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Contents.

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SGIENTIFIC AMERICAN SUPPLEMENT No. 920.
For the Week Ending Augast 19, 1893.


RAIBING VEsBELS BY HEANs of atr sacks. The Glenola, a two-masted schooner, which was sunk about six months ago in Great South Bay, N. Y., has been successfully raised by means of air sacks. Although the principle involved is old, Messrs. Grant Bros.' air sack system of raising vessels seems to be practically successful. Divers descended into the hold and adjusted huge canvas bags or sacks, which measured twenty by four and one-half feet. Each sack was connected by hose pipes to a powerful air pump, and gradually inflated by air. The gradual inflation of the bags with air slowly lifted the vessel to the surface. It required only about one hour to
raise the Glenola after the work of adjusting the raise the Glenola after the work of adjusting the on this plan is inished. The cost of raising was $\$ 1,500$ to $\$ 2,000$, and required the services of sixteen men. The system has been used successfully in Puget Sound in raising the Premier, an 800 ton vessel.

## WATER POWER TRANBFORMED INTO LIGHT.

Among the notable industrial enterprises recently inaugurated in Mexico is the electric lighting of the city of Guadalajara. The plant utilizes the famous Juanacatlan waterfalls, which are situated about 18 miles from Guadalajara. The Thomson-Houston generators are actuated by Leffel turbines, the head of water being 58 feet. Three turbines of 550 horse power are used. The dynamos for arc lighting have a capacity each for 50 are lights of 2,000 candle power. The current strength is 10 amperes, and consequently the maximum voltage is 2,500 . The incandescent dynamo consumes about 750 horse power and yields approximately 350 amperes at 1,000 volts, or say 350 kilowatts. The voltage is increased from 1,000 to 5,000 volts by means of ten step-up transformers. They transform the energy of the dynamo at an efficiency of about 98 per cent, delivering to the line, therefore, 98 per cent of the energy supplied them and at five times the pressure. The high potential incandescent circuit is reduced to 1,000 volts by step-down transformers at Guadalajara, 17 miles away from the source of electricity.
The installation of the San Antonio Light and Power Company, of Pomona, California, possesses many features of interest. The current is carried twenty-eight miles under the enormous pressure of 10,000 volts. The generators are of the standard 120 kilowatt, 12 pole, 1,000 volt Westinghouse alternator, which delivers current at 7,200 alternations on being driven at 600 revolutions per minute. The generators are coupled direct to Pelton water wheels, the head being 395 feet. The 1,000 volt current is taken to the switchboard and from there to the bank of stepup transformers, from which the current is delivered under a pressure of 10,000 volts. One circuit is car ried to Pomona, fifteen miles, and the other to San Bernardino, twenty-eight miles away. The wire used is No. 7 B. \& S. hard-drawn, bare copper wire, and is carefully supported on poles by insulators
specially designed for this plant. A potential of specially designed for this plant. A potential of
9,500 volts is received in Pomona and 9,000 in San Bernardino. The potential on the city lines is maintained at 1,000 volts.

## AERIAL NAVIGATION.

During recent sessions of the World's Congress Auxiliary at Chicago, a special branch of the department of engineering known as the aerial navigation confer. ence afforded the occasion for a most interesting presentation of facts and comparison of views of the 1 most experienced experimenters and the best equipped scientists who have given this subject their attention. The conference was organized and actively promoted by Mr. Octave Chanute, the eminent engineer, assisted by Prof. A. F. Zahm, of the Notre Dame University, of Indiana, and the reading of papers and dis versity, of Indiana, and the rea
cussions occupied four sessions.
At the outset it was manifest that there was a general indorsement of Mr. Chanute's views, that, diff cult as was the problem of aerial navigation, there was still enough of promise in it to lead men, through patient and intelligent inquiry and research, to hope for ultimate good results. The mere purpose of carry ing passengers and heavy loads of freight was dismissed as being quite impracticable, for it was not likely that the railway and the steamboat would ever be competed with successfully by air ships, however efficient they might be. But there were many and important trolled at the will of man, as in cases of war and in the study of meteorology.
One of the most interesting papers presented at the first session was that by Prof. Langley, secretary of the Smithsonian Institution, Washington, D. C. (read by Prof. George E. Curtis of the same institute), under the title of "The Internal Work of Moving Air." In during several years of soaring birds, such as the buz zards, from which he draws the conclusion that flying machines can be made to imitate this flight and to sail in the air when the latter is in movement as easily and in the air when the latter is in movement as easily and
with as evidently little effort as the soaring binds. It
is worthy of note to find that in two other papers presented at the second session the same kind of studies were recorded and similar conclusions presented by observers in Europe and Africa, one being on "Gliding Flight," by J. Bretonniere, engineer and observer, Constantine, Algeria, and the other on "Theory of Soaring Flight," by Chevalier de Louvrie, engineer, of Combebigu, France. Other papers bearing relation to the above were presented, one on "Observations of Birds," by G. Crosland Taylor, F.R.G.S. and A.I. E.E., of Helsby, England; another by the same author on "Theories of Soaring and Sailing," and another by A. M. Wellington, editor of the Engineer ing News, of New York, on a "Theory of Sailing Flight."
In regard to the construction and propulsion of the future air ship. Dr. R. H. Thurston, director of Sibley College, Ithaca. N. Y., read a most interesting paper on "Materials of Aeronautic Engineering," in which he gave facts regarding the strength of metals, some of which were new even to the scientific men in his hearing. He showed that of all metals steel combined most strength with lightness, and was, therefore, bet ter fitted for the construction of air vessels than any ther.
The subject of kite flying was taken up, and the paper on "Experiments with Hexagon and Tailless Kites," by W. A. Eddy, experimenter, of Bayonne, N J., illustrated by drawings on the blackboard, was a most interesting one. He had succeeded by his method n flying kites to a height of over 4,000 feet.
Papers on ballooning were read by Mr. C. E. Myers, aeronautical engineer, of Frankfort, N. Y. These were "Manufacturing Hydrogen Gas Balloons," "Natural Gas Balloon Ascensions," "Maneuvering of Balloons," and "Balloon Meteorology."
A paper on "Flotation vs. Aviation," by Prof. De Volson Wood, of Stevens Institute, Hoboken, N. J., in which the professor advocated a departure from the bird method in flying machines, provoked some discus sion, in which the bird method was ably advocated. Gen. W. Hutchinson, of the British army, Silver dale, England, submitted a published paper on "De sign of Navigable Balloons." This was an old idea of Gen. Hutchinson's, and related to the employment of balloons in warfare.
One of the most interesting of the papers read at the conference was by Prof. Mark W. Harrington, but it had reference rather to the work of the government weather bureau than to the navigation of the air, and advocated the establishment of special balloon and kite stations for observational purposes.
Prof. A. F. Zahm, "secretaty of the conference, whose subject was "The Stability of Aeroplanes," pre sented descriptions of a variety of models with which he has experimented with a view to securing automatic equilibrium and steadiness of flying machines in all circumstances of wind and calm. He defined the aeroplane as the supporting surface of a flying machine as distinguished from the propelling surface, and stated as some of its requirements, (1) that it should, when launched in any manner, automatically head to the wind and move rapidly forward; (2) that when displaced or overturned it should promptly re cover its position of equilibrium ; and (3) that it should maintain a prescribed and uniform average position and course in the air, as a boat does in the water. The models described comprised various forms of gravity kites. dirigible parachutes and simple and compound aeroplanes.

## Sweet Pickled Watermelon Rinds.

A writer in Harper's Bazar givesthe followingdirecions:
Peel the rinds with a sharp knife that will take off the graen skin evenly. Trim off also every trace of the pink flesh of the fruit, because it is too juicy to make a flrm, crisp pickle. Then cut the strips of rind into small pieces, two to three inches long, and placing them in a large earthen dish, sprinkle them lightly and evenly with salt. Cover the dish and let it stand over night. In the morning drain off the water that will have formed, rinse the rinds in cold water, and cook them in a steamer until a broom splint will readily pierce them. Cooking the rinds by steam is an easy method, as they are less liable to burn than when cooked in the spiced vinegar. When the rịnds are ten der, take them out carefully with a skimmer and put them into a stone jar.
Take good cider vinegar for the basis of the pickle. Allow a pound of sugar to a pint of vinegar, and add also half an ounce of stick cinnamon broken into inch pieces, and a half teaspoonful each of wholecloves and blades of mace. The whole amount of vinegar, sugar and spices used must, of course, depend on the quantity of rinds to be pickled, but a quart of vinegar is usually sufficient for the rinds of a medium sized melon. Boil the vinegar, sugar, and spices together vigorously half an hour, skimming off the froth, and pour the pickle boiling hot over the rinds. Press the rinds down under the pickle by means of an earthen plate or saucer, fasten the cover on, and tie a cloth over the whole fasten the cover on, and tie a cloth over the wh
These pickles will be ready for use in two weeks.


The Indian School exhibits, made by the United States government, are both interesting and remarkable. One school comes and stays nearly a month, then another, and 80 on, until each one has exhibited in turn. The exhibit during the early part of August was that of a Haskell Institute, at Lawrence, Kansas. Forty-sir scholars werein attendance-thirty-one boys and fifteen girls, and these scholars represented twen-ty-three Indian tribes. A brass band of twenty-four pieces, composedentirely of boys in this school, played each morning at half-past nine. There was a constant stream of visitors passing through the school. One day's record was 21,000 people, and the first eleven days 146,500 people visited it. Thedisplay includes an exhibit of the work of the pupils in various stages of education, from the kindergarten to painting, draw. ing, and various oecupations. The boys are at work making shoes, harnesses, clothing, carpenter work, etc. Many fine, strong faces are to be seen among the children of these schools.
Bark wigwams of the Crees and allied Indian tribes of the Northwestern Territory of Canada are shown, and there are several families in connection with this exhibit. The State of Maine sends as exhibits several families of Penobscot Indians, who have erected birch bark wigwams, in which they live and sell specimens of their handiwork, such as baskets and head work. The Winnebagos and Chippewas, from Wiscon sin and Minnesota, are represented and oecapy typical houses of hides and bark. Other Indion habi bark. Other lndian habi pees, Hogans, Navahos, Apaches, and other Western tribes. Three wooden huts aie occupied by Quackuhl Indians, from Vancouver Island. In front of each is an im mense totem pole, carved in grotesque fashion
The State of New York represents the Six Nations,
the Iroquois, Senecas, Mohawks, Onondagas, Cayugas, Oneidas and Tuecaroras. The confederation of these tribes, declared by Daniel Webster to be the most consummate piece of statesmanship in the history of the world, dates back many generations: Although the present representatives of these nations live like ordinary citizens in houses of wood or stone, many reminders of these early days are still carefully preserved. The Long House, built here at the Exposition, is an exact reproduction of the one that formerly stood on the site of the city of Albany, N. Y. It is forty-five feet long and twenty feet wide, and is constructed 60 that three apartments can be arranged on each side with a passageway through the center in which the council fires were built, one between each opposite pair of rooms. This building is constructed exactly keeping with the primitive style, not a nail or a pin being used in itwithes of hickory or slippery elm being used. This structure is utilized as a salesroom, and many of the manufactures of these Indians are to be had here, al of them being made on the spot. The hereditary chief of the Six Nations must be a member of the Onondaga. Tribe. This man, called in the native tongue Otatsho, is Daniel La Forte. Mr. La Forte speaks English with perfect fluency, and is equally proficient in the tongue of each of the Six Nations, 80 that a the conncil meetings he is able to nnderstand al that is said by a representative of any tribe, and is need be, can answer him in the same tongue. The first chief who arrived at the Exposition was Chief Lather Jack, who took an importent part in the recoption to the handy mariner of the Columbui
caravels and the Viking ship. The accompanying illastration represents this chief with squaws of the same tribe seated in front of the railing surrounding the Basin, waiting for the reoeption to begin. An other important representative of the Six Nations is Thomas Webster, who is the chief wampum keeper. The bark used in covering the Indian houses her shown is usually of basswood or elm. These structures represent the type of dwellings occupied by the members of the Sir Nations at the time white men first came to America, and as a background to it there is shown near by a $\log$ cabin, which is an exact reproduction of the general type of cabin occupied by the early settlers of this country, This house is curnished in an exact reproduction of the early days, with a hand loom, spinning wheel, and all other urniture.
The two distinctive engineering concessions, that is the Ferris Wheel and the Movable Sidewalk, are prov ing very popular and give every indication of being amongthemostsuccessful concessionsin the Exposition grounds 80 far as financial returns are concerned. The wheel has an average daily attendance of eight or ten thousand people, and at this rate it will not only pay for iteelf, but probably give the stockholders a large dividend.
Tablets commemorative of the great work done at the Exposition by John W. Root, the architect, who did so much toward laying out and planning the Ex


CHIEF LUTHER JACK AND SQUAWS OF THE SIX NATIONS.

Germany, Holland, Canada, Merioo, Great Britain Italy and from the United States and the army and navy. These papers discussed work in all lines of civil engineering, highways, railway mattere, the construc tion of bridges, the building of canala, etc. Several of the most interesting and important engineering works now under way in various parts of the world were do scribed by engineers cennected with them.
The Mechanical Engineering Congress was opened by an address from Mr. E. B. Coxe, president of the American Society of Mechanical Engineers.
President Henry M. Howe, of the Institute of Mining Engineers, opened the Mining Congress. Thisdivision and the Metallurgical held a joint session. Mining schools were pretty thoroughly considered and varions papers were read discussing mining and geological papjects.
Prof. Ira O. Baker opened the Congress of Engineering Education, and at the several sessions papers were raad by professors representing the leading engineering schools of this conutry and Europe.
The Congress of Military Engineers opened with an address by Major Clifton Conly of the United States army. Prominent engineers and army officers attended and important papers were read discussing coast and other defenses, torpedoes, submarine work, fortifes tions, roads and bridges, transportation, the handling of troops, modern guns, and explosives.
Commodore George W. Melville, chief engineer of the United States navy opened the division of Marine and Naval Engineering. In this congress, naval architecture and all matters pertaining to the construction, building, and equipping of vessels were fully discussed, pa pere being presented by engineers $1 \mathrm{ra}-\mathrm{m}$ varions foreign nations as well as from engineers from the navy and leading shipnavy and leading ship-
building concerns of the United States.
In the division of Aerial Navigation, Mr. Chanute delivered the opening address and many papers were presented. The subject of aerial navigation wes discuseed more freely and completely than ever before.
The members of the congresses visited the engineering works abont the city of Chicago and inspected the work now in progress on the great drajage canal, which is expected to afford whole some drainage for the city. When I came to Chi cago I was prepared to see a great Exposition, but I found it was even greater than my imagination could picture it. One walks all day seeing and
position, and to Henry Sergeant Codman, the land scapist, who laid out the grounds, have been placed on the south front of the Fine Arts building. These tablets are offered by friends and associates of these two eminent men, all of whom worked together in the early days of the Exposition, and who perfected and carried out the marvelons work as now seen.
A remarkable exhibit in the Mining building is that of "carborundnm," a new compound, which is made by combining silica and carbon by means of electrical action. This product possesses such remarkable grinding qualities that it cuts glass and polishes diamonds. Its abrasive qualities are believed to be greater than those of any other material, and this is particularly interesting from the fact that is a manufactured and not natural product.
The week beginning July 31 was devoted to the Engineering Congresses. These included eight divisions, as follows: Civil Engineering, Mechanical Engineering, Mining Engineering, Metallurgical Engineering, Engineering Education, Military Engineering, Marine and Naval Engineering, and Aerial Navigation. The divisions met in general session, when addresses were made. Thereafter each congress met in its own session and listened to the reading of papers and their discossion.
Eminent engineers from all parts of the world were in attendance and contributed papers, adding greatly to the value of the congreeses.
In the Civil Engineering department the opening addrees was delivered by William Metcalf, president of the Amierican Eooiety of Oivil Engineers. Papers were tudying and examining with much earnestness, only to be disgusted at night becanse the day's work counts for so little in comparison with what there is to see. The exhibits are almost numberless, the areas of the building are estimated in acres; and because of the bigness of everything it is neceasary to do a great amount of walking. In every direction there is something particularly to attract the eye Nothing seems to be lacking that could add to the completeness of the picture. I am overcome by the conception of the Exposition and the lavish magniflcence with which it is carried out, and it makes my patriotism simmer with pride to feel that this is a thoroughly American undertaking and is held in the bosom of the country.
Among the things that seemed strange to me was the number of wheeled chairs constantly moving about. I was not surprised to see a good many women riding, but at first I thought there must be an abundance of lazy men at the Erposition. After I had tramped vigorously two or tbree days and used myself up without seeing but a small part of the Exposition, I was not surprised that there were so many apparently lazy men. Even a profedonal pedestrian would find it a hard task to tramp about thees butidings and grounds from early morning antil late in the evening and not get ueed up. Another oddity is a little red camp chair of simple and almost crade conetruction which many people carried. These are hined for the day and can be returned at any booth. It is some bother to carry these ohaire aboat atilizhey 10 pay their cost of ten cente a day many times over.
(Contisued on pade 119.)

A READILY APPLIED BURGLAR ALARM.
The device shown in the picture may be conveniently applied to a door or window, trunk or bureau drawer, etc. It has been patented by Mr. Charles J. Fisher, of No. 90 Evergreen Avenue, Chicago, Ill. A diamond-shaped base plate of insulating material has on its opposite sides conducting plates, as shown in


## FISHER'S BURGLAR ALARM,

the small figure, the center of each plate having an opening for a screw, and these screws being conductors. A third screw at one end is connected with one end of a spring which extends over the base and passes through a metal eye, the body of which is carried through to the bottom of the base, on the under surface of which are oppositely disposed conducting plates, one connected with the screw to which the spring is attached, and the other with the eye. The base plate is attached to any object by passing screw eyes or like fastenings through the side apertures, the positive and negative wires of the battery being connected with the eyes, and a bell being located in the circuit. Then, as long as the spring extended over the base remains in the middle of the eye the circuit will be open, but the engagement of the eye by the spring closes the circuit, as all of the plates, the spring and the wires of the battery are in connection, and the bell will be sounded. In the application of the improvement as shown in the illustration, the door needs to be opened only slightly to force the spring into contact with the guide eye, and thus give an alarm, while the device may be also connected with the door knob, so that the turning of the latter well bell.

THE FOX BAFBTY
RAZOR AFD
8TROP.
This well known razor, with which it is an exceedingly rare thing for one to cut one's self while shaving, is of very simple construction, and shaving with it is readily accomplished by the most inexperienced. It is formed of an out-
sideframe and guard in one piece, two inches long, in which is inserted the razor blade, one and seveneighths inches long, and the removable handle. Within the outside frame is another movable frame which presses against the blade when inserted, the blade being quickly adjusted in correct position by means of two screws.
A special patented device for stropping and honing is shown in one of the views. The blade is held in the bottom of the frame holder, through which is passed the swing strop under the friction roller, and the device is then moved forward and back over the strop, on which the roller slightly presses, the blade being automatically turned on its back with each reverse motion of the device on the strop. The strokes may be short or long, quick or slow, but it is quite impossible to cut into the leather, and a fine, keen edge possible to cut into the leather, and a ine, ken edge
may be quickly obtained. M. E. Iothair Schmitz No. 92 Reade Street, New York City, is the patentee and manufacturer of these devices

## AN EXPERIMENT IN DIVINATION

I place hefore your eyes three face cards, a queen of clubs, a jack of diamonds and a king of spades, During my absence in a neighboring room, whence it will be impos neighboring room, whence
sible for me to see you, you will turn one of sible for me to see you, you will turn one of
these cards upside down. When you call me, I will tell you which of these cards you have thus inverted. It is unnecessary to say. that one must operate with douhle headed face cards that have absolutely the same aspect in both directions.
The following is the manner in which the operator can recognize the card inverted He selects from the pack three cards in which the line engraved around the card is nearer the edge at one extremity than at the other. He places the three cards upon a table before the spectators in such a way that the wide margin of the card is at the bottom with respect to the spectators and the narrower at the top, as is the case with the three cards represented herewith. The three top margins are narrower than the bottom ones. This is especially perceptible in the king of spades, but is very apparent also in the two other cards, which are acoarately reproduced from a photograph. When a card has been inverted, it is easy to perceive it in no ticing that the wider margin is at the top with respect to the spectators. The difference in width of the two margins is very appreciable to the operator, but escapes the eyes of the spectators who are not posted. This amusing experiment never fails to excite astonishment. -Dr. Z., in La Nature.

## The Aneieat and the moderm Gun.

An engineer, after visiting the caravel Santa Maria remarked that the little guns of that vessel were silent witnesses as to the limited advance in the science of ordnance, but bore potent testimony of the advance in the mechanic art. "Here," said the engineer, "is a built-up, breech-lcading gun ; it has a central tube, on which jackets are shrunk (or forced) in short sections; at the joints between thesesections there are other iron bands, tightly shrunk. The breech hlock, which is chambered, contains the cartridge; it is held in place hy a key or wedge. This gun is certified to be a fac simile of those actually used by Columbus on board the Santa Maria
"The difference between this gun and thoee now be ing huilt, and about which we read such interest ing accounts, is in magnitude, not in principle. The molecular strain in a forging or casting of great size led to the abandonment of cast guns and the adoption of built-up guns in our own generation. It seems evident that as the cupolas advanced in size and the mould ers' art progressed, the cast guns of large size became practicable; but with the increased internal pressures demanded the castings reached their limit, and built-up gans became essential.
"The gun of to day is composed of a central tube, on which are shrunk 'hoops' in shorter sections. Its breech block is held in place by a slotted screw, which is but another form of the wedge, being a circular inclined plane.
"The difference between the guns of Columbus' ships and those of to-day is due almost exclusively to the mechanic arts; to the steam engine as the power; furnaces, the cupolas, the hammens, and the lathes as the tools, and to the brawny sons of toll who work these machines The advance has been gradnal, and is wrought by mechanice and draughtsmen,
and the claim that gunnery.or that ordnance helongs to the occult science pales before the scrating of common sense observation."

## A Selenite mine.

At a recent meeting of the Royal Microscopical Bociety, Dr. J. E. Talmage, of Salt Lake City, Utah, exhibited and gave an account of some specimens of selenite found in the interior of a mound at South Wash, near Fremont River, Utah. As a rule, portions of selenite useful for optical purposes are measured by inches and weighed by ounces, but here he had found some which weighed 1,000 pounds. The formation around the mound was mostly sand and clay, and the region bore everywhere strong evidences of weathering, by means of which the mound had been weathered out into relief. He had removed some twenty tons of the crystals, among which were many single crystals,


## A TRICX WITH CARD8

measuring 4 to 5 feet in length, and entirely perfect, the most regular being 4 feet long, with faces of 6 inches. One fine crystal, 5 feet long, had no less than ineteen small ones jutting out from it; twins and groups were also very common. Inclusions of sand, clay, and liquid were often present.

## A RAILWAY CATTLE GUARD

The illustration shows a simple and inexpensive apoaratus for application to a cattle gap, to prevent cattle from getting their legs caught between the sleepers above the gap, and also to prevent their passing over it; and to frigbten them away. The improvement has been patented by Mr. Lorenzo Hills, of Pittsburg, Texas. The part of the gap on which the cattle are likely to approach is covered by a vertically movable platform extending beneath the rails, and hinged at one edge, the sleepers being recessed to provide for the limited up and down movement of the platform. On the under side of the platform is a cleat carrying a depending arm pivoted at its lower end between parallel tilting arms which oscillate on a shaft supported in hangers. To the inner ends of the tilting arms is fastened a depending brace whose lower end is


Hills' Cattle guard.
secured to a rod which carries the guard strips, and is adapted when swung upward to project them to the uffheight necessary to prevent the passage of cattle, as shown in one of the views. The guard strips are preferably of metal, painted some bright color, that they may more efficiently frighten away cattle as they are suddenly thrust upward. When tbe platform is de pressed by an animal stepping upon it, one end of the tilting arms is swung down and the other lifted, thus carrying upwand the depending brace and rod, with the attached guard strips. The latter, while of suffcient stifiness to stand upright ordinarily, are designed to bend over under heavy pressure, as in case of a stampede of cattle, when the strips may be pushed down to allow the cattle to pass withoat injury.

## A CONVENIENT BENCH VI8E.

The illustration represents a vise which may be readily moved into any desired position to hold the work at different angles to the horizontally moving file in the hands of the mechanic, to facilitate the proper filing of hexagons, octagons, or articles of other shapes. The improvement has been patented by Mr. Abraham Lurie, of No. 330 East Seventieth Street. New York City. In the base plate turns a circular offset projecting from the bottom of a casing carrying the vise proper, which is locked in place by


## LORIE'S BENCH VISE

a set screw. In the rear end of the casing, near its bottom, is a pivot on which [is hung the foot of the shank of the fixed jaw, the opposite movable jaw having its shank formed in the shape of a casing fitted between the parallel sides of the outer casing. The bottom of the casing for the shank of the movable jaw has dovetails engaging corresponding grooves in opposite sides of the shank of the fixed jaw, so when the latter is moved into an angular position on its pivot, as indicated by the dotted lines in the illustration, the movable jaw moves with it, without disturbing the relative position of the two jaws, the screw rod at the same time operating to move the movable jaw toward or from the fixed jaw. To lock the fixed jaw in the desired angular position, a locking device, consisting of two $\mathrm{L}_{1}$-shaped latches, is attached to its \&oot, the latches being normally held in an outermost position by a spring, when they engage correspondingly shaped notches in the segmental edge of the sides of the outer casing. The latches may, by press-
ing inward, be readily disengaged from either set of notches, and the casing carrying the jaws may' be turned in its base on loosening the set screw. There are sliding plates between the jaws, and a fired plate extending rearward from the fixed jaw, to prevent filings from passing into the casing.

## THAWING OUT FROZEN PIPES, ETC.

The difficulties, inconvenience, and sometimes very considerable loss which may attend the sudden freez ing up of pipes, drains, etc., have suggested the im provement shown in the accompanying illustration, for the ready thawing out of such conduits, and for which a patent has been granted to Mr. Daniel H. Streeper, of Norristown, Pa. The apparatus is contained in a box, in which a boiler is held over a plumber's furnace, a hand pump at one end of the box forcing water into the boiler through a huse, while a pipe from the boiler leads to a pipe which forms the axle of a drum supplied with water by an independent filling tube. A portion of the pipe forming the axle of the drum is perforated, and it is surrounded by a hollow axle whose ends are closed by stuffing boxes, a pipe leading from one end of the hollow axle outward on one face of the drum to the rim, on which the pipe is formed into a coil, adapted to be unwound from the drum as required in use. The pipe is preferably of lead, but a hose may be em ployed instead, and on its outer end is a pilot for conveniently guiding the end of the pipe into and through the frozen pipe to be thawed out. For foreing a flexible hose forward in a frozen pipe a rod may be attached to the pilot, or the pilot may be flexibly attached in case the pipe is to pass around curves. In operation the water heated by the furnace is forced by the hand pump from the boiler into the hollow axle, where it heats the water in the drum and the pipe coiled on it, the hot water or steam at the same time passing through the pipe itself, and through the pilot at its end, into the frozen pipe, the coil being unreeled from the drum and pushed into the frozen pipe as the operation progresses.

## THE IMPERIAL INETITUTE, LONDON.

Among all the stately and happy ceremonials of the Queen's Jubilee, none possessed greater intrinsic significance than the recent opening of the Imperial Institute by Her Majesty. That event, as it marked the completion of the idea of showing by a permanent memorial the expansion of the empire during the fifty years of Queen Victoria's reign, was of national importance. To day a magnificent palace, ample in its proportions as befitting the world-wide empire which it symbolizes, and well adapted for the several purposes for which it is intended, occupies the site at South
of which the Colonial and Indian Exhibition of 1886 was the last.
By accepting the advantageous offer of the Royal Commissioners of the first International Exhibition, the owners of the site, the executive of the Imperial Institute have been enabled to devote to the building the greater part of the public funds raised, and a tota area of nine acres is now covered with the structure and its courts. Looking down from the great square central tower, one notes immediately on the north side the full proportions of the Albert Hall dome, with the


STREEPER'S APPARATUS FOR THAWING OJT FROZEN PIPES, ETC.
cross of the Prince Consort Memorial rising behind it The Royal College of Music, also in process of building, occupies the ground between the north gallery of the Institute and the Albert Hall, with the City and Guilds of London Technical Institute adjacent. In front, to the south, the immediate object seen is the Natural History Museum, the ground intervening on the other side of the new wide avenue lying ready for new buildings of the South Kensington Museum, or other public institution, which should harmonize with the surroundings. The trees of Hyde Park and Kensington Gardens, the open spaces, and the glint of the Serpentine form an agreeable contrast to the regular lines of streets and blocks of tall houses--dwarfed from this height, however-which characterize this: part of London.
Though the building is to a certain extent shut in by


THE NEW IMPERIAL LFBTITUTB, LONDON.
idea of its actual dimensions, yet no eye can fail to be captivated by the magnificent facade along the north side of the Imperial Institute road. The actual length of the main building is a little over 200 yards, but with the arcades the whole frontage presents one long line of 300 yards.
Mr. T. E. Colcutt, the architect, has adopted the Renaissance characteristics, and the general impression conveyed by the ensemble of the building is one of strength and permanence, relieved by ample mouldings in the gables and carvings of the balustrades.
Portland stone is the material chiefly employed in the structure, and as this comes from the Whitbed Quarry, it is hoped to long withstand deterioration in the London atmosphere. The great portal, flanked by lions and other statuary from Mr. Pegram's chisel, is ornamented with a frieze covered with symbolic sculptures, and with a seated figure of the Queen. At the side is the great foundation stone, brought from the Cape, of three tons weight.
Passing through the main entrance, a vestibule is reached, into which a polished stone corridor opens, running on either side to the end of the building. The vestibule gives access behind to the great reception hall, the finest part of the interior. Opening out of the corridor on the principal floor are spacious conferthe corridor on the principal floor are spacious confer-
ence rooms for the American, Australasian, African, and Indian sections, the administrativepoffices, and temporary library and reading room. Ascending from the main entrance by a highly decorated marble staircase, we reach the first floor, which is devoted to conference rooms of the crown colonies, meeting rooms for societies connected with the institute, and the departments of commercial intelligence. The corresponding rooms on the floor above are chiefly intended for the sample examination stores and laboratories, a map department, and for the social use of the fellows of the institute. Parallel with the main building, in its rear, and separated by quadrangles, ran two long galleries, the intermediate and the north, in which are stored, in individual sections, the exhibits of the various colonies. In many cases a nucleus has been acquired in stores handed over by the Colonial Commissioners from the handed over by the Colonial Commissioners from the
Colonial Exhibition of 1886, the Indian section espeColonial Exhibition of 1886, the Indian section espe-
cially starting, through this means, with a considerable display.
In his letter to the Lord Mayor of London in 1886, the Prince of Wales sketched in outline the objects of this Jubilee memorial, the form of which is due to his own suggestion, and which has taken definite shape uuder his constant active supervision. It was to be "at once a museum, an exhibition, and the proper locality for a museum, an exhibition, and the proper localit
the discussion of Colonial and Indian subjects."
The grants already guaranteed by several of the great colonies insure their active interest in the maintenance of their own sections.
In their own stately chambers in the front of the building, decorated with woodwork sent from the colonies themselves, the special conferences of the British American representatives, and of the British Australasian in the west wing, and those of the British African and the British Indian in the east wing, may be expected to decide issues of great commercial importance. The colonial importer and the manufacturer of the great industrial centers will find a common meeting place for the discussion of kindred interests, while opportunities will beafforded for the inspection in the galleries of samples of the products of every part of the empire. As an intelligence department serves to keep the War Office acquainted with the military resources and requirements of every land
under the protection of the British flag, so a commerunder the protection of the British flag, so a commer-
cial intelligence department will have its headquarters in the institute, where systematic information upon the commercial development and the products of the various colonies may be obtained for the furtherance of British trade. The details of this systeru are being worked out with great elaboration. The arrangement of the Indian section is most advanced, and in the index museum it is already possible to compare various specimens of cotton flbers, rice, gum, and other raw products. Thus valuable help in no long time will be forth coming from the institute in the improvement of commercial education by scientific organization. Another side of the institute's usefulness will be brought into prominence when its fellows enter upon th if privileges. That these are sufficiently attractive nay
be ganged from the fact that more than a thousand be ganged from the fact that more than a thousand
candidates were elected at the last meeting of the executive council. The annual subscription entitles to free use of the reading and conference rooms and to admittance to the meetings held by theinstitnte, while in the building itself Dooms are set apart for their special comfort, much as in a club house.

A building so vast necessarily requires an immense amount of machinery for purposes of lighting, heating, and lifting. The machine room contains engines capable of supplying electricity for the 1,200 small lamps and 100 arc lights, and of driving hot or cold air through miles of piping. There are eleven lifts worked by hydraulic pressure obtained by pumping engines and power storage plant. The tanks for the
water required in the building are placed in the three
towers, oi which the central will reach an altitude of towers, oi which the central will reach an altitude of
300 feet, while the flanking towers, only one of which has yet been completed, and which will have an exceedingly graceful appearance, will le 178 feet in height. The estimated cost of the building when fully completed is not far from $\$ 3,000,000$.

## The Ox Bot Fiy.

In North America, so far as we yet know, Hypoderma bovis does not occur. Considering the frequency with which cattle have been imported into this country from abroad this fact seems almost incredible, yet until the species is observed and recorded we must consider its presence in America as merely conjectural. The American ox warble, in every case so far observed, is the larva of Hypoderma lineata. This species has come to be known, especially through the South and Southwest, as the heel fiy, on account of the habit which the female has of frequenting the legs of animals for purposes of oriposition. While the eggs are laid on other parts of the body that may be reached by the tongue, the species shows quite a strong tendency to select the flanks and legs around the cattle have of seeking to protect their legs by running into water during the bot fly season finds its explanainto water during the bot fly season finds its explana-
tion in these facts. The eggs are attached firmly, by a strong cleft, in rows of from five to ten or more, to the hairs.
When the cattle lick themselves, the young larve are taken into the mouth, as, under pressure and moisture, the egg readily splits at its anterior end and releases the young larva, which is already well developed when the egg is laid. Doubtless quite frequently the eggs with the contained larveare taken with the hair in this licking, but in either event the larva in leaving the egg is armed with many minute spines, which permit it to adhere to and to penetrate the walls of the cosophagus. Here it soon moults and takes on the second or smooth stage, which for eight or nine months wanders slowly in the tissues of its host. The slow movement and the little nourishment taken reduce the inflammation and irritation to a minimum; in fact, the most remarkable thing in the life-history of this larva is the long period of latency and the slight development that takes place during the summer and autumn months. During the late winter the larva reaches a point beneath the skin in the region of the back and penetrates the ekin, anal end first, as Dr. Curtice believes, and as seems most probable. Here it moults a second time and reassumes its spinogs character, producing more or less inflammation and developing rapidly, with its enlarged spiracles fitted for more perfect breathing. The third moult soon follows, and we get the more strongly spined grub, with its still larger spiracles, which lives in the swellings or sacs so well known to stockmen. It finally works its way out, drops to the ground, which it enters, and where it contracts, hardens, and darkens in co
weeks afterward the perfect fly issues.
That such is the normal and invariable life-history of Hypoderma lineata I think there can no longer be a doubt, and the burden of proof of any departure from it will rest hereafter with those who contend otherwise. That the remarkable life-history of such a well known insect, and one which does so much injury to our cattle interests, should have remained so many years unknown, is only another illustration of the fact that we have yet much to learn of our commonest species.
That this life-history of Hypodermalineata will be fruitful in bringing to light the actual facts in reference to the European Hypoderma boois there can be little doubt. The unity of habit in the same genus, the structure of the egg, as already known, of Hypoderma bovis, and the fact that nothing deflnite is yet known of the earlier larval stages or the mode of oviposition, all convince me that this species will be found in Europe to have a precisely similar life-history.-C. $V$. Riley, in Insect Life.

## The Buak-Ivanhoe Tannel.

On June 30 last there remained $1,084 \mathrm{ft}$. of tunnel to be bored to complete the Busk-Ivanhoe Tunnel, on the line of the Colorado Midland Railroad. M. H. Keefe, the contractor for building the tuonel, estimates that the headings will meet in four months' time. The total length of the tunnel is $9,400 \mathrm{ft}$. The boring from the Ivanhoe end of the tunnel has been temporarily suspended because of the trouble in keeping the tunnel at that end free of water, the pumping plant erected for that purpose having proved inadequate. The grade of the tunnel descends uniformly from the Ivanhoe to the Busk end, the latter being 184 ft . lower than the Ivanhoe end; as a conseguence water follows the workings of the tannel
into the hill at the Ivanhoe end, and to keep the into the hill at the Ivanhoe end, and to keep the
tunnel free of water the contractor erected two Cameron pumps, one with a 8 in. discharge, capable of handling 100 gallons of water a minute, and one with a 4 in. discharge, capable of handling 800 gallons of water a minute ; and also a Deane duplex pump, capable of handling 400 gallons a minute.

## Sorrespondence.

## Forging Copperm

To the Editor of the Bcientiffc American:
In your issue of July 15,
In your issue of July 15, 1893, H. K. gives his experience casting solder coppers and then trying to forge them and failing. I made a solder copper in the following manner:
I had no copper but some scrapsof sheet copper used in making steam pipes. I suppose it was pure. I closed and welded one end of a $1 ; 2$ inch pipe (short piece), melted my copper in a crucible in the forge, warmed the piece of pipe, and set it closed end down in one of the holes in my swage block. Had my copper good and hot, in order that it should be limpid and pour free. I stood well back while pouring it, for fear it should " blow," but it didn't. When it was cold, I split the pipe and took the copper in my tongs, heated, and forged it nicely. I used no alloy or flux. The top end, as cast, was somewhat porous or "bubbly ;" but this only affected it for a half inch or so.
W. H. Woodruby.

Willapa, Wash., July 19, 1893.

## Velocity of Projeetiles.

To the Editor of the Scientiftc American:
In the Scientific american for July 1, 1893, on page 7, appears a "Simple Method of Determining the Velocity of Projectiles." As I understand it, it is entirely wrong and is worthless for the purpose intended. Gravity pulls the projectile down, whether the sights are above or below the bore of the rifle. If the line of sight is exactly parallel with the axis of the bore, then the shot will strike at a certain distance below the bull's eye, whether the sights are above or below the bore. In this case, "half the difference in the elevation of the two bullet marks" will be zero, and hence the effect of gravity in drawing the bullet down is nothing. Absurd! The difference between the bullet imarks can only be caused by an angle between the line of sight and the axis of the bore. Gravity has nothing to do with the difference.
F. R. Brainard,

## Lieut. V. S. Naoy.

J. S. S. Kearsarge. Portsmouth, N. H., July 28, 1898.

## sperryilte.

To the Editor of the Scientiflc American:
In the letter of your Chicago correspondent published on page 26 of your issue of July 8, 1893, the stato ment is made, relative to sperrylite, that "it is a yellow, dust-like powder, found in pockets, and assays fifteen ounces to a ton of platinum."
While this statement is rather equivocal in its meaning, it is also an erroneous one, in so far as its description of the mineral in question goes. In the last edition of his "Mineralogy," Prof. Dana describes the species as occurring in minute crystals, usually in cubes or cubo-cctahedrons, etc. . Fracture conchoidal. Luster metallic, brilliant. Color, tin-white. The specimens usually seen in collections agree closely with this description. Neither is it a fine powder. It occurs in scription. N
small grains.
As this is one of the most interesting minerals recently described, I thought the mistake of sufficient importance to call your attention to.

Georgr Vaux, Jr.
Bryn Mawr, Pa., July 28, 1893.

## Preserving Batter with COs.

It is some time since the solidification of carbon dioxide has been effected, and in such a manner as to ender the article of considerable commercial value, and readils adapted to a multitude of useful purposes. Two fresh instances, says Le Génie Civil, have recently presented themselves of the extensive sphere opened to the application of the frozen gas. By its aid, butter can be preserved, without in the least interfering with its taste or general properties. The process of preservation consists in placing the butter in an iron vessel, or it can provided with a pipe and tap, by means of which the carbonic acid is injected under a pressure of six atmospheres, and drives out the air. In this condition the butter will remain fresh for four or five weeks. The second instance is one in which the carbonic acid is forced into whey to the point of saturation, and converts that liquid into a refreshing and agreeable beverage which "fizzes" like champagne. The carbonated whey can be inclosed in siphons like ordinary mineral waters, and will remain fit for use for the next six weeks.

## Touts with Emmonsite.

The ordnance officers are making some interesting tests of high explosives at Sandy Hook. Shells filled with gun cotton and with emmensite were fired recently from the 12 -inch mortars. The object of the test was to see if emmensite could be fired without danger of explosion of the gun or mortar. The emmensite shell carried 87 pounds of the explosive. The tests were successful, and when a proper fuse has been secured the army and navy will have an explosive even more efficient than the melinite of the French artillery.

WORLD'S FAIR NOTES.
(Continued from page 115.)
The landscape gardening in the Exposition grounds is very grand. The park stretches along the southern shore of Lake Michigan and for about a mile there is a graceful curve with a low sloping beach upon which the waves splash, usually with the gentleness of a land-locked arm of the sea, but during a storm with a vigor that approaches that of the ocean itself. A broad promenade follows along the edge of the beach, giving a beautiful view of the lake and the many buildings that face it. Two canals extend from the lake into the center of the Exposition grounds, giving outlets to the waterways called the lagoons and the Basin with their connecting canal. These waterways, especially the lagoons, are superb. I am told these are not natural, but that they were dredged out and the earth taken from them used to raise the foundations of the Exposition buildings above the line of the swamp of which this park consisted before the Exposition was located here. The banks of the lagoons are lined with foliage, all aquatic shrabs indigenous to northern Illinois being transplanted.
In the center of the lagoons is what is called the Wooded Island. This is the garden spot of the grounds. It comprises about ten acres and is laid out with winding paths. Nearly all of its area is given over to the exhibits of flowers and flowering shrubs and foliage plants. The Basin is a body of water of considerable size walled in on all sides by walls of staff resembling marble, and surrounded by the noblest of the Exposition buildings. In fact, the region about this Basin is called the Court of Honor; here the illuminating in the evening is done, and in this vicinity are located the grandest works of sculpture and architecture.

The collection of old watches in the Swiss section of the Manufactures building is very curious, as it shows the gradual advancement of the science and art of horology from the clumsy affairs of former centuries to the matchless timepieces of to-day. The oldest watch on exhibition bears the date 1074 of the Hegira, the watch being of Arabian workmanship. The watch has a hammered bronze case, which covers works of oriental simplicity. The hand marked the hours on a dial inscribed with Arabian numerals. A "Nuremberg egg," dated 1550, is shown, as well as a watch which dates from the time of the French revolution. The dial divides the day into ten hours and each hour into 100 minutes, according to a decree of the National Convention, which ordered that the decimal system be used for all measures. Some watches are shown which were made by the great-grandfather of Jean Jacques Rousseau. A wooden watch made by a Siberian convict attracts many visitors. The workmanship was so marvelous that such a workman could not be lost to art, and he was pardoned. Some of the modern watches are wonderful. Watches for rings, bracelets, etc., are shown mounted and unmounted. A spring in the back of a small beetle opens, displaying a tiny watch.
The lighting of the Ferris Wheel is effected by means of 1,400 electrical lamps.
A model of St. Peter's, at Rome, is exhibited near the Ferris Wheel, in the Midway Plaisance, by L. De B. Spindor. The model is 30 feet long, 15 feet wide, and about 15 feet high. Two men in front of the building, dressed in the orthodox uniforms of the Swiss guards of the Vatican, bid for custom with trombones. The model is made of wood, and is covered with a kind of varnish or stucco, which imitates stone. Various other models are included in the exhibit, as the Milan Cathedral, St. Agnes' Church, at Rome, the Piombino Palace, etc.
A gigantic flagstone is exhibited from Colorado. The stone is 25 feet long, 8 feet wide, and 10 inches thick.
A writer in the Century Magazine gives the following advice to visitors: Take a day first to satisfy your curiosity, to gratify your sense of wonderment and your love of beauty, to get your bearings and discover how much exertion you can support. Go all over the Fair grounds, and to the top of at least one of the big domes or towers. See the Fair, as a Fair, from its various centers and from different parts of its circumference, especially from the lake. I think you can do this in one or two days, if you start early and end late, if you are strong, and if you have yourself conveyed by all the available means of conveyance-encircling railways, boats, and rolling chairs-and if you do not step inside a single building except for the ascent in search of your bird's eye view. Then go home, stayjn bed the following day, if you are wise, and the next day spread the wings and stiffen the spine of your conscience, and go in search of the things you have come to study-steam boilers or roses, fishes or stuffed birds, needle work or statistics of idiot asylums, methods of slaughtering men or cattle, or of preserving human life or edible fruits. Stay at this task until you have finished it, or until it has exhausted your powers of application. Then release and relax yourself. Go to see something else-palms if you have been studying plows, pictures if you have been studying electric notors.

## COLTMBIAN COLTEBIAN EXPOSITION-A VIEW IN COLUMBIAN AVENOE, AND LIBERAL ARTS.

The Manufactures building is at once the wonde nd the glory of the Fair. This huge structure, which is rectangular in form, measuring 1,687 by 787 feet, was designed by Mr. Geo. B. Post, of New York, and the great fabric abundantly testifies to Mr. Post's ability as an engineer as well as an architect. The Manufaetures building is said to be the largest roofed building ever constracted, and some idea of its magnitude may be obtained when it is stated that the tota floor space of both the main floor and gallery is fortyfour acres. The Palace of Mechanic Arts at the Paris Exposition of 1889 could be placed inside the Manufactures building without touching any portion of the walls or roof, even with the Eiffel Tower laid flat on top. Seventeen million feet of lumber entered into the construction of the building, as well as $12,000,000$ pounds of steel and five car loads of nails. The amount of staff used on the exterior could not be easily calculated. The total cost was $\$ 1,700,000$, and this cost would be entirely paid up if the building could be filled with an audience at $\$ 5.65$ a head, for the build ing would seat 300,000 people or three and three quarter imes the seating capacity of the coliseum at Rome.
The exterior of the building is plain, which adds to its effect of grandeur. Decoration is entirely subservient to construction, and decoration is shown chiefly in the eight entrances, over each of which is a small
dome, decorated by a celebrated American artist. All effects of colorare obtained by llags and pennants on the roof. Crossing the bridge by the Electricity building, the main entrance is reached. There is really no difference in the entrances, but the one through which the greatest number of people enter the building, is called the main entrance. Passing under the beautifully decorated dome, the visitor enters the great building and in a moment stands in Columbian Avenue, the main thoroughfare trance and looking north the effect is grand. On each side rise the exhibits of foreign nations, which in many cases come from thousands and even tens of thousands of miles. In the distance the clock tower breaks the seemingly endless vista. Overhead the huge trusses show the skeleton which forms the backbone of the building. Suspended from the roof are.great coronas of arc lights, which alternate with huge flags. At the left of our illustration will be seen the pavilion of a sister republic-Switzerland. The collection of watches in the Swiss section is very wonderful, and some of the tiny examples of the horologists' art seem almost too small to keep time. Directly beyond the Swiss pavilion rises the lofty tower of the Danish section. The exhibit of Denmark, and in fact all of the northern countries, is very creditable. A narrow aisle Just beyond thark from Ganall be noticed the obe lisks surmounting the pavilion of Austria. At the right of the cut, near the bottom, is the section of Norway, which is admirably flled with the products of the land of the midnight sun.
Beyond the Norwegian section is the carved wood pavilion of Russia, which contains marvelous works executed in silver, malachite, rhodonite, and lapis lazuli. This section was opened by a mitered bishop of the Greek Church, with all the pomp and ceremony of the Greek ritual. The Belgium pavilion is beyond the Russian section, and beyond this again is the very ornate façade of the French section. The entrance to
the French section is very imposing, and is justly admired. The column with the ball on the top, just beyond the clock tower, is the beginning of the United States section, the column being directly above the exhibit of Messrs. Tiffany.

## Queen of the Eventng sky.

Venus, after an absence of nearly a year, has again made her appearance as an evening star, and may now be seen for a short time in the early evening in the west. She will continue to adorn the western skies and brighter, and not reaching her greatest brilliancy until the 6th of January next.
As Vesper, the evening star par excellence, this brilliant planet, which Homer, ages ago, apostrophized in words indorsed by all succeeding generations as "the most beautiful star that stands in the beavens," is always a welcome visitor and an object of keen interest for every one whose eyes are open to the beauties of the starry firmament. As a "naked eye" object, it stands without a rival. Even Jupiter, the giant of the solar system, and Sirius, the giant among the fixed stars, pale before Venus when at her brightest.
One would sappose that Venus would form a spendid object for a telescope. On the contrary, it is one of the most difficult objects in the heavens to see satisfactorily with this instrument. Its dazzling light brings out all the defects of a telescope, and, being low in the heavens after dark, it is always more or less tremulous. The best telescopic views of Venus are obtained in broad
daylight, when it is high abovethe horizon. All aatra
nomical studies of it are made at that time. Thus viewed, with its strong light subdued by the glare of the day and posed upon a background of blue sky, it is indeed a beautiful object, resembling the moon seen under the same conditions, but free from the dark blotehes that disfigure that luminary.
Venus has no markings distinguishable with a small elescope. It is interesting mainly for its changing phases. Being an "inferior" planet, and passing at times between us and the sun, it goes through the same changes of aspect as are familiar in the monthly changes of the moon, with the important difference that, being when "full" nearly seven times as far a way as when in its most slender crescent phase, it under goes a corresponding change in apparent size.
As it appears now, having but just emerged from behind the sun, it is nearly full. On December 6 it will be at its greatest apparent distance from the sun, and on January 6 it will have attained its greatest brilliancy. After this last date it will draw rapidly toward the sun, and its crescent will grow more and more slender until it becomes invisible, except through the largest telescopes.-Phila. Record.

## An Invention Wanted

United States Consul Edward Bedloe, writing from dmoy, China, to the State Department, says:
A fortune lies in store for the man who will discover some process for cheaply making wood proof against white ants. These pests are the curse of existence in Amoy and every other tropical or sub-tropical city. Their voracity is incredible. They ate the framework of a new door in this consulate in three weeks. In the same period they almost consumed a large and handsome cabinet in the court room and a heavy pinesettee in the anteroom. Their work isinvisible. They attack the wood from a mere point, through which they bore to the interior and there eat everything until only a shell or film remains. Wood which will successfully resist these insect pests must be thoroughly charged with some powerful chemical, both poisonous and nonevaporable. A solution of corrosive sublimate, chloride of zinc, arsenic, or antimony would seem to meet the want. But how to force these into the fibers until the atter are saturated, and to do so at a merely fractional cost of the wood itself, is the problem that confronts the inventor. The American genius is so prolific in invention and discovery that I feel assured the problem will be satisfactorily solved.

## The Comet through Lick Lens.

Director Holden, of the Lick Observatory, has pre ented the San Francisco Examiner with an exact reproduction of a photograph made with the Lick telescope by Professor W. J. Hussey, of the comet now at tracting attention in the northwestern sky. The plate was exposed from $9: 10$ to $10: 20$ on the evening of Thursday, July 13. The picture is intensely interesting.
It shows, says the journal mentioned, "what was doubtless the earliest apparition of the 'secondary' comet. In the tail of the great comet is to be plainly discerned the nucleus of an 'auxiliary' cometforming, just as the Holmes comet was seen to divide into sepa rate components when Barnard photographed that very interesting object last November. Usually comets have been supposed to divide at the nucleus through some force not thoroughly understood, as in the case of the celebrated comet of Biela, or again when Sawerthal's comet of 1888 exhibited no less than three distinct nuclei. But with the Holmes comet, and that now under observation, the separation seems to be effected in the tail of the comet. It wonld certainly seem, from these photographs, that the tail of the comet must be composed of solid particles, else how could a secondary comet be formed from it ?"
There is no record in all astronomical history of one comet within the tail of another. As yet there is not enough of data obtained to determine whether the comets have the same or different rates of speed, or whether they are near to or remote from each other. It may be that the "secondary" was formed out of the brighter comet, either through some internal disrup tive action, or as the result of the more or less intimate contact with some other celestial vagrant like itself. Of course, comets have been known to dissolve. Some also have been observed to break up; but the parts have never been seen to present the like apparent relative positions as in the present instance. Theories to account for the phenomenon may be imagined in any number ; but there are not enough of well-ascertained facts to sustain a single plausible one of them.

## I,arge Guns for the Navy.

The experience of Great Britain and Italy has not tended to predispose our authorities in favor of exceptionally heavy ordnance. The 110 ton guns have been removed from Italian ships. The war vessels Indiana Massachusetts, and Oregon are each to be supplied with four 13 inch pieces. They are nearly 40 foet in ength. The diameter at the breech is somewhat over 4 feet and at the muzzle 21 inches. These guns throw a projectile of 1,100 pounds, with 550 pounds of powder

## An Anti-Smolre leaw.

The legislature of Massachusetts, at its last session, enacted the following law relating to the prevention of smoke:
"In cities of over 800,000 inhabitants, no personshall, after the first day of July, in the year 1893, use bituminous coal for the purpose of making steam in boilers in any building, unless th furnace in which said coa is burned is so built, managed, arranged, or equipped that at least 75 per ent of th moke irom said coal is consumed or oth rwise prevented irom entering the atmosphere, the degres of suppression being determined by the quantitiy of such smoke emicted, as shown by the density and color of the issuing smoke, and the length of time which it is visible, the maximum standand of comparison being a continuous discharge of dense, dark smoke during the time the furnace is in aotive operation."

## MILL ENGINES.

The illustration represents a pair of high-pressure non-condensing reversing mill engines, as constructed by Galloways, Limited, Manchester, for Messrs. Leach, Flower \& Co., of the Melyn Tin Plate Works, Briton Ferry, and shown in the Engineer. These engines

## Volatility of motale.

Intarasting experiments with the electric farnaceare, says Nature, described by M. Moisean in the carrent number of the Comptes Renders. By attaching to the fo ace a condensing tube of copper shaped like the letter D , and 80 constructed as to be surrounded by an outer jacket of cold water constantly changing under high pressure, M. Moissan has been enabed to distill and condense most of the elements which have hitherto been found so refractory. When a piece of metallic copper, weighing over a hundred grammes, was placed in the inner crucible of the furnace and subjected to the are furnished by a current of $\mathbf{3 5 0}$ amperes, brilliant flames shot forth from the apertures through which the carbon terminals were inserted. The flames were accompanied by copious yellow fumes, due to the combustion of the issuing vapor of copper in contact with the oxygen of the air. After the expiration of five minutes nearly thirty grammes of copper had been volatilized. Under the cover of the furnace an annular deposit of globules of metallic copper was found, and upon examination of the condensing tube a large proportion of the volatilized copper was discovered condensed in almost a pure state.
It has long been known that silver is volatile; it is
limate of a deep purple color. Manganese is remarkably volatile. A quantity of the metal weighing four hundred igrammes entirely volatilizes in ten minutes. Iron is likewise readily distilled, and is deposited in the form of a gray powder, among which are inter spersed numerous small particles exhibiting brilliant surfaces.
Not only are the metals capable of distillation at the temperature of the electric arc. Silicon rapidly vola tilizes and condenses in the copper condensing tube in minute spheres and dust. Carbon becomes almost immediately converted to graphite, which distills over into the condenser and deposits in the form of light semi-transparent plates, which hy transmitted light exhibit a beautiful chestnut color. Distilled carbon would thus appear to consist of the fourth variety of the element recently described by M. Berthelot. The refractory alkaline earths, appear also to be capable of distillation in the electric furnace. The experiment succeeds best, however. with a more powerful arc. Em ploying an are furnished by a current of a thousand amperee, M. Moissan has distilled one hundred grammes of lime in five minutes, the vapor condensing in the copper tube like fine flour. Magnesia passes over some what more slowly than lime, but its distillation is one


ROLLING MILL ENGINES, MELYN TIN PLATE WORES.
embody the results of the very large experience which the makers have had in supplying machinery ally The engines in queation have cylinders 40 in. bore and 4 ft .6 in . stroke, the main shaft has a singlesweep crank for one cylinder, the other cylinder gle-sweep crank for one cylinder, the other cylinder
being connected to a crank pin secured in a disk at the end of the shaft, this disk being arranged to balance the connecting rods of both engines, as well as the sweep crank, so constituting a very simple and efficient form of connection to the mill. The valve gear, as will be seen, is on Joy's system, which lends itself admirably to the type of engine here illustrated. The platform is so arranged that the man handling the engine looks direct to the rolls, and has under his immediate control the reversing gear, steam stop valve, regulating valve, waste water valvea, and the lubrication of the steam oylinders.

## Nataral Water Pipen.

A curioas phenomenon has zeen discovered near Eddy, New Merico. In Dark Canyon, about three mbles from Eddy, a number of tunnels were run in order to tap streams of water to get a supply for the waterworks. The waterwas found running in small natural pipas, made by the deposit of lime from the water. The whole space cut by the tannels was found to be perforsted with these lime pipes.
above description silver may be brought to full ebulli tion in a few moments, and it distills with ease, condensing in the copper condenser in the form of globules, whose size varies from that of small shot to spherules of microscopic dimensions, and a certain proportion is usually deposited in the form of arborescent fragments. Platinum fuses in a few minutes, and very soon after commences to volatilize, and condenses in the U-tabe in brilliant little spheres and fine dust. Aluminum distills very readily, and condenses in the form of a gray powder, containing admired spherulesexhibiting brilliant metallic luster. Tin likewise distills with facility, and the condnesed product usually contains a considerable proportion of a curious fibrous variety of the metal. The distillation of gold in the electric furnace is particularly interesting. Abundant fumes of a light yellowish-green colorare emitted at thibelectrode apertures, and the metal is deposited in the condenser in the form a powder, exhibiting a beantifnl purple theen. The powder consists of minute ragalarspheres, which, when examined under the microecope, appear to refleet the usual yyellow color of pold. Upon the under side of the cover of the furnace three distinct annular deposits are obsorved, the inner one consisting of yellow globules of considerable size, round which is a metallic deposit of smaller spheres of such a size as to reflect a bright red tint, and outside this is an annular sub-
of the prettiest of these remarkable experiments, the tints assumed by the escaping fumes and the brilliance of the incandescent vapor being particularly striking. Illustrations of the electric furnace and other interesting particulars will be found in the Scientific American for May 18, 1893, and in our Supplement, Nos. 898, 201, 804, 905.

## A Loenst Yoar.

The Department of Agriculture has sent out circulars making inquiries over a widé extent of territory regarding the "seventeen-year locusts," which have made an appearance this vear in eight States of the Union. The object of the department is to ascertain accurately the limits of the areas occupied by the insects. There are twenty-two known broods of them, and they turn up in different years in various parts of the country. Though to some extent the infested territories overlap, each brood comes out of the ground only once in seventeen years. Strictly speaklng, the insects are not locusts, but cicads. Bome jears ago it was sought to introduce these insects an an article of diet; but the experiments in that lirection did not promise success. Clearing of land has done much to diminish the number of these creatures; but their most destructive foe is the English sparrow, which drops every other kind of food and feeds on them exclusively when it has the opportunity.

## HOO-DEN, OR JAPANESE BUILDING.

The Hoo-den, or Japanese building, on the Wooded Island is a very attractive building. The building is in three sections, the center one being a fac-simile of a room in the Nijo Castle, Kioto, built by Tokugawa Iyeyasu in 1601. No expense has been spared in the execution of these buildings and in the selection of their choice contents. Though the buildings aresmall $t$ still they are without doubt among the most expensive of the foreign buildings on the grounds. The entire series of buildings is presented to Chicago by his Highness the Emperor of Japan.

## SOUTH 8EA IBLAND VILLAGE

The South Sea Islanders have an exhibit in the Midway Plaisance consisting of four Samoan houses constructed by natives. The largest of the houses tood for ten years in the village of King Mataafa and made from the wood of the bread-fruit treethatched wenty-five villagers, natives of Samoa, Fiji Islands, etc.
Aluminum Solder.
This is an alloy consisting solder.
to 3 (or even 4) of silver, and 2 to 4 (or even 5) of copper. A silver-copper-zinc-aluminum alloyand a silver-brass-aluminum alloy are also described; moreover, the zinc may be replaced by cadmium or bismuth or a fusible alloy, such as "Wood's metal." A small proportion of gold may also be added. In making the alloys, the copper and silver are first melted together, molten aluminum added, and solid zinc then dropped in. To use the alloy it is broken up and spread between the use the alloy it is broken up and spread between the
surfaces of the articles to be soldered, previously heated. These are then pressed together with the solder ed. These are then pressed to
ing iron. No flux is required.

the palace of electricity.


THE GOVERNMENT BUILDING.


SOUTH BEA IBLAND HUT.


JAPANESE HOO-DEN - WOODED ISLAND.


VIEW ON THE LAGOON LOORING NORTH-PALACE OF MANUFACTURES ON THE LEFT,

the marine casino.

## Some Rutinet Lakee

RALFH s. TARE.
The investigations of members of the United States Geological Survey have revealed to usmany interesting episodes in the geological history of the country, and have thrown much light on the physical geography of the past. Two of these events in particular are of interest, for the reason that they tell of most interesting changes, not only of geograpby but of climate. I refer to the former existence of great lakes, one in the vicinity of Great Salt Lake, the other in the valley of the Red River of the North.
It was very early known (indeed, the early settlers could see it) that there had at one time been a great lake on the site of the present salt lake and desert in Utah. The early explorers noted the presence of terraces, flat-topped and often of remarkably uniform height, which they knew to be water-formed. There were bars, also, across the mouths of side streams, and spits, wave-cut cliffs at headlands, and, indeed, all the phenomena of lake shores along these terraces. Not only is there one terrace, but several which mark changes in the level of the lake

Mr. G. K. Gilbert, of the United States Survey, undertook the task of unraveling the history of this re gion as shown by the terraces and gravels, and has published a most fascinating account of his results as a monograph of the United States Geological Survey, bearing the title of "Lake Bonneville," the name given to the extinct lake. What I have to say in this part of the article is merely a summary of his book, which every one interested in the subject should read.
Every tourist to Salt Lake City must have noticed the flat benches clinging to the mountain sides and have marked the flat desert tract in which the Great Salt Lake is situated, and, perhaps, have wondered what it means. They may have noticed the small inountain peaks rising from the desert like islands in the sea. These were once islands, and now they rise out of the lake sediments in which they are partly buried.

The mountain streams flow out upon the plain and disappear in the gravel. Here and there a shallow pool of saline water stretches over a depressed part of the plain, where some unusual rains give to thestreams an excessive supply of water; but these soon evaporate and leave a dry mud, flat ertarsh, perhaps glistening with salt or alkali. The tc- playa hasere given to these patches, and when שweyaretransfornersto a lake they become playa lakes. are continuous and their current sufficiest, accumulate and remain throughout the thére is no escape for the water except through evapo ration, and as evaporation takes only the pure water, and as all water carries salt and other substances in solution, obtained as it passes over the rocks, this is left behind, and each year the undrained lake becomes salter.
This is the present condition, and for many years the region has been in essentially this same condition; but a study of the terraces shows that at one time this great basin was filled with water and overflowed by way of Red Rock Pass into Marsh Creek and thence into the Columbia. This is shown not only by the high terraces, but also by the outlet itself. At present this outlet is a divide occupied by small vacillating streams and dry channel-ways, and by the crumbling of its steep walls it is being clogged. That it was once occupied by a mighty torrent might almost have been determined without the additional evidence of the as sociated shore lines. It has been cut to a depth of several hundred feet, with a width of a third of a mile.
When Lake Bonneville was full of water to overfiowing, it had a surface of 19,750 square miles-a magnitude ranking it with the Great Lakes. It maximum depth was 1,050 feet. Of it Mr. Gilbert says: "If the water were to rise again to its old mark, more than one hundred towns and villages would be submerged and 120,000 persons would be driven from their homes. The Mormon temple would stand in 850 feet of water," and 700 miles of railroad would be immersed.

The history of the lake is even more complicated than has been indicated. There is evidence that long before the existence of the overflowing lake the site was practically dry and arid. The water afterward rose, but not to its rim, and then another change in climate occurred and aridity again set in and the lake basin became nearly if not quite dry. A second rise occurred, and this time the lake overflowed to the ocean. Since that time the climate has been growing progressively more arid, and the author predicts that this may possibly continue until even the last remnant of the salt lake is evaporated. The evidence of these changes is conclusive, and will not be given here, but can be found in the monograph.
As to the duration of these periods, little can be said that is definite. The first period of aridity was probably much longer than any subseguent one, and the flrst rise of water a ppeara to have lasted nearly five times as long as the second. The intervening dry period appears to have beenof greater duration than the present period of aridity. There are no data at hand present period of aridity. There are no data at hand
for an estimate of this period in years; but if, as ceams
probable, they were associated in point of time with the advances and retreats of the ios in glacial times, each episode must be represented in thousands, perless reliable, it hasobeen estimated that the close of the last glacial epoch was not far from 10,000 years ago, and it seems probable that at this time the last period of desiccation set in. We, therefore, have a rough basis for a calculation in years.
Just why these climatic changes have taken place no one can say with definiteness, although there is no lack of theory to acconnt for it. The presence of a body of ice on northern America would amply account for an increase of precipitation; but here the difficulty is not lessened, for we must account for the ice. Some suppose that the land was higher in the north, and hence colder. Others suppose that astronomical causes must be sought for; and still others that a change in ocean currents accounts for the climatic variations. Many think that the real explanation is a combination of two or more of these causes. This much we know, that the present arid condition of the region is the result of the dryness of the air, which has been robbed of its moistare as it pasees from the sea over the land and over the high monntains; but why this wasnot formerly the case, we cannot adequately explain.
Other interesting
Other interesting phenomena are revealed by this
study. Before, during, and since the , during, and since the period of high water, the great basin has been the seat of considerable volcanic activity. At times the lava has flowed on the margin of the lake, again it has entered the waters, and volcanic eruptions have occurred even in the lake itself. At present, all volcanic activity seems to have cersed, though some of the lava has been erupted
in very recent times.
Not only has the level of the waterchanged, bat even the level of the land has suffered a change since the water sank below the terrace levels. Lakebeacheeare, of course, all formed in a horizontal position, and normally they should be at the same level in every part. But some of the terraces of Lake Bonneville are disturbed by faulting and folding, and are no longer level. These changes may possibly be associated with the volcanic eruptions.
It is not improbable that there are secularvariations of climate, extending over great periods of time and changing so slowly as to have escaped our attentiongreat curves of variation, first of dryness, then of aridity, dependent upon some cause which we have not yet discovered. There even ceems eome reason to suppose that the world is at greant to a coadition of aridity. Arid basins are common in varions paite of the world, and many of them seem to show signs of having been at one time ocoupied by water, as was the great basin of the West. There are many ingfances of this, and the ancestor of the Great Salt Lake is by no means the only one in the plateau region of the West. There are many such lake beds in New Mexico, Arizona, Nevada, and also in other parts of the world; but of foreign examples watnow little, for their history has never been studied in detail.

The second instance of a great lake, now extinctthat of the valley of the Red River of the North-is also associated in origin with the glacial invasion, and it has been appropriately named Lake Agassiz, in honor of the one who flrst proved that the northern part of the continent had been occopied by an ice sheet. This has been studied in much detail and reported upon admirably by Mr. Warren Upham in reports of the Minnesota State Geological Survey and in the ;publication of the Canadian Geological Burvey. He is also preparing a monograph upon the sabject for the United States Survey.
Here, as in Utah, the lake beaches, bars, terraces, and cliffs mark the history of the lake, and the broad, flat plains of the Red River Valley record the presence of a sheet of water. At present the Red River flows north through the plain; but when Lake Agassiz existed it was forced to flow southward, into the Mississippi. Here, too, the outlet was through a broad, deep valley, now partially clogged and occupied by shallow valley, now partially clogged and occupied by shallow
lakes and swamps, forming the divide between the lakes and swamps, forming the divide betw
drainage of the Arctic and the Gulf of Merico.
The history of this lake is simpler and more easily anderstood than is that of Lake Bonneville. As the ce disappeared from the country, ite front stood at sucoessively different positions, gradually retreating northward. At one time it must have stood south of the divide bstween the Mississippi drainage and that of the Red River. Later, it stood on the divide, and, finally, north of the divide. It then formed a wall acruss a north-flowing stream and forced it 'to flow southward. Since the old preglacial valley existed with a northerly slope, a lake was formed with thetwo valley walls as east and west banks, theice front as the northern boundary and the divide as the outlet, through which the mighty torrent, farnished by the melting ice, passed-a veritable Niagara in volume. When, finally, the glacier disappeared from the valley or perinitted the natural northerly flow to begin, the lake dwindled down and finally dicappeared, leaving
ence ; but this is sufficient, for the story is most plainly told by them. Like Lake Bonneville, its history was complicated, and at different times its surface was at different heights, since the ontlet varied when the ice allowed its escape through some lower channel. Unlike Bonneville, there is one shore not now to be seen, and this is the shore line cut in the northern ice wall nd which disappeared wben the ice went.
Mr. Upham estimates the area of Lake Agassiz, when it was at its highest stage, at about 110,000 square niles, and it then exceeded by more than 15,000 square wiles the total area of the five Great Lakes combined. The area of the three great lakes, Manitoba, Winnepeg, and Winnipegasis, aggregate about 12,500 square miles, and they exist in the basin of extinct Lake Agassiz, being in a way descendants of that great lake, filling shallow depressions which were not filled with lake sediments. During the formation of the highest beach, the depth of Lake Agassiz was in many place as great as 500 or $\mathbf{0 0 0}$ feet. It was thus a colosssl lake, reater than any now in existence on the earth.
The type of lake to which Lake Agassiz belongs is essentially extinct to-day, though it was very common on a smaller scale when the ice sheet was disappearing. Many of the north-flowing rivers of New England were thus dammed and their valleys transformed to lakee The area of the Great Lakes was at times changed and enlarged, and their outflow was through different channels at different times. At present there are in regions of valley glaciers small lakes formed by an ice dam across a stream valley; but they are pygmies compared with Lake Agassiz, and are interesting chiefly as they show at present, on a small scale, what was ormerly common on a much larger scale.
These two instances of great lakes now extinct are interesting, not only in themselves, but chiefiy in showingnsthat the presentconditionsof physical geography are but stages in a great and complicated history, and not, as we are too apt to think, fixed and permanent parts of the earth. Everything in nature is changing geographical forms no less than others. These are perhaps, exceptional cases, showing unusualle great changes in a comparatively short time ; but thiey are, neverthless, instructive, and may be taken as indices of other great changes of a different character, acting more slowly bat, nevertheless, surely.

## A Youth's Prospeets in the U. 8. Navy

Boys of good character, who have no phyaical defeet, and who can read and write fairly well, are admitted ipto the natr between the ages of fourteen: and eighteen years. Between fourteen and fifteen years a boy must measure 4 feet 9 inches in height, and weigh not less than 70 pounds; between fifteen and sirteen, 4 feet 11 inches, and 80 pounds; between sixteen and seventeen, 5 feet 1 inch, and 90 pounds; and between seventeen and eighteen, 5 feet 2 inches, and 100 pounds. Theymust serve till the age of twenty-one as boys and junior eesmen and after that age they rank as seamen or petty officers. They are now allowed a sum of $\$ 45$ for outfit, a fact which considerably enhances the value of the service. To discover the exact number of petty officers on board a rully equipped ship is by no means an easy task; but, at all events, the number of these minor prizes is encouragingly large, while still higher up, as the final goal of the common sailor's aspirations, are the substantial bertbs of the four warrant officers-held by the boatswain, the carpenter, the gunner and the sail-maker-whose pay and privilegesare the same as those of the junior officers. And now as to rates of pay : The pay of boys enlisted as third-class apprentices is $\$ 9$ a month; the next promotion, to second-class apprentice, brings 110 ; the next, to first-class apprentice, $\$ 11$ a month. Further on we have secondclass seamen apprentices with $\$ 19$ a month, followed by first-class seamen apprentices with $\$ 24$ a month, these two grades corresponding respectively to ordinary seamen and able seamen, or simply seamen, whose pay is also $\$ 19$ and $\$ 24$ a month.
It can thus be seen that a first-class seaman apprentice and an able seaman get each the respectable sum of \$288 a year, which is $\$ 128$ in excess of the highest sum paid to a first-class seaman in the British service, the only other navy in the world worth consideration on the score of pay and promotion.
There is, besides, the daily ration of thirty cents, which runs through the ship from the apprentice to commander, for, strange as it may appear to some people, Uncle Bam distributes just the samefare to the officens as to the apprentice, and that, too, only when on sea duty. There are no other allowances whatsoever made to the officers; they have to furnish all their own mess equipments and everything else. -Harper's Young People.

## wotion of the sun through space.

Mr. A. D. Risteen, in a recently published paper in the Astronomical Journal on a new method for determining the direction of the sun's motion through space, concludes that he has obtained results which not only show the reality of such motion, but that its rate is 109 miles per second.

## Mifea.

Mica fills the interstices of modern progress. A few decades ago we were seeking practical use and market for the output of mica mines already found; now we are seeking new mines to supply the multifarious uses to which mica can be applied. Thus the law of necessity changes in its relation to all things.
Mica is now as essential to the various uses of electricity as this great force is necessary to human progress. In all appliances for electrical lighting and power the most important reciprocal agent entering' into their machanism is mica. All armatures are built up with its insulation, whether for dynamos, motors, generators, or transformers. Without its use as an insulation the core of the armature would burn out with a flash. But by placing sheets of mica between the thin sheets of iron, which are secured to the shaft that runs through the drum of the armatnre, insulation becomes perfect. Thus armatures of even the largest generators can be rnn for twenty-four continuous hours without heating them more than $80^{\circ}$ Fahrenheit above the temperature of the surroundng air. By this use of mica the lines of force are dissipated, but do not lose any of their electrical energy.

In all electrical safety appliances mica also performs an important part as an insulator. To its infusible and indestructible nature rheostat can be ascribed.
This wonderful mechanThis wonderful mechan-
ism, which is applied as a motor starter, a governor of speed, a reversing switch, and an automatic safety switch, is absolutely fireproof, and can be subjected to a red heat without mechanical injury. This is rendered possible by making the resistance of thin plates of iron pack ed clemely together, but separated by mica.

Thus the lines of force operate on the same principle as in the armature. Aside from these import ant uses of mica in electrical apparatus, it is also applied to a thousand minor ones, which make it the constant and willing servant of the greatest power that man has turn ed to intelligent subjugation.
Mica is also an important factor in many branches of manufacture and art. Owing to its peculiar elas. ticity and toughness, qualities in which it is not ex celled by anything natura or artificial, it is used as an absorbent of nitro glycerine, and when so used explosions by percussion are rendered almost impossible, while at the same timenotbing is taken from the energy of the nitro-glycerine when exploded by fulminates or similar device. For such purpose the plumose mica is used, or that in which the scales are arranged in feathery form.

The prismatic or foliated mica is also used by passing it through a mill. This vastly increases the mica's bulk and forms masses of bran-like scales, translucent and beautiful. The French silver mouldings are also made with this ground mica. The unalterable nature of mica and the fact that it entirely resists the action of corrosive acids, smoke, and dust, make it a'valuable material for edificial decoration. It can be readily colored or metalized, and its transparency preserves in all its pristine beauty anything to which it is applied. This ground mica is also used as a lubricant and axle grease, and for such purposes has no superior except plumbago. Coarsely pulverized, it is also used for roofing material and as a fireproofing for iron safes.

The cleavage of mica is so perfect it is estimated that it can be split or divided into leaves 250,000 to an inch. Much of its commercial value depends upon this wonderful property of lamination. The largest plates of mica with such foliacious structure are obtained from the Siberian mines, and they some. times attain a diameter of five and seven feet. Crystals over two feet in diameter have been found in Pennsylvania, eighteen to twenty-four inches in New Mexico, and fourteen inches in North Carolina. Blocks of crystals weighing over one hundred pounds are frequently mined. The North Carolina mines are supposed to be very ancient.
trimmed to particular shapes, and it is supposed they were used for windows, mirrors, and ornaments. The number of the mines and the magnitude of these ancient operations excite wonder. Some of the mines are tunneled to a considerable lengtn, and distinctly show marks of chisel-shaped tools. Mica in some form exists all over the earth, but not in quantities of any commercial value. It can be found in granite and quartz rubellite, green tourmaline, feldspar, lepidolite and other minerals, also in granular limestone, gneiss, and slate. It varies in color from white through green, yellowish, and brownish shades to black. Its chemical composition is silicite of alumina and potash, with a small amount of iron, magnesia and soda, and about, five per cent water. -Inter-Ocean.

## VISITING THE VIKING SHIP.

This now famous little Scandinavian vessel, only 74 feet long, which was sailed across the ocean from Norway in May last, is a constant attraction to large numbers of visitors at the Fair. She is an exceedingly well built little craft, but as to this it is said she in no way surpasses the original for which she serves as a model, and the interest in her, therefore, clearly lies entirely in the fact of her being an exact copy of one of the old Viking vessels, such as used to cruise along the English and French coasts about a thousand pears

The speed of a ship at sea approximates more nearly
ago. In this way the vessel affords one of the many valuable historical object lessons in which the Exposi-
tion abounds, and which amplify its far-reaching educational character.

## Fast Deean Stoamerr.

At the recent meeting of Naval Architects, London, Dr. Francis Elgar read a paper on this subject. The author sketched the history of the Great Eastern and compared her construction with that of the Campania, and then passed on to some of the general questions involved by the growing demand for increased speed at sea.
There are already several ships that can cross the Atlantic at an average speed of over 20 knots or 23 statute miles per hour. The Campania crossed from Sandy Hook to Queenstown, on her first voyage in May last, at an average of 21.3 knots, and during one day she averaged $22 \cdot 3$ knots. These speeds are a little over $241 / 2$ and $251 / 2$ statute miles per hour respectively. Among the conditions essential to high speed in all weathers are: (1) Great size of ship; (2) a form suitable for driving easily at high speeds over beavy seas without shipping heavy water, or lifting the propellers sufficiently to cause racing; (3) deep draught of water; (4) steadiness in a seaway; (5) great strength of structure and of machinery ; (6) a large proportion of boiler power, so as to enable a full supply of steam for the engines to be easily kept; (7) a full and well regulated phe of air to the furnaces. to that obtained in still water, with the same propul-


THE WORLD'S COLUMBIAN EXPOSITION-THE VIRING SHIP FROM NORWAY.
sive power, the larger she is made. No doubt length is the principal element of size in this respect; but depth, or draught of water, is also very important. Whatever might be the speed obtained with a ship on trial in smooth water, the extent to which her average sea speed would afterward approach this would depend very greatly upon her size.
The full effect of form upon average speed at sea, over long voyages and in all weathers, cannot be measured by still-water trials.
One of the chief points in connection with the form best adapted for sea speed is that it should offer resistance to pitching. The fineness of ends that would give the best results in smooth water requires to be corrected by the fullness necessary to prevent undue pitching.

Deep draught of water is a most important element of speed at sea, and it is now strictly limited by the depth of water in the ports and docks used by the fast passenger steamers on both sides of the Atlantic. Twenty-seven feet is the extreme limit of depth to which a ship can load on either side. The Campania cannot load an inch deeper than the Umbria, although she is 100 feet longer.
Steadiness is important, not only as a very desirable ement of comfort to passengers, butalso as contributing to speed. When a vessel is rolling heavily from side to side, her resistance must be increased.

He concluded by saying that the improvements that would have the greatest effect in promoting the increase of speed at sea are: Increase of depth of water in harbors and docks, such as would admit of much greater draughts of water being obtained; and improvements in boil. ers, by which greater steam power could be developed out of the same space and weight. The Atlantic trade is increasing at such a rapid rate that larger and swifter ships are certain to be soon called for. The depth of water has lately been somewhat increased at Liverpool ; but much deeperharbors and docks will be required if further great increases of speed at sea are to be obtained without excessive difficulty and excess.

## The New York Aquarlam.

The old historic fortress known as Castle Garden, situated on the extreme point of land at the south end of the city, where the waters of the Hudson and East Rivers unite, is now transformed into a free aquarium. The legislature appropriated $\$ 150,000$ to pay for converting it,
under the charge of the Park Department. The building has been remodeled by Mr. H. T. Wood-
man, a scientific aquarist. Round the walls and beman, a scientific aquarist. Round the walls and be-
neath a light circular gallery are two ranges of brick cells, which will form the tanks, and beneath the dome in the center of the building is a large central tank, which will in time become the home of a white whale or grampus; and six small tanks around the center tanks will be used for sharks, seals, etc. There are thirty-six side tanks in all, which will be lined with white tiles and faced with plate glass. In the gallery eighty-four small tanks will be placed. Great care is taken with the lighting, which is accomplished by means of skylights. Special tanksare provided for the blind fishes, and experiments will be carried on to see if the blind fishes will not, on favorable conditions, recover their sight. Abundant supplies of fresh and filtered salt water will be provided. The three great aqnariums of the world are situated at Naples, Brighton, and Berlin. The present aquarium is much better equipped than the Berlin aquarium, and will doubtless in time rival the other two great aquariums. It is a valuable acquisition to the city.

Lead as a Coating for Iron and other Metals.
To 100 pounds of lead are added 5 pounds of alum inum, 2 ounces salammoniac, $1 / 2$ ounce arsenic, $1 / 2$ ounce of borax or 1 pound of alum, and 1 pound of cryolite. The alloy of lead, aluminum, and arsenic gives a harder and more firmly adhering coat than is obtained in the ordinary process. The plates to be coated are cleaned and passed through the bath in the usual way.

RBGETTLY PATENTED INVENTIONS. Rallway Applianees.
Switch.-John W. Tew, Rome, Ga., and John D. Riggs, Selma, Ala This invention provides such means of locking a awitch that the exerclice relese, thne preventing the altering of the exilch by unauthorized persana. The coastraction is such that when the locomotive stops with one of its wheels on a contact plate the switch will be nnlocked and can be moved as derdrea, being closed and locked again after
the paeasge of the train. The contact plates or tripping locomotive or car to operate them.

## Electrical.

Arc Lamp.-Patrick J. Barrett, Bosion, Mase. This lamp is degegned to run on a low roltage carrent and give a verf ateady and brilliant light. wo or more carbons are fed downward through converging tubes, whose lower ende approach beneath the
base plate of the euspoailig frame, the feed being very base plate of the esuppoading frrame, the feed being very
nicell coontrolled and the apread or the arc being anto. nicety contrineel, and regulted by a magnet through which pansee Hons of the carbone is constantly maintalieed.

## Mechanical.

Combination Tool.-Andrew Knudsen, Tucson, Arizona Ter. This tool comprisea, in
compact shape, eheara,
nippere, an ad adjatable wrench, compact shape, shears, nippers, an adjuetable wrench,
tack hammer, screw driver, and tack poller. It is a strong, cheap, and convenient tool, having the genera appearance of pliere
Mortising Tool-Simeon J. Hicks, Kinglewood, II. A hollow chisel has at its cutting end transverse cottiens whooe catting edgee are flash with the in anison pass through the openinge formed by the cating motion and slldes in suitable goideways arranged on the usual mortising machine, and the tool is dealgned to quickly and conveniently form a complete square or rectangelar
or chisel.
Gfrating Bolt.-William E. Getzs, Quincy, III. This is a mill bolt which is easily adjastable in an adjostable pivoted frame are jonrnaled ehafte at right angles carrying crank arme, there being ball and ocket joints on the crank arms connected with a sieve which extends parallel to the frame. The arrangemen cloth grater in the same plane, and the sieve boinelf gy rater in the inclined poodtion given to it by the adjneted Inclination of the frame.

## Fining, Ete.

Caim for Stanp Mills.-Albert Ams onry, Keystone, sonth Dakota. This cam is compose of two Bections, arranged for convenient application to the revolnble ehait, withont dieturbing the latter in its heels of the sections form the hab of the cam, the ar angement being anch that any deaired depun or hab ca also interlocked by means of flanges.
Treating Refractory Ores. Charles J. Fanvel, London, England. This invention provides a method of breaking np and removing any ad herent sidn of iron oxide from particles of precione
metals in freshly roasted rebellons ores. These ores are cansed to fall as a stream of incandeecent particles, the falling streambeing sabjected to the action of jets of water croeing it at right angles, the particles falling
into a running stream of water, and the particles of ore being kept out by contact with the air after they have eing kept out by contact
Skimmer and Sweater.-William H. Howara, Pueblo, CoL. Well invention provaes an ap paratos for desilveriving lead bollion in the zinc pot,
coasisting of hinged pesforated platea adapted to be passed into the zinc pot in a folded condition, and then opened and raised to carry off the zinc and silver alloy the mechanically combined lead being ameated out when the pla
ecam.

## Agricultural.

Rotary Plow and Cultivator. George $F$. Whitmore, Weat Union, Iowa. This is a ro stable plewordigger frame formed of a number of coite or shovele to form a series of radially arranged buckets in which operate movable pane or followera fornulng the bottom of the trickets, and which are antomatically re ciprocated in the backets to diacharge the dirt after it has been elevated. A pulverizing platiorm is arranged the colter frame which servea to crosh the dirt, and dro it to the rear of the colter frame.

## miseellaneout.

Aerial Machine.-Dr. S. B. Battey, No. 89 Weat Twentyferenth Streat, New York City. mortarahaped holder for exploesives, adapted to swing latersily on the rear end of a cigar-shaped balloon, a feed pipe with an antomanc delivery device delivering ulated intervals, the pelista being received in a yleidingiy mounted recelver and ignited by an electric Aringderice thas affording a powerfal backward areanore apon the air to propel the machine, the discharge tabe at the same time constitating a rudder. The machine is dealgned
to be very light, haviag no machinery to carry, and it is claimes that a suffcient quantity of explowives to drive it

and described in the Solsntify Axrerions of Octobe 22,1892 , and the inventor states that the constroction of
a machine will be commenced at once.
Baling Press. - Edmund M. Ivens, New Orleans, Ls. This press has a main frame rotating which alted spinde or straln rod, with two chamber which alternately form a cotton-receiving and a comwhile the cotton in one chamber is being baled the other chamber will be receiving a freah sapply of cotton, the frame being torned after the bale is removed so that the empty chamber is bronght onder the cotton-supplying devicea and the last illed chamber ovar the compreading
Another patent by the eame inventor provides a rotat able press box having dual compartmenta in which are arranged connkerbalaneed followers adapted to be hel in any of their interuediate sdjusted positions by hy
dranlic power, there being simple means operated by the preseer platen feed mechanism for swinging the press box. There is also a variable and accumolative presse platen feed mechanism, whereby the bale can be treated to a plarality of presser applications of diferent speed

Dumping Scow.-Patrick Ryan, New YorkCity. This boat has a tat.bottomed holl, with a
downward slope on each side edgr of the maln deck, there being lengthwiseaertending rock ehatis which sugtain tilting tables adapted to receive the losd The tablea are strongly braced by stay rods, and at each end of the chan, mainly below decks, is a ratchet and lever me
chlt the tables for the diacharge of the losd, the tables being tilted simaltaneonsly or aucceseively as denired.
Sewer Cleaning Apparatus.-Alred Mandell, Brooklyn, N. Y. By means of a windiass a cable or rope is drawn throngh the sewer from one backeta, one bebind another, the cabere are side of each bucket being prolonged to act as a scraper. Means are also provided for raialing the backeta at the manholes
withoat injurg to the sewer construction, and the entir withont injury to the sewer construction, and the entire apl sediment from a sewer at a minimum expense.
Anti-Rattler.-William H. Pardee, Antigo, Wis. Combined with a thlll conplling having the asas clip and knackle is a spring lever folcrumed pivoted to the free end of the lever hookng over the back end of the clip plate, while there is a cam mechanism for moving the badl and apring lever. The device is simple, cheap and durable, and may be applied withoat
the use of tools to an ordinary thill conpling, effectively adng op all lost motion and preventing any ratuling.
Spring Bed.-Olin R. Gould, Dayton, lowa. Upon the slats of the frame are held apiral springs
of differcot aized wire, with strengthening croes spiral or difersot gized wira, with strengthening crose spiral mutually support and brace each other, forming a cheap, strong and dilmple bed, which has an even and hat parto lie apon.
Bed Brace.-William H. Fitzgerald, Monroe, N. C. Thls is a atretching device for flexible rande attached to the side ralls and corner posta, com handle plece, with log, and a right and left hand screw eagaing threated holes in the handle piece and to the bracket block. It may be quickly applied to any open bedstead, to etiffen it in all drections of strain, thas endering a light bedstead comfortable and safe.
JUMPER AND APRON.-Thomas R. dambers, Brooklyn, N. Y. This is a combination garment for workmen, having galdea at each side of its goides, whersby the garment may be quickly and easlly ecared upon the person, and will admit of the wearer asroming any posture that might be aken when an or
Suspenders. - Jacob H. Bley, New ork City. The ensponder ende ane, accorang to this mprovement, formed of bent braid, while the shoulder traps are jointed at he rear and a rear suepender end formed of a aingle bent braid having part of ita ad lecnt edges lastened tagectser to form a head, which and eecore ende are thne formed and the usoal attaching plates for the rear ende are dispensed with.
Bird Cage Food Holder.-Louis F. Shanovstd and Barnet Rubenstein, Chicago, IIl. This older is composed of wing clasp, a brace or medallion connecting the side rods. The improvement avoide bending the wires of the cage and keepe the food clean
and in good condition, being adapted to oecuroly hold and in good condition, being sdapted to ecct.
Dish Cleaner. - Walter A. Adams, Hogan, Montana. This cleaner has an onter part elmilar to an ordinary dish pan and an inner dleh.receiving re bejag on the bottom whe or perforated sheet metal, there a serles of rollers. The inner receptacle, when fllled with dishes, is rapidly rotated by means of its handles, arser having been plsced in the onter receptacie, contain-
fing hot water and the cleansing compoand, a dmilar ing hot water and the cleansing
Stovepipe Hanger.-Williain H. repne, Chicago. Ill. An adjuatable band encircles the held adjastably in a eleeve, a plate enpportling the a being adapted to be fastaned to the ceiling or other support. The device is atrong and simpie, and readlly applied and adjasted to hold the pipe in the deaired poot-

Fire Lighter.-Peter Peschong, alon, Iowa. This is a device comprising an outer meallic chamber and an inner sheet metal receiver within which is held another receiver elapted to contain a hemical by which a fuse may be ignited to iight the fire, the ignition being made to take place by means of a
cloctwork eechaniam at any aredocirninad time the
combnatiblea having been previoosily arranged in the
stove or grste. The deviee is deaigned to be entiraly liable and quite inexpenaive.
Pocket Book.-Isaac Scheuer, New York City. A filat epring is eecured to the stationary ba of the frame of a pocket book, satchel or similar article, ransverse alot formed in the bar, the head haing into it andar aide a kecpar for engegament with the catche held on the hinged sildes of the frame. The derice per mita of conventently lociting both sidea of the article thout presentang any projection on the frame.
Tag Fastener.-Samuel E. Adams a aehington Court Honse, Ohio. This is an exceedingly simple device, eapecially adapted for seearing price tage on bolts of goods, or a thaching a tag to grods of any deccription. It coasists of a plate having a loop for the re ception of a tag, a needle point projecting from the apper surface of the plate near the front, and a eecond needle
point extending from the lower surface of the plate near the rear, the eecond needlepofint bejng in the form of a hook.
Dental Articulation Cop.-George K. Bagby, New Berras, N. O. This invention proridee cap having outer and inner arched walls, with connect ing ribs, the outer wall having a hinge and the inner one of dfferent widthe of jaw. By means of the improre ment the dentirt can take an edditional impression fo the articulation or bite at the same sitting that he take he Impresion $f$ or the plate.
Nors.-Copies of any of the above patents will be
forolohed by Munn \& Co, for 28 centa each. Please
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## ERW BOOKS AND PUBLICATIONS

## The I.Ocomotive Catrchism. B

 man W. Henley \& Co. LondonE. \& F. N. Spon. Pp. 362. Price \$2 Robert Grimahaw, widely known asan author on tech nical snbjects, bas acquired mnch of his success from works written in the forms of catechisms or of gaestion and answer. In his treatment of sobjecta he has a pe
cullarly crispand graphic style, which lends liself well to cullarly crispand graphic style, which lends issoir well th the question and answer treatment, which is eidoptar in
this book. The exhanstive natare of it is evident from ita large number of questions, nearis 1,800 in number each of which is clearly and eimply anawered. The preface stating that novices and expert locomotive engine ranners have selected many of them and examining engt neers have selected many more. As regaris the illug only moet elogantly produced, but have a apeciar value in bejng derived from the last examples of practice. Th author poseesead unnaual facilitiea for procaring drawing of the most recant types, and of these facilitles he ha work is ap to the present date is shown by the fact that a cat of the famons engine " 989 ," drawing the World' Fair epecial, is given. Namerons folding platea a contained, each in itself being rirtally a working draw ing. One of these plates is devoted to the eame engine "g89," "o that the possersor has at once the pictorial and constructive drawngg of this last example of moder locomotive bulling. Tho sibject or accidents is treated ant
British Forest Trees and their Syl VICultural Characteristics and
Treatment. By John Nisbet. Lon don and New York: Macmillan \&
Co. 1893. Pp. xvi, 352. Price \$2.50. America ls so mach a beltar fied for arboricentur han England that it is to be sapposed that this book will be of equal interest and value to the American written. The 0 ods of the $t$ Pocontrie are very nearly wricken. The woods of the two conntries are very nearly the sabject of forestry will be warmls welcomed by all.

Gravitation the Determining Force. By Ethan Samuel Chapin Riverside Press. 1887. Pp. xiv, 169. No index.
The anthor of thle book claims that more than twents arve recently work does not lend itself easily to a review. To th tereating.
Contributions from thr Lick Ob mospheric Absorption of the Photo graphic Rays of Light. By J. M. M.
Schaeberle. Sacramento: 8 tate Schaeberle. $\begin{aligned} & \text { Sacramento: } 8 \text { tate } \\ & \text { ofice. A. Johnston, Supt. State } \\ & \text { Printing. 1893. Pp. } 90 \text {. }\end{aligned}$
In this, the third contribation from the Lick Obeerva folly a developes, and to such it will be found a mannal of apecial interest and value.
The Yosemite, Alaska, and the Yei lowstone. By William H. Wiley Offices of Engineering. New York John Wi
The admirable graphic style of the text of this descrip don of Western wavel, the numeroas illustrations, ind pendent of the personal sesocistions of the anthor B topographical story of our conntry. Although full of aneciote and graphic to the last degroe it posesemesis true sclentisic value from the numerous data meladed in it, the review of the progress of the grest Weat and ite
history. Many illostratlons are exceedilogly atriling, notably theinterior view of the Mormon Tabernacle, with tabsilipticalvanited roof. It is needlees to say that the
standpoint, and the entire aspect is sach as to make one
wish for more such work from the same hands. In the preface written by Mr. J. Drelve the anperfluity of any introduction to the Americanpablic of this book and ts authors is rightly noticed. To the British pablic the book ibelt, Mr. Dreige etates, will be the best introducHon. Mr. Dreige's part in the matter appears in its havtug been originally pablished in London Engineering. An excellent purtrait of Mr. Wiley foring the frontig-
piece. The anthor covered eome 10,000 miles in his iece. The anthor covered some
The Slide Rule. Third Edition. By William Cox. New York: Published
by Keuffel \& Esser Co. Pp. 14. by Keuffel
Price 50 cents.
This description of what can be done with the slide ale is exceeningly clever, and it is astonishlng to find The mork is very conciee and cellent ehapa
The Book of the Fair. An Historical and Descriptive Presentation of the
World's Science, Art and Industry es Viewed through the Columbian Exposition at Chicago in 1893. By
Hubert Howe Bancroft. Chicago and San Francisco : The Bancroft
Company. 1893. Pp. 40. Price \$1. This is the fint (nstallment of what will eventaaly be very saperb monograph on the World's Fair. It is pormsely illostrated and the entire work, when comlefed, bldafair to be oneof the moat important contri-
anitari Engineering in India. For the use of municipalities and engi-
neers. By John Wallace. Bombay: neers. By John Walace. Bombay:
Printed at the Education Society's Steam Press. 1893. Pp. vii, 238, xi.
Price $\$ 3.25$.
dis wooldcertain

India wouldcertainly seem to be an excellent field for the amilarian. The anthor gives somevery starting exaplizes, and the work shonld certainly find a place in he laboratory of the sanitary engineer. It is of some inerest to know that it is printed in Bombay, as it affords an lllustration of the printing induetry as conducted in British India.
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lehed. MONA \& Co., 881 Broadway, New York,

## SCIENTIFIC AMERICAN

BUILDING EDITION.
AUGUST, 1893.-(No. 94.)

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Hegant plate in colors, showing the villa erected for J. Armoy Knox, at Primroee Park, Monnt Ver-
non, N. Y., at a cost of $\$ 14,928$ complete. Floor deagn.
2. Plate in colors showing the colonial residence of L . Allyn Wight, at Montclair, N. J., erected at a loorplane. Mesers. McKim, Mead \& White, architecta, New York. An attractive design. cottage erected at Portland, Me. Perspective view
and floor plans. A model design. Coet $\$ 3,400$ complete. Mr. J. C. Stevens, architect, Portland, Me. ${ }^{\text {s. }}$
4. A Queen Anne cottage, erected at Wagne, Pa., at a cost of 86,000 complete. Floor plans, perspective
view, etc. Mesars. F. L. \& W. L. Price, architects, Phladelphia, Pa. An excellent design.
5. Kograving and floor plane of a dwelling recently rected for A. B. Root, Esq., at Springteld, Mses.,
B. Engraving and ground plan of Grace Episcopal Charch, at Plainfield, N. J., erected at a cost of
sta,000, complete. Mr. R. W. Gibson, New York Clty, archltect
7. A dwelling recently completed at Brookline Hills, Mane, at a cost of elevation and foor plane.
8. A cottage at Elm Station, Pa., erected at a coot of Wood and stone dwelling at Narberth, Pa deaign. Perspective elevation and floor plans. Estimanted coot $\$ 5,000$, complete.
10. Design for a village library.

1. The Frfth Arenne Theater, New York. View of the Mr. Francia H. Kimball, architect drop curtaln. eaggeation in corner decoration. Ray window decorations.
2. Miscellaneons contents: Wiring of baildinge for J. Y. - A novel eystem ijinatrated.-Wood mantels and ornamental areplaces, illantrated.-Fencing made of sheet metal,
illuatrated.-The Hartman aliding blind ; view of illustrated.-The Hartman sliding blind ; view of factorles,-An improved dimension esir, illng trated.- Plumbers' and ateamnitters'su
Capitol hot water heater, illuatrated.
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minera sent for eraminstion should be distinctly
marked or labeled.
(5268) W. P. M. says : I am making a water trbe boiler on the porcapine plan. Is there any ob-
jectlon to uallog plpefor the porcapline as emall as halt jection to using pipefor the porcapine as amall as half
an finch, where the plpea will be two feet long 9 A. Halp an inch, where the plpea will be two feet long 9 A. Hair plne boller; the circulation will be sloggisb and carse the
boiler to Hft Its water by the accumalation of steam in the small tabes, so fast as to $\leqq$ push the water out. The fonling of amall tabes is also an objection. Not leas than 1 inch tubes shonld be ased, with as large standpipe as posesible; will mak the best working boiler. 2. As re-
gards speed, are hollow or straight water lines desirable for a steamboat $9 A$. The concave bow and stern wate lines or wave lines are the lines for speed. 8. I am uasting in my lannch an oll-burning boller. Oil is fed to boller
by steam, which is very objectionable for many things, by steam, which is very objectionable for many things,
especially noise. Can you tell me a simple way to make a vaporizer so that I can barn ofl in the form of vapor ander a boller better or asfer than the jet apray, elthe air or steam. The air jet makes the cleanest fire, but
the combined steam and air jet is most convenient and in general use. The sleam and sir jet has not been con sidered objectionable when properly regolated; perhap your st am nozzle is too large and carries too little air into the fire chamber; try a emaller steam nozzle
bined with an annolar air nozzle for the atomizer.
(5269) N. L. T. writes: 1. In an altot nating transformer what will be the relative amparage and E. M. F. of carrent in the secondary coll as com-
pared to that of the primary, sappoaing both coils belng pared to that of the primary, sappoaing both colla belng
of the same length and eize of wire and both wound alik nponan iron ring or continnoone core? $A$. The relative voltage of primary and secondary is in the ratio of the number of torms of wire in the asme. The eame nomber of tarns gives the eame voltage. There will be a loss in amperage in this case of abont 10 per cent. 2. In wha ratio does the increase of the frequency of alterastion In the primary increase the E. M. F. o: tenilon of the in duced carrent : A. There is no connection. 8. Will a re sistance in the eecondsry circait have the same effect apo
the primary current as if the same reaistance were place in the primary circalt 9 A. It will have what if practically the same effect by developing connter E.M.F. meaning of the expreasion self-induction and capecity A. Selp.indnction ls electric inertis. A corrent requires
time to be fully started and time to cease. Capecity re time to be folly started and time to cease. Capacity re
fers to the quantity of charge retainable at a given pres anre (voltage). This is analogous
heat or Hght waves, or to both, and having some electry
cal conducting power and which will retaln the soldd form cal condacting power and which will retaln the soldd form
or withatand beat ap to $88 y 200^{\circ}$ Fah. A. There is no sach sabrance. The general rale is that conductors (5270) W. H. F. says: 1. I wish to make a compass. 12 inches long; canf ase commonhor draw the needle on the magnet? A. Stroke it roon end to end, always in the same direction, with one pole of the magnet, retorolng the magnet throagh the alr. 2 I want to make a helix to magnetize a $5 / 8$ steel bar, 5 Inches long; what number wire mast I ase and how many layers on the helix, and how many gravity batterles
shonld be need, and how mnat the bar be fastened in shonld be need, and how mnst the bar be fastened in
the heliry A. No. 20 wire is a convenlent size. There the heliry A. No. 20 wire li a convenlent size. There
are nofixed dimenalons. Gravity batteries are of rathe high resistance. The wire may be wound disctly on the bar. 3. I have a tac bor in a 12 inches deep $101 / 2$ Inches dameter, 24 Inches wide, and carbon fo same. What preparation can I ne for a dry battery of same? A. For dry batteries we referyou to our Supresmexnt, Nos. 157, 787, and 782. 4. A few daye ago a conali of mine photographed a kite. In the negative are four perfect kitees. A. We shoold like to see print from the
negative. Nojadgment can be given without this.
(5271) N. L. M. asks how to preserve bird akin. A. Make an incision from the breastbone to the vent with a amall plece of wood work the akin from the fiesh. When the leg le reached, cat throagh the knee joint and clear the shank as far as poesible, then whd a pnt roand the bone do the same with the other lea pnt roand the bone; do the same with the other leg,
Now divlde spline from root of tall, taking care not to cat too near the tail feathers, or they will comeont. Next ekin the wings are far as poselble and cat off. The akin will now be entirely clear of the body. The ekin most now be tarned inelde ont and the neck and ekin gently polled in opposite directions till the eyeballe are fally exposed. The whole of the back of the head may be cat if and the eyes and bralns taken ont and thelr places well with arsenical roturned to its natural pooition, when, after filling the body with a little dry grass or wool, the job ls done. It is very easy, and the akln of a bird la mach tongher than one wonld sappose, though of course they vary, the night jar being very thin, while homming brda are fairly
tongh. An the apparatas required is a sharp knife anda pair of eciesore, or, for large blads, a atrong palr of nippent to divide the bones. From the "Sclentif (5272) W. L. C. writes : To settle a dispate between myseli, a city editor, and a learned gentle man, I wish yon would anower hig: Is the Pacific Ocean along the coast from Lower Caifornis to Paget Sonnd waves than the eastern or Atlantic coast of the United States? Ifeo, why? Are the Callforis, Oregon, and Washington ports harder to enter by reason of rough eea than from Maine to Florlda 9 A. The prevalling winda along the Pacific coast of the United States are westerly, or on-shore winds, wbile the prevalling winds on the astern cosast are also weaterly, or off shore winds. An
on-ehore prevalling whin makes a rongh sea along a on-shore prevailling wind makes a rongh sea along a Coast and at the entrance of harbors, espectally to where comprativels 3 or cess to harbors. The storn winds temporarily change this condition, bat it is the prevaillngwinds that give the ecculiar charracter to the two cossts as regards the ronghness of the ees and the difficulty of navigation along the coaste and entrance to shallow harbors. The month of The Columbla
(5273) D. H. asks how to clean orna mental bronze door knobs and platea, light inish, aleo ow to keep them bright. An, The finish of this clase of ponnds of dipping acide, then washed in clean hot water nd dried. The bright parts are then baroished and the articles lacquered with varlons colored lacquers for the equired shade. Snch work ahould never be cleaned; deatroys the lacquer cost and the recses of the orma mentation become fonl. It ahonld be sent to a fintsherof ach work for renewal of the lacquered sirface.
(5274) A. A. P.-To smooth parchment Fhich has become wrinkled, place the parchment face downward apon clean blotting paper. Beat np to a clear
roth, with a few dropa of clove oll, the whitea of ser roth, with a few drope of clove oil, the whites of sev-
ral fresh eggs, and with the fingers spread this over the oral fresh eggs, and with the ingers spread tais over the
back of the sheet and rab it in ontil the parchment be comes amooth and ylelding. Then spread it ont a mooth as posible, cover with oll silk and prese for a and prese with a warm fron.
(5275) L. D. S. asks how to make the dn tye. A. 1. Chloride tin, 8 drm. 2. Nitric acdd, 10祭to a glass vessel with sufficient water to 8 parts fill, the add No. a, ehake well ontil diseolved. Now place No. 8 throngh a cork and insert in solntion, so that no part shall tonch top, bottom or alde of glass vessel. Let the
whole rest quietly for a ahort time. The tree will grow whole rest qnietly for a ahort time.
(5276) J. M. H. asks where the worms we see on ajdewalks after a rain come from. I have
heard it stated that they fall with the raln, bnt to my ears that explanation seems hardly plausblble. Are there any well sathenticated acconnts of ralog of frogs, etc. A. The worme and froge or toads come trom their holes
or hiding placee in the soll doring rain, either driven ont by the water fllling their holes, or perhape for a bath There are no anthentic eccoants of the falling of worms, fohes, or toads
(5277) F. A. says: We send you a bug for examination, fond on our featherbede. We are hinkding it ls more trooblesome to a man than the mosquitoes or bedbug, and we wonld like to know ite
natare. Answer by C.L. Marlott, Acting Entomologith. The insect mentioned as occorring in festberbeds la on af Athous foenularis Lec. Ito appearang on the bed

## was almply acclde the room by light.

(5278) F. K. J. asks : How can I get the rast outor wrought iron water pipea $\%$ They are in th groand abont four years, and the water runs through hhem aboat half as atrong as at first. A. The pipe can
not be cleaned while in the ground; it muat be taken ap and the ruat cleaned out with an fron rod, or lay new gal enized iron pipe, which does not rast.
(5279) R. I. S.-About 166 feet of gas be made trom a allo prooline ?
(5280) F. A. K. Writes : Please settle a dispate by answerlng the following in your Notes and Querles: A holds that when a person in Anstralis or sun at noon he will be focing noth; or in other words the north side of the ectreet is the or in ouner worde B holde that sun le always sonth of a person at noon, no matter what part of the earth he is on. Who if igh ty A. A ls partially right and B is wrong. To a Anstralla, the son 19 eropic of Capifia, zenith and castis his shanow to the conth ; and if he is north of the tropic Cancer, the san le always sonth, and casta his shado别 the sun's declination from his zenth.
(52 1) C. K. asks: How long will it take a storage battery carrent to decompose a pint of water lino ite gases? How many volt are reacred ent form of apparatos to do this work A. To decom pose water it ls well to allow two volts difference of po tential. An ampere for five minates is 800 conlombe which will decompose $0 \cdot 88$ grain of water. The numbe of cells required to decompose a pint of water mast be deduced from their amperage as given by the makers of the cell. For apparatus use copper or iron electrode
and a dilute solution of caustic alkali as electrolyte.
(5282) W. H. C. says: Will you please explaln the way that nails are graded, just what is mean by a tenpenny, a ninepenny nain, also what is the rela ton betweea trie length and name of nall 1 a. We glve
the nama alze, and weight of nalls as follows:


The lengthe are standard for all kinds, bat the nom ber to a ponnd varies with different makers and for th
different knde, as ordinary, light, and filahing nails.
(5283) W. L. R. says : We have a hori ontal tabolar boiler 10 feet long, 36 inches in diamete with 50 fines 8 inches in diameter. Also a 20 hors power engine, ${ }^{2} \times 12$ cylinder, making 200 revolations pe cearery to develop the fall 20 horse power? A. Th boller is nominally 20 horse power. Ita effective hore power may be much larger with high pressare. The re the engine will begoverned by the point of cat-off, whic if $3 / 3$ will require 45 ponnds bofler pressure. If $1 / 6$ cat-off
40 ponnds preseare. If $1 / 6$ cat-off, 35 ponnds preseare.
(5284) R. S. asks: If there are fift incandescent lampa connected ap in serlies, voitage 110, lamperes 6 -1 thor each, resistance in obms 168 for each and what is the canse i A. Yes; because each pasees the asme corre
filaments.
(5285) P. H. H. writes: I have two am meters, and when I connect them together they do no
reglater the same. Is there any way of adjusting them register the same. Is there any way of adjusting them
withont having a standard instrament to go by ? $\mathbf{A}$. If yon can eccure an absolutely constant carrent, then yo can determine its amperage by a silver amperameter.
The method, a very almple one, la alven in Ayrton's "Practical Electricity," which we can supply for $\$ 9.50$. Soch a
meters.

## meters.

TO INVENTOR8,





## INDEX OF INVENTIONS

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