ASPECTS OF THE PLANETS FOR APRIL.

VENUS

is evening star, and the only one among the planets whose movements excite a marked interest during the month. She has now advanced far enough in her eastern course to be seen in the west soon after sunset, and to allow the observer to obtain a glimpse of the beauty to be revealed during her nearly ten months' course as evening star. She will soon be the brightest in radiance, the largest in size, the softest in color of the myriad golden points that glitter in the celestial archway. Neither is she to be considered alone in an æsthetic light. The Queen of the Stars has unwittingly a mission to perform, when, closing her career as evening star in December with the grand event of the transit, she furnishes the inhabitants of the planet that shines so brightly in her sky one means for measuring the unapproachable, the much-desired solution of the problem—the earth's distance from the sun.

No better time than the present can befound for a careful study of the laws that rule the movements of Venus. To an observer on the earth, as she passes from superior conjunction round to superior conjunction again, she seems to oscillate in straight lines east and west of the sun like a golden bead strung on an invisible wire. Since her superior conjunction with the sun on the 20th of February she has been advancing on her eastward track. This she will continue to do until the 26th of September, when shereaches her greatest eastern elongation or extreme distance east from the sun. She then reverses her course, drawing nearer to the sun until her inferior conjunction on the 6th of December, when her rôle of evening star is ended, half her synodic revolution is completed, and, passing to the sun's western side, she repeats the same phases in reversed order as morning star.

Any intelligent observer can verify the process for himself, and will find the beautiful star a little farther east and a little longer above the horizon every evening until the eastern elongation. If he once keep track of her movements during an entire revolution he has learned the lesson for a lifetime, for every five hundred and eighty-four days the same succession of events occurs. Thus the aspects of our nearest planetary neighbor may become as familiar as those of the sun and the moon.

Venus commences this month the series of charming celestial scenes in which she will appear as chief actor. On the 19th she is in conjunction with Saturn. As Saturn is moving westward and approaching the sun, and Venus, in his near vicinity, is moving eastward and receding from the sun, it is inevitable that they should meet and pass each other. This event, known as their conjunction or nearest approach, occurs at 2 o'clock on the afternoon of the 19th, Venus passing nearly two degrees north of Saturn. If the night be clear the two planets will make a charming picture on the twilight sky. Venus sets on that evening a few minutes before 8 o'clock, Saturn about five minutes earlier than Venus, and both of them about an hour after sunset. On the evening of the conjunction Venus must be looked for about four and a half degrees north of the sunset point, and Saturn nearly midway between Venus and the sunset point. Both planets will be found about fifteen degrees east of the sun. An opera-glass or a spyglass will be a valuable assistant in picking up the planets, for they are too near the sun and too far from the earth to appear under favorable conditions.

On the 21st Venus is in conjunction with Neptune, passing about a degree and a half north of him. The conjunction is invisible, as Neptune is never seen by the naked eye, but it proves how near Neptune and Saturn are to each other, as seen from the earth, Venus passing the one two days after the other.

Venus reaches her descending node on the 26th. As her orbit or path round the sun is inclined to the ecliptic or sun's path she must be above or below it except at the crossing points, called ascending and descending nodes. One of these points, her descending node, she reaches on the 26th. When she comes round to the same node again, after passing her ascending node in the intervening time, she will be directly between the earth and sun, and the transit will occur. Venus sets now at seven minutes after 7 o'clock; at the close of the month she sets about eighteen minutes after 8 o'clock in the evening.

SATURN

is evening star, and drawing so near his conjunction with the sun that he will fade into invisibility in the latter part of the month. He is in conjunction with Venus on the 19th; we have already called attention to this, his farewell appearance as evening star. Saturn for a season will no longer be seen among the stars, but we are reconciled to his temporary absence, for when he reappears to grace the summer morning sky he will don a more brilliant aspect than he did last year at the same time, for his northern declination will be increasing, his rings opening more widely, and his perihelion drawing nearer. All these phases will culminate between the present time and 1885. Saturn passes the meridian now two minutes before 2 o'clock in the afternoon; at the end of the month about eighteen minutes after midday. He sets about a quarter before 9 o'clock in the evening; at the end of the month he sets a few minutes after 7 o'clock.

NEPTUNE

is evening star, and gains upon Saturn as they travel toward conjunction. On the 1st of the month he passes the meridian eleven minutes after Saturn; on the last of the month he is only four minutes behind him. He is in conjunction with Venus on the 21st, but the event is not of much importance, as it is invisible. In imagination, however, Saturn and Neptune can be seen rolling their vast spheres toward the sun, while Venus, receding from the sun, passes them in her course. In reality the planets as well as the earth are revolving in elliptical orbits round the sun, while their positions in the sky result from the fact that the earth from which we view them is a moving observatory, complicating their apparent movements.

Thus Neptune is one hundred and sixty-five years in making a single revolution round the sun, while to an observer on the earth he seems to complete the circuit of the heavens in about three hundred and sixty-seven days.

Neptune now sets a few minutes after 9 o'clock in the evening; at the end of the month he sets about a quarter after 7 o'clock.

JUPITER

is evening star, and remains third on the list of the outer planets traveling to the same goal. He lags behind his brother planets, passing the meridian more than an hour behind them at the end of the month. Though departing and shining with diminished size and luster, he still leads the starry host and sinks majestically toward the west as if conscious that he is first and foremost among the sun's family of worlds.

Jupiter sets on the 1st of the month at 10 o'clock in the evening; at the end of the month he sets at forty minutes after 8 o'clock.

MARS

is evening star, and, like the trio that precedes him, making slow progress on the same road. He is in quadrature with the sun on the first day of the month, being half way between opposition and conjunction, or ninety degrees from each. He is now on the meridian at 6 o'clock in the evening, and looks down from this high elevation as soon as it is dark enough for him to be visible. He is not of much account among the planets, for he has lost the martial air he assumed when in opposition, and now takes on the aspect of a red star, shining more serenely than his neighbors, Procyon and Aldebaran, of the same color. He has passed into the sign Cancer, and after the 5th his extreme northern declination will decrease.

Mars sets now not far from 2 o'clock in the morning; at the close of the month he sets a quarter before 1 o'clock.

URANUS

is evening star and the fifth and last on the list of planets traveling to conjunction with the sun. He still shines in the reflected radiance of his last month's opposition and perihelion, and may be found by careful observers nearly in the position then indicated, in the constellation Leo. His right ascension is now 11h. 7m., and his declination 6° 29′ north.

Uranus sets about a quarter before 5 o'clock in the morning; at the close of the month he sets a few minutes before 3 o'clock.

MERCURY

is morning star and worthy of mention simply from the fact that he is sole representative of the brotherhood in the morning sky, for he is too near the sun during the month to be seen by the unaided eye. He is traveling from his western elongation to superior conjunction, rising later every morning until the goal is reached.

Mercury rises about 5 o'clock in the morning; at the end of the month he rises a few minutes after 5 o'clock, about five minutes before the sun.

THE APRIL MOON

fulls on the 3d. She is the most distinguished moon of the year, and exerts indirectly a mighty influence on human affairs, for she determines the time when Easter Sunday shall fall and thus rules the movable feasts and fasts of the Church. The law that regulates the festival, simply stated, is that Easter shall fall upon the first Sunday after the full moon which happens upon or next after the vernal equinox. The April full moon carries out these conditions and secures this pre-eminence.

The new moon of the 17th commences her course with a brilliant record. On the 18th, the day after her change, she pays her respects to three planets—Venus, Saturn, and Neptune—on the same evening. It is difficult to see the moon when a day old, for the crescent is but a slender thread, still it can be done. If the evening be exceptionally clear, the keen-eyed observer may behold the lovely picture, the moon passing about two degrees north of Venus and three degrees and a half north of Saturn. But the loveliest exhibition of the month will occur on the 19th, when the two days' old crescent will be in conjunction with Jupiter, and only forty minutes north of him. As the moon does not set until after 9 o'clock there will be ample opportunity for seeing the show, if the clouds are kind.

Telescopic observers will not find abundant material for study among the planets that play their parts on the April sky. Uranus still displays to advantage his sea-green disk; Venus retains her gibbous phase, and Mercury takes on the form of an evening moon. The outer planets have had their day. A small telescope will be of great assistance in showing the conjunction of the moon with Venus and Saturn, and also the conjunction of Venus and Saturn with each other.

April is not a field-day on planetary annals, but there are incidents enough to reward close study. Three planets, Saturn, Neptune, and Jupiter, are clustering closely around the sun. Venus, moving eastward, passes Saturn and then Neptune in her unswerving course. Six planets are evening stars, and only one represents the brotherhood in the morning sky. Two conjunctions of planets, and the moon in conjunction with three planets on the same evening, take rank as specialties. Perhaps the most marked feature of the month is that Saturn, Neptune, Jupiter, Venus, and the moon are all in the sign Taurus. According to astrologers the conjunction of the moon with Saturn, Neptune, and Venus in this sign has an ill-boding influence for the countries ruled by Taurus, and earthquakes may be looked for in the east of Europe at the time of the conjunction. But the modern astronomer looks serenely upon these portents of ill, secure in the faith that the planets in their courses have a higher mission to perform than that of ruling the destinies of this planet and determining the horoscope of those whose little lives are rounded by a few short years as we count time.

MISCELLANEOUS INVENTIONS.

An improved regulator for electric store boxes and lights has been patented by Mr. Henry B. Sheridan, of Cleveland, Ohio. This invention relates to a system of lighting by electricity, and designed to keep the lamps alight by shunting into the circuit automatically a box stored with electricity. The storage box can be charged with electricity directly from the generator, and by an automatic mechanism made to supply the lamps in circuit with sufficient electricity to keep them alight; or the storage box can be connected with the generator and the circuit in such a manner as to receive and retain the surplus electricity when more is generated than required to support the lights, and give out the stored electricity when less is generated than is required to support the lights.

Messrs. Robert M. Mason and George M. Wooster, of Bristol, N. H., have patented an improvement in the manufacture of board from wood pulp. The object of this invention is to manufacture wood pulp boards of desirable thickness and with the fibers or grain distributed equally in every direction, similar to paper and paper boards. This is accomplished by the adaptation of the Fourdrinier machine and process to such manufacture.

Mr. Gustav Speckhart, of Nuremberg, Germany, has patented a new and improved case for watches which will keep out dust and moisture and prevent damage to the glass and works in case the watch is accidentally dropped. The invention consists in a soft rubber case adapted to receive the watch, and provided with an aperture surrounded by a bead for the pendant, and an aperture surrounded by a bead for the dial, and with a circumferential bead.

An improvement in swivel buttons has been patented by Mr. Silas O. Parker, of Littleton, N. H. The object of this invention is to prevent the bar of a swivel button from sliding in the head and to hold it in any desired position, and to prevent the lower edge of the swiveled eyelet to which the head is attached from chafing and scratching the wrist. The swivel button is constructed with a tubular shank containing a spiral spring which presses upward against the bar passing through the head of the shank, which spring rests on a series of studs formed by pressing part of the shank inward. The shank is held to the material by an outer washer provided with a raised part and by an inner washer provided with a recessed part, whereby the tubular shank will be held properly, and its lower outwardly turned edge cannot chafe and scratch the wrist.

An improvement in beehives has been patented by Mr. Hugh L. T. Overbey, of Subligna, Ga. The hive is ventilated through openings in the cover, which are covered at their inner ends by wire gauze to prevent moth-millers and other insects from entering the hive. The hive is constructed so that the surplus honey frames and their combs can be readily removed and replaced by empty frames by taking off the cover.

An improved prospecting tool for miners, patented by Mr. James B. Thornton Chase, of Pueblo, Col., has the curve of an arc of a circle, and constructed with its pick portion tapering on all sides to a sharp point, and its heel made with a central projecting point.

An improved apparatus used for medical purposes, combining mechanical manipulation and electrical treatment, has been patented by Mr. John Butler, of New York city. The object of the invention is to allow of using a galvanic battery for such purpose in connection with a manipulating roller. The invention consists in an apparatus combining a roller and induction coil.

An improvement in heddle-frames has been patented by Mr. John Ashworth, of Wetheredville, Md. The invention consists in the combination with the heddle-frame having slotted side bars, the heddles, and the ordinary bars upon which the heddles are strung, of additional outer bars or rods and links and hooks or eyes for uniting the bars and connecting them with the frame, whereby the ordinary inner bars upon which the heddles are strung are prevented from bending and twisting, and the heddles are rendered easily changeable.

Mr. Henry H. Whitcomb, of Bridgeport, Conn., has patented a toy pistol provided with a figure adapted to be displayed before firing, and to entirely disappear upon pull ing the trigger.

An improvement in universal joints has been patented by Mr. Edmund Garrigues, of Massillon, Ohio. This invention consists principally of a universal shaft connection, joint, or coupling, the ball of which is formed with an oil chamber, of casting the yokes upon the ball, and of the method of casting the ball and yokes whereby the journals and bearings of the coupling will be chilled.

On Energy as a Measurable Quantity.

Gravity being the most common and universal force, and also practically constant over the habitable portion of the earth, it is usually taken as the form in which to express quantities of energy. There are several units in use, but the one most generally used in England is known as the "foot pound," and consists, as its name implies, of the energy necessary to raise a weight of one pound one foot high. It will be obvious that whether we raise ten pounds one foot high or one pound ten feet high the quantity of energy expended in the two cases will be the same, viz., ten units, so that if any substance be raised the quantity of energy expended and retained by it in virtue of gravity will be represented by the weight of the substance in pounds multiplied by its height in feet. The unit mentioned in my last paper as the one used by engineers—that is, the "horse power"—is equal to 550 foot pounds per second, which means that an engine of one horse power (indicated) will raise 550 pounds one foot high per second.

Having now fixed on our unit, we can proceed to measure the other principal forces in terms of this the "mechanical unit," as it is called, which we will do more or less fully in proportion to their importance.

Momentum.—Suppose we raise a pound weight one foot high, it will, as we have learned, possess one unit of energy. If it be allowed to fall again immediately before striking the earth, this energy will obviously exist entirely as momentum. Now the velocity acquired by the weight at this moment will be eight feet per second. Hence this velocity represents a force of one unit; if the weight fall four feet the velocity will be sixteen feet per second; and if it fall nine feet the velocity will be twenty-four feet per second. Therefore, the velocities of sixteen and twenty-four feet per second represent forces of four and nine units respectively. On putting these numbers in tabular form we shall see an important connection between them, viz.,

Height in Feet.	Velocity per Second in Feet.	Units of Energy.
1	8	1
4	16	4
9	24	9

that the quantity of energy is proportional to the velocity squared; for, while the velocities are in the proportion 1, 2, 3, the energy they represent are the squares of these numbers, *i. e.*, 1, 4, 9, and that to measure the energy due to momentum in units we have only to divide the velocity by eight and square the quotient.

The velocity acquired by a body in falling is independent of its weight. Obviously also with a given velocity the energy possessed by a body is the same in whatever direction it be moving; hence, if we multiply the product obtained as described in the last paragraph by the weight of the body in pounds it becomes applicable to all cases. Thus the energy possessed by a weight of one hundred pounds moving at the rate of eighty feet per second will be $(\frac{80}{8})^2 \times 100 = 10,000$ foot pounds. Calculating in the same way the energy due to the earth's motion, we get the enormous quantity of 156,000,000 foot pounds for every pound of matter; and if the earth were to fall into the sun the energy due to the momentum acquired would be equal to that given out by the sun during 6,000 years.

Heat.—For the exact determination of the energy value of heat in terms of foot pounds, or the mechanical equivalent of heat, the world is indebted to Dr. Joule, of Manchester, and whose experiments—perhaps more than anything else—led to and confirmed the modern doctrine of energy. Now the other forms of energy being, as we know, so readily converted into heat, it will be seen how important this determination becomes; for, knowing the energy value of heat, we can, by measuring the other forces as such, immediately obtain their values.

Dr. Joule used several different methods in his experiments, the most important of which I will describe.

The apparatus consisted of a brass paddlewheel furnished with eight sets of revolving fans working between four sets of stationary vanes. The paddlewheel and vanes fitted firmly into a copper vessel containing water, in the lid of which were two necks—one for the axis of the wheel to revolve in without touching, and the other for the insertion of a thermometer. Motion was given to the axis by the descent of two leaden weights suspended by strings from the axis of two wooden pulleys, their axis being supported on friction wheels and the pulleys being connected by fine twine with a wooden roller, which, by means of a pin, could be easily attached to or removed from the friction apparatus.

The mode of experimenting was as follows: The temperature of the frictional apparatus having been ascertained, and the weights wound up, the roller was fixed to the axis and the precise height of the weights ascertained. The roller was then set at liberty and allowed to revolve till the weights touched the floor. The roller was then detached, the weights wound up again, and the process repeated. This having been done twenty times, the experiment was concluded with another observation of the temperature of the apparatus.

Supposing the weights to fall freely—which they would practically do were it not for the friction produced by the paddle—they would, as we know, convert their energy of position entirely into momentum, and in consequence would strike the floor with a certain velocity representing that energy. Now, friction produces heat, so that the paddle in revolving raises the temperature of the water in the vessel, thereby subtracting a proportionate amount of energy from the falling weights and causing them to strike the floor with a greatly diminished velocity, and, as will be seen, the quantity of energy which has been converted into heat can then be readily calculated.

In these experiments corrections were made for the effects of radiation and conduction, and for the heat absorbed by the copper vessel and paddle; also for the friction and rigidity of the strings.

As the result of a great number of very accurate experiments with this and other methods, Dr. Joule found that whenever energy is spent in generating heat the quantity of heat produced is always proportional to the quantity of energy expended, and whenever work is performed by the agency of heat an amount of heat disappears equivalent to the work performed. He also established the important fact that the unit of heat (the quantity necessary to raise one pound of water 1° F.) requires for its production the expenditure of 772 foot pounds of energy. This number, 772 foot pounds, is known as the mechanical equivalent of heat, or Joule's "equivalent."

Experiments made by other philosophers on the work done by a steam engine, on the heat evolved by an electro-magnetic engine at rest and in motion, and on the heat evolved in the circuit of a voltaic battery, have given values very nearly identical to the above (Watts).

Chemical Action.—When substances combine chemically there usually occurs an evolution of more or less heat; and when this is sufficient to render the substances incandescent they are said to undergo combustion. Take, for instance, the case of a mixture of oxygen and hydrogen. They possess in virtue of their chemical attraction for each other a store of potential energy, and we may justly compare this attraction to that between the earth and a raised weight. For, as in the latter case, on releasing the weight it falls to the earth and converts its energy into heat, so on applying a light to the mixture we may imagine the atoms of oxygen and hydrogen to rush together with immense velocities, and thus also convert their energy into heat; and if we can measure the quantity of heat given out we have at once a measure of the energy due to the combination. Various instruments have been constructed for this purpose called "calorimeters" (heat measurers), their efficiency depending upon the more or less perfect communication of the entire heat produced to a given quantity of matter—preferably water. The following table gives in round numbers a few of these determinations:

ENERGY OF CHEMICAL ACTION.

With Oxygen.	Pounds of Water Raised 1° F. by the Combination of 1 Pound of each Substance.	Foot Pounds.
Hydrogen	61,000	47,092,000
Coal	14,000	10,808,000
Wood (dry)	7,000	5,404,000
Ether	16,000	12,352,000
Alcohol	12,000	9,264,000
Sulphur	4,000	3,088,000
With Chlorine.		
Hydrogen	40,000	30,880,000
Zinc	2,300	1,775,600

Some of these numbers have been confirmed by reversing the determination; thus, the quantity of energy necessary to set free one pound of hydrogen from its combination with oxygen has been ascertained. In all cases it is found that the quantity required is the same as that set free by the combination.

Radiant Energy.—The determination of the mechanical value of radiant energy is, unfortunately for us, in a very unsatisfactory state at present, owing principally to the variety of effects which it produces. Various valuable instruments have, it is true, been devised for measuring particular effects—notably those of Herschel, Draper, Roscoe, and Abney for the chemical effects; but these are not adapted for the purpose. The most perfect instrument yet devised is probably that of Pouillet's, and called by him a "pyrheliometer." It is constructed on the following principle: A shallow cylindrical box, made of silver, is filled with water, in the water is the bulb of a delicate thermometer, the stem of which is inclosed in the hollow tube which supports the cylinder. At the lower end of the tube is a disk equal and parallel to the base of the cylinder; this is for the purpose of receiving the shadow of the cylinder, and thus assisting the operator in pointing the instrument directly toward the sun. The front of the cylinder is blackened.

In using this instrument it is pointed directly to the sun for five minutes, and the increase of the temperature of the water noted. On then making the necessary corrections for radiation from the instrument, etc., the amount of radiant energy per area of the cylinder can be readily calculated. The weak point in this instrument is the assumption that the whole of the energy which falls upon it is converted into heat.

From data obtained with this instrument it has been calculated that 1,600,000 foot pounds of radiant energy are emitted per minute from each square inch of the sun's surface. Taking this to be true, a powerful electric light should emit about 80,000, a lime light about 10,000, and a candle flame 9 foot pounds per inch of surface per minute.

Electricity.—The measurement of electricity in mechanical units is very readily accomplished, all that is necessary being to pass a given quantity through acidulated water and collecting the hydrogen evolved at the negative pole in a graduated glass vessel. The volume being read off, its weight is ascertained (100 cubic inches, at standard temperature and pressure, weigh 2·227 grains); then, knowing the quantity of energy necessary to set free one pound of hydrogen to be 47,092,000 foot pounds, the equivalent is readily obtained.

It will be noticed that the unit of energy is the same as the unit of work; they represent, in fact, the same thing. Or, to quote the late Professor Clerk Maxwell, "Work is a transference of energy from one system to another." The system which gives out energy is said to do work on the system which receives it, and the amount of energy given out by the first system is always exactly equal to that received by the second. I shall conclude this article with another appropriate remark of the same eminent authority. "The discussion of the various forms of energy, with the conditions of their transformation from one form to another, and the constant dissipation of the energy available for producing work, constitutes the whole of physical science."—*E. H. Farmer, in Brit. Jour. of Photography.*

Telephones and Electric Lights in Brazil.

The *Rio News* reports a condition of things in Rio Janeiro not at all creditable to certain public officers of the empire. The Director-General of the State Telegraph Department in particular has seen fit to take a position of violent hostility to the introduction of telephones not under his control, and the indications are very strong that his hostility extends also to electric lights, while his methods of manifesting his dislike are not such as public officers commonly resort to.

The *News* says: "Ever since the telephone company of this city—which is so unfortunate as to be a foreign enterprise—began to stretch their lines from the central office to the various suburbs, there has been a systematic effort on the part of certain interested parties to impede the work and damage the property. The means usually employed is the cutting of the wires. Regardless of the fact that this is an injury to private parties as well as to the company, this contemptible work has been prosecuted not only without hinderance, but with the well known approval of influential parties in this city."

After describing at some length the course of the Director-General of the Telegraph Department in this connection, the *News* remarks:

"It is no longer a personal matter; the good faith of the government is at stake. If a privilege to a foreign enterprise is worth one straw in Brazil, then the government is bound to guard and protect it. If, however, a foreigner has no protection for his labor and investments as against the malice of influential personages, then let us know it at once. If matters go on in this way a little while longer—in the confiscation of property, the breach of contracts, the destruction of electrical machines, and the cutting of telephone wires—this country will be saddled with a reputation which will not only keep enterprise and capital at a distance, but will even drive away those that are now here. It is full time that the steady, thinking portion of this community take these occurrences into consideration, and determine where they are being led."

The destruction of electrical machines referred to occurred during the late National Exposition, the victims being the Edison electric light people, the aim being to prove that system of lighting irregular in its action and untrustworthy.

"It was thought a suspicious circumstance that two armatures in succession should be burned, but when a third was ready to be put in place, an examination of the upright columns of the dynamo developed the fact that a sharp instrument had been inserted beneath the canvas covering at their lower ends, and that the wires had been cut. That the cutting was done by an expert is clearly evident from its location and character. The damage was examined by a commission of the Engineering Club, who are satisfied that the cutting was done willfully and maliciously."

Speaking of this outrage the *News* observes:

"We have heard of no effort on the part of the Associação Industrial, in whose charge the Edison apparatus was at the time of the accident, to ferret out the guilty party Even the Director-General of the Telegraph Department, who should make every effort to guarantee fair play, does not seem to have noticed the trick. Fortunately, however, the Edison light has been placed in the Dom Pedro II. railway station, where the public may judge of its merits without interference."

American Fences.

There are six million miles of fencing in the United States, the total cost of which has been more than two thousand millions. The census reports show that during the census year, there were expended $78,629,000 alone. Of this amount the largest contribution was from Illinois: the second from Pennsylvania.

Security against Counterfeiting.

N. J. Heckmann adds five per cent of cyanide of potash and sulphide of ammonium to the sizing water, and passes the sized paper through a thin solution of sulphate of magnesia or copper. If any attempt is made to remove writing from such paper by means of acids or alkalies the tint of the paper is immediately changed. If any erasures are attempted the coloring matter, which is only upon the surface, is removed.—*Dingl. Journal.*

The Plethysmograph.

This is an apparatus for detecting the variation in the size or dilatation of a body. For example, by its use the dilatation or contraction of the human hand, arm, or other organ can be ascertained. The hand or organ to be tested is placed in a vessel containing a liquid. Connected with the vessel is a test tube, a stylus, rotating cylinder, etc.

At a meeting of the Massachusetts Institute of Technology, Dr. Bowditch proceeded to exhibit this use of the instrument. For this purpose an assistant placed his arm in the apparatus, and the arm was then surrounded by water heated to a blood heat. The connections having been made, Dr. Bowditch waited until the style was describing a line nearly horizontal, and then directed the assistant to multiply twenty-three by seventeen in his head. As soon as he began to think this out, the style rose rapidly and remained up till he had finished the computation, when it fell, thus showing that during this process a certain amount of blood rushed away from the arm. When the style began again, after a minute or two, to trace a line nearly horizontal, the assistant was directed to multiply thirteen by twelve. During this process the style rose, but not nearly as much as in the former case, showing that a smaller quantity of blood left the arm in this case than in the preceding.

Dr. Bowditch then related the story that a friend of Prof. Mosso, who claimed that he could read Greek as easily as he could Italian, had his arm placed in the apparatus by the professor, who presented him successively an Italian and a Greek book to read. While reading Greek the style rose very much more than while reading Italian, and thus the instrument demonstrated that the friend was mistaken in regard to his powers, and that it was much easier for him to read Italian than Greek.

In answer to a question as to whether it could be used to study the effect of digestion, Dr. Bowditch replied that it probably could, but that the fact that digestion is exceedingly slow might present a difficulty.

In answer to some other questions, Dr. Bowditch said that the results shown by the instrument in its present state of advancement are purely qualitative, and that no quantitative determinations have been made; also, that, because we have a certain amount of blood leaving one arm during a mental process, it would not be safe to assume that the same amount left the other arm, or even to assume that the amounts of blood leaving one arm during certain mental processes were proportional to the amounts leaving the whole body.

IMPROVED JOURNAL BOX.

The improved journal box shown in the annexed engraving is especially designed for car axles, and it is claimed by the inventor a very large percentage (40 to 50 per cent) of the power required for drawing cars is saved, the effect being to practically double the propelling power of an engine. A great advantage possessed by this journal box is that it cannot become heated even at the greatest speed attainable. The construction of the box is such as to exclude dirt and dispense with the use of cotton waste. It uses only about one-fourth the quantity of lubricant consumed by the ordinary journal box. It can be readily substituted for the ordinary journal box, and as the most of the sliding friction is converted into rolling friction the journal box is practically indestructible by wear.

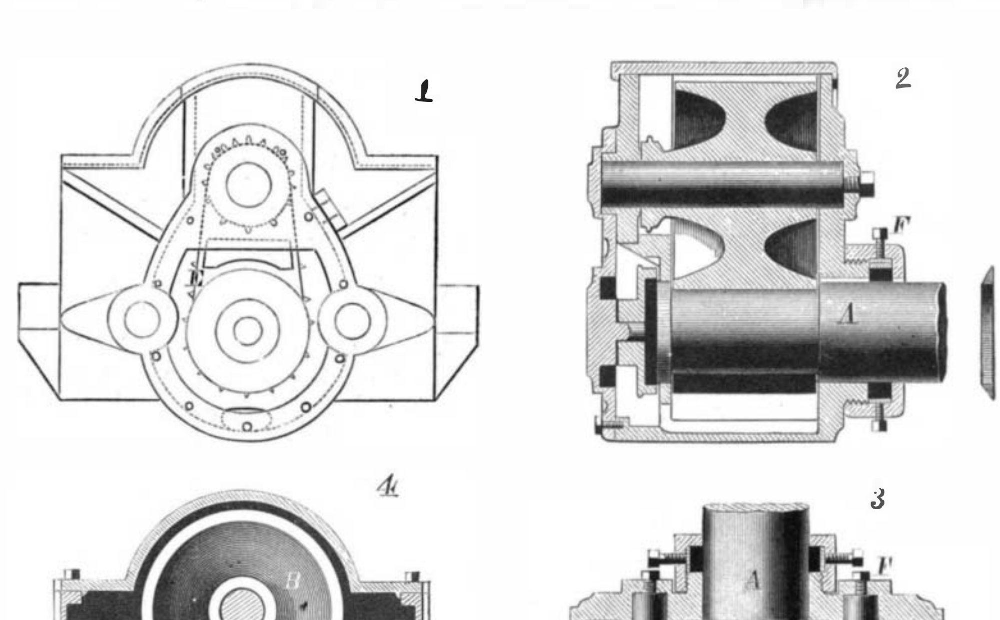
The engraving shows four views of the journal box, Fig. 1 being a side view, Fig. 2 a vertical transverse section, Fig. 3 a horizontal section, and Fig. 4 a vertical section taken at right angles to the car axle.

The lower portion of the box forms a basin containing the lubricant. The box is closed on all sides, and all of the joints are packed to exclude dust. It is divided by a vertical partition forming two chambers, the larger one containing the anti-friction rollers and journal of the axle, the smaller one containing the lubricating devices.

The smaller chamber is made accessible by the removal of the front plate, and the two chambers connect by an opening in the lower part of the partition, so that the lubricant may be at the same level in both and pass freely from one to the other.

The axle extends through a stuffing box, F, in the back plate and through the larger chamber. Friction rollers, B and C C, are placed in the larger chamber, the roller, B, being directly above the axle journal, with the two smaller rollers, C, at opposite sides of the axle, with their axes slightly above the center of the axle. The rollers turn loosely on spindles secured in the boxes. The hub of the upper friction roller projects over the oil chamber, and is toothed, forming a wheel carrying a chain provided with buckets or knobs which carry up the oil to the roller, B, insuring a continuous supply of lubricant to the roller.

This invention was recently patented by Mr. Charles E. Candee, and is owned by the Candee Anti-Friction Journal Bearing Company, 38 Dey street, New York city.



CANDEE'S ANTI-FRICTION JOURNAL BOX.

A NEW FIRE ESCAPE.

Our engraving represents the construction and use of a simple and cheap fire escape, which any one is free to make and use.

It would seem to be particularly well adapted to meet the requirements of travelers, ordinary households, and especially operatives in the upper rooms of factories.

NEW FIRE ESCAPE.

It consists of a maple stick an inch thick, two inches wide, and about fifteen inches long, and having five holes, of the size of the rope used, bored through it, as shown in the engraving. In the lower single hole is the loop for the feet, in which to stand while descending. With the upper end of the rope secured to any fixed object, the stick is held in the left hand, and the rope paid out as rapidly as desired with the right hand. With this device, which should not cost above twenty-five cents, a person may descend from any height with safety. Employers of operatives in upper stories could well afford to furnish this cheap affair to each employe, and instruct them in its use from slight altitudes.

Importation of Vegetables.

Large importations of potatoes from Europe are a peculiar feature of this year's trade, the receipts at this port amounting at times to 3,000 tons a week. The potatoes cost in Liverpool from $15 to $20 a ton, and are sold in this city at 90 cents to $1 a bushel, domestic potatoes bringing about $1.25 a bushel. Including freight and other expenses, the foreign potatoes cost about $33 a ton. Most of the imported potatoes are raised in England and Scotland, but a few come from Ireland and Germany. Those that come from the last named country are of an inferior quality and do not sell very readily. They are soft, greenish in color, and watery when boiled or baked. The dealers regard the present trade in imported potatoes as being only temporary.

The high price of cabbages—from $15 to $30 a hundred, wholesale—has led to large importations from Germany. They are brought in crates; and some sauerkraut is imported ready pickled in tierces. Turnips, celery, carrots, are also to be seen among the freight of incoming vessels. While we are importing vegetables we are exporting large cargoes of hay, that crop having been a comparative failure in England and Scotland.

Cattle Poisoned by Lead.

The *Kolnische Zeitung* remarks that in some parts of the Euskirchen district there have occurred sudden cases of illness and subsequent deaths of cattle, which have been ascribed to lead poisoning. According to the details given, it would seem that particles of ore frequently find their way into a stream which passes Clausthal, a seat of mineral industry. This metallic deposit is carried over the adjacent fields when inundations occur (which are not unfrequent). After the subsidence of the water, the lead remains on the ground and affects the vegetation. An instance is quoted of some cattle having been poisoned which had been fed upon beetroot grown upon land subject to the conditions described. The presence of lead in minute quantity (one-tenth per cent of the weight of the vegetables) was discovered by chemical analysis upon the surface of the beetroot. It is recommended for agriculturists to be cautious as to the use of vegetables, etc., which have been grown upon land subject to the overflow of any stream likely to receive particles of lead from mineral works on its banks.

Rats in Granaries.

A correspondent of the *Journal d'Agriculture Progressive* suggests a method of getting rid of these pests, that has the advantage of having been most successful in his own case It is to fill their holes with chloride of lime and oxalic acid, when a violent disengagement of chlorine takes place, their holes are filled with this gas, and they are suffocated.

Remarkable Gas Well.

In the spring of 1881, C. A. & D. Cornen were drilling a wildcat well on lot 586, Clarendon, Pa., when, at a depth of a little more than a thousand feet, they encountered a powerful vein of gas. Drilling was continued only about five feet in the gas sand, as it was very difficult to make much progress under the circumstances. All the sand rock cut by the drill was thrown out as soon as loosened from the main body of rock. Chunks the size of hens' eggs were sent up through the derrick as though shot from a cannon. All idea of an oil well was abandoned, and a project was inaugurated for utilizing the enormous amount of gas for light and fuel. A gas company was formed, with sufficient capital stock to make the venture a success. A charter was obtained, and a pipe line laid to Clarendon, a distance of three and a quarter miles. It was the company's intention to continue the line to Warren, six miles further, but winter coming on when the line was completed to Clarendon, work was temporarily suspended until spring. The well is now furnishing fuel to twenty-six drilling wells, three pumping wells, one hundred and twenty-five stoves, two machine shops, and two pump stations. Recently, on a rather cold day, the gauge in the company's office showed a pressure then of seventy-three pounds to the square inch. This gas is dry, containing no oil, gasoline, or water, and has never frozen on any part of the line, although the pipe is, in many places, exposed to the weather. An effort was made at one time to test the pressure, and the stop-cock could not be turned more than half-way round, when the indicator would fly as far as possible, showing two hundred pounds to the square inch. It was feared that the casing would be torn to pieces if the investigations were