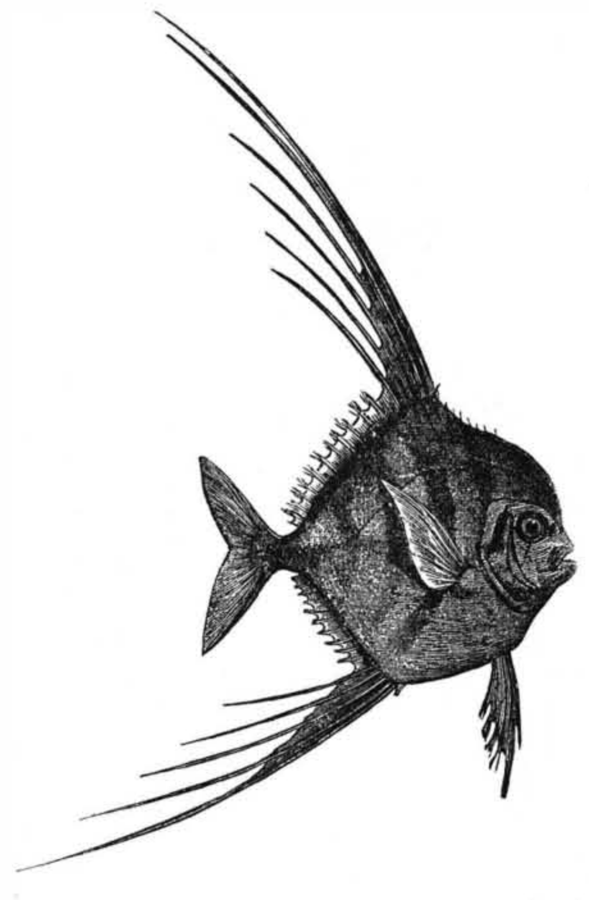
THE CORDONNIER, OR COBBLER FISH.

This fish (*caranx ciliaris*) derives its name from the long sharp spines of the dorsal and anal fins, which to many persons have a fancied resemblance to the awl and bristles employed by cobblers in their trade. It is found quite common in various localities, from the Red Sea, throughout all the Indian seas, and is a good example of the genus to which it belongs. No less than seventy species having been classed in this genus.

The form of this fish is sufficiently curious to render it a conspicuous species, and it may be easily distinguished from



its many congeners by an oblong spot on the aperculum and six black bands that are drawn across the body, reaching nearly to the abdomen.

HOW TO CHUCK AND BORE AN ENGINE CROSSHEAD.

A correspondent asks: "How can I chuck a crosshead for a 12 horse engine, and ensure that the holes for the piston rod and the wrist pin shall be true and at right angles with each other?" If the crosshead is a forged one, or if it is of cast iron and the first one cast from the pattern, it will be necessary to line it out with a square, compasses, and scribing block to ensure that there is stock enough to allow it to work clean; if, however, it is known that there is ample material to come off, this may be omitted. The hole for the wrist pin should be bored first, because one hole must be used in connection with a mandril when chucking the crosshead for the second boring. It is easier to turn a mandril for the wrist pin hole than to turn one for the piston rod hole; and furthermore, the wrist pin mandrel can extend through both sides of the crosshead, which would be inconvenient in the case of the piston rod hole on account of the taper.

If the crosshead is lined out, and the lines are carried the full length of the casting or forging, they will still be too short to set the crosshead by, because the thickness of a fine line in the length of the crosshead becomes considerable when multiplied by the length the connecting rod will be; hence, when the crosshead end of that rod is connected, a very minute variation from being square with the wrist pin will cause the connecting rod to require to be sprung to come as it should be with the crank pin journal, unless, indeed, the error be corrected by filing the bore of the connecting rod to suit the want of squareness in the wrist pin. If the latter expedient is resorted to, the brasses at that end will wear unduly on one side face. From these considerations we proceed as follows: We first chuck the crosshead to bore the hole for the wrist pin, clamping it to the face plate of the lathe, and setting it to the scribed lines, if there be any; or we may chuck and hold it by the outside of the metal, trying it with the surface gauge as well as making it run true. By so doing, if there is a want of truth in the casting or forging, between the part parallel with the lathe centers and that parallel with the lathe face plate, we may divide the difference between the two. While setting the crosshead, the holding plates should not be screwed up too tight, so that the work may be moved without giving it heavy blows. When the work is set, the plates must be tightened up gradually, first tightening one a little and then the other, until whole are sufficiently tightened. This is necessary, because completely tightening one bolt first may spring or force the work out of true. After the whole of the bolts are tightened the setting should be tested, to ensure that the work has not moved. The next procedure is to balance the weight of the crosshead upon the lathe face plate by bolting thereon a weight as a counterbalance, testing the balancing by pulling the lathe round by hand and observing if the face plate always stops with one particular part of the work uppermost. If it does, further counterbalancing is necessary. The hole should be bored with a stout tool, held as close in to the tool post as the circumstances will admit. The last boring should be taken at a comparatively fast speed, and with a fine cut.

The next operation is to turn up a mandrel to fit the holes bored as above. The length of this mandrel should be equal to the diameter of the lathe face plate. This mandrel need not be turned from end to end, but only just as far as to let the mandrel stand central with the face plate when the crosshead is chucked the second time. The mandrel should be for an inch at each end parallel and of equal diameter, its middle being a snug fit, so as to drive very lightly into the two wrist pin holes.

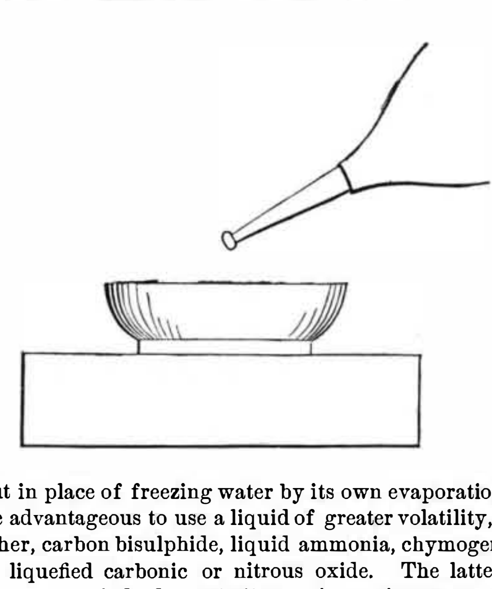
Then chuck the crosshead to bore the piston rod hole, setting it so that the mandrel stands exactly parallel with the face plate of the lathe, and making the outer end run true according to the outside of the metal. To test the setting, the surface gauge is held against the face plate and the hook end of the surface gauge scriber is tried over each end of the mandrel, taking care that the scriber point touches the mandril very lightly, as otherwise it would be apt to spring. After the turning at this end is roughed out, it would be well to test the work again, because sometimes the packing used in setting the work will compress a little, throwing the work out of true. In cases where the rod end is tried into the hole to fit the taper, watchfulness is required to see that trying the rod does not affect the setting of the work. In finishing the work, two or three fine cuts should be taken so as to ensure a clean, true, and smooth taper hole, which will not take much grinding to get a smooth polished bearing. Instead of using a chalk mark upon the rod end in trying it into the crosshead, it is better to use a little Venetian red mixed with lubricating oil, giving the work a very slight coat.

SIMPLE WAY TO MAKE ICE.

Among the different principles on which the production of artificial cold is founded, stands foremost the evaporation of volatile liquids, during which evaporation the heat made latent in the vapor causes its temperature to be far below that of the liquid from which it originates, and so robs the remainder of this liquid and the surrounding bodies from a great deal of their heat, in this way producing a cold of which the intensity is proportional to the rapidity of the evaporation, and therefore depends greatly on the degree of volatility of the liquid used.

It is a common lecture room experiment to freeze a small quantity of water under the bell jar of an air pump, when the vacuum is produced with sufficient rapidity; a tablespoonfull of water placed in a watchglass may be frozen in less than a minute, all what is necessary is that the pump be able to remove the watery vapor formed as fast as it is generated. If the air pump is not in perfect condition, it is necessary to add some auxiliary agent, and this is to place under the bell jar a flat dish filled with sulphuric acid; this, by its great affinity for watery vapor, aids the action of the pump, and makes the experiment successful, even if the pump is in a lesser degree perfect.

This lecture room experiment has been modified into a practical machine by Carré of Paris, and is since some years in operation in many of the Paris restaurants. It consists of a hand air pump, which exhausts the air and watery vapor from a strong glass bottle half filled with water, while this air and vapor before reaching the pump passes through a cylinder with sulphuric acid, which retains most of the watery vapor and makes the evaporation so rapid that a quart of water can be easily frozen in a few minutes, according to condition of machine, of season, and locality.

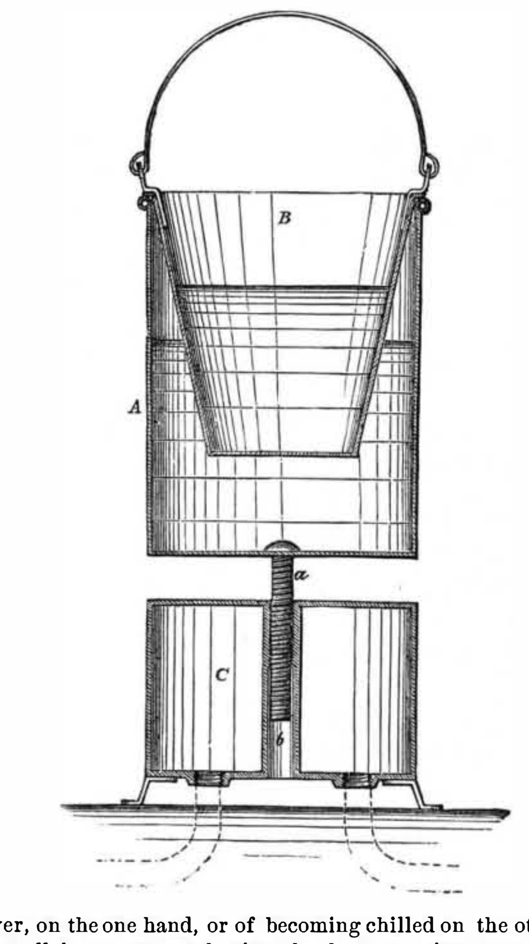


But in place of freezing water by its own evaporation it is more advantageous to use a liquid of greater volatility, such as ether, carbon bisulphide, liquid ammonia, chymogene, or even liquefied carbonic or nitrous oxide. The latter two substances are indeed so volatile that it requires no machinery to freeze water with them; it is sufficient to surround a vessel with either of those substances, when the water in it will be rapidly congealed.

Less volatile substances may also be made to evaporate rapidly enough to freeze water, without the aid of vacuum pumps, by simply aiding their evaporation by means of a blast of air. Böttger has published a simple method of which the whole apparatus required is represented in the engraving. It consists in a flat dish of very thin sheet copper, in which some carbon bisulphide, ether, or chymogene is poured; this dish is placed on a small square board of pine wood, on which some water is placed, so as to be between the board and the bottom of the dish. When in this condition the nozzle of a bellows is kept over it in the position indicated in the figure, and by working the bellows a blast of air is thrown upon the surface of the volatile liquid in the dish, and so its evaporation accelerated. After continuing this for a little while, the water under the dish is found to be frozen.

IMPROVED GLUE POT.

The desirability of keeping glue, while being used, at the right temperature, and avoiding all liability of its boiling



over, on the one hand, or of becoming chilled on the other, is well known to mechanics who have occasion to prepare and use the material. By the invention illustrated herewith this is claimed to be accomplished with certainty and without trouble. To the center of the under side of the bottom of the shell, A, is secured a screw, *a*, which extends downward and at right angles to the bottom. C represents the base, from which emanates the heat designed to dissolve the glue. This base has formed through its center an orifice, *b*, which has within it screw threads corresponding to the threads on the screw, *a*. The upper surface of the base, C, is closed, as well as its under surface. The screw, *a*, after being entered within the orifice, *b*, may be received entirely within said orifice, or but partially so.

Heat being applied into the base, C, by steam, or in any other desirable manner, the shell, A, of the glue pot is turned so as to send the screw, *a*, after being entered within the orifice, *b*, which will bring the under surface of the shell closely in contact with the upper surface of the base. In this position the greatest amount of heat is brought to bear upon the glue pot, and the glue within it very speedily begins to boil. Now, to keep the glue, after being properly prepared, at the requisite temperature, it is only necessary to revolve the shell, A, until its bottom is brought out of contact with the surface of the base. In this position a stratum of air, entering between the base and the bottom of the shell, will modify the temperature to any degree desired; and by simply screwing up or down the cylinder, A, bringing it nearer to or further from the upper surface of the base, the glue may be kept on the boil, or simmer, or otherwise, at pleasure, without danger of boiling or getting too cool to use. This invention was patented January 11, 1876, by Mr. C. S. Comins, of New York city.

Hospitals for those who can Pay.

What is called the Home Hospital Association has been organized in London for the purpose of providing comfortable hospital accommodation, with skilled nurses, in various parts of London, for the benefit of patients who can afford to pay for such advantages. Such hospitals will not only be a great convenience to the public, but will prevent the abuse of charities intended only for the poor.

A scheme is also on foot in London for the establishment of a large hospital composed of separate departments, each devoted to special diseases. It is thought that in this way one general medical staff may be able to superintend the whole institution, and that the material may be rendered more valuable for purposes of clinical instruction.

AN analysis by Charles C. Dreuding shows that the organic constituents of cotton root bark are a red and a yellow resinous coloring matter, fixed oil, gum, sugar, tannin and chlorophyll.

ON August 20th last, Frederick Cavill swam the English channel, twenty miles, from Cape Grisnez, France, to Dover, England. Time, 12 hours.

Rise and Progress of the Beet Sugar Industry in France.

The following is extracted from the Inaugural Address delivered by M. Drouyn de Lhuys at the Agricultural Congress at Compiegne:

Though the avowal be made at the cost of patriotism, it must be owned that the art of extracting sugar from the beet, which has now attained such a marvelous development, is not of French origin. Even the plant itself is not indigenous, having been introduced from Bohemia by the barbarian hordes that ravaged Gaul at the time of the Roman Empire. In his "Theatre d'Agriculture," Oliver de Serres speaks of it as a kind of forage, and appears to have presaged the possibility of extracting the matter which furnished its fermented juice. Its value as food for cattle was enthusiastically advocated by the Abbé Commerel, in a pamphlet published at Paris in 1786, under the title of "Instruction sur la Culture, l'Usage, et les Avantages de la Betterave Champêtre."

The honor of having demonstrated the existence of sugar in the beet belongs to a German chemist, named Margraff, who was born in 1709. He conceived the idea of treating various indigenous saccharine plants, such as carrot and beetroot, with alcohol, and established the fact that beets contain as much as 6 per cent of their weight of sugar. The following extracts from a memoir, which he published in 1745, show in an interesting manner how this valuable discovery, of whose immense future he could have no conception, gradually dawned upon Margraff: "I took the roots of white beet, cut them into slices, and allowed them to dry. Then I reduced them to a coarse powder, eight ounces of which I put into a stopped bottle, and poured upon them sixteen ounces of rectified spirits of wine. The whole was then subjected to heat, which was pushed up to the boiling point of the spirit, while the powder collected at the bottom of the vessel was stirred about from time to time. Immediately the boiling point was reached I removed the vessel from the fire, poured its contents into a small linen bag, and squeezed out the liquid part thoroughly from the latter. The liquid thus expressed was filtered while still hot, poured into a flat-bottomed glass vessel, corked up, and set aside in a cool place. The spirits of wine at once became turbid and at the end of some weeks small crystals were formed, having all the characteristics of tolerably pure sugar. These I dissolved anew in spirits, and thus obtained them of greater purity."

This procedure of Margraff was a mere laboratory experiment. Half a century had still to pass before any practical application of his discovery was made. The second step was also the work of a German, his name, Achard, indicates descent from a French stock. In 1795 he grew large quantities of beet on his farm in Silesia, and extracted from them sugar in abundance. He even got as far as refining the product, and in 1799 presented specimens of loaf sugar to Frederick William III. of Prussia.

In 1800 Achard published his method in a work entitled "Instruction sur la preparation du Sucre brut, du Sirop, et de l'Eau-de-vie de Betterave," which attracted the attention of the Institute of France. This body caused a detailed report of the new industry to be drawn up, the matter being then of much consequence owing to the loss of the French colonies. Sugar became still dearer when the Continental blockade suppressed maritime traffic, rising then to six and even twelve francs per kilogramme. Impressed by the necessity of procuring for the population an article of diet which had by this time become an actual necessary of life, the Government caused experiments to be made, one by one, upon all plants cultivated in France which were in any degree capable of replacing the sugar cane. In this manner grapes, plums, maize, sorgho, carrot, and maple were passed under review. Rewards were offered for the encouragement of investigation, and in 1810 Proust received from the Emperor Napoleon the Cross of the Legion of Honor and a sum of 100,000 francs for his discovery of grape sugar; while one of his competitors, Fouquet, was awarded 40,000 francs in acknowledgement of his efforts in the same direction. Grape sugar, however, is not crystallizable; it is friable; it must be employed in quantities twice or thrice as large as are required of cane or beet sugar; and in the form of syrup, extracted directly from the grape, it is even less satisfactory.

Further researches were necessary, and now the turn of beet root came. The first French factory for the extract of sugar from beet was founded at Lille, in 1810, by M. Crespel-Delisse. Some Spaniards interned in the Departement du Nord, who were familiar with the manufacture of cane sugar, lent him their assistance as workmen, and the venture soon became a great success. From 400 kilogrammes manufactured the first year, the output rose to over 10,000 in the next. The Institute had nominated a commission, composed of Chaptal, Fourcroy, Darcel, Guyton-Morvan, de Cels, Teissier, Vauquelin, and Deyeux, who were meanwhile occupied in studying the methods recommended by Achard, and seeking to improve upon them. On March 21, 1811, a *resumé* of their investigation appeared under the title of "Instruction pour Extraire le Sucre de la Betterave." Soon the impetuous genius of Napoleon, excited by a report of Chaptal's, aspired to solve the problem by main force. A decree of January 15 directed the creation of five schools of chemistry, to which 100 pupils were to be attached, 100,000 acres of land were to be cropped with beet, and four imperial factories at once established. The downfall of the Empire carried with it the ruin of this organization, established at enormous cost, by re-establishing ocean traffic, and the restoration of the colonies. On the same day that peace was declared the price of sugar fell two thirds, and declined, little by little, to 1 fr. 40c. per kilogramme. The majority of home-grown sugar makers at once succumbed in the unequal contest, but some few brave spirits still maintained the competition. Among these was M. Crespel-Delisse, who had already gone through the crises of 1812 and 1814. With renewed energy he established a central refinery at Arras, attached to it nineteen agricultural estates, destined to supply its wants in raw material, and constructed special workshops for the manufacture of the necessary plant. His contribution to the general output of sugar in the whole of France rose to 4,000,000 kilogrammes yearly. In 1824 M. Crespel-Delisse's labors were made the subject of a special report by Chaptal; in 1827 he was awarded the great gold medal, and 1864 the Government of the Second Empire claimed for him a national recompense as a public benefactor to his country.

It is scarcely necessary to recall how few industries have had such difficulties to surmount and have achieved such rapid successes. In fact, the produce from the beet, when first called into unexpected competition with that of the cane, was little more than a coarse brown sugar (*cassonade*), and there has been no lack of pleasantries at its expence. Many may remember a caricature representing the little King of Rome holding a beetroot in his hand, and crying sadly, "Papa *says* that it is sugar." Nowaday it is assuredly sugar, and good sugar too. But what vigorous efforts and what indefatigable perseverance have been required to attain this end! To achieve this victory nothing less than a triple alliance of agricultural, chemical, and mechanical science has sufficed.

Let us measure by the aid of figures the distance we have traversed in our onward march since 1827. At that date the annual production of sugar was estimated at 1,000,000 kilogrammes, in 1840 at 27,000,000 kilos., in 1852 at 75,000,000 kilos., in 1846 at 247,000,000 kilos., and in 1871 at 336,000,000 kilos. In 1875 the production had risen to 450,000,000 kilos., while the home consumption did not exceed 250,000,000 kilos., and thus 200,000,000 were available for exportation. Looking back to the glass vessel in which Margraff first crystallized the juice of beet, heated with spirits of wine, it must fain be acknowledged that the career of the home-grown sugar in Austria and in France has been a brilliant one indeed.

Epitaph on an Engineer.

The *Chicago Age of Steel* says that the following epitaph is genuine:

Here lies in a horizontal position,
The remains of
George Washington Brown,
Steam Engineer,
Whose abilities and skill were an honor
To the craft.
His fire was even; water-line at the middle cock;
Steam—just right.
Every action was marked by the pressure gauge,
And limited by the safety-valve,
And so accurately was his machinery regulated
By the governor,
He never met with an accident,
Until most mysteriously—'twas an unlucky day—
Boiler, engine and building, with mortals ten,
All went up
Higher than a kite!
Poor Brown, with nine others, departed this life
By steam
Aged 46, Cincinnati, O., April 14, 1871.
At the inquest,
The Coroner held the deceased "a blameless man."
He was always true;
'Twas the iron that was false;
Providential—so it was to be.
Peace to his dust.

The School Blackboard.

A correspondent of the *New England Journal of Education* states that the Rev. S. R. Hall, LL.D., who recently died in Brownington, Vt., at the age of 82, where he was pastor of the Congregational church for some thirty years, originated the notion of using a blackboard in schools. He first used it in Rumford, Me., in 1816, to illustrate arithmetic. The first one was made of black paper, which he marked upon with white chalk. The notion was at first ridiculed, but Mr. Hall persisted in its use, and finally met with favor He next used it in Concord, N. H., where he taught for some years. Here it was a great novelty in the public schools, and many visited the school to see its use; but this way of explaining arithmetic was so successful that it was adopted very soon after 1812 all through New England, and now no teacher seems to be able to get on without it.

New Steamship.

The City of Macon, lately launched from the yard of John Roach, Chester, Pa., has been built for the Ocean Steamship Company of Savannah. She is of iron, 2,250 tons; length, 272 feet over all; 38 feet 6 inches beam moulded; depth from base line to top of spar deck, 26 feet 10 inches; depth of hold, 24 feet 10 inches. She has two compound surface condensing engines of 1,650 horse power. Her boilers are four in number, and are tubular cylindrical. Her propeller is of the Hirsch patent. She will ply between New York and Savannah, in connection with the Georgia Central Railroad.

A Satisfactory Grasshopper Machine.

Professor Riley, of the Entomological Commission, has during the summer perfected a grasshopper machine, which seems to be just the thing. It is intended to do away with all extra material, like coal oil, which in the long run is expensive, and to work at all seasons, whether the insects are just hatching or full grown. It is not patented, nor does the Professor intend to patent it, unless it is found necessary to prevent others from doing so. In the *Industrialist*, the organ of the Kansas State Agricultural College at Manhattan, Mr. A. N. Godfrey thus speaks of the machine:

The Mechanical Department has constructed a new locust exterminator for Professor Riley. This machine operates upon the bagging principle. It is, briefly, a large canvas bag stretched upon a light but strong frame and placed upon runners, which extend with curved tips a little in front of the mouth. The canvas is stretched upon the inside of the frame, thus making the bag smooth and even within. This bag has a mouth ten feet long and two feet high, and converges backward to a small box one foot square with an opening covered with wire cloth above, and containing a slide cut-off at the end. This box opens into a small cylindrical bag two and a half feet long and one foot in diameter. This bag is kept in position by two tin hoops attached to a wide runner beneath, which is fastened to the main machine by leather straps. The hinder ring contains the door, which is of wire cloth stretched upon a stout iron ring, which fits tightly within the bag-ring, and swings upon a pivot like the damper in a stovepipe. The door is fastened by a small iron rod dropped through holes in the bag-ring at right angles to the axis of the door. The machine is made to "take more land" by means of two triangular wings about six feet long attached to the ends, from which are suspended a number of teeth or beaters, which, swinging loosely, drive the 'hoppers towards the center. The wings also serve as attachments for the motor power.

On smooth ground the machine can be easily hauled by two men, but where the grass is tall and thick it pulls harder. The locusts on hopping into the machine soon reach the small back portion, enter the small bag and are attracted to the rear end by the light which enters at the gauze door. When a sufficient number are thus captured, the machine is stopped; the cut-off is slid down in the box, thus shutting the 'hoppers in the bag; a hole is dug behind the machine, the bag tipped into it, the 'hoppers buried, and "presto!" the thing is done.

The advantages of this machine are many, some of which are that it requires no additional expense to run it, as for oil, tar, etc.; it will catch the winged locusts as well as the young, if operated on cool morning and evenings; and is adapted to almost all conditions of growing grain. The machine can be made for about ten dollars, and perhaps less. From all appearances the machine will give good satisfaction, and armed with it we may hope to make a successful "strike" against any "locust monopoly" that may try to crush us in the future.

A New Case of Aniline Poisoning.

Not long since we published an article by Dr. Seidler, on the aniline dyes and their effect on the system (SCIENTIFIC AMERICAN, page 40, July 21, 1877). Notwithstanding his very plausible theories in regard to the non-injurious effects of infinitesimal quantities of the poison, if such it be, we have some facts from Berlin that seem to throw doubt on his conclusions. On pleasant Sundays in summer large numbers of the denizens of that metropolis seek recreation in the pleasant retreats of Potsdam, the summer residence of royalty. On the last Sunday of July a large number of these pleasure seekers suffered injury from fuchsine poisoning. It seems that reports had reached the Potsdam police that sickness had followed the partaking of some so-called raspberry extract, a favorite flavoring over there, and usually of a very bright red color. The police at once instituted an investigation and found that the raspberry extract sold by a certain Potsdam merchant contained but very little of the juice of the berry and very much aniline, especially fuchsine. The raspberry juice found was at once confiscated and an official warning published in the Potsdam papers against raspberry juice. These praiseworthy precautions prevented any further poisoning during the ensuing week among the citizens of Potsdam, but the calamity broke out again with greater severity among the Sunday guests from Berlin. A number of persons who had been wandering about the beautiful gardens of Sans Souci were resting in Blume's café near the orangery, and drinking white beer mixed with raspberry extract. Soon after partaking of these, symptoms of poisoning were noticed, nausea and vomiting, etc.; some of the ladies even fainted away. Police-consul Thiedecke, Dr. Frank, and others have attributed this sickness to fuchsine, although some of our readers might consider this strange admixture of raspberry and weiss beer, upon the empty stomach of a weary pedestrian, able to produce sickness without the aid of fuchsine. Be this as it may, Berlin raspberry juice is at least suspicious.

Fire Arms Improvements.

Col. Silver, of London, Eng., has made two very good improvements, specially useful in heavy and rapid firing. The first consists of a soft rubber heel plate, which is readily attached to any gun. It takes up the recoil in an admirable manner, and thus permits the firing of heavy charges with impunity.

The second improvement consists of a hard rubber hand guard, made in the form of a sleeve, that slips over the barrel and forms a non-heat-conducting cover. By the use of this guard the gun barrel may be firmly held in the hand even after it has become scorching hot under rapid firing.

Samples of these devices are furnished by Mr. Joseph Dixon, 7 Bloom Grove, Lower Norwood, London.

Professor Loomis' New Meteorological Deductions.

Professor Elias Loomis of Yale College, after examining the immense number of weather observations collected by the United States Signal Service, deduces the following generalizations. The seven papers wherein the detailed discussion has been embodied have appeared in the *American Journal of Science and Arts* whence the summarized conclusions below given are extracted:

1. Areas of low barometer result from a general movement of the atmosphere towards a central area, and this movement is accompanied by a deflection of the wind to the right, which causes a tendency to circulate around the center with a motion spirally inward.

2. This deflection to the right, which results from the earth's rotation, causes a diminished pressure within the area of this inward movement, and the pressure is still further diminished by the centrifugal force resulting from the circulation about a center.

3. The amount of the barometric depression depends upon the force of the wind, and the geographical extent of the revolving atmosphere. The effect of centrifugal force is not considerable except when the velocity of the wind approaches that of a hurricane. With a velocity of 100 miles per hour, the depression due to centrifugal force may amount to about two inches; but in the winter storms of the middle latitudes, with a velocity not exceeding forty miles per hour, the depression due to centrifugal force seldom exceeds one or two tenths of an inch. In these storms, three quarters of the observed depression of the barometer is usually the effect of the earth's rotation: but in order that the depression at the center may amount to as much as one inch, it is generally necessary that this system of circulating winds should prevail over an area nearly 2,000 miles in diameter.

4. In North America, south of latitude 35°, areas of low pressure are less frequent and generally exhibit a less depression than near latitude 45°, because the area over which a cyclonic movement of the winds prevails is small; and this area is small because, if a cyclonic area could be formed having a radius of 1,000 miles with its center in latitude 30°, its circumference must extend southward to latitude 16°, where the trade winds are steady and seldom interrupted. Such a diversion of the winds toward the north, even if it could be produced, could not be long maintained; so that a large cyclonic area with its center in latitude 30° is well nigh impossible; and it is impossible that there should be a great depression of the barometer in latitude 30°, except with a wind having a hurricane velocity. This is believed to be the reason why in North America the centers of great storms are generally found north of latitude 40°.

5. The causes which may produce a general movement of the atmosphere toward a central area are (A) unequal pressure as shown by the barometer; (B) unequal temperature; and (C) unequal amount of aqueous vapor. Of these three causes the effect of the first is generally so decided that the influence of the other two causes can only be detected by careful observation; but when the pressure of the air is nearly uniform over a large extent of country, the influence of the other two causes is sometimes very palpable, and their influence is generally seen in a slight deflection of the winds from the direction they would have if wholly controlled by the first cause.

6. A cyclonic movement of a large mass of air is generally attended by an upward motion in certain localities, chiefly on the eastern side of the center of low pressure, and this upward movement results in rainfall. The rainfall is then not generally the original cause of the barometric depression, but rather an incident of the cycloidal movement of the atmosphere. The fall of the barometer during a rain storm cannot be ascribed to the simple condensation of the vapor of the atmosphere, as some have supposed, since a rainfall of one or two inches prevailing over an area 300 miles in diameter near latitude 30° produces scarcely an appreciable effect upon the barometer.

7. The progress of areas of low barometer in all latitudes is determined mainly by the same causes which determine the general system of circulation of the atmosphere; and their normal direction is changed by whatever causes may change the direction of the winds.

8. The heat which is liberated in the condensation of a large amount of aqueous vapor must exert an influence upon the movements of the air, so that while the rain is generally to be regarded not as the original cause but rather as one of the incidents of extensive cycloidal movement, if the rain area has great geographical extent, it may have a decided influence upon the amount of the barometric depression and upon the velocity with which the storm advances; sometimes accelerating its motion, sometimes retarding it, and sometimes holding it nearly stationary in position for two or three days.

The Electric Light.

The Russian Government, it appears, is turning its attention to the electric light as an illuminator for military purposes. In some experiments recently made at St. Petersburg, with the special object of increasing the distance to which the light produced by electricity may be thrown, it was found that the power of the light is greatly augmented by covering the carbon burner with a thin sheet of copper. The augmented light was sufficiently powerful to render objects visible at night at a distance of upwards of 3,000 yards.

Professor Langley's Apparatus for Eliminating Personal Equations.

A well known source of error in astronomical observations is that due to the deficiencies of the observer himself in the shape of defects in vision, perceptive power, etc. In order to eliminate this, astronomers have adopted two courses; either to find the amount of personal error in each case and apply a subsequent correction, or to diminish or eliminate the same by suitable devices during the act of observation. Professor S. P. Langley describes, in the *American Journal of Science and Arts*, and new and very ingenious apparatus for eliminating the "personal equation" on the star itself. It is constructed and operated as follows:

On the transit pier (or in any other convenient locality) is a small clock, with a conical pendulum, whose bob slides freely up and down the graduated rod, retaining its position where left. A small horizontal wheel in the clock is controlled by the pendulum, and turns once for a certain constant number of its revolutions. This wheel revolves once for each equatorial interval of the transit wires, when the bob is set at a mark near the top of the rod, and by sliding the bob sufficiently downward; with the use of a readily constructed table, we can, given the declination of any star between the limits 0° and ± 60°, set the pendulum, so that this wheel shall make exactly one revolution while the star passes from wire to wire. This wheel carries near its periphery a mercury drop or other contact piece, which once in a revolution is carried past a point fixed near the periphery of a stationary horizontal wheel, concentric with the first, and immediately above it, but insulated and entirely detached from it.

This upper wheel, while thus related to the lower, is entirely disconnected from the machinery of the clock, and is thus far stationary; but it can be revolved by cords passing from a groove in its circumference to the hand of the observer at the transit. As the upper, or ordinarily fixed, and the lower or constantly moving, wheels have a common vertical axis of revolution, and as the radial distance of the point in the upper from this axis is the same as that of the contact piece on the lower, it will be seen, while the upper wheel remains motionless, electric contact accompanied by a simultaneous flash, if we desire it, at the transit lantern or elsewhere, will be made at equal and uniformly recurrent epochs, the interval between which depends only on the adjustment of the pendulum. If the upper wheel be rotated forward by hand, through a small distance, and then left, the next contact will still occur, but at a later epoch, owing to the lower wheel's having to complete more than one revolution to make contact, but after this the contact and simultaneous flash will recur at the same intervals, and with the same regularity as before. If the upper wheel be moved backward, the flash will occur once, earlier, and thereafter with regularity. Moving the upper wheel, then, changes the epoch from which any series of such flashes dates, and adjusting the pendulum bob fixes the interval between subsequent flashes. In practice the lamp is removed from the transit lantern, and the two terminals of a battery or induction coil in its place cause the flash to be thrown upon the wires, whenever the mercury drop is in contact with the point, and at the same instant a mark is made automatically on the chronograph and interpolated in the regular record of the beats of the sidereal clock, which go on in the usual way quite independently of any reference to the apparatus just described.

The mode of observation will be anticipated. Before the transit of any star the observer adjusts the conical pendulum beside him (this is the work of but a few seconds), and then seats himself at the instrument holding the cords in one hand like the "reins" of an equatorial. If a flash occur just as a star is crossing the first wire (which is most unlikely) he has nothing to do, except possibly to note which was the middle wire, for each records itself on the chronograph without any intervention of his. But if the star be, for instance, two thirds of the way from the first to the second wire at the first flash, he will draw one of the cords, accelerating the flash and thus causing the star to appear nearly coincident with the second wire when the next spark comes, and repeat the adjustment by the light of subsequent flashes, till the bisection is perfect. Three or four trials are in practice found to yield a bisection which will satisfy a fastidious eye, and when a satisfactory one has been once made, the effect is automatically repeated.

Under the general conception, then, of the possibility of diminishing to any limit personal error, by employing brief views of the star or wire and utilizing the phenomena of persistence of vision, the particularly described device assumes to dispense with the observer's record upon the chronograph altogether, and to substitute a purely automatic one giving the same virtual result as though the image of the star were a tangible object, itself making electric contact with each wire. The share of personality in any observation is relegated to the prior act of bisecting a star, virtually motionless with relation to the bisecting wire, so that if (as seems to be the case) this act is independent of quickness or slowness of perception, of the time of cognition, or of the speed of nerve transmission; personality, in the technical sense, appears not to intervene at all.

Recent American and Foreign Patents.

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NEW HOUSEHOLD INVENTIONS.

IMPROVED SAD IRON AND FLUTING IRON COMBINED.

Christopher C. Burke, Cuthbert, Ga.—This improvement consists in forming the iron in box form with four smoothing faces, two large ones and two smaller ones, and combining it with a handle in such a manner as to be reversible, and with a heating plug or block to be inserted in the hollow iron which has four faces, corresponding to the four faces of the iron. It also consists in the particular means for connecting and disconnecting a plate carrying one of the ironing faces, to admit the insertion or removal of the plug or block, and the adjustment of a fluter.

IMPROVED RECIPROCATING CHURN.

Allen D. Ferris, Blakeley, Minn.—This invention relates to oscillating churns; and the nature of the invention consists in combining, with a semi-circular cylindrical oscillating churn box, a removable rectangular frame, having slats arranged in it in such manner that when the box is rocked rapidly the milk in it will be violently agitated, the currents being directed upward and downward by reason of the position of the dashers or slats. The slats on one side of the frame are inclined in an opposite direction to those on the other side of the frame, and the angle of inclination of the slats is such that the milk is directed both upward and downward by the same slats at each oscillation of the churn box. The currents are thus opposed to each other, and a violent agitation is produced which greatly shortens the operation of churning. The slats also serve to gather the butter when it comes.

IMPROVED COMBINED LAMP REST AND SHADE HOLDER.

Partrick J. Clark and Joseph Kintz, West Meriden, Conn.—This invention relates to an improved lamp rest and shade holder combined, by which the shade may be readily swung out of the way, and securely retained in raised position while the fount is taken off for refilling and other purposes, the fount being securely applied to the fount plate or basket, and any danger of upsetting or dropping the lamp effectually prevented. The invention consists in the connection of the lamp fount, having a central cavity, with a spring wire holder or clamp that screws the fount or basket tightly to the bracket or chandelier; and it also consists in the connection of a fount plate or basket with an adjustable rod carrying the swinging shade holder. The fount when placed on the spring wire holder is rigidly retained on the plate or basket without danger of being thrown off or detached from the same in accidental manner. The wire holder admits at the same time the ready sliding of the fount when lifted in vertical direction, for clearing, refilling, etc., and the instant replacing by pressing the fount down on the holding device. The shade or chimney is swung back on the fount as soon as the same is placed in position on the holder, being securely supported in raised position as as to remove and replace the fount and light the lamp in convenient manner.

IMPROVED BROILER AND TOASTER.

Andrew C. Bolton, Greenport, N. Y.—This invention consists of two light wire frames hinged together, and provided with a spring fastening and with a wooden handle. The object of the invention is to provide a simple and efficient device for holding meat or bread over the fire while broiling or toasting The frame is formed by bending a wire into a rectangular form, and twisting it together at the center of one of the sides of the frame. This frame is stiffened and supported by two wires which pass through the first twist of the wire that forms the frame. The wires that diverge from this point and pass under the transverse wires which are fastened to the frame, and are attached to the end of the frame opposite that in which the twist is formed. The wires and the ends of the wire that forms the frame are parallel outside of the twist, and are placed in a wooden or non-conducting handle.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED THILL COUPLING.

Francis E. Justice, Marysville, O.—The object of this invention is to provide a simple means for preventing the detachment of the thill iron except when the thills are raised to a vertical position, and also for supporting the thill ends off the ground when the carriage is not in use. The said means consists of a horizontal bar attached to the under side of the eye of the thill iron, so as to come in contact with an elastic block which is secured in the socket of the clip in such position as to act as a buffer for the said bar when the thills are lowered.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED SCROLL-SAWING MACHINE.

William Hinchliffe, Nashville, Tenn.—The object of this invention is to provide a simple easy-running scroll saw, that maintains an even tension on the blade at every portion of the stroke. The table, similar to an ordinary sawing machine table, in which the shaft of the driving wheel is journaled, and in the lower part of which is pivoted the treadle which is connected by a pitman with the crank formed in the shaft of the wheel. The saw blade is clamped to the bars by means of the clamping screws. and the position of the saw in the clamping device is determined by a pin that projects from the side of each head. The machine is operated by working the treadle, and more or less tension is given the saw by turning a screw, and by turning another screw the table may be pitched or inclined. The arrangement of the spring is such that the tension on the saw is always the same in all parts of the stroke.

IMPROVED DEVICE FOR SUPPLYING LOCOMOTIVE TENDERS WITH FUEL.

Will C. Hamner, Water Valley, Miss.—The object of this invention is to furnish an improved device for supplying locomotive tenders with coal or which shall be so constructed as to discharge the required supply into the tender at once, so as to avoid the delay which is unavoidable when the tenders are supplied in the usual way. The invention consists in the employment of a pivoted or tilting box for supplying locomotive tenders with fuel. To the platform of the railroad track are attached two posts, to the upper ends of which is pivoted a box. The box is made of such a size as to contain the quantity of coal or wood to be supplied to a tender at a time. To the side of the box is pivoted a hook latch to catch upon a pin attached to a post secured to the platform. The latch is held forward by a spring attached to the box, and its forward movement is limited by a stop pin also attached to said box, so that the latch will always be in position to catch upon the pin automatically when the box is swung back into place after being tilted to discharge its contents.