THE PROPAGATION OF NERVE EXCITEMENTS.

Physiologists differ widely on the question as to whether moter and sensory nerves are identical or different in their formation and capabilities: in other words, whether a sensory nerve may conduct excitations having for their result a bodily movement, or *vice versa*. It is not even definitely known whether an excitation of a nerve near the middle of the latter propagates itself simultaneously in both directions, centripetal and centrifugal. In order to obtain some *data* on this interesting subject, M. Paul Bert has recently made some curious experiments, an account of which, with the accompanying illustrations, we find in *La Nature*.

If at any point of its length, says M. Bert, a sensory nerve be pricked, the pain experienced indicates quite clearly that the excitation is propagated in centripetal direction. We have no similar certain knowledge that centrifugal propagation occurs, for the simple reason that at the terminal extremity of the nerve there is no perceptive nervous apparatus. Now if we can succeed in placing that extremity in connection with a perceptive center—that is to say, with the brain—then, if we find sensation, it must follow that centrifugal propagation takes place.

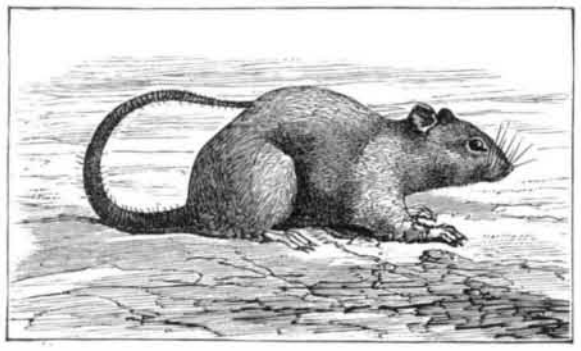


FIG. 1.—M. BERT'S EXPERIMENTS ON THE NERVES.

A rat was the subject of the experiment thus indicated. The skin was removed from the end of the tail of the animal for a distance of nearly an inch; and an orifice being made above the spine, the exposed end of the tail was inserted in the cellular subcutaneous tissue. A few sutures sufficed to keep the parts in place, and eventually complete adherence was obtained.

At the end of eight months the tail was cut at about the middle; so that the animal had two tails apparently—one growing out of the back, the other in natural position. Immediately after the section, the dorsal portion was manifestly sensitive; as, when it was pinched, the rat squealed, and attempted to escape. It was therefore evident that, in this fragment of the tail, excitation of the sensory nerves was propagated from the large to the smaller end—that is to say, in inverse direction to the supposed normal course. What had occurred?

The sensitive nerves, says M. Bert, which extended to the end of the tail, wounded by the removal of the skin, united with the nerves of the dorsal region, which had likewise been cut in making the necessary orifice. After a sufficient period, the nervous cicatrix became capable of passing vibrations. Then, when the end of the dorsal tail was pinched, the vibration traveled in the excited caudal nerve, traversed the cicatrix, and followed the dorso-cutaneous nerve to the spinal marrow, which conducted it to the brain, which organ translated the vibration into a sensation of pain. This will be clearly understood from Fig. 2, in which M E is the spinal marrow, and N C one of the nerve filaments passing to the end of the tail, the extremity of which was exposed. G is its ganglion, N one of the nervous filaments in the back exposed when the orifice was made, C the nervous cicatrix formed when the nerves united, S the point of section of the tail, and *a b* arrows indicating the two directions in which the excitations which determine sensibility are propagated.

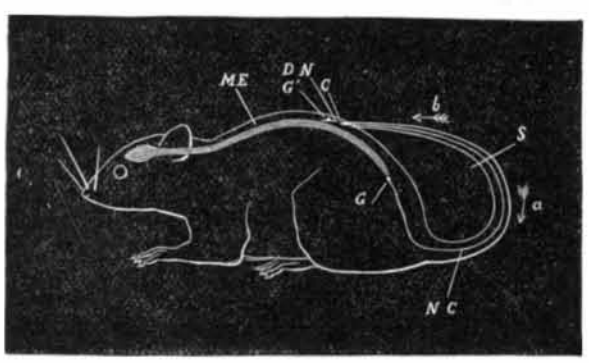


FIG. 2.—M. BERT'S EXPERIMENTS ON THE NERVES.

On the second day after the section was effected, the sensibility of the dorsal tail diminished and finally disappeared altogether. Examination with the microscope showed that the nerves of this portion had undergone the usual alterations of nerves separated from their trophic centers, and that this had taken place in part under the skin as well as that outside, although the appendage had grown to the animal and seemed healthy and vigorous. The nerves in the true tail were, on the contrary, perfectly free from degeneration.

M. Bert's conclusions are that an excitation in a sensory is propagated simultaneously both centripetally and centrifugally; and he thinks the same holds true for motor nerves. It is also very probable that, as Vulpian has shown, nerves are simple conductors, which are differentiated only by their mode of working, which depends upon the apparatus existing at their air extremities: namely, nervous motor cellule and muscular fiber for motor nerves, receptive nervous cellule and impressionable termination for sensory nerves.

Clothes Pins.

The Newark *Advertiser* says: Insignificant as the common wooden clothes pin is itself, its manufacture forms no mean part in American industries, and the numerous factories in New England and other States furnish employment to thousands of people. There are several large clothes pin manufactories in Pennsylvania and Ohio, and one in the vicinity of Saratoga, N. Y., each of which is capable of turning out a thousand boxes, or 72,000 pins, per week. There are several small factories scattered throughout Massachusetts, New Hampshire and Vermont, and all are run by water power. As a rule, those engaged in the manufacture of clothes pins are Quakers. Beech, white birch, and poplar are the woods used in making the article, the birch and poplar being considered the best. The machinery employed is very simple. The wood is first sawed into logs four feet in length, and then cut into small square sticks by means of a cutting machine. Each stick, after being rounded in a lathe, is passed into another machine which throws out a number of perfectly formed pins at one cut and with great rapidity. The pins are then thrown into a large revolving cylinder and smoothed by friction with each other. New York and Boston are the principal markets for this ware, and hence they are shipped in large quantities to the West, and to England and Australia. Over 100,000 boxes of pins are annually sent to England, and a corresponding number to Melbourne, Sydney, New Zealand, and the Sandwich Islands. Owing to the depression in business, during the past two years prices have fallen off 25 per cent, and some of the manufacturers in New England have ceased operations because they could buy cheaper from the West than they could manufacture themselves, besides saving the expense of packing and transportation. The price depends entirely upon the finish and number in a box.

An Observatory on Etna.

Professor Tacchini sends us a note read before the Genoese Academy on September 22, 1876, entitled, "On the Convenience and Utility of Erecting an Astronomico-Meteorological Station on Mount Etna," in which, after describing his experiences during a brief ascent on September 15 and 16, he expresses his views with regard to the establishment and most desirable fitting of an observatory on the mountain, to be mainly devoted to spectroscopic and meteorological observations.

Professor Tacchini ascended on the morning of September 15 from Catania to the station occupied by a party of the English and American expeditions on the occasion of the total solar eclipse of December, 1870, and found there a diminution of temperature of 73·8° Fah. He had taken with him a Dollond telescope of 3¾ inches aperture, a spectroscope of strong dispersion by Tauber, a small spectroscope of Janssen, an aneroid barometer, thermometers, and a polariscope. At 10h. 30m. A.M., on the 16th, a few detached clouds only being present, he remarked that the blue of the sky was much deeper than at Palermo or Catania. The solar light had a special character, it seemed whiter and more tranquil, as though due to artificial illumination by magnetism. Viewing the sun rapidly with the naked eye, it was seen as a black disk surrounded by an aureola of limited extent, projected on the blue ground of the sky. On interposing an opaque body before the disk the aureola was seen better, but always limited, and the pure blue sky terminated the same, which extended to rather more than half the solar radius; with the naked eye it was difficult to judge if the aureola was of equal breadth all round the disk, and the only thing well marked was the difference from the view obtained at the level of the sea; while the sky is ordinarily whitish about the sun, on Etna it remained blue, and the aureola acquired a better defined contour. With a helioscope the aureola was much better seen, and its border appeared irregular, and as though it were rather more extended at four points, which, at noon, corresponded to the extremities of the vertical and horizontal diameters of the disk. At 3 P.M., after interruptions from clouds (which in passing rapidly at short intervals produced a striking effect by the formation of a stupendous series of colored rings round the sun, containing all the gradations of color in the spectrum, a phenomenon new to Professor Tacchini), the Tauber spectroscope was applied to the telescope for examination of the solar spectrum, and the observer expresses his surprise at the fine definition of the lines and the extraordinary distinctness of the whole; the chromosphere was bright.

In the evening, at 10h., the spectacle of the starlit sky was novel and enchanting. Sirius appeared to rival Venus, the finer constellations acquired an altogether special aspect, and the appearance of the *Via Lactea* was astounding. The image of the planet Saturn was admirable, and the peculiarities of the ring and belt were seen to much greater advantage than at Palermo, shortly before leaving. Venus afforded remarkable proof of the rare quality of the sky of Etna. The planet shown with a powerful light, which cast shadows during the ascent of the mountain; it scintillated frequently like a star. The telescope showed, on the northern part of the phase, an oblong space, less illuminated than the rest of the disk, which Professor Tacchini says was "sicuramente una macchia del pianeta."

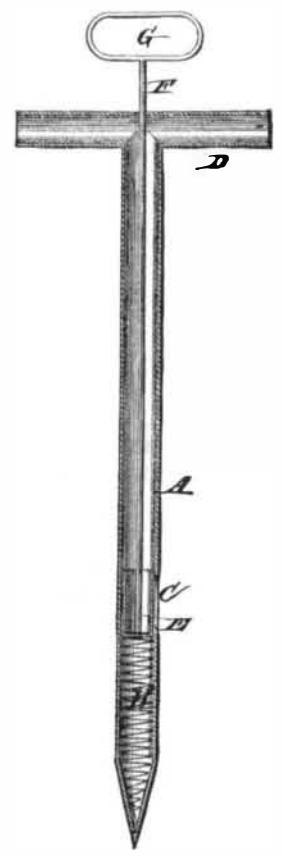
Spectroscopic observations were renewed on the following morning, when the sun had attained an altitude of 10°. The chromosphere was magnificent; the inversion of the magnesium and of 1,474 was immediately evident, which was not seen at Palermo with the same telescope.

With regard to the proposed observatory, which Professor Tacchini is desirous should be an accomplished fact before the meeting of the scientific bodies at Rome in September next, he proposes that it should be erected at the *Casina degl' Inglesi*, and should be named after Bellini, and that it should belong to the University of Catania. He suggests that it ought to be provided with a refractor of first-rate quality and of at least about 6·3 inches aperture; and he advises that, while the meteorological instruments, which should be adapted to the requirements of the day, as indicated by the London Congress, would remain constantly at the Bellini Observatory, a duplicate mounting might be provided for the refractor at some spot within the University of Catania, with its proper dome, the other being fixed on Etna: so that, while from June to the end of September astronomical observations could be carried on upon the mountain, during the winter they might be made at Catania, where the sky is a very good one; the astronomer would thus have only the object glass with its tube to transport to and fro. Professor Tacchini further suggests that accommodation for visitors should be provided, with the view to increasing their numbers, and that a certain payment should be made by them, to go towards the maintenance of the Observatory and its custodian.

We wish every success to the scheme thus energetically brought before the Italian authorities by Professor Tacchini, and have no hesitation in predicting important gains to Science from its adoption.—*Nature.*

IMPROVED GRAIN SAMPLER.

We illustrate herewith a simple device for sampling grain in bags or in bulk. A is a pointed tube, which is provided with an aperture, C, in one side. A tubular handle, D, is attached, and a valve, E, is provided for closing the aperture. A rod, F, is centrally attached to the valve, E, and runs through the handle, D, and is provided with a handle, G. A coil spring, H, is placed in the tube, A, between the coned end and the valve, E, for closing the said valve. When a sample from the interior of a body of grain is required, the tube, A, is forced into the grain as far as may be desired, when the valve, E, is pushed back, opening the aperture, C, allowing the grain to run into and partially fill the tube, A. The rod, F, being released, the spring, H, returns the valve to its normal position. The instrument is removed from the bulk of the grain, and the contained sample is poured through either arm of the tubular handle. The conical end permits the insertion of the tube in bags by displacing the meshes of the material of the bag as the tube is forced in.



Patented through the Scientific American Patent Agency December 5, 1876, by Mr. J. F. Gent, of Columbus, Ind.

A Salmon's Endurance.

Land and Water relates the following, concerning a remarkable battle lasting for sixteen hours, between a plucky sportsman and an obdurate salmon, before the latter was conquered: "On Friday, at four P. M., Mr. A. Crawshay hooked a fish below Haughton Castle, but did not land him till Saturday morning, the 24th inst., at eight A. M. Immediately after being hooked, the fish went down the river, taking out upwards of 100 yards of line. The water being strong and the fish determined, it was impossible to get him back. A wood by the water side made it equally impossible for Mr. Crawshay to follow his fish, and so things remained until a boat was brought at daylight next morning from some distance, by which means the wood was passed, and the fish at last landed on a gravel bed, in the presence of many spectators, some of whom had passed the night with the angler. The fish was a splendid male, forty inches long, and twenty-two inches girth; weight, 25½ lbs."

Portland Cement.

Mr. I. J. Mann, assistant engineer, Port and Docks Office, Dublin, has made experiments upon the qualities of Portland cement, which prove that coarsely ground cement when used neat (without sand) is stronger than finely ground cement; but when used with sand, as in concrete and mortar, it was found that cement containing only twenty-five per cent of coarse cement particles had but half the strength of mortar mixed with fine cement, the cement used being in each case four weeks old. On the other hand, extremely fine sand diminished the strength of the mortar to less than one half of that which was mixed with coarse sand.

[*Continued from first page.*]

ing above mentioned. Its forward end is suitably connected to a second pivoted bar, G; so that, when the first bar has a lateral movement, that motion is, through the connection, transmitted to the second bar. To the rear extremity of the latter is attached a chain which passes around and is secured to the small cam, H, Fig. 1. I is a larger cam, rigidly attached to and hence working on the same pivot as cam, H. Around cam, I, and secured to it, is another chain, which passes over a guide pulley at the rear end of the platform and is fastened to the caboose car. The peripheries of each of these cams, or rather eccentrics, gradually increase from the point of connection of the cables, so that the caboose is thus made to serve as a counterweight to the resistance of the plows and drag, adapting itself readily to increased or decreased strain.

The present invention is one of a series designed for grading railroad beds in all situations, except through stone, and also to keep the same in repair. Two other machines have been devised, one to make a "cut" and a "fill," and the other for ditching purposes.

Parties who will interest themselves in the securing of contracts for use of the device above described are invited to address the inventor, Mr. J. J. Harden, 83 West Van Buren street, Chicago, Ill.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Notwithstanding the general stagnation of business, the issue of patents still keeps on, the hard times appearing to have sharpened the wits of our inventors, thus proving, in more senses than one, tbat "necessity is the mother of invention," and causing the business of the Office to increase very much of late. The issue of March 6 was about four hundred, including patents, reissues, designs, trade marks, and labels.

An examination of the list of the acts of Congress of the last session that received the signature of the President shows but three relating to patents, namely, the acts for the relief of Henry Voelter, T. Bussell, and W. W. Hubbard. The first two of these is to authorize the Commissioner of Patents to extend the patents of the two gentlemen named, the first for a process for the manufacture of paper pulp from wood and the other for a car spring. The last act, according to the title, is "to make compensation for the past making, using, or vending of his patent explosive shell fuses and percussion exploders by the United States." There were other patent extension cases passed, but failed to meet the approval of the President, and hence have not become laws. No sewing machine patents have been extended, and it therefore appears that the monopoly of the sewing machine combination is about to end, and that about May next the prices of sewing machines will drop to a reasonable figure, or as soon thereafter as other manufacturers can supply the market.

Mr. Nathan Appleton has been in consultation with the late Centennial authorities at Philadelphia, and, as a result, has presented to Secretary Evarts a sketch of an organization for the proposed American exhibit at the next Paris Exposition, together with an estimate of the necessary expenses. He estimates that $300,000 is the least amount with which a proper exhibition can be made, and this on the supposition that the goods will be received at New York in government warehouses and shipped to Havre in United States Government vessels. He believes, however, that $500,000 should be appropriated to do the country credit at Paris. The gentlemen who are shaping the present movement entertain strong hopes that the President will be able in some way to accept the invitation of the French republic at an early date, as they find there is a general desire among Americans to take part in the Exposition.

I hear of no changes worth noting in the officials of the Patent Office, although rumors of the proposed removal of the Commissioner and his assistant have been flying around of late; but I have been unable to trace these rumors to any reliable source, and it is generally believed there is no foundation for them, as the new Secretary of the Interior is said to be a strong believer in civil service reform, and he would have to stultify his past record to make these removals. He is said to be now engaged in framing his views in relation to the civil service into the form of a code of rules to govern the department over which he presides, and which will, it is believed, form the basis of the government of the other departments in the matter of appointments, etc. It is reported that he has signified his intention of making no removals where the incumbent proves qualified, diligent, and efficient, and it is therefore hoped that all the trustworthy officials in the Patent Office will retain their positions.

The Post Office has invited tenders for the contract to manufacture postal cards for the next four years, from which it appears that, during the last fiscal year, 150,815,000 cards were issued; and it is expected that the issues for the current year will be about 180,000,000. It is thought that the number required during the next contract term will reach the enormous number of 1,000,000,000 at least.

Washington, D. C. OCCASIONAL.

Friction of Slide Valves.

To the Editor of the Scientific American:

In your SUPPLEMENT, No. 62, there is an article by Mr. Hill on the friction of slide valves, which, while it contains some truth, is yet enough in error to deserve notice. Allow me to say in the beginning that I am not one of those "semi-mechanics" who, to use Mr. Hill's expression, have been "peddling" balance slide valves. I am simply a mechanic who, in common with a great army of similarly situated men, contrive to gather up from year to year considerable information from the columns of the SCIENTIFIC AMERICAN, and it is because so many young mechanics make that paper their textbook that I venture to offer objections to Mr. Hill's conclusions. There are in the country mechanics who have invented, and no doubt to some extent "peddled," balance slide valves, and who, in point of ability, might not suffer in comparison even with Mr. Hill himself, and it certainly does not assist his argument to disparage these men at its commencement. Some of these inventors have, as is well known, supplemented fair scientific attainments by exhaustive practical experiments; and while they do not claim to save "25 to 50 per centum" they do claim to show a slight saving in fuel, a very material saving in eccentric and connection to valve, and undoubtedly considerably more than the highest figure named by Mr. Hill in the wear of valve and seat and consequent "blowing." Mr. Hill is certainly to be commiserated if, in all his varied experience, "there is not a single relieved valve in use" that does not leak to the extent he indicates; and he may be assured that he can find several of them in this section which have been running from two to five years without any repairs whatever. All the leak from the packing of these valves passes directly into the engine room without becoming a nuisance at that. So much for Mr. Hill's gratuitous attack upon the venders of balance valves.

In regard to that very useful and somewhat intelligent class, engine builders, whom he tells with so much modesty that they have always been in the wrong as to the pressure on a slide valve, it is to be presumed they will hold their "erroneous ideas" notwithstanding the demonstration which makes the case much clearer to Mr. Hill than to men who know better by experience. There need be no question in any one's mind, if he obtain his data for balancing slide valves from these conclusions, that it will not require even a "very short time" for them to become so leaky as to be voted a nuisance. In fact, were Mr. Hill to construct a valve of the dimensions indicated in his article, deducting as constant counterpressure his steam post and additional area, which at full steam chest pressure shall be the equivalent of the highest pressure reached by compression acting constantly upon the exhaust cavity of the valve, allowing besides a liberal margin for holding the weight of valve, there is no doubt any of the "half mechanics" would guarantee his valve to stay anywhere else in the chest rather than in its proper place against its seat.

Troy, N. Y. NOT A PEDDLER.

Facts in Nature.

To the Editor of the Scientific American:

I read in your journal for March 17 an article entitled "Do Snakes Catch Fish?" Perhaps it is not a generally known fact, but most of our water snakes are expert fishers. Especially so is our common species, *tropidonotus sipedon*, Linn. Last spring my brother witnessed the capture of a water snake in a small stream flowing into the Schuylkill. The stomach of the snake was observed to be greatly distended, and on being cut open, to ascertain the cause, a large catfish, apparently just swallowed, was extricated. The snake measured two and a half feet in length, and the catfish seven inches. The fish was fully armed with the long sharp spines common to the genus, and must have proved a reluctant dinner, dying "game to the last."

I once saw a water snake in full chase of an eel. I was sitting on a small rock, quite near the surface of the stream, and observed them well. As they passed me, the eel led by about two feet; and as far as they were visible, the snake seemed to be gaining ground. But although I dropped my rod, and soaked my lower extremities considerably in the attempt, I was unable to see the termination of the affair. The snake appeared to be three feet in length, and the eel about the same size, certainly not more than two inches less. Professor Allen once saw a water snake hauled from the water and killed, that had a live pickerel in its mouth a foot in length.

The common water snake does not always capture its prey by a fair chase. I have several times seen it lying in wait among rocks and stones, with its head and part of its neck only visible; and when a fish or tadpole swam by, it would instantaneously dart forward and seize the unknowing trespasser.

Philadelphia, Pa. C. F. SEISS.

Patterns for Fret Saw Work.

To the Editor of the Scientific American:

Those who wish to duplicate the above named patterns find the use of impression paper tedious and inaccurate. My method is as follows: Take two pieces of wood of proper size, cut any number of sheets of common writing paper to the same size as the wood, place the sheets on one piece and tack the other piece of wood to it with the paper between. Paste your design on one side and saw through paper and all. Saw the holes first and then the outlines accurately; and when done you will have as many beautiful designs as you wish with the least possible labor.

McLean, Ill. FRET SAW.

The Frost Plant of Russia.

To the Editor of the Scientific American:

In your issue of February 24, I see a picture of what is entitled "The Frost Plant of Russia." I have seen the identical phenomenon on a certain kind of weed stalks in Fayette county, Tenn. While teaching a country school in that county, in 1873–4, my school children and I gathered the "frost flowers" frequently. They were most beautiful in the morning, and usually melted away during the day when the sun shone. I do not think that snow had any influence over them, and am of Dr. Darlington's opinion as to their formation.

Fall River, Mass. T. R. VESTAL.

Beavers in California.

The Stockton (Cal.) *Independent* publishes the following: "As the tules of this vicinity abound in beaver, numbers of hunters and trappers have made an excellent living in capturing them for their pelts. The latter are worth $2.50 each, and an industrious trapper can catch from 30 to 50 a month. In the equable climate of California the time of year seems to have no especial effect on the excellence of the beaver fur, it being equally good in summer and winter. The trapper can, therefore, pursue his avocation uninterruptedly the year through. With the beaver he can catch and the other game he can send to market, an industrious man can make $100 a month and live as his own master. The trapper's outfit for the San Joaquin tules is a peculiar one. Two hunters usually join together in the outfit of an ark, or floating house, with which they paddle out through the innumerable sloughs that intersect the pathless jungle of tules. The ark affords one small room or cabin, provided with sleeping bunks, and furnished with a stove and complete culinary outfit. In this ark the hunter lives in comfort, always having a shelter, while its compact shape and size allows it to float in the smallest stream, thus bringing the hunter and his home in the very midst of his game."

A New Fire Extinguisher.

A new fire-extinguishing chemical compound has been lately devised, which, in its application for extinguishing fires, is quite different from the fire annihilators in general use. The new composition is a mixture of chemicals which, on being ignited, evolve sulphurous acid and carbonic acid gases, which fill the apartment or building, producing an atmosphere which smothers combustion. A successful trial of the invention was recently had in front of the City Hall in this city.

A board shanty, 13 feet square and 10 feet high, was erected to represent an apartment, and furnished with a door, window, and a stovepipe coming through the roof. The interior was coated with tar. On a bench were placed seven basins containing benzine, coal oil, and naphtha. In one corner was a 10 lbs. box of the extinguishing compound, with a fuse attached to it running round the walls, on the self-igniting plan. The combustibles were set on fire, and in an instant the interior was one sheet of flame, bursting out through the door, window, stovepipe, and every aperture. A few moments after the compound was ignited, the gases that were generated therefrom instantly subdued the flames; and in less than half a minute the fire was entirely extinguished.

The new substance is called "Reec's Compound Fire Extinguisher." G. J. Crikelair, of 263 Broadway, is the general agent for New York, New Jersey, and Connecticut.

Good Forgers.

The question has often been asked us, says the *Carriage Monthly*, "How is it that some smiths are able to make better forgings than others?" or "How is it that ——— is always so successful with his welds?" The secret of all this is in first knowing how, and after knowing how, in doing, or trying to perform, what we know. The knowing smith so lays out his work at the close of the day that his first work in the morning will be the heaviest, and such as requires but little welding. By doing this he not only leaves the lighter portion of his labors for the waning of the day and also the tiring of his arm, but he removes the chill from the anvil and other tools to such an extent as to prevent the iron from becoming chilled before the weld is properly made. His fire is always clean. His tool rack is always in order, thus enabling him to grasp the required tool at the proper time. He never places his iron in the fire a second time until, with a file, he has removed all the scales. The ice-cold anvil will chill the thin part of the "scaff," and prevent the welding of that portion. It is impossible to take a clean heat with a fire full of slag. If you have to hunt five minutes for a tool, your iron has become cold, and unless you remove the scales and other matter, your forgings will not be perfect.

Sawdust in Rough Casting.

Siehr recommends very highly the use of sawdust in mortar, as superior even to hair for the prevention of cracking, and subsequent peeling off, of rough casting under the action of storms and frost. His own house, exposed to prolonged storms on the seacoast, had patches of mortar to be renewed each spring; and, after trying without effect a number of substances to prevent it, he found sawdust perfectly satisfactory. It was first thoroughly dried, and sifted through an ordinary grain sieve, to remove the larger particles. The mortar was made by mixing one part of cement, two of lime, two of sawdust, and five of sharp sand, the sawdust being first well mixed dry with the cement and sand.