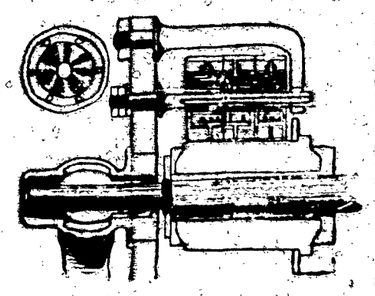
FIELD OF SCIENCE.

LATEST DEVELOPMENTS IN THE INDUSTRIAL WORLD.

Labor Saving Devices in Many Forms—Experiments in Chemical and Electric Science—Filtering Water in Zurich—Scientific Miscellany.

An Improved Commutator Brush.

In the brush for dynamos and motors shown in section in the accompanying illustration the contact of the brush with the commutator cylinder is a rolling instead of a sliding one. The commutator cylinder carried by the armature shaft is of ordinary construction, and the brush arm is pivoted on the journal box of the armature shaft as usual. A longitudinal stud inserted in the brush arm, and insulated therefrom, has a longitudinal groove, and the outer end of the stud is supported in a split insulating thimble by an arm projecting from the brush arm. Upon the stud are shown three collecting wheels, though a greater or less number may be used, the boss of each wheel having a feather which fits in the groove of the stud, the boss also having an integral collar and a shoulder supporting a loose collar, while a ring between the collars has an attached spring, the arrangement being such that a collecting wheel running on the ring will accommodate itself to the inequalities of the commutator cylinder. The outer portion of the wheel consists of a tread and web, the latter bored out and provided with a steel lining, between which and the ring are placed hardened steel rollers. In the collars are capsules, each containing a contact piece pressed forward by a spiral spring. The boss and attached collars being stationary, and the movable portions of the collector being in good electrical contact with the contact pieces, the current collected by the movable part of the brush is conveyed to the stud, to be taken therefrom in the same manner as from the brush-holding studs of sliding brushes.



BRUSH FOR DYNAMOS, ETC.

Air and Coal.

A thorough and scientific examination made by an English chemist on the effect of air and ventilation on coal gives the following results. First, the danger of spontaneous fring of coal in large lumps is very slight, but is much greater with smaller coal and greater still with dust, the increase of danger being due to the larger extent of surface exposed to the air in proportion to the mass of the coal; second, air-dried coal which contains more than 3 per cent of moisture is dangerous, but if it contains less the danger diminishes, the moisture contained being a measure of the absorbent power of the coal for air, and the more absorbent the coal the more dangerous; third, the danger is somewhat increased by the presence of pyrites in large quantity; fourth, newly won coal should be shielded from the air as much as possible to prevent the chance of rapid heating, and for the same reason it is best not to stack it in large heaps, since these retain the heat; fifth, all external sources of heat, such as steam pipes, boilers and hot flues in the neighborhood of the coal, add very greatly to the risk. spontaneous heating becoming vastly more rapid when it is assisted from without. Of course these conclusions have special relation to coal that is stored or shipped in cargoes

Artificial Ice.

A successful system of producing artificial ice surfaces has been inaugurated in Paris, and available in large areas at all seasons of the year. As explained, the machinery consists of two ammonia ice machines, driven by two 50-horse power steam engines; this ice apparatus has pumps which force ammoniacal gas into water-cooled condensers, liquefying the gas, which then passes into large reservoirs, where it expands with the production of cold, the same gas being pumped back and used continuously. In the application of this system for the formation of a skating surface, a rink has been constructed 60 by 130 feet, having a floor of cork and cement, upon this being laid three miles of connected iron pipe; through this pipe circulates a solution of chloride of calcium, an unfreezeable liquid, which, by passage through spirals in the refrigerating reservoirs, is cooled to some five to twenty degrees below zero. The water over the pipe is thus kept frozen, and daily sweeping and flooding insure smoothness.

Phosphorescent Tubes.

The statement is made that phosphorescent tubes are being introduced in England for practical lighting in places where beauty is of more importance than a very brilliant illumination—a substitute for some of the ordinary electric arrangements. A generator of special but comparatively simple construction is used. One form of vacuum tube is made of a spiral of a thin glass tube, the ends of which are connected to two bulbs, which contain the electrodes—this using, it is calculated, about one watt per foot of tube lighted. The objection to these tubes is stated to be that when brilliantly phosphoresced they become heated, and the glass is apt to melt. The light is never brilliant enough to replace ordinary incandescent lamps, though, where a soft moonlight appearance is desired, they are said to produce very pleasing effects. From 50,000 to 100,000 volts are required for the vacuum tubes, and this is obtained by means of a transformer in oil. The tubes are lighted by induction effects, and are connected in series with parallel condensers.

Bronze Powder.

Nearly a hundred establishments are engaged in the manufacture of bronze powder in and near the cities of Furth and Nuremberg, Germany. The article is composed of copper, tin, zinc, and antimony, melted in proper proportions, and cast first into rods of half an inch in diameter and about three feet long, these rods being rolled until about two inches wide and then cut into suitable lengths for hand-ing. The pieces go to the hammers, where they are beaten into a very small fraction of their former thickness and are then taken to a sulphuric acid bath, where each sheet is washed to remove all impurities, rust and dirt. After being thoroughly dried, the sheets are again hammered by steam hammers until no further reduction is possible, there being a limit to which machinery can be used. Up to this stage the treatment with the metal receives, whether intended for powder or metal leaf, is identical; but now the process changes. If designed for metal leaf, the further beating is done by hand, but if for bronze powder, the sheets go to the shears, where they are cut up into small particles and become known as clippings. These are now ready for the stamp mills, which are run in batteries, enabling one man to run or attend fifty or more. When sufficiently pulverized, the powder is sifted in a special manner, the heavier and better qualities going to one receptacle and the inferior grades to another.

Tenacity of Iron.

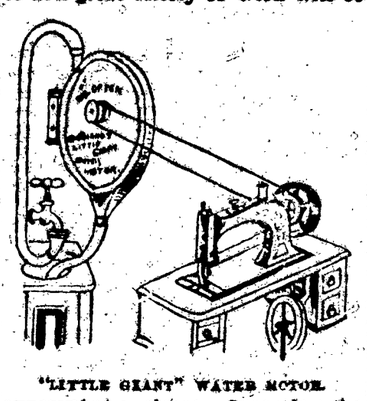
An official statement of tests made at the Massachusetts arsenal to ascertain the effect of temperature on the strength of iron has appeared. The specimens were heated by rows of Bunsen burners, which were arranged in a muffle, and the temperatures of the test specimens were judged by their observed expansions. Each piece was heated to the temperature of the test before being strained, and its expansion determined by a micrometer, and the coefficient of expansion of each grade of metal having been determined before the tests began, the temperature could be inferred with considerable precision. An abstract of five of these tests—the temperature being all on the Fahrenheit scale—is in evidence that the strength of steel is greater at about five hundred degrees than it is at seventy. These five series of tests were made with five different qualities of steel, containing, respectively, .09, .20, .31, .37, and .51 per cent of carbon, and the percentage of strength was obtained by dividing the tensile strength of a sample of steel at a given temperature by the strength of the same quality of steel at seventy degrees. The result presents the interesting fact that the specimens in question were all stronger in the neighborhood of zero than they were at ordinary temperatures—all of them, in fact, showing a minimum of strength at 210 degrees or thereabouts, and a maximum of strength at about 550.

For Band Sawing.

An improved band saw is now being manufactured by a Dover, N. H., concern, some of the features of which are specially noteworthy, including an effective resawing attachment. Unlike most resawing devices, it is not lifted bodily from the table, or raised and lowered by rack and pinion, but swings easily in and out of place on a vertical axis. The feed-driving mechanism is automatically connected when the device is swung into place, and a separate lever is provided by which the rolls may be instantly started or stopped. The friction feed is of an entirely new form, absolutely positive in action, and may be varied as desired between ten and thirty feet per minute by the turning of a hand screw. The rolls are four in number, all geared, and provided with compensation springs to allow for inequalities of stock—the right hand pair, however, may be clamped, if desired, at any required distance from the saw, for veneer and fine resawing work. The entire change from band saw to resaw, or vice versa, including change of saws, is easily accomplished in less than two minutes. As a band saw, it will handle stock eighteen inches thick, and has a clearance of forty-eight inches between saw and frame.

A Cheap and Efficient Motor.

The ease and simplicity with which such a motor as the one shown in the illustration may be set up and utilized to do a great variety of work will be



"LITTLE GIANT" WATER MOTOR.

apparent at a glance. Supposing the house or shop to be supplied with water under pressure, the motor is preferably secured in position at a washstand, sink or hydrant, the fittings being adjustable to all sizes of faucets or spigots without alteration. It is then connected by a light belt with sewing machines, fans, egg beaters, coffee mills, ice cream freezers, churns or with lathes, dental engines, scroll saws, washing machines, printing presses, etc. It is made in two sizes. No. 1, with a five and one-half inch wheel for light work, and No. 2, with a fifteen inch wheel for heavy work. It is offered at a low cost, is not liable to get out of order, and invariably causes surprise when first used by the amount of work of various kinds it performs.

One of Washington's bright women was present while her husband discussed the financial situation.

"I must confess," he said, "that the money market has worried me a great deal."

"It wasn't the money market that worried me," observed his wife.

"What was it?"

"It was the market money."

Wife—Who was at the back gate just now?

Husband—A tramp, who wanted something to eat.

Wife—Did you invite him in to get a bite?

Husband—I invited him in, but Towser's got the bite.

Steep Grade Railway.

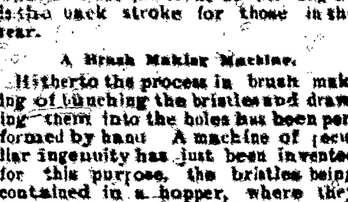
On one of the Kentucky railways is a remarkable little locomotive having eight wheels, all drivers, but the length of the wheel base, or distance between front and rear axle, is only sixteen feet. It weighs but eight tons, being designed to work on steep grades and curves, and has hauled a train of four empty cars, weighing sixteen thousand pounds up a grade of six hundred feet to the mile, and around curves of fifty feet radius, where the grade was four hundred and fifty feet to the mile, at a speed of twelve miles an hour. It has but one pair of cylinders, which are rigidly attached to the middle of the frame, and the wheels are carried under two trucks, one at each end and both able to turn about a center pin like the trucks under passenger coaches. The front and rear axles, that is, the first axle on the front truck and the last axle on the second truck, are hollow, the diameter of the inside being sufficiently large to permit a second axle to run through, the connecting rods driving these interior axles by means of crank pins, and the motion is communicated to the tubular axles by universal joints at their center point. In this manner the inner and outer axles are not always parallel, but the rotation of the former forces the latter to revolve with it. The tubular axle carries an angular crank from which the other wheels on the truck are driven. As the cylinder is midway between the trucks, there is a piston rod on each face of the piston, and the forward stroke for the wheels under the front of the engine is the back stroke for those in the rear.

A Brush Making Machine.

Hitherto the process in brush making of bunching the bristles and drawing them into the holes has been performed by hand. A machine of peculiar ingenuity has just been invented for this purpose, the bristles being contained in a hopper, where they rest horizontally at right angles on the top of a disk, which, by means of a treadle, is caused to partially rotate, first in one direction and then in the other. The disk has a notch formed in its periphery, and, as the notch passes under the bristles, some of them enter into the notch; before the disk returns, a plate joined to the disk is moved and closes the mouth of the notch, the disk then comes back and carries away the tuft of bristle retained in the notch to a position from which it can readily be taken by the fingers of the operative. The whole arrangement is that of a pecker or gripper, and can be regulated according to the quantity of the material required to fill the hole, the operative passing the wire through the hole by means of a special needle fitted to a clamp which is held in the right hand, the loop being automatically formed. Into this loop the operator passes the tuft of bristles, pulls the wire, and thus draws the bristles into the hole

A Device to Teach Spelling.

This is a cheap and simple device, which may be easily carried in the pocket. It consists of a small and light frame, flush with the back side of which is inserted a glass, while its top or outer portion has flanged edges



DEVICE TO TEACH SPELLING.

adapted to inclose a slide block designed to be moved along over the glass. The device may be applied to words or numbers upon a book or any other surface, so as to cover a portion and expose other portions, dividing the word into syllables and letters, as may be desirable in teaching small children, or exposing successive figures as may be advantageous in teaching the reading of numbers. The improvement has been patented by Jose Gallegos, Ocos, Guatemala, Central America.

Galvanizing Processes.

Among the recent experimental processes with iron and other metals is a new process of galvanizing, which would appear to have some advantages over the older method of steeping articles in molten zinc, the claim being that by cold galvanizing a more uniform coating is obtained, and, in case of wire, the tensile strength is not diminished. Comparative tests of the hardness of the coating on iron sheets show that the plate thus galvanized has a somewhat harder surface than that obtained by the usual means. An equally interesting result of recent investigations is the successful coating of metal surfaces with glass, in which operation there are melted together about 125 parts, by weight, of ordinary flint glass fragments, twenty-nine parts carbonate of sodium and twelve parts of boric acid; the fused mass is poured out upon some cold surface, as of stone or metal, and pulverized when cool, then of this mixture a powder is made with silicate of soda, water, glass—solution 60 degrees Baume—and with this coat the metal is glazed, being heated in a muffle or other furnace until it has arrived at the requisite fusion; this coating is represented as adhering very firmly to steel or iron.

Advance in Chemistry.

The fact is well understood that, for years, chemists have known that precisely the same elements necessary for ammoniacal manufactures are to be found in the heated vapors of the blast furnace, which have been allowed to go to waste—the tremendous heat, as Prof. Mark e puts it, seeming to negative their utilization, but under pressure of necessity a means to that end has been found which, it is declared, is a commercial success. In Scotland, especially, the progress within a comparatively short time has been very rapid in this line, about 50 per cent of the furnaces in that country having been "capped," the heated gas being carried through miles of condensers and the products saved. The magnitude and value of this important advance in chemistry may be judged by the fact that the plant to reclaim the waste products is greater in cost than is the blast furnace itself, and in some of the furnaces the pig iron is in reality the waste product, while the tar and tar products are of great value.

MUCH IN LIFE.

By the death of eight relatives in a month, a San Francisco Swedish woman has come to a fortune of $60,000.

The Navajo Indians are great sheep herds, unlike most redmen, and are said to have herds of a million sheep near Flagstaff in Arizona.

"Copy" for advertisements in Mexican newspapers has to have government stamps thereon in proportion to the space called for. Mexican tax laws are ingenious.

About twelve years ago Judge Denny of Oregon imported eleven Chinese pheasants from China to his state and turned them loose. There are 1,000,000 in the state now, sprung from these eleven.

At Attalla, Ala., as Joe Moragne prepared to get in bed on one side, a large blacksnake, a yard long, crawled off the other side. He succeeded in killing it, but excused himself from sleeping in that bed, and also in that room that night.

A fish was caught in the lake at Heilbronn, Swabia, in the year 1497, which has a brass ring attached bearing record of the fact that the same fish had been caught in the year 1230 and released after having the label affixed to its body.

Andrew Spengler, a brave Newark, N. J., man, lifted a manhole cover and dropped into a sewer in that city in search of a 4-year-old boy he had seen disappearing down an inlet, and succeeded in finding and bringing the child to the surface.

Rattlesnake hunting is a profession in Connecticut. The snake hunters go armed with a staff from six to eight feet long into the end of which is set a sharp steel blade eight inches long. By a dexterous swish of his lance the hunter severs the snake's head and the game is his.

A marriage, in which both the bride and groom were over seventy years old and grandparents, was solemnized in New York lately. The names of the couple were Conrad Gerstawein and Mrs. Catharine Hill. Five years ago they intended getting married, but abandoned the idea, thinking themselves too old. They could not, however, live apart, and recently reconsidered their determination, the marriage being the result.

ONE THING AND ANOTHER.

Astronomers agree that we are moving through space, but the direction of the movement is better known than the pace. The rate is sometimes set down as thirty miles a second.

A rare bird in this country is the "African snake," which is owned by a resident of Monroe, La. The bird is web-footed, and was swimming among the finder's ducks when captured.

Old garden flowers are coming into fashion again, that is, the flowers that are to be found in old gardens, like hollyhocks, marigold, bouncing Bess, phlox, dahlias, peonies and the commoner varieties of pinks and roses.

On the side of Old Rag, a spur of the Blue Ridge mountains, near Luray, Va., about three-fourths of the way up its side glows a strange and beautiful light. Every effort to reach it or to solve the mystery has failed.

A new-fangled Austrian cigarette tube contains a glass compartment in the middle. By placing blank sheets of paper, which are negatives, in the glass part and smoking a few minutes, you find printed on the paper the picture of an actress.

A red-headed Zulu who was doing a big collection business in the churches of New Haven on Sunday, was arrested in one of them on a complaint charging him with being the only heathen the funds ever reached. He is known variously as Borneo Muskego and Tippoo Tib.

"Rheumatic rings, $1," is the legend on a card that flies in a tray of lead-colored rings displayed by a New York jeweler. The belief that such rings protect the wearer from rheumatism has a pretty strong hold upon a part of this community. The rings, according to those who deal in them, are made of seven metals.

WITH THE WITS.

"Do you believe all that talk about Benton's being untruthful?" Bangs—No; he's the soul of honor. I wouldn't believe otherwise if he told me himself.

Customer, to landlady of the lion—I trust the eggs used for this omelet were perfectly fresh? Landlady—Oh! yes, sir; the eggs were laid especially for you.

Hills—How are you succeeding as an amateur photographer? Rills—Capitally. I have taken seventeen plates so far, and only sixteen were failures.

"A business man, thirty-two years of age, desires to make the acquaintance of a lady with a view to matrimony. Age, beauty, religion, character, nationality and fortune are of no consequence."

Skiggs—I should think men with shady records would want to steer clear of hotel porters and bellboys. Skaggs—I don't see why. Skiggs—You don't? Ain't it a big part of their business to show people up?

Old Lady, in Midway—Ugh! Those horrid Fijians! But what are those awful looking fellows with pie pans on their heads? Are they savages, too? Guide—No; those are Chicago young men. "What do they carry those horrid clubs for?" "Exercise."

"Going to the lodge, Arthur?" exclaimed the young wife in surprise. "I didn't know you were a member of any lodge!" "Why—aw—yes, Georgiana," said the young husband. "I belong to the Order of Elks." "And would you rather spend the evening with a lot of elks than with your own little dear?" And Arthur meekly hung his hat up again.