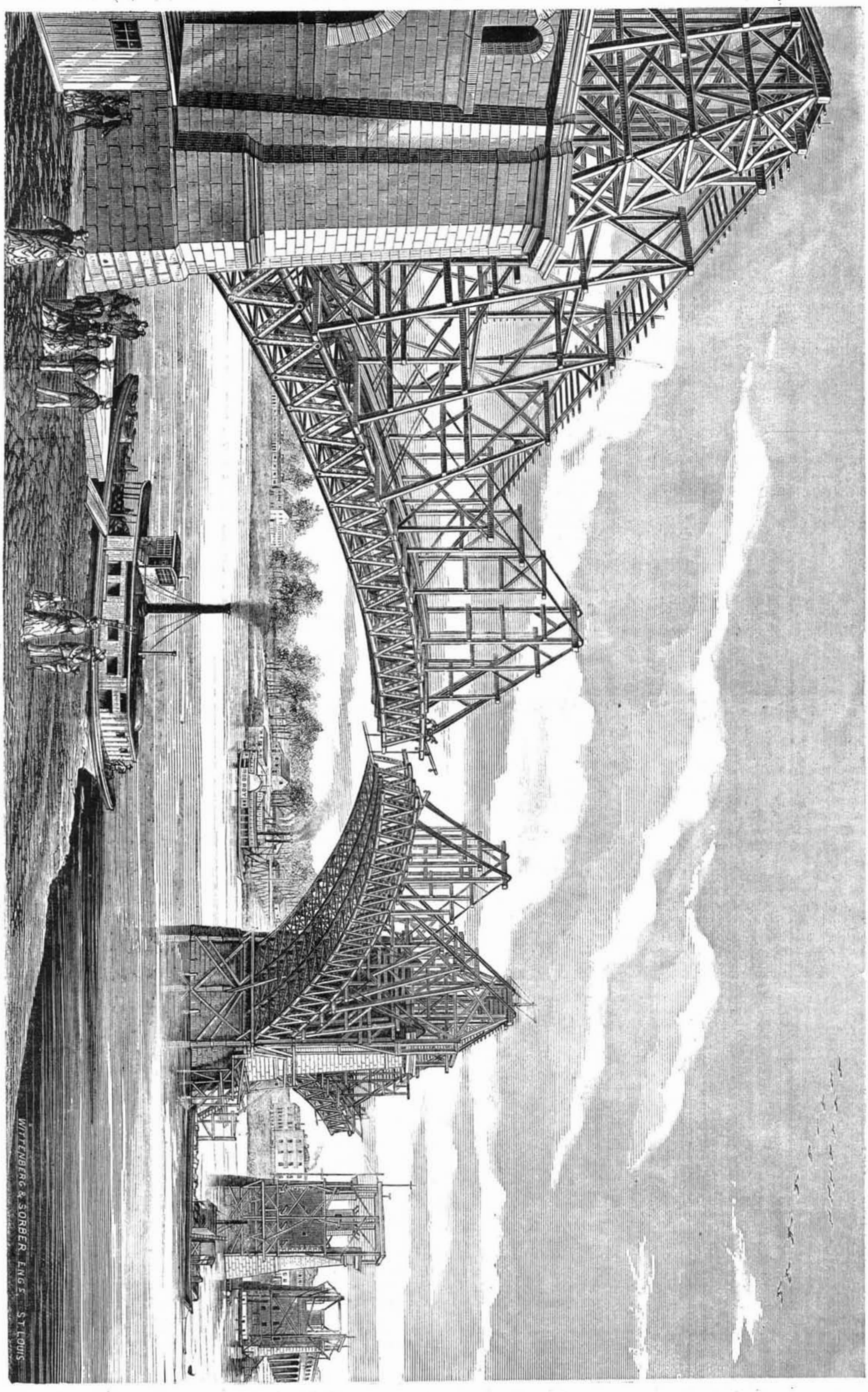
## THE GREAT BRIDGE AT ST. LOUIS.

In former numbers of the SCIENTIFIC AMERICAN, we have given various interesting details pertaining to the remarkable work involved in building the granite piers of this great example of engineering. We have also given various illustrations thereof, and of the superstructure. We now present an engraving which will intelligibly illustrate the ingenious manner in which the placing of the superstructure is being executed. This work is now proceeding at St. Louis, and by its novelty attracts the attention of engineers from all parts of the world. The chief engineer of this great work is Captain James B. Eads, of St. Louis, to whose fame as a man of science the success of the structure will add many laurels. It is expected that the bridge will be finished in July, 1874. The following interesting particulars are derived from a letter in the New York *Times:*

The river is spanned by three arches springing from east and west abutment towers to piers in the river. From the abutments to the piers, east and west, the arches have a span of 502 feet; the central arch from pier to pier has a span of 520 feet. These arches are of cast steel. The bridge being double, the arches are double, but the principle can be more easily shown with one part; for as it is built, it is really two bridges joined together, and it could be made indefinitely broader or narrower according to requirement. The arch is composed of tubes, each twelve feet in length, joined together by most admirable couplings. There are four sets of tubes, arranged two above and two below. The top and bottom row form what is technically called a chord, and these are united together by main braces in the form of the letter A. The two chords are united laterally by huge tie rods. That is the whole principle of the matter.

The *modus operandi* is as follows: The tubes are brought in barges underneath the place where the men are working, and are elevated by a small stationary engine. The ends of the tubes are so nicely grooved that they fit in very tightly, even without the couplings. They are grooved also on the outside, to correspond with the grooves and fillets of the couplings. When the latter have been applied, an enormous pin, with a diameter of five inches and a weight of 100 pounds, is screwed through the couplings, going, of course, also through the united ends of the two tubes. The bridge being double, there are eight rows of tubes, making, for the side arches 340 to the span, and 342 for the central one. The men are working now on the eastern half of the bridge, the other being in such a forward state that it has to be neglected until the rest of the work balances it. In this gigantic work the utmost thought of little things is imperatively needed. The moment that one tube is in place, the tube that balances it on the other side of the pier must be put into position. The strain upon the iron cables that support the tubes until they form a perfect arch is regulated to a pound weight by means of hydraulic rams. When the temperature rises the cables stretch, and the whole fabric of uncompleted arching sinks a little. It has to be raised up, and the rams do this by taking a little gentle pull upon the cables, or, as the mariners would say, "hauling taut." This is effected by pumping a little glycerin into the rams. If, on the contrary, the temperature falls, the cables contract and tilt up the arching a trifle more than is required. Then the watcher over the rams has to pump out a little glycerin, and the pressure on the cables is relaxed. This little place where the rams are may be considered the great artery of the work. The perfect control that Captain Eads and his assistant have over their offspring is sometimes evinced in an amusing way. The method of construction to preserve the just balance is naturally to build the tubes half way from each side of a pier at the same time, so that one half balances the other half. The engineers commenced in this manner with the pier nearest the western bank, building up, at the same time, the tubing from the western abutment. When the latter met the western half of the first pier, the extremely hot weather had expanded the metal, and the tubes would not unite. Baron Fladd immediately bought hundreds of bales of gunny bags, and packed the recalcitrant tubes in ice. All night the thermometer kept rising, but the ice did its work, and they came together so closely that you could not have seen daylight between them. The same result could have been obtained by blasts of cold air, but the Keystone Bridge Company, of Pittsburgh, who have the contract for the superstructure, were in a hurry to close the western arch, so the ice was used.

The workmen now thoroughly understand the handling of the tubes, and are putting them together on the eastern half at the rate of twenty-four a day. The frames, from which the long curves of tubing stand, are all inserted. These are called skewbacks, and are of wrought iron, forged in one piece of three tuns—a very creditable specimen of the handi-




THE GREAT BRIDGE AT ST. LOUIS—ERECTION OF THE SUPERSTRUCTURE.

work of Pittsburgh. The first tube, which is very short and stout, is screwed to this with four steel bolts, five inches in diameter, which go back into the very bowels of the pier, twenty-eight feet, and are then driven through an anchor plate. This fact will give a better idea of the huge masses of masonry serving as piers than any formal statements or measurements. The men engaged in the construction belong to a class which American enterprise has called into existence. They are bridge builders, working at nothing else; and though not scientifically educated, have a rough and ready comprehension of the work they do, which tends to elevate their minds. They are trained to perfect exactitude in the smallest details. If a bolt does not fit perfectly, there is no thought of assisting it promptly with a sledge hammer; but there is an instant conclusion that, by some accident, the bolts have become mixed, and that this is not the special bolt for that particular hole. For down to the minutest scrap of iron, everything has been fitted at Pittsburgh, and must fit here. To nearly fit will not do; it must absolutely fit. The consequence of such exact training is exemplied in the conduct and manner of the men who are, without exception, the most intelligent and orderly body of workmen I have ever seen. With such men rapid progress is certain, and there can be no doubt that the arches will be completed before the end of November. But the bridge will not be finished then, by any means. The roadways have to be built upon it. The upper one will be for omnibuses, foot passengers, etc., the lower for a double tracked railway. These two will be supported by struts, the longest of which near the piers, will be 56 feet, and then gradually diminished as they approach the center of the arch. These struts will rest upon the heads of the couplings where the tubes are strongest, and, as only a direct weight comes upon them, will be able to bear five times more than the bridge company will ever permit; for the transit of trains will be entirely in the hands of the company's officers.

### Molecules.

Professor Clark Maxwell lately delivered an interesting lecture before the British Association upon molecules, by which is meant the subdivision of matter into the greatest possible number of portions, similar to each other. Thus, if a number of molecules of water are combined, they form a mass of water. Molecules of some compound substances may be subdivided into their component substances. Thus the molecule of water separates into two molecules of hydrogen and one of oxygen.

The ancient atomic theory, described more than two thousand years ago by Lucretius, was that the molecules of all bodies are in motion even when the body appears to be at rest, and this is the accepted theory of today. In the case of solids, these motions are confined within such narrow limits that we cannot, even with the microscope, detect any alteration in their positions. But liquids and gases may be subjected to experiments which afford convincing proofs of molecular motion. If the gases of ammonia and hydrochloric acid, for example, be placed in a glass tube, with a stratum of air between, the lighter gas, ammonia, above, the gases diffuse through the air and produce a white cloud when they meet.

Air confined in a vessel presses, as we say, against the wall thereof. What we term pressure is simply the impact of the moving molecules against the interior surfaces of the vessel. The amount of the pressure depends upon the number of molecules of air or gas within the vessel. By the application of heat, the movement of the molecules is increased in velocity, and such increase of course causes each molecule to strike harder against the walls of the vessel; in other words, the pressure is increased; the law of such increase of pressure being as the square of the velocity of the molecules.

Dr. Joule has calculated the velocity of hydrogen molecules, at the temperature of melting ice, at a little over 6,000 feet per second. The molecules of ammonia move about 2,000 feet per second. The molecules of common air move with a velocity of seventeen miles per minute; and if they all moved in the same direction, nothing could stand such a wind. But molecules constantly impinge against each other; and by this contact, their directions of motion are incessantly changed.

Professor Maxwell has calculated the size and weight of hydrogen molecules, and finds that about two millions of them, placed side by side in a row, would occupy a length of about one twenty-fifth of an inch; and that a package of them, containing a million, million, million, million of them, would weigh 62 grains, or not quite one eighth of an ounce.

Each molecule throughout the universe, says our author, bears impressed on it the stamp of a metric system as distinctly as does the meter of the archives at Paris, or the double royal cubit of the Temple of Karnac.

No theory of evolution can be formed to account for the similarity of molecules, for evolution necessarily implies continuous change, and the molecule is incapable of growth or decay, of generation or destruction. None of the processes of nature, since the time when Nature began, have produced the slightest difference in the properties of any molecule. We are therefore unable to ascribe either the existence of the molecules or the identity of their properties to the operation of any of the causes which we call natural. On the other hand, the exact equality of each molecule to all others of the same kind gives it, as Sir John Herschel has well said, the essential character of a manufactured article, and precludes the idea of its being eternal and self-existent.

Thus we have been led, along a strictly scientific path, very near to the point at which science must stop. Not that science is debarred from studying the internal mechanism of a molecule which she cannot take to pieces any more than from investigating an organism which she cannot put together. But in tracing back the history of matter, science is arrested when she assures herself, on the one hand, that the molecule has been made, and on the other that it has not been made by any of the processes we call natural.

Science is incompetent to reason upon the creation of matter itself out of nothing. We have reached the utmost limit of our thinking faculties when we have admitted that, because matter cannot be eternal and self-existent, it must have been created. It is only when we contemplate, not matter in itself, but the form in which it actually exists, that our mind finds something on which it can lay hold. That matter, as such, should have certain fundamental properties, that it should exist in space and be capable of motion, that its motion should be persistent, and so on, are truths which may, for anything we know, be of the kind which metaphysicians call necessary. We may use our knowledge of such truths for purposes of deduction, but we have no data for speculating as to their origin. But that there should be exactly so much matter and no more in every molecule of hydrogen is a fact of a very different order. We have here a particular distribution of matter, a collocation, to use the expression of Dr. Chalmers—of things which we have no difficulty in imagining to have been arranged otherwise. The form and dimensions of the orbits of the planets, for instance, are not determined by any law of Nature, but depend upon a particular collocation of matter. The same is the case with respect to the size of the earth, from which the standard of what is called the metrical system has been derived. But these astronomical and terrestrial magnitudes are far inferior in scientific importance to that most fundamental of all standards which forms the base of the molecular system. Natural causes, as we know, are at work, which tend to modify, if they do not at length destroy, all the arrangements and dimensions of the earth and the whole solar system. But though in the course of ages catastrophes have occurred and may yet occur in the heavens, though ancient systems may be dissolved and new systems evolved out of their ruins, the molecules out of which these systems are built—the foundation stones of the material universe—remain unbroken and unworn. They continue this day as they were created, perfect in number and measure and weight; and from the ineffaceable characters impressed on them we may learn that those aspirations after accuracy in measurement, truth in statement, and justice in action, which we reckon among our noblest attributes as men, are ours because they are essential constituents of the image of Him who in the beginning created, not only the heaven and the earth, but the materials of which heaven and earth consist.

### Odd Fish.

The summer's work of the American Fish Commission is of unusual interest from the fact that a large number of queer marine animals have been brought to the surface by the improved dredging apparatus employed; and, besides, much valuable information has been added to our knowledge regarding the habitat of various fishes and mollusks. A correspondent of *Forest and Stream* epitomizes, in an interesting communication, the labors of the scientists who have conducted the explorations, and we extract therefrom the following particulars regarding the progress and discoveries made: A live *calista convexa* (a species of clam), brought up in Casco Bay, has, it seems, upset the opinion that it was extinct so far north. Quohogs, which once existed in plenty and the shells of which are found in the Indian shell mounds which cover Peak's Island on the coast of Maine, are now obtained only in a little cove in Casco Bay; while oyster shells, to which a saddle rock is but a pigmy, are thickly planted below the bottom of Portland Harbor, though as living organisms their species is now extinct.

Down in these ocean depths, the animal kingdom takes from the floral tribe the duty of embellishment, but these flowers wave their graceful petals but to entrance a victim, which, when seized, is pressed close to its mouth and then, even if larger than its captor, is swallowed whole. Holding tightly to its prey, the sea anemone gradually protrudes its stomach from its mouth; and turning it inside out, envelopes its dinner and then lies quietly waiting the death of its food and subsequent digestion. Then such portions as are not suitable are rejected, and the stomach is again stowed away for future use. The sea cucumber (*pentacta frondosa*) is another curious creature. First found, it is a small compact gherkin: but left to itself, it swells and developes into an immense cucumber. Two magnificent specimens of a star fish known as a *gomaster phrygianus* were found in deep water, where an almost icy temperature made for them a constant winter. They are four or five inches from point to point, and of a deep scarlet hue with a surface embossed like shagreen. Hundreds of a pale straw colored star fish (*clenediscus crispatus*), hitherto esteemed very rare, were brought up from these icy depths. Three large specimens of a rare and beautiful anemone (*urticina digitata*), the first perfect ones ever found, were also obtained, a discovery of interest from the fact that none of the species have been recorded as existing nearer the coast than George's Bank and at a depth of 400 fathoms.

Worms predominate in the hauls of the dredge. Many sorts and sizes were found, from tiny creatures, the peculiarities of which are distinguishable only under the microscope, to the grand *cerianthus borealis*, one of the anemone family, a foot in length. All have the same style of house, and exude from their bodies a slime, which probably has chemical affinity for the lime in the water and which causes the mud to adhere. One specimen caught had a tube around him, an inch in diameter and a foot in length. He was thrown into a basin of water where he moved rapidly about, evidently ill at ease. The next day he was lying quiet; and about his neck was a ring of mud formed from the floating particles in his prison. During the evening, he was found stretched out at full length, trying to swallow an anemone that had been imprisoned with him.

The hermit crab is a common but curious creature, resembling a little lobster, armed with powerful claws and a very thick breast plate. He is a quarrelsome customer; but unfortunately for him, the after part of his body is soft and defenceless. Left to his own resources, he is a great coward, but gets an accession of bravery when he discovers an empty univalve shell. This he examines inside and out, turning it over and over until satisfied that there is no weak place in the rear, when he passes into it tail first, and then, calmly folding his strong claws across the entrance, is ready for the fray. When a larger crab finds a shell that suits him, in which a smaller one of his own species has already taken refuge, he unceremoniously inserts a claw and drags the little one out. The shell becomes the home also of a beautiful hydroid which appears like a velvet coat of waving fibers. These, seen through a microscope, resolve themselves into a triune creature, three bodies on one stem, each with its special function to perform, making one little single life. One body absorbs food, another reproduces the young, while a third, armed with tiny jaws, defends the little community against other creatures still smaller.

Another odd specimen found was the goose fish or *lophius Americanus*. It is about two and a half feet long, a flat, thick mud-colored, mis-shapen monster, whose small fins proclaim it not a rapid swimmer. Burrowing close to the mud, it elevates two little fishing rods, each about twelve inches in length, formed of a stiff elastic substance like the spine of a catfish. These spring from the upper part of the nose; and when not in use, lie back flat upon the head. When the first wants his dinner, however, the rods are raised at various angles and moved slowly about; on the end of each dangles a red muscular fiber which dilates and contracts like a worm. Attracted by this bait, the unsuspicious pollak attempts to appropriate it. Slowly the goose fish lowers its lip, and then suddenly engulfs the unwary victim in its mouth, which, set with great fangs, opens like an old fashioned carpet bag.

Another curious find was the egg of a skate, seemingly a dark colored case, of texture somewhat like a beetle's back, but tougher. It was shaped like a fisherman's creel, a rectangle with the ends cut out, leaving a square center with four projections on which to wind the line. The egg shell is not unusual and can be found on sandy beaches, thrown up by the tide, dried and empty, looking like the husk of some nut. The specimen found was opened, and the little creature released and placed in a basin of water, where it swam around for several days. The yolk of the egg remained attached and appeared quite as large as the fish.

### Regular Eating.

Half of all ordinary diseases, says Dr. Hall in his *Journal of Health*, would be banished from civilized life, and dyspepsia become almost unknown, if everybody would eat but thrice a day at regular times, and not an atom between meals, the intervals being not less than five hours, that being the time required to digest a full meal and pass it out of the stomach.

If a person eats between meals, the process of digestion of the food already in the stomach is arrested, until the last which has been eaten is brought into the condition of the former meal; just as, if water is boiling and ice is put in the whole ceases to boil until the ice has been melted and brought to the boiling point, and then the whole boils together.

But it is a law of nature that all food begins to decay, after exposure to heat and moisture for a certain time. If a meal is eaten, and in two hours another, the whole remains undigested for seven hours, before which time the rottening process commences, and the man has his stomach full of carrion—the very idea of which is horribly disgusting.

As, then, all the food in the stomach is in a state of fermentive decay, it becomes unfit for the purposes of nutrition and for making good pure blood. Small wonder is it that dyspeptics have such a variety of symptoms, and aches, and complaints in every part of the system, for there is not one drop of pure blood in the whole body; hence, the nerves, which feed on this impure and imperfect blood, are not properly nourished and, as a consequence, become diseased. They "complain"; they are hungry—and like a hungry man—are peevish, fretful, restless. We call it nervousness, and no one ever knew a dyspeptic who was not restless, fretful, fidgety, and essentially disagreeable, fitful and uncertain.

The stomach is made up of a number of muscles, all of which are brought into requisition in the process of digestion. But no muscle can work always. The busy heart is in a state of perfect repose for one third of its time. The eye can work twice in a second, but this could not be continued five minutes. The hands and feet must have rest, and so with the muscles of the stomach; they only can rest when there is no work for them to do—no food in the stomach to digest. Even at five hours' interval, and eating thrice a day, they are kept constantly at work from breakfast until the last meal is disposed of, usually ten o'clock at night. But multitudes eat heartily within an hour of bed time; thus, while the other portions of the body are at rest, the stomach is kept laboring until almost daylight, and made to begin again at breakfast time. No wonder is it that the stomach is worn out—has lost its power of action. Many girls be-

come dyspeptic before they are out of their teens, in consequence of being about the house and nibbling at everything they lay their eyes on that is good to eat.

In the *Chronique de la Société d' Acclimatation*, M. Ruimet states that, by feeding silkworms on vine leaves, he has obtained silk of a fine red color; and that by giving the worms lettuce leaves, they have produced cocoons of an emerald green color. M. Delidon de St. Gilles, of Vendée, has also, by feeding silkworms—during the last twenty days of the larva period—on vine, lettuce, and nettle leaves, obtained green, yellow, and violet cocoons.

THE AYRSHIRE COW.—The Ayrshire is bred, and has been bred, for milk; her inheritance is all in the line of milk producing. Her form indicates it; her records prove it. When aged and dry, the same functions which ordinarily fill the udder fill her muscles with fat; but while milking, inheritance, intensified yearly by selection, turns the energies of her system towards extracting materials from her food, and secreting the larger and richer part in the udder. As the shorthorn stands with the grazier, who has tried their quality, so does the Ayrshire stand with the dairyman. By seeking improved breeds, the farmer is adding materially to the profits of his farm, for he is utilizing the great power and unerring certainty of inheritance.—*Dr. Sturtevant.*

## Recent American and Foreign Patents.

### Improved Apparatus for Extracting Cane Juice.

Duncan Moffat, New Orleans, La.—This invention consists in the arrangement of a holding device with the delivery rolls of the mill and the rotary cutting apparatus; also of a vat containing a secondary steaming compartment under the one into which the crushed and chopped cane is first received, containing revolving chopping and beating blades; also, stationary ones to continue the disintegrating process until the cane is reduced to pulp. The bottom of said compartment is perforated to filter the juice from the pulp as much as possible; and has a spout leading from it to conduct the pulp to an endless carrier, by which it is delivered to pressing rollers to expel the remaining juice. The two compartments of the steaming vat are separated by a valve, which is turned from time to time to deliver the cane to the lower compartment in batches, which have been subjected to the steam in the upper compartment a sufficient length of time. Below the filtering bottom of the lower compartment there is a trough, which receives the juice falling down from said compartment, and conducts it to the evaporator.

### Improved Needle Threader for Sewing Machines.

Thomas Schofield, Grass Valley, Cal.—The body or handle part of the needle threader is of thin sheet metal, and the instrument may be placed in an upright position. At one end of the handle is a forward projecting guide piece which passes up and down along the side of the needle, until a hook strikes the eye of the needle and enters through it. The hook has a curved end of very small size, which takes up the thread and draws the same back through the eye of the needle. The rear part of the hook is bent in U shape, and held in a groove in handle by means of a plate and screw. A small set screw regulates the distance of the hook from guide piece, to be adjusted to needles of different thicknesses. At the other end of handle a hook and needle guide are placed in similar manner, but under a right angle to the body of the handle, so that needles may be threaded from the sides, back, or front.

### Improved Propelling Mechanism for Vessels.

Lindsay Murdoch, Marble Hill, Mo.—This invention consists in a horizontally sliding frame and a bar carrying at its lower end paddle floats sliding vertically therein and horizontally therewith. By this arrangement the paddles have parallel vertical and horizontal motions, so that they are presented to and leave the water edgewise and move against it directly in the line of the motion of the boat.

### Improved Saw Sharpening Device.

John B. Drake, Goshen, Ind.—The file guide has, at one end, jaws to hold the file, and is rounded at the other to slide in a hole through an adjustable guide, by means of which it may be placed at any desired hight. This apparatus is applicable to vertical saws as well as to circular saws. By means of it the file is carried in a straight line across the saw.

### Improved Automatic Fire Escape for Safes.

Ira Parke, Mineral Point, Mo.—It is proposed to have a safe resting on a platform having wheels, and pivoted at one end, while the end next to the wall of the building is suspended by an easily combustible rope or other contrivance, to be destroyed by a fuse or a gun discharged against it, or burned off to let the platform fall. The platform, which is arranged in front of a trap door in the wall opening into the street, is to unfasten the door in its fall and force it open, and the door is to form a continuation of a descending track, of which the platform is the other part, on which the safe will roll into the street, and thus be saved from the fire. Fuse may be connected with the suspending rope, and arranged throughout all parts of the building, to ignite the rope or discharge the gun against it when the fire breaks out in any part of the building; and the fuse will also be arranged to communicate the alarm to the office or other apartment.

### Improved Tap Holder Attachment for Beer Coolers.

Joseph Hyde Fisher, Chicago, Ill.—This invention consists of an attachment to beer coolers for packing the hole through which the faucet projects to prevent the escape of the cold air, which is composed of metal clamping rings, and a rubber packing ring, arranged in two parts, of which one is fastened to the box, and the other to the door, in connection with the tap hole.

### Improved Boy's Sled.

Samuel D. Mott, Milford, Pa.—The rear ends of two springs are secured to the frame work of the sled, to the forward ends of which is attached a cross bar, in such a position that the rider, when sitting upon the sled, may rest his feet upon the said cross bar, either upon the outer or inner sides of the side frames of the sled, as may be desired. To the center of the cross bar is pivoted a small runner, which is made of a much less hight than the sled, and the springs are made of such a strength as to hold the said runner away from the ground, except when pressed down by the rider's feet, resting upon the cross bar. To the runner is attached a cross bar, to which are attached the ends of cords. By pressing the runner down to the ground with his feet, and pulling upon one of the cords, the rider can incline the runner to one or the other side, and thus guide the sled as desired.

### Improved Fountain Hand Stamp.

Francis J. Coutant, New York city.—This invention relates to the construction of stamps for certifying checks and for similar purposes, having special reference to what is known as the "ribbon stamp;" and consists in a fountain for the ink and in a movable pad. The shafts being immersed in ink, the ribbon is of course saturated with it. As the ribbon is drawn from the fountain it passes between two packing pieces, the object of which is to strip off the surplus ink from the ribbon and to keep the fountain closed. These packing pieces are made of elastic material, compressed by means of the metallic plates and screws. After leaving the packing pieces, the ribbon is drawn over the rollers and beneath the type plate, and then upward and into the fountain. By this invention the trouble and expense of frequently renewing or saturating the ribbons are avoided. The pad, by means of a lever, is thrown upward against the ribbon and type, instead of operating the stamp, in the usual manner, by a blow on the stem. With a pad constructed in this manner the stamping may be done with the same hand that holds the paper, or with one hand.

### Improved Metal Planing Machine.

John T. Kichner and William H. Odenatt, Philadelphia, Pa.—This machine is specially designed for planing the valve seats of locomotive and other engines, it being secured to the engine by screwing its stand bolts into the holes of the steam chest bolts when the steam chest is removed, and to adapt it for attaching it to different engines, in which the holes vary in the distance apart. The top frame or disk on which a revolving disk is arranged is provided with short radial arms for attaching the stand bolts to, which are adjustable radially and circumferentially. The feed screw is turned by a star wheel, which is brought in contact with one or more stationary pins each time it makes a circuit.

### Improved Car Coupling.

August Schorg and Benjamin Van Valkenburgh, Cobleskill, N. Y.—A band which slides on closes the drawhead, and is operated by a forked lever. The drawhead is made in two parts, one of which is attached rigidly to the truck by means of clips. The other part is hinged, and drops down by its own gravity when unsupported. The parts are each recessed out to form the mouth and opening of the drawhead, and are held firmly together by the band when the latter is slipped forward. At the top and bottom of the flange is a loop, which the forks of the lever enter. The lever is held in position by means of a forked iron attached to the timber of the truck. The handle end of the lever is bent upward to make it convenient to handle as well as to fasten. When the handle end of the lever is thrown up to the truck, the band is thrown outward, so as to keep the drawhead closed and the coupling link confined. In this position the lever is confined by a pin in the forked iron. When the lever is thrown outward, the band is thrown back, which allows the part of the drawhead to drop down ready to receive the link of the opposite coupling.

### Improved Apparatus for Graining Wood, etc.

Charles Falke, New York city.—In using the extension roller, the requisite width of the article to be grained is first taken, and the apparatus is then adjusted by loosening the handle frame, setting the female screws and shells to the desired width, fastening the handle frame again, inserting the band rollers and flexible band fitting that width. The roller is pressed over the color board, which leaves the imprint of its grain on the periphery of the cylinder. The grain marks are thence transferred to the surfaces to be grained.

### Improved Nut Lock.

Daniel Sawyer, Washington, Ind.—A washer plate is placed upon the bolts before the nuts are screwed on, to which is secured one or more pieces of steel, which are made thin and fastened edgewise, and upon the upper part of each is formed a spring, standing out a little upon one side, preferably upon the side next the nut to be locked. A plate is pivoted to the pieces near one end, and is slotted so that it may be turned down upon the washer or turned back. The inner edge of the slotted plate is turned up at right angles, and the steel piece is placed at such a distance from the nut to be locked that the turned up part of the plate may rest against the side of the nut, and thus prevent the said nut from turning. By this construction, when the plate is turned down, the steel piece passes through the slot in the plate and the spring springs out over the said plate, preventing it from rising.

### Improved Snow Plow.

William J. Roberts, Cold Spring, N. Y.—A revolving bucket wheel is arranged in front of the locomotive on a vertical shaft, and is revolved by means of a belt, or gearing may be substituted, from a pulley on the axle of the locomotive to the pulley on the vertical wheel shaft. The wheel is the frustum of a solid cone. The outer edges of the buckets are parallel with the side of the cone, the ends being cut on the plane of the base and upper surface of the cone. A loose upper clutch revolves with the shaft, and is dropped down by means of a screw or otherwise, and engages with the pulley clutch when it is desired to run the snow plow. As the locomotive moves forward, the wheel clears away the snow from the track and throws it to one side.

### Improved Faucet Attachment.

James Church, St. Louis, Mo.—This invention consists of a cup of india-rubber or other elastic material, or partly of elastic material and partly of metal, combined with the faucet in such a manner that, when the barrel is tapped, by driving the cork into the barrel with the end of the faucet, the cup will prevent the escape of the liquid while the faucet is being adjusted and before it is made sufficiently tight to stop the leak.

### Improved Refrigerator.

Charles Camp, Mott Haven, N.Y.—This invention consists in a removable ice box, fitted into the upper part of the smaller of two compartments of the main box, so that it may be conveniently taken out and put in when desired. The cold air from the ice chamber passes through a pipe and into a horizontal hollow shaft, and escapes through the holes in the sides of said shaft. To the end parts of the hollow perforated shaft are attached two four-armed plates, to the ends of the arms of which are pivoted the turned up ends of shelves, so that the said shelves will always hang downward and be right side up, however the shaft may be turned. This construction enables any desired shelf to be turned toward the door so that anything can be readily put upon and taken from it. The shelves are secured in any desirable position by a long screw which passes in from the front of the box through the end wall of the said box, so that its forward end may bear against the side of the end of the shaft, and thus prevent it from turning.

### Improved Washing Machine.

Arthur M. Campbell, Kline's Grove, Pa.—This invention consists in the combination of the binding frame with the suds box of a washing machine to strengthen said box against the pressure of the operating mechanism, in the U spring, in combination with the lever and the rigid arm attached to the presser board, which allows the end of the lever to be readily adjusted upon the arm to adjust the presser board to the amount of clothes to be operated upon. By suitable construction, as the presser board moves forward, the clothes are pressed between said presser board and a stationary presser board, pressing out the water, which carries the dirt with it. As the presser board moves back, the back rush of the water sweeps the clothes back from the stationary board, and turns them over so that they are operated upon by the presser each time in a different place, and are thus cleaned thoroughly in all their parts.

### Improved Printing Press.

Jacob G. Peterson, Morgantown, N. C.—The rollers are arranged in a reciprocating carriage, which is suspended on the type bed by the upper roller. The bearings of the lower roller are immovable in the carriage. The bearings of the upper roller are capable of moving up or down in the carriage, and have an adjusting screw by which the pressure of the rollers in the bed is regulated. The carriage has two toothed bars, extending from one side, between two wheels on the crank shaft and the presser rollers, which are mounted in stationary housings. The crank shaft being turned forward and backward by a half revolution each way will cause the presser rollers to move forward beyond the type and back again, which makes the impression on the paper. After each operation the tympan is raised, the printed sheet is removed, and an unprinted sheet is applied, and the tympan is lowered for the next operation.

### Improved Quilting Attachment for Sewing Machines.

William H. Null, Blandinsville, Ill.—This invention relates to an improvement in the class of machines for supporting, stretching, and moving quilts or other fabrics across the feed plate of a sewing machine; and consists in a peculiarly constructed carriage and a tilting roller frame, on which it is supported, and in devices for holding and adjusting the fabric.

### Improved Plow Carriage.

Henry M. Bullitt, Louisville, Ky.—This invention consists of independent axles for the truck wheels, having a long upright arm at right angles to them inside of the wheels, said arm having a series of holes at short distances apart, and connected by a short axle, which can be shifted higher or lower by changing it in the holes. From the center of this arm the beam is hung by a crotchet hanger, and is connected by adjustable braces with the lower ends of the arms to maintain them in the upright position. The depth of the furrow is governed by the position of the suspending axle in the arms, and the plow is supported entirely above the ground, for transporting it from place to place, by adjusting the suspending axle in the top holes.

### Improved Pruning Instrument.

William H. Collings, Raytown, Mo.—A pole of any desired length is made hollow to receive a wire, which passes through it longitudinally. Upon the upper end of the wire is cut a thread to screw into the shank of the saw which projects above the end of the pole, and fits into a dovetailed groove or socket in the side of a ferrule attached to the upper part of the pole, where it is secured by a set screw. By this construction, in using the instrument, the hook is passed over the twig to be cut, and the wire pulled down through the pole. The saw is operated by the reciprocating movement of the wire and pole upon each other.

### Improved Self-Closing Faucet Attachment.

Robert McConnell, William Truesdell, and Fredrick Mertsheimer, Omaha, Nebraska.—An inside collar, at the end of the faucet tube, serves as shoulder rest for a spiral spring, which coils around a tubular valve, resting with its other end against a shoulder of the same. Apertures at the end of the valve allow the liquid to pass out through the tube when that end projects outside. A solid extension of valve, of smaller diameter than the same, is threaded, and holds, by nut, a soft rubber disk and a strainer on the end of the tube. The rubber disk is of the same diameter as the tube end, the strainer fitting closely over the same. By the joint action of the spiral spring and nut, the disk is pressed firmly against the end of the tube, closing the same effectively, so that no liquid can escape. The faucet, when it is desired to draw off the fluid, is turned in far enough to strike the valve, forcing the same back, so that the disk is carried toward the inside of the vessel, and the apertures of the valve pass to the outside of the tube. The liquid enters, therefore, through the strainer and apertures into the valve and the faucet, and is easily allowed to escape.

### Improved Boring and Drilling Machine.

John J. Sheridan, New York city.—This invention has for its object to furnish an improved device for drilling, boring, cutting screw threads, etc. The machine may be adjusted by means of set screws, and its base is secured to the table by bolts, so that it may be further altered in position by simply loosing the nuts of said bolts. Screws, which pass down through the base and rest against the table, enable the machine to be conveniently adjusted horizontally or plumbed, and the bolts secure it firmly in place when adjusted. The upright frame of the machine is made in the form of a segment of a hollow cone, in two parts, flanged and bolted together so that the upper and lower parts may be adjusted upon each other. The tool holding shaft passes up through the hub of a bevel gear wheel, so that the said wheel may carry the said tool holder with it in its revolution while the said tool holder may be free to move longitudinally in said wheel. The latter revolves in bearings in the frame, and engages, by a gear wheel and also by pulleys and band, with the driving shaft. The shaft is provided with two sliding clutches, and is made to carry the band pulley or gear wheel with it in its revolution, according as one or the other of the clutches is thrown into gear. A three armed lever has forks upon two of its arms, which enter grooves in the clutches, so that one of them may be thrown into and the other out of gear by a single movement of the lever. The third arm of the lever serves as a handle. Power is applied directly to the shaft by means of another shaft meeting it at an angle and connected with it by bevel gear wheels. To the upper side of the gear wheel, through which the tool holder passes, and upon the opposite sides of the center, are attached studs, the upper ends of which are connected by a bar. To the middle part of the bar is swiveled a screw, which screws into the upper end of the tool holder, so that the tool can be fed down to its work or raised from its work by turning the said screw in one or the other direction. By suitable mechanism, each revolution of the gear wheel feeds the tool shaft down the distance of one thread of the swiveled screw. By a suitable device, when a female screw thread has been cut, the cutter may be withdrawn from said thread, allowing the holder to be run out quickly, and without danger of injuring said screw thread.

### Improved Bee Hive.

George Miller, Battle Ground, Wash. Ter.—This invention consists in an improved bee hive formed of a number of cells, provided with a roof, and supported by a single shaft or post from a base. Around the foot of the post is placed a vessel to receive water to prevent ants and other insects from crawling up. The main frames are formed of an upper and a lower plate within the cells, connected at their side edges by two or more bars. In the top and bottom plates of the main frames, and midway between the side bars of said main frames, are formed grooves to receive the top and bottom bars of the single frames, so that the said frames attached to them may be drawn out conveniently and without breaking or otherwise injuring the comb, or the comb in the main frames. The bottom plates of the main frames are slotted, to give free passage ways to the bees. The lower or open ends of the cells are closed with plates, which are secured in place by buttons pivoted to the partition walls. The buttons are semicircular in form, which enables them to be turned to release one plate without releasing the other.

### Improved Propulsion of Vessels.

George Boucher de Boucherville, Quebec, Canada.—This invention consists in an improved wave motor for turning the propeller screw of a ship, vessel, or boat. A heavy platform is suspended by pivoted rods so as to vibrate freely with the pitching of the ship. The after rods are extended each some distance upward; and to their upward ends are pivoted bars which are also pivoted to vibratory rods which carry reversed spring pawls. These pawls move alternately ratchet wheels which are rigidly attached to independent sleeves that are loose on a shaft, and have each a large bevel spur wheel. Between these wheels and engaging with both is a small bevel pinion on the propeller shaft, which, by the motion of the two large wheels, is turned by either alternately in the same direction. The vibrations of the platform are thus utilized and transferred to the propeller. Patents on this invention have also been obtained in England and various countries on the continent.

### Improved Inclinometer or Grading Level.

Dr. John Thomley, Charlottesville, Va.—This invention has for its object to furnish a simple and inexpensive but efficient instrument for readily determining grades, inclinations or angles of various surfaces; and it consists in applying a graduated extensible bar to the ordinary carpenter's or mason's level, and providing such means for adjustment and clamping the same as will enable it to support the level at various inclinations and indicate the grade.

### Improved Bee Hive.

John H. Stockwell, Bronson, Mich.—This invention consists in making the honey frame of a bee hive in separate sections, so as to turn like the leaves of a book, thus facilitating inspection, and in making the case in sections, locked detachably by suitable projections and recesses, to enable too large a swarm of bees to be easily divided.

### Improved Gage Cock.

Albert A. Murray, Baltimore, Md.—This invention consists in a cock valve and seat, the former arranged to rotate about the stem in combination with a spiral spring that yields sufficiently to allow readily the rotation of the valve and yet to hold it in any position desired.

### Improved Car Coupling.

William W. Haver, Schuyler, assignor to himself, James Atwell, of same place, and William Gates, Frankfort, New York.—The coupling pins are passed through the bumper head, and are made with shoulders upon their upper ends, which rest upon the upper sides of the bumper heads and are secured in place by pins passed through them at the lower side of the said bumper head. Upon the upper ends of the pins are formed hooks, which point toward the car bodies. The coupling link couples the cars by being dropped over the hooks of the pins. A short standard is connected with the middle part of the coupling link and receives an arm which is pivoted to said standard by a pin passing through a longitudinal slot in the said arm, to give the link the necessary play to accommodate itself to the various movements of the bumpers. The other or inner end of the arm is attached to a short shaft, which is pivoted and to which is attached a short arm, to the outer end of which is pivoted the lower end of the rod which passes up through a keeper attached to the car body. To the rod is attached a double stop to hold it in place. By this construction, by raising the rod the link will be raised from the hook pins, uncoupling the cars; and when the rod is lowered, the link will be lowered upon the hook pins, coupling the cars.