sold for the genuine article. The true tarantula is usually not abundant near the trap doors, so that a collector is very liable not to learn of the fallacy.

I send by this mail a true tarantula, recently found traveling about at dusk. It is imperfect, and about one-third the size often or usually attained. It is often found under stones and rubbish, and on the dry plains it occupies the cracks in the adobe soil, or in other holes (not of its own make as far as known), and is credited with making a tubular web. Little, however, is known about the habits of any of these spiders or even about themselves, as they have never been very closely observed. C. R. ORCUTT.

San Diego, Cal., Aug. 12, 1884.

[The specimen sent by our correspondent is about the size of the one we illustrated, but differs greatly in color, the under side of the body and legs being of a very dark brown, while the remaining parts are of a dark mouse color. It is entirely covered with a fine fur, and upon the legs are long, coarse hairs. In regard to the name of this ugly animal, the American Cyclopædia states that "the great hairy spiders of the genus Mygale are called tarantulas in the Southwestern States," and that "other species in California are called trap door spiders, from their hollowing a more or less conical nest . . . in the clayey soil."]

Meeting of the British Association, Montreal.

It is now fifty-three years since the British Association for the Advancement of Science was formed, principally through the efforts of Sir David Brewster, Sir Humphry Davy, Sir John Herschel, and other leading scientists. The main feature of the association is its annual gatherings, at which members who suppose they have made a real advance in science read their papers for the criticism of others engaged in similar lines of scientific work; reports are also made upon particular departments, their progress and needs, and as a guide to further inquiry. This year, however, affords the first instance of the meeting of the Association outside of the British Isles, and the session which commenced at Montreal August 28 has, therefore, excited more general interest among American readers than any former assembling of the body. It is estimated that some 600 foreign scientists have crossed the ocean to take part in the proceedings of this meeting, not a few of whom have been here for many weeks, making themselves acquainted with the country, people, and institutions in the United States as well as in British North America, and a great many will linger behind after its close, for such purposes as well as to attend the meeting of the American Association, to be held in Philadelphia from Sept. 4 to 11.

Before the opening of the meeting, the Council of the Association invited the standing committees and fellows of the American Association to attend as honorary members, and among the American visitors were Profs. George F. Barker, Mendenhall, Rowland, James Hall, Asa Gray, Smith, of the University of Virginia; Putnam Newberry, of Columbia; Carhart, of Evanston; Newcombe Scudder, of Cambridge; C. S. Minot, Woolsey Johnson, and Bickmore, of the American Museum of Natural History; Commander Sampson, United States Navy, Dr. Youmans, and Lieut. Greely of the late Arctic expedition.

Among distinguished foreigners present were:

Sir William Thomson, Prof. Tyler, the astronomers John Couch Adams and Robert S. Ball, the Rev. Thomas George Bourey, Prof. Roscoe, Prof. Dewar, Capt. Bedford Pitt, Sir Lyon Playfair, Prof. E. A. Schafer, Prof. William A. Tilden, Dr. T. Sterry Hunt, Prof. Dawson, and others of note, although it is to be regretted that many great names, such as those of Tyndall, Huxley, Joseph Dalton Hooker, and Sir John Lubbock, are absent from the list of members in attendance.

The different sections into which the work of the Association is divided were presided over as follows:

Sir William Thomson over the section devoted to mathematical and physical science, with Vice-Presidents Prof. J. B. Cherriman and J. W. L. Glaisher, the aeronautic celebrity; Prof. Sir H. E. Roscoe over the section of chemical science, assisted by Prof. Dewar and B. J. Harrington; geological section W. T. Blanford, and Prof. T. Rupert Jones and A. R. C. Selwyn assisting; in biology Prof. H. N. Moseley, with Surgeon-Major G. E. Dobson and Prof. R. G. Lawson assisting; geographical section, Gen. Sir J. H. Lefroy, assisted by Col. Rhodes and P. L. Sclater; Sir Richard Temple presides over the section devoted to economic science and statistics, assisted by J. B. Martin and Prof. J. Clark Murray; mechanical science section, Sir F. J. Bramwell, assisted by Prof. H. T. Bovey and W. H. Preece; the section of anthropology, Prof. E. B. Tyler as its chief, aided by Profs. W. Boyd Dawkins and Daniel Wilson.

Lord Rayleigh, the President elect, is comparatively a young man to be the president of such an Association, being only 42 years old, but he is Professor of Experimental Physics and of Mathematics in Cambridge University, and his mathematical works have already called forth the praise of the highest living authorities. It is impossible for us to make room here for even an abstract of the President's address, but perhaps the following excerpt will attract more attention from mechanics and engineers than any other portion of this most able paper: "In thermodynamics, the first law, which asserts that heat and mechanical work can be transformed one into the other at a fixed rate, is well understood. The second law is now receiving the attention it merits. It is that the real value of heat as a source of mechanical power depends upon the temperature of the body in which it resides—the hotter the body in relation to its surroundings, the more available the heat. In order to see the relations which obtain between the first and the second law of thermodynamics it is only necessary for us to glance at the theory of the steam engine. Not many years ago calculations were plentiful, demonstrating the inefficiency of the steam engine on the basis of a comparison of the work actually got out the engine with the mechanical equivalent of the heat supplied to the boiler. Such calculations took into account only the first law of thermodynamics, which deals with the equivalents of heat and work, and has very little bearing upon the practical question of efficiency, which requires us to have regard also to the second law. According to that law, the fraction of the total energy which can be converted into work depends upon the relative temperatures of the boiler and condenser, and it is therefore manifest that, as the temperature of the boiler cannot be raised indefinitely, it is impossible to utilize all the energy which, according to the first law of thermodynamics, is resident in the coal. On a sounder view of the matter, the efficiency of the steam engine is found to be so high that there is no great margin remaining for improvement. The higher initial temperature possible in the gas engine opens out much wider possibilities, and many good judges look forward to a time when the steam engine will have to give way to its younger rival." Passing through a number of more technical matters, Lord Rayleigh went on to say: "It is remarkable how many of the playthings of our childhood give rise to questions of the deepest scientific interest. The top is or may be understood, but a complete comprehension of the kite and of the soap bubble would carry us far beyond our present stage of knowledge. In spite of the admirable investigations of Plateau, it still remains a mystery why soapy water stands almost alone among fluids as a material for bubbles."

On the "Kinetic Theory of Matter," Sir William Thomson, president of the mathematical and physical section, read an able paper, in which he said that "the now well-known kinetic theory of gases is a step so important in the way of explaining seemingly static properties of matter by motion that it is scarcely possible to help anticipating in idea the arrival at a complete theory of matter, in which all its properties will be seen to be merely attributes of motion. If we are to look for the origin of this idea, we must go back to Democritus, Epicurus, and Lucretius. We may then, I believe, without missing a step, skip 1,800 years."

The speaker then showed how Malebranche, early in the last century, gave expression to a distinct conception in support of the kinetic theory of matter.

Prof. Henry Enfield Roscoe, the president of the chemical section, made an address in which he reviewed the progress of the science between 1848 and 1884. The first date is that of the death of Berzelius. The second that of Dumas, the chemist. The differences between what the speaker called the Berzelian era and that with which the name of Dumas will be associated show themselves, he said, in many ways, but in none more markedly than by the distinct views entertained as to the nature of a chemical compound. According to the older notions, the properties of compounds are essentially governed by the qualitative nature of their constituent atoms, which were supposed to be so arranged as to form a binary system. Under the new ideas, on the other hand, it is mainly the number and arrangement of the atoms within the molecule which regulate the characteristics of the compound, which is to be looked on, not as built up of two constituent groups of atoms, but as forming one group. The general method now adopted in an experimental inquiry into the molecular arrangement or chemical constitution of a given compound is either to build up the structure from less complicated ones of known constitution or to resolve it into such component parts. "The discovery of anl line colors by Perkin, their elaboration by Hoffman, the synthesis of alizarin by Graebe and Liebermann, being the first vegetable coloring matter which has been artificially obtained, the artificial production of indigo by Baeyer, and, lastly, the preparation by Fischer of kairine—a febrifuge as potent as quinine—are some of the well-known recent triumphs of modern synthetical chemistry. And these triumphs, let us remember, have not been obtained by any such 'random haphazarding' as yielded results in Priestley's time. In the virgin soil of a century ago the ground only required to be scratched and the seed thrown in to yield a fruitful crop. Now the surface soil has long been exhausted, and the successful cultivator can only obtain results by a deep and thorough preparation, and by a systematic and scientific treatment of his material."

Prof. H. N. Mosely, M.A., F.R.S., Linacre Professor of Human and Comparative Anatomy in the University of Oxford, addressed the biological section of the Association, of which department he is president, on the phenomena of pelagic and deep-sea life. Knowledge of the subject, he said, was at present in most active progress, and was of the widest and deepest interest to the physiologist as well as the zoologist, and also claimed a share of attention from the botanist. No physiologist had as yet set forth comprehensively and dwelt upon the numerous difficulties which are encountered when the attempt was made to comprehend the mode in which the ordinary physiological processes of vertebrata and other animals are carried on under the peculiar physical conditions which exist at great depths.

One of the most interesting of the addresses was that of Sir Richard Temple, president of Section F, devoted to economic science and statistics. The title of his essay was "The General Statistics of the British Empire," and it embraced an enormous amount of information about the territory under the sway of Great Britain, its inhabitants, and the works of man as displayed in that vast theater of action. This paper was succeeded, however, by one even more complete from Mr. Edward Atkinson, of Boston, which treated in the broadest way the question, "What makes the Rate of Wages?" Unquestionably Mr. Atkinson has given to the consideration of such subjects an amount of consideration which renders his opinions, backed up as they are by a long array of statistics, worth the thoughtful attention of all who are endeavoring to better the social and economic condition of the world's wage workers.

After the close of the meeting, those who desire to attend the meeting of the American Association at Philadelphia will be provided with a special train to take them through from Montreal by daylight, without change of cars.

Successful Test of a Safety Track and Switch.

Within the past two years the New York, New Haven, and Hartford Railroad Company have been testing an improved automatic safety switch and signal, with the intention of protecting their many draw bridges upon the line of their road, and thereby avoid the stoppage of trains.

In view of the accident at South Norwalk some years ago, when a train ran off an open draw and several persons were killed, it was found necessary to devise a mechanism whereby the safety of a train would not be imperiled should the engineer neglect to notice the danger signals.

An automatic arrangement has been attached to the draw bridges at Westport and Cos Cob, Conn., which works substantially as follows: Before the draw bridge tender can open the draw, he is obliged, by means of suitable levers arranged in a cabin at the draw, first to set two danger signals, on each side of the bridge and distant therefrom respectively 300 and 1,200 feet, and then by means of iron rods and levers to move a switch at a point 200 feet from the bridge, from the main track to a siding which terminates in a sand bank; the lock of the draw is then automatically released, allowing the same to be opened.

Unexpectedly to the company, the apparatus received a very efficient test on the night of the 31st July, at the Cos Cob bridge, near Greenwich, Conn.

A vessel was passing through the draw at the time, the danger signals and safety switches had been set as was required, when suddenly an accommodation train from New York filled with passengers dashed along by the danger signals, passing on to the safety switch, ran over the length of the siding, coming to a standstill on the sand bank at the end of the same; not a passenger was injured. The engineer had not observed the danger signals, and had it not been for the safety switch and side track, the train would inevitably have plunged into the river.

New Intensifier for Gelatine Plates.

A formula for an intensifier which has the merit of giving to a negative or transparency a rich, dark-brown wine color has lately been given as follows:

No. 1.

Water	6 ounces.
Of a saturated solution of bichloride of mercury	1 ounce.

No. 2.

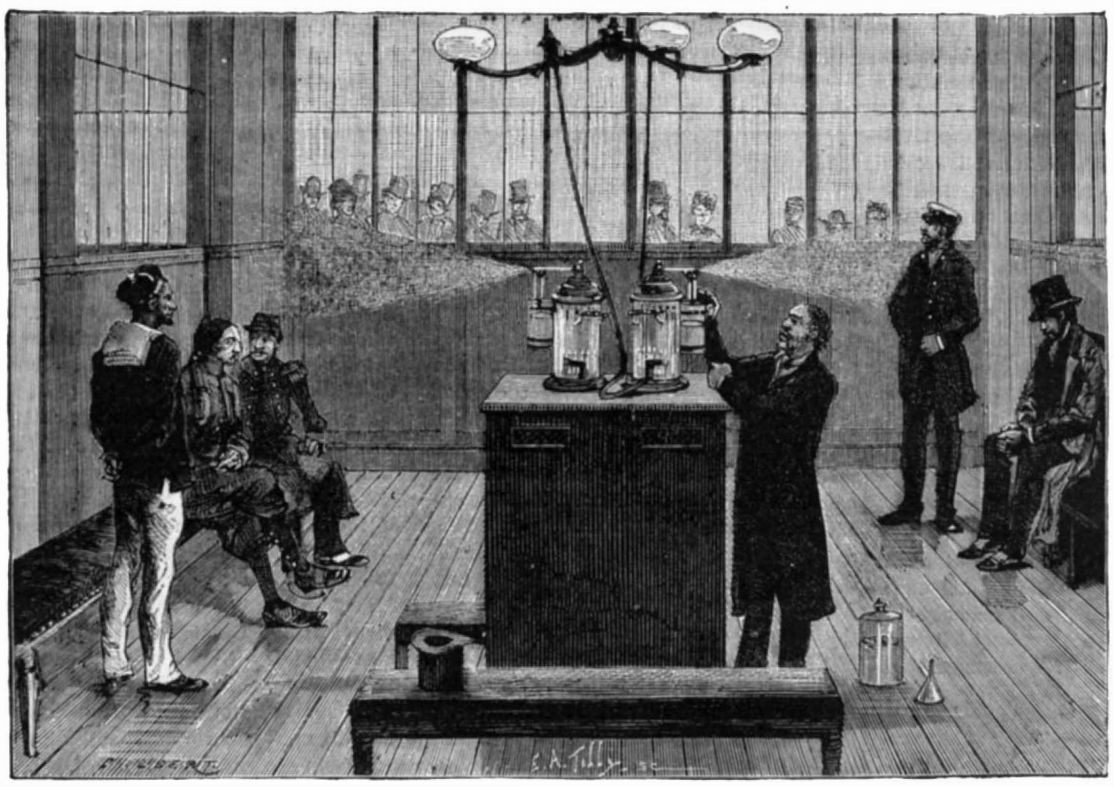
Water	6 ounces.
Sulphite of soda (crystals)	120 grains.

The negative is laid in No 1 for a length of time according to the amount of intensity desired. The solution whitens the film; if a small amount of intensification is desired, the plate is left just long enough to bleach or whiten the surface of the film; after careful washing it is next placed in a bath of No. 2, and rapidly assumes a dark, rich-brown color. If No. 2 works slow, more sulphite soda should be added. For line work negatives this intensifier is highly recommended.

THE CHOLERA IN 1884.

When the English took possession of Egypt last year there was, for a time, a live panic, which was caused less by the political upheaval that was possibly to be the consequence of the cannons fired at Alexandria and Tel-el-Keber than by the announcement of a new invasion of the cholera. Since the year 1865, thanks to the application of rigorous measures, that disease which spreads terror had not crossed the barrier of the Red Sea. The neglect of the usual precautions, and the freedom with which the British authorities threw aside international regulations, had its immediate consequences.

A ship which started with free license from Bombay brought the cholera to the banks of the Suez Canal, and in a few days the epidemic gained the whole of Lower Egypt. A rigorous sequestration of Egyptian and Indian merchandise, and an observance of quarantine regulations, protected us against contamination. Everything, then, led us to believe that we had been delivered from so terrible an invasion, when, lo and behold, without one of those offensive and quite frequently observed epidemics having occurred in Egypt, the telegraph apprised us one fine day that the cholera was raging at Toulon, that it had broken out in the middle of the port upon one of the stationary vessels of the fleet, and that it was on the way toward propagating itself in the city. The surprise was so much the greater in that we were sleeping, confident of the power of quarantine and of those severe regulations that had preserved us the year previous. Reassured for a moment by the announcement that it was a simple epidemic of sporadic cholera, it soon became necessary to surrender to the evidence. The diagnosis that had been solemnly made by an official was erroneous—it was indeed Asiatic cholera. Terror was now at its height, and such terror is difficult to calm, however slow be the epidemic in its evolution. Asiatic, or true, cholera is endemic in India. Has it existed there from all times, as is asserted by Dr. Thologan, and are traces of it to be found in the writings of antiquity? Was there formerly only a malady that had other characters, and was capable of being thereby confounded with cholera? Was it a question of cholera morbus? All these are questions upon which epidemiologists are divided, and which the international conference at Constantinople could not decide.



DISINFECTING ROOM AT THE LYONS RAILWAY STATION.

Dating from 1817, this disease, which started from the banks of the Ganges, has established itself permanently in India, notably in Bengal. Every year this endemic focus gives rise to epidemics of varying seriousness that strike Madras, Pooree, and other regions where pilgrimages occur, and, consequently, the agglomerations of Hindoos. At a little more distant intervals it extends into other provinces.

Up to 1823 the cholera, despite such endemicity, had not crossed the frontiers of Asia. At that epoch it was carried by caravans into Persia, reached Astrachan, and, fortunately for Europe, soon disappeared in that province. But it could already be foreseen that if a serious barrier had not been opposed the scourge would have advanced further. This is what happened in 1830—the epoch of the first cholera epidemic in Europe. Coming from Persia, it entered Russia through the Caucasus, and thence, after ravaging the entire district of Astrachan, it ascended the Volga, extended into Russia, and reached the rest of Europe in passing through England before entering France.

In 1846, starting from the same points, it again entered through Russia, and proceeding by successive marches, always in the same identical path, and reaching distant regions in measure with emigration, it traversed Germany, France, and entire Europe. This second epidemic lasted nearly ten years. The best authorities on cholera are agreed in connecting the return of it in 1852–55 with the epidemic of 1846. It cost France alone 250,000 persons.

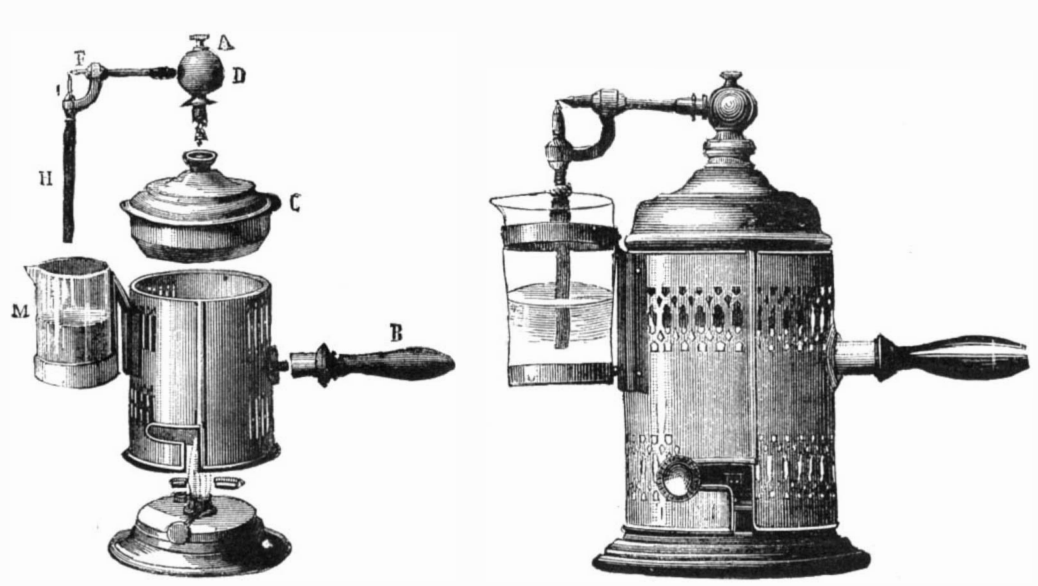
The epidemic of 1865 inaugurated the importation of the disease by way of the ocean. As in the preceding year, it came from India, and was imported into Hedjaz by ships coming from Calcutta and Bombay loaded with pilgrims. The boats landed thousands of these pious travelers at Suez on their return from their pilgrimage. The disease soon broke out at Alexandria, then spread with the emigrants to Constantinople, Smyrna, Marseilles, and Odessa, and from thence to other parts, as far as to America.

Like the preceding, this epidemic did not become extinct until after a number of years. The slight epidemics of Gallicia, Bohemia, and Paris in 1873 may be considered as the last throes of the scourge. Under the influence of local causes, telluric conditions, or other circumstances, some foci where the disease had not been fully stamped out, or had quartered itself in an endemic state, suddenly kindled the flames again.

The Toulon epidemic presents the curious character of having apparently been generated *in situ*. We say apparently, since there is no doubt that the ordinary laws of choleric transmission presided over its birth. Messrs. Brouardel and Proust's severe and searching inquest did not succeed in discovering the mode in which it was imported. But a light will perhaps be thrown upon the enigma some day by some detail that has passed unnoticed. Cholera most assuredly reaches us from India or Indo-China. It may be that a but partially extinct focus in Egypt was the point of its origin in this case.

The transmission of cholera always occurs in the same manner. It was long ago proved that air is not the vehicle of the contagion; but, notwithstanding this, agents for transmitting it are not wanting. In the front rank of these stand the sick. We do not speak here of those who, through diarrhea, cramps, or cyanosis, are confined to a bed which they will perhaps never leave, but those who, ignorant of their contamination, are in the period of incubation, who have only the premonitory symptoms, and who will perhaps not go beyond this first stage.

Through necessity, or ceding to fear (which is more contagious than the disease itself), these unsuspicious cholerics emigrate from the city, flee to a distance before the disease, and spread the epidemic to the four points of the compass. It is not in their clothes that they carry the poison, but in their stomach, as a very distinguished physician has remarked. They have a slight diarrhea only, and they go to lodge in a hotel or at a friend's house. Their dejections, which are, as a consequence of their contamination, pestilential, create a genuine focus of contagion. They have transported the cholera unbeknown to themselves. They may leave, cured of their indisposition, but an epidemic breaks out behind them which has its origin in the house in which they stopped. The dose of poison, either because it was too small or the receptiveness insufficient, brought about in them only a simple diarrhea, but one that was capable of giving rise to an epidemic of perhaps considerable seriousness.



STEAM ATOMIZERS.

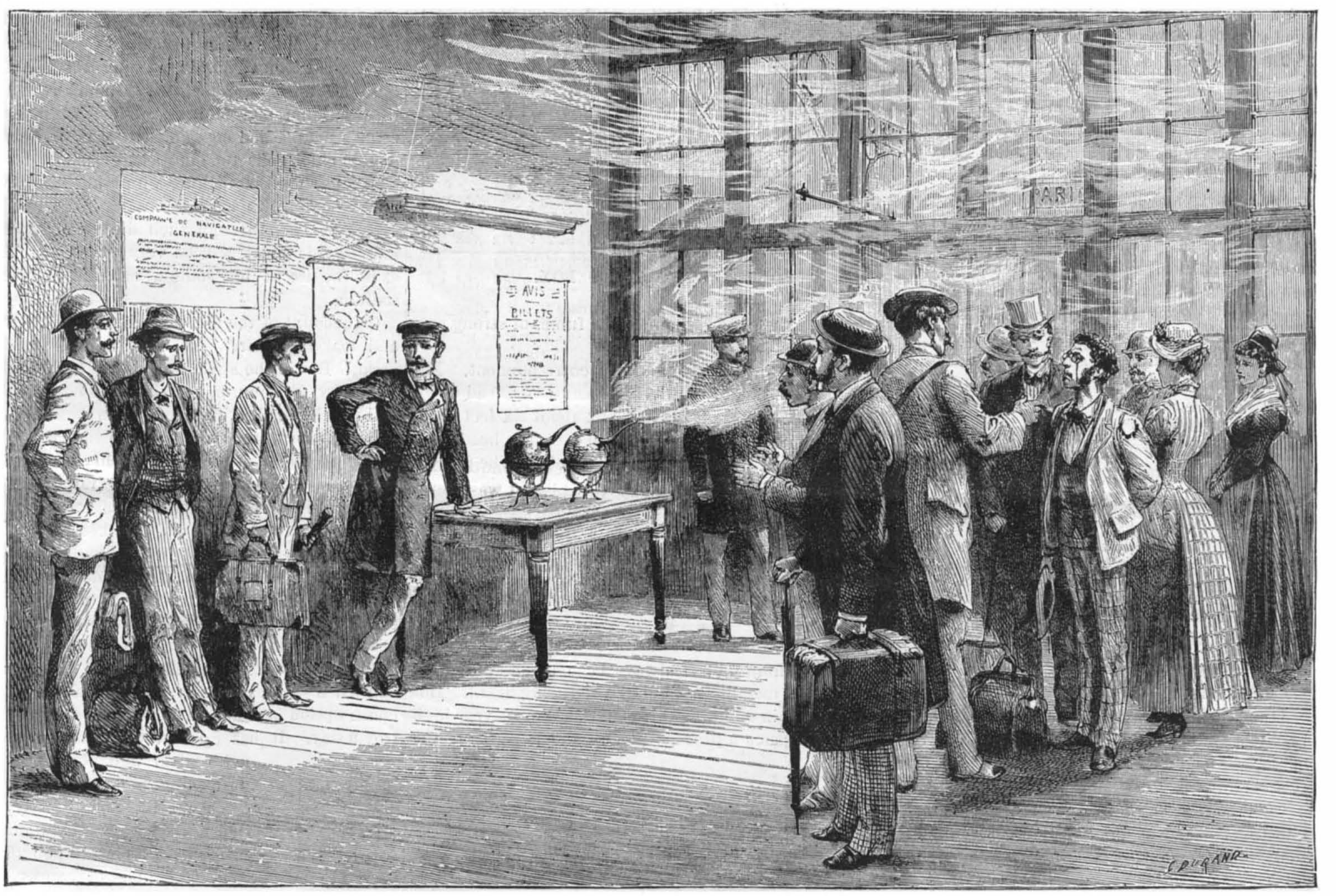
But such are not the sole agents of transmission, for the linen or effects that have belonged to a cholera patient are contagious to the highest degree if they have not been subjected to perfect disinfection. Certain goods, like wool, skins, and rags, should be regarded as suspicious when they have traversed regions that were being ravaged by the disease. It has long been asked whether a subject in perfect health can transmit cholera. The reality of such a transmission has not as yet been demonstrated, and the facts that have been interpreted in favor of such an opinion may be explained on the theory of a simple contact with cholera subjects, or by a simultaneous carriage of objects or clothing soiled with cholera matter.

Once transported through one of these various intermediaries, cholera makes its appearance. At first, there is but a small isolated focus, but one that soon extends farther and farther to a more distant point through the same mode of transmission. Under such circumstances, taking into consideration the organization of our present social life and our frequent moving about, people find it hard to explain why it is that certain localities absolutely escape the contagion or see but a limited epidemic appear. It is because there are conditions which are very favorable to the extension of the scourge, and which are not met with everywhere. These conditions are natural ones, such as the arrangement and composition of the subsoil, and local ones, such as the bad management of sewers and privy vaults, and overcrowding in dirty, badly ventilated, and badly lighted houses, etc. These natural, telluric conditions give of themselves an explanation of the immunity of certain points. Lyons, for example, is one of those rare cities which presents a very curious case of immunity. The hygienic conditions of this city do not differ perceptibly from those of Paris or other great centers. Now Lyons absolutely escaped the epidemic of 1832–35, which caused considerable ravages at Marseilles and on the shores of the Rhone. In 1865 the cholera passed almost unnoticed; in 1849 the cases were but few; but in 1854 the disease was more serious, and got about 200 victims.

Such an immunity is connected with a peculiar arrangement of the subsoil, and with an almost constant equality of the subterranean stratum of water, whose sudden variations at other points permit of and favor the decomposition of organic matters. This stratum of water is fed almost exclusively by the Rhone, and is constantly purified by the power and abundance of that stream. The organic matters and the cholera or other germs that it contains do not find conditions that are suited to their development and dispersion. What tends to prove that this assertion is well founded is that in 1854, the only year in which the cholera made a serious appearance there, the waters of the Rhone had descended to a level that had never before been observed, and they were, for several months, two-thirds lower than their mean. The influence of these different telluric and hygienic conditions is so real that we might ask, if a cholera germ were introduced into a village that was an ideal of cleanliness, provided with excellent potable water, and peopled with inhabitants obedient to the strict laws of hygiene, whether it would find therein conditions sufficient for its development and multiplication. Although this question remains hypothetical, the opposite of it surely finds one of the most decisive answers in the epidemic of 1884. The unheard-of state in which the sewer of Toulon had been left certainly favored the rapid extension of the cholera in that city.

Let us now pass to the history of the present epidemic, of which we shall give but a short resume. On the 14th of June, while the sanitary state of Toulon exhibited nothing abnormal, the board of health suddenly made it known that cholera had appeared upon the Montebello. This vessel, the Jupiter, the Alexander, and the Kleber, are old boats that have been converted into barracks, and that are anchored in the old wet dock. Each of these vessels lodges 400 and often 500 or 600 sailors belonging to the fleet. The patient was at once taken to the hospital. The next day a second case occurred on board of the same vessel, then another on board of the Jupiter, and two on board of the Alexander.

The first two sailors had not been on the sea in two years, and had had no communication with the city or the rest of the fleet. These first cases were attributed to cholera morbus. This supposition was so much the better founded in that these vessels are anchored in an annex of the port, which is merely a vast sewer mouth. At Toulon they are still back in the practices of the Middle Ages, and if a traveler who stops there in the evening does not run the risk of getting an unsavory bath, he is lucky. Sewers do not exist there, and each inhabitant empties the entire contents, liquid and solid, of his night vessel into the brooklet that flows past his door. If the weather is rainy, or if by a lucky accident the waters of the reservoir reserved for washing the streets are turned on at this moment, the filth is swept along a little more quickly. All this ordure runs into the Old Port, into the wet dock in which the vessels of the division are anchored. There being no tide to carry it off every day, this deposit accumulates and forms a fecal mass, from which, when a stick is plunged into it, an abundance of mephitic gases is disengaged.



THE CHOLERA IN FRANCE.—FUMIGATION OF TRAVELERS.

At the first news of the epidemic, Drs. Bouardel and Proust were delegated by the Minister of Commerce to proceed to an investigation of the nature of the cholera and of its origin. The disease at length appeared in the city; on the 21st of June a young pupil died at the Lyceum; then the deaths increased, and the doctors seemed to be in accord in recognizing the characters of Asiatic cholera. The Sarthe, a boat from Cochin-China, was accused of introducing the disease into France. The inquest of the sanitary delegates had the following questions to solve: Was it truly an epidemic of Asiatic cholera, and, if so, how was it imported?

The first question was a delicate one to determine, since in the two forms of cholera the symptoms and the lesions recognized upon an autopsy do not offer sufficient dissimilarity to allow the nature of an epidemic to be established from this fact alone. It became necessary, then, before everything else to seek the origin of it. Admiral Krantz placed himself at the disposal of the delegates, and facilitated all researches and investigations. But the inquest did not allow of the true origin being established. The Sarthe, which had been regarded as the cause of all the trouble, could not be criminated. It will be allowed that the public was not all wrong in suspecting this vessel. At the moment of her leaving Cochin-China she had a man (a machinist) on board who had the cholera, and who was put on shore and died in a few hours. All his personal effects—clothing, satchel, hammock, etc., were put off at the same time. The Governor at once ordered a quarantine at Cape St. James, at 15 kilometers from Saigon. There a second case showed itself. The boat was then ordered to return to the wharf, her whole cargo was landed, and she was completely disinfected, fumigated, scraped, and painted.

On the 20th of April the vessel proceeded to sea again, and arrived at Toulon on the 3d of June, where, after remaining in the bay for three days, she was admitted to the port. During these forty-three days of navigation and three of quarantine the sanitary state had been perfect. In the presence of these facts, which do not permit of the possibility of contagion by way of the ocean being seen, Drs. Brouardel and Proust were obliged to hold themselves in reserve as to the nature of the cholera. They had scarcely any doubts upon an examination of the cases, but they could not, however, give the minister an official, categorical affirmation, since proofs were wanting. In default of the true source of importation, some facts of a new order removed their scruples and allowed them to have no further hesitation. These facts were the importation of the cholera to a distance by travelers from Toulon. On Friday, a student who had started from the college the evening previous died of cholera at Marseilles. On the same day six other cases broke out in the same city, three of which occurred in a group of contiguous houses in front of which there is a fair held. This fair had occurred a few days previous, and some peddlers from Toulon had attended it.

The three subjects were attacked on the same day, and nearly at the same hour, and all three died within an interval of a few hours. Another proof was drawn from the observation of what are called interior cases in hospitals, that is to say, of patients who had long resided in the wards and who contracted the disease from the entrance of choleric persons. At the last moment, while the convinced delegates were *en route* to Paris, Dr. Cuneo telegraphed to one of them that the disease had caused two deaths at Valette and Pradet, clean and well ordered villages in the environs of Toulon, the subjects being persons who had recently come from that city.

There was no longer any doubt as to the true nature of the epidemic—it was indeed Asiatic cholera; and although the inquest did not bring to light its true point of origin, it nevertheless fixed upon the character of the epidemic.

Up to the present the scourge has quartered itself at Toulon and Marseilles; but we have seen by the means of transmission what facilities may be offered to its diffusion. So all cities have taken their precautions to prevent such an invasion. Foreign countries have made themselves conspicuous by the energy with which they have taken measures against it, by disinfection of stations, and by frontier quarantining. These are useless precautions, and purely vexatious. The only result that can be expected from them is perhaps a moral effect, but the value of these different prophylactic means is more than doubtful.

When the International Conference prescribed quarantine at sea, it knew that by this practice the countries of Europe could be effectively protected. A strict, vigorous quarantine (which is unfortunately a rare exception) prevents the invasion of the cholera into the Red Sea. If a neglect to observe the regulations allows Egypt to be contaminated, Europe will be greatly imperiled, since all the points of the Mediterranean may become pestilential foci. When once cholera has crossed the Mediterranean and is in Europe, do not try to defend yourself by quarantining, for it is useless. The network of a sanitary *cordon* will never prove closely enough drawn to retain this terrible microbe, and all you will do will be to interfere with commerce and paralyze the movement of business. But it will be said, these are interfered with in another way by ocean quarantine. Agreed, but then we are sure as to the result. Have those who insist upon not only a rigorous quarantine, but a sanitary *cordon*, reflected upon the practical difficulties that such a process involves?

Establish a sanitary *cordon* around a city, Toulon if you please, since that is the cradle of the present epidemic; then, in the first place, it will be necessary for you to have a second one, and a third, since the first will be certainly contaminated through contact with emigrants. Suppose you grant an entire army for this work of safety. But have you thought of the fright of those five, ten, fifteen, twenty thousand persons who are fleeing before this epidemic, who, for want of railway transportation, are piling into all the vehicles possible? When this excited mass shall present itself pressing against your sanitary *cordon*, give the order to use weapons, and cause a horrible massacre. There is not a government that would take the responsibility of such measures.

Sanitary barriers are impracticable, quarantine subserves no purpose, and disinfections are of not much more account! Why this is so we have explained at the beginning of this article, where we stated that it was less through clothing that cholera was propagated than through diarrhetics who were not yet sick and who might not be so at all. But such measures do not trouble travelers much, and do not infringe upon personal liberty, and we see no harm in continuing them. At the Lyons railway station the prefect of police has taken measures to have all travelers coming from Toulon undergo a quick disinfection. To effect this, a waiting room has been specially arranged as shown in Fig. 1. Here fumigating vessels disengage nitrous acid vapors in quantities that are scarcely perceptible to the sense of smell, but sufficient to destroy any microbes that may chance to be upon the surface of one's clothing. In addition to this there are employed two steam atomizers which were constructed by M. Waseige, and which are shown in Figs. 2 and 3. The liquid used in these apparatus consists of 1 gramme of thymol and 10 grammes of boric acid to a liter of water.

Travelers have to remain in this room about half an hour. Baggage undergoes a similar disinfection in another room, where it is submitted to the action of sulphate of nitrosyle. It is not till after these different operations have been performed that travelers are allowed to go about Paris. Their names and addresses are carefully taken, in order that the administration may be able to verify every new case of contagion.

At Marseilles and Toulon, the city governments have, in conformity with an old custom in times of epidemic, caused great fires to be lighted at the street corners. Crowds gather around these, and, at Toulon, great numbers hail the lighting of them every evening. On several occasions a quantity of tar furnished by the superintendent of the gas works has been burned upon Place de la Liberte in the last named city.

It appears useless to point out in this place the hygienic measures to be taken in order to avoid the cholera. The Committee on Hygiene has already published them in the papers. The surest thing is to live calmly and tranquilly without changing one's ordinary habits, not to get fatigued by overwork, and not to get at all frightened. Fear has a bad effect upon the viscera; it puts the entire organism into a psychical and physical state of depression which renders it more apt to contract disease. Let us preserve ourselves from fear, live an ordinary life, and hope that we shall avoid the appearance of this dangerous visitor.—*La Nature.*

Suture of Nerves.

The report that has just appeared to the effect that M. Tillaux has communicated to the Academy of Sciences the successful suture of nerve in two cases, and that in one case function has been restored in a nerve divided for a period of fifteen years, is, if confirmed, one of the most important facts we have had presented to us in our day. The physiologist, not less than the surgeon, will be led to important work by this event, and fresh fields of inquiry relative to nerve conduction may open new and unexpected advances in the theory as well as the practice of the medical art.

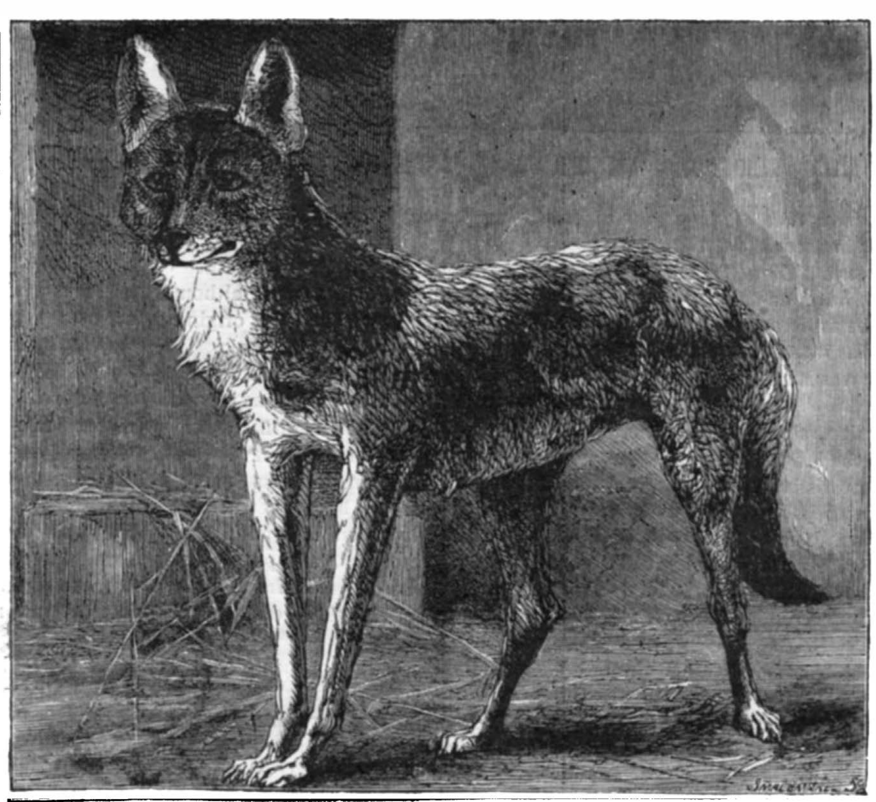
Our Petroleum Industry.

A retrospect of the past condition of the American petroleum industry, compared with its present state, discloses some interesting facts. The first American petroleum was exported in 1852. Charles Lockhart, of Pittsburg, sent nearly 600,000 gallons to Europe in that year, and sold it for $2,000 less than the cost of transport. In 1883 nearly 400,000,000 gallons were exported, for which $60,000,000 was returned to America. At the present day there are 20,000 producing oil wells in Pennsylvania, yielding 60,000 barrels of oil a day. It requires 5,000 miles of pipe line and 1,600 iron tanks of an average capacity of 25,000 barrels each to transport and store the oil and surplus stocks. There are now nearly 38,000,000 barrels stored in the oil region tanks.

Besides the 5,000 miles of pipe line in use in that region, there are in operation 1,200 miles of trunk pipe lines connecting the region with Cleveland, Pittsburg, Buffalo, and New York, and lines building to Philadelphia and Baltimore. In the line between Olean and New York 16,000 barrels of oil are transported daily. These are all the property of the Standard Oil Company, except one between Bradford and Williamsport, Pennsylvania. The Standard employs 100,000 men. The products of its refineries require the making of 25,000 oak barrels of 40 gallons each, and 100,000 tin cans holding 5 gallons each, every day. The money actually invested in petroleum production since 1860 is estimated to be more than $425,000,000, of which $200,000,000 was capital from New York city. Since 1880 more than $12,000,000 has been used in building iron tanks, and nearly as much in pipe lines, all by one corporation. The tanks cost on an average $8,000 each. A 35,000 barrel tank is 90 feet in diameter and 28 feet high. The lowest price ever brought by crude petroleum was 10 cents a barrel in 1861. In 1859, when there was only one well in existence, Colonel Drake's "Pioneer" at Titusville, the price was $24 a barrel. The value of crude petroleum delivered in London is now 6⅛d. per gallon (a fraction over 1*l.* or $5 per barrel, containing, on an average, 40 gallons).

AN ENGLISH WOLF.

Concerning the animal depicted in our engraving, which has aroused much interest among naturalists and others, Mr. A. D. Bartlett, the Superintendent of the Zoological Society's Gardens, Regent's Park, writes thus: "The prairie wolf now being exhibited in these gardens was presented by Mr. R. Payze, of Leytonstone, who says he bought the animal about a year ago. It was then a very small cub; it was one of three that had been taken in Epping Forest by some farm laborers, Mr. Payze believing at the time that it was a fox cub. Its subsequent growth, however, caused him to suspect that it was not a fox, and as it became troublesome on account of its destructive habits, notwithstanding that it had been reared perfectly tame, he decided to get rid of it, and accordingly presented it to this Society. Inquiry is now being instituted with a view to ascertain, if possible, the manner in which the parents had been introduced into that part of the country. It is said that, some years ago, some foreign cubs, supposed to be foxes, were turned out in the neighborhood of Epping Forest."—*London Graphic.*



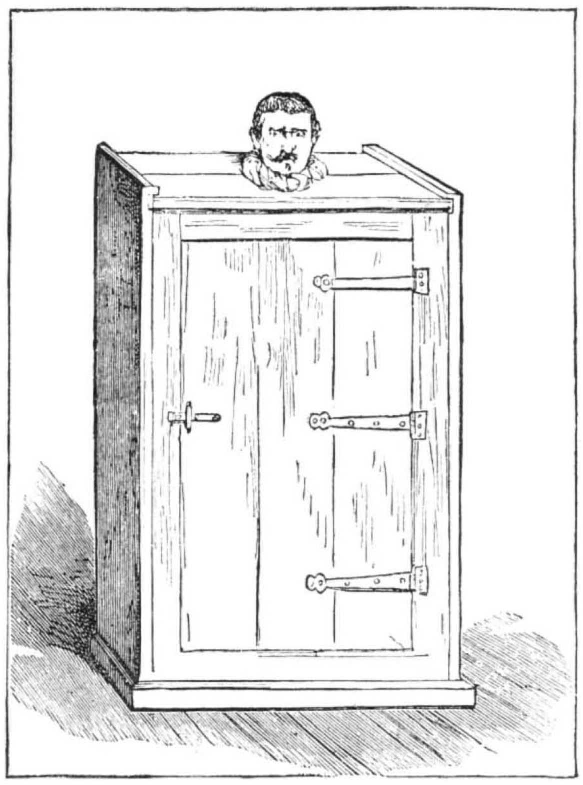
A PRAIRIE WOLF, CAUGHT IN EPPING FOREST.

A Sea Atmosphere for the Sick Room.

The solution to be used and diffused as spray consisted of solution of peroxide of hydrogen (10 volumes strength) containing 1 per cent of ozonic ether, iodine to saturation, and 2·50 per cent of sea salt. The solution placed in a steam or hand spray diffuser can be distributed in the finest spray in the sick room at the rate of two fluid ounces in a quarter of an hour. It communicates a pleasant sea odor, and is the best purifier of the air of the sick room I have ever used. It is a powerful disinfectant as well as deodorizer, acting briskly on ozonized test solutions and papers. Mr. Carl R. Schomberg has recently invented a large spray producer, which will diffuse the artificial sea air through a hospital ward.—*B. W. Richardson, M.D.*

FUMIGATING PASSENGERS FOR CHOLERA.

Those persons whom business takes to the infected districts of Southern France—for few are likely to resort thither for pleasure at the present time—will be glad to learn that the fumigation system at the Marseilles and Toulon railway stations has been abolished as useless and vexatious. This disagreeable ordeal was in full force at Avignon early in July, as is shown by this sketch by Mr. E. Prioleau Warren, A.R.I.B.A., who, with other unfortunates, was



CHOLERA FUMIGATING BOX.

exposed for a quarter of an hour to the fumes of strong carbolic acid.

In Geneva, according to another correspondent, Mr. Thomas Howie, still more stringent precautions are adopted. The suspected person is placed in a box about six feet high, and in which he stands upright, with only his head outside, a towel being wrapped round his neck. The process occupies from three to four minutes, and the disinfectants used are chloride of lime and carbolic acid. The top piece of the box is made to slide in, and is removed when the process is completed by simply pulling outward. While the sliding board is being removed, the towel comes in handily as a respirator.—*London Graphic.*

Manufacture of Aluminum.

Heretofore aluminum has always been made by treating its chloride with metallic sodium as a reducing agent. But the great trouble in handling this material, and its very high cost, have made such a process difficult and expensive—the price of aluminum at present being higher per ounce troy than silver. This has limited its uses and its manufacture in commercial quantities to the sole factory in Paris, France.

William Frishmuth, a German chemist, living in Philadelphia, and a pupil of Woehler, who discovered aluminum, has been working for twenty-eight years to solve the problem of making cheap aluminum in commercial quantities. Within the past few years, he has discovered and secured patents throughout most of the civilized world, for a process that now produces aluminum in a commercial way at one-third the cost of any other, with almost a certainty of being reduced to $1.25 per pound avoirdupois when worked in a large plant, with proper technical and practical management, ample capital, and perfected mechanical and chemical means.

Instead of using metallic sodium as before mentioned, he uses a vapor, produced or generated in a suitable vessel from a mixture of sodium carbonate, or other suitable compound of sodium, and carbon or other reducing agent. And this sodium vapor, not metallic sodium, as used in the Deville process, is made to react in various ways upon the aluminous materials to produce aluminum. Therefore, the economy of the proved Frishmuth process is about as follows, estimated for illustration on a theoretical basis: The manufacture of 20 pounds of aluminum requires 115 pounds of sodium carbonate, at a cent a pound, or 50 pounds metallic sodium at from $2.50 to $3.50 a pound. Therefore, one pound of aluminum requires, by the Deville process, 2½ pounds metallic sodium, costing from $6.25 to $8.75; or by the Frishmuth process, 6 pounds sodium carbonate, costing say 6 cents. Practical operations are said to increase the quantities by the Deville process to from 3 to 4 pounds of metallic sodium, and by the Frishmuth process to say 12 pounds sodium carbonate.

Both Deville and Frishmuth have to use the double chloride of aluminum and sodium, although Frishmuth has a patent for his successful use of the double fluoride of aluminum and sodium in making aluminum. This is another great item of cost in making this metal. But Frishmuth has made improvements in making the double chloride of aluminum and sodium that reduce its cost to a few cents a pound, and consequently that of the metal. As this double chloride is the cheapest of a few known chemical substances used in making aluminum cheaply and in commercial quantities by chemical or electrical processes, the saving in cost, through such discovery by Frishmuth, in making this metal, will be very great, and almost as much as by the use of his sodium mixture in place of metallic sodium.

On account of the use of sodium and chloride, the wear and tear on retorts, crucibles, and apparatus is usually great. But in the apparatus now used in Philadelphia, designed by Frishmuth, this item of cost is much reduced, and will be further reduced when heated by Wilson producer gas instead of coke.

The metal is superior in quality to the French, being purer and whiter. Its specific gravity is 2·73. It has been tested in New York, London, and Paris, in a commercial way, and can be sold at the market price. All manufacture has been in the experimental and developing way, and Frishmuth has sold metal thus made to the extent of many thousands of ounces. Recently he made in a few days several ingots of 40 ounces Troy each, the quality of which was severely tested.

The use of the metal will increase as the price decreases, and when sold eventually, say, at 30 cents an ounce, the consumption here and in Europe should be 120,000 ounces troy a day. It has greatest value as an alloy, especially with silver and copper, as it gives a non-tarnishing and noncorrosive quality to such metals, and greatly increases the tensile strength. Aluminum bronze is made by alloying 10 pounds of aluminum with 90 pounds of copper, and has a tensile strength of three tons per square inch more than Bessemer steel. Frishmuth has invented a solder for aluminum that welds the metal with itself or with copper, tin, lead, and iron. The color is the same as the metal. This will greatly increase the use of the metal, and is of great benefit to the arts and industries.

Hay Fever.

This is the period for hay fever, a malady from which many suffer, and which admits of few methods of relief not embodying change of altitude or climate. Dr. W. T. Phillips, of Andover, recommends belladonna—one and one-fourth minims of the succus every hour until relieved (30 m. to 3 ounces of water, teaspoonful dose). Dr. G. E. Dobbson, in the *Lancet*, has had satisfactory success by the inhalation of the vapor of camphor and steam, made to come in contact with the outer surface of the face about the nose by means of a paper cone, placed with the large end downward in a vessel containing hot water and a drachm of coarsely powdered or shredded camphor. He asserts most positively that if this procedure is continued for 20 minutes, and repeated 3 or 4 times in as many hours, great and usually permanent relief follows.

CAPT. WILLIAM LUND, of the Hawaiian brig Dora, lately presented to the Academy of Sciences, San Francisco, a collection of water snakes found ten miles at sea; also a live *Illama*, 12 feet long, or species of boa constrictor, found by him on Tres Marias Island.

Brief History of Electric and Magnetic Locomotion.

BY E. M. BENTLEY.

The electric motor was invented over fifty years ago, and has been in extensive use ever since. The first inventor is a matter of some dispute, but the invention follows very naturally from the investigations in electro-magnetism made by Professor Henry about 1830.

Probably the first motor giving direct rotary motion was made by Sturgeon in 1832. A number of others soon followed, but the one attracting the most attention, and on which great hopes were based, was invented by Thomas Davenport, of Brandon, Vt., and was fully described in the *American Journal of Science and Arts* for April, 1837. Of his experiments it was said, "One of the machines with a motive wheel only seven inches in diameter has been attached to a turning lathe, and moves it with astonishing strength compared with the small size of the propelling engine."

We also find the following financial appeal, which to the stock sellers of the present day must seem an example of untutored simplicity: "For the purpose of raising funds to carry on experiments, etc., a joint stock association has been formed in New York, of which Mr. Edwin Williams, No. 76 Cedar Street, is agent. By this arrangement, the principal interests of the patent for the United States and Europe being placed in a stock of three thousand shares, the proprietors offer an opportunity to public spirited individuals to become associated with them in the enterprise, which it is hoped for the benefit of mankind may be successful."

Another electric motor attracting wide attention about that time was invented by Prof. Charles G. Page, of Washington, D. C. An account of this motor and its application to locomotive purposes was given in a lecture delivered by the inventor in New York, and printed in the SCIENTIFIC AMERICAN of November 15, 1851. At that early date electric motors were successfully applied to locomotion, both on land and water. In April, 1837, Sturgeon announced his having succeeded in propelling a boat, and also a locomotive carriage, by electro magnetism—see "Sturgeon's Annals of Electricity," vol. i., page 250. In the same publication for October, 1840, are given a cut and description of the electric locomotive of Uriah Clark, of Leicester, England, which was run for two months on a circular track at the Leicester Exhibition of that year. Davenport, whose motor was mentioned above, ran a locomotive in 1842 on a railway near Glasgow. This locomotive, which is described in the lecture by Professor Page, above cited, weighed five tons, and developed one horse power, attaining a speed of four miles an hour. In this country, about the same time, Professor Page obtained an appropriation from Congress to aid in experiments on this subject, and constructed a locomotive which traveled from Washington to Bladensburg on the Baltimore and Ohio Railroad.

In electric locomotion by water, the most successful inventor was Professor Jacobi, who, in 1839, propelled a boat by electricity on the Neva.

The following very interesting letter from Jacobi to Faraday is found in the *Mechanics' Journal*, 1839, vol. xxxii., page 64:

"During the past autumn, and at a season already too far advanced, I made, as you perhaps have learned from the gazettes, the first experiments in navigation on the Neva, with a ten oared shallop furnished with paddle wheels, which were put into motion by an electro-magnetic engine. Although we journeyed during entire days, and usually with ten or twelve persons on board, I was not well satisfied with this first trial; for there were so many faults of construction and want of insulation in machines and batteries, which could not be repaired on the spot, that I was terribly annoyed. All these repairs and important changes being accomplished, the experiments will shortly be recommenced. If Heaven preserve my health, which is a little affected by continual labors, I hope that within a year from this time I shall have equipped an electro-magnetic vessel of from forty to fifty horse power."

In all the inventions I have described the source of electricity was a galvanic battery carried by the locomotive itself; but others used a stationary generator, and conducted the electricity to the propelling motor by means of conductors laid along the track or by the rails themselves. Mr. Pinkers, an Englishman, invented, in 1840, an electric railway of this description; from his stationary source of supply the current was led to his moving locomotive by two copper conductors, which were fastened to a beam of insulating material laid between the rails; two sliding blocks of copper depended from the locomotive and rested in contact with the two conductors respectively, and from thence to the two blocks the current passed to the propelling motor on the train. Mr. Pinkers' electric railway is fully described in his English patent, No. 8,644, of 1840. A railway of this kind is described in the *Mechanics' Magazine* for 1847, vol. xlvii., page 559. It was invented by Messrs. Lilly & Colton, of Pittsburg, Pa. In the description it is said: "The power is applied, not to the locomotive, but to the track, and herein consists the novelty of the invention or discovery. Two currents of electricity, positive and negative, are applied to the rails, and from thence communicate with the engine. The latter is provided with two magnets, which, by a process of attraction and repulsion, drive the car over the track. Heretofore the propelling power has been used on the car itself; in this instance, however, the power is in the rails, and an engineer may remain in one town and with his battery send a locomotive and train to any distance required." Of a later date is the railway of Bellet and De Rouvre, described in an English patent of 1864, No. 2,681, in which two wires are stretched beneath the car to convey the current to the locomotive; also that of Hallez de Arros, of Nancy, France, in 1873, in which the inventor in his patent says, after describing his locomotive: "The battery or source of electrical power may be mounted on the carriage, as above described, or it might be fixed in position and the electrical current might be transmitted by conductors laid along the rails, or by the rails themselves."

In the railway invented by Mr. W. H. Knight and myself, which has recently gone into practical operation in Cleveland, in connection with the Brush system, we make no extravagant claims to be the first persons to whom the idea of electric locomotion has come, but we do claim that we have taken up only devices which are free as air to every inventor, and by inventions of the utmost importance have rendered electric railways a practical success.

Water Power for Cities.

In London the plan of distributing water power in pipes for manufacturing purposes, running lathes, elevators, etc., is now in successful operation. The franchise is owned by the General Hydraulic Power Company. The water is taken from the Thames, filtered through sponge filters, then forced through the pipes by steam power. There is a pressure of 700 pounds to the inch in the mains. The mains, which now measure in the aggregate seven or eight miles, are cast iron pipes 6 inches in diameter. They are cast in 9 foot lengths, and are tested to 2,500 pounds per square inch at the works. The joints are turned and bored spigots and sockets, and are made tight with gutta percha rings, the necessary pressure being obtained by two 1¼ inch bolts passing through lugs on each pipe. As each section is laid, the water is admitted to test the joints; and after that, if they are tight, very little more trouble is experienced. Stop valves are inserted every 400 or 500 yards, and by their aid the position of a leak can be located within that distance, after which it is easily found.

The financial success of the company is no longer a matter of doubt. Since January 1 of the present year the amount of water delivered has increased 40 per cent, and would be much greater if all the intended consumers had their machinery in place. The charges for power are based upon a minimum payment of 25s. per quarter for each machine, and a sliding scale for the water, which is measured by meter as it is exhausted. The following is the scale of prices:

					£	s.	d.
					Per Machine.		
Under	3,000 gals. per quarter				1	5	0
					Per 1000 gals.		
Above	3,000 "	not exceeding		5,000 gals.	0	8	0
"	5,000 "	"	"	10,000 "	0	7	0
"	10,000 "	"	"	20,000 "	0	6	0
"	20,000 "	"	"	50,000 "	0	5	0
"	50,000 "	"	"	100,000 "	0	4	0
"	100,000 "	"	"	200,000 "	0	3	0
"	200,000 by special terms.						

In many cases the cost of lifting by the company's power is as low as one halfpenny per ton lifted 50 feet high.

The Philadelphia Electrical Exhibition.

The arrangements seem to be in a promising state of forwardness for the prompt opening of this exhibition as designed, on Sept. 2. The main building has been completed, and the former Pennsylvania passenger depot is to be used as an annex. Twelve engines, of the combined capacity of 1,800 horse power, will run the dynamos which will brilliantly illuminate the buildings and grounds. There will be 5,600 incandescent lights, Edison furnishing one dynamo larger than any heretofore constructed, and capable of producing electricity to supply 2,000 lights. A part of the exterior illumination will be furnished by a monster arc light of 100,000 candle power. A conspicuous feature is to be an electrical fountain, the water jets and spray from which are to be gorgeously illuminated by rays of colored electric light thrown from invisible points, and controlled by cunningly devised optical apparatus.

It is expected that there will be in all about three hundred exhibitors, the great electric light companies being very completely represented. In the schedule prepared there are five classes of apparatus for the *production* of electricity. Electric *conductors* alone require seven classes, and each of these classes will have many exhibits. The most delicate and beautiful apparatus for making *measurements* of electricity and its different properties will be shown under four classes. The *practical* application of electricity covers two sections, one embracing apparatus requiring electric currents of low power, and the other currents of high power. Under the former section come electric telegraphs, telephones, microphones, etc., fire and burglar alarms, annunciators, electric clocks and time telegraphs, electric registering and signal apparatus, applications of electricity to dentistry, to warfare, to mining and blasting, to spinning and weaving, to traps and snares, to pneumatic apparatus, to musical instruments, to writing and printing, to conjuring apparatus and to toys. Currents of high power will be shown as used in electric illumination, in electro-metallurgy, and other chemical applications, in storage batteries, in the transmission of power to electric motors, and in magnetic brakes. Other sections of the exhibition will be devoted to atmospheric electricity, terrestrial magnetism, etc., historical apparatus, and books on the general subject.

The Franklin Institute, which is carrying out the exhibition, has decided that no awards or premiums shall be given, but in place thereof a report to the Institute will be prepared by a Board of Examiners, which report will be as full as the time and opportunity will permit. Exhibitors are requested to give, at the time of the opening of the exhibition, detailed descriptions of their exhibits, addressed to the Board of Examiners, describing the merits of each exhibit as understood by the exhibitor. If any of the exhibitors desire expert examination or competitive tests of their displays, such tests will be conducted by the Institute to the extent practicable in the time, provided the cost of the materials and instruments used be borne by the exhibitors desiring the test. The Institute reserves the right to enter into such other scientific work touching the exhibition (not requested by the exhibitors) as in its judgment may tend to the advancement of science. The examiners shall be appointed by the Board of Managers, and shall be men of acknowledged integrity, skill, and experience in the class of goods assigned to them. All parties making application for tests thereby bind themselves to acquiesce, without appeal, in the results of the tests.

The English Government has taken official action, and has detailed Lieutenant Chisholm Batten, of the Royal Navy, to attend, and, after a careful study of all its features and developments, to make a report to his government. The Royal Society of England will be represented by John Hopkinson, M.D., F.R.S.; V. H. Preece, C.E., F.R.S.; Lord Rayleigh, D.C.L., F.R.S.; and Prof. Sir William Thomson, LL.D., F.R.S.; and the French Academy will send a representative, as will also France and the other Continental Governments; the Canadian Royal Society and the Republic of Mexico, and nearly every one of the North and South American Governments will send commissioners.

The United States Government has not been backward in lending its aid to the exhibition, and has appropriated $7,500 for the expenses of a Commission to provide for an international conference of electricians to be held during the continuation of the exhibition. The Commission was authorized to invite scientific men, native and foreign, to participate in its labors, and power was given it to determine the scope and character of its work. The members are to serve without compensation. In accordance with this act the President named eleven Commissioners as follows: Professor H. A. Rowland, Johns Hopkins University; John Trowbridge, of Harvard College; George F. Barker, University of Pennsylvania; M. B. Snyder, High School Observatory, Philadelphia; J. Willard Gibbs, Yale College; Simon Newcomb, *Nautical Almanac;* Edwin J. Houston, Philadelphia Central High School; Charles A. Young, Princeton College; Dr. W. H. Wahl, Franklin Institute, Philadelphia; F. C. Vandyck, of Rutgers College; and C. F. Brackett, of Princeton. This Commission has chosen Prof. H. A. Rowland, of Johns Hopkins University, President; Professor M. B. Snyder, of Philadelphia, Recording Secretary; Professor G. F. Barker, Corresponding Secretary; and the following Executive Committee: Professors Rowland, Snyder, Barker, Dr. W. H. Wahl, and Professor Simon Newcomb.

During the progress of the exhibition there will be held in Philadelphia meetings of the American Association for the Advancement of Science and the American Institute of Mining Engineers, and it is known that many members of the British Association, holding its meeting this year in Montreal, will be present as guests of American scientists. The topics to be discussed in the electrical conference are informally announced as follows: The sources of electrical energy; the theoretical conditions necessary to the most efficient construction of the dynamo-electric machine for the various purposes of practical work, the electrical transmission of energy; the systems of arc and incandescent lighting; the theory of the electric arc, storage batteries, electro-metallurgy; lighthouses for the coast; applications of electricity to military and mining engineering; lightning protection; induction in telephone lines, and the problem of long distance telephoning; the question of underground wires; atmospheric electricity; earth currents and terrestrial magnetism; photometry and standards for photometric measurements, the ratio of the electro-magnetic to the electro-static system of units and the electro-magnetic theory of light, and, finally, on account of the pressing necessity for accurate and uniform electrical measurements, it is probable that the question of establishing a National Bureau of Physical Standards will receive proper attention.

Three grand receptions will be given during the time of the exhibition, one at the Academy of Music on Sept. 5, one at the Academy of Fine Arts, and a third at Haverford College.

Poisonous Postal Notes.

The Post Office Department is issuing a new style of postal note. It is of the same size as the old one, but differs in color and in the method of indicating the number of dollars to be paid. The old one was made of bright yellow paper, with a broad design on the back printed in green. The amount to be paid was indicated by punching figures in the margin. The new one is made of paper of a faded lilac color, and is printed in black on the face and blue on the back. The number of dollars is indicated by the number of stubs attached to it after it is torn from the book.

The chief reason for making the change was the poisonous character of the ink on the back of the old notes.

ENGINEERING INVENTIONS.

A hydraulic thrust block for propeller shafts has been patented by Mr. William Cousins, of New York city. It is constructed with a piston attached to the shaft, in a cylinder supplied at both ends with water by a force pump through pipes with valves opened by the movement of the piston, so the thrust of the shaft will be sustained by a water cushion, the escape of water around the shaft being prevented at each end of the cylinder by packing rings.

A steam boiler has been patented by Mr. Benjamin F. Wright, of Oneida, Kansas. This invention covers a special construction of boiler in which a cylindrical fire box is entirely surrounded by water, and the gases, smoke, and heated air from the fire are driven directly through the water in the boiler without the aid of flues, the object being to prevent the escape and loss of heat, and secure a higher degree of economy in combustion, while preventing sparks.

An adjustable crank shaft has been patented by Mr. Edward Barrath, of Brooklyn, N. Y. The shaft sections have upon their adjacent ends heads with eccentric female screws having different diameters and reverse screw threads, the male screws having oblong openings to receive the ends of the crank, the screws having exterior and interior screw threads to screw into the female screws of the heads, and upon the ends of the crank, and the crank having oblong ends and male screw threads, so the crank can be readily adjusted and will be securely held.

MECHANICAL INVENTIONS.

A nut lock has been patented by Mr. Jacob C. McAfee, of Dallas, West Va. The invention consists in making the recess for the threaded block entirely through the nut, and the threaded block of the same thickness as the nut, and combining with it a wedge which is driven in behind the block.

An oil cup has been patented by Messrs. Edward Mancort and Charles Thirion, of New York city. A diagonal passage is provided for, with a spindle set in line therewith, with other novel features, to prevent all varying of the flow after the spindle is once properly set to secure the desired feed of oil.

A means for connecting loom shuttle binders to shuttle boxes has been patented by Mr. Luman D. Bennett, of Jewett City, Conn. This invention provides a simple and efficient detachable joint, which allows of the binder being readily taken out or replaced, and in which the binder pivot shall be locked or held securely in its eye or socket when the binder is in its working position.

A chest for tools has been patented by Mr. John F. Zimmerman, of Washington Center, Mo. In combination with a chest and its lid is a series of trays, connected with each other and with the chest and its lid, so that when the lid of the chest is swung up and back the trays will be swung up and backward; a hinged front is also provided for, on the back of which a box is formed, so connected with the trays that it swings out when the trays swing up.

A clutch has been patented by Mr. Edward Barrath, of Brooklyn, N. Y. It is designed for presses and other machinery, and is especially for use where the clutches are to work both ways, the clutch bar being placed in a groove in a shaft and in recesses in collars attached to the shaft, pivoted at its ends to a link and lever, and connected at one end with a spiral spring to raise it into gear with the grooved pulley hub, with other novel features.

AGRICULTURAL INVENTIONS.

A cane planting machine has been patented by Mr. Charles Coleman, of Honolulu, Oahu, Sandwich Islands. This invention covers an improvement on a former patent issued to the same inventor, simplifying the construction of the machine, and rendering it more reliable in operation.

A reaper attachment for traction engines has been patented by Mr. William Kimmel, of Cambridge City, Ind. This invention covers a novel construction whereby a traction engine and one or more self-binding reapers are adapted to work together, the engine furnishing the power to work the reapers.

A grain cleaner has been patented by Mr. Bertrand Scott, of Keyser, W. Va. The machine is compact and simple in construction, and is for taking off the fuzz or beard from the small ends of grains of wheat, removing all dust and impurities from the grain, thoroughly scouring it, and polishing and cleaning without crushing or breaking it.

A land furrower and roller has been patented by Messrs. David, Levi S., and Thomas T. Holdaway, of Provo City, Utah Ter. The invention combines with the draught bar or pole and the plows, diverging arms, having their forward ends pivoted to the draught bar or pole, and with bearings at their rear ends, with a roller journaled in the bearings.

A harrow has been patented by Mr. Chas. P. Snow, of Lanark, Ill. Combined with the main frame is a sliding frame and swinging teeth, bent at their upper ends to form pivots, the bearings being secured to the sliding frame, and having apertures with upper and lower flared surfaces, and means for adjusting the sliding frame.

A combined harrow and cultivator has been patented by Mr. John R. Dunlap, of Sherman, Ill. The side beams have harrow teeth, and are secured at a little distance from their forward end to a cross bar, in such position that their forward ends will be at a little distance from each other, so the plants can pass between the ends, and there are other novel features.

A self-clearing revolving beam harrow has been patented by Mr. John D. Winters, of Davisville, Cal. It has a lower frame with rotating beams with teeth upon their opposite sides, and with cross rods at right angles with the teeth, and an upper frame with cross bars connected with the lower frame by hinged bars and a bail and lever, so the tooth beams can be allowed to rotate to clear the teeth of rubbish.

A horse hay rake has been patented by Mr. Adolphus W. Stevenson, of Troy, O. The draught frame and rake head are hinged to each other, and the seat standard is attached to a bar or other suitable device hinged at its forward end to the draught frame, and so connected at its rear end with the rake head that the driver's weight will assist in tilting the rake, and the rake head will be relieved of the strain of a downward impulse upon the seat bar, with other novel features.

MISCELLANEOUS INVENTIONS.

A plaque has been patented by Stella A. Jackson, of New York city. It is of glass, with a transparent spot in the center on which to mount a picture, the remainder of the plaque being frosted or made in imitation of porcelain by grinding, or by grinding and painting.

A scarf has been patented by Mr. George Lennig, of New York city. It consists of an embossed leather front, with stiffening and lining, making a scarf which is simple and durable, will readily take any desired shape, will retain its color, and can be readily cleaned when soiled.

A basin trap cleaner has been patented by Mr. James E. Kelsey, of Brooklyn, N. Y. The invention provides for a flexible pipe, with a hollow tapering stopper at one end, so the waste pipe and faucet may be connected, and the clearer is adapted also to be applied to basins with large or small outlets.

A combined satchel and pillow has been patented by Mr. Benjamin Kiam, of Houston, Texas. This invention combines with a valise or satchel an air bag permanently incorporated therewith to form one of its sides, and having a mouthpiece upon the exterior, so the bag can be inflated without opening the valise.

A buckle has been patented by Mr. Albert H. Mantey, of Mound City, Kansas. The buckle has a sliding tongue plate held in a slot or passage made through the lower cross piece of the buckle frame, and the tongue plate is curved to facilitate the insertion and removal of the tongue from the strap, with other novel features.

A bushing for sheaves has been patented by Mr. Willard F. Wellman, of Belfast, Me. This invention relates more especially to roller bushings for the sheaves of ships' blocks, and provides for such construction as to do away with the friction of the bearing rollers upon each other and upon the pintle of the sheave.

A rope reel has been patented by Mr. Ephraim M. Bishop, of Olive Bridge, N. Y. This invention provides a new and improved spool on which coils or balls of rope or cord of various sizes may be held, doing away with the necessity of rewinding when it comes from the manufacturer, before being sold by the dealer.

A flying target has been patented by Messrs. Elmer and Howard Ridge, of Philadelphia, Pa. It is formed of a flat ring in which a bulb is held which can be inflated to give the target body, the bulb being secured to the inner end of a tube passed radially through the ring, and retained by wires or bands pivoted in the ring.

A quilting attachment for sewing machines has been patented by Mr. William G. Humphreys, of Seneca, S. C. This invention covers a novel arrangement and construction of parts, the frame being moved backward and forward as the work progresses, and the goods shifted by rolling and unrolling rollers, being all the time kept taut edgewise and lengthwise.

A cant hook has been patented by Mr. Geo. W. Lord, of Bloomington, Pa. This invention covers novel constructions of the hook proper and joint portion of the clip to which it is pivoted, so the hook is prevented from falling unduly forward or moving unduly back, and thus is always kept within a convenient range of motion for its work, with other novel features.

A windmill has been patented by Mr. Merritt W. Palmer, of Holland, Mich. This invention relates to self-regulating windmills, where two rock shafts, with steering vanes, are mounted on a wheel frame, and geared together at right angles, made to throw the wheel more or less edgewise to the wind about a vertical axis in proportion to the strength of the wind.

A gate has been patented by Mr. John A. Anderson, of Hepburn, Iowa. It is made with longitudinal and cross bars connected by pivots, with a sliding latch having recesses in its lower edge to engage with a pin attached to a pair of the cross bars, and connected with the lower part of the gate by inclined bars, so the gate can be raised and lowered, and will be held in place when adjusted.

A shelf for exhibiting goods has been patented by Mr. Norman Robertson, of Kincardine, Ontario, Canada. The invention consists in the combination, with a shelf, of one or more eccentric V-shaped clamps pivoted to the under side of the shelf, between which clamp and the next lower shelf the goods are held, it being convenient to hold the goods by one or more clamps according to size.

A sash fastener has been patented by Mr. John McPherson Lowrey, of Jonesborough, Ga. A sash lock is formed of two metal strips crossed and pivoted to each other out of the middle, provided at their ends with jaws, of which those on the short ends have smooth edges and those on the long ends serrated edges, making a detachable device for holding and locking window sashes in any desired position.

A wick trimmer has been patented by Mr. Robert Hoffman, of Cohoes, N. Y. This invention covers an improvement in addition to a former invention of the same patentee, whereby a wick trimmer is combined with a clamping frame for pressing and holding the wick to the edge of levers or blades of the wick trimmer, for trimming lamp wicks which are to have their upper ends rounded.

A combined wagon jack and tire tightener has been patented by Mr. Melzar W. Coon, of Walla Walla, Washington Ter. A chain lever is mounted between two standards, and connected by a chain with a sliding block placed between the standards, and provided with a pawl of engaging ratchet teeth formed on the back of the standards, to lift and expand the wheel in the tire without resetting the latter.

A thermostat has been patented by Messrs. Willey J. P. and George L. Kingsley, of Rome, N. Y. This invention relates to the class of thermostats where metals of different coefficients of expansion are employed to operate an electric circuit, being designed for use where changes of temperature are only slight, and being capable of adjustment by a screw to the required temperature; it may also be used in connection with mechanical devices.

A nut lock has been patented by Mr. Gwilym Bowen, of Murphysborough, Ill. The washer has curved grooves with inclined ends, so that when a locking pin is forced through one of the grooves its ends will be bent outward beyond the face of the washer; when the pin is properly driven into place both ends will project beyond the face of the washer, when they may be struck a light blow and bent against the nut.

A sash cord fastener has been patented by Mr. Frederick S. Heiser, of Brooklyn, N. Y. The invention consists in a rod or plate adapted to be held in the side bar of a sash, with means for fastening the cord or chain near its lower end, and of such length that in any position of the sash the cord will be free to pass over the pulley, and so the plate or rod can be withdrawn from the top of the sash, and the balance cord secured without removing the sash from its frame.

A clasp, for use as a stocking supporter, skirt and sleeve adjuster, etc., has been patented by Mr. Henry Binley, of Albany, N. Y. The clasp comprises a book with a tongue pivoted at one end, and having a bifurcated or forked end; in attaching the clasp the fabric is placed in the hook in a doubled condition, and the tongue then closed down upon it, so the material is caught and wedged between the end of the tongue and the body.

A ship's log has been patented by Mr. David Carroll, of Union City, Pa. The invention covers a contrivance for setting the wheels in the line of the well, for passing them through a well of small size, and afterward swinging them up horizontally and into position in advance of the supporting rod, to enable the water to act on them in advance of any disturbing effect of the supporting rod, the forward and leeway motions of the ship being indicated by pointers.

An artificial stone vessel has been patented by Mr. Alexander S. Johnson, of New York city. This invention relates more particularly to stone wash tubs, and provides a metallic lining therefor, for protecting the bottom and side walls, and also a method of making a water tight joint between the lining and the walls of the vessel, by moulding the vessel upon its lining, or with a groove upon the inside, into which the edges of the lining may be worked by a tool and cemented.

An improvement in barrels, tubs, pails, etc., has been patented by Mr. James W. Weston, of New York city. The invention consists in a combination of tapering or wedge shaped keys with each other and with a separated head section, with an inner support or follower, affording a novel means of securing the heads on barrels, etc., and allowing of their ready opening and closing without removing the hoops around the chine when removing the head.

A combined burglar alarm and door bell has been patented by Mr. Eugene B. Travis, of Peekskill, N. Y. The invention consists in two parallel plates with lever hammers and their springs and stops, in connection with a bell, a collar on a knob spindle having spring pressed pawls, so that an alarm will be sounded when the knob is turned, whether the door be fastened or not, and whether attached to a door or anything else.

A wick trimmer has been patented by Mr. Robert Hoffman, of Cohoes, N. Y. It combines two levers, one having a flat plate formed on one end, with a curved recess in its under side at the inner edge, and with a flange along the outer edge on the upper surface, the other lever having a plate on its end fitting on the curved part of the other plate, making a trimmer that is very simple in construction and one that need not always be held in exactly the same position.

An electric wire insulator has been patented by Mr. George W. Prince, of Brooklyn, N. Y. The insulator is formed with a special perforation and slots in its upper part, and upwardly inclined grooves in its lower part, whereby the electric wire can be readily inserted and secured in the insulator, and the wire and insulator will not be liable to become disconnected even if the insulator should be detached from its supporting pin.

A washing machine has been patented by Mr. Paul Maisonneuve, of Chicago, Ill. It is constructed with corrugated staves connected with each other and with a top cross bar by open annular rods and bolts, with an adjustable base bar to regulate the height and a rotary bottom with radial semicylindrical corrugated cleats, and rotated by shafts and gear wheels, the machine in use being placed in and secured to a wash tub.

A nut lock has been patented by Messrs. Isaac D. Weaver and Christian G. Singer, of Lebanon, Pa. The invention consists in a plate with apertures for nuts, and with a spring on the front of the plate having at its free end an aperture and with a flange, the plate being placed on the fish plate and over the nuts, or over some and against others of the nuts, one of the bolts being passed through the aperture in the spring strip, the device being specially adapted for locking nuts on rails.

A quilting machine has been patented by Mr. Evans Wood, of Lyons Station, Krohne P. O., Texas. Combined with a needle frame adapted to carry a series of needles is a feed plate, eccentric shaft, rock shaft, and various special features of construction, it being designed to operate the machine at the rear of a cotton condenser of a cotton gin, so that the thick bat of cotton as it issues from the condenser may be fed between the upper and lower webs of cloth used for making the quilt.

Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or mail, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) P. C. A.—Of what is pewter composed? I want a metal cheap, capable of making fine castings, of being run in steel moulds, not subject to rust, or that may be galvanized. A. Pewter is four parts tin and one part lead. The metal that answers your requirements is zinc (spelter). It will not rust, and does not require galvanizing. Very fine castings can be made from it. It flows easily. The metal mould should be warm

(2) B. F. C. wants a good recipe for making soldering fluid for soft soldering jewelry; something that will not rust his tools. A. Dissolve sheet zinc in muriatic acid until the acid will take up no more zinc. Turn off the clear liquid and dilute it with alcohol instead of water. When diluted with water it must retain acid enough to rust, but with alcohol the dilution can go on until the acid is not perceptible to the tongue.

(3) P. J. D. says he wants to blue the "tops" of skates, probably the sheet of steel on which the foot rests. All bluing is done, after polishing, simply by heating. The polished article is laid in a bath of hot sand or ashes until it turns blue. Then let it cool in the air or cool it in water. If the article is of steel and has been hardened, the bluing will bring it to a spring temper—that of saw blades and case knives and wood firmer chisels. You can harden the bottom edge of skate runners, without springing or cracking, by heating them in the red hot lead bath and chilling in water. The edge, only, of the skate runner needs to be made red hot.

(4) J. W. P. asks: 1. What is the greatest engine piston speed recorded? A. In locomotive practice the piston speed will sometimes run from 1,400 to 1,600 feet per minute, though we do not know of any record of the absolute highest speed. 2. I see an old idea revived in Europe for propelling boats by forcing water through a tunnel parallel to the keel, or rather forcing boat over water in tunnel. Is it practicable? If not, why? A. This idea has been tried by many, and so far has failed to prove as economical as the other accepted methods of boat propulsion.

(5) C. R. B.—The best way to tin old copper utensils is to thoroughly clean them with sand and oxalic acid, and tin with a large copper soldering iron, using muriate of zinc and salammoniac (soldering fluid) for flowing the tin. It can also be done by heating the vessel and flushing melted tin over the surface, first sprinkling the surface with powdered resin. You may succeed in this after a few trials.

(6) E. A. C. writes: I wish to construct an apparatus to level between points a few feet apart (say 12 feet or less) where a common level cannot be used on account of intermediate obstructions. To do this I propose to use two glass hollow tubes ¼ inch diameter, say 3 inches or 4 inches long, each one to set in stand of metal, and each to have a scale marked on same; then connect the two stands by rubber tube, and fill with some liquid. Now, what I wish to know is, what liquid can I use that will show level on its surface in the tube, and not concave like water? Mercury would do, I suppose, only, being so heavy, it would be bad to handle in a rubber tube 10 feet or 10 feet long. Can you suggest anything? A. The device you describe is already in use. Use water with glass large enough to contain a little float. The capillary edge of the water is sufficiently accurate for most purposes.

(7) C. D. V. says: Admitting the fact that a base ball can be made to curve by causing it to take a revolving motion, why does not a rifle ball curve shot out of a grooved barrel? A. All round balls shot from rifled guns do curve to the right or left, according as they revolve to the right or left. But elongated balls or bolts of a length of 2 or 3 diameters are now principally used with rifled guns, and these projectiles go straight.

(8) W. R. H.—Can you tell me how I can retin copper cooking vessels? A. Make the copper chemically clean by washing with a saturated solution of zinc in muriatic acid, the acid to be weakened with water to half strength after the dissolving of the zinc. Heat the copper vessel and pour in a small quantity of metal, of tin one, lead one, and shake or tip the vessel until the tinning runs over the parts. Or, "wipe" the melted tin over the bare places with a cotton canvas pad.

(9) O. W. K. asks how, in japanning small articles like buttons, back hooks, eyelets, etc., they are kept from sticking together while baking? A. By stringing upon fine wire stretched.

(10) E. P. McC.—A man is never too old to learn a trade. Every trade has its living grade. Success depends entirely upon industry and mental application. If you have given no thought until the age of 20 as to your future employment and aim in life, it is a matter of deep regret, and you should flee to the first industrial opening, resolved that you will be contented to work until you have accomplished a trade or calling.

(11) E. L. H. asks for some rule by which to figure the weight of counterbalances for the drivers (leading and trailing) of a locomotive. A. The weight of counterweights should be equal to the weight of the moving parts at the same distance from the center, or in proportion inversely as the center of gyration of the counterweight is further from the center of the wheel than the crank pin. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 368, on Balancing of Machinery.

(12) W. T. P. asks the amount of pressure to square inch a copper holder eight inches in diameter and twenty-nine inches long will stand. Holder is made of one-sixteenth inch brazier's copper with heads of three thirty-seconds inch in thickness, well riveted and sweat, soldered in. A. If properly made and with raised heads, should be safe at 250 pounds pressure.

(13) J. McI.—Steam pipes in contact with wood with the ordinary use of steam do not ignite or set fire to the wood. Superheated steam caused by low water in the boiler has caused the pipes near boilers to set fire to wood work in contact. There have been a few cases where mysterious fires have been attributed to spontaneous combustion from dust, paper, rags, wool, or cotton lying in contact with steam pipes. The "insurance interest" requires that all steam pipes shall be three-fourths of an inch or more clear of wood.

(14) E. E. C.—For processes of galvanizing iron see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 265, 176, 161. Zinc and galvanized iron are in common use for water coolers; they are not as good or healthy as porcelain or brown stone ware. Nevertheless we use them constantly as linings in our water coolers without experiencing any poisonous effects. If water stands for a day in zinc, it acquires a disagreeable taste from the absorption of a small portion of zinc. Water remaining in galvanized pipes over night should be discharged in the morning, it being so impregnated with zinc as to be unfit for drinking or cooking.

(15) M. N. asks: Is there any method for removing the tin from what is known as tin plate that will pay commercially? A. The makers of colors for dyeing use the tin scrap in the vicinity of New York by boiling the scrap in nitric and hydrochloric acids, precipitating the coloring matter. There are chemical establishments that make this a part of their business.

(16) E. A. S. asks: 1. What length of oar (spoon shaped) do I need to obtain greatest speed out of a boat 15 feet long, 2 feet 4 inches wide, and 1 foot 2 inches deep, weighing about 50 pounds; also what length and breadth of blade? A. Oar of ash, 8 feet, blade 20 inches by 6 inches wide. 2. The above boat being made of one-quarter inch poplar, what is the best way of treating the wood to keep it from absorbing water and rotting? Would soaking it in raw linseed oil, then putting a coat of "filler" on and finishing in hard oil, answer my purpose? A. Use boiled linseed oil with a filler coat, rub down, and oil varnish.

(17) A. F. S. asks the rule for determining the size and focal length of the small mirror used in the Gregorian reflecting telescope when the focal length of large mirror is known. The small mirror is to remain stationary, and focusing to be done by rack and pinion. A. Make small mirror one and a half times the diameter of the field glass of the eye piece and one-tenth shorter focus than the large mirror. See works on optics.

(18) J. D. F., M.D., writes: In SCIENTIFIC AMERICAN SUPPLEMENT, No. 339, is an article on peroxide of hydrogen. In preparing the hair on a living person for bleaching with peroxide of hydrogen, how is it possible to digest the hair for twelve hours in ammonia and water, at a certain temperature too? Can you not state more clearly the process of bleaching hair on the head of a living person? A. In the article referred to, it is explicitly stated that "hot liquids or drying in drying chambers is excluded." When the hair is bleached on living persons, therefore, the process consists in simply applying the mixture of peroxide, to which about 10 per cent of ammonium hydroxide at 26° B. is added.

(19) J. H. says: I have a steam yacht thirty-four feet long, seven feet beam, draws thirty inches water, ordinary inverted link motion engine 5 inches by 5 inches, plenty of steam, can carry to 95 pounds pressure. What diameter pitch and number of blades should a wheel have to give the best results for speed and economy? A. Wheel about 28 inches diameter and 38 inches to 40 inches pitch; 3 blades.

(20) A. H. McC. asks how to bend the ribs for a small steam yacht. A. The ribs must be steamed or soaked in hot water till they are quite flexible, then bent and kept in their shape till dry. 2. How the boards are attached to the ribs? A. The plank can be fastened to the ribs by copper rivets, or by nails driven through from outside and riveted; put a forelock under the head and over the point.

(21) C. F. T. writes: I want something to add to a mixture composed of shellac dissolved in borax and water to prevent its drying too rapidly. I have tried glycerine, but it thickens or rather congeals it. A. The addition of more water is the only remedy we can suggest. Almost everything else which would tend to make it dry slowly would also have the effect of preventing its drying at all, or else act as the glycerine did.

(22) E. P.—According to the act of March 3, 1883, antiquities are admitted into this country free of duty. An antiquity however is something that was produced or manufactured prior to the 15th century. Artistic copies are likewise admitted free of duty when the same are for a private collection or for some public institution.

(23) F. L. S. asks how the operation of washing emery so as to render it suitable for lens grinding is performed. A. Emery of all grades to a fineness of 120 can be purchased of emery dealers. For fine grinding or finishing, the finest flour may be gently stirred in a large pitcher, at the same time allow a small stream of water, size of a straw, to run in and overflow at the spout into a wash basin, and from the wash basin upon the opposite side of the pitcher spout. By careful management you may obtain emery of almost any fineness in the wash bowl. One pound is enough for a charge.

(24) W. M. C. writes: In a 12 inch iron pipe running full of water (fresh) at 10 feet per second, 40,000 feet long, what will be the total amount of friction in pounds? A. The head due to friction alone is 304 feet, or 132 pounds pressure. The head required for the rate of discharge through 40,000 feet of 12 inch pipe is 1,600 feet.

(25) C. J. M. asks: What amount of cement is needed to cover 3,300 square feet of surface? What kind, and how thick should it be spread? The soil is about 2 parts clay, 1 sand, which run together during beating rain. Wishing to use tank or reservoir for irrigation, I must raise the banks about four feet above surface level. A. About 200 barrels. Make a mixture of 2 parts sand, 1 part cement, stiff enough to beat firm with a large faced ram or block. If the backing is firm, 3 or 4 inches deep will be sufficient. Finish with a thin wash of pure cement.

(26) P. P. asks the price of sumac delivered in New York. He means the leaves. A. New York is not a market for sumac leaves. Only the ground sumac is sold here, the domestic product being principally ground at Richmond, Fredericksburg, and Petersburg, Va. Ground Virginia is now selling at $60 to $75 a ton.

(27) J. A. B.—Notwithstanding all the old prejudices in regard to the matter, there is nothing to show that planting when the moon is fulling or waning, or at any portion of the signs of the zodiac, has anything to do with the growth of plants, any more than that certain stars have any effect on the destinies of those born thereunder. Numerous experiments in the planting of quick growing plants, at regular and short intervals, have shown their growth not at all dependent on the stage of the moon at the time of planting.

(28) E. S. asks at what depth the most valuable or the best paying gold ore is found. A. Metallic gold is generally found in superficial deposits. When it is in combination with pyrite, it may be found at any depth. See Professor J. S. Newberry's paper on the "Genesis and Distribution of Gold," SCIENTIFIC AMERICAN SUPPLEMENT, No. 329.

(29) W. H. E.—What is the process of making cast iron malleable? A. The castings are made from "white hard" iron, very hard and brittle. They are packed in cast iron boxes with forge scales and powdered salammoniac, placed in oven and kept at a red heat for from six to eight days, depending on the size of castings; then gradually cooled.

(30) Boys.—We would discourage the use of a pretentious Latin name for your workshop, and would prefer to recommend the use of a title that would be expressive of the work, such as Mechanical Inventing Company or Iron Experimental Workshop.

(31) Dentist writes: An alloy composed of 19 grains tin, 19 grains copper, and the remainder of the ounce gold, when a sufficient quantity of mercury is mixed with it, becomes a plastic mass. Will the application of heat, or absorbing the surplus mercury, make this plastic mass hard and solid again, or what will do it and what will be its color? A. The hardening of your proposed amalgam by heat would require a temperature sufficient to evaporate the mercury, about 600° Fah. This could be readily done in ordinary mechanical work, but for filling for teeth it will be impracticable. Any agent that would absorb the mercury would only act upon the surface. We think that this method would not give satisfaction. The principle upon which amalgams for the filling of teeth are made is the mixing of the mercury quickly with a powdered metal that will absorb or make a chemical union of the two metals within a proper time to meet the necessities of this kind of dental surgery. Heretofore silver has been found to fill the bill. It would be very desirable to do this with a gold amalgam, and as pure gold does not make a permanent amalgam with mercury (to our knowledge), some of its alloys may be possible. We think, however, that you will find in the silver and copper alloys with gold a better amalgam than with tin. A trial with jeweler's red gold, which you may obtain from any manufacturing jeweler in your town, will no doubt give you a passable color for the amalgam. In order to obtain a fine full color for the amalgam, we fear that an excess of copper will have to be used which is objectionable in a sanitary sense.

(32) J. O. M. asks how to make a reliable composition to be applied on narrow strips of stout paper at intervals for cigar and taper lighter; the strips are rolled up and put in a box, and by a movement in the box when the lid is raised the strip is pushed up by a small friction clutch and the composition is ignited. A. According to Prof. Prescott who analyzed several compositions, it was found that they consisted of black sulphide of antimony, potassium chlorate, and potassium nitrate; another composition was simply potassium chlorate and sodium hypophosphite. The mixture is made in varying proportion, generally with a greater preponderance of the chlorate, and combined with liquid glue.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. L. M.—The specimen is selenite, a variety of gypsum or calcium sulphate. Its principal use is as a fertilizer, also as plaster of Paris for making cornices, etc.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

August 19, 1884,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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APPARATUS FOR ELECTRICAL MEASurements.—Illustrations and description of the various interesting apparatus for measuring electricity that were shown at the Munich Exhibition, including Wiedemann's bifilar galvanometer; Wiedemann's galvanometer for strong currents; Zenger's differential photometer; Von Beetz's solenoid; apparatus for demonstrating the principle of the Gramme machine; Van Rysselberghe's thermometrograph; Von Beetz's chronograph; and Harlacher's apparatus for studying deep currents. Illustrated with seventeen engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **421**. Price 10 cents. To be had at this office and from all newsdealers.

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