Iron-Aluminum Alloys.

The advantages of an addition of aluminum to fluid iron are important. With moderate care absolutely pure and solid castings can be obtained capable of receiving a high polish. An addition of aluminum is especially to be recommended for the manufacture of steam cylinders, engine castings, press cylinders, and generally for castings which are to be subjected to a high pressure. A few hints will serve to show how aluminum is best alloyed with iron. As aluminum only lends itself with difficulty to combination with iron, it is not immediately to be introduced in the ladle which is to be poured into the mould; a smaller ladle is selected, in which is placed the heated aluminum; somewhat fluid iron is brought from the furnace, poured in the ladle, and stirred until the aluminum-iron compound begins to stiffen. The iron intended to be cast is now let out of the furnace into the ladle intended for it; the aluminum-iron mixture is poured in, the lot being intimately mixed. The molten metal should not be poured into the mould too quickly, as it does not solidify so rapidly as ordinary iron. Aluminum-iron in the fluid condition is very active; small globules are formed, which gradually extend to the edge of the ladle, where they disappear. At first the iron is of a milk white color; then it becomes orange yellow, and forms a thin film on the top. When this moment has arrived, the film is removed and casting is proceeded with, care being taken that the mould is always kept full. For 100 kilogrammes the proportion of aluminum recommended is 200 grammes. Cost can be no drawback in view of the present cheapness of aluminum, particularly when it is considered with how much greater certainty clean castings can be obtained. Aluminum improves cast iron as phosphorus improves tombac and brass; the thin fluidity is increased and the oxide separated.—*Metallarbeiter.*

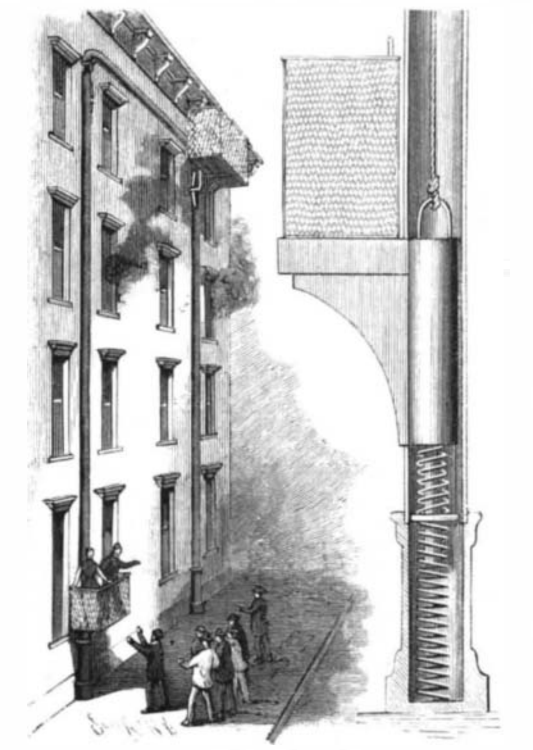
A CONVENIENT KITCHEN CABINET.

The cabinet shown in the illustration is adapted to contain nearly or quite all the articles commonly used in cooking, so arranged as to be protected from dust, and all within easy reach. For this improvement a patent has been allowed Mr. Charles Holt, of Walla Walla, Washington. The lower or base portion of the cabinet has a large number of drawers suitable to hold various articles or utensils, and this base carries on its top a sliding kneading board, readily pulled out for use and pushed inward when not needed. The top part of the cabinet is entirely removable, having recesses in its bottom portion which fit upon corresponding lugs on the top of the base, while a swinging lid closes down over the kneading board. The top part is divided by vertical partitions into compartments, preferably three in number, the two end compartments for different qualities of flour and the center one for sugar. Immediately below the compartments is a hollow framework with depending flanges supporting a sieve under each flour compartment, as shown in the sectional view. Plates serving as floors to the flour compartments each carry a slide with an inwardly extending rod terminating in a knob, on pulling which the flour is permitted to drop to the sieve below, the sieves being so secured in place that they may be removed from the frame by pulling downward upon a spring catch. Within each sieve is a swinging wire rod loop, the rod extending through the front of the sieve, where it is formed into a crank, by turning which the flour will be passed through the sieve. Centrally between the sieves is a cross plate forming the floor of the sugar compartment, and in this plate is a slideway in which is a hole adapted to register with a hole in a slide, by moving which the sugar is allowed to flow through. Beneath the central compartment is a bin to receive the sugar, and on each side are smaller bins for baking powder, spices, etc., there being larger bins near the ends for the flour. A rolling pin, when not in use, may be kept on top of the bins. The entire sifting and regulating mechanism may be easily removed to be repaired or cleaned.

HOLT'S KITCHEN CABINET.

AN IMPROVED FIRE ESCAPE.

The construction shown in the accompanying illustration is designed to be of a simple, durable, and inexpensive character, and adapted to be placed at the side of a building without detracting from its appearance. It forms the subject of a patent which has been issued to Dr. Henry Schwannecke, of No. 1280 Fulton Avenue, New York City. The improvement consists essentially of two chairs or balconies, so connected that when one descends the other will ascend, the descent of the balconies being stopped at the bottom by spring cushions, so that the occupants will experience no shock. Two tubular standards are located at any desired point upon the building, connected at the top by a transverse tubular slideway, and each standard has a hollow base in which is located a coil spring, as shown in the sectional view. Each standard has in its front face a vertical groove extending from the base to the top, and a bar sliding in the standard has a flange or projection extending out through the groove, to which the chair or balcony is securely attached in any approved manner. The bars carrying the chairs have reduced lower ends, around which are springs carrying disks adapted to enter the hollow base of the standard, this arrangement preventing any rebound, while forming a thoroughly effective cushion for the chair in its descent. The chairs or balconies are connected by a cable, the ends of which are attached to the upper ends of the bars, the cable passing through the standards and over pulleys through the upper slideway. Each balcony has a brake, whose handle extends up within convenient reach, the shoes of the brake being normally held against the standards by a spring, and near the top of each standard is a keeper, adapted to engage and lock the brake shoe when the chair is in its most elevated position. Upon persons entering the upper chair, and disengaging the brake from the keeper, the chair descends by gravity, the other chair at the same time ascending to receive others desiring to descend.



SCHWANNECKE'S FIRE ESCAPE.

The Harvard Astronomical Station in Peru.

Dr. Edward C. Pickering, director of the Astronomical Observatory, Harvard College, in his last annual report, gives the following interesting information:

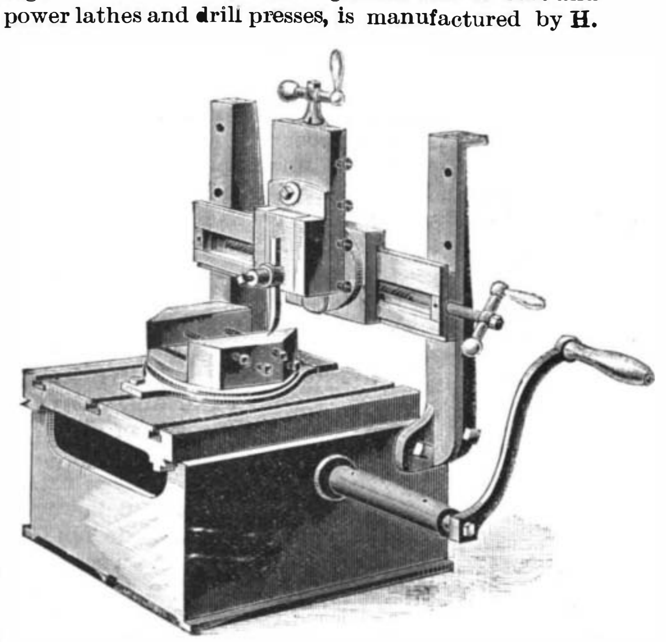
The expedition sent to Peru in 1889 under the direction of Mr. S. I. Bailey, having successfully completed the observations with the meridian photometer, returned to Cambridge with that instrument, which has been remounted here and will be used for a revision of the Harvard Photometry and for other photometric work. During the two years ending May 1, 1891, Mr. Bailey took 217 series of observations and made 98,756 photometric comparisons of about eight thousand southern stars. These include all the stars of the sixth magnitude and brighter south of —30° and all known catalogue stars in a series of zones 20′ wide at intervals of 5° in declination from —25° to —80°; also all known stars south of —80° and a miscellaneous list of variables, stars having peculiar spectra, etc. The reduction of these observations is nearly completed and their publication will be begun shortly. A large part of the work assigned to the Bache telescope has also been completed, and the instrument has been remounted at Arequipa, where its work will be continued.

An expedition under the direction of Professor William H. Pickering left Cambridge in December, 1890, and established a station about three miles northwest of Arequipa, where the thirteen-inch equatorial has been mounted. This station has an elevation of a little over 8,000 feet and has a nearly cloudless sky during a large part of the year. The air is remarkably steady, the images of the stars are small and round and the diffraction rings, seldom seen with large instruments, are clearly visible. Even with high powers the fluctuation of the images is very slight. In fact, at this station the limit to observation will probably be the size of the instrument instead of, as at other observatories, the condition of the air. Although the aperture of this instrument is only thirteen inches, it appears to be the largest refracting telescope in use in the southern hemisphere, while about thirty larger telescopes are mounted in the northern hemisphere. Since all of these instruments are north of +35°, nearly one quarter of the entire sky, and that containing many objects of the greatest interest, has never been studied by a refractor of the highest grade. For both these reasons an excellent opportunity is afforded to add to astronomical discovery by the erection of a telescope of a large size at this station. It is hoped that patrons of astronomy will consider the advantages of erecting a large telescope where it will be kept constantly at work, where the sky is clear a large part of the year, where the condition of the air is probably more favorable than at any other existing observatory, and where a large part of the sky could be examined for the first time under such satisfactory conditions.

Photographs have not yet been obtained with the thirteen-inch telescope, but it is hoped that its advantages for this kind of work will be as great as for visual observations. The expense of establishing this station was much greater than had been anticipated, since it was necessary to erect a stone dwelling house for the observers. A considerable advance from the future income of the fund has accordingly been required. Important aid was rendered to the expedition by many residents in Peru. Mr. MacCord, superintendent of the Mollendo Railway, should be especially mentioned for his hospitality to the observers, who resided with him while the new house was in process of erection. Without his aid the establishment of the station would have been extremely difficult. Two interesting expeditions have been made in Peru. One of them by the courtesy of Mr. Anderson, American Minister to Bolivia, was to Tiahuanuco and the sacred islands of the Incas on Lake Titicaca, and led to results of much archæological interest. The other was to the summit of El Misti, a nearly extinct volcano about nineteen thousand feet high.

AN IMPROVED HAND PLANER.

The accompanying illustration represents a compact, well made machine, designed to do exact work rapidly. It planes 12 inches long, 9 inches wide and 8 inches high, and has a universal planer chuck. A second size is made to plane 24 inches long, 12 inches wide and 12 high. This machine, with a general line of foot and power lathes and drill presses, is manufactured by H. L. Shephard, agent, No. 141 West Second Street, Cincinnati, Ohio.



SHEPHARD'S NEW HAND PLANER.

Magnesium Flash Signals.

In 1889 some interesting experiments were made by Mr. W. P. Gerrish on distributing time accurately by flashes of magnesium powder. Signals were thus sent from a station on Blue Hill, Mass., twelve miles distant. They were readily visible, and the exact time to within a fraction of a second could be taken from them. These flashes were also seen from Princeton and Mount Wachusett, forty-four miles distant, and from numerous nearer points.

The Influenza Bacillus.

Authentic documents are now to hand which enable us to form an estimate of the accuracy and trustworthiness of the alleged discovery of a bacillus as the exciting cause of the influenza. It had already been surmised that the influenza poison resides in a minute bacillus, and there is now little doubt that this bacillus has at last been discovered, identified, separated, and cultivated by three different observers, all of whom have been working independently of one another. These bacteriologists are D. R. Pfeiffer, who has carried on his investigations at the Institute for Infectious Diseases at Berlin, Dr. Kitasato, and Dr. P. Canon, of the Municipal Moabit Hospital at Berlin. Their results are identical, and although all new discoveries are received by the scientific and medical world with considerable reserve till they have been abundantly and independently confirmed, it is earnestly hoped that the discovery of the cause may lead to that of the cure of the disease.

Dr. Pfeiffer has found the bacilli in the saliva and the bronchial discharges characteristic of influenza. They exist in the form of tiny rodlets, strung together sometimes in chains; they congregate in minute drops as clear as pure water. They can be obtained in pure cultures—that is, separated from all other forms of bacilli—in pure agar and sugar, or glycerine agar. In the saliva of influenza patients, the bacilli are found in immense quantities; they may penetrate from the pus cells into the tissue of the lung, and even pass as far as the surface of the pleura. This fact will explain the rapidity and fatality of lung complications in influenza. Dr. Kitasato, the learned Japanese assistant of Prof. Koch, has obtained identical results with those of Dr. Pfeiffer, and has cultivated the influenza bacillus in glycerine agar with marked success. Dr. Canon comes forward, however, at the same time with a still more striking discovery, for he has found the presence of the influenza bacillus in the blood of patients suffering from the disease, and, according to the opinion of Prof. Koch, the bacillus discovered by Dr. Pfeiffer in the saliva is the same as that discovered by Dr. Canon in the blood of influenza patients.

To the public these laboratory researches and discoveries are not merely matters of passing scientific interest. They are of deep and practical importance. The power to cure disease may not be vouchsafed to the physician even after the most earnest and arduous study; but to prevent disease is the crown of the medical art. The knowledge that a bacillus residing in the saliva causes influenza will not cure the epidemic; but the prompt and practical application of this knowledge by complete disinfection of all bronchial and nasal secretions and the isolation of influenza patients will stay the plague. It also indicates the reasonableness of what is known as the carbolic acid treatment of influenza, which has been practiced with considerable success, especially in the early stages.—*Daily Graphic.*

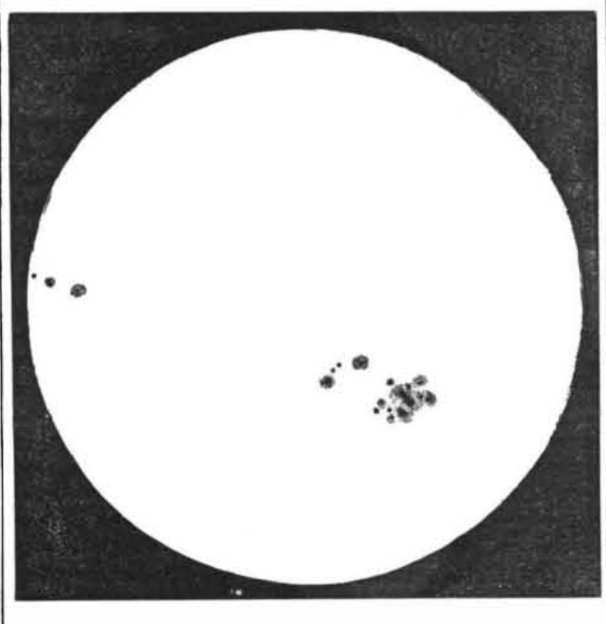
The Lacquer Tree of Japan.

A very interesting experiment has recently been recorded as having been conducted at Frankfort by Professor Rein, of Bonn, so well known for his splendidly illustrated work on Japanese arts. One of the principal of these arts is that of lacquering, in which no other nation can excel the Japanese. The art is one of great antiquity, and the old examples are very costly. The lacquer, unlike the European varnishes and polishes, which are compound substances, consists of the juice of a small tree known to botanists as *Rhus vernicifera*, and this juice is drawn from the trunks by making incisions in them, from which it flows into bamboo pots placed to receive it. The juices of this and all other species of *Rhus* are extremely acrid and poisonous, blistering the skin severely if allowed to come in contact with it. Consequently the Japanese collectors use thick gloves to cover the hands during the process of collecting. After the crude juice has been drawn from the tree, it is prepared in different ways by the Japanese experts, and the process of applying it to the wood or metal work is a very tedious one, and one which can only be properly effected by a native artist. The modern lacquer ware of Japan, however, is a totally different article from that of one hundred and fifty or even one hundred years ago. There is at present a great demand in the European markets for cheap lacquered articles, in consequence of which they have to be produced quickly and in large quantities, so that a very inferior article is produced, both in design and finish. Nevertheless, the process of lacquering has never been mastered by Europeans. It has been tried by practical varnish makers in this country, but always without success, and it is now thought by Professor Rein that if the trees could be established in Europe and the juice freshly drawn from the trunks, some of the difficulties of its manipulation might be overcome. Considering that several species of *Rhus* are hardy plants in our shrubberies, there is, perhaps, no reason why *Rhus vernicifera* should not be included among them. Indeed, this question seems set at rest by the fact that a number of healthy trees, some 30 ft. high, are now flourishing at Frankfort, the trees originally planted there having produced seed, from which other trees have been raised. The next question seemed to be whether the changed conditions of growth and climate would in any way affect the nature or composition of the juice, and to prove this some of the trees at Frankfort have been tapped and the juice sent to Japan to be experimented with by the native artists. Besides this, the native and European juices have been analyzed by German chemists, upon whose reports, coupled with those of the Japanese artists, it is expected the fate of lacquering as an industry in Europe will stand or fall. If the reports on the quality of the juice from Japan be favorable, it is proposed to plant the tree largely and bring over some expert workers from Japan to teach their peculiar art to European students.

There is, however, another use to which the Japanese lacquer tree might be put should it prove to take so kindly to European soil as to produce its fruits abundantly. These individual fruits are small—not much larger than a pea, but somewhat flattened—and are borne in bunches or clusters. They are covered with a thin, light brown shiny skin, under which, and immediately surrounding the seed, is a deposit of white wax, which forms, together with that of an allied species (*Rhus succedanea*), the product known as Japan wax, which is used by the Japanese for making candles, and is also exported in large quantities to China and to this country to some extent for a similar purpose, as well as for making wax matches.—*Industries.*

A GREAT SPOT ON THE SUN.

The largest sun spot that has made its appearance since 1883 became visible to the naked eye on February 10, the observer, of course, having the protection of a



smoked or deeply colored glass. The first careful observations of it at the Dudley Observatory, Albany, by Professor Lochner, indicated that the spot, or rather group of spots, covered a disturbed area of 140,000 miles in length, and from 90,000 to 100,000 miles in width. The principal spot had, according to Professor Lochner, two nuclei, each having a diameter of about 14,000 miles, while the penumbra around the principal spot had an extreme width of 65,000 miles.

The accompanying illustration represents the appearance of the disturbed area of the sun's surface according to an observation made at the SCIENTIFIC AMERICAN office at 10 o'clock on the morning of February 13. In looking with the naked eye, one sees only what appears to be a single spot, a telescope being required to make the separation into several spots or groups.

The Advance of Chemical Science in 1891.

Vast additions have been made to the science of chemistry during the year; new combinations of elements have been discovered, new properties of existing elements, new relations between physical and chemical action, and especially between the latter and those other forms of the all-pervading force which we call electricity. One of the latest announcements in this connection was that made at the Royal Society, in the beginning of December, that Prof. Dewar, of the Royal Institution, had "placed a quantity of liquid oxygen in the state of rapid ebullition in air (and therefore at a temperature of —181° Centigrade) between the poles of the historic Faraday magnet in a cup-shaped piece of rock salt," and to his surprise Professor Dewar saw the liquid oxygen, as soon as the electro-magnet was stimulated, "suddenly leap up to the poles and remain there permanently attracted until it evaporated." Dr. Gladstone has been as busy as usual investigating the molecular refraction and dispersion of various substances. Professor Crookes has been as busy as Dr. Gladstone, and his experiments on electrical evaporation have attracted special attention.

The burning question of "solutions" has been attracting much attention in the chemical world, giving rise to nearly as much difference of opinion, if not quite so much bitterness, as that of evolution in the biological world. It is strange to find a name intimately associated with English literature figuring as that of the author of an able address on the subject of solutions at last year's meeting of the Australian Association for the Advancement of Science. Professor Masson, of Edinburgh, has not deserted his old love, but his son in Australia, who has chosen the severer path of chemistry, proves, we are glad to say, that in the matter of careful and hard work he is a true son of his father. Professor Judd has been again dealing with his favorite subject of crystals, and, though he approaches it from the geological standpoint, it really belongs to the domain of chemistry. Professor Judd treats these products of nature as if they really lived and moved and had being, just indeed as if they were organic bodies. He talks of the "rejuvenescence" of crystals, and attributes to them other properties, which hitherto we have associated only with life. His researches are important as bearing on the very foundation of geological science. Professor Roberts-Austen's discovery of the most brilliant alloy known (75 per cent of gold with 25 per cent of aluminum) is of curious interest. More important are Mr. T. Andrews' researches on the passive state of iron and steel, which take us to the borderland between physics and chemistry. Two French chemists, MM. Cailletet and Collardeau, have been working at the critical point of water vapor. M. Moissan's researches on the element fluorine have yielded interesting results, owing to the intense chemical activity of this element. Another French chemist has been carrying on quantitative investigations as to the chemical action of light.

A research of interest, as showing the intimate relations between chemistry and biology, has attracted some attention during the year. It has been carried out by a young chemist, Mr. Cuthbert Day, who superintends the scientific work in Younger's brewery in Edinburgh. It deals with the sprouting of barley, and Mr. Day has by means of an ingeniously contrived apparatus endeavored to ascertain the precise influence of temperature on the process, with results that ought to be of both scientific and practical value. The chief point to be noticed is that, though there is a considerable falling off in the increase of the quantity of carbon dioxide produced when the temperature rises above 55° Fah., yet the effect in diminishing the increase in the weight of dry root is much more marked. To this almost random selection from the chemical work of the year must be added as an event of importance the jubilee of the Chemical Society on February 24, when, among others, Lord Salisbury gave an address full of suggestive skepticism, if not pessimism, in science.—*Chem. Tr. Jour.*

Government Trials of Magazine Firearms.

We learn from Capt. S. E. Blunt, Captain Ordnance Department, U. S. A., that the Secretary of War has lately given orders to the board on magazine arms "not to receive, unless authorized by the War Department, arms for trial after June 1, 1892, and for the board to then complete its labors and forward its report as soon as practicable."

All inventors or others who have corresponded with the board have been notified of these instructions and that the board's next session would be held at this armory, commencing on February 23.

Other sessions will be held as frequently and for as long periods as there may be guns on hand awaiting trial.

The trials are made at the National Armory grounds, Springfield, Mass.

It is understood the government is desirous of adopting the latest and best invention in magazine guns, and is looking for something superior, if possible, to the new European guns. Engravings and descriptions of those adopted in the armies of England, France, Germany, Austria, and Russia will be found in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 591, 597, 744, 783, 798.

Business Maxims.

The elder Baron Rothschild had the walls of his bank placarded with the following curious maxims:

Carefully examine every detail of your business.
Be prompt in everything.
Take time to consider, and then decide quickly.
Dare to go forward.
Bear troubles patiently.
Be brave in the struggle of life.
Maintain your integrity as a sacred thing.
Never tell business lies.
Make no useless acquaintances.
Never try to appear something more than you are.
Pay your debts promptly.
Learn how to risk your money at the right moment.
Shun strong liquor.
Employ your time well.
Do not reckon upon chance.
Be polite to everybody.
Never be discouraged.
Then work hard and you will be certain to succeed!