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## DOUBLE TENONING MACHINE

The chief points of advantage to be noted in the improved form of double tenoning machine, illustrated in the accompanying engràings, consist in the mechanical devices by means of which the cutter heads, aside from their individual motion, can be so connected together that when the cylinders are adjusted to the required thickness of tenon, both heads can be moved at once. They can thus be arranged at a suitable hight from the carriage to give the desired depth shoulder.
A, Fig. 1, is the car riage upon which the material rests while being operated upon $B$ is the pulley which drives the cutters, drives the cutters, and D, one of which is shown more clearly in Fig. 4, through the medium of the smalle pulleys on the arbors E F. These arbor work in composition boxes in frames which have a free vertical motion on the mai stand, and which are coupled together by the rightand left hand screw, G, working in suitable nuts. Thi suitable nuts. This screw, $G$, is rotated by the hand wheal, by the hand wheel, I, and serves both to ad just the cutters, C D parallel to each other and also to raise and lower the cutter frame as desired. By refer ring to Fig. 5, the read er will understand how this is accomplished J is a section of the hub of the bevel gear, H , through which the lower portion of the screw is seen passing. $K$ is a plug, tapped on its end so that it will form a part of the gear nut thread, which is slipped into the hole made for the set screw, L. When this set screw is not tightened, the plug will press against the screw, G, with sufficient friction to turn it: and consequently, when the bevel gear, $H$, is rotated, it will elevate or depress the screw, and with it the cutter frames in which it operates. If, however, the plug, K, be tightly clamped, so as to bite against the screw, $G$, the latter will be compelled to revolve with the gear; which, as it is threaded in opposite directions, will cause the frames to recede from or approach each other in accordance with the direr in acco which it is turned tion in which it is turned. By this ingenious arrangement it is clear that the two cutters, C and D , can be arranged in any suitable position either relative or together, according to the desired thickness of the tenon shoulder. Their vertical adjustment being thus provided for, a horizontal motion may be imparted to the heads in order to cause them to cut to a required depth, as, for instance, in cases where it is necessary to make one shoul. der of a tenon deeper than the other This is effected by connecting the rear the journals of the arbors, $E$ $F$, with sliding boxes. In the extremities of the latter,screws are tapped which are actuated by the small hand wheels, M. The wheel, N; on the screw, G, enables the latter to be revolved in order to cause slight changes in the position of the cutters. 0 is a tightening pulley, and is shown more clearly in Fig. 2. It runs in a frame which is moved up or down in accordance with th adjustment of the cutters by means of the rack, $P$, connect

NEW YORK, MAY 10, 1873.

ing with a pinion, Q, which communicates with a ratchet, lever, and weight (not shown) on the back of the machine. The portions thus far described serve to cut a single tenon. To make a double tenon after the patterns shown in the foreground of Fig. 1, other devices come into play. R (Fig. 2) is a vertical shaft which revolves in a sliding frame, $S$, just back of the tenoning cylinders On its upper end is a horizontal cutter head, T, shown partly in section in Fig. 2, zontal cutter head, T, shown partly in section in Fig. 2,
and in perspective in Fig. 1. U is a bevel gearing actua-


BUCK'S DOUBLE TENONING MACHINE
abled to move the gaining cylinder up or down to any desired point, or he can place it altogether out of the way, so that the carriage will pass directly over it, when making single or double tenons. As the belt which drives this cylinder will necessarily vary in length as the latter changes position, a tightener, $Z^{\prime}$, is provided, arranged in an iron frame as shown, which presses upon the belt, and is of sufficient weight to fulfill all requirements.
The machine is self-contained, having one countershaft un derneath, on which is a sufficient number of pulleys to drive it different parts, and a second countersbaft suspended on bracke hangers (shown broke in Fig. 2), bolted on the back of the appa ratus to actuate the double cutter shaft.
From the above ex planation of the es ential parts, the es hod of readily followed timber to be tenoned is placed upon the car riage, which is suita bly mounted on trucks and in this position is passed between the tenoning cylinders. As it emerges, cut in one thick tenon or in th outlines of two, it comes in contact with the cutter on the with the cutter one vert cal shaft. This make its way through th center of the thick tenon, cutting out a space and completing
the double tenon. The gaining cylinder cut gains from the unde side of the timberas it
ted by the lower of the two hand wheels shown, which com- $\mid$ passes over it while on the carriage, making them from on municates with the screw, V, which works in a nut in the sixteenth to two inches in depth,and by forming severalcuts, sliding frame, S . By this means the cutter, T , can be placed of any length. The machine is particularly suitable for use in any desired position vertically, orit may be thrown entire- in railroad workshops, as it is claimed to be capable of oper ly out of the way while making single tenons.

| y out of the way while making single tenons. | ating upon the largest and |
| :--- | :--- |
| W, Figs. 2 and 3, is the gaining cylinder, which is actuated | struction of railroad cars. |

W, Figs. 2 and 3, is the gaining cylinder, which is actuated
at the back of the machine, where the operator stands while
struction of railroad cars.
Patented February 25, 1873
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## [Mammoth Remains,

In 1872 a party of Americans led by P. Pavy, left San Fran cisco to endeavor to reach Wrangel Land in the Arctic Sea They landed near the mouth a large river running from the a large river running from the N. W., and, about eighty miles inland, observed many indications of mammoth remains. On clearing away the snow from one of the spots, the whole of a well-preserved animal of this genus was exposed to view. The head was beset with long thick white hair, and the tusks, eleven feet eight inches in length, were curved backwards towards the eyes. The animal was in a kneeling position, the hinder part of the body being deeply buried in the snow, and in such an attitude as it would take if it had died while endeavoring to extricate itself from the bog. In its stomach was found bark and grass. These remains were distributed for miles over the plain and were
using the same. It runs in metal boxes placed at the upper ends | so abundant that it appeared as if a numerous herd had perof the wrought iron rods. These rods are connected, as ished there. The place swarms with polar bears, which live shown at their lower ends, by a cast iron bar, in the center of which is tapped a nut which receives a screw which, by the evel gear, Y, communicates with the hand wheel, $\mathbf{Z}$, at the

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## THE PHYSICAL CONDITION OF THE PLANETS.

While the savants of former centuries have, with the u most minuteness, determineã all the details of the motions of the bodies which constitute our planetary system, and definitely settled the astronomical aspect of the question, it was reserved for the astronomers of the present day, the lat ter half of the nineteenth century, to determine the particu lars of their actual condition, and to settle the physical a pect of the question.
First of all, astronomy having long ago proved that our earth contains scarcely the four hundred thousandth part of the matter constituting our planetary system, and that she has a common origin with the rest of the same, the new science of geology proved that our earth had passed through a gradual cooling process, that many portions of her surface were to all intents and purposes equivalent to a burnt up cinder, while other portions of the surface had been disinte rated, washed, dissolved, precipitated, etc., by the long pro onged action of water. We are, as it were, driven to the conclusion that the history of the other members of our planetary system must be similar to that of our earth, that ocner or later they have gone or will go through the same phases of existence, and that the fate in store for our earth nay be learned from the condition of those planetary bodies which are the furthest advanced in this slow cooling process.
The celebrated French naturalist Buffon was the first to make experiments in order to determine the period of time required for highly heated bodies of different size to cool off by radiation; he had very large iron balls cast of different sizes, exposed them freely to the air in order to cause them to cool down, and noticed carefully the difference in time required by the large as compared with the small ones, He thus found the law regulating the relation between the ize of the ball and the time required for its cooling; and applying this law directly to a ball of the size of our earth in the supposition that it was once white or red hot, he found the lapse of millions upon millions of years neces sary for her cooling down to the present temperature. Hi experiments were more recently verified by Bischoff in Ger many, who had balls cast of certain furnace slags simila to basalt; some of these balls were of colossal size. He came to similar conclusions, supporting the evidences of the geologists in regard to the immensity of the period of time required for the past history of our planet. This consider ation alone makes the now almost antiquated idea, that the planets are all inhabitable at the present period of thei existence, if not untenable at least very doubtful Th planets are of very different sizes; they therefore require different periods of time for cooling down, and as they or ginated from the same nebulous mass of matter, and had fter its first condensation, by gravitation (not by cooling) early the same temperature, they must now have reached ery different conditions of heat, which vary according to heir sizes.
Let us now see what the combination of the modern spec roscope, photometer, and telescope reveals to us in this re sect, and whether these conclusions are confirmed by the most scrutinous observations of the present day. Fortu nately one of the smallest bodies of the pianetary system, and therefore one of those which must have cooled the soon est, is the nearest to us, our moon. Observations point to the ndeniable fact that, in the moon, all effects of its own heat have utterly ceased, that the whole satellite is cooled down to a low temperature, scarcely reached on earth by the tops of the Himalayas and Andes; that all former volcanic action, of which she bears strong evidences, has utterly ended and that all water ever possessed by her has long ago been
absorbed by her lavas and rocks as water of hydration while no trace of an atmosphere can be discovered, so that we even do not know whether she ever had one
The next body of which we have some definite knowledge is the planet Mars. Although he is at several hundred times greater distance from us than the moon, we can observe his atmosphere, clouds, and changes of seasons in his two hemispheres, by the periodical increase and decrease of the ice belt around.his poles. In fact, there is no heavenly body in which the conditions are so similar to those of our earth at the present time; but the planet is much smaller than our earth, and is further from the warming influence of the sun therefore the probability is that he is farther advanced in the cooling process, and this is confirmed by the closest mod he observations. Clouds and wator are much more seare there than on our earth, and the fate awaiting us, of drying here than on our earth, and the fate awaiting us, of drying to be realized there on a large scale, as on our earth it is realized over limited surfaces, such as the Asiatic and African esert
In order to understand the reason of this continual dimi nution of the amount of water on a planet, we have only to consider that aiter every volcanic eruption, by the hydration of the cooled lavas, a certain amount of liquid water is with drawn from the general provision and solidified in the rock and that the liquid interior of our earth contains enough of this material to absorb many times all the water of ou oceans; as-these extend down to scarcely the one thousandth part of the earth's diameter, while only a comparatively thin solid crust covers the hot interior. These two bodies, th moon and Mars, are thus ahead of the earth in history, whil the other members of the system are behind. Jupiter, by reason of his immense size, 1,000 times that of the earth, is not yet cooled below the red heat, and is surrounded by a tmosphere of superheated steam, as we mentioned on a fo mer occasion; Venus by its neighborhood to the sun, being nearly of the same size as our earth, is in very much th same condition as Jupiter, only cooled down a little further and on the eve of becoming fit for vegetable and animal life Of Mercury, still nearer to the sun, we know nothing, butthe probability is that he is hotter than Venus. The satellites of Jupiter have been proved to be darker than the planet it self, emitting no light of their own, as the planet does, and may therefore rejoice in the existence of life, if the othe complex conditions of proper atmosphere, water, etc., are fa orable; but this is improbable, as the main planets appea o appropriate the atmosphere of their satellites. In regar o Saturn, it appears that this planet is very much in th ame condition as Jupiter, only, on account of its somewha mall disk and greater distance from the sun, its cooling ha progressed further, as evidenced by observations. Uranu and Neptune are too far off for us to found any conclusion or observations; while of the moons of all these planets we now nothing, and it is reserved for future astronomers to come to any positive conclusions in regard to their condi .
On the whole, we must recognize that, in all the discussions in defense of the plurality of inhabited worlds, two elements been overlooked, time and space. The first is eternal都 latter infinite; and if even only one inhabitable world ex ists at a time, and if each of their great number has its urn to become the scene of life, eternity is long enough to give such an opportunity to every world in the infinite uni verse.

## HE FLY WHEEL.---EXACT FORMULAS BY WHICH T

 PROPORTION ITA correspondent wrote recently, asking us to quote known authorities upon the subject of proportioning fly wheels, and he desired information was given in the ScIentific Amercan, current volume, page 177. The best set of complete formulas for exact determinations that we have yet seen has nce been given in the London Engineering, in the cours hich has so long lder contemporary the Engineer We extract the follow ing, omitting the mathematical disquisition, of which the formulas are a part, as out of place in our columns:
The accumulated work in a fly wheel rim, moving
The accumulated work in a fly wheel rim, moving at known ve!ocity, is the amount of work which was necessari
y expended upon it to give it its motion, and the amoun which it must itself do before it can come to rest. This is qual to $\mathbf{W}=\frac{\mathbf{N}^{2} \mathbf{w b}\left(\mathbf{R}^{4}-\mathbf{R}^{\prime 4}\right)}{3738}$ $\qquad$
cases, first where the revolving body is a disk, like a grind stone, or, second, where it is a rim like that of a fly wheel These equations may be expressed by the following rule Multiply the square of the number of revolutions per min te, by the weight of material per cubic foot, by the thick ess of the disk or rim in feet, and by the quantity obtained by subtracting the fourth power of the inner radius of the wheel rim from the same power of the outside radius in eet (in the disk by the fourth power of the outside radius ince the inner radius is zero), and dividing the whole pro uct by 3738. The result is in foot pounds, that is, it rep esents the product of any resistance, or driving force, in pounds by the distance through which it must act to dp n amount of work equal to that accumulated in the wheel Thus, for a grindstcne 6 feet in diameter, $1 \frac{1}{5}$ feet thick, and weighing 144 lbs. per cubic foot, we get $120^{2} \times 144 \times 1$ $\times 3 \div 3738=53912$ foot pounds.
An iron fly wheel rim, similarly, would require, to stop it f making 20 revolutions, having a diameter of 20 feet out ide, 18 feet inside, and rim 6 inches thick the weight of , say, 444 lbs. per cubic foot
$\mathrm{W}=20^{2} \times 444 \times \frac{1}{2} \times\left(10^{4}-9^{4}\right) \div 3738$, more than 80,000
foot pounds, and this, if expended by stopping the wheel in one minute, would yield a mean of two and a half horse power.
The stress on the rim of a cast iron fly wheel is given by $\mathrm{S}=\frac{\mathrm{RN}^{2} \mathrm{r}^{2}}{952}$ 952 , Mim, and by the sques, by the square of the number of revolutions the the product of 952 . Thus, a wheel having a section of rim $=72$ square inches, a mean radius of $9 \frac{1}{2}$ feet, and mak. ing 20 revolutions per minute, would have a strain upon its
cross section of $72 \times 20^{2} \times 9 \frac{1}{2}^{2} \div 952=2730$ lbs., which would tend to tear the rim apart.
The weight of a wheel of cast iron weighing 444 pounds per cubic foot $=38.75 \mathrm{r} R,=$ the product of the mean radius by the cross section and by $38 \cdot 75$. The weight assumed is equivalent to a specific gravity of $7 \cdot 1$, which is a fair figure or ordinary cast iron.
These formulas and rules, together with those already given in the earlier numbers of this paper, will afford our readers the information necessary to correctly proportion the fy wheel in any case that is likely to present itself, and to determine the power and weight of one already constructed.

## THE NEW OCEAN TELEGRAPH CABLE.

The British steamer Kangaroo has arrived at New York with the shore portion of the new telegraph cable which is to be laid this summer between England and the United States, viâ Nova Scotia. The cable is to be landed here on the south side of Long Island near Rockaway beach. The Great Eastern, with the ocean part of the cable on board, is xpected to arrive here soon.
The French cable recently broke, and communication was suspended. It will be a serious job to fish up and repair the wire. The break is supposed to be at a joint 230 miles out from the French coast. All business is now done over the Atlantic or Newfoundland cable, and such is the pressure of work on the line, that the rates have been advanced to $\$ 1.50$ per word.

## ANOTHER PHASE OF THE VIENNA EXPOSITION.

It is a source of national regret that the information which as reached the State Department, relative to irregularities alleged to have been committed by some of the commission rs to the Vienna Exposition, appointed under the act of 1872, has been considered as based on sufficient proof to wa rant the investigating committee in Vienna, Minister Ja and Mr. McElrath, in advising the suspension of these off cials, pending further examination, and also the appointmen f a temporary commission in their stead. The exact nature f the charges is not yet made public, but it is hinted that permits for restaurants, saloons, etc, have been sold. Th eromm hower, been by the President, and the necessary orders were recently forwarded by cable, placing Messrs. L. B. Cannon, Jackson S. Schultz, W H. Aspinwall, S. C. Ward, W. T. Blodgett, and others in office until permanert appointments can be made.
The suspensions, it is understood, are not to be taken as an opinion pronounced againstany particular person suspend ed, and therefore any of the original commissioners may be recommended for re-appointment; nor does the measur affect the skilled artisans, scientific or honorary commission ers, holding office under the act of 1873 , whose appointment ere made subsequent to the irregularities under investiga tion.

THE GEOGRAPHICAL WORK OF THE WORLD IN 1872 Chief Justice C. P. Daly recently delivered before the American Geographical Society, of which he is the president very able and elaborate address on the progress of geo raphical knowledge during 1872, giving a full account of he labors of the various surveys and exploring expeditions, nd explaining the work accomplished up to the beginning of the present year. After alluding to the physical events, of a geographical character, which have been especially marked: including earthquakes, atmospheric disturbance an similar phenomena: the subject of American exploration nd suiveys was first considered

## THE VOYAGE OF THE HASSLER

asted nine months. The chief scientific results have been the bservation by Professor Agassiz of the evidence of post lacial action on the coast of South America: both on th Atlantic and Pacific sides, below the thirty-seventh paralle of south latitude, with the detection of existing glaciers in th traits of Magellan and on the coast of Chili : and an immens zoological collection embracing 100,000 specimens, the fish in which alone amount to 30,000 . The conclusion drawn by Professor Agassiz, from what he saw, was that during the lacial period both hemispheres must have each been capped with an enormous sheet of ice, one moving northwardly rom the Antarctic and the other south wardly from the Arctic oward the equator. Ice, he considers, has been the great machine by which the rocky surfaces of the globe have bee ashioned.
PROFESSOR HAYDEN'S EXPLORATIONS, IN UTAH, IDAHO AND montana
were principally devoted to examination of the valleys of the Yellow Stone, Madison and Gallatin rivers, a tract of 3,57 quare miles which has been set apart as a grand national park. The event of the season was the ascent of the Grand Teton, 13,762 feet above the sea, the summit of which no white man had ever before reached. A rude enclosure wa ound there, evidently designed as a protection against wind and probably hundreds of years old. On Lake Shoshonie a new geyser basin was discovered, containing over one hun
dred springs. All this wonderful region was carefully sur veyed and mapped.

## EXPLORATIONS IN THE ALEUTIAN ISLANDS

have been carried on by Mr. W. H. Dall. He has discovered in these islands the remains of a people antecedent to the villages, he found burial caves in which the dead bodies had been placed soas to indicate their ordinary occupations: men in canoes, as in the act of rowing, women dressing skins, holding children, etc.

## THE DARIEN EXPEDITION

was dispatched for the second time in the winter of 1871 under Commander T. O. Selfridge, U. S. N., to explore the route by the Atrato and Tuyra rivers, which was done, and found impracticable. Another route was, however, surveyed from the Pacific to the Atrato, which appeared so favorable that at the close of last year Commander Selfridge was sent back to complete the work, If a canal by this route is practicable, its construction will shorten the voyage from New York to Hong Kong for sailing vessels from 110 to 83 days. There is also an expedition for a survey across Nicaragua a work at the present time.
the american palestine exploring expedition is in charge of Lieutenant E. Z. Sleever, U. S. Engineer Corps, who, with three associates and a number of natives, will explore the country east of the river Jordan and in the northern part of Syria. Besides the labors above described, the ger,graphical work accomplished in 1872, and in progress, in this country, comprises the continuation of the sur vey of the 40 th parallel, explorations west of the 100th meridian, a reconnoissance of the basin of the Yellow Stone
river, explorations of the Colorado river, surveys for the river, explorations of the Colorado river, surveys for the
building of the Northern Pacific Railroad, and some others principally devoted to cartographical objects. The various

## ARCTIC EXPLORATIONS

and their present condition, we have recently referred to a length. The Swedish expedition wintered in Mossell Bay, Greenland, and during the coming summer will endeavor to reach the pole by sledges. Another party sailed from Sweden, during the year, to establish a colony on the southwest
coast of Spitzbergen, for the obtaining of phosphates for coast of Spitzbergen, for the obtaining of phosphates for
artificial manure. Count Wilezek, of the Austrian expedition, returned home in November. The Tegethoff, the re maining vessel of the.fleet, intended to penetrate the sea east of Nova Zembla. Nothing has been heard from the Polaris since August 5, 1871. Captain Hall was then in latitude $73^{\prime} 21^{\prime \prime}$ north, longitude $56^{\circ} 5^{\prime} \mathrm{W}$., and all were well He sailed for Smith Sound, following the route of Kane and Hayes. An interesting relic has been found by the maste of a small Swedish sloop, who succeeded in passing the north east point of Nova Zembla. It was the hut left by Barentz,
the Dutch navigator, 276 years ago, and which has since never been entered by man. The sleeping berths, halberds, muskets, and clock upon the wall, were untouched, and muskets, and clock upon the wall, were untouched, and
among the books was found a description of China, the counamong the books was found a description of China, the coun
try the explorers hoped to reach by the north east passage The remains were purchased by the Dutch government.

GENERAL GEOGRAPHICAL LABORS.
Government surveys are in progress connected with the publication of maps of various European countries. The examine the great ocean basins of the world. A group of islands in the South Pacific known as the New Hebrides have been explored and other investigations have been made of general scientific value. Among the

## rcherogical discoveries

of the year is that of lake dwellings or lacustrine villages of the prehistoric inhabitants of Europe at Bienne in Switzer land and elsewhere, the finding of a skeleton of a man at Mentone in France, which is supposed to be of great antiquity, and the exploration of pit dwellings in England. In the United States, the ruins of what was once a populous city, covering an area of 3 square miles, have been found in Arizona. The entire space within the enclosing wall of sand. stone had been covered with houses, built of solid sandstone without mortar. The ruins consisted entirely of stone, not a stick of wood being visible. On the N. W. coast of Asia Dr. Schlieman claims to have found the remains of ancient Troy. His excavations have led him through ruins of suc cessive settlements, at the lowest of which were structures
built of massive stones. A wall of huge stones joined tobuilt of massive stones. A wall of huge stones joined to-
gether with clay, and the ruins of a solid tower of masonry gether with clay, and the ruins of a solid tower of masonry
forty feet thick, built upon the primitive rock, were found. General Di Cesnola's Phœnician antiquities we have already fully described; they are at present being arranged in a suit able museum in this city. The principal

Asiatic explorations
have been made by English engineers in Persia, for the location of telegraph lines. The Russian government has had under consideration a canal connecting the Black and Caspian seas, which, although only abrut six miles in length, will require the labor of $32,000 \mathrm{men}$ for six years. Surveys are being made for a railroad from Scutari, on the Bosphorus, to Shikabore, in India,
Moscow to Pekin. In
africa,
the results of the year have been the rescue of Dr. Living. stone by the Herald reporter, Stanley, and the knowledge of the explorations of Dr. Schweinfurth, in the regions west of Khartoum and to within $3 \frac{1}{2}$ degrees of the equator. The lat
ter traveller has found a race of pigmies, ordwarfs, supposed ter traveller has found a race of pigmies, ordwarfs, supposed
to be the same described by Herodotus. M. Alfred Grandidier has devoted his labors to Madagascar, and has fixed the latitude of 188 points, and examined the coast line for 1,250 miles. Karl Mauch, the discoverer of the gold fields in 1871,
has fownd a ruined city on the east coast of Africa, contain
ing massive stone structures of great antiquity. He think the spot to be the famous Ophir so long sought for, to which Solomon sent for gold and precious stones. Sir Samuel Baker left Gondokoro in 1871, sinee which time no authentic news has been received from him. Sir Bartle Frere has ar rived at Zanzibar, and communicated with the Sultan, relative to the suppression of the slave trade, and two English expeditions have been despatched to coöperate with Dr. Livingstone.

## THE PROBLEM OF THE COMING TRANSITS

In resuming the consideration of this subject, commence in our last weeks issue, we must remember that, a last transits was an undiscovered art at the time of the same results were aimed at by the method proposed by the great astronomer Halley. According to this method, the observer, instead of attempting the hopeless task of determining the planet's exact position on the sun's disk at any moment, merely notes the duration of her transit, which is necessarily different for different stations. Having the exact time occupied by the planetin traversing her chord of transit, the length of the chord can be calculated, and consequently its distance from the sun's center. A comparison of two hords obtained from the observations made at two stations suffices to show, as in the photographs, the planet's displace-
ment for the two stations; the distance between the stations ment for the two stations; the distance between the stations being known, the planet's distances from the earth and from the sun follow as before. This method requires simply that each observer shall note the exact beginning and end of the he interval correctly; bun, and that his clock shals as a com paratively broad disk on the sun's face, it is no easy matter to determine the precise instant when her center crosses the sun's edge at the beginning and end of the transit. To do this, the observer has to note with infinite precision the mo ment when the edge of the planet first touches the sun's rim hat is, her first external contact; next, the instant when the planet is just wholly immersed and the broken edge of the un appears to close, that is, her first internal contact; and lastly, he must repeat both observations in reverse order
when the planet leaves the sun's disk. The obstacles to the when the planet leaves the sun's disk. The obstacles to the easy and exact observation of these phenomena are numer site distance between the points of observation, it is necessar that one station be as far north, the other as far south, as possible; hence the sun cannot fail to be near the horizon, a which times the outline of his disk is greatly distorted. At mospheric causes very frequently aggravate this difficulty by giving the sun's edge an uneven or rippled appearance. Then the planet, when just in contact with the sun's edge, lways assumes a peculiar pear-shaped aspect which make all but impossible the exact moment of contact, an
There remains one more method, which can be described in There remains one more method, which can be described in
few words. It is known as Delisle's, and is especially valuble in that it aims to determine the sun's distance in a man ner entirely different from those thus far noticed, and is ap plicable at times and places altogether unfavorable to Halley's method. Again our ball and circle may help to make the matter more easily comprehensible. Suppose the camera to be placed as before and the ball be made to pass from left to right between the instruments and the screen at a uniform rate of motion. It is obvious that the ball will come in line between the edge of the circle and the left hand camera first. After an interval, depending on the ball's rate of motion and he distance between the points of view, the ball will come in line between the right hand camera and the edge of the ircle. When it reaches the other side of the circle, the ap earance will be reversed; that is, it will seem to the observ rat the left hand camera to leave the circle sooner than to the one at the right. Let us confine our attention to the first case. If each observer notes the exact time when the ball appears to him to touch the rim of the circle, the difference -say four seconds-will measure the interval occupied by the ball in passing a certain distance. Now if that distance can be exactly calculated, the ball's rate of motion can be asily ascertained.
We know the distance between the cameras ( 12 inches). The position of the ball, relative to the cameras and the creen, is also known, since it divides the whole space into parts having to each other the ratio of two to five. Hence, y a simple geometrical principle, the space passed over by the ball, in the given interval, is to the distance between the
cameras as five to seven; which gives $8 \frac{4}{7}$ inches. If the ball moves over $8 \frac{4}{7}$ inches in four seconds, its rate of motion must be $2 \frac{1}{7}$ inches a second.
In like manner the rate at which Venus moves in her orbit is calculated from the interval between two observations of
the same phase of transit as seen from two stations. The ime which the planet takes to make a complete circuit of her orbit is known; this time, multiplied by the planet's rate of motion, gives the circumference of her orbit in miles, whence its radius, or the distance of Venus from the sun, is easily found. The ratios of the planetary distances being know by Kepler's third law, the sun's distance from the earth o ny other planet in miles follows by a simple prop
The isadvantages arise from the fact that the exact mom. Its which the planet's ingress or egress occurs must be known. Besides the obstacle to the nice determination of these phases, this method involves the further difficulty that the clocks
made use of at each station must show absolutely true time at the moment of observation. And since, to determine the
exact interval between different observations the local time at each station must be changed to some common standard, say Greenwich time, it is essential that the longitude of the stations be determined with especial accuracy. Halley's determination of the observer's position, and a time rough which shall not vary appreciably in the course of four or five hours. Both methods, supplemented by photography, will hours. Both methods, supplemented by photography, will
be employed in the observation of the coming transits. The reasons which govern the choice of stations for each method reasons which govern the choice of stations for each method
are not within the scope of this article. The main point is are not within the scope of this article. The main point
that the stations shall be sufficiently numerous and carefully selected to give the minimum risk of the thwartiug of all bservation by foul weather.

## SCIENTIFIC AND PRACTICAL INFORMATION.

HIPPOPHAGY IN PARIS.
There are forty stores in Paris devoted to the sale of horse meat as an article of food. During 1872, 9,725 horses, 866 sses, and 51 mules were consumed by the inhabitants. Les Mondes says that the animals are prepared for the market in he ordinary way, and that the meat sells for about half the price of beef. The horses are inspected at the slaughter house with the greatest care. It may be noted as an inter esting fact that hippophagy is decidedly on the increase, as 2 , 408,076 pounds of equine meat were eaten in 1872 as against $1,113,024$ in 1869.

## dLteration of Ultramarine.

Ultramarine may be adulterated with some finely ground white substance, like alabaster, gypsum or isinglass, by conriving to color the outside of the particles with ultrama rine. This is accomplished, according to Dingler's Polytech nisches Journal, by sifting them together, then moistening the compound with a very fine sprinkler until it packs in the hand and no dry powder remains. It is left for 3 or 4 hours, then ifted, dried, etc., in such a manner that the blue still adheres to each white grain.
The adulteration can easily be detected by rubbing a little of it on a piece of paper with a knife, thus exposing the white surface of some of the grains, so that on comparing it with the original sample it has a lighter color.
preparation of pure sulphate of potassium.
Commercial sulphate of rotassium usually contains a large amount of sulphate of sodium. To free it from this, on a large scale, E . Sonstadt proposes the following method: $\mathbf{6 6 4}$ parts of the salt is dissolved in boiling water and 149 parts of chloride of potassium added in small quantities. Thereupon pure sulphate of potassium immediately separates as a fine crystaline powder, and as the liquor cools a fresh quantity crystalizes out. The mother liquor may then be concenrated by evaporation, until saturated at the boiling temperaure. It is then allowed to cool, and a crust of pure sul. phate of potassium forms on top. The process may be re-
peated three or four times before the liquor is sufficiently peated three or four times before the liquor is sufficiently
concentrated for the chloride of sodium, formed by the mu ual decomposition, to crystalize out. Common salt is also as soluble in cold water as in hot, which the sulphate of potassium is not, and a solution not saturated with the former when hot will not deposit it on cooling.
toillet soaps by the cold process.
There are two methods by which toilet soaps may be prepared; these are known as the hot and the cold processes. The fine English soaps are chiefly made by boiling, while most of the fancy soaps in this country are made by the cold method. When made by boiling, a weak caustic lye is used nd the soap is boiled until it is almost perfectly free from al kali. The soap which is then in sclution is separated from the water by "salting out;" the glycerin, of course, remains
in the water and is lost. The cold process is briefly as follows: The fat is melted in a well cleaned iron or coppe kettle at a low temperature, then filtered through fine linen or muslin into another kettle, and cooled to $101^{\circ}$ Fah. or lbs. of fat requiring about 40 lbs . of lye. It is then stirred with a wooden paddle until a ring made by stirring may be ecognized. At this time the coloring matter and perfumery re added. It is next run into frames lined with muslin closed, and left for 12 hours, by which time saponification will have taken placo, the temperature rising to over $175^{\circ} \mathrm{Fah}$ it is now ready to be taken from the frame, cut, dried, and old. Soaps made by this process are softer and pleasanter because they contain the glycerin; but they are unfortu nately always more or less alkaline, no matter how much
care is bestowed upon their preparation. A Frenchman care is bestowed upon their preparation. A Frenchman
named Mialhe claims to have invented a method of neutral zing the free alkali and thus combining the advantages of both methods and making a perfectly neutral glycerin soap. This is accomplished by taking the ordinary soap prepared by the cold process, shaving it up fine, and spreading it out on grates in suitable chambers, where it is exposed to the action of carbonic acid gas until 8.11 the free soda is convert ed into the bicarbonate of soda. Thus a perfectly neutral soap is obtained, which contains all the glycerin present in the grease and a certain quantity of bicarbonate of soda.

The railroad tunnel at Baltimore, which is to unite the oads on the north and south sides of the city, is to be completed before the end of June, and, until the completion of the Broadway Underground Railway in New York, will form the largest underground railroad possessed by any city in America.
General George S. Green, formerly Chief Engineer of he Croton Aqueduct, New York, has been appointed Chair man of the Engineer Commissioners who are to supervi
the construction of the Broadway Underground Railway.

THE ORNAMENTAL USE OF METAL.
The custom of embellishing parks with statuary and othe ornamental objects, arising with the Greeks, was never carried to so great an extent as in the famous pleasure grounds of Italy. In the neighborhood of Romethere still exist the celebrated villas of the Dorias and Di Medicis, while near Genoathe great Pallavicini gardens yet form the principal attraction of the city. It was in these grounds that the famous sculptors of the Middle Ages designed their choicest works, and even now, too weather worn and injured to meet places in the museums, a few antique vases and figures still stand in the same spots where centuries ago they were first placed.
It has been asserted that the art of sculpture, as now practiced, is but reproductive, and that the genius of the present age tends more toward the rejuvenation of ideas of the past than toward the development of orig inal conceptions. The reason, perhaps, may be traced in the fact that the world is no longer content with a single embodiment of a grand or beautiful thought, but demands its infinite multiplication-calling upon modern invention for processes reiterative of ancient prototypes rather than for fresh creations of the imagination. The same figures of Flora, of Venus, of satyrs, dryads, and wood nymphs, which, buried in ancient foliage, decay in the villas or are admired by millions in the museums of Italy, are now trite and every day ornaments. We turn the cover of a work before us, and their familiar forms appear upon the initial sheet. Metal has replaced the stone, the molder's flask and the melting furnace have superseded the sculptor's mallet and chisel; and while the originals remain immured in the cities of Europe, their counterparts, by thousands, beautify the pleasure grounds of the New World.
Ornamental wyork in metal, as now carried on, is not Ornamental mork in metal, as now carried on, is not represents an article of garden furniture of exquisite and entirely original design, which, for grace and beauty, will favorably compare with many similar works of ancient art. The vase in the smaller engraving is, it is true, copied, but from an object the fame of which is worldwide, the celebrated Warwick Vase, still existing in Warwick Castle, England. Filled with flowers and trailing plants, no more elegant ornament could be desired.

There is another thought suggested by these tasteful objects, and that is the great progress which is being made in adapting the metals, especially zinc and iron, to all kinds of ornamentation. The latter is becoming more and more employed for architectural decoration to exclusion of stone; the former, in the hands of a skillful artist, is capable of the most finished and expressive treatment. For counterfeiting the fine lines of statuary, and more especially floral subjects, it is excellently suited, as the thin petals and leaves of plants can be worked out in it, in all theirinfinite variety. As a material for out-door exhibition, in connection with iron, it is superior to either stone or terr cotta, being neither as expensive as the one nor as easily in-
jured as the other. A coat of paint protects it from the ef fects of the weather, and insures its durability while giving it the appearance of the marble or other material it is in ended to represent.
We select the accompanying engravings from a number of beautiful designs of various objects of art and ornamentaal tion in the catalogue of the J. L. Mott Iron Works, No. 90


THE WARWICK VASE, REPRODUOED IN IRON.
Beekmanstreet, in this city, one of the largest establishments devoted to the specialty of ornamental work in the United States.

## Glue Making.

According to Yardley's process, the bones are put into an apparatus in the shape of a hollow globe, and made of wrought iron (copper cannot be used because the gelatin has a very powerful action upon it). The first process is
to cleanse the bones by immersing them in a pit orcistern of water, where they remain about twelve hours; the water is then drawn off and fresh water added to them; this opera ion is sometimes repeated to remove any dirt, etc. Th water being withdrawn from the bones, a solution of lime in the proportion of one bushel of lime to 500 gallons of r, is to be poured into the cistern for the more perfect cleansing of the bones and the removal of any super fluous matter. After three or four days' saturation, the lime solution should be drawn off and fresh water added to get rid of the lime. Thus prepared, the bones are placed in the globular vessel called the extractor, which is filled with them by removing the interior plate which covers the manhole; this aperture is of an elliptical form, and allows the plate to be slipped round and re fixed inits place by turning a nut which draws it up tight against the interior surface of the extractor, and th junctures are made air-tight by luting. The extracto turns upon a horizontal cylindrical shaft; one half of this shaft is made hollow, or consists of a strong tube which tube also proceeds downward towards the cente of the vessel to conduct the steam beneath the grating upon which the bones are laid. The steam, of about 15 pounds pressure, is admitted by the cylindrical shaft proceeds first to the bottom of the extractor, then rise up through the grating and among the bones, until the vessel is completely charged; previously to this, howe ver, the air in the extractor is got rid of by opening cock at the top of the extractor, and closing it after the admission of steam. While the steam is acting upon the bones, the extractor is occasionally turned round by means of a hand wiinch. When at rest, a quantity of fluid gelatin is collected at the bottom of the extrac tor, whence it is discharged by means of a cock int a tub beneath, after opening the air cock to allow it to run off. This done, steam is again admitted from the boiler into the extractor to act upon the bones for an other hour, when the second portion of condensed liquor is drawn off. When the products thus obtained have become cold, the fat which has formed upon the surface is to be carefully removed by skimming, and the gelatinous portion only is to be returned to the extractor by means of a funnel through the cock on the top. The steam is then admitted to the extractor for another hour, after which it is finally drawn off into an other vessel to undergo a simple evaporating process until it arrives at a proper consistency to solidify when cold, previous to which some alum is added to clarify it. When cold, this gelatinous mass is cut into square cakes and dried as usual in the open air.

The Commissioner of Patents, Canada, has presented to Parliament a bill for the further amendment of the Canadian patent laws. The amendment simplifies the preparation of the application, and does away with a great deal of the red tape proceedings now required. The design is to assimilate both the proceedings in preparation of papers, and the procedure before the Patent Office to those of the United States


NEW IRON GARDEN SETTEE

## STEVENS INSTITUTE LECTURES.---MOONLIGHT AND ITS

 SOURCE.The moon shines, as is well known, by reflected light; and a consideration of the nature of reflected light will therea consideration of the nature of reflected light will there-
fore be a profitable introduction to the study of the moon itfore be a profitable introduction to the study of the moon it-
self. When a pebble is dropped in the smooth water surself. When a pebble is dropped in the smooth water sur-
face of a pond, circular ripples or waves will be formed, constantly expanding as they recede from the center of disturbance. In like manner, a source of light produces a disturbance in the ether pervading all space, thereby throwing it into ripples or waves, which differ from the former only in being spherical instead of being confined to a flat surface. When one of these advancing waves of light strikes against an obstacle, it will be thrown back as an india rubber ball would be when thrown against a wall, returning with the same force with which it struck, because the impinging ethe is perfectly elastic.


In the accompanying figure are seen a series of waves proceeding from the center, $C$. One of them has arrived at an obstacle, $D$, but for which it would have reached E , as shown by the dotted lines, $F,{ }^{\prime} \mathrm{E}, \mathrm{G}$; as it is, however, the wave is thrown baciz with the force with which it struck, evi dently describing the curve, $F, H$, G, just as far above the obstacle as the unobstructed wave would
have gone below it. The other waves would be reflected in the same manner and give rise to a series of curves having a center at $\mathrm{C}^{\prime}$, as far below $D$ as $C$ is above it. When speaking of reflection, it has bee cnstomary to explain the phenomena by using the term "rays;" but it fast be remembered that these only repre sent the direction in which waves proceed, and not the manner of their propagation. If a line joining $C$ and $G$ repre sent the direction of the wave striking at the latter point, the direction of the reflected ray wilk be indicated by a line joining $\mathrm{C}^{\prime}$ and $G$, thus furnishing an easy proof of the law that the "angle of reflection is equal to the angle of inci dence."
After the above new.explanation of the familiar law, the lecturcr exhibited the reflection of waves upon the screen, by means of a beautiful piece of apparatus. The light of an oxycalcium burner was reflected by means of an inclined mirror through a flat horizontal glass tank filled with water By means oi puffs of air, waves were produced upon the center of the water surface, and these were reflected upon the screen by a large inclined mirror above the tank. The sides of the latter were made to slope considerably outward, so as to avoid reflection from them; and the audience wa thus enabled to verify what had been stated about the propagation of waves. A glass plate held in the water on the side of the tank reflected back the waves of water, in circles having very much the appearance of those in Fig. 1.
After dwelling brietly upon the well known laws of reflec tion, and exhibiting in illustration some of those beautiful Yo Semite views where the eye strives in vain to discover which is the landscape and which the reflection in the river the lecturer described how objects thus reflecting light become of themselves secondary sources of illumination. A number of objects, lighted up by the lime light and thrown upon the screen by means of a lens, apreared in bold relief and startling proportions. The engraving herewith, representing the professor's hand, will give some idea of the effect. senting the professor's hand, will git moon receives its light from the sun and becomes in turn a source of illumination to us
Passing thence to the consideration of the moon itself, photo graphs representing its different phases were exhibited. These the lecturer stated, made by Mr Rutherfurd and Dr. Draper, wer productions of which America might be justly proud, as nothing had ever been produced in othe had ever been produced in othe parison with them. The topo parison with them. The topo graphy of the moon has been ac curately studied and the differen portions of her surface have re ceived names, some of them poet-
ical. Thus ical. Thus we have the Sea of Nectar, the Sea of Storms, the Frozen Sea, the Lake of Sleep the Lake of Death, .the Misty Marsh, the Meadow of Dreams; the mountains have been named after distinguished men. Some of the most important are Tycho Brahe. Ptolemy, Herschel, Archimedes, Copernicus, etc. The different regions containin these various parts were separately discussed. It seem that the moon is composed of burnt out craters of immense volcanoes, some of them a hundred miles across the top, and that there is no vestige of water or atmosphere about it. Consequently the stars will be visible thence, even when the full blaze of the sun is upon it, during its day of fourteen terrestrial days, because there is no diffusion of light. It is the presence of our atmosphere that prevents us from seeing the stars in daytime. The manner of measuring the hight of lunar mountains is by observing their shadows at differ-
ent times of day. They are carefully measured by means of the micrometer; and from their length and the accurately determined relative position of sun and moon at the time, the astronomer is enabled to calculate the highit of the mountains. Different views taken from paintings by Mr James Hamilton, an artist of note, of what must be the ap pearance of portions of the moon by earth-light and by day ight were then exhibited. They gave an excellent idea of what is believed to be the condition of the moon's surface All we know of the moon is of one side only; for she neve urns the other towards us Professor Janssen accounts fo his fact by supposing that the greater part of the mas of the moon lies on the side away from us, and that our side is the moon lies on the side away from us, and that our side comparatively light and frothy, thus giving it an eccentricity which would prevent the other side from ever turning to wards us. If there existed any water or air on the moon, it
would, according to this hypothesis, be drawn away from our would, according to this hypot
side towards the opposite one.

It has been advanced as a theory that the moon has passed hrough the different stages which geology teaches us took place on the earth; that finally, by cooling off, all the air and water have been absorbed and that she is now a dead planet evoid alike of animal and vegetable life, burnt out and rozen. This is represented to be the ultimate destiny of our earth and of all the planets, though millions and millions f yeaps may be required to accomplish it. The earth we yose has pertilly cooled from a liquid molten mass, and
 egreater part of wards she was covered by immense glaciers, which have left their imprints upon the rocks all over her surface. These
stages of development can be seen now going on simultaneously in the other planets. Jupiter being greatest in bulk and consequently requiring a longer time to cool, according to the hypothesis, has not yet arrived at our stage. Obser vations by Professor Mayer and others demonstrate that it has for some time been undergoing changes and sending out more light than it received from the sun; while Mars has passed our stage and exhibits the phenomena of huge snoworms and evidences of an Arctic period. Maps of the two anets, showing their characteristics, were produced upon he screen in this connection. According to this bold hypo thesis, the moon represents the very remote future of the planet on which we live, a time when it will be no longer a it habitation forman.

## THE WONDEES OF THE EGG.---SECOND LECTURE.

The following lecture was recently delivered by Professo gassiz before the Museum of Comparative Zöology at Cambridge, Mass.
I closed my last lecture with the remark that before ap proaching the question of origin it was indispensable to be amiliar with the conditions under which organized beings were multiplied. It is a feature which is too frequently neglected in any discussion of this kind. I propose to bring before you, as plainly and methodically as I can, the conditions accompanying the maintenance of animal life upon the earth. Do you realize that all the living beings which surround us, however great their diversity, have a short time since been eggs; that there is not a human being, nor quadruped, nor a bird, nor a reptile,nor a fish, which has no an ovarian egg; that generation after generation thes hey were produced, and that this is an indispensable condi ion for the very existence of all the life with which we are familiar? But this is not all. Besides the inwe are familiar? But this is not all. Besides the in-
rganisms, and especially in the class of radiates, that com ine the three modes of reproduction: multiply by eggs, uds, and self division at various times. Others propagate by the two first processes alone, without the last. Among he higher animals propagation by eggs is the only method known. Neither mammal, bird, reptile, nor fish multiplies ts kind in any other way. All eggs arise in what are called varies. These are clusters of cells, forming bunches of omewhat glandular characterin appearance. Between thes ells the eggs are formed and in such a way as at first to be hardly distinguished from the cells themselves. The sam true of sperm cells, which arise in organs of the sam character as the ovary, and are formed in a manner perfectly imilar to the of the manner perfectly a ese lin ar in the essence of the two is hardly to be determined by ob the essence of the two is hardly to be determined by ob-
servation. It is only by the process of growth, by the in fuences produced by the one upon the other, and by th onsequences of these influences, that we recognize the es ential difference which distinguishes them.
In order fully to appreciate what eggs are, we must re nember-what has been known for about a half a centur only-that all organized bodies are composed of little bag which are called cells, and which are formed and multiplied in various ways. Most of these cells are so small that the an only be perceived by the aid of high magnifying power here it is true a few cell structures large enough to be There ith the een win in in of mon elder pith, or the coarse cells of the orange. It is on of the great problems of modern research to ascertain how ione cells are formed and what is their mode of reproduc ion. For it does not seem that cells are formed in the sam way under all circumstances. Some naturalists assum hat in the animal substance secreted by a living body, such as milk, which is secreted by the mammary glands or similar ubstances secreted by other organs, certain particles becom enters of action, around which other particles crowd; and when a little collection of this kind, microscopically small, as been formed, an envelope arises around it, and we have the utricle or cell. Others believe that minute, imperceptible particles of animal substance swell and enlarge, and be ome hollow, so that a little bag is formed, a cell envelope in short,which fills as it enlarges into a fluid substance.
As yet we know but imperfectly what cells are; still more mperfectly do we know how they are formed, and still less do we understand their function. Yet the amount of fact lready ascertained respecting them is truly overwhelming This much, however, may be positively stated: betwee varian eggs in their earliest condition and cells in thei lementary state, such as constitute the substance of all an mal bodies, there is no essential difference.

## the egg of the mammalia

Let us now consider the ovarian egg as we know it in mammalia, and then proceed to compare it with the ovarian gg as far as is known in other classes of vertebrates. When it has acquired its ultimate growth, prior to the formation of the germ, the egg of the mammalia presents a bag the walls of which are exceedingly transparent. This bag is filled with a substance which is itself transparent, and yet which appears, under a very high magnifying power, to be ranular, as if dotted with particles floating in the fluid n that outer bag is another diminutive bag containing als a transparent fluid. This inner bag occupies an eccentric position with reference to the periphery of the outer bag, and in it are contained one or several dots. These parts of

Fig. 2.-ILlumination by radiation. ponding set of individuals from whom the egg receives a mpulse, leading to the formation of the new being within it n other words, the egg must be started by an influence from without, that is, by contact with sperm cells, into those suc essive changes or transformations by which the new being is produced. This is true of all beings not provided with he power of reproduction by budding or self-division; al hough, as I said in my last lecture; there are occasiona exceptions to the rule, as among bees and certain moths and butterflies, known to produce living beings by means of non fecundated eggs. We have many animals among the lowe
the mature egrhave received name he mature egghave received name The outer envelope is called the $v$ telline membrane, because it has been ascertained by comparison tha it corresponds exactly to the ex ceedingly thin skin inclosing the yolk in the hen's egg. A yolk is called the vitellus, and hence the name. The bag contains the yolk and however transparent this fluid may be, it retains the name of yolk. To the naturalist the word yolk no longer designates that peculiar sub stance contained in the bird's egg of a yellowish color. The yolkmay be ny substance which is contained in the outer envelope of the egg. The inner bag is called the germinativ esicle. That name was given to it under the impression that from the germ arises. The name has been setained, though I wish at the out ret that you should free yourself rom the idea that it has any spe cial connection with the formatio of the new being. The dot or dots within the germinative vesicle ar ordinarily called the germinativ
 dots. From their discoverers these parts have also had some other name-applied to them. It was Professor Purkinje, of Breslau, who discovered the germinative vesicle, and in his honor some physiologists call it the Purkinjen membrane or vesicle. Professor Wagner of Göttingen diacovered the presence of the dot in the germinative vesicle, and in his onor it is occasionally called the Wagnerian dot or dots.
The dimensions of such a mammalian egg are very small. It comes just within the range of the power of the human eye. Practiced embryologists may detect, without the use of the lens, an ovarian egg in its organ when it has reached
maturity. Owing to the difference in the power of human vision, some observers will easily detect the egg in its natural position in the ovary with the naked eye, while others are unable to see it except by the aid of the magnifier. Place the ovary under the microscope and you will find that it contains eggs of various dimensions in various stages of growth. In some th:e amount of yolk is less than in others; in some the germinative dot exists; in others it is not formed; in deed vesicles are found in the ovary in which neither ger minative dot nor germinative vesicle exists, and which are supposed to be eggs in process of formation.

## Comergymudemfe.

## The Retrograde or Direct Motion of the Sun.

 To the Editor of the Scientific American:In your issue of March 12, a scientific friend, C. H. B., has very kindly tried to set me right in relation to precession ; he thinks that I am "wrong in some of his [my] views." Well, may be I am ; I will not assert that I am absolutely right; but I have the strongest kind of evidence to show that I am right, namely, proof, and I am satisfied that C. H. B. and many others of your readers will be astonished to see it, if you will allow me to present the same to them. C. H. B. says that "' the retrograde motion of the equinoxes is real, and does not necessarily involve the idea of a direct or other motion of the sun," etc. By this language I understand him to mean that the earth makes a gyratory wabble, retrogressively, as Newton said, and as all Newtonians assert, and that it is independent to solar movementaltogether. Now let us test the truth of this by diagram, and we will soon find out who is in error. E is the earth; S , the sun; A B C and D, stars in the ecliptic, or in a circle surrounding the pole of the ecliptic, and at all points $23 \frac{1}{2}^{\circ}$ from it. E is understood to be rotating always at a regular rate, in the
 direction of the arrows, Conse quently, in rotating, it will take the same time exactly to turn round from $S$ and come to $S$ again that it will require to turn from ABC or D and return to it again. The pole of E i now inclined to A, but must be
understood as gradually leaving it and traveling towards B , passing it and moving to C , and so on, until it comes to A again in 25,868 years.
Now the first lesson we learn from this diagram is that the Newton notion of the earth making a retrograde gyrato ry wabble is not true; for, when we suppose that the pole of E , now laying towards A, gradually moves retrogressively and comes to B, we find that solar and sidereal time would both be the same. Why? Because it would take the same time, as we have already said, for $E$ to turn from $S$ and return, as it would to turn from any of the stars marked A B, etc., and return to them. If the earth was really making any such independent revolution, there would be a recession
of the equinoxes, it is true; but where would be the differof the equinoxes, it is true; but where would be the differ-
ence between solar and sidereal time? Could there be (if $S$ ence between solar and sidereal time? Could there be (if $S$
remained where it now is) one single moment's difference in ten thousand years, aye, or in ten thousand recessionary revolutions? This simple little trifle, to wit, no difference be tween solar and sidereal time, kills the Newtonian notion entirely ; for Nature yields a difference annually of 20 minutes and about 23 seconds.
Further, suppose $S$ to continually move in the direction of $B$, and $E$ to swing her poles round in the direction of A B C $D$ in 25,868 years. In every revolution $E$ made from $A$ to $A$, a recession of the equinoxes, and, of course, of the four seasons of the year, would result. But, in all that time, and with such direct solar motion, not a single minute's difference in solar as compared with sidereal time would re sult. Is not that plain? Is not that a fact? Where is Newton's notion now?
Again, suppose $S$ were to jursue a path towards $e$, and E to keep swinging her poles and rotating on her axis, as we have supposed. Would not solar time, then, be longer than sidereal time? Would not B be in the meridian before e could? And would not the increase of solar time depend upon the rate of advance of S to $e$ ? These facts are so manifestly true that none who study the subject enough to understand it would attempt to deny any one of them. Such a result is not the result of Nature; therefore we know that the direct motion of the sun, which popular astronomy so universally claims to be true, is not true, and never was What say you to that, popular astronomy?
Again, and lastly : Suppose $S$ to be moving in the direction of $f$, and E to be rotating and swinging her poles round, as before supposed; would not solar time be shorter than sidereal time? Would not E (the earth), in her rotary movement, arrive sooner at $f$ than she would at B? And would not the degree of shortening be in proportion to the rate of retrograde motion of S to $f$ ? Now such a result is the yield of Nature; hence we know, certainly, that the sun (S) is pursuing a retrograde orbit in the direction of B C D A. These, my much respected friend, C. H. B., are facts, which I think you will be willing to admit, when you next write. Although, as you say, the retrograde motion of the equinoxes does not necessarily involve the idea of a direct or other motion of the sun; yet the difference between solar and sidereal time does; and it is by this that we know that the sun is moving retrogressively in his orbit. Nothing is clearerin all astronomy.
As to the one day, so called, of precession, I would remark that it cannot be a day of 24 hours. It may be called (if we

## ength.

It is true that from the moment the pole of the earth pro onged leaves H (I allude to C. H. B.'s diagram, Fig. 2 an
 nexed), or A in my ow diagram, it cannot return thither again until about 25,868 years. But in res pect to the rotary move ment of the earth or side real time, as compared to solar time, is not the differ ence 1 in 25,868 ? And i so, then a solar day is short er than a sidereal day to the amount of one day in 25,868 dayd, and to one year in the same number of I ho
hope, at some future time, to give a diagram of my theory of solar motion, show ing how precession of the stars, and recession of the fou seasons of the year, is produced, which I believe will be both interesting and instructive to your many scientific readers, as well as to my friend C. H. B., who, I hope, will send me his foll name, so that I can privately thank him with much gra titude for the kind and gentlemanly manner in which h as made an endeavor to convince and correct me.

John Hepburn.
Gloucester, N. J.

## Wrinkle No. 2.

To the Editor of the Scientific American:
I noticed a short time ago, in your journal, an article entitled 'A Wrinkle;" the idea is undoubtedly of benefit to the practical workman, and you will allow me to suggest another which may be of equal value. It is customary with black smiths, in making hooks for chains, clevises, and other like articles having an eye, to draw out the bar, bend it over to form the eye, and then weld down the lap, back of the eye This always makes an imperfect eye, to say nothing of over heating the end of the partturned, which is invariably the beginning which is invariably the beginning
of a fracture. (1.) Now let the of a fracture. (1.) Now let the
smith cut off the iron, or leave it smith cut off the iron, or leave it
on the bar, as he may think proper, bring the end to a welding heat, and bend (over the edge of the anvil), at right angles, as much as he
 desires, to form the head; then draw it on the face of the anvil, with end up (2); strike on the end thus turned until flattened down (this must be done while there is a weld.
ing heat on iron); then punch a hole back of the center of the head, and work out the eye on the horn of the anvil as large as desired. There you have it.
To such as are accustomed to draw out and form the eye in the old way, I would suggest the above plan; and should they find reason to be thankful, let them bestow a favor on the Scientific American and its many readers. If they know of any process by which their class will be benefitted, and by which we may become more intelligent and skillfu workmen, give us the benefit of such knowledge.
N. P. Q. R. S. T.

Mansfield, Pa.

## Tried on the Square

To the Editor of the Scientific American:
I notice that, in many shops, it is the custom of pattern makers to make templets of thin pieces of wood, for the purpose of determining the accuracy of the half circle in core boxes which are chambered or made to a larger circle in the center than at their ends. It never occurs to them that an ordinary square may be used for the above purpose, in the construction of machine core boxes. It will be seen at a glance, however, that the square will test a circle of any size with as much accu part of a circle.
George B. Durkee. Farmington, Ill.

## The New Patent Law Bill in England.

## To the Editor of the Scientific American:

As one of the Committee of London Patent Agents, who pre pared the new patent law bill which was severely criticized in your issue of March 29, permit me to explain its object and its bearing on the cause of patent law reform. In the years 1871-2 a select committee of the House of Commons sat "to enquire into the law and practice and the effect of grants of letters patent for inventions." The result of this enquiry was a report embodying several recommendations which were supposed to be needed for improving the working of the patent laws. These recommendations commanded by no means the general approval of patent agents, and some of them were even denounced as impracticable. It was however thought and, I venture to say, not unreasonably, that if the recommendations were to be followed, the putting them into working order, so that the least possible amount of mischief should accrue therefrom, might be the best effected by those whose
experience enabled them to judge of their ultimate action.

The patent agents therefore undertook to embody in one bill the existing statutes, and clauses which would include the machinery for working out the recommendations of the Com mittee of the House of Commons.
All that is new, therefore, in principle in the bill, the Commons committee is answerable for, and all that is old is the work of the legislature. Our self-imposed task was simply to supply the details for putting the resolutions into a work in supply the details for putting the resolutions into a work
inge. For my own part, I agree with you that " nearly ing shape. For my own part, I agree with you that "nearly
all the changes proposed in this bill are steps in a backward all the changes proposed in this bill are steps in a backward
direction," but you will understand that it is of no small direction," but you will understand that it is of no small
importance for the legislature to have before it, whenever the importance for the legislature to have before it, whenever the
mendment of the patent laws may be taken in hand, no mendment of the patent laws may be taken in hand, no only the whole law as it exists, but also the recommendations of the Committee in a working shape, combined in one docu ment. Moreover, suggestions may at the first blush seem to possess some value, but when put into working shape their impracticability may be demonstrated. If this result has beenattained by the labors of the Committee of Patent Agents, and your remarks seem to indicate that it has, I venture to say that good service has been rendered, by the drafting of our bill, to patent law reform. At any rate you may rest assured that the bill will never become law in its present form if it is within the power of the London patent agents to revent it
A. V. Newton

60 Chancery Lane, London.

## Superheated Steam,

## To the Editor of the Scientific American:

Knowing how much every one using steam power is interested in producing it economically, I send you the following facts, which have added very much to my opinion of the advantage of using superheated siteam:
We have been using in our business for some years an up right tubular boiler, the tubes passing entirely through the steam space, giving us very dry steam. This boiler furnishes a little more power than did a horizontal tubular boiler, hav ing more fire surface and using more fuel, which was used to run the same machinery. I was still move impressed with the economy of our boiler by the following comparison Last summer a foundery and machine shop was established in a building adjacent to ours. They put in an ordinary two flue horizontal boiler. By a careful estimate, I judged they flue horizontal boiler. By a careful estimate, I judged they
used about three quarters the power we do, while they consumed nearly one half more coal. I noticed that they worked very damp steam, which was evident from the water escaping from the cylinder cocks, which were always open. Thei ing from the cylirdercocks, which were always open. Their
boiler has a dome and mud drum ; ours has neither; and boiler has a dome and mud drum; ours has neither; and
although our middle gage is only 15 inches from the top of the boiler, it never foams unless we are using very dirty water. We are not using any "lime or dirt extractor," al though we take water from the Missouri river, which is often very muddy. After three years' use, the boiler appears to be very slight incrusted with scale. I account for this from the fact that our engineer pumps water into the boiler after he ha drawn the fire, which seems to settle the impurities, which he blows out through the mud cock. The only trouble we have with our boiler is that it sometimes gets to leaking around the upper end of the tubes, which we stop in a few minutes with an expander. I lay this fault to the engineer who, when late, makes up a very hot fire to raise steam in a few minutes, which causes the upper end of the tubes, not surrounded with water, to become red hot. I do not think this would ever occur with slow firing at the start, for I am of the opinion that steam under a slight pressure would take off the heat nearly as fast as water. S. E. Worrell. Hannibal, Mo.

Professor Young on our Knowledge of the Sun To the Editor of the Scientific American:
In your journal of March 1, 1873, pages 131, 132, is a par of one of Professor Young's lectures on the sun; and, if $h$ said what is there reported, it is hard to see how his state ments can be reconciled. In speaking of the heat of the sun, quoting Sir John Herschel, he says: "Suppose ice could be ormed into a rod forty five miles in diameter, and that rod of ice should be darted at the sun with the velocity of light if all the heat of the sun could be concentrated upon the javelin of ice, it would never approach the sun, for the point would melt off as fast as it came." At that rate the sun would melt $305,363,520$ cubic miles of ice in a second, if light would melt $305,363,520$ cubic miles of ice in a second, if light
moves 192,000 miles in a second. He says agair: "Suppose we should take two and a quarter miles square of solid ice we should take two and a quarter mencentrate uprn that the heat of the sun, it would and should concentrate uprinthat the heat of the sun, it would to imply a cube of that size, he would make the sun melt $11 \frac{25}{4}$ cubic miles of ice in a second. Now if by one estimat the sun will melt over three hundred million cubic miles of ice in a second, and by the other, less than twelve cubic miles here is certainly an appreciable difference in the estimates the ratio being over twenty-five millions to one, not very lose for an "exact science.
But perhaps these estimates are about as satisfactory as any that can be made on the subject of the solar heat, for I notice that by different scientists the sun's heat is estimated at from less than $212^{\circ}$ Fah. to eight or ten million degrees of the same scale.
The Professor thinks that "if the sun were of solid coal t would have been completely burned out in 5,000 years.' have seen it estimated that it would burn out in less than five minutes. And the latter estimate seems more correct as it was based on the ratio of the sun's mass and radiation compared with a globe equal in diameter to the earth's orbit.
He thinks also that "meteors" help to keep up the solar heat. But, according to the Science Record, the meteors
are only the dust from the comets' tails, blown off by the atmosphere. Of the thousands which have been seen in the August and November showers, I have never heard that a single person has been able to light his pipe from the heat they have produced. If, then, the known effect of the great er part of meteors is so small, upon what principle is so grea an effect attributed to them as that of contributing largely to heat up such a body as the sun, and through it the vast spac of the solar system? Can any one tell? Does not the Pro essor's lecture need to have its statements better ha nonized?
Floride, Mass.

## Ignition by superheated steam

To the Editor of the Scientific American
I have noticed the letters that have appeared in your journal lately, on steam ignition, and I will give you a singular fa which occurred in my own experience a few days ago
I had prepared some gun cotton, and after washing it a little from the acids, I laid it on the T joint of a steam pipe 0 dry, 80 yards distant from the boilers; the pipe runs 40 yards of the distance under ground. In about three minutes,
there was a flash like lightning; the cotton I laid on the T there was a flash like lightning; the cotton I la
joint had exploded by spontaneous combustion.
I have often seen cotton yarns and raw cotton, that hav been dyed with sulpho-nitrates and nitro muriates, ignite in a few hours, being in contact with superheated steam pipes May not wood, under certain circumstances, absorb inflammable gases, and thus be rendered more liable to spontaneous combustion?
acques Nicholson.
Frankfort, Ky.

## Retardation by Ocean Tides.

To the Editor of the Scientific American:
In the Scientific american of April 12, there is a paper on this subject alleging that the "tidal wave spends its force, moving from east to west, on the coasts of Africa and America. retarding the rotation of the earth"; but the wave does not remain there, and the reflux would be equal to the afflux. Without surface oceans, no thought of retardation by the moon's attraction would be entertained; and, if surrounded freely with ocean water, the earth being supposed to be stationary, a swell of the water directly under the moon would result; and as the earth might begin its rotation east, that side of the swell-would fall back or recede, and the western progress of the moon's attraction would continue to renew the swell from the approaching western supply. Thus the swell would undulate around the earth, without change of place as a whole
T. W. B.

Pittsburgh, Pa.

## CHEMICAL NOTES

zinc and Aluminum in the sun
The observation that the number and length of the lines in the spectra of metallic vapors depend upon the density of the absorbing or radiating vapor, and that only the longest lines remain visible when the vapors are rarefied, oitains additional importance by the author's discovery that the inverted lines in the solar spectrum are without exception the longest lines observed in the spectrum of the vapor of each element. The presence of zinc and aluminum in the sun had hitherto been extremely doubtful, as only very few lines of their spectra had been found inverted in the solar spec-
trum; this doubt we may now consider as removed, since trum; this doubt we may now consider as removed, since
the author has found that the lines corresponding to these the author has found that the lines corresponding to these
elements in the solar spectrum are the longest lines of the spectra of their vapors. $-N$. Lockyer.

## The Spectrum of Nitrogen.

According to A. Schuster, the true line spectrum of nitroen invariably shows a bright green line followed (towards the blue end of the spectrum) by a green band. The fluted spectrum shows shaded violet bands.

Phosphoretted Hydrogen and Ammonia
K. B. Hofmann says that the spectrum of phosphoretted hydrogen shows four green lines, lying between D and F (Fraunhofer). The green color,according to the author,is not due to burning phosphorus, because phosphorus burnedalone shows nospectral lines; nor is it due to the burning of the gas phosphoretted hydrogen, because this gas when heated is split up. The chemical process going forward in the mantle of the flame is supposed by the author to produce beams of consta
The spectrum of ammonia is yellow. This spectrum is not to be accounted for by the decomposition of ammonia and the burning of the nitrogen.

Production of Light by Atomic Movements. Many bodies emit light at ordinary temperatures. This fact forms the basis of a speculation by the author, in which he supposes that the atom of a substance may rotate without any appreciable movement of the molecules, and that the production of light may, in many instances, be due to such atomic movements.
These movements will depend upon the mass of the atoms and the chemical force binding them together. When these movements are so extensive as to cause a disruption of the molecule, a new substance is formed, accompanied by a greater emission of light. The tension of vapors and the change $c^{£}$ volume upon increase of temperature are to be regarded as caused by molecular movements. The atomic movements causing emission of light waves may be tak
up by the molecules, and so we have absorption of light.
As the sphere of action between any two atoms must be limi-
ted,chernical decomposition will ensue as soon as the atoms pass out of this sphere; if their excursions exceed the disance between the middle points of the neighboring molecules,
a complete breaking up of the molecule must ensue.-Jour nal of the Chemical Society.

## Interference Colors of Gold

W. Stein observes that gold in thin plates, or when pre cipitated from very dilute solutions (by action of sulphu dioxide in water), manifests dichroism, appearing indigo blue by transmitted light, but reddish yellow by reflected light. But if the particles of gold be very small (as when gold is precipitated from its solution by means of stan nous chloride) the laws of interference come into play and the gold appeais purple. Such gold the author calls molecular gold, and he thus distinguishes three modifications of gold, (1) ordinary, (2) dichroitic, (3) molecular. Ruby glass he regards as a solution of molecular gold in glass.

Experiments with Oxyhydric Illumination
With a recent issue of the American Gas Light Joumal there is published, as a supplement, a careful translation, by the editor, of a report made by Simon Schiele, a distin guished gas expert of Frankfort, Germany, on the subject of oxygen illumination in that country. He does not coincide with the conclusions of Le Blanc on the Tessié du Motay process as tested in Paris.
Mr. Schiele's report says that the illumination by the Tessié du Motay method comes no dearer than any other mode of lighting, and that it is perfectly well adapted for publicillumination. The carbon in the rich gas is consumed, in all cases, more-completely and with greater light-production than in any other mode of combustion hitherto practiced When the two gases are adjusted to the proper relative proportions, in suitable burners like the Andreae, there occurs no waste of either the one or the other gas.
As carburreting at the place of burning may
As carbureting ay proved methods, be averted, this objection becomes futile. The gas may be conducted into the interior of houses and through all parts thereof. By the recent improvements in
Vienna,rich gas of uniform quality can be delivered through pipes to very remote localities; and there is no doubt but tha oxygen also,of nearly uniformly good quality, can always be sent forward through mains over wide spaces. The results of the Vienna experiments prove the practicability of the oxygen illumination for all towns and even for large cities, while the profits of the plan are as little to be doubted as those of any other gas-lighting enterprise. There is no necessity of delivering the oxygen in a state of compression to consumers when it can be readily, as proved, transmitted through pipes. With regard to the hygienic value of oxygen lighting, as compared with ordinary gas lighting,Mr. Schiele observes that when the oxygen necessary to combustion is furnished specially and directly to the flame, that of the room lighted by the latter is of course not drawn upon; and when the hydrocarbon employed for the production of an equal amount of light is diminished in amount, the quantity of carbonic acid resulting from the combustion must be pro portionally less than in the case of ordinary gas lights.

## Volcanic Eruption in Iceland

A great eruption of the Skaptar Yokul, a volcano in Iceland, took place on the 9th of January. It lasted over four days, and the magnificent sight it presen ted was visible from most parts of the country. The Yokuls, or enormous ice mountains, are among the greatest elevations in Iceland. The Oreefa Yokul, 6,280 feet in elevation, is the most lofty of which any accurate measurement has been obtained. The celebrated volcano Hecla is more remarkable for the fre quency and violence of its eruptions than for its elevation,
which is only about 5,200 feet. Besides more than thirty volcanic mountains,there exists an immense number of small cones and craters, from which streams of melted substances
have been poured forth over the surrounding regions. Nine have been poured forth over the surrounding regions. Nine
volcanoes were activeduring the last century. Twenty-three eruptions of Hecla are recorded. The most extensive and devastating eruption ever experienced in the island happened in 1783; it proceeded from the Skaptar Yokul, a volcano (or rather volcanic tract, having several cones) near the center of the country. This eruption did not entirely cease for about two years. It destroyed twenty villages and 9,000 human beings.

## New Musical Instrument.

If into a glass tube two flames of convenient size be introduced, at a distance of one third the length of the pipe, counting from its base, these flames will vibrate in unison The phenomenon continues as long as the flames remain sep-
arate, but the sound ceases the moment they are brought in contact. If the position of the flames in the tube be varied, it is found that the sound decreases until one half the entire length is approached.
Based on these facts, M. Kastner has constructed a new musical instrument of a very peculiar timbre, closely resembling that of the human voice. The "pyrophone," as it is termed, has three key boards ; each key of which is, by simple mechanism, placed in communication with the conduit pipes of the flames in the glass: tubes. By pressing upon the keys, the flames separate and sound is produced. When the pressure is removed, it isinstantly stilled by the junction of the flames.

Conicat Joint for Iron Pipes. - In the manufacture of cast iron tubes, the practice has been introduced, with satis factory results, of turning off one end conically, and boring ort the end of the tube to which it is to be united at the same angle, the end of one tube being thus inserted into the other without the necessity of applying any cement, the junction being effected in this way very readily, and the joint being perfectly tight.

The Hartiord Steam Boiler Inspection and
The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the month of February, 1873:
During this month, there were 855 visits of inspection made, and 1,520 boilers examined, of which 443 were carefully inspected internally and externally, the boilers being blown down and cool; 151 were tested by hydraulic pressure. The number of defects in all discovered were 782, of which 192 were regarded as dangerous. These defects were as follows:
Furnaces out of shape, 39-8 dangerous ; fractures, 76-25 dangerous; burned plates, 52-15 dangerous; blistered plates, 106-13 dangerous; case of deposit of sediment, 133-14 dangerous; incrustation and scale, 134-13 dangerous; external corrosion, 60-15 dangerous; internal corrosion, 27-10 dangerous; internal grooving, 16-12 dangerous; water gages defective, 29-9 dangerous; blow-out defective, 13-3 dangerous; safety valves out of order and overloaded, 26-4 dangerous; pressure gages defective, 101-19 dangerous, varying from -20 to +20 ; boilers without gages, 1 ; cases of deficiency of water, 14-10 dangerous; cases of broken braces and stays, 24-11 dangerous; boilers condemned as unsound and unfit for use, 18.
There were 10 boiler explosions during this month. None of them, however, were under the care of this company 3 were of rolling mills, 3 locomotives, 1 cotton mill, 1 flour mill, 1 agricultural works, and 1 mill the occupation of which we were unable to ascertain. By these explosions, 23 persons were killed and 55 injured. We were unable to gain any satisfactory particulars of some of these disasters. Coroner's juries on such occasions are not usually composed of practi cal men, and the verdict is generally "low water" or "a Providential visitation," both of which may be true; but it would be very satisfactory sometimes to those investigating the subject of boiler explosions, and studying their cause and cure, to be permitted to examine fragments of the exploded boiler, and see if some corroded spot, broken brace or defective safety valve, might not be made the cause of the accident, and the responsibility thereby shifted from Providence to a mercenary steam user, who, to save (?) expense had employed an incompetent engineer or run a weak and over worked boiler for months, and perhapa years, without examination or repair. Every month of our work reveals the grossest carelessness in the care and management of boilers, and why they do not oftener explode is more than we can say.
How the Transit of venus will be Photographed The following method, devised by M. Janssen, is to be employed in photographing the apparent contacts of Venus with the sun's edge. The sensitive plate of the apparatu is in the form of a disk, fixed upon a plane which rotates on an axis parallel to that of the telescope. The disk is eccen tric, so that the images are formed near its circumference Before it, a second disk forming a screen is arranged, in which is made a small aperture in order to limit the photo graphic impression of the portion of the solarimage to around the locality where the contacts take place. The circular plate which carries the sensitized material is toothed and placed in communication with a small escapement apparatu actuated by an electric current. At each second the pendu lum of a clock interrupts the current, the plate turns ahead one tooth and thus disposes, under the hole in the screen, blank part of the negative for another impression. If, there fore, the disk has 180 teeth, the plate will receive 180 image of the solar edge. The photography can thus be begun a minute and a half lefore the presumed instant of contact then when the series relating to the first contact is obtained, the sensitive plate is withdrawn and replaced by anothe which gives the second contact and so on for the four. The plates
scope.

## Cornell University.

The annual report of the President and Register of Cornell University furnishes a gratifying exhibit of the rapid and substantial growth of that institution. There are at present five hundred students, and the faculty consists of forty pro fessors and instructors. We note the erection of a college of mechanical engineering, provided with machine shop and all accessories through the munificence of Mr. Hiram Sibley of Rochester. The college library ranks third in size, and second in value, of those of its kind in the country. The university now comprises five large buildings of stone, three of brick and two of wood, constructed almost entirely by the aid of money, aggregating $\$ 1,400,000$, donated by friends. The regulations of the institution state that its benefits are open to all, but only students resident in the State of New York receive free instruction. It is not a manual labo school though opportunities are offered for work, but employ ment is not guaranteed to any student. It is stated that limited number of good practical machinists, who have al oughly scientific master mechanics, may be able to do some oughly scientific master mechanics, may be able to do some-
thing toward their own support by making models of instruments, apparatus, etc., for the museum in the new machine shop. This requires skilled labor and a good knowledge of the use of tools.

New York City is supplied with early vegetables from the Bermuda Islands. New potatoes are found in our mar ket from the above locality in February. Strawberries from Charleston, S. C., are now selling here for $\$ 2.50$ per quart green peas from Florida, $\$ 8$ per barrel; hot house cucum bers, $\$ 5$ a dozen; Bermuda new potatoes, $\$ 10$ a barrel.

## THE TAY BRIDGE.

We are indebted to the Engineer for the accompanying il lustrations, representing operations in the construction of one of the greatest civil engineering works ever undertaken in Great Britain. The bridge, which will be the largest iron structure of its class in the world, will cross the Tay river in Scotland, about one and a quarter miles west of Dundee bringing the great coal fields of Fifeshire into direct com munication with that city and adding much to its im portance as a shipping port
The total length of the bridge, from shore to shore is 10,320 feet. Commencing from the south, or Fife side, there will be three spans of 60 feet, two of 70 feet, twen ty-two of 120 feet, fourteen of. 200 feet, sixteen of 120 feet, twenty-five of 66 feet, one of 160 feet, and six of 27 feet. The first three spans ( 60 feet), south side, are on a descending gradient of 1 in 100 , the two 80 feet spans are level; the bridge the rises with a gradient of 1 in 353 to the center of the 200 feet spans. It again descends with It again de in 73.56 to a gradient of in 73.56 to the north shore passing at a hight of abou 48 feet over Magdalen Poin and the esplanade now be ing constructed.

The bridge thus comprise eighty-nine spans, and at the commencement on the south side the rails are 78 fee now hich water running abov the ops the cirder over the tops of the girder as far as the 200 feet spans which cross the navigabl channel of the river.

The greater part of the piers are built of brick, va rying in diameter from 6 fee to 15 feet.

The method of building the piers and sinking them to the foundation is carried out in a novel manner, and specially adapted to rivers having strong currents, and with little soil overlying th why bed-which here i rocky bed-which here in one case did not exceed feet-prohibiting the use of timber staging, as heretoto used for such structures.
The piers are first built up to the hight of 15 feet on the foreshore on a temporary basis of concrete; the gird ers, carried by the pontoon shown, are floated over the pier, and with the falling tide are left hanging to the pier by brackets, the pon toons being floated away and moored in the harbor. and moor is then built up to The pier is then built up to such a hight that, when rest ing on the bottom in its permanent position, the top wil be above low water. The girders, on which are rest ing the hydraulic rams for lowering the pier, are then connected to the wrough iron lowering links with the base of the pier. The pontoons are floated underneath the girders, and the whole pier floated from its tempopary resting place at high rary resting place at high permanent position.
ermanent position.
The caisson piers are The caisson piers are formed by combining the two cylinders into one base, having long straight side with circular ends. This base is provided with verti cal suspending bars to which are connected a pair of balancing crosshead plates by with crosshead plates, andic rams are similarly provided there is one on each pontoon-with a few strokes raises the , and the upper and lower sets are conned hydrauh ams have a stroke of 12 inches, and the links pass through slotted holes in their bases. These links are com posed of wrought iron bars. In the first place the weight of the pier is carried out on steel pins passed through the


SINKING THE CAISSONS OF THE TAY BRIDGE
holes in the links, and resting in bearings provided on the ed, and the rams pumped up again to the top of the stroke the bases of the rams. The whole mass is then towed out at Links, which are 4 feet long, are added as the lowering pro high water to its place, the pier being then submerged to the artent of feet only. The pontoons are securely anchored
 eads on the rams are connected by pins with the links a the top of the stroke. The hydraulic force pump-of which eeds, and the whole apparatus is under such control tha the time taken in lowering 1 foot is only $4 \frac{8}{4}$ minutes. In the diagram the ram is at half its stroke downwards.
The heaviest piers floated out weighed 145 tuns, and were lowered by six hydraulic rams. The lowering tad during the ebb tide, and a little before low water the pier is grounded-the exact position having been ascertained by sighting lines from the shore, and a measuring chain from the last pier. During the last half hour of the ebb tide the pier resting on the bottom of the river is carefully watched with a spirit level, and any tenden cy to sink into the bed of the river unequally is checked by the hydraulic rams being pumped up on the lower side of the pier until the settlement is equal. When the pier has fairly settled, the links are disconnected above water and the pontoons floated away, the links being recovered by a diver.
The construction of the double or combined piers is epresented in our engraving, giving half elevation and half vertical section, showing the men excavating the foundation. A wrought iron base, 3 feet high, 22 feet 7 inches long, and 10 feet 6 inches wide, with flat sides and circular ends, is laid on a concrete foundation on the foreshore, dry at low water. This is surmounted by a conical cast iron five feet length, provided with a broad top flange 2 feet 6 inches wide. This forms the working chamber during the time of sinking the pier. On the broad flange the brick work is carried up in two circular towers, 9 feet 6 inch in diametor surrounded 6 in diameter, surrounded with cast iron cylinders of $\frac{8}{4}$ inch metal in four segments, each tower having a shaft left open 4 feet in diameter
in its center. The brick in its center. The brick
work is carried up inside work is carried up inside space of 2 inches being left between the brick work and the castings, which is filled in with cement grout, the castings being carried up to low water level. After the piers are in position, temporary cast and wrought iron caissons are put on to about 6 feet above high water, the brick work being also carried up until sufficient weight is obtained to prevent the pier floating when filled with air during sinking to its permanent foundation. Two air bells are fixed, as shown, on top of the caissons, with pumps and engines attached. Air is pumped into the pier until the bed of the river is dry inside, and the excava tion is carried out in the or dinary manner, the soil be ing sent up to the top through lock shoots in the air bells. The man shown in the section of the bell operates the soil shoot on the inside, it being closed by a door inside and out side. These air bells, hav ng to be shifted from pier to pier by a crane working is one on each pontoon-with a few strokes raises the on a barge, were designed by the contractors specially for pier about $\frac{1}{8}$ inch, so that the weight is no longer on the steel the work. Lightness being a great object, they are, with pins; they are then drawn out and placed in the link holes the exception of the doors and shoots, made of wrought iron foot higher up; by means of a suitable arrangement of and have answered the purpose admirably, each bell, with ocks the water is let out of the rams, first on one side then its accompanying boiler and engine, weighing only six tuns, on the other, and the pier lowered until the steel pins again It will be noticed that the 3 feet wrought iron and 5 feet cast rest on their bearings. The crossheads are then disconnect- ${ }_{\text {iron lengths are hollow, making a working chamber } 8 \text { fee }}^{t}$
high, sufficient for twelve men to work. As soon as the pier is sunk to its permanent foundation, concrete, in the propor tion of one of cement to four of broken stone and sand, is sent in under air pressure, filling the work chamber, the flanges carrying the brick work being carefully packed and run in with cement concrete. The shafts are then filled up, the air bells and temporary caissons removed, and the brick work carried up to about $6 \frac{1}{2}$ feet above high water level. It will be noticed that the two circular shafts are connected with an arched passage immediately above the working chamber, this being provided. to give room for packing the concrete under the broad flanges. During the progress of the pier downwards it is steadied by means of two hydraulic
oxalic acid, perchloride of iron and water. Under the influence of the rays, the perchloride was decomposed and became protochloride; the chlorine, set at liberty, combined with the hydrogen of the water to form hydrochloric acid; and the oxygen of the water, uniting with the oxalic acid, transformed it into carbonic acid, which was disengaged. The quantity of carbonic acid thus given off is proportional to the intensity of the light, and serves as its measure. The diffculty was, however, to determine accurately the amount of carbonic acid without having recourse to mercurial apparatus, very expensive and hard to manage. M. Marchand has found, however, and Les Mondes terms it a great discovery in prac tical chemistry, that, for the determination of the carbonic
that it may be utilized or suggest a similar or better plan for defending our Western settlers against Indian depreda tions.
The idea is well explained by our engraving. Two farmers, for instance, are breaking up the prairie soil preparatory to planting their first crop. They are surprised by Indians, who, probably, having just received a new supply of ammu nition from Washington, are bent on testing the quality of the same by robbing and murdering such citizens of the United States as may be in the neighborhood.
Naturally, the first thought of the hardy pioneers would be judicious retreat, and such a course they would undoubtedly adopt were they not fortunately provided with the can.


## FLOATING THE PIERS OF THE TAY BRIDGE INTO POSITION

telescopic legs. These are placed on the south side. From acid, glycerin may be well substituted for mercury. He has the last pier finished, heavy chains are connected with the pier being sunk, which, with the hydraulic legs, effectually steady it during sinking. The superstructure consists of lattice girders continuous over four spans, each set being provided with its own fixed and expansion bearings.
The brick work is built with Portland cement, in the proportion of one of cement to one of sand; and such is the its strength that, after a few months, those cylinders which capsized after being floated on to the foreshore could cnly be broken up by blasting.
There will be used in the construction of the bridge 3,600 tuns of wrought iron work, 2,600 tuns of cast iron work 35,000 cubic yards of brick work, 87,845 cubic feet of timber, etc.
The construction is being carried out from the designs of Mr. Thomas Bouch, M. I. C. E., of Edinburgh. The whole of the work was undertaken by Messrs. C. de Bergue \& Co., of London, Manchester, and Cardiff.

## ation of Coal Dust.

Dr. J. R. Hays, of Washington, D. C., has recently published a raper on a means of using up the dust coal which lies in heaps near the shafts of most coal pits. He mixes the coal dust with clay and coal tar, and estimates that the cost of these, together with labor, will not exceed $\$ 1.00$ per tun and if the waste coal can be delivered in the cities at $\$ 2.00$ per tun, a fuel of great excellence can be easily prepared at $\$ 3.00$ per tun, which will be an economical improvement of great importance to the poor.

Chemical Action of the Solar Rays.
M. Marchand, says Les Mondes, has just completed a long and careful study of the chemical aetion of solar rays. He exposed to the light a mixture of definite proportions of
acid, glycerin may be well substituted for mercury. He has
also observed that his mixture, considered as a reagent of chemical rays, differs from the nitrate of silver in the particular that the maximum of its intensity is at the middle of the blue, while that of the nitrate is at or near the violet.

## A PATENT CANNON PLOW.

This novel idea is the invention of Messrs. French and Fancher, of Waterloo, N. Y., and was designed at the be

inning of our late war, probably as a means of self-pro tection for farmers against raiding bands of guerillas and bushwhackers. We publish it at the present time, thinking
non plow. Instead of running away, therefore, they coolly unhitch their horses, load the hollow metal plow beams with a charge of canister, scrap iron, old nails, pebbles, etc., drop a little loose powder in the venis, light their pipes, and seat themselves at the rear of their implements to await the ar rival of the unsuspecting "Los." The latter gentry, advancingwith the prospect of two easily obtained scalps, are suddenly astonished by a metallic hailstorm, which continues until they recollect a pressing engagement in another vicinity, and find it to their interest to defer their present operations until some more convenient time.

## cting Iron

Cast iron water pipes and other articles may be preserved by covering inside and out with pitch, heated to $300^{\circ}$ Fahren heit and kept at this point during the dipping. As the ma terial deteriorates after a number of pipes have been dipped fresh pitch is frequently added, and at least eight per cen of heavy linseed oil put to it daily ; the vessel is also entirely emptied of the pitch and refilled with fresh material, as often as is necessary to insure the perfection of the process. Each casting is kept immersed from thirty to forty-five min utes, or until it attains a temperature of $300^{\circ}$. After the bath is completed, the castings are removed and placed to drip in such a position that the thickness of the varnish will be uniform. It is essential that the coating be tenacious when cold, and not brittle or disposed to scale off. Tha pitch or varnish is made from coal tar, distilled until all the naphtha is removed, the material deodorized, and the pitch like wax or very thick molasses.

Leprosy still prevails to an alarming extent in the Sand wich Islands. The doctors can find no remedy. The lepers are isolated and live in large communities by themselves, under rigid laws of exclusion from other mortals.

## ASTRONOMICAL NOTES

Observatory of Vassar College.
For the computations, which are only approximate, in the following notes, and for much of the information, I am in debted to students.

## Thermometer.

The highest recorded thermometer at 2 P. M. (up to this date, April 20) is $61^{\circ}$ on the 8 th and 11 th.
The dandelion was first seen in this locality on the 8th, the the 19th.

## Auroras

The aurora was noticed on the $16 \mathrm{th}, 19 \mathrm{th}$, and 20 th of April.

## Meteors.

Meteors were unusually frequent on March 28th. One was reported at 7 h .15 m . It was bright enough to attract the attention of a person who was reading by gaslight. Others, less marked, were reported between 7 and 8 P. M. Meteor were also reported on March 31st.

Sun Spots.
On March 17th and 27th, the spots on the sun could be seen with the naked eye.

Positions of Planets for May, 1873.
Mercury.
On May 1st Mercury rises a littleafter 4 A . M., and sets at about half past four in the afternoon. It is at its greatest elongation from the sun on May 3d, and should be looked for before sunrise. On the 31 st Mercury rises at 3 h .58 m . and sets at 6 h .30 m .

## Venus.

On the 1st Venus souths only 16 minutes after the sun, but, being in high northern declination, does not set until about 7 h .40 m . P. M.
On the 31st it souths before the sun and sets at 4 h .31 m . P. M., so that it must be looked for in the morning. It rises at that time about 3 in the morning.
At this time (April 20th) Venus appears as a very narrow crescent, which can be seen with a field glass.

## Mars.

Mars, with its red light, is becoming a conspicuous object in the east during the evening. It rises on the 1 st at 6 h . 20 m . and sets at 4 h .47 m . the next morning.
On the 31st it rises at 3 h .46 m . P. M., and sets at 2 h . 24 m . the next morning. It is moving westerly among the small stars of Virgo and Libra.

## Jupiter.

On the 1st Jupiter rises at noon and sets at 1 h .54 m . the next morning. On the 31 st it rises at 10 h .17 m . A. M., and sets at midnight.
On the 3 d of April, Jupiter passed over its 1 st and 4 th satellite. Both became very dim as the planet swept toward them ; the 4th, which is usually next to the largest, appearing no larger than the second.

## Saturn.

Saturn is above the horizon only nine hours and a half. It rises on the 1st a few minutes before one in the morning and set about half past ten in the forenoon.
On the 31 st it rises at $10 \mathrm{~h} .54 \mathrm{~m} . \mathrm{P} . \mathrm{M}$., and sets at 8 h . 24 m . the next morning.
Saturn is moving among the stars of Capricornus on the 1 st, but becomes stationary on the 12 th. It moves among the stars easterly before the 12 th and westerly after that date.

## Uranus

Uranus rises on the 1 st at 10 h .21 m . A. M., and sets before 1 h . the next morning. On the 31st it rises about half past 8 , and sets, about 11 P. M.

## Neptune

May 1st Neptune rises at 4h. 32m., and sets at about half past 5 the next morning. On the 31 st it rises at 2 h . 05 m . P. M., and sets at 3 h .41 m . of the next morning.

## Progress of the Great Suspension Bridge

 between New York and Brooklyn.The work on the foundations for the anchorages for the cables has lately been commenced; the towers on both sides of the river are advancing towards completion. The bridge will be supported by four cables-two outer ones and two near the middle of the flooring.
By a cable is meant six thousand wires laid out straight together and wound round with other wires, the whole composed of galvanized tempered cast steel, having a strength of one hundred and sixty thousand pounds per square inch. The cables have each a diameter of sixteen inches, and go through the tower near the top (together upholding the superstructure of the main span, the aggregate weight of which, including the cables, will be five thousand tuns), are carried straight to the anchorage, entering the masonry at an elevation of eighty-two feet above the river, and, after passing into the wall for twenty-five feet,form a connection with the chains. The latter, consisting of cast steel bars, thirteen feet long and ten inches wide by one and a half inches thick, go through the masonry in a curved line, and are fastened to the anchor plates at the base
The four anchor plates are to be laid side by side at the base of the anchorage, in
nty-three tuns, and is of a singular shape. It is seventeen feet and a half by sixteen feet over all, with sixteen radial arms extending from a solid center. In this center piece are eighteen openings through which the links pass, connected with the four cables spanning the river, and the wire work suspended from them will weigh not less than five thousand tuns. The links are held in each anchor plate by two massive iron pins.

## Whitney's Gas Carbonizer.

Our attention has recently been directed to a gas carboniz ing apparatus, arranged in the form of a neat and ornamental drop light, by the aid of which, it is claimed, a saving of hal the gas consumed will be effected, while a better illuminatio will at the same time be obtained. The gas enters a carbon zing chamber on a stand adapted for the table, from which it has no outlet except through the vertical, perforated walls. In its progress through the latter it passes through fiberous material which is impregnated with benzole, and is thus sup plied with sufficient carbon to materially increase its illuminating power. A protecting jacket of incombustible minera substance surrounds the device, rendering it fireproof, and also serves to protect the hydrocarbon from the injurious effects of a varying temperature outside. Filling is easily and expeditiously effected through very simple means. There is no automatic machinery, and all glass tubes, cocks, gages, etc., are rendered unnecessary by the compactness and sim plicity of the construction. Professor Doremus in a repor upon the invention states that gas companies, by its adoption in a form adapted for meter attachments, can give the publi a light equaling from twenty to twenty-two candle power and make dividends twenty-five per cent larger than at present By employing the portable form above alluded to, gas con sumers, it is believed, can save nearly half their present bills.

The drop lights are of various elegant patterns in plate and bronze, and are so arranged that by turning a key the gas can be changed from common to the carbonized light and vice vers $\hat{\alpha}$. They are manufactured under the patent of Mr . Samuel Whitney and sold at quite moderate prices by the New England Gas Carbonizing Company, 202 State Street New Haven, Conn.

## Ingenious Engineering.

During the construction of the bridge at Kuilenborg, Hol land, says the Chronique de l'Industrie, one of the principal traverses, some 465 feet in length, was placed about one inch too far on the piles. This error was rectified in a very ingenious manner. The expansion of the mass of metal was exactly .0394 inches per Fahrenheit degree. At the locality of the work the difference between the temperature of the atmosphere by day and by night was $25^{\circ}$ Fah. In the morning the too far advanced end of the traverse was securely bolted down, when during the day the heat of the sun expanded the metal so that the free extremity advanced 985 of an inch. Then at night the latter end was fastened and the contraction caused a like movement of the opposite free extremity. This operation, twice repeated, brought the traverse into its proper position.

Temperatures at which Caleareous salts are Deposited.
The temperatures at wh:ch calcareous matters are precip itated in boiler waters are as follows:
Carbonates of lime, between.......... 1769 and 2480 Fahr.
Sulphates of lime, between......... 2840 and 4240 Fahr. Sulphates of lime,between............. 2840 and 424o Fahr.
Chlorides of magnesium, between.... 2120 and 257 F . Chlorides of magnesium, between..... 2120 and 2574. Fahr.
Chlorides of sodium, between......... 3240 and 3640 Fahr. In order to free water from these salts, it must consequent ly be heated to the above temperatures.

Mr. Charles Stodder writes to explain that when he stated, on page 194 of our current volume, that there was no chemical test for distinguishing flax from cotton, he referred to strictly chemical tests or analysis. The test by dyeing, described by Mr. H. M. Wilder on page 261, was well known to Mr. Stodder when he wrote the first letter.
All new subscriptions to the Scientific American will be commenced with the number issued in the week the names are received at this office, unless back numbers are ordered. All the numbers back to January 1st may be had, and subscriptions entered from that date if desired.

The Springfield Republican records the death of Rev. P Shehan, at Hinsdale, Mass., from poison Dy arsenic, derived from the wall paper of the sleeping apartment of the deceased. The paper was tinted with Paris green. The use of arsenical colors for such purposes should be by law prohibited.

New Metal Band.-For use in collieries, suspension bridges, and for other purposes instead of wire rope, Messrs. Scott, of England, have recently patented a band composed of two or more layers of flat steel, charcoal iron, or other metal, of a suitable thickness and breadth. The layers are each made in one piece and are joined together by brazing, welding, or riveting.
A. K. says: I would not do without your paper for twice its cost now, and I consider that I have lost a great deal by not taking it before.

## DECISIONS OF THE COURTS

United States Circuit Court---Southern District New York.
horsford's patent phosphoric acid







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## new proofs to be taken heard on the te The case now came on to be reheard. BLatchrord, Judge:

Blatchrord, Judge:

The evidence shows that the Lawes process is the same as that of the
plaintifis patent. In ean yroud calctned bone are mixed with water and
sulphuric actid, the proper chemical action and decomposition are allowed


 against John Hecker and Georergeing case the case of the same plaintiffs
was heard, being argued by the same counsel. founded on the same patent, Blatchford, Judge:




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 attending such sales, in connection with the use by the vendees or facte
things sold
Willial iwhiting and ,
United States Circuit Court---District of Michigan,
PATENT RAILWAY HAND CAR.-HENRY L. Brown vs. JAMES D. HiNKiey AND Motion for a preliminary injunction to restrain an alleged infringement of
a patent right ont the billof complaint and accompanying affidavits. The
 complatnant
11,1873 .
Longyear, J.

fined to the reissued patent.
It it in that is patented, we look to the claitm.
Iooking at the claims accompatinganying both divisions of the reissued patent,





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## NEW BOOKS AND PUBLICATIONS

Notes on the First Book of Benson＇s Geometry．By 149 Grand Street
This author is a circle squarer，with at least the usual amount of self possession ：and he devotes as much space to quibbling on Euclid＇s deflif tions as Euclid does to his first ten or twelve propositions，which have laid
the foundation，for all time，of the science of geometry． Cosmical and Molecular Harmonies．By Pliny Earle Chase，M．A．，Professor of Physics in Haverford College． The author of this pamphlet discourses on a universal cosmical law．He highest pitch and those of light，thus establishing a comparable relation
Proceedings of the California Academy of Sciences． Volume IV．，p
Francisco，Cal．
This issue completes the published transactions of the society for the year into the geology，topography，and physical making thorough investigation into the geology，topography，and physical character of our extreme West－
ern States，and exhbibts a zeal in the cause that has already been repaid by discoveries of value to science．The zoölogy，botany，conchology，and
archæology of California are being examined in detail by the Academy， archeology of California are being examined in detail by the Academy，
and its labors will probably soon complete a natural history of the State，

Views of Nature，and of the Elements，Forces and Phenomena of Nature and of Mind．By Ezra C．
Seaman．New York：Scribner，Armstrong \＆Co．． 654 Broadway
This is a little volume of reflections on the cosmical and vital phenomena of the natural world．Its salient point is doubt of the truth of the vibratory ment，＂＂a subtile fluid，＂which＂permeates everything and combines chem－ fcally with nothing．＂These few phrases will serve to characterize the book and the author，and the courage with which he does battle with Joule Mayer，Tyndall，and other philosophers．
Geological Report of New Jersey．
Professor Coook，State Geologist of New Jersey，favors us with his annual eport for 1872．The mineral resources of the State are succinctly described in this report，and many valuable suggestions as to the best mode of devel
oping them are given．Professor Cook has the happy faculty of presenting oping them are given．Professor cook has the happy fac．
a large amount of information in a very condensed form．
The American Grainer＇s Hand Book：A Popular and
Fancy Woods；with Examples and Illustrations，both in
Oil and Distemper．New York ：John W．Masury \＆Son，
Oil and Distemper．
111 Fulton Street．
This is an elegant little volume of practical and sound information，pub－
iished by a flrm well known in the special industry whereof it treats．It is lished by a firm well known in the special industry whereof it treats．It is
illustrated with specimens beautifully printed in colors，representing viv－ Idly the successful treatment of wood by a skillful grainer．It is a complete
and trustworthy manual，and deserves to be read by every one practically and trustworthy manual，and deserves to be read by every one practically First Studies in Drawing：Drawings for Little Folks； Drawings of Cottages；Drawings of Heads，Animals，etc．
Drawings of Landscapes．By Benjamin F．Coe，Teacher Drawings of Landscapes．By Benjamin F．Coe，Teacher
of Drawing．New York：John Wiley \＆Son， 15 Astor of Dra
Place．
the use of beginners and aft rwards for more advanced pupilis．The copie are admirably drawn and printed，and areaccompanied by excellent instruc tion as to materials and manipulation．The publication is sure to be found
useful to many teachers and students．

Inventions Patented in England by Americans．
［Compiled from the Commissioners of Patents＇Journal．］ From April \＆to April 9， 1873
Elevator．－C．Du Bois，Fishkill Landing，N．Y．
Monitor Vessel．－L．Goddu，Mass
Printing TyPe，etc．－W．Shaw，
Printing Type，etc．－W．Shaw，Hollister，Cal．

## 

Method of Flash Signaling by Reflected Light． Martin M．Kenney，Travis，Texas．－The invention consists in a mirror sus uncovered，or one portion of its back combined with an adjustable post for the purpose of verifying the place upon which a flash signal is to be made， and thus enabling the party signaling to be sure that the flash or fla
certainly come under the observation cf the party to be signaled．
Improved Brush．
Philipp Wagner，New York city．－The invention consists in a metallic cap that holds the bristles down in the socket．It consists also in forming a rib on the inside of the socket so as to cause the ferule to hold the bristles by
lateral pressure against said rib，thus firmly retaining the bristles in place It also consists in applying a tapering ferule to the lower end of the handle， to prevent the latter from becoming loose．

Improved Oyster Rake．
Breslau，N．Y．- The invention coner
Isaac A．Ketcham，Breslau，N．Y．－The invention consists in making the
teeth of oyster rakes with an end－bent shank so that they can be readily re－ teeth of oyster rakes with an end－bent shank so that they can be readily re－
moved and replaced．It consists also in making the rake bar with a groove or each tooth，so tat the same a be ponally located plate over eachen when at work．It also consists in a diagonally located plate over each end
of the rake bar，to prevent the oysters from slipplng off laterally when being Dorne backward into the bag or net placed to receive them．It consists also
in the means employed for holding the lever gage at any position required， and also for holding levers while the rake is being drawn in and over the roller of the boat

Improved Liquid Measuring Register．
Moritz Springwater，Evansvilie，Ind．－This invention relates to a new at
tachment to the tubs or vessels used in distilling or brewing machines with tachment to the tubs or vessels used in distilling or brewing machines with
the object of ascertaning and indicating the exact quantity of liquor there in contained during any given length of time，and of thereby preventing or at least detecting fraudulent removal or false returns to the government
revenue officers．The invention consists in the arrangement，within such a revenue offlcers．The invention consists in the arrangement，within such a
tub or vessel，of a concealed float or swimmer，which is connected with a locked recording apparatus so as to move the same in ascending，but not du－
ring a descent．Every addition of liquor within such tub or vessel will

Improved Machine for Making Spool Blanks． John T．Hawkins，Salisbury，Vt．，assignor of one half of his right to Geo．
R．Holt，of same place．The object of the invention is to furnish an im－ proved machine adapted for turning thread spool blanks and other like ar Ing this result being an oscillating reciprocating carrlage for supporting tating cutter head as to carry the wooden barup to the same and hold it till the spool blank is turned，and then into contact with a saw for severing the
olank from the bar；the whole mechanism being automatic，and yet adapt－ to be thrown into and out of gear with the driving shaft．
 air furnaces．The invention in the Anrat oconsists in in roviding a dooble
and perfectly uniform return draft，therehy greatly fncreasing the radia－ and perfectly uniform return draft，thereby greatly increasing the radia－
ting capacity of the furnace and distributing the heant equally vover the en－ tire radating surface．This insures great durabintity for the radiators
the
whit which can never be heated red hot．It also consists in so arranging
the different fues that each shall be self－cleaning．It also consists in the arrangement of $s$ dust damper，by which the accumulations from the flue are empted into the ash pit．It also consists in mak：ng the funnel project
over the air chamber and，by its conical form，reflect the current of heated air back upon the top of the furnace，thus more thoroughly heating said air before It ascends to its destination．The second Invention consists in a fur－ ward through vertical flues to a chamber below the ash pit，and passing thence up though a smoke flue，said fue being all in the ait chamber．In
also consists in an a d justable emoke fue，adapting the furnace to be properly set，no matter what may be the location which it is required to occupy in the cellar or basement．It also consists in the construction of the base of
the furnace so that the smoke fue may be conveniently within the air hamber．
Johan B．Schmid，Salem，Va．－－This in inention relates to for setting，by one motion，two，four，or more saw teeth，one half into one side，and the remainder to the other．It consistes in the application of a
series of setting plates to the aws ofa patr of tongs，the platecting being rally adjustable，to be used on teeth that are more or less far apart from
 of the tongs，with ascrew passing through one of the ears．By means of Is screw，the tongs can be made to close to a certain distance，to allow the saw teeth to be raisea more or less，and evenly，if they have been set too far
aside for any one particular object，or if they were not upset quite regula 1 l, the saw teeth being in that case drawn through between the ears．

Improved Hoisting Machine．
nnock，N．Y．－The object of this inven
Ira Smith，Tomhannock，N．Y．－The object of this invention is to furnish a cheap and simple machine forhoisting welghts．A projecting arm and brace therfxture by hinges，so that the arm willswinglike the arm of an ord nary crane．The hoisting wheel is supported by a shaft near the outer end
of the arm．The rim of this wheel is grooved，to gulde the hoisting belt． the arm．The rim of this wheel is grooved，to gulde the hoisting belt． ley，to which one end of the belt may be attached．The other end of the belt is attached to the wheel around which it is wound．A wheel is secured round the latter wheel as the main wheel is revolved．A grapple is attache to the article to be lifted．The power applied may be greally increased by
means of a crank wheel so that a small boy may raise a heavy weight．This machine may be employed in loading and unloading carsat railroad station and vessels at the dock，as well as wagons at the farmer＇s door．

Improved Can Opener． improved knife for opening tin cans，such as fruit cans，oyster cans，etc．
The blade is made with a sharp point，and upon its back，close to its point formed a shoulder or notch．The shoulder is intended to keep the blad from being pushel in too far when forcing the point into the can，and als

Improved Sieve for Separators．
Byron Miller and Maj on the Church sieve，patented June 27，1846．It consists in constructin he sleve so that the tops of the perpendicular and inclined plates are ought into the same plane，while the inclined plates are short，and the

Improved Doughnut Mold．
wark，N．J．－Theobject of this inve
Georg Machlet，Newark，N．J．－Theobject of this invention is to construct oughnuts，and the unsightly irregular form of the same be changed to a regular one，and fancy forms be produced，such as fishes，stars，rings，o
others．The invention consists in two rims with handes，which suppor the two halves of the mold，formed of suitable wire gauze．The molds ar

Improved Marbleized Composition Stone． Thomas Carson，Brooklyn，assignor to himself and Thomas F．Attix，of ew York city．－This invention consists in the production of mantles，table narbleized surfaces imitating in appearance the variuus fine marbles with variagated colors，the said imitation marble surfaces being applied to the surfaces of slabs or other forms of the ordinary composition stone or
marble．It consists，chiefly，in frst providing the surface to be marbleized marble．It consists，chiefly，in first providing the surface to be marbleized
with any desired color for the ground color by means of a brush or other－ with any desired color for the ground color by means of a
wise；second，immersing the surface to be marbleized in a bath of water， varnish，mainly the latter－is floated and broken by rapidly stirring，an another veining color，mixed mainly with oil，is also floated and broken
and，lastly，removing the surface and drying the coating so applied，afte and，lastly，removing the surface and drying the coating so appied，afte ahich a finishing coating
lmproved Device for Sharpening Scissors． Thomas Halvorsen，New York city．－The object of this invention is t venient instrument which can be applied to a table or other convenient
place for sharpening of scissors and shears．It consists of the arrangement of two flles under a certain angle，so that by introducing one blade of a pai and forth the edge matic

Improved Combined Garden Hoe und Roller． urnish an Improved tool designed for gardeners＇use，which shall beso con－ structed that it may be used for opening a furrow to receive the seed，cov－
ering the seed，and rolling the soil down upon it．The hoe part of the tool designed for opening the furrow，trench，or drill，to receive the seed is formed upon a bend made $U$ shaped，and the ends of its arms are twisted or
inclined to give them the proper form for drawing in the soilf from the sides of the trench or furrow to cover the seeds．To the arms of the part，at proper distance from their ends，are rigidly attached two short arms，to the
outer ends of which are pivoted the 湖别 of the roller，which，when the and presses down the soil upon the seed．

## Improved Fire Proof Shutter

Washington M．Vars，Westerly，R．I．－This invention consists in a wate tank shutter，and in a water conducting cap to the window or door．The
water enters the shutter from the cap，which is opened at the top．The cap therefore aets as a conductor to convey the water thrown against the wall ter may be kept full during a fire．Steam will，of course，be generated，bu the water will flow in by its own gravity，while the steam will escap through the opening above．There may be holes througle the front plate a
the top of the shutter for the discharge of the steam．The windows of bullding，therefore，instead of belng the weakest and most inviting poin for the flames to enter，become the safest part．
lmproved Stop Cock．
John P．Mern，New York city．－The object of this invention is to permit the repair of the stop－cock spindle or stem，or its replacement when brok－ ken，without requiring the removal or elevation of the cock from or beyond
the pipe．The invention consists in fitting into the upper part of the valve or cock a nut，into which the stem is screwed．This nutis conflned between
two outwardly projecting lips of the valve in such manner that when the stem is broken or requires to be repaired the nut may be turned one quarter
of a revolution，and thereby brought with its narrow side between the said

Ips，so that it can be lifted clear out of the same，thus permitting the bod nd its detachment from the nut．The nut，and a new or repaired stem，ma replaced witheut disturbing the valve in the pipe or withoutopening the pipe．
Lewis H．Sondheim，New York city．This inventine
ghe parts of the tongue together by means of screw threads， he pin is made detachable，and its full strength secured．The breast pin iece，the latter having an eye by which it is jointed to the inner side of the reastpinby a pintle pin．A screw thread is cut upon the butt end of the in to fit the hinge socket，and the two parts are screwed together，th o heat thread of the pin cutting a thread for itself in the said hinge socke ated at any time by unscrewing，if desired．This latter feature is not s ssential as to a void the use of heat，although it is convenient to have th nd is an effectual fastening

Improved Locomotive Spark Arrester． flcient means for arresting the sparks and dust which escape from the
moke stacks of locomotive bollers．A hood covers nearly one half of the op of the smoke stack，and rises above it two feet，more or less，with
conical top．It consists of two semicircular recesses，the backs or walls of hich are made partly of sheet metal and partly of wire gauze．The al moke and cinders which rise from the smoke stack into the hood．The ward the，and dust whin side to the right and left from a centranib， jecting edges of the gauze and drop by thefr own gravity into the tank thus purifled will find its way through the wire gauze and scape． oad train may be relieved of dust and cinders．

Improved Horse Shoe．
Isaac De Mott，Cannonsville，N．F．－The object in this invention is to so onstruct the shoes of horses and oxen，and so attach the calks theret that the latter may be readily removed for sharpening or renewal with－
out removing the shoe；and it consists in the manner of fastening th calks to the shoe．A lip isturned up from the shoe at the toe and heel，to which the calk is doweled．Theselips are turned so as to form angles with
the face of the shoe，and the calks are fited to the angles and are doweled he thelips，while the other branch of the calk is fitted to the face of th hoe，and fastened thereto with a screw．With the lip a single dowel and ew is all that is required to nold the calk flrmly to its place．

Improved Post Driver．
Isaac V．Adair，Romulus， rivers．Upon the wagon frame is placed a narrow frame resting on false bolsters．The end pleces of the frame are curved on the lower edge，to
form a eradie on which the frame can vibrate laterally．Longitudinal dis－ placement is prevented by a tenon on one of the pieces entering a mortise ected with the reach of the wagon so that it can，by such connection，be ected with the reach of the wagon so that it can，by such connection，be
ocked at any suitable angle．This is for the purpose of bringing the ham mer strisht down upon the post，even if the wagon stands inclined．A
shaft or windlass is hung in a windlass frame hinged at one end and oon． shaft or windlass is hung in a windlass frame hinged at one end and oon－
nected with the spring at the other．By turning the windlass and a cam， nected with the spring at the other．By turning the windlass and a cam
which is under a lever，by horse power or otherwise，the lever will be alter ately raised and dropped to have the desired effect upon the post unde under the hammer．The shaft of the windlass can be made to slide in the
bearings and locked by a key and unlocked when the cam is to be drawn out from under the lever，and the operating rope rewound upon the wind． out from
lass．

## Combined Wrench and Grappling Tool

 Simon B．Dexter，Mason City，Iowa．－This invention relates to improve－ents in a combined pinchers and grappling tool for which letters patent
of the United States have been already granted，to the same inventor，the都ing in the mode of connecting the ehank and wedge shape Hie with the handle，and in the operation thereof．By turning a handle a mank rod．As they slide the long ends of the levers are spread apart rought together and the jaws adjusted nearer together or further apart，as cety and forced toward each other with uuftcint power tomegreate rument valuable as a hand viseformany purposes．By suitable arrang ng up the handle．By means of the swivel connection，the jaws are moved nd made to compress withgreat

Improved Grapple．
Simon B．Dexter，Mason City，Iowa．－The object of this invention is to rovide convenient and simple means for raising or turning stones and ther heavy bodies forbuilding or other purposes by means of derricks or
cranes；and It consists in an adjustable grappling implement in which the ws may be adjusted to the size of the stone or other object，as may

Improved Wagon Loader．
Jeremiah Johnson，Iowa City，Iowa．－For loading wagons，carts，and
ucks with earth in grading，digging canals，making embankments，and in ther work where large quantities of earth are to be removed from one nd Inexpensive method of loading it with hand shovels，by the use of oisting and dumping platform in a portable frame and with power hoist ing gear，so arranged that he can scrape the earth on the platform by horse
scrapers，or draw it on by the scrapers and dump it：then raise the plat orm，drive the platform into the wagon．

Adjustable Grain Wheel for Harvester Plattorms．
eorge M．Patten，Auburn，N．Y．－This invention has for its object to Grnish an improved device for connecting the supporting wheel of a har vester platform with said platform．An upwardly projecting flange is upright plate finged to receive the flaned upon the of the face of a block．Upon the face of the plate are formed sets of ratche eeth，the lower set pointing upward，and theupperset pointing down war． in recesses in the opposite ends of the block are placed pawls，which are eld down upon the ratchet teeth by coiled springs．By this construction， it from moving downward．When it is destred to move the block in eth irection，the pawl at that end of the block is raised，and a ring orcross hea pivoted to its stem is turned across the slot in the said block，which hold he pawlaway from the ratchet teeth．To the block is attached the stand
rd of the wheel that supports the outer end of the platform，accordin sit is desired to use a caster or rigid wheel．This construction enables the latform
Improved Children＇s Swing．
William H．Alcorn，West Hoboken，N．J．－This invention has for its ob ject to furnish a swing for children which shall be so constructed that a child sitting upon its seat and pulling upon a lever can give the seat an os
cillating movement．The invention consists of the combination of the vers and connecting rods with the stationary frame and with the seat or des of the seat or carriage are pivoted the rear ends of the conuecting ods，the forward ends of which are plvoted to the levers，the lower end of which are pivoted to the lower forward ends of the frame．The upper
nds of the levers may be so formed as to resemble horses＇heads，and may provided withstraps or reins extending back to the seat so that the child，by pulling

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send his address to J. B. Fuller, 996 Cherry St, i. Y . $\underset{\text { of the new Elastic Truss, } \text {, witch is worn with so much }}{\text { A Sigificant }}$ comtort, and which retalno the rupture secere at all
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E. J. E. asks: What kind of
use to meit a few pounds of brass in ?
H. R. asks: Will water that has been clar
D. B. asks: How can I clean out a choked
F. S. asks for a simple recipe for a marking
C. E. M. asks for a description of the pro J. S. W. asks: What is the best kind of
paint for use on tin that is exposed to the weather?
J. E. C. asks: What are the ingredients of
preparation to dip hot steel in before cooling in water, to temper it for drills, chisels, etc.?
Z. T. D. asks: Why is it that hop rines
twine around a pole or tree in one direction, and bean Ines in the opposite
N. J. asks: Is there such a thing as an elec-tro-magnetic clock whith will keep correct time, and
what kind of battery is used for such an instrument?
N. J. asks: 1. How can I lay out a line for ink motion which treats the subject without the use
lgebra?
Z. T. D. says: Last winter my apple trees were greacypamageapy rand the stem. Can I save my
peeled complety arom how?
trees and
J. D. W. asks for a preparation to be aphard and smooth so that any alkal wwhll not penetrat the gratin of the wood.
H. P. L. asks: What is the best material to common lime mortar, and it crumbles out. Is blu ay good for the purpose
$\underset{\text { what temperature, when regulated by and thermome at at a }}{\text { H. }}$ colled spring go feet long and 22 inches whtde ought to be a
drawn to 10 gape thick to ensure will not set or break?
G. C. says: Suppose a pile driver of 2,500 lbs. weif ght, when a it has just completed the distance or
25 feet in falling, strikes one end of a scale beam ; with how many pounds will the preal
he end be equally balanced?
G. E. K. . says: I am engared in cutting dog so that $I$ fearit it is useless. Can you suggest tay treat nent by whichit can be preserved from spirtting? Boil
ng the blocks in water is sulueless. owa about the middele of March.
G. D. asks for a formula for finding the length of the braces in a Howe truss bridge, the lengt
of panel and distance between chords belng glven? Th braces are to be cut off at right angles to theflo own cen.
ter line and of suchleng th hat their corners shall just touch the chords and tie rods.
J. M. R. says: I would like to enquire what pump chamber and a galvanized iron case ( $\left(\frac{1}{2}\right.$ inch space)
 composition of rosis cement and asphaltum is too
H. L. asks: 1. If a piston leaks while in bumptngin the cylinder? 2. What effect would a sligh derangement (say a looseness of the jam nuts or any ther silght cause of a silide valve have on an engine While in motion, and would 14
of something belng wrong?
G. F. wishes some practical individual to What is the kind of machinery employed to promot saving of labor, the best mode of pollshing, the grade
of quartz used, and the length and speed of sand belts of yartz used, and the length and spead of sand beits?
What st the best season of the year for cutting paoke tmber? Is there any machinery known that will dres S. E. W. says: There is an objection to su-
perheating steam in an upright tubular boller, on a ount of the upper end of the flues or tubes becoming be superheated In a common horizontal boller without this fanlut in the following manner: Take an ordinany
horlzontal boller, and run one or more emall tues from end to end above the water line, so arranged as not to ecome too heated untll there was a pressure of stean
$\underset{\text { A. . McK. says: }}{ }$ I had a very simple and mon strong stove, 14 tnches $\times 3$ feet, for wood, enclosed
with brick 4 niches from the stove all round, with a
and To heat the rooms above, on each side there is a tin pipe, inches in dameter, from the top of the furnace to a
ventllator in the floor of each room. The plpe which ventlator in the floor of each room. The pipe which
conducts the smoke ascends directly above the stove nto thehall, and through the upper flat hall, thus ser gite heat botah halis and the rooms in the apper fal
uite comptably. To prevent too much heat ascend ing in the smoke pipe, it is necessary to have a tee or
four knees above the stove and inside the furnace. The only objection to this simple method of heating 1s that When the fuel 18 befng put into the stove, a little smoss
scapes throub the tin pipes into the rooms. Can yo oint out some remedy for this orgive a simpler method

## 

J. S. asks for a gold dip for brass. Answer
See J. L. B.s reply to G . W. S., in this column. J. S. asks what to put into glue to make it
adhere to belting. Answer: Try the following compo part Gutta percha, 8 parts, india rubber, 2 parts, pitch part, ,11nseed oll, 1 part. Cut the rubber in shreds and
ad the ofll, which latter will soften the rubber in a few days. Melt the gutta percha and pitch together, and
stir in the rubber solution, apply hot, and press the ets tighty togethe
G. B. B. D. asks: 1 . Does any body run faster
and the water that carrles it? the working of the atr pump attached to the under
ground gas machine: Answer: 1. Yes. Boats may be driven by a stream obllquely across the stream, at a fast your efer to is generally of the rotating kind, something
 atr hrough the on or naphtha; the air takes up a por-
tion of the naphtha, just as a sponge takes up water.
J. S. W. asks: What sized feed pipe is re-
quired io get the maximum power on an engine 555 and sfeet from a boiler carrying 100 los. pressure, the engine
tring a propeller whee 28 Inches dlameter? The lead
 an engine of 5 Incheses dlameter of cyllidere, and other did mensions as glven, we should say about $1 \%$ inches in
J. W. says: I have ten acres of land which
 creek. I intend bullaing a bank 6 feet high along the creek to keep the water off the land. Now by what pro-
cess can I keep this land dry, letting this stream of 1 foot ens
y 2 feet run under this bank into the creek, when the cek 184 feet higher than the land? How an a aluluce b
rran ged that will keee the land dry under above condt tlons? Answer: Only by running the slutce back sever-
al hundred feet, so as to still give fall enough to carry off tts water freely when swollen by heary raln, we should suppose. Probably no system of pumping would pay in such a case, and our correspondent can best deter
hich he must buil
E. J. E. will probably find the pickle de cribed on p. 283, vol. 28, serve to clean his castings, an
recipe for lacquer in another column of this issue.
A. B. L. says: I contend that there isa point
on the circumference of $a$ wagon wheel which stand still when the wageo in progressing. When this potn
strikes on the surface, it has to stop for a moment until t leaves the surfaceagaln; the time that it stops is har y perceptible, yet it stops, and at the same time the top of the wheel travels twice as fast as the wagon. An-
swer: We have often answered this question, and our ent is correct tn his theory
. H. K. says: 1 . My trade is that of a pracsecond and first, on high pressure boats, although I was
not licensed tll1 186, and then as the second en IIneer. In May, 1872 , I applied to the local Inspector of this dls trict for a, Arrst engineer's sicense. After askIng $m$
ome question about esttng bollers and linng en gines, he told me that he did not think me competent to
lake charge of a boat, but that he would 9 glve me anothe take charge of a boat, but that he would give me another
hearing in August. He did not come down our way till hearingin August. He did not ome own our way till
the following March. I went to him agatn. with an ap. plitation IIgneed by four out of the six culief engineers
there are in this place. He asked me how to set a palr there are th this place. He asked me how to eeta a pari
of bollers in a boat. My answer was: Run two line Of bollers in a boat. My answer was: Run two lines
across the boat parallel with the sheer planks, one at the cross the boat parallel with the sheer planks, one at
after and one at the forward end of where you wish your bollers to come. He next asked me about luning up
engines, and acknowledged that my way would do ut that it wasa very old way. His next question wa this: If, after a boat has run some time, the sllde the tnstid only, or the outer edges gone up, how would
you get them in line again? My answer was that I would tun aline through the center of the cyllinder to the cen er of the shatt; then run two Hines, one at the after and ne, und forward ends of the sildes, across the cente
 silde question. I have asked other engIneers; they sa
that $I$ am I ghth. I I wh y you would giveme your opinlon there a re thers besides myself who think that the In
There
 hence the trouble in getting my license. Aboard the
oppositton boats, , hhey are short of licensed engineers, oppostton boats, they are short of lic ensed engineers
and he has given licenses to men that have not been on the river more than elight months, putting them in this position, as I hold, contrary to law, for $I$ belleve that the taw says that a man has to be three years o o a boat be
fore he can get a license. You may think that I should 500 miles from here, and $I$ would rather have your optnIon. 2. What book should I get that will give me the
rules for putting machinery in light water steamers? rules for puttlng machinery in 1 ight water steamers
Answers : 1. Probably the Inspector may have thought that the replies were not full enough. Our correspon dent would get his guldes ritght, however. Who is the
nspector who lends himself to such Injustice as that complatined of? It is the duty of our correspondent tion
inform the Secretary of the Treasury and the Supervis ng Inspector General of the f
Catechism of the Steam Englie
N. P. M. asks how to measure the velocity
fthe wind with accuracy. Answer: The velocity of the wind can bemeasured by the use of the anemome. paratus for that purpose. Iet can be obtained with con-
siderale acuract elthe with the
 cing its velocity by the $m$
J. V. Says: 1. I have seen in your columns
process for removing incrustatation from steam bollers. The substance to be used is a solution of sal soda and g. Then the boler is ot the top of the water, comes in contact with ever plate of the botier. What I want to know is, must not
his oll be blown off, before steam is generated in the boller, and might it not prove dangerous to some extent y the heat of the steam if left there? 2. I would also ise to know how a steam gage is tested, so as to ascer
ain tis correctness. 3 . What is the reason that the arts whith are operated on by steam in the gage be Answers: 1 . The ofl need not be blown out. Use heavy liswricating oinl, on nat naptha or benzine. No danger of
lixploding the bollers need be ayprehended. 2 . Steam exploding the boliers need be apprehended. 2. Steam
gagesare tested by comparison with standard gages, Eages are eterted by comparison with stand of mercury
which are orignanyly checced by a column of and frequently themselves retested. 3. Because the
spring 1s usually of steel, and steam or molsture are ery apt to $g$
J. G. says: 1. On page 200 of your current
olume, you say that Congress has passed a bill author zing the President to cause such experiments and such Information to be collected as, in his opiniton, may be
useful and important to guard against the bursting of steam bolilers. I wrote to Hon. C. Sumnere, on the sub
ject and got no reoly. I called on our repeesentative ject and got no reply. I called on our reperesentative,
Mr. Hoar, and he informed me there was no such bill passed by Congress ast session. I would dile to know of bollers that have not made their appearance in the
arket yet ; wlll you inform me how I can Introduce market yet; will you inform me how I can introduce
hem? Answers: Write to the Secretary of the Navy, o whom, we are told, 1 Is inturusted the clarge of the
Thater referred to romptly and satisfactorlly, get some well known and Intellif gent manuacturer to take hold of it, proving ite
good qualtites by exact methods of test in presence of ries among the scl Ftifc and enfireering journals, with fllustrated des riptions where possible. See that every boller buill
akes a good record and that the publicare made a ware L. W. asks: Does a magnet constantly in A magnet, kept in une, carrying a constant load, will
probably never lose its power of carrying that load. Ite probably never lose its power of carrying that load. Its
strength may be increased to to the point of maximum Srength may be increased to the point of maxime
possilie strenth, or of saturation, as it it termed, by
 ut the simple removal of the ""keeper" or armatur ill destroy all the surp of strength. Where the ese of ure, the magnet will gradually lose its strength, it not nally become devold of magnetism.
K. H. says: I am building a small steam
ngine and bonler. The size of cylinder is 1x1// inches, vith a common silde valve. Would tit be scientific to nnect he governorwinh ine vive tem In such a man
er as not to allow the valve to move full stroke (when the engine runs too fast) Which would not open the
ports to the full, and would not allow the steam to fill ports to the full, and would not allow the steam to fill
the cyllider quite as readly? Would it work well that the cyllinder quite as readly? Would it work well that
way? I can fix it tin that way much more easily than I way? I can fix it in that way much more easily than I
an inut oftre steam with another raive, moved by the
overnor. I would like to ask a great many more "bo
questions," but your time must be occupted with other
things. Answer: The regulator would probably an things. Answer: The regulator would probably an-
swer very well, arranged as proposed. We are always pleased to have our younger readers ask intelligent
questions, and shall always be glad to reply to them when the subject is one that will interest our readers. T. A. P. says: On page 74 of your current
volume, P.Bros.give you the proportions of their safety valve, which were as follows: Lever, $221 /$ Inches; from
center of valve stem to fulcrum, $21 / 2$ Inches; diameter of center of valve stem to fulcrum, $23 /$ inches; diameter of
valve $2 \% /$ inches; aetion of lever 20 lbs ., (meaning, I presume, welght on lever.) He asks you to estimate at what pressure the valve will blow off. Youanswer that "the pressure on stem of safety valve must be $42 \times 22 \frac{1}{3}$
$\div 2 \frac{1}{2}=378$ lbs. + the weight due to the lever." This is all concerned. But where do you get the factor 42 , which goes to make up the result? Of course, you know tha as the long arm of a lever is to the short, so is the powe to the weight; or you can reverse the language, and have
it the other way. Then the result of the preceding com. bination of figures should be: $20 \times 22 \frac{1}{2} \div 2 \frac{1}{2}=180+$ weight due to the lever; but you make it 378 by the use of your 42, and Iam at a loss to know where it comes from. wer safety valve, to keep in a given pressure You an. swer: To find the total length of safety valve lever for a required maximum pressure, multiply the distance
from center line of stem to pin on which the lever is ung, and divide by weight of suspended weight. Of pressure of steam $x$ distance from fulcrum to valve di-
vided by weight on lever. But you give no rule for estivided by weight on lever. But you give no rule for esti-
mating the pressure of lever of a given weight on valve ; mating the pressure of this is what $I$ want to get at. For example, if a a afety valve lever is 40 inches in total length, weight 16 ibs.
distance of center of valve stem to center of fulcrum $33 / 2$ inches, what will be its pressure in lbs. on the valve And again, if the above mentioned lever is used on a
valve 3 inches in diameter, at what distance from the fulcrum will I have to place a welght of 34 lbs. to keep
in a pressure of 55 lbs. to the square inch ? I have a way of estimating the pressure due to the welght of a lever. But a safety valve of the kind and proportions I men-
tioned blew off, by a new steam gage, at 15 lbs. less than 1 snticipated. And I want also to say that the gage did not Indicate a bit of steam-In the bofter, when there was actually enough in it to blow the whistle in a lively manner; and on raising the safety valve there was quite a
rush out of steam. Was the gag? made properly, or was the result due, in some way, to the air conflned in the expert, but they are somewhat perplexing to a novice like myself. Answer: There was an error in printing the cation at hand, but presume that nt 42 pounds was the weight suspended from the lever, and 20 pounds the pressure due the "action of the lever," and that our re-
ply was correct. In the second case, an omission occurred, as indicated by T. A.P., the words "Into pres-
sure of steam" should be supplied. To determine the additional pressure due the weight of safety valve lever, palance the lever across a sharp edged or rounded supt balances-the center of gravity-to the pin. Multiply this distance by the weight of the lever and divide by the product of the effective area of valve into the dis-
tance of the valve stem to the pin. The quottent is the pressure per square inch due to the weight of lever unloaded. In case supposed, if the lever were straight,
the center of gravity would be at its middle point, and this pressure would be $20 \times 16 \div 3 \frac{1}{2}=91 \frac{13}{103}$, which quantity, divided by the effective area of valve, would give the re-
sulting pressure per square inch. The difference noted by our correspondent may be due to the same cause as
that referred to at page 74 of our current volume, and not to error in his estimate. Unless a valve is rade
with a very narrow seat, it is often difficult to determine $\underset{\text { if the number of teeth in a saw can be reduced with good }}{\text { P. Bays. in reply to G. B. L. . who asked }}$ result : I have run saws in soft pine, oak, walnut, and
hard or soothern pine, and, according to my experience, reducing the teeth would be bad business:: yet it depends mong the mills sawing hard pine is a tooth for every nch of diameter, but that becomes too many when the
saw wears smaller. From 40 to 48 teeth for a 56 inch saw is very good. A fine toothed saw will run longer
without tling than a coarse one, but tit takes longer to have one saw no was 56 Inches. I doubled the teeth, and the change 1 $\underset{\text { asked what preparation is used for the bright yellow }}{\text { J. L. B., says in ans }}$ laccuer on brass castings: Take of seedlac, 6 ozs., amber
or copal, ground on porphry, 2 ozs., dragon's blood, 40 grains, orlental saffron, 36 grains, pounded glass, 4 ozs. very pure alcohol, 40 ozs. To apply this varnish to articles of brass, expose them to a gentle heat and dip them
into the lacquer. Two or three coatings may be applied if necessary. The lacquer is durable and has a beautiful
color. Articles varnished in this manner may be cleaned with water and a dry rag

J P. H. says, in answer to W. E. G., who
enquired as to the formation of minerals:
that you are right saccording to cert ain kinds of rocks, that you are right according to cert ain kinds of rocks, others. Take mineral coal, for instance; it is formed from the debris of forests, in swamps and elsewhere,
wherever there has been any immense quantity of vegetable matter. This latter has slowly accumulated in
vast'beds which have in time changed from peat to coal. The limestones are mostly formed by vast accumulations animals. The sandstones are formed by the sediment that has been carried down from hills and mountalns by
water, and deposited in various places to all thicknesses; they are simply the fragments of rocks, both worn and torn of by the action of water; there are seldom found,
if ever, any fossil remains in them. Granite and kindred rocks are the only kind which were the foundations of and purest of our minerals, such as the magnetic fron found at Port Henry, N. Y., the copper found at West
Farley, Vt., and the gold in Callfornia. I would advise Farley, Vt., and the gold in California. I would advise
both correspondents to read up Dana's 's Manual of Geology,",
works.
J. P. H. replies to N. J. J., who asked how
to stock his lake with fish: Try the common perch, rock bass, Saco bass, and lake trout, with plenty of little min-
nows, shiners, and red fins, for bait and to feed the other nows, shiners, and red ins, for balt and of feed the other of fish to plant in your lake.
G. A. H. says, in reply to E. C. M., who pro-

 erated In each second, that Is, the acceleration; we shall
then find the space passed over in 10 seconds by the well equal to one half of the product of the acceleration int
the suare of the time. It 1 s no the proper measure of the moving effect of a constan is the product of the mass of the body into the accelera-
tion
tion Ion, or, as we may express it , force=mass $\times$ acceleratio must remember that the pound 18 a unit of mass, not of force, betng the quantity of mater in a certann plath
uum welght kept in London. In this case, then, the mass moved is equal to the sum of the masses of the two sion for the force. For brevtry, call the body weighning 1bs. $P$, and the other body $Q$. II 18 clear that a certal
part of the welght of $P$ is neutralzed by holding $Q$ equllibrium on the inclined plane, and that the accelerated motion of $P$ (together with $Q$ ) is wholly due to the
 quilibrium on an Incllined plane (power: welght:: hligh
ength) the portion of the welght of $P$ whtch 1 s requre to balance $Q$ is equal to $6 \div V_{2}^{\prime}=4 \cdot 243 \mathrm{lbs}$., very nearly leaving an unbalanced welght of 0.757 lbs. to produce ac.
celeration. We are here using the word pound in its secondary and very common sense of a a nutt of force, or
rather of pressure. In this sense it statical or gravitatton unit of force. Buc the primar meaning of the term-1s accertain unit of mass, and whe employed, as is often convenient, to denote a unlt of force, it denotes the pressure produced by the action of
gravty on the unlt of mass, or pound of matter. The unbalanced pressure, therefore, of 0.757 lbs. is that pro duced by.the force of gravity acting on a mass of 0 - 575 ibs., and this force is measured in the usual way by mul4iplylng the mass moved by the acceleration due to the
ravity, or 32 feet per second, nearly. Thls g gives as the measure of the force $0.757 \times 32=25 \cdot 224$. Therefore the value of the acceleration actualy yiven to the movthy system of
he two bodies is equal to $55.224+11=2 \cdot 293$ feet per second The space passed over in 10 :seconds willibe $\frac{1}{2} \times 2 \cdot 293 \times 100=$ two bodies, $g$ the acceleration of gravity, a the angle of inclination of the plane, the space passed over in $t$ seconds $w$
beequalto $\frac{1}{[ }(\mathrm{P}-Q)$ sin.a. $] \div(\mathrm{P}+Q) \times \mathrm{t}^{2}$. In fact the cond eequal
tons of motion are very similar to those in the twond machine, the orly difference betng that, in the present
case, the motion of one of the bodies is rendered les Imple by taking place on an inclined plane. We havo supposed the ncilined plane to be perfectiy smooth. In
polnt of fact such planes do not exist; all are more or less rough, the degree of roughness belng expressed by
a quantity called the coefflclent of friction. If udenotes he coefflclent of friction in any case it may be easilly
easily shown that in $t$ seconds

G. H. H. replies to H. M. who asked what the saw and mandrel is to move forward in the direction of the cut; ; and of the opposite end, to retreat. In other
words, the mandrel words, the mandrel would turn horizontally .upon some
undetermined center were it free from Its bearings, like a gyroscope. I have a saw upon short eteel mandrel well balanced, and run by belt at an angle, down and vack from the cut; this relleves the journal next to th saw, but keeps the opposite journal hot, and we are un.
able to prevent It; this journal 1 s also constructed with it more length of bearlng surface than the other. H.M.
runs his sa w mandrel by friction. The driver, we woul. suppose to be elther back of or beneath the mandrel he must run his saw by friction, let hlm shift hls driver as close to the free end of mandrel as possible, and add from 1 to $\%$ \% more length to the box next to the eaw. Or
run by a belt, with the pulley as close to the saw as the all

 face containtng one thousand square feet moving at the
velocity of thirty milles per hour: The resistance in one suaare foot, moving in a still atmosphere at the
rate of one mile per hour 1 is met with restance rate of one mille per hour, is met with a resistance of 1
$\times 1 \times \cdot 005=005$. At thlty miles an hour, we proceed
 of 1,0co square feet. Am I correct, Messrs Eadtors? An-
swer: Our correspondent tis right according to Smeat. The maximum pressure of the wind is as great as 55
pounds on the square foot of fat surface, which Igure is used in calculating the required stability of tall chim neys and lighthouses. For a cylindical shaft half the
E. A. G. says, in answer to T. M. S. . Who
asked about the force required to burst out the head of a barrel: I would say that a barrel, as described. would

 given matnly by thickness of head, which generally bulges out. Hoops, if good, rarely burst. T. M. S.'s bar-
rel, having $1 \%$ inch heads and small diameter, would stand more than the average. The above ifgures are ap. teaming, preparatory to using for elther clder or vine.
gar. V. says that W. E. G., who believes that muzzle of the barrel, 18 right , and that tit speed continu-
 cructble, flux it with corrosive subllimate ; if it does no P. T. says, in reply to L. C. C. M., who asked
how tomake bright green pleckles : if hard,greencucumber plckles are wanted, salt down in dry salt, putting a
layer of salt in a jar, then a layer of pickies, and so until full. This will produce plekles as green as they can be made, but 11 tis more costly than making rinie.
If you have stock to feed the salt to, it will be better than the old process. Souring may be done in the usual way. Of course the above process is not calculated for
 to make a biackoord on a wail: Make a glue size and
go over your wall then take shellac varnlsh and lamp
black mixed to a thin conssistence.
G. W. . . .ays that T. A. B., who asked how t
of ten leather pump valves,
 G. W. says that J. T. T., who asked how to hang wall paper on a horizontal celling: Cover your
celling with cheap cotton cloth or print, stretched tight and tacked at the edges. Then paper on
usual way. Any width of paper will do.
J. T. B. S. s. says: As many of your corres
pondents
have enquired about machtrery for stean launches, I Will give some particulars of Englligh practice
The following table glves the sizes of steam launche bullt by Yarrow and Hedley, of London, who make them
a specialty, and bulld hundreds of boats for use in all

## Length of launch. $\quad$ Beam. $\quad \begin{gathered}\text { Horse power } \\ \text { (indicateece). }\end{gathered} \quad \begin{gathered}\text { Draft of } \\ \text { water. }\end{gathered}$

|  |  |  |  |
| :---: | :---: | :---: | :---: |
| ${ }_{30}^{23 \mathrm{ft}} \mathbf{3} \mathrm{ft}$. | $\begin{aligned} & 5 \mathrm{ft.} 3 \mathrm{in} . \\ & 6 \mathrm{ft.} . \end{aligned}$ | 7 | $2 \mathrm{ft}$. |
| 37 ft . | $6 \mathrm{ft}$.6 in . | 12 | $2 \mathrm{ft}$. |
| 43 ft . | 8 ft f. | 16 | $2 \mathrm{ft}$. |
| 50 ft . | 9 ft .6 | 30 |  |

John Penn \& Son, of Greenwich, use about the sam
izes. More speed can be had by sacrifccing room, bu the above is standard practice. When light draft it imas toe has its own indenendent engine ; but In ordinary Mractice and know no better rule in designing than those on pa 35 of Haswell's "Engineering." It is better to have the screw too sum the entine illustrated on page as, current
the engine. The
roume but there is too much complication. A single engine 18
much better on the score of simplictty, and can be built or about one half the cost of a double engine of the F. A. K. says that T. K. B., who asked how
o prevent ccale from forming on pollshed steel when ardened, should try the plan suggested to H. B. age 75 of our current volume.
J. N. S. says that A. W. P., who asked how
os often an oilstone, should try boilling it to extract the oil, if that be the cause of its hardening. He should try
doft water stone, and use oll soft water stone, and use oil on it as on a regular on
tone. " $I$ have one of that kind, and it works well.
N. L. T. says that R. W., who asked for a remedy for serews working oout, can always pre vent It by cutting a series of notches across the thread
around the screw, in such $a$ manner that the thread will be formed 1 to serles of teeth smillor to thead w ratchet wheel. As the screw is inserted, these teeth
offer no resistance; but on belng turned the opposite way, they catch agalist the fibers of the wood and pre
 mond: I have drilled through hoft glass, at a tolerably
slow speed with a common drill wet with kerosene or slow speed, with a common drill wet with 'kerosene or
sprits of turpentine; buta
better way is to drill with a ead or copper drill, if the hole is to be small, or with a brass or copper tube fed with oll and emery, if large.
Do not run It too fast, and use gentle pressure. For the ube, use a wooden support for the bearings and a pul ey fitted upon the tube for a ariver. Put oll and emer
nside end ice. It is to be understood that the tube is placed up. mery. G. W. says to J. H. L. who asked for opin-
ons on his mode of buillaing: If you bunld your honse as proposed, you will have damp walls in wet and frosty
weather But if you put your brick edgewise, leaylng an Inch space between brick and weatherboardtng, and also an inch space bet ween the plaster and brick, lath.
ng and plastering as usual, you will have a warm house with dry walls.
ERRATUM.-On page 28, fourth column, wer to F. o. W.'s question. The fractions should b

## COMMUNICATIONS RECEIVED.

The Editor of the Scientific America cknowledges, with much pleasure, the re eipt of original papers and contribution upon the following subjects:
On the New Patent Law in England. By
On the Pulsometer. By J. H. H.
On the Bars at the Mouth of the Mississ ppi. By C. G. F.
On the Manufacture of Combs. By G.F.B On the Power of the Tides. By A. H. E. On Creeping Rails. By C. 0 .
On a Newly Discovered Novaculite. By
On Distinguishing Fibers. By C. S.
On Aniline Inks. By G. E. D.
On the Proposed Panama Ship Canal. By . T. F.
On Saving Life from Shipwreck. By F.D nd by A. R.
On the Wreck of the Atlantic. By J. L. G
On Steam Boiler Explosions. By B. W
On Water as Fuel. By W. H.
On the Ocean Tides. By W.H. P
On the Dimensions of Ocean Steamers. By
On Terrestrial Retardation by the Oce
Tides. By T. W. B.
Also enquiries from the following

 | P.s. |
| :---: |
| P. |
| Corre |

Correspondents who write toask the address of certatn also those having goods for sale, or who want to to partners, should send with their communications an amount sufficent to cover the cost of publication under
the ehead of cisuinessand and Personal," which is specially
[OFFICIAL.]

## Index of Inventions

for which

## Letters Patent of the United States

were granted for the week ending April 8, 1873,
and each bearing that date.
[Those marked (r) are retssued patents.]


Liquid meter. F. A. Morley....
Loom, pile fabric, E. K. Davis
Loom, pile fabric, E. K. Davis (r)..
Loom shuttle guard, C. H. Hudson
Loom shuttle guard, C. H. Huds
Loom beam, etc., G. L. Garsed..
Mattress, spring, H. A. Gaston.. Mattress, spring, H. A. Gaston...... Medical compound, H. Gahn.
Medical compound, W. E. Rose Medical componind, W. E. Rose....
Minlistones, adjusting, A. W. Winall Mower, lawn, S. D. King.
Musical instrument, J. \& H...............
Nail plate feeder, S. K. Paden
Nail plate feeder, S. K. Paden
Oyster dredges, raising, w.T. Howard. Pail, milking, H. Springer. Paper bags, constructing, L.................
Paper stock, washing, G. L. Lovett.....
Piano key, Goffrie \& Schuch
Picture mounting machine, E. B. Chrietmas
Pipe joint, Prosser \& Morgan...............
Pipes, connecting cement, G. C. Nichols.
Pipes, connectirg cement, G.
Planter, corn, A. C. Martin...
Planter,
Plow, gang, G. W. Manuel.
Plow, wheel, Janes. Tucker, \& Terry
Press for printing fabric
Press, fan fly, P. A. Cotter H. H. Townsend
Printer's miter machine, J. A. Stansbury
Printing press. W. \& W. H. Dunkerly
Privies, etc., cleaning A. M. Hobbs
Privies, etc., cleaning,
Pump, W. D. Baxter...
Railroad rail joint, T. v. Allis
Raillroad safety guard, C. Latim
Railroad switch, H.S. Dewey....
Refrigerator, etc., J. S. Bateman
Sash holder, R. B. Huguni
Sash holder, R. B. Hugunin.........
Saw grinding machine, D. M. Meftor
Saw set, C. E. Grandy..
Saw sharpening device, C. Wil.
Sawing machine, C. H. Smith.
Sawing machine, S. Wheeler.........
Sawing machine, band, B. D. Whitn
Scythes, rolling.II. Waters...
Seeding machine, S. B. Mille
Seeding machinne, S. B. Mille
Sewing machine, J. o'Nell...
Sewing machine, J. O'Neil...
Sewing machine, G. C. Walter
Sewing machine, G. C. Walters................
Sewing machine, button hole, G. Kallmeyer
Sewing machine ruffer, A. Johnston
Sewing machine shuttle, C. W. Eils.
Sewing machine, wax thread, E. E. and F. Bean
Shafting, hanger for, W. W. Carey
Sheet metal elbow, L. Bancroft.
Shutter, rolling, A. Clark.
Skate, E. H. Barney.......
Skate heel plate, G. Havell
Soda water faucet, J. Patterson.
Spike machine, T. O'Connor..........
Spike, molder's draw, R. A. Thomp
Spool head machine, L. H. Dwelley
Spring, furniture, W. T. Doremus.
Stage machinery, J. Schonberg.
Stalk cutter, S. B. Miller
Steam crane, D. Tillson...........
Stirrup, J.S. Fee
Stove, portable.N.E. Chase
Stove grate, W. B. Sutor.............. Stove draft regulator, Sprague \& Osgood ugar cane, extracting juice Table, folding, S. V. Cornell.........
Table, folding froning, W. Ed wards
Tent, E. M. Turner.
hrashing machine, Lippy \& Blyme
Tin scraps, tin from, H. Panton
Trap, insect, J. W. Anderson..
Uterine supporter, H. N. Cane
Valve, balanced, N. H. Bundy..
Valve, safety, E. C. Fernald
Vehicle, Coffee \& Bernard....
Vehicle wheel, o. D. Spalding
Vehicle recorder, Guebhard
Vehicle recorder, Guebhard \& Tronchon
Wagons, seat for, C. H. Howell..
Wagons, unloading, J. K. Wilson
. Wiso
Washer, steam, C. A. Bradley....
Washing machine, P. A. Downer
Water wheel, H. B. Weaver.........
Water wheel, turbine, W. H. Elmer
Well curb, N. H. Lindley.
Wells. device for clean
Windmill, J. B. Park..
Windmill E S. Smith.
Window platform, portable, G. H. Peabody
Window, waterproof, B. Smith.
Wire, etc., cutting, C.M. Spence
APPLICATIONS FOR EXTENSIONS
Applications have been duly fled, and are now pending,
for the extension of the following Letters Patent. Hearor the extension of the following Letters Patent. Hea ings upon the respective applicat
the days hereinafter mentioned:
24,734.-Paper bag Machine.-W. Goodale. June 25.
24,748 .-Paint Can, etc.-J. W. Masury. June 25. 24,773.-HoLIOW AUEER.-A. Wyasoff. June 25. 24,905.-PIANOFORTE.-J. U. Fischer. July 9 .
25,191.-PAPER BAG MACHINE.-W. DISCLAAMER.
23,635.-Canal Lock Gate.-C. W. Williams.
EXTENSIONS GRANTED
8,654.-Iron Fence.-H. Jpnkins.
23,642.-ObTaining Fiber From Felt.-J. F. Gre 23,643.-Disintegrating Felt.-J. F. Gree 23,963.-Cooking Stove.-P. P. Stewart.
23, CaNAL Lock Gate.-C. W. William

DESIGNS PATENTED.
6,558 to 6,560.-Carppers.-R. R. Campbell, Lowell, Mass. 6,561-CARPET.-R. Cartiton, Liversedge. England.
6,562 to 6,571 .-CARPETS:-J.M. Christie, Brooklyn, 6,562 to 6,571.-CARPETs:-J.M. Christie, Brooklyn, N.
6,572.-TrimyIng.-J. B. Clarke, Brooklyn, N. Y.
 6,575 6 6,56.-CARPETs.-J. Hamer, Lowell, Mass.
6,577.-FORE HANDLE.-M. H. Mossman, Waterbur 6,578\& 6,579-CARPETs.-C. A.Righter, Philadelphia,

## 6,51.-CARTLAGE POIIE.-A. Searis, Newark, N. J. 6,583.-PAPER STIAN.-T. F. Spencer, Morrisania, N. Y. E. J. Steele, New Haven, Conn.  <br> TRADE MARKS REGISTERED. <br> 1,199.-HAMs, ETC.-W. G. Bell \& Co., Boston, Mass- 1,200 . - Brandy. Cazade \& Crooks, New York city , 201-GLAAs WARE.-T. G. Cook \& Co.,Philadelphia, P 1,203.-BAKING PowDER.-J.H.Lippincott,Pittsburgh,Pa <br> , ,205--TRIMMINGs.-EErskine \& Co., New York city. ,206. - Medicive.-J. H. Hopkins, Providence, R. I. <br> l., 206.-MEDICINE.-J. H. Hopkins, Providence, R. $1,207 .-\mathrm{W}$ Hisk Y. Morehead \& Co., St. Louis, Mo. <br> $1,208 \&$ 1,209.-Rubber Paint.-Rubber Paint Co.,Cleve land, Ohio. <br> SCHEDULE OF PATENT FEES <br> On each Caveat...... <br> On fling each application fora Patent (17......................... <br> On appeal to Examiners-In-Chief. <br> On appeal to Commissioner of Patents. On application for Reissue <br> On application for Extension of Patent. <br> On granting the Extension <br> On an application for Design (31/2 years) On an application for Design (7 years). <br> VALDE OF PATEIITS <br> And How to Obtain Them.

Practical Hints to Inventors

HROBABLY no investment of a small sum of money briugs a greater return than th When the invention is but a small one. Large well. The names of Blanchard, Morse, Bige low, Colt, Ericsson, Howe, McCormick, Hoe
and others, who have amassed immense for tunes from their inventions, are well known nd there are thousands of others who
ealized large sums from their patents More than Fifty Thousand inventors have avail themselves of the services of MUNN \& Co. during the
TWENTY-SIX years they have acted as solicitors and Publishers of the Scientific American. They stand at the head in this class of business; and their large corps
of assistants, mostly selected from the ranks of the Patent Offlce: men capable of rendering the best ofrvice
to the inventor, from the experience practicallyobtained while examiners in the Patent Offlce: enables MUNN \& and CHEAPER than any other reliable agency.

HOW TO ry letter, describing some invention which comes to this complete application for a patent to the Commissione of Patents. An application consists of a Model, Draw-
ings, Petition, Oath, and full Specification. Various offcial rules and formalities must also be observed. The generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons expe rinced in patent business, and have all the work don veragain. The best plan is to solicut proper advice ate men, the inventor may safely conflde his ideas to them they will advise whether the improvement is probably
patentable, and will give him all the directions needful o protect his rights.
How Can I Best Secure My Invention? This is an inquiry which one inventor naturally asks
another, who has had some experience in obtaining pat ents. His answer generally is as follows, and correct:
Construct a neat model, not over a foot in any dimen slon-smaller if possible-and send by express, prepaid, addressed to MUNN \& CO., 37 Park Row, toget her with description of its operation and merits. On receipt
thereot, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if
you have not time, or the means at hand, to construct a
model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of $\varepsilon$ patent will be received, usually, by
return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves
the cost of an application for a patent.

## Preliminary Examination.

In order to have such search, make out a written de
scription of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of \$5, by mail, addressed to MUNN \& Co., 37 Park Row,
and in due time you will receive an acknowledgmen and in due time you will receive an acknowledgmen
thercof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvemen
To Make an Application for a Patent The applicant for a patent should furnish a model of
his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should
be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a disway to remit money is by a draft, or postal order, on New York, payable to the orderof MUNN \& Co. Persons Who live in remote parts of the country can usually purchase drafts fro
correspondents.

## Reissues.

A reissue is granted to the original patentee, his heirs,
of an insufficient or defective specification, the original
patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudu ent or deceptive intention.
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