
a WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, ANI MANUFACTURES.



THE INDIANA-VIEW FROM TOP OF EIGHT INCH GUN TURRET, LOOKING FORWARD.


THE BATTLESHIP INDIANA-THE GREAT THIRTEEN INCH GUNS SWUNG OVER TO STARBOARD.-[See page 172.]

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ESTABLISHED 1845.
MUNN \& CO.. Editors and Proprietors. PUBLISHED WEEKLY AT

## No. 361 BIROADIVAY. NEDV YORK.

## TERMS FOR THE SCIENTIFIC AMERICAN


Renit by postal or express money order, or by bank draft or check.
MUNN \& C 0 ., 361 Broadway, corner of Franklin Street, Nex York.
The scienific American Supplemen (Eviablished 1896.

cientific America
(Eatablished 1598)

NEW YORK, SATURDAY, AUGUST 22, 1896.


## TABLE OF CONTENTS OF <br> SCTENFFFIC AMERICAN SUPPLEMENT

NO. 1077.
For the week Ending August 22, 1896.

1. BroLDGY--The Invisible Foof of Figh.-The food of usn and the pais
 - ELECTRICAL ENGINEERINS.-ELeectric Furnaces and the





 VI. MFiAA LURGP. Cleaning Cavities in Metal Work.-Some ox VIL Meiteorologi.-Italian Thuaderstorms.









## the recent heat wave.

The phenomenal heat wave which has recently passed over the Eastern States was marked by a long list of fatalities to man and beast, and will be memorable in the meteorological records as one of the longest and most destructive visitations of the kind on record. The temperature readings of the United States Weather Bureau in New York City, which cover a period of twenty-six years, can show no parallel, for the month
of August, to the heat of the nine days from August 4 to August 12 of the present year. It is true that in certain previous years the temperature for any particular day of the nine may have been exceeded, but in such cases the rise of temperature has been temporary. The general average for these nine days has never been approached in any previous August. The temperature readings are given below

| Date. | Temperature. | Exceeded in |
| :---: | :---: | :---: |
| August 4 | ${ }_{89} 87$ degrees. | 1873, 1881, 1888. |
| .، $6 .$. | ${ }_{91}^{89}$. |  |
| " 7......................... | 91 " | Maximum. |
| " 8 8........................ | ${ }_{90}^{92}$ " | Maximum. |
| " 10........................ | 91 " | 1894. |
| "، 11................. | ${ }_{92}^{94}$ " | Maximum. |
| 12. | 92 . | Maximum. |

The readings of the New York City Bureau are taken from thermometers on the top of the Manhattan Life building, at an elevation of 298 feet above mean sea level. It is considered that this great elevation is favor able to a correct record of the passing heat waves, inasmuch as the instruments are free from the local variations which are caused by radiation and reflection from the pavements and walls of the city below. It is un deniable that the heat in the streets of the city and in its stores and offices has often risen many degrees higher than the official records, and a street temperature of from 97 to 103 degrees has been common on such days as the 8 th, 11 th and 12 th instant.
To residents in some-of the Western States, such, for instance, as Arizona, where from 110 to 115 in the shade is not uncommon, there may seem to be nothing phenomenal in these New York temperatures, and the terrible fatality which accompanies them will be a mystery. The fatalities are to be ascribed to the accompanying humidity of the atmosphere and to the fact that the victims are unaccustomed to, and quite unable to endure, a spell of heat of such long continuance. The air of Arizona, moreover, is extremely dry, and the evaporation from the body is proportionately rapid, bringing instant and continual relief to the system. In New York, during the recent hot waves, the humidity rose as highras 93 per cent, and the average humidity taken at 8 A . M. and at 8 P. M. was 73 per cent of full saturation. In accordance with the laws of evaporation, the perspiration from the body was proportionately sluggish, the overloaded atmosphere refusing to take up the the overloaded atmosphere refusing to take up the
moisture of the body, which condensed upon the skin and produced extreme discomfort; killing, either by prostration or by overheating, such as were not physically able to endure the continuous strain put upon the system.
That the fatalities were due to the duration of the heat is shown by the steady increase in the number of deaths and prostrations on successive days:


The heat wrought terrible havoc among the horses mployed in the city of New York, particularly among some 1,500 in all perished
The heat wave was marked by an unusually steady barometer, the highest readings on the instrument in the Scientific American office being 30.03 inches, and the lowest $29 \cdot 85$, a variation for the nine days of only eighteen-hundredths of an inch. This will account for the absence of cooling breezes, which contributed argely to the oppressive humidity of the atmosphere The fatalities accompanying this spell of hot weather bring to mind the similar scourge-it is nothing lesshat visited Australia during the early part of the presfell below 90 degrees in the shade and in some localitie rose as high as 122 degrees. The Australian heat dif fered from this in New York in the fact that it was ac companied, and largely caused, by a strong wind from the interior, which was intensely dry and hot and caused the drying up of rivers and streams, burning up the crops and killing the cattle in the fields. As in the East ern States, people were sunstruck and horses dropped in the streets.
It is probably more than a coincidence that heat wave of unprecedented power and duration should have visited the three continents of Australia, America, and Europe in the same year; and science has yet to dis cover t
going.

## ARTIFICIAL FLIGHT.

The problem of artificial flight has recently received everal additions to its history, additions which will make the present epoch an important one if the problem is ever to be solved. For of course if it prove insoluble and if it is relegated to the limbo of abandoned efforts, and to the realms of the impossible, the death of the most successful human soarer, the flight of the most successful mechanical soaring machine, the partial success and wreck of Maxim's apparatus and the work of Andree's balloon will be of little interest. But if man does learn to fly by mechanical means, or even to float for an indefinite period by a balloon, then Lilienthal's death, the half mile flight of Langley's machine, and the other achievements will be a group of notable occurrences. Slowly a tangible theory of soaring has been evolved. The support given to an aeroplane in horizontal motion through air has been experiment ally tested and has proved surprisingly great. The fact that air currents constantly vary in velocity gives the quality of internal energy to the air in reference to a body suspended in it, which energy it appears might be adequate to support a body whose inertia enables it to utilize these changes in wind velocity for its own support. Again, an upward component of winds has been recognized, which by a parachutelike action would go to arrest the descent of an aeroplane, and help to support it. Working on these bases, it appears that a soaring bird, with exquisite balancing, presents a surface of wing to the air which blows against it with varying velocity. The inertia of the bird's mass preventing it from yielding to the frequent changes acts like a kite string to hold it relatively fixed in face of the wind pressure or of portions thereof. These fractional portions of the wind, acting on the inclined plane formed by the under sur face of the wings, would uniformly operate to push it up against the force of gravity.
Lilienthal, enamored of the problem, found that it involved as its most difficult part the question of safe alighting. Flying for a limited distance proved comparatively simple. Starting from his elevated platform, he performed many flights and soared for considerable distances. The erratic nature of the flights, sometimes involving a rise in the air, showed how great were the reserve powers in a heavy body moving on aeroplanesreserve powers in a heavy body moving on aeroplanes-
powers which human ingenuity seemed unable to fully utilize. The instant changes in direction to which a mov ing aeroplane is subject, and its dependence for action on motion, actual or relative, make it an exceedingly difficult engine to manipulate. This fact led to many accidents to Lilienthal, and finally to his death. It required an intrepid experimenter to trust himself to the support of the air. Accident after accident went to prove the difficulty of operation, and the aeroplane inflicted many an injury before it claimed its victim.
The mere fact that so very few have dared to person ally experiment in a"tificial flight goes to prove its dan ger. Any numb $\mathbf{r}$ of performers can be found to essay such feats as walking on ropes or wires over abysses o at great heights, or who will dive from a height of many feet into water tanks for the delectation of audiences but soaring through the air has been tried by very few The peculiar stability of the support given by the air under certain conditions is very strikingly shown by the failure to support when the conditions are changed A kite floats peacefully in a high wind until its string parts, when it floats helplessly away. A boomerang follows its curiously definite path as long as it rotates rapidly. As the rotation fails, its flight loses life and it drops more or less directly to earth, according to the extent to which its rotation persists. The soaring bird when shot, parts with its equilibrium and falls help less. When man, supported by aeroplanes, his powers reinforced, if need be, by an engine, can maintain certain unknown, or nearly unknown, conditions, he will have achieved the desired end. But the conditions are so little understood as to be virtually unknown, and the possibility of disposing of them is, of course, uncertain.
In ballooning proper there is room for one advance which once made, would seriously modify the prob lem. This advance is in the construction of the con taining envelope or gas bag. All that has made balloon work so very unsatisfactory is the leakage and diffusion of the gas. The fact that a balloon cannot be driven in any desired direction is a trouble less in degree than the impossibility of maintaining its buoyancy. A bal oon has to be made of extra capacity to admit of the carrying of a quantity of ballast, which is discharged from time to time as the buoyancy diminishes. The entire area of the cloth envelope must be pictured a full of pores, through which the contents are constantly escaping, and through which air is more slowly enter ing. This action takes place independent of any ressure, owing to the buoyancy of its contents, which may exist in the gas bag.
With a really impervious envelope a balloon could be kept afloat indefinitely. Its flotation could be reguated by pumping gas out of the envelope into cyrnder under pressure or by admitting it from such cylinder into the envelope. The clumsy sand bag would no longer be required, and the drag rope would prove an ple to regulate the height of flight
The most serious attempt at advanced ballooning is
that of M. Andree, who hopes to explore the north polar regions in a balloon. The last refinements of the aeronaut's art are represented in it; an elaborate outfit of meteorological instruments are mounted; and the drag ropes even are of improved construction. We have already published a number of articles describing this balloon.* But what is most extraordinary is that it is claimed that its envelope is almost impervious to gas. If this prove true in practice and actual use, then the balloon will take a new position among the re sources of the scientist. The inevitable loss of buoy ancy, which has hitherto made ballooning so danger ous and unsatisfactory, being once disposed of, the new condition opens up a wide scope of possibilities fo the explorer. Hitherto the danger of being blown out to sea in a balloon involved the certainty of an enforced descent into the ocean. Without such result the de parture from the land area would be of minor import ance and the old ideal of finding at some altitude a wind of the desired direction would seem possible of realization.
Soon more will be known of all these things. Langley's work, it is to be hoped, will soon be described in ex tenso and the result of Andree's exhibition will be eagerly watched for. Nansen is reported as having got within a few degrees of the north pole by sea. Andree and his collaborators may yet be destined to look down upo the unknown axial region of the terrestrial sphere.

## Death of otto Lilienthal.

Herr Lilienthal, an engineer, who for many years was experimenting in the building of flying machines, met with an accident on August 11 that resulted in his death. He started with one of his machines to fly from a hilltop at Rhinow, near Berlin. The apparatus worked all right for a few minutes, and Lilienthal flew quite a distance, when suddenly the machinery of the apparatus got out of order, and man and machine fell to the ground. Lilienthal was so badly injured tha he died in the hospital to which he was removed.

Herr Otto Lilienthal was born in Anklam, near th Baltic coast of Pomerania, about forty-seven years ago. He attained considerable celebrity by the invention of his machine, which was modeled on that of a bird's wing, and he was generally known as "the fly ing man." Herr Lilienthal was an engineer, and estab lished in Berlin a manufactory of small steam engines, where the mechanical appliances furnished him with every facility for the construction of his flying apparatus. He often succeeded in keeping in the air for some time with the aid of his artificial wings, which seemed to be adapted rather for soaring than for flying in the proper sense of the term. His machine was made almost entirely of closely woven muslin, washed with collodion to render it impervious to air, and stretched upon a ribbed frame of split willow, which was found to be the lightest and strongest material for this purpose. During the past two or three years he gave much attention to motive force, and reached the conclusion that the vapor of liquid carbonic acid would be effective.

## Hubert Anson Nowton.

The world of science is poorer by the loss of Hubert Anson Newton, who for the past forty years has had charge of the mathematical department of Yale College, his election to the chair having taken place in 1855, and his active occupation of it dating from a year later. He is best known in scientific literature by his investigations of the laws governing meteoric and other similar bodies. He demonstrated that the period of revolution of the shooting stars known as November shower "must have one of five accurately determined values." His computations were followed up by other authorities, so that it became possible to connect these meteors with the comet of 1866 . He determined the numbers and frequency of the sporadic meteors in the earth's orbit, and proved that they moved in long orbits like that of the comets. He was instrumental in having the metric system of weights and measures introduced into the arithmetics of this country.
In 1868 he received the degree of LL.D. from the University of Michigan. He was one of the men origin ally appointed by Congress to constitute the National Academy of Sciences. He was elected an associate of the Royal Astronomical Society of London in 1872 and a fellow of the Royal Philosophical Society of Edinburgh in 1886 . He had been president of the Connecticut Academy of Arts and Sciences. He was a member of the American Association for the Advancement of Science from 1850, its vice-president in 1875 and it president in 1885.
Yale College is greatly indebted to the zeal and counsels of Prof. Newton. He was associate editor o the American Journal of Science and his writings consisted largely of memoirs of the National Academy of Sciences.

A NEW terramara, or prehistoric settlement, 500 yards long by 250 yards wide, has been discovered at Caste naso, near Bologna, Italy.
*Scientific American, vol. 73, No. 2; vol. 75, No. 7. Supplement Nos.
1026, 1027, 1067.

The Total Eclipse of the Sun.
On August 8 a total eclipse of the sun occurred, the first since 1893. It was visible in localities along the north coast of the European continent, thence along a diagonal path through Siberia and Japan and out on he Pacific Ocean. Naturally very elaborate prepara ions were made to observe it, especially for the study of the corona. Amherst College, under Prof. D. P Todd, sent out an extensive expedition, which had th service of the yacht Coronet, owned by D. Willis James, whose liberal owner is responsible for the expe dition. This party went to Japan, and near it was stablished the Lick Observatory party under Prof. J M. Schaeberle. In Nova Zembia and Siberia there were four Russian posts, and all along the path amateur and professional observers were distributed. The reneral résumé of reports, as far as received, is to the ffect that comparatively little of value was done, owing to unfavorable climatic conditions, clouds interposing to prevent the success of the observers. This has hap pened to so many expeditions for the observation of total eclipses that it is a misfortune that will always be anticipated as highly probable. Of the recent total eclipses good observations were secured on the Caroline Islands in a total eclipse in 1883, although there was a narrow escape, as the morning of the day was showery, but just before the eclipse the sky cleared. In 1886 some observations were successful, while the weather interfered with those at other stations. The eclipse of 1887 was not observed at all, owing to the clouds. Of he last eclipse of April 16, 1893, and one or two preced ing ones, excellent observations were obtained.

## Hints to Beginners in Photography.

Many amateurs do not succeed in getting creditable pictures, even with good cameras, first, because they do not understand the general principles of optics, and second, because they do not know the special peculiari ies and the capabilities of the instruments which they are using.
In a general way they forget that one cannot get a good picture of an object that is between them and the un, or on which the sun's rays fall directly vertical Then they expect too much of a so-called "universa ocus" lens, thinking that it will reach out sidewise so as to get both ends of a passenger car sixty feet long a a distance of twenty feet, and at the same time get the details of a ruined tower on a hillside half a mile or ore away
They also expect to get an undistorted picture of all building only forty feet away ; and to get a good sharp picture of a smutty black object like a locomo ive just come in from a long run. Or, they will think hat a moving object can be as readily "snap-shotted" rom the top of a street car or omnibus going rapidly the opposite direction as from a stationary location
They also expect the same speed from a $\$ 5$ lens as from one costing $\$ 50$ or more ; the same speed with a given shutter, no matter what kind of plate, or with the same plate, no matter what the shutter or the lens, or the same speed in Leipzig as in Naples or Cairo. Also, they will use the same developers and fixers with Thomas', Richard's or Henry's plates, and expect to et the same results; and the same way with papers They will use the same baths with the celebrated $\mathbf{X}$ as with the renowned $Y$ or the famous $Z$ brand.
The best plan is to pick out some one good make of plate or film that can be got in photographic supply shops generally, and learn how to use it, first under only one set of controllable conditions (as lens, stops, baths, etc.) and then gradually work up to a full knowledge of the behavior of that kind of negative under various conditions which it is desirable to change. Sticking to one brand of negative leads to better results in the end than experimenting.
And now for the camera itself. We will say that it is hand camera with a "pull-out" on which the distances are not marked for very near objects. If there is a ground glass plate on which to observe the image set the instrument on table or tripod a given distance as three feet from a wall which is well illuminated by direct sunlight and on which there is an ordinary placard with some letters as small as one-fourth of an inch in height, and pull out the "draw" until the letters appear sharp and clear. Then make a knife scratch so that that amount of pull-out can be found again when wanted, and mark it " 3 ." Similarly mark he " $4, "$ " 6, " " 8 " and " 10 " positions.
Now tack up on the wall a two foot rule, or a yard stick, or other convenient measure, and for each posi tion of the "draw" see what length can be distinctly seen. Thus we will say that at three feet only 15 inches can'be seen the "short way" of the plate; at six feet, 36 inches, and so on. This will prevent miscalculations of distance and frequent disappointments when there the object being photographed.
Where the camera has no ground glass plate, it may be feasible to substitute one temporarily for the film
 ground glass is available, tracing paper, or tracing cloth, or paraffined or oiled paper will answer quite
well. If the substitution cannot be made, then perhaps the objective can be taken out and tested with a glass or paper screen at various focal distances, with objects at measured distances away. If all these methods fail, then mark on your poster a ring one foot or two in diameter, and take half a dozen or a dozen negatives at various distances from the poster and with various positions of the pull-out. You will thus learn the "sharp" positions of the pull-out for each distance rom the object to be photographed and also the size circle within which you may work. Thus, if at a given distance you find that your two foot circle occupies half the short diameter of a $4 \times 5$ inch plate, you may rest assured that the maximum circle within which you may operate at that distance will be four feet in diameter; but you might also take in an object that was five feet one way if it was not more than four feet in the opposite dimension (provided, of course, that the long way of the plate came with the long way of the object).
It is also a good plan to practice with the various "stops" under various known conditions; and to test the finders, where there are any, to see if they are of the right size and in the right position, as they are very often hastily placed, and also sometimes get slid out of adjustment.

## The Kick of a Rifle.

When a man gets a rifle for big game shooting, he ometimes forgets to consider one of the most important points-the kick-says the New York Sun. A gun which uses 70 grains of powder and 500 grains of lead caves a weak man's shoulder in and makes the flesh black and blue. If the man has more pluck than sense, he continues to use the big gun in spite of the discomfort, and thereby sometimes ruins himself as a shot.
When one of the big bore, big charge rifle cranks picks up a rifle and fires it at a target, alive or dead, a painful expression twists his face, and just as he pulls the trigger the butt, shoulder flinches from the recoil. That flinch is ruinous to the aim, and men often get so used to flinching that they dodge the kick of a 22 short cartridge as vigorously as they do a $50-110-500$ one.
Men who flinch from their guns do not know it usualy, until some time they are standing nicely balanced on a freshly peeled hemlock log, or some other slippery place, and the gun misses fire. The man flinches and his foot slips at that, and down he tumbles. Even then the chances are that he will not understand the reason of it.

What "Good will" Means.
We frequently hear the term "good will" used in describing a benefit or advantage existing as a part of or in connection with a business, says an exchange. It is defined in several cases as the advantage or benefit which is acquired by an establishment beyond the mere value of the capital, stock, funds, or property employed therein, in consequence of the general public patronage and encouragement which it receives from constant or habitual customers on account of its local position, or common celebrity, or reputation for skill or affluence, or punctuality, from other accidental circumstances or necessities, or even from ancient partialities or prejudices. This is a definition given by Story and followed in several cases. Boiled down, this definition would seem to mean simply that the good will of a business consists in the probability that customers will continue to come to the old place of business. At best it is a sale of a mere chance, which vests in the purwhich has

The Old Britannic Breaks Her Own Record.
A noteworthy feat was accomplished on the last voyage of the White Star liner Britannic from Liverpool to New York, when she crossed in 7 days 7 hours and 30 minutes. This was done with the identical boilers and old-fashioned compound engines which were put into the ship when she was launched by Messrs. Harland \& Wolf, at Belfast, in 1874. That a ship should grow faster as she grows older bears testimony to the excellence of the work which was put into the early transatlantic liners. The performance was due, however, in part to the weather, which was exceptionally quiet. The calm which has settled upon the Eastern States during the recent hot wave has evidently extended across the Atlantic, and probably has been of unprecedented duration.

## Another Record Trip by the st. Paul.

The sister ships of the American Line are cutting down the record time from Southampton to New York with each trip they make; the 6 days 2 hours and 24 minutes record of last week by the St. Louis being reduced to 6 days and 31 minutes by the St. Paul on her voyage ending Friday, the 14th inst. The average speed for the whole trip was 21.08 knots. When we bear in mind that the St. Paul was only designed for a sea speed of 20 knots this is a really splendid performance. She will undoubtedly cross within 6 days during

## an accessible sewer gas trap

The improved trap shown in the illustration is designed to be perfectly proof against sewer gas and not liable to siphon, while being readily accessible for cleaning and other purposes. It has been patented by George J. Dehn, of Iron Mountain, Mich. Fig. 1 represents the trap in perspective, with a portion of its shell broken away to show the interior, and Fig. 2 i.s a sectional plan view where the inner valve is hinged. In the side of the trap body, below the inlet opening, a valve is pivoted on a clamping pivot held on a cap


DEHN'S SEWER GAS TRAP.
screwing in the lower end of the body. The cap has an apertured and externally threaded lug, normally closed by a small cap, permitting the attachment to the bottom of the trap of a hose from a water main or force pump, to remove any stoppage in the outlet pipe. The upper end of the body of the trap is provided with a vent pipe, connected with the trap by a suitable coupling. By unscrewing the large cap any matter which may clog up the body of the trap is readily removed. When the small cap is removed, the valve is closed to prevent sewer gas from passing through the empty trap body and up the inlet pipe.

APPARATUS FOR TREATING JUICE AND VAPOR.
For condensing the vapors produced by evaporation in the vacuum pans of sugar processes, and economi cally heating and clarifying the juice, the apparatus shown in the accompanying illustration has been patented by Alphonse F. Gaiennie, of Lafourche (Thibo daux P. O.), La. The condenser, A, has a shell with upper and lower heads carrying pipes opening at their lower ends into a chamber connected with an inlet pipe bringing cane juice from the mill, the upper ends of the pipes discharging into a tank at the top. Near it upper end the condenser, $A$, is connected with a vapo pipe provided with a catch-all, B, the vapors thus pass

gaiennie's juice and vapor treating apparatus.
ing from the vacuum process of evaporation, and sur rounding the pipes, giving off the heat of the vapors to the juice flowing upward through the pipes. The vapors flow downward around the pipes and in a nearly condensed state pass through a pipe to a water con denser, C , to be finally condensed, their being in the pipe an outlet to carry off any condensed liquid. The juice passing upward through the pipes in the condenser A, and accumulating in the tank at its top, passes from the latter into a chamber forming the lower end of a superheater, D, through which pass pipes whose upper ends open into a tank with an outlet pipe connected
with settling tanks. The central shell of the super heater is connected with a suitable source of steam supply, whereby the juice passing upward through the pipes is heated. It is designed that the juice flowing upward through the condenser, A, will be heated up to about $130^{\circ}$ to $140^{\circ} \mathrm{Fah}$., to be in proper condition for additional heating in the superheater, 1 , while the vapors flowing downward around the pipes will have their temperature so lowered that they will readily con dense in the water condenser, C , the whole process of condensing the vapors and heating and clarifying the juice being thus carried on in a very.economical man ner.

## surface Colors

The object of the little book on this subject* by Dr Walter, of Hamburg, is apparently to furnish zoologists, mineralogists, and chemists with an accurate explanation of certain color phenomena which are not as yet tion of certain color phenomena which are not as yet
universally understood, and which are incompletely treated even in the best text books on physics. The keynote of the whole book is given in a single sentence of the introductory chapter: "The intensity of the light reflected from any body may be calculated by Fresnel's ordinary formulæ for colorless substances, in the case of those rays which are slightly or not at al absorbed by the body in question; but for wave lengths which are strongly absorbed by the given substance Cauchy's formulæ for the intensity of metallic reflection should be used." It appears from these formulæ that the intensity of the reflected light depends on the index the intensity of the reflected light depends on the index
of refraction and on the coefficient of absorption of of refraction and on the coefficient of absorption of
the substance presenting the reflecting surface. Since the substance presenting the reflecting surface. Since
both these factors are different for light of different both these factors are different for light of different
colors, it is shown that white light must be reflected with some of its "components" relatively weaker than others, i. e., no longer in the proper proportion to give the sensation of white light. The application to the colors seen in the mineral kingdom is illustrated by the example of magnesium cyanplatinite, $\mathrm{MgPt}(\mathrm{CN})_{4}$ where-as is true of most crystals-the index of refrac tion and the coefficient of absorption vary with the direction in which the light vibrates, as well as with the wave length of the light. The extent to which true surface color is observable on minerals is not indicated though the possibility of a very wide application is clearly shown. In the appendices, certain mathemati cal aspects of the subject are treated in a manner suited to the requirements of physicists.-The American Naturalist.

## ACCIDENT TO DRY DOCR NO. 2-NEW YORK NAVY

 YARD.An accident to the great Simpson dry dock at th New York Navy Yard, Brooklyn, N. Y., occurred on the evening of August 8. The dry dock was pumped out and by some means the caisson, closing its mouth was lifted from its seat so as to permit the entrance of water. As the water increased in depth, the caisson was lifted from its seat. The water madly rushed into the dock, carrying with it the caisson, which capsized and sank, and the torpedo boat Ericsson, which was badly injured, having its bows stove in. The commandant's launch was wreck-
ed. Other vessels were nearly torn from their moorings and torn from their moorings and
some minor damage was done. The accident, which done. The accident, which
was an unprecedented one, is was an unprecedented one, is
attributed to the fact that attributed to the fact that
the caisson was too light. It seems that a number of tons of ballast had been removed from it in order to permit the cleaning of its bottom, and this ballast it was proposed to replace by concrete ballast It was supposed naturally that the caisson would stay that the caisson would stay
in its place as the water in its place as the wate pressed it against the gaske ally high tide or other cause, the accident occurred.
We thought it of interest to our readers to give the annexed cuts to show what sort of structure the caisson is. It is to all intents and purposes


CAISSON IN POSITION. a very deep narrow vessel
scored a hit, or in cases of almost simultaneous hits who delivered the point first. By a very simple arrangement the wires passing from the batteries to the combatants' collars are kept well out the way, how ever sudden may be their movements of advance or retreat. The wires did not interfere in the least with the foil play of the competitors, who were scarcely conscious of the connection. Captain Hutton and othe distinguished amateurs who were present expressed themselves as much pleased with the "electric umpire," an opinion which M. Bertrand, who has done so much for the encouragement of fencing, shares.

EXPRESS PASSENGER ENGINE, NORTHEASTERN RAILWAY ENGLAND.
We are indebted to the courtesy of Mr. Wilson Worsdell, Locomotive Superintendent of the Northeastern Railway, England, for a photograph and details of the locomotive shown in the accompanying illustration. No. 1870 is the second locomotive of its class to be turned out of the company's shops, and it may be taken to represent the latest English ideas on the question of designing powerful locomotives to haul heavy trains at high speed.
It must be admitted that within the limitations im posed by the English custom of placing the cylinders inside the frame, and hiding the working parts from view, which to American eyes always appears to rob a locomotive of much of its charm, this is a very handsome and well-proportioned machine, the general contour being harmonious and agreeable to the mechanical eve. A familiar feature will be recognized in the roomy cab, and particularly in the clerestory ventilator. Mr Worsdell was the first English engineer to place a cab that was worthy the name upon his locomotives, and they have proved so popular that the engine driver upon other lines are agitating to have the same common sense article placed upon their locomotives.

These fine engines present many features of interest. They were built under the spur of the keen competition which takes place between the East and West Coast routes from London to Scotland for the summer and autumn travel. This year the East Coast route has placed a new train of eight cars in service, which is built on the American plan, the cars being about 70
ing heavy loads at express speed, and we believe the powerful compounds of the Queen Empress type, de signed by F. W. Webb, for the West Coast route, were seldom placed in front of the racing trains during last year's competition.
This tabular comparison between the latest American and English practice presents some strange anomalies. In the first place the lightest locomotive (English) has the largest cylinder capacity, and its load on drivers is the lightest; though this is somewhat compensated by the large drivers, 7 feet $7 \frac{1}{4}$ inches. More striking, however, is the disparity between heating surface and cylinder capacity. The No. 403 of the N. Y., N. H. and H. Railroad has 2,114 square feet of heating surface for 20 by 24 inch cylinders; whereas the English engine with larger cylinders, 20 by 26 inch, has only 1,216 square feet of heating surface, or not much more than half the amount. This is an extraordinary difference, and shows how widely divergent the practice of the two countries is to-day on this question of boiler capacity The difference is to be explained in part by the superior quality of the English coal and by the higher conductivity of the copper fire box and brass tubes with which No. 1870 is fitted, and, furthermore, by the larger size of her driving wheels, which does not necessitate so frequent filling of the cylinders. But after all these deductions have been made there yet remains a large sur plus of steam-producing power in favor of the American ocomotive. If one were to venture a prediction re garding the Northeastern engines, it would be that they will be found to be over-cylindered. The driving wheels, 7 feet 7 inches in diameter, are the largest set of wheels, 7 feet 7 inches in diameter, are the largest set of
four coupled wheels in the world, and were only exceeded
himself propped up in the corner of his cabin and set to work, and become so absorbed as to be unconscious that there has been a gale blowing while he was at work. And yet, if recalled to ordinary life by some passing questioner, his gentle face lights up with interest, when others, more self-conscious than he, would display irritation. Indeed, I never knew a man less self-conscious. He is absolutely without affectation or any thought of self-importance. He will converse with a nobody in a manner so respectful and attentive as to make that nobody imagine himself that he has been delightfully interesting and even informing to Lord Kelvin. This arises from the simplicity and sweetnes of a great nature.

## The New Japanese Cathedral.

When foreign architects visit Japan and see the cathedral of Buddhism the first time, they aregenerally astonished at the magnificent structure. It is executed in pure Oriental style, and is richly ornamented with carvings. H. Ioto, a famous builder, of Nagova City designed it. The structure was commenced in 1878 and was completed last year. The cost has been esti mated at seventeen million dollars. It would hav greatly exceeded this amount had not numbers of Buddhists worked without any recompense. As the tructure neared completion, the committee having the work in charge was much perplexed as to fire insur ance. They found that no company would assume the risk on such a valuable wooden structure, the dange of destruction by fire being very great, and thus the premium would amount to an enormous sum of money premium would amount to an enormous sum of money.
At last the committee decided on a design devised by


EXPRESS PASSENGER ENGINE, NORTHEASTERN RAILWAY, ENGLAND.
Cylinders, $20 \times 26$ inches; driving wheels, 7 feet $7 \frac{1}{4}$ inches; steam pressure, 180 pounds.
feet long, and weighing some 40 tons, the whole weight $\mid$ by some 8 foot 3 inch six-coupled wheels tried on the of the train being about 320 tons. This, it will be seen, Continent some years ago. is a very heavy load, as things have been going lately in record-breaking runs, and called for a locomotive of exceptional power. The result is seen in No. 1870, which is the largest and most powerful machine of its kind in England, and one of the most powerful in the world today, as will be seen from the comparative table below :

| Dimensions. | C., B. \& Q. 590. | N. Y., N. H. \& H. 403. | C., R. I. \& P. 1101. | N. Y. C. 999. | N. E. R., England, 1870. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Total weight | 138,000 pounds. | 131,000 pounds. | 123,000 pounds. | 124,000 pounds. | 113,792 pounds. |
| Cylinders. ${ }^{\text {Weider }}$ - |  | , | ${ }^{1931 / 2826 ~ i n c h e s . ~}$ | ${ }_{84} 9 \times 24$ inches. | $20 \times 26$ inches, |
| Boiler type.... | Straight. | ended wagon top. | Wagon top. | Wagon top. | Straight. |
| Boiler pressure. | 200 pounds. | 199 pounds. | 190 pounds. | 190 pounds. | ${ }^{80}$ pounds. |
| Boiler diameter Number of atabes. | ${ }^{583} / 210$ inches. | $623 / 8$ inches. | 61 inches. | 58 inches. | 52 inches. |
| Heating surface-firebox. | $187 \cdot 4$ square feet. | 16752 square feet. | $103 \cdot 3$ square feet. | 232:92 square fe | 127 square fe |
| Heating surface-tubes | , $392 \cdot 7$ square feet. |  | 1,795 square f | $7 \cdot 45$ squa | 1,089 squa |
| Heating surface- | ,58. 11 square | 2,14\%24 square feet. | 1,988.3 square feet. | square | 6 squa |
| Maximum travel of valve | 6 inches. | 2 square feet. 6 inches. | 5 square feet. | 7 square feet. 51/ inches. | 7 square fee |
| Lap-outside | $1 / 1$ inch. | $11 / 8$ inches. | $11 /$ inches. | 1 inch. | 1 18 inches. |
| Drivers-diamete | inc | inc |  | 36 inches. | $91 / 4$ inches. |
| Driving wheel base. | eet 6 inches. | 8 feet 6 inches. | eet 6 inches. | 8 feet 6 inches. | 9 feet 6 inches. |
| Tender-coal capacity. | 000 gallons 7 tons | 4,500 gallons. <br> $81 / 2$ tons. | 4,300 gallons. 7 tons. | 3,587 gallons. 61/2 tons. | 4,000 gallons. $53 / 4$ tons. |

The comparison of No. 1870 is made with American in preference to English locomotives for the reason that this is the home of powerful express locomotives, and there is only one English express engine, the Great Northernsingle driver, which can compare with it in cylinder power. This has cylinders $191 / 2$ inch diameter by 28 inch stroke and an eight foot driving wheel. It is a noteworthy fact that in his latest design, Mr. Worsdell has forsaken the compound for the simple engine, and the single driver in favor of the four coupled. The latter type seems to have re-established itself as the best for haul-
the shape of a well-known notebook of the kind used by reporters, and which he carries in his pocket and produces at the most unexpected times. I have seen him, when on a visit to a country house, in a crowded going on in full flood, sitting with his notebook and filling page after .page with intricate calculations, seeking the solution of some problem which awaited investigation.
Lord Kelvin can do this in railway carriages, and in a storm at sea, as calmly as in his library. He will get

Dr. Tanabe. Numbers of powerful fountains were constructed, both exterior and interior, which can be made to play on all parts of the structure at the same time. Usually only one great ornamental fountain is playing, Usually only one great ornamental fountain is playing,
rising to the great height of 157 feet. This is probably rising to the great height of 157 feet. This is probably
the largest artificial fountain in existence, emitting the largest artificial fountain in existence, emitting
82,080 gallons per hour. In case of fire, all the water 82,080 gallons per hour. In case of fire, all the water
pressure can be directed through numbers of exterior pressure can be directed through nart of the structure, both inside and outside, could soon be drenched and any conflagration soon extinguished.-Cincinnati Commercial Gazette.

## Coal Consumption.

An industrious trifler, writing in a French review, has been at the pains to ascertain what is the annual consumption of coal on the railways and steam companies of the country, and he has worked out a total of $3,782,850$ tons. This, he tells us, would make a pyramid 516 feet high and 894 feet at the basis, or nearly 70 feet above the heïght of the Great Pyramid. Then he goes on to calculate that if all this coal were loaded in trucks on to calculate that if all this coal were loaded in trucks
the train would be 1,625 miles, or-as with a nice feeling for the Franco-Russian alliance he puts it-the distance between Paris and St. Petersburg. If this train had to travel at the rate of $181 / 2$ miles an hour, it would take between 3 and 4 days to pass a given point. The railways of the whole world consume, he asserts, on the faith of statistics which are doubtless fairly accurate, nearly $63,000,000$ tons of coal, which would make 25 "Great Pyramids," but he does not draw any moral from these figures except that a great deal of carbonic acid is thus precipitated into the atmosphere.-Westminster Gazette. <br> \section*{\section*{EDWARD DRINKER COPE. <br> \section*{\section*{EDWARD DRINKER COPE. <br> <br> by marcus menjamin, phid.}}

American science honors its representatives by an election to the National Academy of Sciences or by an election to the presidency of the American Association for the Advancement of Science. This year the lastnamed organization is fortunate in having as its pre siding officer a scientist who is also a member of the National Academy, for it was at its Springfield meeting last summer that Prof. Edward Drinker Cope, who ranks among the foremost of American paleontologists, was chosen to preside over its forthcoming Buffalo meeting.
Prof. Cope was born in Philadelphia, Pa., on July 28, 1840, of distinguished American ancestry. His great-grandfather was Caleb Cope, a Quaker of Lancaster, Pa., who protected the ill-fated Major Andre from a mob in 1775 . His son, Thomas Pym Cope, whose line of ships made regular trips across the ocean, founded the great linen house in Philadelphia, which on his retirement passed into the hands of his sons Henry and Alfred, who then formed the well-known firm of Cope Brothers. Prof. Cope is the son of the younger of these two brothers.
His academic education was acquired at Westown Academy and at the University of Pennsylvania, but he did not graduate, and turned his attention to science. He studied comparative anatomy in the Academy of Sciences, in Philadelphia, and in 1859 he joined the group of young naturalists who were associated together in the Smithsonian Institution under Prof. Baird. Their names are best recalled by the following stanza, improvised by one of their num ber, after a hotly contested argument on some disputed point in natural history
Into this well of learning dip with spoon of Wood o Into this
Horn,
For students Meek and holy silver spoons should treat
with scorn. heom.

## If Gabb should have the gift of Gill (As Gill has gift of Gabb), To try to Cope with Meek.

Then he went abroad and spent the years $1863-64$ in study in the universities of Europe, returning in 1864 to accept the chair of natural sciences in Haver ford College, which he resigned three years later. Meanwhile he became pale ontologist to the government geologica surveys, serving at first under Hayden, on the survey of the Territories, and then under Wheeler, on the survey west of the 100th meridian. His work in this con nection has resulted in the discovery of more than one thousand new species of extinct and as many recent vertebrata There is not space here to consider these in detail, or, indeed, to even mention them, but, as has been well said, the title of his papers, some four hundred in num ber, "form a systematic record of the development of paleontology in the United States." Of his larger works on this branch of science, most of which are contained in government reports, the following are the more important:

Systematic Arrangement of the La certilia and Ophidia" (1864); "Primary Groups of the Batrachia Anura" (1865); "History of the Cetacea of the Eastern North American Coast" (1866); "Synopsis of the Extinct Cetacea of the United States" (1867-68); "Systematic Arrangement of the Extinct Batrachia, Reptilia, and Aves of North America" (1869-70) : "Systematic Re lations of the Fishes" (1871); "Systematic Relations of the Tailed Batrachia" (1872); "Extinct Vertebrata of the Eocene Formations of Wyoming " (1873); "Cre taceous Vertebrata of the West" (1877); "Tertiary Vertebrata" (1885); "Catalogue of the Batrachians and Reptiles of Central America and Mexico" (1887); "The Batrachia of North America" (1889); and he has just completed for the press "The Snakes and Lizards of North America," which will be issued by the Smithsonian Institution during the coming year.

Philadelphia has for many years been the home of Prof. Cope and, on the death of Prof. Joseph Leidy in 1889, Prof. Cope was called to the vapcant chair of geology in the University of Pennsylvania, which post he still fills. Besides the duties of his chair he has long been the senior editor of the American Naturalist.

Prof. Cope is also well known as the graceful writer of numerous popular contributions in book form to the literature in favor of the now generally accepted doctrine of evolution. These include :
"On the Origin of Genera" (1868) ; "Hypothesis of Evolution, Physical and Metaphysical" (1870); "Method of Creation of Organic Types" (1871); "Evolution and its Consequences" (1872); "Consciousness in Evolution" (1875) ; "Relation of Man to Tertiary Mammalia" (1875); "On the Theory of Evolution" (1876); "The

Origin of Will" (1877) ; "The Relation of Animal Motion to Animal Evolution" (1878) ; "A Review of the Modern Doctrine of Evolution" (1879) ; "Origin of Man and Other Vertebrates" (1885) ; "The Energy of Life Evolution and how it has Acted " (1885) ; "The Origin of the Fittest" (1886) ; and "The Primary Factors of Organic Evolution" (1896).
He is a formidable antagonist, and his strong pen was wielded relentlessly until the victory was won.
Honors have come to him. The Bigsby gold medal was conferred on him by the Geological Survey o Great Britain in 1879, and his name is on the rolls of many of the scientific societies in this country and abroad, including our own National Academy of Sciences, to which he was admitted in 1872
He joined the American Association in 1868, and in 1875 was advanced to the grade of fellow. The section on biology made him its presiding officer in 1884, and in the following year he addressed the society on "Catagenesis." His name has frequently been urged upon the association for its highest office, but it was not un til last year that the well merited honor came to him.

The Discoverer of zinc Etching.
But few of the readers of this journal [The American Art Printer] know that photo-zinc etching and photolithography, in so very many ways the same thing, were invented by two different men at almost the same
time, the one being in England, the other nearly on


EDWARD DRINKER COPE.
the opposite side of the globe, in Melbourne, Australia. It was in the year 1859 that Mr. Osborn, of the Sur vey Department of Australia, sent a young man to England to confer with Sir Henry James about the new Australian method of reproducing and making printing plates for publication. Sir Henry James was surprised that the method was so very much like his own invention, which he made-nearly-by accident and he showed the young man some very good prints, and told him the story of how he came to invent this great medium of modern reproduction.
According to a book on zine etching, published in 862, by A. D. C. Scott, Sir Henry James was visiting riends at Ryde, on the Isle of Wight, and made the acquaintance of a young lady artist who had great skil and talent in copper etching. She mentioned to Sir Henry James that it would be of great advantage to the public if there could be a way of producing art subjects in a cheaper manner than that of copper etch ing or steel engraving. That idea aroused in Si Henry James the desire of finding some means of dupli cating the etching made originally by the artist, so that prints might be obtained in quantity. After trying several methods of fixing a picture on a metal plate, he tried to make a print on chrome carbon paper, which process was used at that time (1859) in photography He prepared the paper, printed a picture on it, then inked it in and developed it, and obtained a very nic copy, which he transferred to a sheet of zinc. H Century.
urther prepared and etched it, and his pleasure knew no bounds at the satisfactory result he attained in tching his plate deep enough to orint many thousand copies from it. He began to improve his method day by day, and in a short time he found himself over worked on reproducing old manuscripts and master pieces of ancient art. Handwriting of Edward I and the great Doomsday Book, written in the year 1086, at Winchester, were among the first great works of repro uction by this invention. Day after day new treasure f art of long forgotten masters, authors, and celebri ties came to light, and brought refinement and edu cation to mankind

A Great Historic Tablet
Last winter I was permitted to excavate along a part of the ruin-strewn desert at Thebes, and to examin the sites of temples which stand there. On these few urlongs I found that there had been seven temples of the kings or the eighteenth and nineteenth dynasties about 1450-1150 B.C. Most of these I entirely cleare out ; the largest piece of all-the great buildings around the Rameseum-being the clearance of the Egyptian Research Account worked by Mr. Quibell. Each site gave us some return in information or objects; but the most valuable of the sites, as it proved, was one of the least inviting. A field of stone chips showed where the least inviting. A field of stone chips showed where the
funeral temple of Merenptah had stood; and, left in the
ruins, I found the great granite tablet bearing the nd the great granite tablet bearing the
long inscription of Merenptah about his Libyan war and his Syrian war, and naming Israel.
This tablet is over ten feet high, over five feet wide, and over a foot thick, o one flawless block of very fine grained granite, or, rather, syenite. It was first cut by one of the most sumptuous kings of Egypt, Amenhotep III ; brilliantly pol ished as flat and glassy as a mirror, and engraved with a scene of the king offering to Amen, the god of Thebes, and an inscription of about three thousand hieroglyphs recording his offerings and glorifying the god. His s.on Akhenaten, who strove after a higher faith, erased all figures and inscriptions of Amen, and so effaced most of his father's fine carv ing on this great tablet. This, however, was all re-engraved by Seti $I$, about fifty years later, as a restoration. Then some two centuries after it had been erected in the temple of Amenhotep III Merenptah cast an envious gaze on th splendid stone, and stole it for his own purpose.
Not taking the trouble to rework it, he simply built the face of it into his own wall, and engraved on the comparatively rough back of the block. At the top he figured a scene of the king offering to Amen, and below an inscription very nearly as large as that of Amenhotep III on the other side. The painting of the sculptured figures still remains as fresh as on the day it was done; for, as the table fell face forward when the temple was de stroyed, the side belonging to Merenptah lay downward, while that of Amenhotep III was uppermost. In the ruins, then amid the fragments of columns and foun dations, heaped over with a foot or two of stone chips, this grand block had lain ince about the time of the Trojan war. All Greek history, Roman, and mediæva -the prophets, Christianity, and Islam-have swep along while this was waiting unsuspected, with it story of the wars of Pharaoh of the Hard Heart, and his crushing of Israel.-Prof. Flinders Petrie, in the

Molybdenum Bronzes by Electrolysis.
Among the future products of electrolysis at high temperatures, it seems probable that useful alloys may find a place; at any rate, electro-metallurgists are de monstrating the possibility of preparing many new compounds, some of which may turn out to be of con iderable industrial utility. In the Berichte, says the English Electrical Review, Stavenhagen and Engels de cribe some molybdenum bronzes which they have re cently succeeded in preparing. Among these, there is one which bears a great resemblance to tungsten bronze, and is formed by electrolyzing fused acid, sodium molybdate. The fusion is performed in a pla tinum crucible, with a current of 8.5 amperes and generated by three accumulators ( 4.9 volts) placed in series. The bronze separates quickly at the cathode in crystals, which have to be washed with boiling water and dilute hydrochloric acid. It is soluble in alkalies, in nitric acid, and aqua regia, but not in hydrochloric or sulphuric acids; its composition is found by analysis to correspond to the formula, $\mathrm{N}_{2} \mathrm{MO}_{5} \mathrm{O}_{15}$. For furthe details consult the original paper in the Berichte der Deutschen Chemischen Gesellschaft, xxviii, page 2280

## NANSEN'S POLAR EXPEDITION.

Advices from Vardoe, on the coast of Norway, in the Arctic Ocean, report the arrival there, on August 13, of Dr. Nansen, the Arctic explorer, who had left Vardoe on his last polar expedition on July 21, 1893. Dr. Nansen is accompanied by Lieut. Hansen, and the expedi tion is said to have reached two degrees and fifty minutes farther north than ever before attained, namely, 86 degrees 14 minutes.
Dr. Nansen says: "The Fram left Jugor Strait. August 4, 1893. We had to force our way through much ice along the Siberian coast. We discovered an island in the Kara Sea and a great number of islands along the coast to Cape Cheljuskin. In several places we found evidences of a glacial epoch, during which northern Siberia must have been covered by inland ice to a great extent. On September 15 we were off the mouth of the Clenek River, but we thought it was too late to go in there to fetch our dogs, as we would not risk losing a year. We passed the new Siberian Islands September 22. We made fast to a floe in latitude 78 degrees 50 minutes north and in longitude 133 degrees 37 minutes east. We then allowed the ship to be closed in by the ice.
"As anticipated, we gradually drifted north and northwest during the autumn and winter, from the constantly exposed and violent ice pressures, but the Fram surpassed our expectations, being superior to any strain. The temperature fell rapidly and was constantly low, with little variation for the whole winter. During weeks the mercury was frozen. The luwest temperature was 62 degrees below zero. Every man on board was in perfect health during the whole voyage. The electric light, generated by a windmill, fulfilled our expectations. The sea was up to ninety fathoms deep south of 79 degrees north, where the depth suddenly increased and was from 1,600 to 1,900 fathoms north of that latitude. The sea bottom was remarkably devoid of organic matter. During the whole drift I had good opportunities to take a series of scientific observations -meteorological, magnetic, astronomical and biological ; soundings, deep sea temperatures, examinations for the salinity of the sea water, etc. Under the stratum of cold ice water covering the surface of the polar basin I soon discovered warmer and more saline water due to the Gulf stream, with temperature from 31 degrees to 33 degrees.
"We saw no land and no open water except narrow cracks in any direction. As anticipated, our drift northwestward was most rapid during the winte and spring, while the northerly winds stopped or drifted us backward during the summer.
"On June 18, 1894, we were on 81 degrees 52 minutes north, but we rrifted then southward only. On October 21 we passed 82 degrees north. On Christ mas Eve, 1894, latitude 83 degrees north was reached, and a few days later 83 degrees 24 minutes, the farthest north latitude previ ously reached by man. On January 4 and 5, 1895, the Fram was exposed to the most violent ice pressures we experienced. She was then firmly frozen in ice of more than thirty feet of measured thickness. This floe was overridden by great ice masses, which were pressed against the port side with irresistible force and threatened to bury, if not crush her. The necessary provisions with the cavas kayaks and other equipments had been placed in safety upon the ice. Every man was ready to leave the ship if necessary, and was prepared to continue with the drift living on the floe. But the living on the floe. But the Fram proved even strong than our trust in her."
Of his late experiences Dr. Nansen says, in another account:
"When the bear flesh was exhausted we were obliged to kill the weakest of the dogs to feed the others, and to continue so doing until the whole pack was slaughtered. If we had had dogs and canoes enough the pole would havelbeen reached, but for lack of dogstwe were compelled to turn back at latitude $86^{\circ} 14^{\prime}$. I and my companions started in the direction of Spitzbergen May 19. After that we occupied six weeks on snow shoes, dragging
after us sledges and kayaks (the Arctic canoe) loaded on sledges. We went partly over land and partly over sea ice. The land voyage was most arduous, but extremely valuable scientific results were obtained.
"Wherever we penetrated we found the ice broken. Large patches of water were also found 3,800 meters deep. Below the depth of 190 meters the water was


## DR. NANSEN.

appreciably warmer, probably owing to the Gulf Stream. Rocky scars (precipitous cliffs) prevented entrance into the Olenek River for days. I left the Fram at latitude 84 in good condition and drifting westward, locked in the ice. I expect she will eventually reach Spitzbergen. In the autumn of 1895 I reached the north coast of Franz Josef Land and built a stone house, in which I lived the whole winter. The Jack-son-Harmsworth expedition arrived at Franz Josef Land the following spring. I met Jackson in June on an ice 1loe off Cape Flora. I was surprised at the presence of explorers on Franz Josef Land, though I had been living for a long time in a hut quite close; it proved to be one of Jackson's stations. We went to Jackson's winter quarters, where we found all in good health. We remained there about six weeks till the steamer Windward arrived.
"The Windward will take to England four English-


NORTH POLAR MAP TO ILLUSTRATE POLLAR EXPEDITIONS. thenticity of the finding of the relics.
based was that ocean currents exist whose direction is from the islands of New Siberia across the North Polar region to Greenland, as indicated by the accompanying map, reproduced from the Geographical Journal, vol. ii. The Jeannette sank off these islands, and it was claimed that relics of the Jeannette were picked up on the shores of Greenland. Other drift relics ware cited as additional proofs of these currents. In the face of this theory there were most emphatic denials, not only of the existence of such currents, but even of the au-

Basing his expedition on this theory, Dr. Nansen had a special ship built for his trip, the Fram. She was a three masted schooner in rig, with engine and screw, rather of the auxiliary type. With a consumption of 234 tons of coal a day the Fram would develop a speed of six miles an hour, the idea being to use sail whenever possible and economize coal for use in emergencies. She was built with a very round bottom and her keel came even with the outer planking, so that nothing was presented for the ice to take hold of. The hopes were that if caught between opposing floes she would be lifted $u_{i}$ J bodily, the ice sliding in under her sloping sides and bottom. She was very strongly built, being planked with double layers of oak $31 / 4$ inches and $41 / 2$ inches thick, sheathed again with ice planking varying from $31 / 4$ inches to $61 / 2$ thick. The ceiling was in alternate strakes $41 / 2$ inches and $81 / 2$ inches thick. The enormous mass of timber for so small a vessel, in conjunction with her shape, seemed enough to make her stand anything. The screw and rudder were arranged so that they could be raised into a well for protection if desired. The ship was 101 feet 6 inches long, displacing 800 tons at 15 feet 6 inches draught with 3 feet 3 inches freeboard. Her carrying capacity was put at 380 tons and she carried five years' supply of provisions. Her crew consisted of eleven men in addition to 1 ). Nansen, and they departed prepared for an absence oi three to five years. The ship was to coast along the northern shores of Europe until she reached the vicinity of the New Siberian Islands; here she was to strike north, depending largely on ocean currents to.carry her along. The course would carry her past the North Cape and then approximately along the 70th and 80th circles of latitude until at or about the 150th parallel of longitude east from Greenwich, and just north of Bennett Island, the course would be changed to the north. Hence the explorer hoped to pass by the pole, to work down along the east coast of Greenland and thence to the east back to Christiansand.

## Remedy for Flies on

Take coal tar two parts and coal oil and grease one part each and mix with a part amount of carbolic acid. Apply with a cloth by moistening the hair and horns of the animal with the liquid. In the applications include feet and legs, and it will drive every fly away, and one application will last ten days or more in dry weather. Apply as often as necessary and your cows will be entirely secure from flios of all kinds. Any kind of old lard or grease can be used. Coal tar is the base of this remedy, and when too thick to spread well, use more coal oil ; when too thin to adhere well, use more coal tar Carbolic acid will cost about 50 or 60 cents in crystals by the pound, and every farmer should alway keep it on hand, as it, in its many uses, is indispensable. This remedy is equally effective as a lice exter minator on poultry, and is used simply by painting the sides of the hennery and roosts and droppin boards with the liquid boar with the iquid For young chickens satu rate a cloth and place in the bottom of a box, and place the mother and young chickens in the box for an hour or so. This
men of the Jackson-Harmsworth expedition-Child, recipe, says H. F. Work, in the Drainage Journal, is Burgess, Fisher and Blomquist. Jackson proposes to equal to any preparation in the market. remain in the Arctic regions until next summer, with the intention of pushing further north. Jackson and his companions are in excellent health and spirits, and ull of hope as to the results of their expedition." The theory on which Dr. Nansen's expedition was
M. Moissan has been experimenting with vanadium in the electric furnace. He finds that it alloys readily with iron, copper, and aluminum, and that its car'bide VC is not affected by water at ordinary temperatures.

THE FIRST CLASS battleship indiana. In our last issue are described io detail the defensive arrangements of the Indiana-her double bottom, side and deck armor, and massive turrets, by means of which she will be able to endure the awful storm of projectiles which will fall upon a modern warship in time of battle. This armor is as thick, and in most cases thicker than that of the best modern battleships of foreign navies, and, moreover, it is of far better quality, having been forged by the famous Harvey process, which was fortunately invented in time to be used on these ships. Judged by her mere power to resist penetration, there is no battleship in the world to-day that could stand attack by such heavy guns, or stand it so long, as the Indiana.
But a battleship is essentially a fighting machine, and her first requirement is that she shall be able to deliver heavy blows, and many of them. Unlike the cruiser, she is not designed on the understanding that she may frequently have to run from a more powerful ship. Her place is always in the thick of the fight ; and when the designer has given her sufficient structural and armored protection to enable her to take her place in the first line of battle, his next object is to arm her with as many armor piercing and rapid fire guns as the limits of her displacement will allow. Judged by this double standard, the Indiana is without a rival; for it is a fact, which has never been disputed, that she carries the heaviest armament of any ship afloat to-day. This preponderance of power is due to the eight 8 inch guns which are carried in four turrets flanking the two turrets of the 13 inch guns. They are an entirely novel feature in battleship design, and may be called the chief distinctive feature of this ship. The accepted type of battleship carries usually a main battery of four heavy guns disposed in two turrets, fore and aft, suppleinented by a broadside secondary battery of five or six inch guns, the first being capable of piercing armor and the latter being used against the lightly armored or unarmored portions of the enemy. Thus the Camperdown, of the British navy, a ship of the same size as the Indiana and less effectively protected, carries four 67 ton guns of about the same power as the heavy guns of the American ship, and a secondary battery of six 6 inch guns. Against this the Indiana carries, in addition to her main and secondary batteries, the eight 8 -inch armor piercing guns above mentioned - a preponderance of power which would give her the certain victory in a naval duel.
Our illustrations in this number are devoted to the armament of the Indiana, and show the me thods of mounting and handling the great guns. This, especially in the case of the 13 inch guns, each of which weighs 67 tons, is a matter calling for great skill in design; and so well has it been carried out, that one man is able to raise or lowe these great masses of metal, and swing them through an arc of 270 degrees, by the manipulation of a few small hand wheels and levers situated within the sighting station of the turret. The gun itself is
mounted in a gun metal seating, to which it is strapped down by the four steel bands shown in the illustration. The seating is arranged to slide, in much the same way as the rest of a lathe upon its bed, upon the upper flanges of a massive steel frame, the forward end of which is hinged to the wall of the turret, the after end being carried by the plunger of a hydraulic ram, by means of which the gun with its carriage is raised or lowered to give the proper elevation. The guns are trained by turning the turret which carries


THE BATTLESHIP INDIANA - LOADING THE AMMUNITION HOISTS FOR 13 INCH GUNS
them. This is effected by hydraulic engines located within the shelter of the barbettes, below the turret, operating a pinion, which engages a circular vertical rack bolted to the inside of the turret. To check the recoil of the guns, which represents an initial energy of over 33,000 foot tons, a recoil cylinder is mounted within


INTERIOR OF SIGHTING HOOD OF 13 INCH GUN _TURRETS.
the gun carriage beneath the gun. It is filled with water, and is provided with a relief valve, which is automatically opened on the discharge of the gun. The plunger or piston is attached to the seating of the gun
and as the gun recoils the water is forced out of the and as the gun recoils the water is forced out of the
room," which is located immediately beneath the turret $t$ is square in form, and at each corner is a watertigh door which leads to the ammunition rooms, where the powder and shell are stored in suitable racks. The charge is transferred to a cradle suspended fron an overhead track and run out into the handling room, where it is unloaded into the ammunition hoists, of which there are two, one to each gun. Each hoist consists of a triple cage of three hollow cylinders, the upper two for the powder, which is done up in two sections, and the lower for the shell The two sections of powder weigh 550 pounds, and the shell 1,100 pounds. The cage is then run up to the breech of the gun by a hydraulic ram and steel wire ropes and pulleys, the speed of the hoist being six times that of the ram. When the shell is opposite the breech it is rammed into the gun by a telescopic hydraulic rammer, which can be seen pivoted against the turret to the rear of the gun, the rammer being swung back against the turret wall when not in use. The two sections of powder are then rammed in after the shot, the breech plug, which is shown swung to the left clear of the gun, is thrust into the breech and locked, the firing attachment is screwed onto the stud, shown within the plug, and the gun is ready for the gunner to lay and fire The breech plug and the mechanism for opening and closing it are very ingeniously designed, and will bear a detailed description. To enable the plug to withstand the shock of discharge, which is as great against the plug as it is against the shell, it is provided with a powerful thread and screwed into the breech of the gun. After the thread has been cut in the lathe, three wide channels are cut across it, parallel to the axis of the plug similar channels being cut across the thread in the breech. When the plug is inserted, it is placed so that the remaining thread on both plug and breech will enter the corresponding channels. After it is driven home the plug is given one-sixth of a turn, thereby bringing the threads into engagement and locking the breech. There is a great variety of breech mechanisms employed in different navies, and some of them are extremely complicated. The system in use on the Indiana is a recent design and a great advance upon previous methods. The three opera tions of unlocking the plug, withdrawing it upon the swinging tray, and throwing the tray round clear of the breech are performed by one man, by means of a crank shown on the right side of the gun. The first motions of the crank turn a gear which engages a rack on the periphery of the plug and gives it a one-sixth turn, thereby disengaging the threads; the crank shaft then operates a screw, which thrusts the plug out upon the tray ; and when this operation is complete another gear is engaged which swings the tray upon its hinges.
In the illustration showing the breech of the 13 inch guns will be noticed a ladder leading up to a plated, box-like structure. This latter is the position occupied by the officer who lays and fires the guns. The top of the compartment projects above the roof of the tur ret, and is heavily armored. It is provided with two narrow vercylinder, the brake action being secured by the small|tical and horizontal slots at which two sighting tele size of the discharge valve. After being loaded the gun is run out to the firing position by admitting water under pressure at the back of the piston in the recoil cylinders.
In describing the process of loading and firing a nch gun, it is necessary to deseend below the steel protec tive deck to the "handling

bamming home the charge in a 13 inch gun.

bREECH OF THE 13 INCH GUNS.


EXTERIOR VIEW OF 6 INCH GUN AND TURRET.
are adjusted simultaneously. The turning gear of the $\cdot$ quantity-between $\$ 2,000,000$ and $\$ 3,000,000$ worth-of turret is set in motion by means of the vertical wheel manufactured goods is purchased annually by that shown in front of the gunner. When the sights coin- country from the United States, and the fact that, notcide with the object, the gun is fired by means of an electric button placed conveniently to hand.
Flanking the main turrets are the four 8 inch gun turrets, whose interior arrangements are very similar to those above described. These guns are carried at a great height above water-no less than 26 feet-and they would, therefore, be well out of reach of the heavier seas in stormy weather. This great command is a valuable feature in a sea fight-command in a gun being like length of reach in a boxer. The shell being delivered from so great a height would have a " plunging" effect, and would also be less liable to be deflected by striking the tops of the waves. The four 6 inch guns are mounted below the 8 inch gun turrets, and on the main deck. The training is effected by means of a pinion and a circular rack, laid on the deck, both of which can be seen in the accompanying illustration. The elevation of the gun is accomplished by the worm and pinion, which meshes into a vertical, circular rack, which can be seen attached to the gun.
Our last illustration shows a part of the broadside rapid fire 6 pounder battery and the hinged grated shelves on which the gunners stand, the shelves hanging down vertically when not in use. There are twenty of these effective little guns in all. They fire a $21 / 4$ inch shell which is capable of penetrating over 3 inches of iron at a distance of 1,000 yards, and as each can deliver some twenty shots a minute, it can be seen that a torpedo boat would be roughly handled, and probably disabled, long before she could get near enough to discharge her torpedoes. There are also six 1 pounder guns placed in the tops and on the superstructure. The weight, penetration, etc., of the guns is as follows :


## Exposilion at Brussels in 1897.

The Department of State has received an invitation, through the Belgian minister, for the participation by the United States in the International Exposition to be held at Brussels, beginning April 24 and closing November 1, 1897, and the Secretary of State, in a letter to the Secretary of the Treasury, has recommended that Congress be asked to appropriate the sum of $\$ 35,000$ to enable this country to be properly represented by a commission. Attention is called to the fact that the Belgian government participated officially at the Chicago Exposition in the most liberal manner, and the opinion is expressed that the industrial and commercial interests of the United States would be greatly promoted by a creditable exhibit. "Although," it is added, " the great bulk of our exports to Belgium consist of raw products and food supplies, a considerable
withstanding her great industrial development, Belgium imports largely of the finished products of other advanced manufacturing countries such as France and England, encourages the hope that similar lines of goods from the United States may find a much larger sale in Belgian markets. As conducive to that result, a proper representation of this country at the Brussels exhibition is obviously most desirable."
In his note transmitting the invitation, the Belgian minister states that the exposition will be under the patronage of his government the Province of Brabant and the city of Brussels. The object of the exposition is "to show the progress of industry, to invite the pro-

the battleship indiana-training a 6 Inct GUN.

## science Notes

Magellan's contrary winds are to be overcome by fleet of powerful tugboats which a Chilean company will maintain in the Straits.
The total area of land surface of the earth is calculated to be 28.3 per cent, and that of sea as 71.7 of the earth's surface, certain assumptions being made for the unknown polar regions. The ratio of land to water surface is thus $1: 2 \cdot 54$, by Professor Hermann Wagner, says The Engineer. Other interesting levels are those of the mean height of the land, 700 meters- 2,300 feetabove actual sea level; and of the condensation spher oid, i. e., the physical globe if the water were condensed to the density of the rocks of the crust, 1,300 metersor 4,260 feet-below present sea level.
An interesting series of experiments on the transpar ency of liquids is described by M. W. Spring in the Bulletin of the Royal Academy of Belgium. The first of M. Spring's papers deals with the colors of the alcohols as compared with water. None of the alcohols observed were colorless when the thickness of fluid was 26 meters; methyl alcohol appeared greenish blue ethyl alcohol the same, but of a less warm color, and amyl alcohol greenish yellow. The pure blue color observed in water becomes thus modified by the admixture of more and more yellow as we pass from one term of the homologous series of compounds to the next. The absorbing powers of the various liquids for ordinary light were also observed, and it was found that these formed a descending series, the simplest sub stance, water, offering the greatest resistance to the passage of light seen by the eye. In a second contribu tion, the same writer discusses the temperature at which the connection currents begin to produce opacity in a column of water of given length. Where the length is $\mathfrak{2}^{\prime}$ ) meters the smallest difference of temperature that will suffice is about $0.5 \pi 0^{\circ}$, and is comparable with that which doubtless exists in lakes and seas. The author concludes that we have here an explanation of the varied colors so often seen on water. These result from the differences of temperature caused by sunshine, on the one hand, and by the cooling action of wind blowing on the surface, on the other.

## Cycle Notes.

A pneumatic tricycle hearse has been built
One French maker is putting out wheels equipped with wooden spokes, rims, and hubs.
A subscription agent of Business goes over large sec tions of the country, wheeling from place to place.
A short time ago a race was run in Paris in which no machine was entered which was not at least twent years old.
In Grand Rapids, Mich., a trailer for the free trans portation of passengers' wheels is run once an hour, attached to a trolley car.
A coin controlled bicycle has been devised. Unless the machine is fed with coins commensurate with the time of hiring, the wheel will refuse to turn.
An analysis of two thousand accident policies, on which benefits were paid, showed that only seventy six were injured in bicycle accidents.
It has been estimated that the expenditure of powe necessary to walk five miles would drive a bicycle on an ordinary road twenty-five miles.
Fifty bicycles were impounded in one day in Paris recently because they failed to have the owner's name and residence soldered to them as the law requires.
An agency was recently opened in Venice for the rental of a water cycle. The gondoliers promptly obtained an injunction restraining the parties from placing their cycles in use.
At some of the stations on the Long Island Railroad facilities have been provided for checking the wheels of the suburban residents, so that they can use the bicycle to carry them to and from their homes.
A good wrinkle in putting a handle on a handle bar is to smear a little vaseline around the edge of the inside ferrule, which will effectually prevent the cement from adhering to the ferrule, should any be squeezed out
Zigzag hill climbing is easier than the straight lift. The cyclist can here learn of the mule. No mule native to a mountainous region takes a straight course up hill with a load, but "weaves" continually from one side of the way to the other.
Although very often but little attention is given to the accurate adjustment of the head, this part stands in need of it as much as any bearing in the machine, and should never be allowed to remain in the slightest degree loose. Not only will a loose head rattle over rough ground, and cause the balls and ball races to wear unevenly, but the risk of a breakage of the steering post or front forks is increased.
The Inventive Age says that the latest invention to facilitate field operations is the typewriter bicycle. This consists of a typewriter mounted on a serviceable wheel, which can follow the movements of the army through an ordinary stretch of country. The operator can take commands and general orders in shorthand and strike off several duplicates on the typewriter being held erect by portable props. It has been tried in England and worked very satisfactorily.

## the broors periodical comet. <br> willism r. brooks, m.A., f.r.A.s

The return to visibility, after its seven years' journey round the sun, of the very interesting comet known as the Brooks periodical comet of 1889 , is a notable event in astronomical annals.
While sweeping the southeastern heavens on th early morning of July 6,1889 , with the ten inch equatorial telescope, the comet was discovered. It was in Cetus, and in right ascension 23 hours, 44 minutes, 30 econds ; declination south $9^{\circ} 10^{\prime}$.
Fig. 1 shows the telescopic field in which the come was discovered. The apparent motion of the come was from right to left, as we look at the figure, but


Fig. 1.-DISCOVERY TELESCOPIC FIELD BROOKS' periodical comet.*
this motion was so slow that it did not move out of the telescopic field of discovery for over a week. The real motion of the comet was nearly in the line of sight, and approaching us and the sun. Hence the comet grew larger and brighter daily. As it came nearer, the main comet was found to be attended by everal companions.
In telescopes of moderate aperture two were seen but in the giant refractor of Mount Hamilton, under the keen vision of Barnard, and in other large tele copes, four of these little attendants were found pre ceding the parent comet in its sweep through space, as illustrated in Fig. 2. It is on this account sometimes called Brooks' multiple comet.
The mathematicians soon found that the comet wa moving in an elliptical orbit, with a period of revolu tion about the sun of a little over seven years. It is thus a member of our own solar system.
Computing backward, however, they found that it


Fig. 2.-BROOKS' PERIODICAL MULTIPLE COMET.†
had not always had this short periodic revolution. It was found by Dr. Chandler that in 1886, or three year previous to the writer's discovery of the comet, it had come into Jupiter's all-powerful attraction, and its orbit and period changed from a previous one o nearly
Nor was this all. It is believed that during this encounter of Jupiter and the comet, the material for the fifth satellite of Jupiter, discovered by Barnard in 1893, was secured-captured from the comet by Jupiter's superior attraction.

* Discovered by Prof. Brooks July 6, 1889
+ Discovered by Wm. R. Brooks July 6, 1896.

I append a short ephemeris of the comet, showing its place in the heavens for the next few weeks.

| August. | Right Ascension. | Declination South. |
| :---: | :---: | :---: |
| 12 | 22 h .33 m. | $18^{\circ} 51^{\prime}$ |
| 16 | 22 h .31 m. | $18^{\circ} 58^{\prime}$ |
| 20 | 22 h .29 m. | $19^{\circ} 33^{\prime}$ |
| 24 | 22 h .26 m. | $19^{\circ} 6^{\prime}$ |
| 28 | 22 h .23 m. | $19^{\circ} 6^{\prime}$ |
| September. | 22 h .20 m. | $19^{\circ}$ |
| $\mathbf{1}$ |  | $\mathbf{4}^{\prime}$ |

From these positions the path of the comet may be traced beyond the above dates. The comet is increasing in brightness, reaching perihelion early in November next.
Smith Observatory, Geneva, N. Y., August 7, 1896.

## The American Institute Fair.

The American Institute Fair will open at the Madison Square Garden on Monday, September 28, and will close on Thursday, October 29, and during this time there will be shown at the usual popular price of twenty-five cents one of the best exhibitions that the twenty-five cents one of the best exhibitions that the
institute has given for a long time. The enterprise of securing the Madison Square Garden has been secsecuring the Madison Square Garden has been sec-
onded by the exhibitors, who appreciate that the institute has had no exhibition since 1892. On the main floor, which will be entirely filled by the best class of exhibits, there will be much active machinery, including silk weaving, the making of asbestos cloth, the manufacture of shoes, the making of hand-made paper, an exhibit showing how cigars and cigarettes are made, and motors adapted to boats and other uses, and a horseless carriage as light almost as an ordinary road wagon. There will also be a beautiful display of boats. The bicycle will of course be represented. In the machinery department down stairs there will be ice machines in operation, high-speed and gas engines, printing presses, farming machinery, and novelties always to be seen in the mechanical department. The show of flowers, fruits, and vegetables, beginning October 5 and continuing in the concert hall under the direction of the committee on agriculture, promises to be an especially attractive feature. The race agent of the American Rules will take charge of the flying of birds from the tower of the garden each day, and will decide upon the awards for number of birds, speed, distance, and will also arrange for the exhibit of homing pigeons during the week ending October 24.

## A Machinery Exhibit in China

The Peking (China) University, an educational institution conducted under the auspices of the American Methodist Episcopal Mission, has recently opened in one of its buildings a museum which it is proposed to devote largely to the exhibition of foreign machinery and mechanical appliances. This museum is visited daily by increasing numbers of people of the better classes, and the authorities would be glad to receive and exhibit working models, photographs, or drawings of machinery and inventions, or specimens thereof, such as plows, ships, firearms, cannon, electric machinery, cars, locomotives, wind mills, looms, printing presses, wagons, engines, etc. Each exhibit which may be presented to them will be marked in Chinese, with the name and address of the maker, together with the description and price, if desired, and a capable translator will explain their use to inquirers.
Correspondence on this subject and articles for exhibition may be sent to the Peking University, Peking, China, or to Mr. Charles H. Taft, treasurer of Peking, China, or to Mr. Charles H. Taft, treasurer of
the Peking University, No. 78 William Street, New the Peking University, No. 78 William Street, New
York City, and under an arrangement with the I. M. customs will be imported to China free of duty.

Medals or Decorations for Inventors.
An "old Scientific American reader," writing from Havana, Cuba, suggests that the government, in granting letters patent to an inventor, should at the same time issue to him a distinctive medal, to be worn externally, indicating his membership in the "American Legion of Inventors," who have done so much to proLegion of Inventors," who have done so much to pro-
mote our wonderful industrial progress. 'Such a medal, mote our wonderful industrial progress. "Such a medal,
made of silver in the form of a star, to be suspended from a ribbon formed of the national colors, our correspondent suggests, would not only be a highly honorable distinction, but might in many cases be of material benefit to the inventor, acting in a manner as an introduction, and aiding him in efforts to obtain capital to facilitate the introduction of his improvement. Inventors obtaining three or more patents, it is recommended, should have a gold medal: and, for all inventions patented before such a law is passed, it is suggested that the inventors may have the medals issued to them on payment of their cost.

Water Supply for Paris and London.
It is proposed to take $440,000,000$ gallons daily to Paris from the lake of Geneva, a distance of about 310 miles. London may have a new supply of fresh water, of equal importance to the Paris supply, from parts of Wales situated at an altitude of 2,790 feet above the sea level, particularly the region from which spring the Towy, Usk, and Wye.

## Forestry as a Science.

Much has been said and written, first and last, about preserving the forests in this country after the methods which have prevailed for half a century and more in Germany and France, and how not only other valuable timber might be saved, but safety from fire and flood timber might
should be had.
It is well understood that for these objects all dead way it would be possible to cut every year one one hunwood, whether underbrush or high reaching trees, must $/$ dred and fiftieth of the whole area, thus securing a uni wood, whether underbrush or high reach
be cleared out of the way, and where they leave too wide spaces their places must be filled with other plantations. There is a scientific method and an unscientific way of doing this, and suc cess depends wholly upon which one of these methods is adopted. For such reasons the science and profession of forestry has flourished in other countries than America, having extensive tracts of woodland, for many years, in the same manner that gardening and botany have flourished.
Little or no attention, however, has been paid in America to forestry until recently, says the New York Times, by either private or public persons. The States of New York, Maine, and a few others with extensive forest land have paid some attention to the sub ject, but the Federal Government has only just awakened to its importance and at the last session of Congress a commission of men who have studied the subject was authorized to investi gate and report on the condition of the woodlands of the Northwest. The commission, consisting of several pro fessors of arboriculture from the leading universities, like Harvard, Yale, Columbia and others with severa government officials, is now at its work in Montana. Mr. Vanderbilt was an early exception to the apathy here on the subject of forest preservation, for shortly after the purchase of his estate at Asheville he began to form plans, not only for the preservation of the great domain of woodland which he found in existence, but for the rehabilitation of that portion of it which had been exhausted. The forest was broken and irregular in character, owing to the fact that the land had been divided among many small farmers, who'had made frequent clearings, or had robbed the forest of its most vigorous and healthy trees. Scientific measures were required for the work of restoration, and Mr. Vanderbilt resolved to spare neither expense nor care in the scheme. It was a question whether at the end of a term of years he would have a noble forest of park-like character and a certain commercial value, or merely a barren and tangled woodland, gradually going to decay, and liable at any time to destruction by fire. Mr. Van derbilt accordingly sought or the best talent among those who had made dendrology a study, and was fortunate in obtaining the skillful services of Mr. Gifford Pinchot, a student of forest management in the best schools of Europe, and a man fully alive to the advantages and disadvantages of the different methods in their application in this country. Mr. Pinchot took hold of Biltmore Forest, of bout 5,000 acres which he bound was composed mein ly of oaks and other deciduous trees, mostly young, with scattered pines, which occasionally covered old and exhausted fields to the exclusion of other species. Nevertheless, there was considerable present and prospectbel pre in pectve value in the timber and firewood of the forest, and in a report which he made of his findings, a year or so ago, he sketched a scheme in which he proposed three general
objects, namely : A profitable production, which will 1893 this deficit became a surplus of more than $\$ 1,200-$ give the forest direct utility; a nearly uniform an nual yield, which will give steady employment to a trained force of foresters-woodchoppers and lumbermen; and a gradual improvement in the condition of the forest itself. These objects he proposed to obtain by dividing the estate into the high forest system and the selection system. The rotation-that is, the length of time allowed for a second crop to be-
$\$ 1,200-$ forest he had to operate in and the difficulties which are always attendant upon the establishment of a new industry, especially in one like this, where all his assistants and workme had to be formed from the very beginning.
But Mr. Vanderbilt has broader and more liberal views in his forest operations than an effort to make his


THE INDIANA-THE AFTER PAIR OF 13 INCH GUNS. orm orm annual crop during the whole period. In the selection system forest trees of all ages are mixed together, instead of being separated in groups according to their ages. The annual product is taken from all parts of the forest, the ripe trees being selected for cutting; but such a method necessitates in the case of a large forest area expensive transportation, and to avoid this Mr. Pinchot has adopted what he calls the location selection system, under which the annual yield is taken from a certain part of the forest during several years, then from another part, and so on.
Mr. Pinchot's balance sheet in his report above mentioned, covering the first year's operations of the Biltmore Forest, shows an expenditure of $\$ 9,911.76$, with receipts amounting to $\$ 5,607.11$, and material on hand worth at local market prices $\$ 3,911.25$, or $\$ 9,519.36$ Meppen, Hanqver.


THE BATTLESHIP INDIANA-BROADSIDE 6 POUNDER RAPD FIRE BATTERY naces; iron, steel and brass foundries; puddling melting, reheating and annealing furnaces; draw benches; a hardening and tempering department file manufactory; rolling mills for plates, rails and tires; railway spring and wheel manufactory; steam hammers, forges, axle turning shop, boiler shop, engineering and repair shops. Besides the above and many other departments, at Essen, connected with the making of cannons, there are steel works at Annen, in Westphalia, three collieries in Westphalia, besides participation in several others; 547 ironmines in Germany; various iron mines at Bilbao, in Spain; four iron works, including one at Duisburg, one at Engers, one at Neuweid and one at Sahn; various quarries of clay sandstone, etc.; four steamers, and artillery ground at
in all, showing a deficit of only $\$ 392.40$. In the year The property owned extends over 974 hectares; and the number of hands employed in the mines and steel works is 25,301 . There are altogether 1,500 furnaces of various $k i n d s$, 3,000 engines and machine tools, 22 roll trains, 111 steam hammers, two hy draulic presses, 263 stationary boilers, 421 stean en gines, representing together a force of 33,139 horse power, and 430 cranes, including travel ers, having a collective lifting power of 4,662 tons.
The total length of the shafting is 8.8 kiloms . ( $51 / 2$ miles), and that of railways, standard and smal gage, 85 kiloms. ( 53 miles), worked by 32 regular trains, with 33 locomotives. The annual consumption of coal amounts to 1,253 , 61 tons, and that of light ing gas to $12,000,000$ cubic meters, while there are 573 arc and 1,804 incandescent electric lamps.

The Yale lock manufacturers have proved that
in a patent lock having six "steps," each capable of being reduced in height twenty times, the number of changes or combinations will be 86,400 . Further, that as the drill pin and the pipes of the keys may be made of three different sizes, the total number of changes will be $2,592,600$. In keys of the smallest size the total number of changes through which they can be run is 648,000 , while in those of large size the number can be increased to not less than 7,776,000 different changes.

RECENTLY PATENTED INVENTIONS. Engineering.
Calcining Furnace.-Arthur H. Wethey, Butte, Montana. Three patents have been granted this inventor for improvements in furnaces such
as illustrated and described in the Scientific American of May 30 , the furnaces being preferably built in pairs, with two furnaces located opposite each other, and each provided with longitudinal hearths or compart sulphurizing ores, in a ground, crushed, or pulverized state. One of the patents is for a traveling shoe to actuate a lever mechanism whereby the end doors are auto matically opened to permit rakes or plows to enter or leave the hearth, the doors automatically closing as soon as the rakes or plows have left the door opening. These rakes or plows are for stirring and moving the contents of the furnaces, and another of the patents is for trip-
ping doors to close the slots on the inner sides of the ping doors to close the slots on the inner sides of the
furnace, the doors being self-closing and normally in a closed position, but being opened successively by the passing through of the stirring device. A series of over-
lapping doors is pivoted at their upper ends and adapted to be engaged edgewise by the axle or other part of the stirring device to cause an upward swinging of the door for the passage of the axle, and one of the patents pro axle carrying a series of ehovels or plows. The carriage is pulled along between the two furnaces, and projectin supports extend into the furnace compartments and with their shovel blades agitate and push forward the material.

## Railway Appliance

Car Fender.-William B. Altick, Lan caster, Pa. This fender may be attached either to the
front or bottom of a car, to remain there as a fixture, and has two frames, a trip and a bed frame, in connec-
tion with a main frame. The two frames are normally tion with a main frame. The two frames are normally
lifted from the ground, but the trip frame, when struck lifted from the ground, but the trip frame, when struck
by an object in the path of the car, releases the bed frame by an object in the path of the car, releases the bed frame struck, the trip frame also dropping with the bed frame Any body in the path of a moving car provided with this fender will, it is designed, be caught up without injury
and safely retained on a yielding bed until the car is

Frejght Car Door.-Alfred P. Le Gros, Louisville, Ky. Crank arms mounted to swing o he side of the car, according to this invention, carry to and bottom runners on which a door is fitted to slide and a crank shaft journaled on the car has a hasp form ing a handle, the shaft having crank arms engaging bear-
ings on the runners to give them a swinging motion This door may be conveniently opened and closed, fittin snugly into the door casing, and is especially adapted facilitate ventilating the car, as the runners may be swung to move the door bodily out of its seat to a position
in front of the door opening, with the hasp still locking the door, and preventing the entry of persons withou

Railway Car Load Indicator.-Car Henrich, Webb City, Mo. This is an improvement in weighing appliances in which an indicating beam is made
to move by the movement of the car body under its load, co-operating with a graduated bar by which the amount of the load is determined. The invention provides an mproved construction of the fulcrum and pivot of the ndicating lever, so that each may be more readily and effectively adjusted, thus making it possible to obtain

Refrigerator Car.-Charles S. Ha dy, san Diego, Cal. This is an improvement in cars which have an "ice plug" and other parts co-operatin with a lid in closing openings that receive ice in the roo to permit the conversion of the plug into a ventilato permitting the same plug to be used in winter, when the cars are employed in the shipment of fruit without ice The apparatus has a separate outer lid or hatch and an nner ice plug with foldable section, whereby its heart may open up and adapt it to co-operate with the lid or batch in forming a ventilator and an outer lid or hatc oor, avoling a use of separate structures and insur ventilator.

## Mechanical.

Wrench. - Thomas Wilson, Dillon, Montana. This tool is especially designed for a nut rench of quick action and large scope, having a ratche ily unlocked by the fingers of the hand grasping the rench handle. Provision is also made for protecting the ratchet teeth of the locking device from possible injury by contact with objects with which the wrench may
硅
Milling Attachment for Lathes. Charles C. Keyser, New Decatur, Ala. According to
this improvement a frame is adapted to be attached to the lathe in place of the tool post, a live center mounted to be turned in the head stock of the frame, and a dead center adjustably held in the tail stock of the frame. quickly attached to the lathe and durable construction, ing all kunds of work usually done on ligh grade milling machines.
Case Rest for Printers' Cabinets. William A. Hurrel, Bloomdale, Ohio. To furnish a quick and ready support for any case in a cabinet or rack, al cess to all the boxes, this inventor provides standards to be attached to the uprights of the cabinet, the standards having channeled sides and offsets and connected arms being adapted to slide upon them, each arm having on
its inner face a slideway to receive a case. The rest may be readiily adjusted vertically, enabling any case to be be readily adjusted vertically, enaint height for setting
brought up or down to a convenient type from it, and when not needed it may be yuickly removed from the rack or cabinet.
Hatters' Shackle.-Frank L. Butter-
ters for curling and ironing the curls of hats, the inven on providing a simple and convenient constructio whereby repeated reheating is avoided. A frame carrie a handle and a burner, and a removable ironing block is attached to the frame in a position to be heated, the block being readily removable in order that differen styles or shapes of brims may be readiy rame.
Folding Shirt Waists. - Joseph onasson, New York City. A simple and inexpensiv machine is furnished by this inventor by means of whic hirt waists and similar articles, after laundering, maig
be quickly and uniformly folded, the machine being specially adapted to fold ladies' and children's wais that they may be packed and displayed to the best ad vantage. A forming board is placed on the garmen pread out on a slotted table, and pivoted below the tab are arms which project through the slots, the arms carry ing rollers, which are made to move over the garm
the folds are made, by the operation of a treadle.

## Miscellaneous.

Optical Lantern. - Charles Good year, Jr., New York City. This is a lantern for scientic readily interchangeable, so that the lantern may be use or projections of widely different character without los of time in making changes and adjustments. Th antern has tubes or sockets to receive the ends of rods o tubes projecting from and forming part of au optica bench, the latter being formed of two rods or tubes wit apporting legs, the rods or tubes having extensions it the tubes or sockets of the lantern. Adapters are also
fited to the optical bench to hold the shanks of the di itted to the optical bench to hold the shanks of the di the adapters of the main optical bench to receive micro scope attachments.
Ruler.-Charles F. Windisch, Cincinati, Ohio. To prevent ink from soiling or blurring the surface being used this inventor provides a ruler formed celluloid, etc., the members being secured together leave a narrow free space between them. The upper nember is wider and projects at both edges beyond the adhere to the upper member only. The edges of the dhere to the upper member only. The edges of ent to repel the ink.
Music Leaf Turner.-John J. Walsh, to a plano, organ, or music stand, without marring the surfaces to which it is attached, and comprises a casing in which are leaf-turning arms, and devices for attaching leaves of music to the several arms. The invention pro vides for a quick releasing of the arms, one by one, whe asheet of music is to be turned, and all the music carr ing arms may be simultaneously carried over to a posi
Reference Guide for Books. James H. Hoch, Marion, Kan. For the use of preachers device to be applied to books to enable the user to readil refer to various texts or solutions. The device consists of an attachment having tablets or markers carried on swinging arms on an articulated frame bar applied to the backs or covers by spring clasp. The articulation of
the frame in the middle enables it to open or close and djust itself automatically to the open or closed condition of the book.
Carriage Shaft.-Marie F. J. Wille min, Paris, France. This is a n unbreakable shaft, havin alls. k . ing sleeves, bolts, and a coupling block forming an articulated connection between the bolts, the block having and springs on the bolts. With a shaft made according to this improvement, if the animal falls, no matter in what
position he may lie on the shaft, the latter will not be

Fence Post.-David N. Bay, Dee oreacre, and Ford s . Dye, Cambridge, Ohio. In fence posts made of terra cotta or oher plastic material, this invention provides for making a post open at the back, readily introduced through the front of the post and cured at the rear for holding fence wires in position. Each post is also made with an anchorage at the base, of a width greater than at any other point, and having such form as is designed to prevent the post from being forced
upward by frost in the ground. The material of which the post is made is so utilized that only a minimum quan ity is required, and the completed posts may be so packed t
tation.
Floor Drainage Valve. - Oliver Barratt, New York City. This is a valve more cspecially
designed for use in tiled floors of hospitals and other build designed for use in tiled floors of hospitals and other build-
ings to carry off the floor wash water, insuring a proper ings to carry of the floor wash water, insuring a proper
closing of the valve after being used by the attendant, to prevent sewer gas from entering the room. The valve
has a bowl shaped body in the bottom of which is the valve seat, a yoke carrying a cap extending in the body, while the valve has a flange screwing into the cap to
open and close the valve. The cover of the valve is or open and close the valve. The cover of the valve is or
dinarily flush with the floor, but when opened to let ou dinarily flush with the floor, but when opened to let out
the wash water, the cover cannot be closed down until the valve is se
into the room.

RUNNER FOR Stoops.-Archia L. Ross, New York City. A series of mats, made of
rubber or similar material, fexibly connected with each other, and preferably fluted longitudinally, are provided by this inventor as a covering or runner for stoops and
sidewalks of private houses, theaters, and other buildings, to prevent slipping and falling in icy weather Each mat is adapted to hook with its rear end on hooks per manently secured on the steps of the building, and the several mats for the steps are preferably connected by eral mats may be readily stored away one on top of the

Window Fastener.-Michael F. Rob gear is mounted to rotate on a supporting plate or ing, a rack meshing with the gear being secured on the window sash, and the casing being provided with square openings in which slides a squared shaft. The shaft car ries a stop which is engaged and disengaged from the teeth of the gear when it is moved endwise, and a spring olds the shaft in normal position. When it is desired or riise or lower the window the sliding shaft is moved
by a key, when the window may be moved up or own as freely as though a fastener were not applied

Steam Cooker.-Albert J. Finlay and Charles Wilson, Silverton, Oregon. This is a simp esired shape, with a cover, and a tray with lesg a to be placed in the vessel. The tray is divided into com partments to contain vegetables, meat, etc., and has fine perforations to permit steam from the water chambe below to pass up into the various compartments, the
steam being prevented from escaping into the compartsteam being prevented from escaping into the compart
ment of the tray until comparatively dry. The tray may ment of the tray until comparatively dry. The tray may
be removed from the body receptacle without danger of ing the hande
Portable Elevator.-John F. Fair man, Axtell, Neb. This is an inclined way elevato jointed trough. A wagon may be hoisted up the an vator to dump its contents in a crib by means of a rope or cable carried over pulleys and then connected with team. The machine is mounted on wheels to enable eing especially advantageous as a time and labor save avoiding the necessity of shoveling or other hand
in unloading corn and other material from a wagon.
Baling Press.-Thomas H. Killingsworth, Waco, Tex. In presses for baling cotton, this
nvention provides a simple and easily operated device nvention provides a simple and easily operated device n which the cotton bat is wound into cylindrical for made in separate sections are mounted rotary drums, here being pressure rollers and tension rollers, each having movable bearings, and endless belts with supporting bands traveling with them. When the conpression is accomplished each layer is compressed as
is added, thus adding to the pressure of the interior of is added, t
Hoisting Device.-Alfred Bogardus Jersey City, N.J. For dumb waiters, etc., this inve wain provides a device by means of which the dum desired. Combined with a hoisting shaft on which is a ratchet wheel is a box wheel loosely mounted upon and surrounding the ratchet wheel, there being gravity pawls in the box wheel and a strap brake engaging its periwhile the load is being lifted, but with the stoppage
whe pull on the hoisting rope the pawls prevent the desce of the load. By slackening a rope connected with the strap braty.
Safety Attachment for Gas Cocks. $\dot{-}^{\text {Charles B. Duffy, New York City. To prevent the }}$ accidental opening of a gas cock after the gas has been turned off, this inventor provides a simple attachme hereby the movement of the plug is controlled by apring-pressed lever operated by a knob or thumb piece quainted with the proper manipulation of gas cocks wil not be able to light a gas burner having this attachmen ntil its operation is explained to them, and an accident opening of $t$
Paring Knife. - John H. Grooters Boyden, Iowa. This is a knife especially adapted fo paring fruit, vegetables, etc., the blade being so located may be taken off, as desired. The biade portion curved and has a slot, in the rear of which, in a counte sunk portion following the curvature of the slot, is secured a cutting blade, while in the front wall of the
curved slot is secured an adjustable guide plate, by whose movement up or down thethickness of the paring is regulated.
Note.-Copies of any of the above patents will b furnished by Munn \& Co., for 10 cents each. Please of this paper

## NEW BOOKS AND PUBLICATIONS

How to Feed Childden. A manual for mothers, nurses, and phesicians.
By Louise Hogan. Pbiladelphia: J.
B. Lippincott. Company. 1896. Pp. 236. Price $\$ 1$.

The fin de siecle child should be a very healthy being, if attention is given to all that is published concerning its welfare. The present book, treating of the advance system of feeding, should be welcomed by those having children in charge, it is a contribution to dietetics, one which will do its pat
coming generations.
The Wisconsin Engineer. University Quarterly. Madison, Wis. Pp. 160 . Quarterly. Madis
Electrical Enginefring in Modern Central Stations. By Louis A
Ferguson. S B Madison, Wis.: P:ib lished by the University. 1896. Pp. 259. Price 35 cents.

The last named excellent monograph, by the electrica engineers of the Chicago Edison Company, gives the
Edison treatment of the central lighting station, problem, which will be of interest to all electrical engineers. Mr. Ferguson is one of the special lecturers of the University
of Wisconsin. We also note the reception of the Wisof Wisconsin. We also note the reception of the Wis-
consin Engineer, a quarto published by the students of the State University, and containing articles by them, the alumni, and professors, with a valuable index of
engineering literature.

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chave Company. Foot of East 138 th Street, New Yor The best book for electricians and beginners in elec tricity is " Fxperimental Science," by Geo. M. Hopkins,
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marked or labeled.
(6931) J. B. O. says: Can you give me A. 1 sort beap oing ............... 2 parts. 1. Soft soap....
Linseed oil..
Annatto solut Turpentin
Dissolve the soap in the water and add the annatto; melt the wax in the oil and turpentine, and
stir in the soap solution, stirring until cold.


Melt the soap and palm oil together at a gentle heat, and add the oleic acid; dissolve the tannic acid in the glycerin, add to the hot soap and oil misture, and stir until cold.


Dissolve the wax in the oil with the aid of the water bath, and the soap in the water; mix the two solutions | $\begin{array}{l}\text { bath, and } \\ \text { in a hot } \\ \text { gist. }\end{array}$ |
| :--- |

(6932) W. S. writes: I have twenty-five 16 candle power lamps, 50 volts, drawing their supply from a dimmer. A. For a dimmer use insulated copper wire of the same size as that of your present lead. Wind it
in a coil one foot long and two inches internal diameter. in a coil one foot long and two inches internal diameter. Mount a bundle of iron wires as ont of the aperture. With a current of sufficiently high frequency of alternation this will be a large enough dimmer. By sliding the core in, the lamps are dimmed.
(6933) E. F. G. writes : I desire to make an alum cell for microscopic projection, to restrain the alum cell be? What proportion of alum should be used in the solution? A. Curve a $1 / 2$ inch square strip of rubber, so as to form the bottom and ends of the cell. On opposite sides of this strip clamppieces of plate glass.
The glass should be at least $1 /$ inch thick. The space The glass should be at least $1 / 8$ inch thick. The space
between the glasses should be $1 /$ inch at least. A strong, but not quite saturated, solution of alum should be used. Water alone answers a very good purpose. To avoid the formation of air bubbles, the alum solution, as well as the water, should be boiled and put in bottles to cool, the bottles being corked as soon as filled. If air bubbles should form in the cell, they may be dislodged by means
of a feather or a wire. A piece of heavy rubber tube may of a feather or a wire. A piece of
be used instead of the rubber strip.
(6934) H. C. S. writes: Please give me he directions and what material to use in making a dry battery. A. Ammonium chloride, 1 part by weight
plaster of Paris, 3 parts; water, 2 parts. Some maker use in addition to this a small proportion of zinc oxide, also of zinc chloride.
(6935) W. W. C. asks: 1. How long What is What is the length of spark given by induction coil
in suppiement, No. 160? A. One to one and a hal in supplement, No. 160? A. One to one and a half
inches. We have not the other records asked for. 3. In

SUPriement, No. 160, do you think by insulating coils
better that spark can be increased in length, if I nied 2 better that spark can be increased in length, if I used
pounds of double covered silk instead of bare wire in No. 160 , would it pay to do that way ? A. Silk iovered wire is no better than bare wire, provided the latter does not short circuit. A very slight increase in size of coil No. 160 would enable it to give a two inch spark. 4 Can better effects be obtained from a Tesla coil for les cost than ordinary coll ? A. The Tesla coil gives very fine results, but introduces more expense. 5. You say in primary coil. Does not length of spark depend on voltage and the voltage on the ratio between the number of convolations on primary and secondary coil. If too mach wire is put on primary, will not the ratio of the two be too uniform thus shortening the spark? A. You misapprehend the case. The extra current in the primary makes its turns efflient in increasing the voltage in the
secondary. This voltage depends on the lines of force of the primary, and these vary directly with the number of turns in it. 6. I have the use of a lathe, but it has no de vice to wind wire, as in Supplement, No. 160. Do you not thinkit would pay to use at least single covered wire ? A. It might as a matter of security
(6936) F. E B. writes : My ice house is filled with choke damp or fixed air, which renders it dan-
gerous and almost impossible for any one to go down into it and remain a sufficient length of time to get a sup ply of ice. Can you tell me how to get rid of it 9 A There is one efflcacious cure-ventilation. If this is ob taining freshly slaked and thoroughly wet lime upon the surface of the ice or packing. One or two bushels of lime should effect the cure.
(6937) R. A. says: I would be pleased to know of a good formula for making a quick drying how to apply it ? A. This powder is prepared by mixing together-

Dextrine............................. 2 parts.
Resin (very finely powdered)
1 part
It may be employed both for application to negatives means of application.

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synopsis of the patent laws of the United States and all
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## INDEX OF INVENTIONS

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bracket. See scafoid bracket. See Car brake. Fressure brake.







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