Irrigation in India.

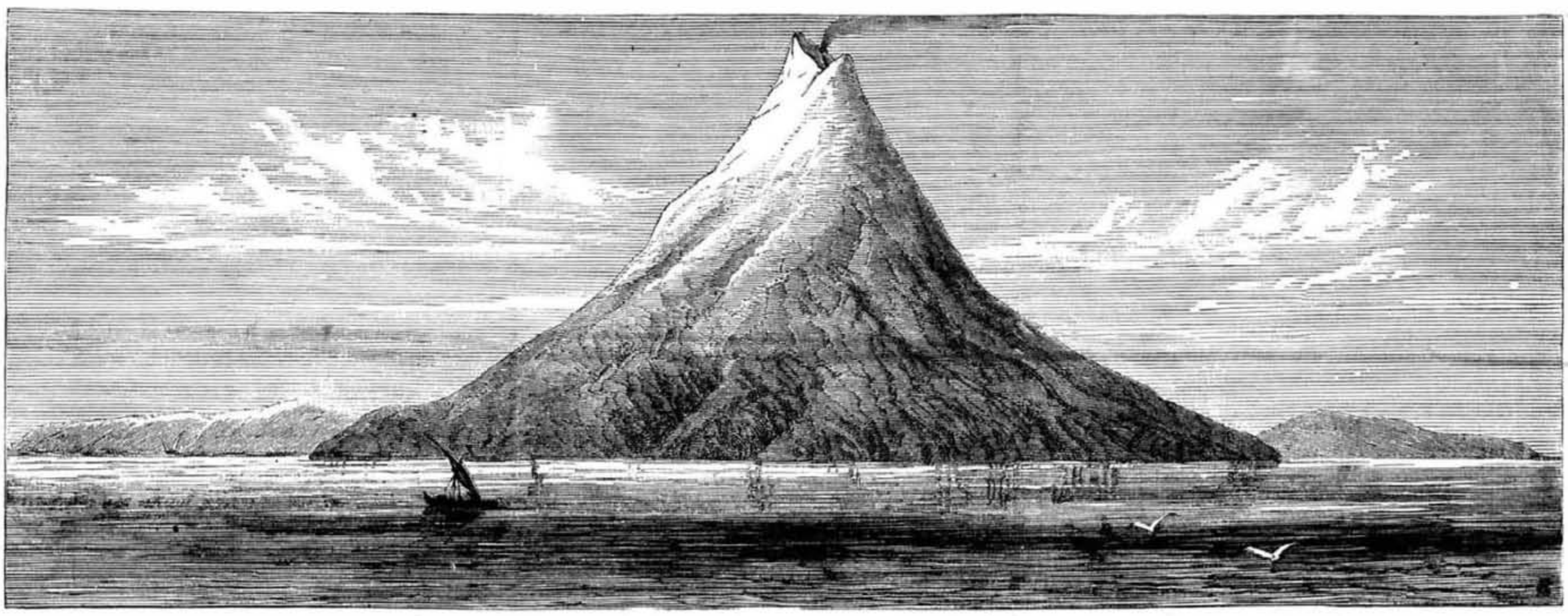
The system of irrigation now in use in the Madras Presidency is on a vast scale, a record, though imperfect, of the tanks in 14 cultivated districts showing them to amount to 43,000 in repair and 10,000 out of repair, or 53,000 in all. The length of embankment required for each may be estimated on a moderate calculation at half a mile, and the number of masonry works in irrigation sluices, waste weirs, and the like may be taken to be at least six. The embankments alone for all these tanks would extend over 30,000 miles, while the total number of separate masonry works are at least 300,000. The most remarkable feature about this gigantic system is that it is entirely of native origin, not one new tank having been made by Europeans; and, according to all accounts, there must be a good many equally fine works which have been allowed to fall into decay. According to the *Tropical Agriculturist*, the revenue dependent on existing works is roughly estimated at 150 lakhs.

Sulphur Phosphorescent.

K. Heumann raises the question whether sulphur, selenium, arsenic, etc., are not, under suitable circumstances, capable of phosphorescing like phosphorus. He finds that when sulphur is heated on a metal or porcelain plate in the dark, the vapors suddenly become phosphorescent, burn with a bluish-gray flame, perfectly distinct from the ordinary fine blue flame of sulphur. The odor given off is not that of sulphurous acid, but resembles that of hydrogen persulphide, camphor, and ozone. The product of the combustion is doubtless a stage of oxidation lower than sulphurous anhydride.

KRAKATOA.

We give herewith a sketch of the island of Krakatoa, in the Straits of Sunda, near the island of Java, which suddenly disappeared during the terrible earthquakes of August 25th and 26th last. A large area of habitable territory was submerged during this extraordinary convulsion of nature. One hundred thousand people lost their lives, most of them being overtaken by the great waves which came from the sea, and swept inland for several miles. Our engraving is from the *Illustrated London News*.



THE ISLAND OF KRAKATOA, FORMERLY IN THE STRAITS OF SUNDA, SUBMERGED DURING THE LATE VOLCANIC ERUPTION IN JAVA.

Death from Passion.

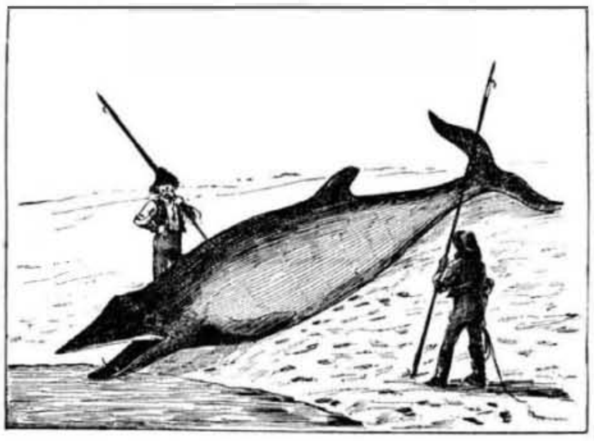
Cases in which death results from the physical excitement consequent on mental passion are, according to the *Lancet*, not uncommon. A recent instance has again called attention to the matter. Unfortunately, those persons who are prone to sudden and overwhelming outbursts of ill temper do not, as a rule, recognize their propensity or realize the perils to which it exposes them; while the stupid idea that such deaths as occur in passion, and which are directly caused by it, ought to be ascribed to "the visitation of God," tends to divert attention from the common sense lesson which such deaths should teach. It is most unwise to allow the mind to excite the brain and body to such extent as to endanger life itself. We do not sufficiently appreciate the need and value of mental discipline as a corrective of bad habits and a preventive of disturbances by which happiness, and life itself, are too often jeopardized.

A Whale Hunt in Shetland.

At West Voe, Dunrossness, on September 20, early in the morning, a number of six oared boats were proceeding to the fishing, when they observed a shoal of whales (twenty-eight in number) disporting themselves close to Sumburgh Head. They immediately gave chase, and succeeded in driving them all ashore. The scene of slaughter was wild in the extreme. Along the head of the Voe were spread the whales, lashing the water into foam in their death struggles, while in the midst of the blood and foam the men, wading waist deep in water, were going from fish to fish and plunging lances into the monsters' sides. One big fellow, managing to get his head seaward, went away at a great rate, sometimes below and sometimes on the surface; but he had been wounded mortally, and he was easily brought ashore again.—*Pall Mall Gazette.*

THE BOTTLE-NOSED WHALE.

A rare specimen of the Mesoplodon, or bottle-nosed whale, of which a picture can be seen on this page, was recently

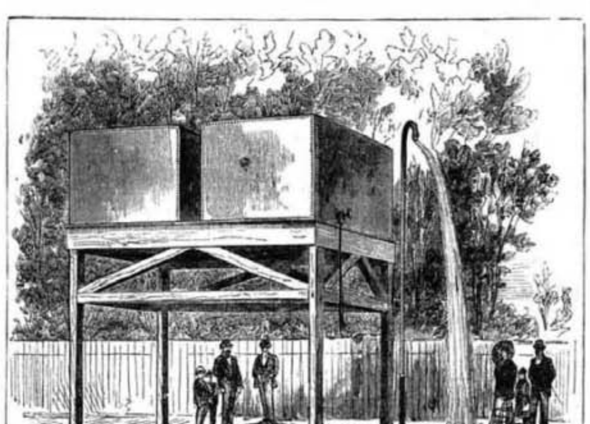


THE BOTTLE-NOSED WHALE.

washed ashore near Long Branch. Professor True and Mr. Palmer of the Smithsonian Institution have taken a plaster cast and removed the bones to Washington. This is said to be the second specimen ever prepared. The only one now known is in the Paris Museum. The body is nineteen feet and four inches long and will probably weigh two tons. —*Graphic.*

ARTESIAN WELLS, AUSTRALIA.

There are two artesian wells at Sale, known respectively as the Borough and the Cunningham Street well. On the



ARTESIAN WELL SALE, AUSTRALIA.

15th of April, 1880, a contract to bore 300 feet, or until the water flowed over the surface, was taken by a German called Niemann, the borough council of Sale, after considerable discussion, having voted a sum of £200 for the purpose. Water which rose 3 feet above the ground was struck on June 17, at a depth of 190 feet; and on sinking some 40 feet deeper, a stream of black water, with a most disagreeable smell, suddenly rushed up the pipe, rising to a height of 43 feet above the surface. This left a heavy deposit, as it passed down the street, of dark gray sand, dead leaves, decayed wood, and nodules of iron. In a few days it became perfectly clear. In boring this well, an iron tube 4 inches in diameter was put down to a depth of about 100 feet, and inside this, gas pipes 2 inches in diameter were put down to the required depth. The uniform outflow of this well (the Borough well), shown in our cut, is 43,000 gallons daily, the whole of the cost of which, including tanks at which water carters can fill their casks, troughs for watering of horses and cattle, pipes for channels, etc., was only £280 16s., whereas the estimated cost of supplying Sale with water from a higher level of the river, by gravitation, was estimated at £36,000.

The following is the analysis of the water made by Mr. Cosmo Newbery. It is bright, colorless, and tasteless; it contains an amount of solid matter in solution equal to 30·7 grains per gallon.

An analysis of this gave:

Chloride of sodium	36·44
" " potassium	trace.
" " calcium	"
" " magnesium	0·46
Carbonate	0·40
" of calcium	trace.
" " silica	0·80
Organic matter	1·60
Total	39·70

In one million parts it contains free ammonia, 0·75; albuminoid ammonia, none; nitrates and nitrites, none. The water is of excellent quality for all domestic purposes, and it is remarkably free from nitrogenous bodies.

Most of the ground bored through was soft; samples of the various strata passed through were religiously preserved and placed in their order, in a long box with a glass front, and were thus sent to the Mining Court of the Melbourne Exhibition.

Water was struck in the Cunningham Street well, which is the property of a private company, on the 25th August, 1882. Two water bearing strata have been tapped here, one at the depth of 190 feet with a 6 inch pipe, the other at 284 feet with a 4½ inch pipe, placed inside the former. The supply of water from the 190 foot level is 250,000 gallons, and that from the 284 foot level 150,000 gallons a day, making in all the immense outflow, rising 40 feet above the surface, of 400,000 gallons a day, of which at present about 380,000 gallons are wasted. This runs through the street into Wishart's Morass, thence into Flooding Creek, and and thence into the Heart Morass, where it floods a lot of selections for a distance of over six miles. It is, however, anticipated that at some future period this water will be used as a motive power. The water from the lower level is kept back by means of cocks The cost of this well was £1,250; during the process of boring, several accidents in connection with the machinery occurred, usually causing the operation to end in failure.

According to Mr. Johnson, Government Analyst, the water from the above well shows only six grains of salt to the gallon, as against 36 grains in that of the Borough well, not a quarter of a mile distant. The water from this latter is said to have proved unsuitable for reticulation purposes, as it not only rots the pipes, but also stops them up with sesquioxide of iron, so that they have to be taken up and cleaned at short intervals; that from the Cunningham Street well, on the other hand, so far from being injurious to iron, is actually said to be improving the boilers of the locomotives in which it is used, and to have been running through 1 inch and 1½ inch pipes for the last four or five months without any sign of injury. The borough council of Sale is talking of reticulating the town, but has not yet decided whether to use the Cunningham Street well or to risk putting down another.—*Town and Country.*

Organisms Living in the Atmosphere.

Dr. P. Miquel, chief of the micrographic service at Montsouris Observatory, has published a volume on this subject, from which are taken the following points, which we translate from the *Bulletin de la Societe Francaise de Hygiene.*

Miquel divides these minute beings into four groups: micrococci, bacteria, bacilli, and vibrios and spiral microbes. Each group or genus can be subdivided into species and varieties, the characteristics of which are unfortunately not well marked.

The *micrococci* usually present the form of globular cells, without the power of spontaneous movement. They vary in size from five ten-millionths to three-millionths of a millimeter in diameter. Their appearance varies with their age, from little cells filled with a protoplasm of very slight refractory power, to brilliant granulations surrounded by a very distinct black circle. They are met with united into groups or chains.

It is generally easy to distinguish micrococci from other bacteria; but it sometimes requires considerable attention to distinguish micrococci from bacteria on the borders of each.

Bacteria have the form of short movable club (batonnet), either single or joined in groups of two, three, or four, seldom more. They are usually longer than they are wide; but they are also found spherical in form, imitating micrococci; at other times they are found larger at the extremity than in the center. One bacterium that was cultivated long enough by Miquel possessed the singular property of transforming a gramme (15½ grains) of sulphur into sulphydric acid within 48 hours in an infusion of tartrate of ammonia in 4 liters of boiling water containing excess of sulphur.

The number of bacteria of a pathological nature is very large. We may mention one only found by Pasteur in the potable waters of Paris that has the power of producing the metastatic abscesses of a purulent nature when injected into the jugular veins of animals. This pus producing microbe demands more complete study.

Bacteria, which approach micrococci very closely at the one extreme, come at least quite as near to the bacilli at the other extreme.

Bacilli are formed of cells arranged in rigid filaments of uncertain length, either movable or immovable, and varying in width from two to five millionths of a millimeter.

Common bacilli have two modes of reproduction—by division and by brilliant seeds or spores. If they are cultivated where the oxygen of the air has free access, the bacillus uniformly obstructs it, and becomes active and relatively short; division takes place without hinderance.

If the oxygen has difficulty in reaching the surface of the liquid, the latter is quickly saturated with carbonic acid; the bacilli come to the surface to get air to breathe; there they continue to increase immoderately without stirring and form an impenetrable network, which subdivides and throws out brilliant spores. It is nevertheless doubtful whether all the aerial bacilli have this power of throwing off spores. On the boundaries of the group it is very difficult to distinguish the varieties of this species from those of the preceding group. The bacteridie of charbon is remarkable type of motionless bacilli; the bacillus subtilis, which is aerial, and butyric ferment, which is not, on the other hand belong to a class of very active bacilli.

The *vibrios* and *spirilles,* both of which are placed by Miquel in one group, ought, it would seem, to form two distinct groups, if they are frequently met with in the dust of the air.

The former are filamentary mossy organisms that grow in the cultivating liquid in the form of needles. Air, rain water, condensed steam, rarely contain germs of these organisms. The others (spirilles) have long filaments, not stretched out, but wound up into helices. They are either very long and then vibrate like the vibrios; or very short, and then are always stiff, having the appearance of a collection of numerous short screws crowded together. Spirilles are frequently found in anatomical macerations and putrefying vegetable infusions; they are rarely met with in dust of the air.

Without following out Miquel's enumeration of bacteria, which will be found given in full in his book, we will briefly give some of his results. The mean number of bacteria that he found in a liter of rain water was 16,000, divided in the following proportion:

	Micro-cocci.	Ba-cilli.	Bac-teria.	Total.
Rain water	28	63	9	100
Air of Montsouris Park	73	19	8	100

The total number of bacteria in a liter of water was found to be distributed in 200,000 liters of air from the park about. This last number, of course, varies with the season, the state of the weather, and direction of the wind on Montsouris. The mean number for each season, deduced from observations extending over three years, were as follows per cubic meter:

Winter, December to February	44
Spring, March to May	76
Summer, June to August	76
Autumn, September to November	134

In autumn they are most abundant, and this season is most exposed to epidemics. Rain cleanses the air of its bacteria as well as of spores; but, on the other hand, humidity is an obstacle to the diffusion of bacteria in air, while prolonged dry weather favors it, and it is only after a long drought that the spores of the air get old and lose in part the power of reproduction in the liquids employed for their cultivation.

The effect of the wind at Montsouris is partially due to this cause and also the position of the observatory on the south side of the city. The numbers were as follow:

Winds from N. and N. E.	138
" " E. and S. E.	102
" " E. and S. W.	50
" " W. and N. W.	92

Just in proportion as we penetrate into Paris the number of bacteria increased enormously, without exactly following the variations noticed at Montsouris. There were found in the Rue de Rivoli, at the height of one of the first story windows of the Mairie of the IV. Arrondissement, the following numbers:

Winter	373
Spring	850
Summer	888
Autumn	888

The effect of private houses was found to be very appreciable; they are very rich in bacteria, and the more so the poorer the ventilation. This is shown by an example of air taken from Hospital de la Pitie, the number per cubic meter being as follows:

	Salle Michon for men.	Salle Lisfranc for women.
Winter	17·720	17·600
Spring	10·740	8 000
Summer	5·280	6·400
Autumn	12·630	12·200

As soon as the season allowed the windows to be opened, the number of microbes indoors decreased, but increased on the street.

It is indeed Paris itself, her inhabitants and her animals, that are the origin of these microbes, because if we examine the air that hovers over the city even at the height of the lantern on the Pantheon, we will find but very few microbes in it.

Top of Pantheon	28
Montsouris Park	45
Mairie of IV. Arrond	462

If we examine the dry dust that falls on the furniture of the rooms, we notice the same increase from the circumference of Paris toward its center.

Bacteria in 1 gramme of dust at the Observatory Montsouris, 750,000. In apartments in Rue de Rennes, 1,300,000. In apartments in Rue Monge, 2,100,000.

The proportions of each kind also vary at the same time.

	Micrococci.	Bacilli.	Bacteria.
At Montsouris	187,500	525,000	13,000
In Rue de Rennes	780,000	442,000	78,000
In Rue Monge	1,575,000	378,000	147,000

The number of bacilli decrease, while the micrococci and bacteria increase.

In spite of the minute size of the microgerms and the facility with which they are transported by the wind, their diffusion through the air can only be perceived through short distances. Whatever it may be that is the center of emanations, its germs are very soon drowned in such a mass of air, and they are rarefied to such an extent, that the most formidable of them are no longer to be dreaded. It is not so with dust transported with whatever has been deposited on it; their activity can be preserved a long time and transmitted almost any distance if there are no special circumstances that destroy them on the way.

In the same city the necessary intercourse of the inhabitants exposes each one of them to the action of noxious germs, and all those which present a suitable soil for their cultivation may feel their influence. Fortunately the greater part of these innumerable microbes of the air are not only inoffensive, but they are powerful auxiliaries in this sense, that they relieve us of organic detritus of every sort, that, without them, would accumulate on the soil and render all fresh life impossible. And yet it is easy to see that in Paris, where all these microgerms spring up and multiply, increased mortality follows at an average distance of eight or ten days; the increase corresponding to the number of bacteria found in the air of Montsouris and Rue de Rivoli. In this total number the noxious microgerms are produced by epidemic batches; but circumstances favorable to the generality of microbes are equally favorable to these.

The bacteria collected in the air of sewers are much less numerous than in the majority of dwellings; but the moisture that prevails there keeps them young and vigorous: they invade and taint the less sensitive infusions in a few days. The bacteria are very numerous, and many of them are anaerobes, those which contribute to the putridity of the fermentations which produce them. Injected into rabbits, Miquel showed that they were perfectly harmless, which does not always take place with house microbes.

The following is a summary of the qualitative composition of the atmosphere in places where Miquel estimated the number of microbes, in percentages of each kind:

	Micrococci.	Bacilli.	Bacteria.
Air of Rue de Rivoli	93	5	2
Air of Montsouris	73	19	8
Air of hospital	86	9	5
Air of Paris dwellings	84	10	6
Air of laboratory, Montsouris	81	16	3
Air of inhabited rooms	54	47	1
Air of sewers	60	14	26
Dry dust, Montsouris	25	70	5
Dry dust, Rue de Rennes	60	34	6
Dry dust, Rue de Monge	75	18	7

We may add that in the park of Montsouris the number of microbes that fell with the dust on a square meter within 24 hours was 28,000. In the micrographic laboratory this number reached 2,400,000. It ought to be still greater in the interior of the hospitals and certain dwellings.

In the presence of these legions of microbes it would be desirable to know how they would act in the presence of substances called antiseptic or disinfectant. This has also been studied by Miquel.

He places oxygenized water, H_2O_2, at the head of the list of bactericides; 5 centigrammes to a liter of bouillon stopped all fermentation. The other agents have much less effect as shown by the following figures taken from a larger table given by Miquel.

The smallest quantity of each substance capable of preventing fermentation completely in one liter of bouillon was as follows:

Oxygenized water	0·05	gramme.
Iodine	0·25	"
Bromine	0·60	"
Chloride zinc	1·90	"
Carbolic acid	3·20	"
Permanganate potash	3·50	"
Boracic acid	7·50	"
Salicylate soda	10·00	"
Borate soda	70·00	"
Anhydrous alcohol	95·00	"

If to this we add the almost absolute harmlessness of oxygenated water derived from baryta, we can understand what a role this reagent is called upon to play in surgical and obstetrical operations.

M. Miquel has just commenced the second part of his work, viz., a study of the microscopic composition of the waters of Paris and its vicinity; but this a much larger operation, the study of these microbes not in their totality, but taken successively and individually.

Asser's Photo-Lithographic Transfer Process.

Unsized paper, as it is habitually used by lithograph printers, must be employed.

It has to be of the best quality and rather thick. It would be better if it were made on purpose by a paper manufacturer. The smooth side is covered with a layer of starch. In order to avoid different kinds of starch, of which one ignores the different peculiar qualities, it is better to use an invariable substance. Experience shows that cooked wheat flour is most suitable for that purpose. It must be rather concentrated, but nevertheless liquid enough, not to prevent regular running off. This starch is poured into a square pit and the smooth side of the paper is carefully placed upon it, so that bubbles are avoided. After that it is laid to dry horizontally on the other side. In a dark room the unstarched side of the paper is laid above a rather concentrated solution of bichromate of potash, till by its porosity the paper is entirely pervaded by the liquid.

Then it is hung on a pin in the dark, left to dry, and transferred on a polished stone in the lithographic press, the starch side toward the stone.

In order to give to the paper a smooth surface, the scraper is pulled several times over it. By this operation light must be avoided.

In this state it is placed as usual under a negative in a photographic chassis, exposed to the light till the enlightened parts present a picture of a strong brown color. Then the paper is taken from the chassis and left in various baths of water till all unaffected parts are of a clear white, and the enlightened ones of a light green tint.

If this result is not obtained by cold water, hot water may be employed to destroy any traces of the dissolvable bichromate of potash. Then it is again hung to dry, on a pin. Sunshine or a moderate fire well contribute greatly to the acquirement of a clear image. In order to transfer the copy, the thus prepared paper is laid on the back side upon water only warmed a little in winter. Then it is placed upon a stone or a glass after the superfluous water is removed by blotting paper. The transfer ink consists of common lithographic printing ink only mixed with a convenient part of oleïne.

Before blackening the image a layer of mastic dissolved in absolute alcohol is conveyed to the paper and spread regularly over it with a little cotton till it is dry.

The above described ink spread upon a stone is put on a wooden roller, covered first with cloth or flannel, and thereupon with cotton or silk velvet.

The liquid that has remained in the paper is sufficient to preserve from ink the places which must not be blackened. If there might still remain some impurity, as frequently happens, it may be removed by using the roller very lightly and finally by taking it off with a wet soft sponge. Afterward the water is again removed by blotting paper.

The velvet of the roller has to be renewed frequently.

After the last preparation the blackened paper is transferred upon a lithographic stone or upon zinc, and handled in the usual manner.

E. T. ASSER.

Amsterdam, 1883.

A Home-made Fountain Pen.

Take two ordinary steel pens of the same pattern and insert them in the common holder. The inner pen will be the writing pen. Between this and the outer pen will be held a supply of ink, when they are once dipped into the inkstand, that will last to write several pages of manuscript. It is not necessary that the points of the two pens should be very near together, but if the flow of ink is not rapid enough the points may be brought nearer by a bit of thread or a minute rubber band.

Autumn Glories.

It is now, in mid-October, that the rural landscape is in its glory. The leaves of the deciduous trees are ripe and resplendent in color; that is, the trees whose leaves fall in autumn. The leaves of these trees ripen as the fruits do. It is the same result from the same cause in both leaves and fruit. Every one who walks along the country roads or lanes, or rides or drives, or takes a railway trip where there is a skirting of woodland, has had sight of the beauty of the foliage with its almost infinite variety of color. Some, of course, have not enjoyed opportunities for strolls, drives, or journeys within eyeshot of these scenes since the glories have been put on; but all who can should do so. It is not every season that the colors are so brilliant or so varied as they are this fall. Sometimes the late summer and early autumn weeks are too dry, the flow of sap ceases prematurely, and the foliage dries up and withers rather than ripens. Then there is but little bright color. But the weather has been highly favorable this season, and the woods, especially on the Jersey side of the Delaware, are aglow to an unusual degree.

It does not require that a long journey should be made to see these beauties. Almost any bit of landscape with a copse or grove or stretch of young timber will show the perfection of autumn leaf coloring at this time, if there are swamp maples, sugar maples, sumac, sweet gum, dogwood, oaks, and sassafras well interspersed among the pines, cedars, spruces and other trees of our neighborhood. Where all these are plentiful, together with climbing vines, the effect is, of course, the more beautiful, especially if the trees are on a hillside. The effect is grandest of all on the flank of a mountain, where the colors are in mass; and, where viewed from a distance, the rounded outlines of the rising banks of trees look like cumulus clouds lighted up by a sunset of crimson purple and gold. The perfect scene is where there is a considerable proportion of evergreen trees—pine, spruce, hemlock, cedar—to make a background and to occupy the interspaces between the trees with colored foliage. Then, there is every color of the spectrum and every shade of blended hue, not even excepting the blues, which in some conditions of the air and of the light are observable in charming tints, among the greens in the distance. From the umbers and buffs and russets to rich orange and golden yellow, from the deep purples, maroons, and bronzes to crimsons and scarlets, with every variety of green—all the intermediate colors can be found in any strip of woods that contains the trees above named, or a majority of them.

But some of the colored maples surpass all other trees in their splendor, as their leaves pass from the golden and orange yellows in the lower branches to the flaming tints on their crowns. The sweet gum is next in varied brilliancy, but these trees are far less numerous hereabouts than maples. They abound, however, in the near counties in South Jersey. The sumacs and dogwoods show handsomely in the distance, but their leaves do not bear close inspection like those of the maple and sweet gum. Some of the oaks, too, are exceedingly beautiful in their variegated leaves of green and red. When you go to look at these roadside or mountain pictures, try to see them in the sunlight. An hour after sunrise or an hour or two before sunset are the choice times; but at all times of the day they are beautiful.—*Philadelphia Ledger.*

Hard-Headed Practice.

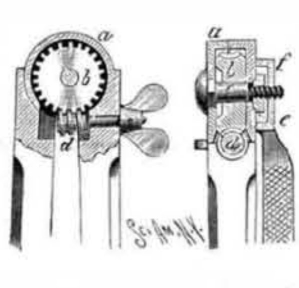
Dr. Walker, President of the Boston Institute of Technology, will have the country much beholden to him if he continue the good work he has so admirably begun of leading youths into useful and practical channels of study. He finds the tendency of the young is toward a professional calling, and as his elder experience proves these avocations to be dangerously overcrowded, he is striving to correct the fanciful disposition to a common-sense regard of the demands of life. He is inducing many of the boys of that city to pursue mechanics as a study, and is by that means fitting them for paths in life that are not already choked up with futile toilers after fame and fortune. The fact is, this country needs more industrial institutions and fewer colleges of law and medicine. We want more common sense and less ideality, more hard-headed practice and less theory, more workers and fewer puddlers. Success in the workshop is infinitely preferable to and more honorable than failure in a profession, and the mere matter of name has come to make but little difference with the estimate of men's worth nowadays. Technical education is what is wanted in our manufactories, and in them is our life.—*Chicago Journal.*

The Signal Service Clock.

A clock of peculiar construction has been manufactured for the United States Signal Service Bureau at Washington. The case is of brass, and allows the swing of a pendulum 39 inches long; it is air tight, and admits of the air being exhausted, and the movement run in a vacuum, thus obviating any possibility of variation due to atmospheric changes. An electrical attachment is connected with the movements, by means of which the clock is wound as it runs, so that there is not the usual liability to variation arising from the differing conditions of the mainspring. This is accomplished by alternately breaking and closing an electric current. The motion thus obtained and the power of the current are used to rewind the spring by means of a worm and other mechanism. The winding keeps exact pace with the running, and the slightest deviation from this standard is shown on an indicator. The train is jeweled, and is therefore little affected by friction.

CALIPERS AND DIVIDERS.

The pair of calipers or dividers herewith illustrated is provided in the joint with a disk having a worm-threaded edge with which a screw pintle engages, which is held loosely in one of the legs, thus permitting the points to be adjusted accurately by turning the screw after the legs have been adjusted in the usual manner. One of the cuts is a longitudinal sectional elevation, and the other is an enlarged detail cross sectional elevation. The disk, *b*, is provided with one flat surface and also with a recessed surface, so that the friction on one will be greater than on the other, so that the disk will be held on the cap of one leg by friction while adjusting the points. The upper end of each leg is provided with a disk having an annular flange, *a*, forming a cap. One of these disks is provided with a circular and the other with a square aperture. Passing through the two disks and through the worm-threaded disk is a bolt, *c*, provided with a head, and having a squared part fitting in one of the disks. The bolt has a tapering shank, the free end of which is screw-threaded. A nut, *e*, holds these parts together. A screw key, *f*, then screws on the threaded end of the bolt, *c*. A pintle, *d*, is held loosely on one of the legs directly below the disk, and on the outer end is provided with wings, and on the inner end, which is enlarged, is a screw thread engaging with the worm thread of the disk, *b*. If the dividers are to be opened or closed, the nut, *f*, is unscrewed, when the legs can be moved as desired. When the legs are moved by hand, the flat surface of the disk, *b*, will slide on the surface of the disk, *a*. When the legs are moved by turning the wings, the disk, *b*, will remain stationary in regard to one disk, and the sliding will take place on the other disk.



This invention has been patented by Mr. William H. Mitchell, Lebanon, N. H.

COMBINATION TOOL.

A novel combination tool recently invented by Mr. I. T. Torrey, of Beeton, Ontario, Canada, is especially intended for the use of railroad men for cutting the wires and tin clips used in sealing freight cars, and combines shears, tack hammer, claw for pulling tacks, and a screw driver. The blades are formed with bows similar to those of an ordinary pair of shears. One bow is formed with a hammer head, and the other with a claw so situated that the part of the bow just in front of the claw will furnish a fulcrum when the tool is used for drawing tacks. The two cutting edges are made on a line with the pivot, so that a firm and powerful grip is furnished for cutting wire or tin.

The cutting portion of one blade is made very short, while that of the other blade is made somewhat longer, and is reduced in width at its extremity, so as to form the screw driver blade. The construction of the tool will be readily understood from the engraving.

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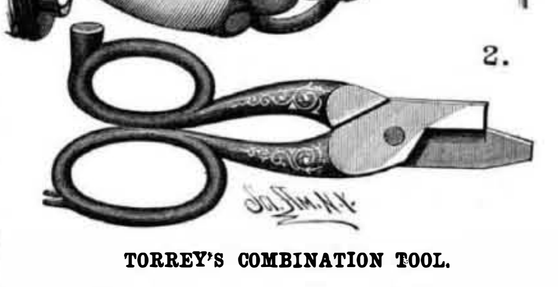

TORREY'S COMBINATION TOOL.

Melted Wool.

M. Heddebault has discovered a method of preparing soluble wool from tissues in which wool and cotton are combined. When subjected to a current of superheated steam, under a pressure of five atmospheres, the wool melts and falls to the bottom of the pan, leaving the cotton, linen, and other vegetable fibers clean and in a condition suitable for paper making. The melted wool is afterward evaporated to dryness, when it becomes completely soluble in water, and is called azotine. The increased value of the rags is sufficient to cover the whole cost of the operation, so that the azotine is produced without cost. It contains all its nitrogen in a soluble condition, and can, therefore, be compared to dried blood, which is worth 2·50 francs per kilogramme of nitrogen. M. Ladureau regards this discovery as one of great interest for agriculture and mechanical industry.—*Soc. Industr. du Nord.*

Waterproofing Fabrics.

Formerly some preparation of India rubber or gutta-percha was generally employed for rendering textile fabrics waterproof, but since that time many other and cheaper materials have been pressed into this service. Some of the processes are thus described in the *Polytechnisches Notizblatt*, No. 12.

Dujardin's process makes use of alum and sugar of lead. It is applicable to cordage and fabrics as well as to wood, leather, and paper. He takes of pulverized potash alum and crushed acetate of lead, each 20 parts, bicarbonate of potassium and Glauber's salt, each 12 parts, and pours over this mixture 3,000 parts of soft water, all by weight. He also dissolves separately in an equal quantity of water 9 parts of oleine soap, and then mixes both solutions. The articles are left in this solution until thoroughly saturated, allowed to drain, dried, brushed, and finally pressed.

For linen, leather, and wood he also adds margarine, 6 parts, and for cotton or paper some gelatine, 3 parts, and resin, 6 parts. Impregnation with this preparation, it is claimed, does not injure the colors. Alum and sugar of lead alone, or alum and caoutchouc, can be used for the same purpose.

To waterproof linen, the *Pharmaceutische Zeitung* recommends a solution of sulphate of alumina in ten times its weight of water, and a soap bath of the following composition: One part of light colored resin and one part of crystallized soda (sal soda) are boiled in ten parts of water until dissolved. The resin soap is precipitated with half part of table salt, and is subsequently dissolved along with one part of white curd soap in thirty parts of hot water. It should be put in wooden tubs for use. On made up articles the two solutions can be applied with a brush and then rinsed off.

According to Stenhouse, paraffine is excellent for waterproofing hempen hose and other things. The article to be treated is tightly stretched and heated over a hot plate of iron, and then rubbed as evenly as possible with a piece of paraffine. It is then pressed with a hot iron or between rollers, so that it will penetrate it thoroughly. Instead of using a piece of paraffine, the paraffine may be cast in a cylinder with a wooden core (like a printer's roller), and the goods drawn over it, pressing them down sufficiently. Or the paraffine can be rubbed on cold and then a hot iron passed over it. Paper can be saturated with melted paraffine on a warm plate of iron, the goods wrapped in it, and the whole pressed between hot iron plates or metallic rolls. Where long pieces of goods are to be treated, the process can be made continuous by passing the stuff over one, or more warm rollers that are kept covered with paraffine by running in a bath of melted paraffine. The excess of paraffine is removed by a scraper, a brush, or hot rollers.

When paraffine is employed in solution, the goods must be previously well and thoroughly dried, or the moisture will prevent the solution from penetrating within the goods and repel it.

A Great Loss from Spontaneous Combustion.

The origin of the disastrous conflagration which destroyed in a few minutes the other day the buildings of the Pittsburg Exposition, with all their contents, has been explained by a theory which is, to say the least, very plausible. It seems that Mr. Warner, the aeronaut, having an ascension to make, spent the day before the fire in repairing his balloon, and in revarnishing the canvas of which it was made with boiled linseed oil. As the most convenient place for his work, he chose the boiler room, and after the varnishing was complete, the balloon was rolled up and put by to dry. A more reckless operation than this it would be difficult to conceive, the warmth of the room, the rolling together of the canvas, and the boiling of the oil all conspiring to make the spontaneous combustion of the inflammable mass almost inevitable, and the opinion of the Pittsburg Fire Marshal will be concurred in by every builder, architect, insurance agent, and painter's apprentice, that the result was simply what ought to have been expected under the circumstances. The only thing that could have made the canvas more certain to take fire than simple saturation with linseed oil would have been to sprinkle it with water before rolling up, but this is by no means essential to the effect. It is, however, a very common factor in the cases of spontaneous combustion which occur every week or so. Some uninstructed person, having been engaged in painting or polishing woodwork, undertakes to save the cotton rag which he has been using by washing out the oil or paint, but after one or two trials, finding this a rather difficult operation, abandons the attempt, and rolls up the rag in a knot, and throws it into some corner, where the oil and water speedily react upon each other to set the whole in a blaze.—*American Architect.*

Electric Light Carbons.

M. Jacquelain has endeavored to prepare a pure carbon for electric purposes that should be as hard and as conductive as gas carbon. He first takes gas carbon, which he submits to four processes: (1) treatment with dry chlorine at a red heat for thirty hours; (2) treatment with hot alkali for about three hours; (3) immersion in hydrofluoric acid (1 to 2 of water) at a temperature of 15° to 25°; (4) carbonized by heating strongly in the vapor of a high-boiling hydrocarbon, for commercial purposes gas tar will do well. All these operations may be performed after the carbon has been cut into sticks. By these processes the impurities have been reduced to a minimum and a good, pure carbon obtained.