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AMERICAN INDUSTRIES.—No. 8.

ALE BREWING,

As conducted at P. Ballantine & Sons' Brewery.

Beer was known to the Egyptians, and it is probable that the Greeks learnt from them the art of brewing. The Romans obtained their knowledge of beer from the Gauls, and like them, called it *cerevisia*. In Germany the brewing of beer has been carried on for many centuries, the fact being mentioned by Tacitus. As long as the malt required was prepared in each house the beer industry remained comparatively undeveloped; but when the monasteries began to brew on a larger scale it attained considerable perfection. The monks were the first to make a distinction between "double beer" and "single beer." The use of hops in brewing dates from the ninth century. White beer was first brewed in Nüremberg, in 1541. The brewing of ale and porter—which are species of beer—dates only from the eighteenth century. Until within the present century brewing was empirical, but modern research has placed it on a truly scientific basis.

To bring before our readers some facts relative to the brewing of ale, we give engravings illustrative of the industry as at present carried on by Messrs. P. Ballantine & Sons, of Newark, N. J.—this establishment being the largest and one of the oldest of its kind in the United States. It has been in existence for more than forty years, and has been located in Newark since 1840.

Since the organization of this business by the elder Mr. Ballantine, in 1835, in Albany—then the headquarters of the brewing business—this industry has slowly but steadily developed until it has reached gigantic proportions. The establishment of Messrs P. Ballantine & Sons, covering about

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THE BREWING OF ALE.

Scientific American.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 167,
For the Week ending March 15, 1879.

Price 10 cents. For sale by all newsdealers.

SCIENCE TO SOLVE INDUSTRIAL PROBLEMS.

In a recent address to the Workingmen's Lyceum, at Cooper Institute, Parke Godwin said that society presented many problems—war, crime, pauperism, intemperance, and a thousand others—but the profoundest of all was that which related to the condition and prospects of labor. After reviewing the conditions of labor and of laboring men in the past and at present, the speaker said that the real social problem was to maintain the freedom of labor, and with it the equilibrium of the industrial forces, and of their results. Many solutions to this problem have been offered, chief among them these three: the moral solution, the political solution, and the economic or social solution—all important, but only one efficient.

The moral solution failed for two reasons: it could not reach the object of its solicitude—individuals; while the evils to be remedied were many of them organic, and could be cured only by organic remedies.

The political solution was but the old form of state intervention, another name for despotism. Not a government on earth can take charge of itself, much less the people; all of them are bankrupt. The people must take care of themselves. The duty of government is to maintain the conditions of liberty, justice, and progress, but there to stop; every step beyond is either toward anarchy or tyranny.

There is but one way of meeting the evils of society, the speaker went on to say, and that was to learn scientifically the laws of social phenomena, and to apply them to all social arrangements and procedures. Do such laws exist? Who can doubt it that has studied statistics, or watched the uniformity of social results? Because man is a being of free will, he is none the less a source and subject of law. His processes, especially the action of large numbers acting together, are not wholly arbitrary and capricious. They can be counted on generally with as much confidence as we count on the rise of the tides or the revolutions of the stars. Because these phenomena are more complicated than natural phenomena, we know less about them; but we shall know more of them in time. How many great minds and noble hearts are now at work to find the key of social science, to unravel its mysteries, to bring the seeming chaos into order? Something has been done in this direction, but much more remains to be done. The publicists and the economists have given us glimpses of the field—the scientists will soon open it to the husbandman and his golden harvests.

ECONOMY IN GAS BURNING.

True economy in gas burning implies the use of burners capable of developing as nearly as possible the full illuminating power of the gas consumed. Judged by this standard, it is safe to say that the great majority of those who think they are most economical in the use of gas are really the most wasteful. In the majority of New York houses the burners used are old and small. When new such burners were not capable of developing half the actual illuminating power of the gas that passed through them, and, worn and rusted as they are in the average house, it is a question whether it would not be an overstatement to say that they get one third as much light from the gas they burn as proper burners would give. In other words, multitudes who are constantly complaining of the magnitude of their gas bills are simply wasting twice as much gas as would suffice to light their apartments. Properly burned, the gas they pay for would give them three times the light they now have; or the same amount of light could easily be got from one third the quantity of gas that passes through their burners. When the burners are inclosed in old-fashioned globes with narrow openings at the bottom, the illumination is still more reduced.

A few weeks ago, Dr. William Wallace, F.R.S.E., read before the British Society of Arts a long paper, giving the results of some hundreds of careful tests of all the leading burners in the English market, under varying conditions of pressure and quality of gas, proving most conclusively that the light obtained depended not so much upon the quantity of gas consumed as upon the conditions under which it was burned.

For example, with 26 candle gas and a series of fish tail burners of the same pattern but of differing sizes, Mr. Wallace obtained the best results with the largest burner at a comparatively low pressure. With this burner and a pressure of half an inch, 7·1 cubic feet of gas gave an illuminating effect of 40·63 candles, or 28·6 candles for 5 cubic feet. The smallest burner of the series, burning 2 cubic feet of gas at 1½ inch pressure, gave an illuminating effect of 3·21 candles, or 8 candles for 5 cubic feet.

Thus, with burners of the same type, a difference in size with difference in pressure may enable one burner to develop three and a half times as much light as another from a given amount of gas. With precisely the same burner, twice as much light was got from a given volume of rich gas at the pressure of ½ inch, as at the pressure of 1½ inch. With common gas the difference was found to be still more remarkable, in some instances only one fourth the obtainable illumination being developed. This with approved burners in good condition. With poor burners out of condition, such as we commonly see in this city, the waste of illuminating power must be much greater.

In his experiments with rat-tail burners, under the most favorable conditions of size and pressure, Mr. Wallace failed to secure more than 60 per cent of the illuminating power of the gas consumed. Fish-tail burners did much better, though those of the bat's-wing type showed greater economy on the whole. A great variety of German and English bat's wings, with tips of various material, was tested, the results ranging between 18·35 candles and 25·56 candles, with 26 candle gas under varying conditions of size and pressure. A number of Argand burners gave results ranging between 17·80 to 25·61 candles, with a 26 candle gas.

Experiments were also made in order to ascertain the loss of light resulting from the use of globes of different kinds and of various shapes. The loss is always considerable, in many cases excessive, and it results partly from the absorption of light from the material of the globe, and partly from the draught caused by the ascension of the heated air in the confined space. As regards material, a piece of clear window glass, held in front of a gas flame, diminishes the light to the extent of about 10 per cent; but in the case of a clear globe it is, in some cases, less, owing to the reflection from the surface furthest from the photometer. Globes frosted or ground all over, technically known as "moons," absorb about 25 per cent of the light when well shaped, and opal or "cornelian" globes, 40 to 50 per cent, according to the thickness and quality of the glass. The following results were obtained with globes of different sizes ground all over, and show the effect of increased draught in diminishing the light.

	Per Cent.
6 inch globe caused a loss of	25
7½ " " "	27½
10 " " "	38

All these globes had the usual opening at bottom, 1¾ inch in diameter. In another series of experiments, to determine the effect of the opening of the globe on the amount of light made available, clear 7½ inch globes were employed, giving the following results, the same burner being used at uniform gas pressure:

	Candles.	Per Cent.
The naked flame gave a light of	16·8	
With clear globe, opening below 2¾ in.,	15·4;	loss 8·3
" " " 2½ "	15·2;	" 9·5
" " " 2 "	13·6;	" 19·0
" " " 1½ "	13·0;	" 22·6
" " " 1 "	12·0;	" 28·6

With openings less than two inches the light was unsteady; at one inch it was practically useless. The best results were obtained with globes having a four inch opening at bottom.

EMIGRATION AND MIGRATION.

The annual report of the New York State Commissioners of Emigration for the year 1878 shows there came to this port from foreign ports during the year 121,369 persons, of whom 75,347 were aliens who had never before entered the United States. These figures show a large and unexpected increase, and indicate for the whole country an immigration of not less than 150,000.

During the same year there was an unprecedented movement of population within our national borders, a heavy migration taking place from the East to the South and West. On the basis of information obtained from government reports and a large amount of special inquiry the *Tribune* gives the following table of land sales during recent years:

Year.	Government Sales for Fiscal Years ending June 30.	Railroad Sales for Calendar Years.	Sales in Texas, Calendar Years.	Immigration, Calendar Years.
	Acres.	Acres.	Acres.	
1872	7,124,725	1,000,000	1,500,000	449,483
1873	6,288,264	980,000	1,500,000	437,004
1874	5,610,243	1,060,000	Not known.	277,593
1875	3,712,420	850,000	Not known.	209,036
1876	4,364,544	1,160,000	Not known.	182,027
1877	3,338,479	1,800,000	3,000,000	130,000
1878	7,592,246	2,950,000	3,500,000	145,000

Of the immigrants of 1878 about 80,000 went West; during the same period the westward migration of Eastern people, was, according to the *Tribune's* calculation, at the least 520,000.

"The heaviest migration took place from New England, the Middle States, and Virginia. These regions have been the most troubled with a surplus of unemployed labor, and they have been of late the scene of active canvassing for emigrants by Western land agents, who, while advertising their own lands, have also done much good by calling attention to the fertility and cheapness of the government lands, a thing they did not care to do particularly, but which was one result of their operations. Private advices received by the *Tribune* report that these persons, who have gone West and South, are in general citizens of intelligence and some small means, and mostly men of families. Many of them are thrifty farmers. A large proportion are mechanics, who, being out of work, have drawn their deposits out of the banks, and, rather than stay in the East and eat up their accumulations, have taken their money and furniture West and begun the world anew. They have gone out on the prairie, broken up the virgin soil, so rich as not to need fertilizing, planted crops and groves of timber, and made themselves independent of all the vicissitudes of labor and fortune in the East. They are all, like their predecessors in that region, in a fair way to make a competence.

"The regions to which they have principally gone are Texas, Kansas, Dakota, Nebraska, Minnesota, and California, in the order named; but some have gone to Florida, Arkansas, Colorado, Iowa, New Mexico, and the regions beyond the Rocky Mountains."

Back Numbers and Volumes.

Subscribers to the SCIENTIFIC AMERICAN will be entered on our books to commence at the date the order is received; but those desiring the back numbers to the commencement of the year will be supplied on their signifying a wish to have them. Volumes of previous year may be had in sheets by mail at regular subscription price, namely, $3.20.

THE CANARY FISHERIES.

For a number of years it has been known that the sea about the Canary Islands was well stocked with cod and other desirable varieties of fish; but it is only recently that the real value of those fishing grounds has begun to be appreciated. A late number of the *Journal of the Society of Arts* contains some very important information on this subject, from which it appears that under proper management the Canary fisheries might be made extremely valuable. Mr. Berthelot, late French consul, reports that the quantity of fish caught by one man in the Canaries is equal to that caught by twenty-six men in Newfoundland. All evidence tends to show that the quantity caught is very great, and that the supply is inexhaustible. And yet neither the native fishermen nor the commercial community of the islands have endeavored to turn this immense field of wealth to any advantage, being satisfied thus far with confining their operations almost exclusively to the supply of the local consumption. The largest fish banks are said to be from the Island of Fuerteventura to Cape Blanco. The vessels fish down to the latter point, and the larger ones sometimes go very near to Cape de Verd.

Until our fish commission succeeds in restocking our coast with cod, American fishermen may find the Canary field worth cultivating, particularly as the best season there is during the winter months.

THE IRON OCEAN PIER AT LONG BRANCH.

Work upon the great pier and breakwater, which are to convert Long Branch into a sea port and an accessible summer resort for New Yorkers, is progressing rapidly.

For the benefit of our distant readers, we will say here, that Long Branch is a favorite seaside resort for the wealthy citizens of New York and Philadelphia. It lies on the New Jersey coast twenty-eight miles south of this city; and the only obstacle to its becoming as noted and popular a bathing place as Coney Island or Rockaway, on the southern shore of Long Island, has been the lack of a landing place. This want is now to be supplied by building a pier straight out into the Atlantic, a distance of 660 feet, and in front of its outer end a breakwater 225 feet long and 50 feet wide. The breakwater is to consist of three lines of iron piling so interlaced with chain work as to form a sort of sieve, through which the first breakers are expected to pass, losing their force thereby and their power to damage the boats made fast to the pier. The cost of the sea wall (to protect the cliff), the pier, and the breakwater is estimated at $200,000. The sea wall is already finished. Work on the pier was begun February 4, and it is expected that the entire structure will be completed in time for the summer's demands. The pier is to be formed of three lines of tubular iron piles, strongly interlaced with iron girders, the deck to rise fifteen feet above high water. As the sea bottom is sand the sinking of the piles is an easy matter. The method adopted for sinking them is as simple as it is effective. At the lower end of each pile is placed a "shoe" shaped like a sugar loaf, and having in its point an inch hole. The pile being held in position by ropes, a stream of water is forced through it by a steam engine or a float, the water cutting away the sand and allowing the pile to sink.

The first result of the improvement will be to make the trip to Long Branch a delightful sail, costing less than half the amount hitherto charged. This, in addition to the attractions of the place, is counted on to divert to it a considerable share of the patronage secured by Coney Island last summer, a patronage rising as high as 70,000 visitors a day.

HONEY SUGAR.

The Bee-Keepers' Association desire to return good for evil. While dishonest men are striving to spoil the honey market by selling imitation honey made of glucose and artificial flavorings, the bee-keepers are anxious to furnish an unquestionably wholesome substitute for the glucose used by cooks, confectioners, and brewers. Accordingly they have offered a prize for the discovery of a method of converting honey into a form of crystalline sugar. California honey already sells for seven cents a pound at wholesale; and whoever will succeed in producing a honey sugar will give a great impetus to an already profitable and rapidly growing industry. It is needless to add that he will also win a prize to which the bee-keepers' offer will be only an earnest.

THE USE OF COLD WATER IN COLD WEATHER.

It should not be forgotten, says the *Lancet*, that in cold weather the sole use of cold water is to stimulate the organism to increased activity. A great mistake is made when any part of the body is immersed in cold water, and left to part with its heat without any guarantee that the energy of heat production, so severely taxed, can respond to the requirement. It may easily happen that the internal calorific force will be exhausted, and if that occurs harm has been done. The obvious principle of health preservation is to maintain the circulation in its integrity; and while the error is avoided of supposing that clothing can do more than keep in the heat generated within, it is not the less needful to guard against the evil of depriving the body of the heat it has produced. The furnace should be well provided with suitable fuel—that is, nutritious food. The machinery of heat production (which takes place throughout the organism, not in any one spot or center) should be kept in working order, and nothing conduces to this end more directly than the free use of the cold douche and the shower bath; but the exhibition of these popular appliances, in all or any of their forms, ought to be restricted to a few seconds of time; and, unless the evidences of stimulation—redness and steaming of the surface—are rapidly produced, the affusion should be laid aside.

The use of cold water in cold weather is a practice which must be governed by rules special to each individual case; and it is with a view of warning the public against the recourse to general recommendations that the subject is alluded to. Whether the practice recommended be that of plunging the feet in cold water before going to bed to procure sleep—a reckless prescription, founded on a physiological fallacy—or any other use of cold water, the only safe course is to seek the counsel of a medical man conversant with the patient's peculiarities; and this precaution should be particularly observed in the cases of children.

GUATEMALA INDIGO.

The catalogue of objects exhibited by the Republic of Salvador at the recent Paris Exhibition contains the following contribution to the history of the cultivation and preparation of indigo in Salvador: This species of indigo is known to American and European commerce as "Guatemala indigo." In Salvador it is called by the native name of "Iiquilite," and is considered the most important agricultural crop of the entire republic. The plant grows wild, but is cultivated in properly prepared ground. Both the crops and produce vary according to the geological composition of the soil. Thus at the base of the volcano of San Salvador the yield of dye is sometimes about half a pound per load of leaves, while at Santa Barbara and Santa Cruz, situated at some distance from the sea, thirteen or fourteen ounces are obtained. Indigo is grown over nearly the whole of Salvador, forming extensive fields, and furnishing one of the most valuable products to its agricultural industry. The localities in which the plants are grown are called "manchones."

The workmen, who are styled "sacateros," cut the plants with a small sickle, and make them up into sheaves of from 50 to 60 pounds weight. The plants, after being cut, are thrown into vats filled with water; they are here allowed to soak for a period of from twelve to seventeen hours, the time varying according to the temperature and quality of the water. When the liquid is in a state of fermentation the coloring matter is drawn off into another vat, where it is beaten, or kept in motion by means of wooden wheels, and then the dye is precipitated by the sap contained in the bark of the "tihuilate," of the "platanillo," or of the "cuaja tinta." The first named bark is referred to a species of *Ionidium*, the second to *Canna indica*, while of the third no clew is given as to the scientific name of the plant. All these plants have an acid reaction. When once the dye is precipitated it is allowed to remain during the night, and the next day it is boiled, filtered, pressed, and lastly dried in the sun. Each bale, or "suron," contains 150 pounds, and the different qualities of grades of the indigo are specified by numbers—from four to six ordinary quality, or "cortes;" from seven to nine, fine or superior, or "sobresalientes."

The usual annual produce of indigo in Salvador amounts to about 2,400,000 pounds, the annual exports being between 14,000 to 15,000 "surons," of 150 pounds each, representing an approximate value of 1,721,378 piastres or dollars. The superior quality indigo is sold at the country fairs at about 8 reals per pound. In the American and European markets the prices vary, of course, according to the supply from other countries.

LIGHT AND LIFE.

During the last few years quite a number of investigations have been made in order to determine the question as to how living organisms are affected by the different colors of the spectrum, the subject of plant life having more especially received the attention of observers. The results of two independent series of researches—one by M. Paul Bert on plants, and the other by M. Young on the eggs of animals—have lately been communicated to the French Academy, and it is interesting to compare them.

M. Bert kept certain plants in a glass trough inclosure, containing an alcoholic solution of chlorophyl, and exposed them thus to a good diffused light. The chlorophyl solution, which was very weak, and in a very thin layer, intercepted little more than the characteristic region of the red in the spectrum. This excluded part, then, was proved to be the indispensable element of white light, for the plants at once ceased to grow, and soon died. It is in this red region (as has been shown by M. Timirigzeff, recently) that the greatest reduction of carbonic acid takes place. If red rays are withheld from the leaf the plant is no longer able to increase its weight, but is reduced to consuming its own reserves previously stored up; and so, gradually exhausting itself, it at length dies. This part of the spectrum, however, although necessary, is not sufficient. Plants can, no doubt, live for a long time behind red glass, but they become under such conditions extremely elongated (or, as gardeners would say, grow "spindly") and pale in color. This is due to the absence of the blue violet rays. So we find, then, that each region of the spectrum contains parts that play an active rôle in the life of plants.

Let us now turn to M. Young's recent experiments on animals, and which we find noticed in the current number of *La Nature*. This gentleman's observations, made in the laboratory of Roscoff, and extending over a period of three years, have had for their object to discover the effect of the different colors of the spectrum on the development of the eggs of the common edible frog, of the trout, and of the fresh water snail. He found that violet light favored the development to a remarkable degree; that blue light comes next in this respect; and is followed by yellow light and white light (these two giving nearly similar results). On the contrary, red and green were found to be positively injurious, for it was impossible to make the eggs develop completely in these two colors. Darkness does not prevent development, but, contrary to what has been affirmed by some, retards it. Tadpoles of the same size, and subjected to the same physical conditions previous to experiment, died more quickly of inanition when deprived of food in violet and blue rays than in the others, because life was more active therein, and consequently the expenditure of life force was greater. In was in the green and red lights that animals were found to live longest.

NEW INSTRUMENT TO DETERMINE THE PRESENCE OF METALS IN ORES.

At a recent meeting of the Philadelphia Academy of Natural Sciences, Professor George A. Koenig, of the University of Pennsylvania, exhibited his recently invented "chromometer," an instrument designed for the purpose of making exquisitely delicate determinations of the presence of certain metals in ores. It is based upon the optical fact that complementary colors will extinguish each other if mingled in proper proportions; for instance, if to a green solution a red solution be added, the liquid, if the proper conditions be complied with, will become colorless. The speaker had applied this principle to the colors which certain metals, as iron, manganese, copper, etc., produce when fused with borax, which is the only chemical used in this method of analysis. He prepares such glasses or beads containing known quantities of a metal in one hundred parts, and observes how thick a glass of the complementary color must be to produce extinction. To accomplish this the instrument is furnished with a glass wedge of a green or red color, cut at an angle of about one degree. By moving this wedge before the glass bead, with the help of a suitable rack movement, a scale moves at the same time, and when the point of extinction of color is arrived at, the reading of the scale refers to a table showing the percentage of metal contained in the examined substance. By this method of analysis a correct determination of manganese in an iron ore can be made in fifteen minutes, which is not more than one third the time required by the usual methods of analysis.

Mr. Edward Goldsmith exhibited a specimen of asphaltum found sixteen feet below the surface in a bed of cretaceous marl near Vincenttown, N. J. In the same bed and within a few feet of the asphaltum was found a yellow mineral resin of the nature of krantzite (first described by Bergeman as occurring at Nienberg, Germany), a species of amber, and containing small white crystals, believed to be succinellinite. This is the first time that either of these minerals has been found in New Jersey.

The Bradley Jig tried on Bituminous Coal.

It is well known that a machine was wanted to thoroughly wash and clean bituminous coal, and at the same time take out the slate and sulphur. No good coke can be made of stock in which is slate, dirt, or pyrites. Many efforts have been made to effect this, and the great development of the iron interests in the bituminous coal regions of the South and West has made good pure coke a necessity. The owners of the Bradley Coal and Ore Jig, which has been so successfully introduced into the anthracite coal regions (where it has entirely changed the old methods of cleaning coal) have lately tried their machines on bituminous coal with the best results, producing good work with a small expenditure of power and a limited quantity of water. Those who need a machine to thoroughly wash and clean fine bituminous coal may obtain full information by addressing Howell Green, Superintendent, Jeansville, Luzerne County, Pa.

The Scientific American Catalogue for 1879.

We now have ready for delivery a catalogue of many of the important papers published in our SUPPLEMENT for some time past. These papers are by eminent writers in all the various departments of science. News agents and others who desire copies of this catalogue can obtain the same free by addressing the publishers, Munn & Co., 37 Park Row, New York.

Louisiana Rock Salt.

The Maryland Academy of Sciences has received a large block of very pure rock salt from the island of Petit Anse. The island comprises a tract of 2,000 acres, near the Gulf of Mexico, rising out of a salt marsh to a height of 170 feet. The shallowness of the approach to the island requires the construction of a causeway to deep water before this remarkable salt mine, which has been opened into the pure salt rock to a depth of 60 feet, can be economically worked. The quantity of underlying salt is estimated as at least 15,000,000 tons. This is, however, but guesswork, but the quality of the salt is shown by analysis to be 99 66-100 of purity, the best Liverpool salt testing but about 98 per cent pure.

THE gas wells of East Liverpool, Ohio, it is said, furnish a continual supply of light and heat to the town, and as the gas costs nothing the street lamps are never extinguished. It is used almost exclusively for fuel, being conducted into the grates and stoves by pipes. For twenty years this has been going on, and there are no indications that the supply of gas is giving out.

ALE BREWING.

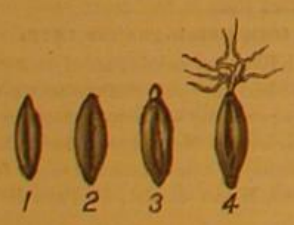
[*Continued from first page.*]

seven acres of ground, has a frontage on the Passaic river of 600 feet; this, in conjunction with the railway lines on the opposite side of the premises, afford the most extensive facilities for receiving and shipping materials and products.

The raw materials used in brewing are barley, hops, yeast, and water.

By letting the barley pass through the process of an interrupted germination an unorganized ferment, diastase, of the nature of the ptyalin of the saliva, is formed, which has the property of changing the starch of the kernel into grape sugar (glucose) and dextrine. To induce germination the grain has to be supplied with moisture, heat, and oxygen, and upon the proper regulation of the three depends the success of malting. The barley is steeped in water until it has absorbed about 50 per cent of the liquid, and then spread on cemented floors. The kernels soon commence to grow and to absorb oxygen, which causes a slow combustion and the generation of carbonic acid gas and heat. By turning and spreading, the heat of the grain is equalized and regulated. The growing is interrupted when the roots have reached the length of 1 1-3 to 1 2-3 of the kernel, and when the cotyledon has advanced 1-2 or 2-3 into it. If the germination be allowed to go on, both starch and diastase would be used up by the young plant to construct its cellular tissue.

The annexed engraving shows the grain during the several stages of germination, Fig. 1 representing the natural grain; Fig. 2, the grain swelled by moisture; Fig. 3, the starting of the germ; and Fig. 4 shows the condition of the grain when germination is arrested by drying. By transferring the grain from the malting floor to the malting kilns (shown on this page) the germination is arrested. Here it is submitted to the currents of hot air generated in the furnaces below. If carefully dried the malt retains its properties for a number of years and may be used in brewing at any time.



BARLEY GRAINS.

Malting and brewing are separate and distinct businesses and may be conducted independently of each other.

In the brewery, the malt is freed from the sprouts, crushed in mills, and mixed with hot water in the "mash tub," shown in the left hand view on this page. By the action of the diastase the starch of the malt is changed into glucose and dextrine. The latter two together with a quantity of albuminates are dissolved and drawn off through the perforated bottom of the mash tub, while the husk of the malt and some unconverted starch remain.

The saccharine liquor, called wort, is conveyed into kettles, one of which is shown in the upper left hand view on the front page, where it is charged with hops and boiled for a number of hours. From the kettles it passes through strainers, called "hop jacks," which retain the hops and coagulated albumen, to the coolers and refrigerators.

When cooled to the required temperature the wort enters the fermenting tubs, shown in the upper right hand view in the larger engraving, to be yeasted. Here the fermentation takes place. Through the action of the yeast a part of the saccharine matter is decomposed into alcohol, which remains, and carbonic acid gas, which escapes into the air.

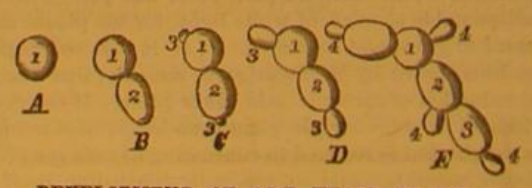
The attack of the yeast upon the beer manifests itself by the reduction of its specific gravity, the alcohol being lighter than the glucose, which it replaces. By observing the changes in that respect it is ascertained whether the progress of the fermentation is to be checked or increased. What is known as stormy fermentation may reduce the density too much, while too slow a fermentation might leave too much of the glucose unchanged.

As soon as the fermentation is finished the beer is transferred to the racking tubs, shown in the lower portion of the title page engraving, where, after having settled, it is drawn into barrels.

It is a peculiarity of ale that, unlike sugar or distilled liquors, it can never be corrected if once spoiled, and that it has and retains the character of the material from which it is made. By additional labor and cost a marketable sugar or liquor may be obtained from poor raw material, but a good ale can only be made from perfect malt and hops, however complete the method of brewing may be. On the other hand the finest malt will turn out a poor ale if the manufacture is trusted to mere guesswork or "rule of thumb."

Brewing, from malting to fermenting, forms one continuous line of the most complicated chemical processes, and it requires a full acquaintance with the nature of these processes to keep them under control, to distinguish the important from the unimportant, and to make use of new discoveries. Any changes of the water or temperatures in malting or mashing alter the chemical composition of the wort. The proportions between glucose, dextrine, albumen, and phosphates become disturbed and an ale of a different character will result.

The development of the delicate yeast cell is affected by

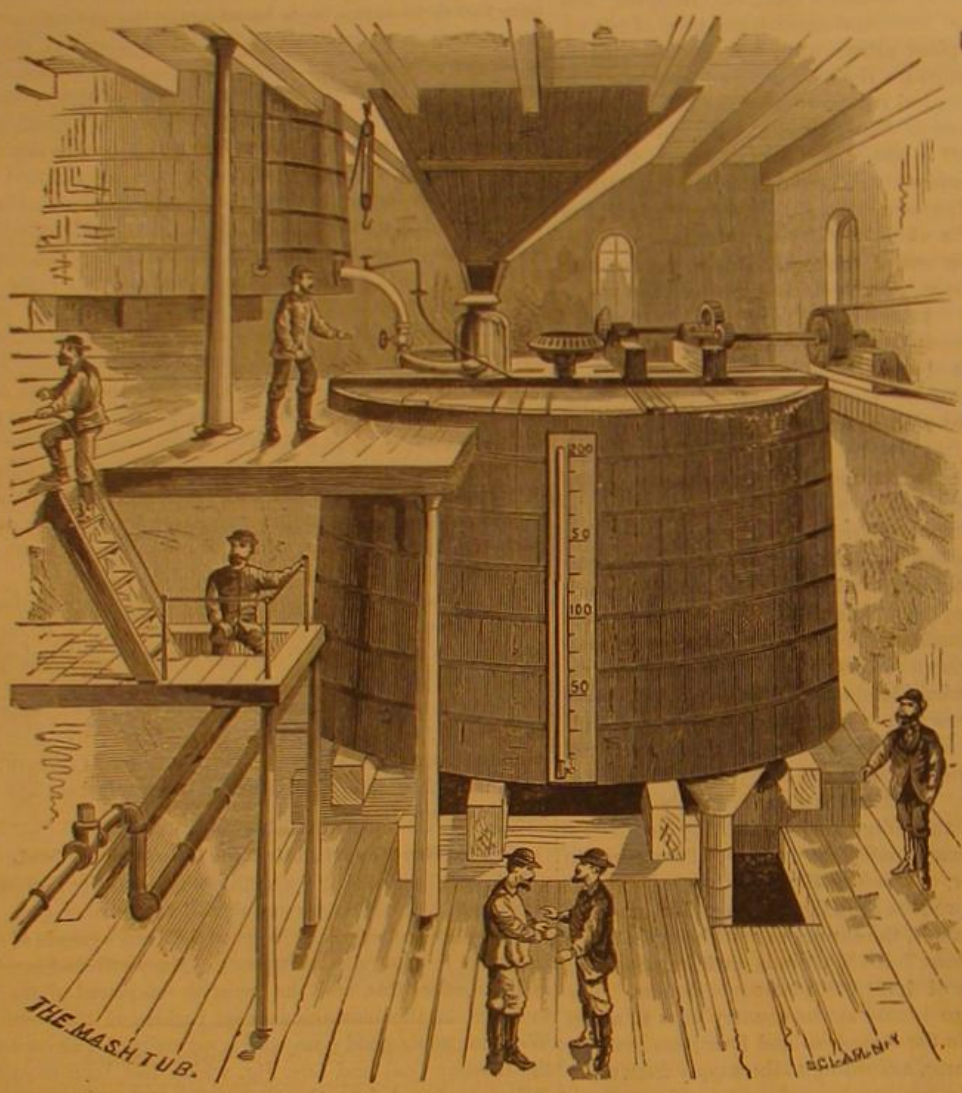


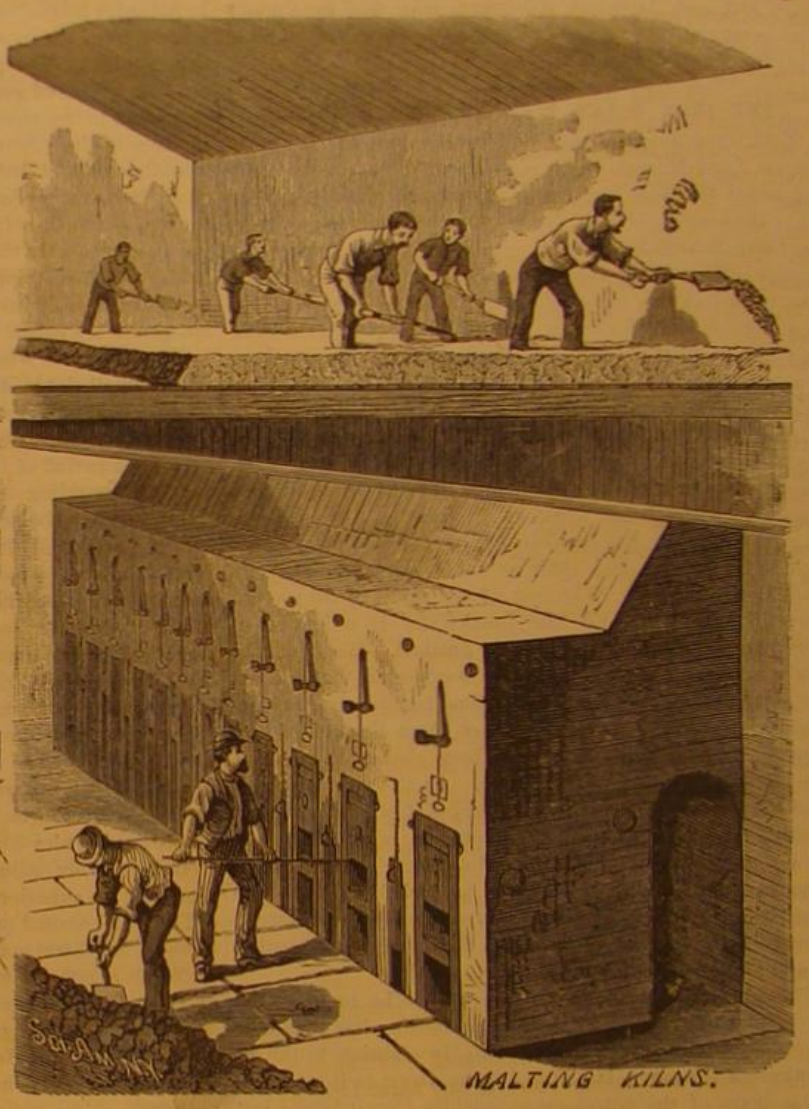
DEVELOPMENT OF THE YEAST PLANT.

the slightest change of temperature, and, like other plants, it is subject to degeneration and parasites.

The great progress which Messrs. Ballantine & Sons have made in the manufacture of ales is solely due to their steadily pursued efforts to place their business upon a true scientific basis by making the best use of the discoveries and researches (into fermentation, etc.) of Cagniard-Latour, Liebig, and Pasteur.

M. S. MESINIER has made mixtures of iron and nickel chlorides, reduced by hydrogen at a red heat, yield well defined alloys, sometimes admirably crystalline, and closely analogous to the meteoritic alloys of iron and nickel.





THE MASH-TUB AND MALTING KILNS.

Sugar in the Northwest.

Several promising experiments have been made during the past season with the early amber sugar cane, which is said to thrive as far north as Massachusetts and Minnesota. The chemist to one of the largest sugar refineries of St. Louis, Mr. Henry Studniczka, says that Minnesota is especially suited for the cultivation of this plant.

An acre of land will readily produce eleven tons of cane, and a ton of cane will give from 85 to 95 gallons of juice by the use of a sixteen horse power mill.

The juice contains 16 per cent solid matter, 13 parts of which are crystallizable sugar, and the remaining 3 parts being invert sugar and organic matter. An acre of cane will safely produce 130 to 150 gallons of sirup of 80 per cent density.

Out of the 130 to 150 gallons of sirup per acre there can be made, by using proper machinery, 1,000 pounds of sugar, and what is left, about 60 gallons, will be a fine article of molasses.

Mr. Bowen, of Litchfield, Ill., cultivated 80 acres of the amber cane last season.

The cane grows from 10 to 11 feet tall, and each stalk, stripped and headed, weighs from 2 to 3 pounds. A man can, with ease, cut 2 acres per day. Two boys, each using a common lath, can strip an acre per day. A team can haul it up in the same time.

For a mill grinding 3 acres in twenty-four hours, will be required three men and a horse, besides two or three boilers.

From the mill the juice should pass into large settling vats, where impurities are taken from it. From here the juice passes into the large clarification pans, where the necessary chemicals for purifying can be applied. When well heated and skimmed, the juice passes into the evaporating pan, from which, if it is desirable to make sugar, it is turned into wooden coolers for crystallization. When crystallized the sugar can be separated from the sirup either with a centrifugal machine or by drainage.

The outfit for a six horse power mill, grinding about 3 acres per day, is 2 or 3 clarification pans, about 12x3 feet and 8 inches deep, and 1 evaporator for finishing. Another filtering of the juice, as it passes from the clarification pans to the finishing evaporator, is of great advantage. Skimmings can be made use of in fattening hogs. The skimmings of the finishing evaporator produce a fine quality of vinegar.

The seed of the amber cane is a good article of food for stock.

The refuse should be composted and returned to the soil, as the sugar in the cane is a product of the atmosphere, containing oxygen, carbon, and hydrogen in equal proportions. Thus the farmer will return to the soil all which the cane takes from it, and consequently this crop will prove far less exhaustive to his land than wheat or other grain.

THERE is to be a grand National Exhibition held in Moscow, Russia, in 1880, which will be accompanied by festivities of no ordinary kind. It coincides in point of time with the 25th anniversary of the Emperor Alexander's accession to the throne.

NEW AGRICULTURAL INVENTIONS.

A novel air blast regulator for the blowers of thrashing machines has been patented by Mr. Jacob Hunsinger, of Metamora, Ind. In this device an ordinary centrifugal governor is employed to open and close the air supply valves of the blower.

A harrow, which is capable of adjustment as to width, and will accommodate itself to inequalities of the ground, and which may be readily separated into two parts for convenience in loading, is the invention of Mr. W. D. Fink, of Strasburg, Ill.

Mr. Albert D. Blanchard, of Hutchinson, Kan., has invented an improved wheel plow, in which the plow beam is pivoted to a long slotted lever, and is raised or lowered by an eccentric lever pivoted to an elongated vertical plow standard. The eccentric lever is provided with a pawl and ratchet for holding it in position.

An improved tobacco hoisting apparatus, patented by L. W. Brewster, of Canton, Ky., consists of a standard upon which slides a sleeve, that may be raised or lowered by means of a rope running over a pulley in the upper end of the standard. The sleeve carries an arm which is provided with hooks for receiving the sticks of tobacco.

An improved grain separator, patented by Mr. Henry H. May, of New Albin, Iowa, is capable of separating oats, cockle, chaff, etc., from the wheat, and to deliver them each separately. It will also clean seed wheat and remove shrunken and broken grains.

A churn, which forces the cream back and forth through a foraminous plate while it is exposed to a column of compressed air, has been patented by Mr. Wm. A. Reich, of Salem, N. C.

Mr. David Crowell, of Florence, Ontario, Canada, has patented a mowing machine which is remarkable for its simplicity. The driving mechanism consists of a single cam wheel placed on the axle, and a lever actuated by the cam wheel and connected with the sickle bar.

A plow adapted for heavy or wet land, and which may be adjusted for depth and width of furrow without changing the clevis or harness, is the invention of Mr. L. E. Woodward, of Waco, Texas.

Edward Walker, of New York city, has patented an improvement in plows. The plow carries a curved plate, which opens a channel for receiving potatoes or other seed as the plow advances.

How Some English Cottons are Loaded.

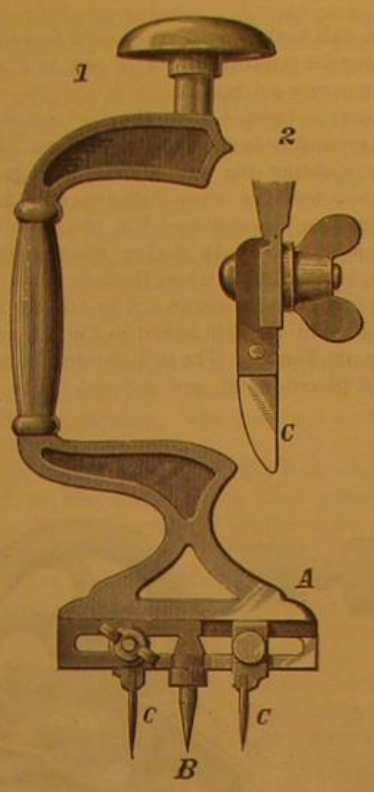
Mr. Albert D. Shaw, United States Consul at Manchester, England, has sent to the Department of State the report of a trial involving the manner of manufacturing and packing of English cotton goods for the Chinese market. A contract was made for the sale of 48,000 pieces of gray shirtings, which were properly packed and shipped to Shanghai. On being opened at that port more than half of the packages were found to be affected by "mildew." It was contended that this "mildew" was not caused by any exterior influence, but by the nature of the sizing used by the manufacturers to make the cloth heavier and thicker. This sizing is composed in part of chlorate of magnesia, chlorate of zinc, glue, and china clay. Originally a flour composite was used.

But improvements have been discovered. Tallow, oil, or paraffine, mixed with starch, removes any harsh feeling the cloth may have. By degrees the manufacturers found that other ingredients could be added. The cloth was not sold by the yard—only by weight, 4 lbs. of cotton being made to weigh 8¼ lbs. by this process of sizing. Moisture being necessary to increase the weight, salt was added. It was contended that the "mildew" was caused by the use of salt in the sizing. Some manufacturers say they have added an ingredient, in the form of an antiseptic, which removes the danger from dampness. In the case before the court the "mildew" was found in the center of the packages and not on the outside, as in packages badly packed.

The press report of Mr. Shaw's communication speaks of the subject as one worthy of attention by American manufacturers. We trust the writer did not mean to hint that our cotton makers might follow the British example with profit. The art of sophisticating cotton goods has not been cultivated here, and the prospects of our cotton trade at home and abroad are all the better for the lack of it.

AN IMPROVED WASHER CUTTER.

The accompanying engraving represents a novel washer cutter recently patented by Mr. Alfred J. Palmer, of Carlton, N. Y. It consists in a fixed central point, B, and adjustable cutters, C, attached to a body, A, which is similar to an ordinary bit stock. A detail view of one of the cutters is shown in Fig. 2.



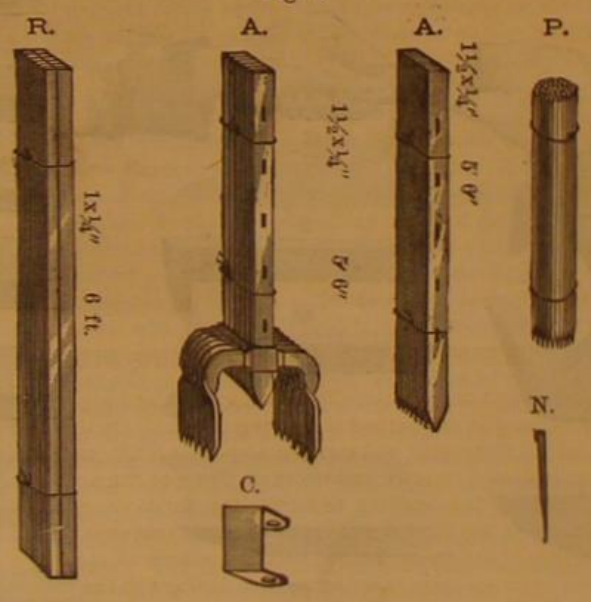
PALMER'S WASHER CUTTER.

This tool is designed for cutting washers of various sizes from leather, one of the knives, C, cutting the outside, and the other the inside of the washer.

A NEW HURDLE FENCE.

English hurdle fences have been in use for forty years or more, yet they show no signs of decay. The durability and desirableness of this kind of fence having been demonstrated, it remained for an American inventor to cheapen and perfect it, and to simplify its construction and facilitate its transportation and erection.

Fig. 2



The accompanying engravings represent this improved fence, Fig. 1 showing it complete in several different forms; Fig. 2 showing it packed ready for shipment. The fence is composed of flat iron bars and posts, alternate posts being provided with prongs or anchors. The horizontal rails are grooved longitudinally to afford a seat for the nail or key, which is driven into the mortise to hold the rail. Wherever the rails lap, the mortise in the post is enlarged. When iron pickets are used, as shown at Nos. 4 and 5, in Fig. 1, the clips, C (Fig. 2), are employed to hold them. The picket passes through the holes in the clip, and the latter is fastened by a key or nail driven in between it and the grooved side of the rail.

Fig. 2 shows at A the posts, at R the rails, and at P the pickets as they appear when packed for shipment. Although the inventor prefers to make the fence entirely of flat bars, he has shown us round and square bar rails adapted to posts with round or square holes.

To insure great strength and steadiness the posts are placed but three feet apart. The fence has a light appearance, but not too light, being readily seen by horses and cattle, besides it is very stiff and strong. It has no barbs to injure stock, neither does it require straining posts or pillars. The rails and posts are sufficiently rigid to be self-sustaining. The fence can be graded or curved to suit any inclination. As to the matter of cost it will compare favorably with a wooden fence, but when its durability is considered it is found to be far cheaper.

Further information may be obtained by addressing the patentee, Mr. J. B. Wickersham, No. 913 Cherry street, Philadelphia, Pa.

German International Exhibition of Milling Machinery.

An international exhibition of milling, baking, and confectionery machinery is to be held in June next, under the auspices of the German Millers' Association, in Berlin. The exhibition will consist of all kinds of motors and machines used in mill work, such as steam engines, turbines, wind motors, and waterwheels, either in their working shape or in model. All parts necessary to the internal operation of mills, transmission contrivances, frameworks, millstones, roller mills, cleaning, dusting, mixing, decorticating, and dressing machines, as well as dressing tools of all kinds, and all implements and contrivances necessary for high and low milling, are also eligible for exhibition. The milling exhibits are intended to include those relating to oil, sawing, paint, rice, bone, and cloth mills, as well as to grain milling; and implements used in pastry making and baking are to be comprehended in the exhibition, as also lighting and lubricating contrivances, fire engines and their appurtenances, articles used for packing, including bags, weighing machines, and carriages used in transport. All the products of the mill and the bakery are also to be included in the exhibition. As the latter takes place at the time when an exhibition of the Berlin industries is to be held, there will be a large influx of visitors to the Prussian capital from all parts, and the exhibition will form a good opportunity for the milling engineers and mill furnishers of this country for bringing their productions before the notice of Continental millers.

Applications for space, etc., will be received by the President, Mr. J. van de Wyngaert, 95 Potsdamerstrasse, Berlin, up to March 1, 1879.

Shipbuilding in the United States.

The following statistics show that the shipbuilding industry is not quite extinct in this country:

During the fiscal year ending June 30, 1878, 32 iron vessels were built, with a tonnage of 25,960·29 tons. This record is second to the best record the country has yet made, which was in 1874, when the tonnage aggregated 33,097 tons. The next best record in tonnage was in 1873, when it amounted to 26,548 tons. The number of iron vessels built during the past year was greater than in any other year, the year which most favorably compares with it being 1873, when 26 were built. Of the vessels built during the past year, 9 were ocean propellers, varying in tonnage from 1,156 tons to 3,548 tons; 1 was a lake propeller of 306 tons; 1 was a stern-wheel river steamer of 1,028 tons; 7 were side-wheel river steamers, ranging from 128 to 1,285 tons; 13 were steam tugs, the largest of which measured 180 tons; and the remaining vessel was a yacht. The current year promises to surpass the last considerably in its additions to our iron shipping.

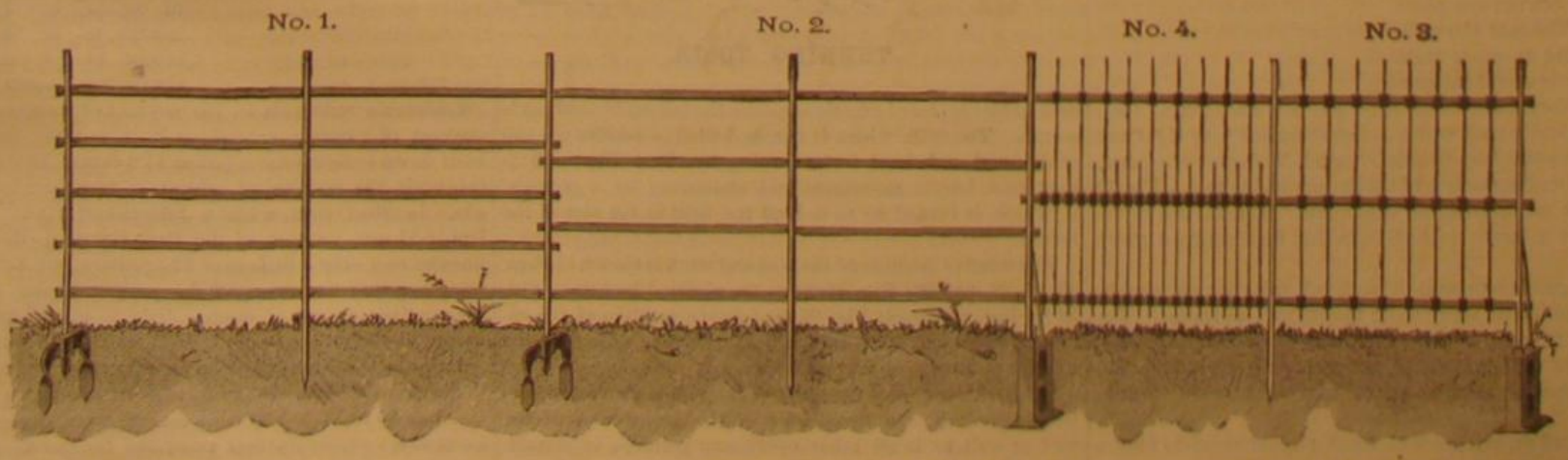


Fig. 1.—AMERICAN HURDLE FENCE.

AMATEUR MECHANICS.

METAL TURNING.

In selecting a lathe an amateur may exercise more or less taste, and he may be governed somewhat by the length of his purse; the same is true in the matter of chucks; but when he comes to the selection or making of turning tools he must conform to fundamental principles; he must profit as far as possible by the experience of others, and will, after all, find enough to be learned by practice.

Tools of almost every description may be purchased at reasonable prices, but the practice of making one's own tools cannot be too strongly recommended. It affords a way out of many an emergency, and where time is not too valuable, a saving will be realized. A few bars of fine tool steel, a hammer, and a small anvil, are all that are required, aside from fire and water. The steel should be heated to a low red, and shaped with as little hammering as possible; it may then be allowed to cool slowly, when it may be filed or ground to give it the required form. It may now be hardened by heating it to a cherry red and plunging it straight down into clean cool (not too cold) water. It should then be polished on two of its sides, when the temper may be drawn in the flame of an alcohol lamp or Bunsen gas burner; or, if these are not convenient a heated bar of iron may be used instead, the tool being placed in contact with it until the required color appears. This for tools to be used in turning steel, iron, and brass may be a straw color. For turning wood it may be softer. The main point to be observed in tempering a tool is to have it as hard as possible without danger of its being broken while in use. By a little experiment the amateur will be able to suit the temper of his tools to the work in hand.

In the engraving accompanying the present article a number of hand turning tools are shown, also a few tools for the slide rest. These tools are familiar to machinists and may be well known to many amateurs; but we give them for the benefit of those who are unacquainted with them and for the sake of completeness in this series of articles.

Fig. 1 is the ordinary diamond tool, made from a square bar of steel ground diagonally so as to give it two similar cutting edges. This tool is perhaps more generally useful than any of the others. The manner of using it is shown in Fig. 23; it is placed on the tool rest and dexterously moved on the rest as a pivot, causing the point to travel in a circular path along the metal in the lathe. Of course only a small distance is traveled over before the tool is moved along on the rest. After a little experience it will be found that by exercising care a good job in plain turning may be done with the tool.

Fig. 2 shows a sharp V shaped tool which will be found useful for many purposes. Fig. 3 is a V shaped tool for finishing screw threads. Figs. 4 and 5 are round-nosed tools for concave surfaces; Fig. 6, a square tool for turning convex and plane surfaces. The tool shown in Fig. 7 should be made right and left; it is useful in turning brass, ivory, hard wood, etc. Fig. 8 is a separating tool; Fig. 9 is an inside tool, which should be made both right and left, and its point may be either round, V shaped or square. Fig. 24 shows the manner of holding an inside tool. Fig. 10 is a tool for making curved undercuts. Fig. 11 is a representative of a large class of tools for duplicating a given form.

These figures represent a series of tools which may be varied infinitely to adapt them to different purposes. The user, if he is wide awake, is not long in discovering what angle to give the cutting edge, what shape to give the point, and what position to give the tool in relation to the work to be done.

Having had experience with hand tools it requires only a little practice and observation to apply the same principles to slide rest tools.

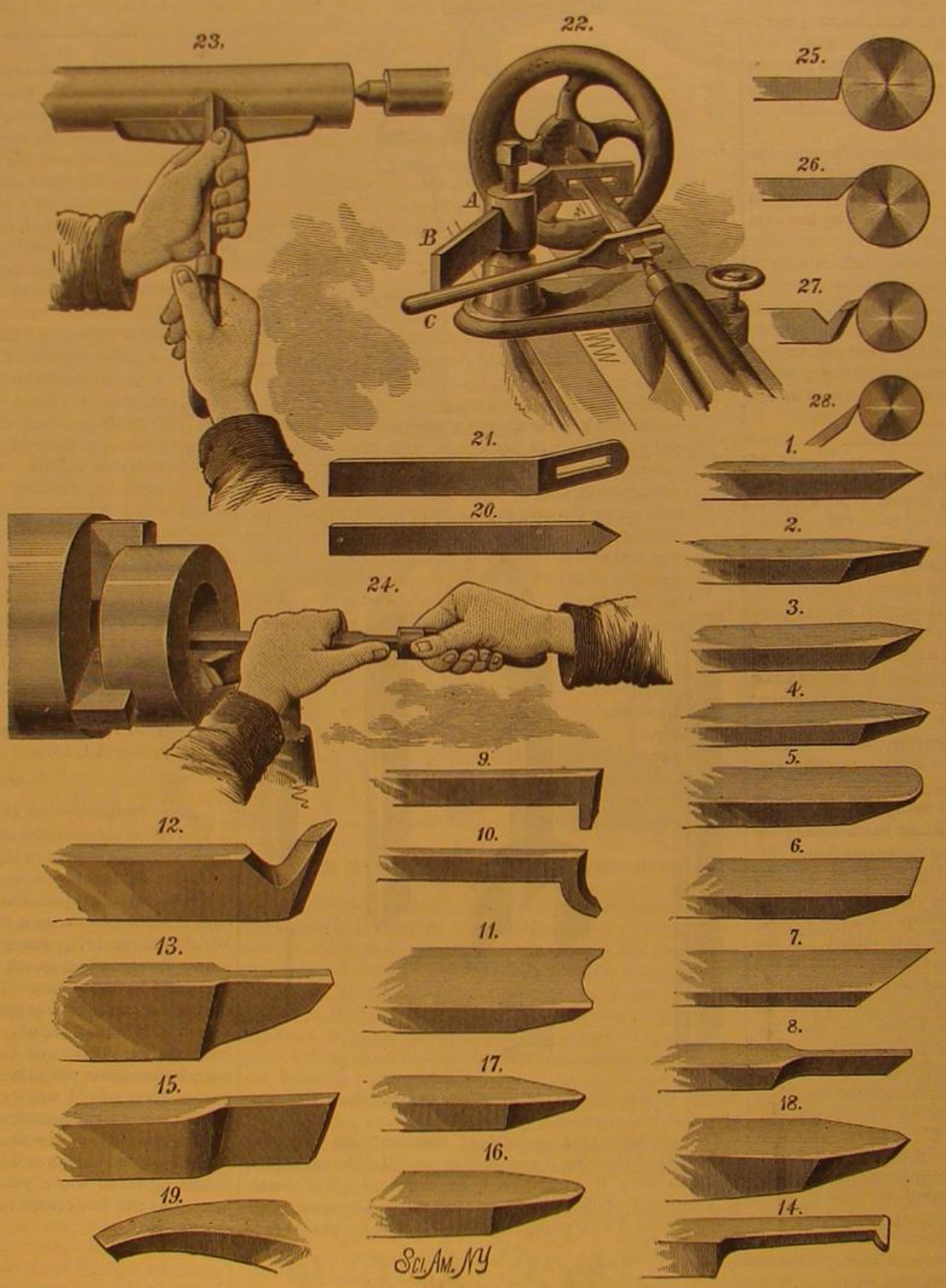
A few examples of this class of tools are given. Fig. 12 is the ordinary diamond pointed tool, which should be made right and left. The cutting edge may have a more or less acute angle, according to the work to be done, and the inclined or front end of the tool may be slightly squared or rounded, according to the work. Fig. 13 is a separating tool, which is a little wider at the cutting edge than anywhere else, so that it will clear itself as it is forced into the work.

For brass this tool should be beveled downward slightly. By giving the point the form shown in Fig. 3 it will be adapted to screw cutting.

Fig. 14 shows an inside tool for the slide rest, its point may be modified according to the work to be done. Fig. 15 is a side tool for squaring the ends of shafts; Figs. 16, 17, 18, and 19 represent tools for brass; Fig. 16 is a round nosed tool for brass, Fig. 17 a V-shaped tool, Fig. 18 a screw thread tool, and Fig. 19 a side tool. In boring, whether the object is cored or not, it is desirable, where the hole is not too large, to take out the first cut with a drill. The drill for the purpose is shown in Fig. 20, the drill holder in Fig. 21, and the manner of using in Fig. 22. The drill holder, B, is held by a mortised post placed in the rest support. The slot of the drill holder is placed exactly opposite the tail center and made secure. The drill, which is flat, is drilled to receive the tail center, and it is kept from turning by the holder, and is kept from lateral movement and chattering by a wrench, C, which is turned so as to bind the drill in the slot of the holder.

The relative position of the tool and work is shown in Figs. 25, 26, 27, and 28; Fig. 25 shows the position for brass; Fig. 26 for iron and steel; Fig. 27 the relative position of the engine rest tool and its work; and Fig. 28 the position of the tool for soft metal and wood.

In all of these cases the point of the tool is above the center of the work. In the matter of the adjustment of the tool, as well as in all other operations referred to, experiment is recommended as the best means of gaining valuable knowledge in the matter of turning metals. M.



TURNING TOOLS.

The Cost of Electric Lighting in Paris.

The report of M. Cernesson to the Municipal Council of Paris, relative to the experiments that have there been made in electric lighting, gives the first authoritative statement of the cost of lighting by the Jablochkoff system. Inasmuch as the figures given by M. Cernesson are accepted as correct, not only by the corps of city engineers and the engineers of the Paris gas company, but also by the engineers of the Paris Electric Light Company, they can be safely received as not far out of the way. Three sources of expense are involved in electric lighting: the power, the dynamo-machine, and the lamp.

The engines employed in the Paris experiments were each of 20 horse power, driving Gramme generators. Each engine was found capable of running 16 Jablochkoff candles; or, in other words, each candle required for its successful operation a force equivalent to 1·25 horse power. Four engines and Gramme generators were necessary to the illumination of the Avenue de l'Opéra. The unit of illuminating power adopted was the light produced by a Carcel lamp consuming 42 grammes of pure oil per hour. It was first ascertained that 10 gas burners, each using 140 liters of gas per hour, are equivalent to 11 Carcel lamps, while a single Jablochkoff candle is equal to 30 Carcels. But, as it was found necessary to the diffusion of the latter to shade it with an opaline globe, its illuminating power was, practically, considerably below this standard, being equal to only 18 or 20 Carcels when the horizontal rays were tested, and to only 10 or 12 when the oblique were under examination—a very meager result, indeed, when compared with the actual light generated. The ultimate comparative result arrived at was that one Jablochkoff candle is practically equal to 11 gas jets of the ordinary caliber used for street illumination. But a comparison of the figures of cost showed that the amount of gas used might be so increased as to give an equivalent light without incurring a fully equivalent expense.

When a burner consuming 200 liters of gas per hour was used, it required only 7 to equal 1 electric candle. Electricians hope to diminish the waste consequent upon the use of opaline globes, and M. Clemandot's invention (that of using two globes, the one fitting loosely into the other, and filling the space between the surfaces with powdered glass) has favorably impressed the scientific men of Paris. The particles of the thin layer of powdered glass appear to exercise a wonderfully diffusive influence without materially reducing the illuminating power. The cost per hour of running the 63 candles used upon the Avenue de l'Opéra is thus stated by Levy, a competent engineer:

	Francs.
Motive force.....	3·20
Coal	6·64
Oil for lubrication.....	1·23
Cost of superintendence	3·20
Sixty-two candles.....	31·00
Total.....	45·27

A calculation upon this basis shows the cost per hour of running one Jablochkoff candle to be 73 centimes (about 14 1-3 cents). The electricians count upon a considerable reduction in the amount of motive force and the cost of candles—enough, at least, to bring the cost per hour down to 60 centimes (about 11·8 cents). But even upon this basis, the economical advantage rests manifestly with gas. In effect, then, while a Jablochkoff candle is equivalent to 11 gas burners of the Paris standard, these 11 gas burners cost only a little over 23 centimes per hour—something less than 5 cents. At the present figures, therefore, the relative expense of electric light to that of gas, illuminating powers being equal, is as 73 to 23, and were the cost reduced to the limit urged by electric engineers as possible under existing circumstances, the proportion would still stand as 60 to 23, a very wide margin to be overcome. M. Cernesson's report further compares the questions of relative convenience, liability to get out of order, etc. Each electric lamp (*foyer*) being supplied with four candles, each

burning 100 minutes, the whole provision has to be renewed every seven hours, while with gas no such renewal is necessary. He finds that from May 30 to October 10 there were 60 extinctions in all on the Avenue de l'Opéra, lasting from merely a minute or two to 15, 30, 35, and even 45 minutes.

Correspondence.

Chemistry at Columbia College, New York.

To the Editor of the Scientific American:

The SCIENTIFIC AMERICAN is in general conducted in a spirit of so commendable fairness that I have observed with some surprise an article in your number for January 11, referring to this institution in a tone which seemed to indicate rather a purpose to disparage than a desire to convey information. The writer says:

"At a time when the value of natural and physical science as a source of mental discipline is beginning to be acknowledged, and science itself to be respected and honored here as elsewhere, it is somewhat remarkable to see one of our oldest colleges abolish the study of chemistry in her regular course. Yet this is what Columbia College has really done. True, the name of chemistry still appears in her list of studies, but it is studied no longer. It is but an outward pretense, a sham, an empty name, a skeleton without flesh, a shell without contents."

Now, whatever might be the facts of the case, there can be no mistaking the animus which inspires language like this. But the fact is that the opportunities afforded to the undergraduate students of Columbia College for pursuing the study of chemistry were never, since the foundation of the institution, so ample as they are at present. We have thought it judicious, as many other colleges have done, to make the extent to which the subject of chemistry is studied dependent, in some degree, upon the option of the student; but the obligatory portion of our chemical course is larger than that of Harvard, where optional supplementary instruction is provided in several different forms; and equal to that of Yale or Williams, where no optional instruction on this subject is given. Our sophomore class attend weekly lectures in elementary general chemistry throughout the year. Deducting the time given to vacations and examinations, the academic year contains about thirty working weeks. At Harvard University the freshman class attend twenty exercises in chemistry, and this is all that the obligatory course embraces in that institution. At Yale College chemistry is studied during one term of the junior year, out of two that the year embraces; and at Williams, during one term out of three—the number of exercises per week not being stated in the catalogue.

During the senior year at Columbia a course of theoretic chemistry is open to the student, of three exercises per week throughout the year.

As to the further strictures of the article in question, they are hardly worth attention. A writer who regards spectroscopic analysis and the mechanical properties of bodies as essential parts of elementary chemistry would do well to understand what he is talking about before he returns to the subject.

I am, sir, respectfully, etc.,
F. A. P. BARNARD,
President of Columbia College.

Columbia College, February 19, 1879.

Fall of a Meteor in Michigan.

To the Editor of the Scientific American:

This morning at 2 (?) I saw a most magnificent spectacle. The world (E.N.E.) was on fire. There was a pyramid of red light, 60° at the base and 30° high. It lasted 6 or 8 seconds, too long to be an electric phenomenon. Was it a meteoric stone? Where did it fall? Possibly into Lake Michigan, 70 or 80 miles away. If it was an aerolite it must have been the most magnificent one ever (?) seen.

(REV.) WM. M. RICHARDS.

Princeton, Green Lake county, Wis., Jan. 28, 1879.

The phenomenon observed by our correspondent was, without doubt, the meteor which (according to the *Herald*, of Traverse City, Mich.) was seen passing over that region about the hour named. It is described as an immense fire ball, which lighted up the country as bright as noonday. A night watchman at Traverse City says that he saw it explode, and that it flew into minute pieces like star dust. The one thing that all agree upon is the explosion. This was heard with equal clearness and with like effect at Mayfield, 13 miles south of Traverse City, and at Williamsburg, 12 miles east. The effect was of an earthquake shock. The houses were shaken, windows shook, and dishes rattled upon the shelves. A swaying motion seemed to be given to the buildings, as of an upheaval and settling back. If the meteor had not been seen it would have been thought an earthquake shock. Mr. R. S. Bassett, who has a fishing shanty within a few rods of Fouch's dock, at the head of Carp Lake, seven miles northwest of Traverse City, was awake and saw the flash, and was almost immediately deafened by the report of the explosion. The next morning a large hole, 50 feet or more in diameter, was discovered in the ice about 600 feet from shore. The ice was solid in this spot the day before. For a long distance around the surface was cracked and broken, and the ice around the hole itself, being 12 or 15 inches in thickness, had the appearance of being driven down. The water at this spot is only 8 or 10 feet deep and the bottom of the lake is soft and muddy.

SOME NEW POINTS IN THE DIAGNOSIS AND PROGNOSIS OF TYPHOID FEVER.

At a recent clinic held at the Pennsylvania Hospital in Philadelphia, Professor I. M. Da Costa developed some very novel and interesting points in connection with the diagnosis and prognosis of typhoid fever. The case under consideration was that of a sailor, who had enjoyed good health until four days before his admission to the wards, when he was attacked with chilliness, fever, headache, and nausea. His bowels were loose and his nose bled profusely. Upon admission the man's face was singularly flushed and he complained of severe pain in his back. His temperature was 104½°, his pulse 92, and his respirations 24 to the minute.

Careful physical examination of the lungs failed to find cause for the heavy flush on the face. Examination of the urine revealed the presence in it of granular hyaline casts and of bladder epithelium.

The patient remained in the same condition with regular morning remissions and evening exacerbations in the fever process. There were a few bronchial râles in the lungs.

On the day after admission profuse epistaxis supervened, and pathognomonic rose colored spots appeared on the abdomen, which grew swollen and tympanitic. The tongue was characteristic, dry, cracked, reddish in spots, and varnished in appearance. The case was undoubtedly one of typhoid fever.

As the disease progressed the face still continued to be flushed, the first sound of the heart grew very feeble, and the throbbing of the carotid arteries at the root of the neck was very marked.

In calling attention to these three symptoms, together with the presence of albumen in the urine so early in the course of the disease, the lecturer was led to remark that the case was a very unusual one.

Speaking first of the albuminuria, which was noticed on the fifth day of the disease, he said that early albuminuria was never present in typhoid fever unless the case was a very grave one; that albumen did not as a general thing appear in the urine until the third week of the disease.

So too with regard to the alteration in the first sound of the heart, which is not usually altered until late in the course of the disease. "When the first sound of the heart is affected early in the course of the disease it becomes a warning."

The flushed face, Dr. Da Costa also considered of unusual significance. When this symptom occurred in typhoid fever, which was but rarely, it always made him suspicious, especially when it was associated with great throbbing of the vessels at the root of the neck. When he noticed this coincidence of symptoms he was in the habit of roughly diagnosticating the case at once as one of typhoid fever before making any further examination. That the present case was without doubt one of much gravity, and that on the strength of the above portentous symptoms he should order the amount of stimulus administered to the patient to be immediately increased.

SAML. M. MILLER.

Weekly Pay Days.

The Springfield *Republican* is vigorously urging upon the New England manufacturers the policy and propriety of substituting weekly for monthly payments of wages to employes. It has been consulting some of the large manufacturing establishments upon the subject, and from the information published we learn that in New England monthly payments are the rule rather than the exception. It is different with us. Of course it is necessary everywhere for great corporations like railroad and steamship lines, which traverse great spaces, and the employes of which are often weeks absent from the place where the payrolls are adjusted, to pay their hands at wider intervals than a week, but with this exception, and excepting also domestic service and farm labor, which are usually hired and compensated by the month, nearly all other wages service in this latitude, and especially that employed in shop and factory, is paid by the week. This is the general rule and practice, and to it there are but few exceptions besides those noted.

The *Republican* observes that those New England employers who have tried the weekly system are not disposed to go back from it, but those who have not tried it see great obstacles to its introduction. They contend that weekly payments require increased clerical force and greater working capital, and that they will encourage an increase in drunkenness among the hands. As the *Republican* truly says: "This conclusion is on the old paternal principle that the laborer cannot safely be trusted with his hire. It is alleged to be a great kindness in the corporation to detain his wages even for a month, although when the fatal pay day comes it is followed by a debauch. If the pay were given oftener, would not the laborer become schooled to a keener sense of responsibility for his own welfare and gradually learn more thrift? If it is wrong to trust him with a week's wages at a time, it must be four times worse to place in his hands a whole month's. There is only one system of labor which is entirely consistent with this theory of the superior intelligence and beneficence of employers, and that is slavery."

Positions of the sort here described, deliberately assumed by the great employers in Massachusetts, go far to teach outsiders that the alleged "undue influences" exerted by corporations upon their workmen to prevent Butler's election may not be without foundation. To refrain from paying weekly wages because it requires an increase of working capital raises another nice question, not simply of propriety, but of morality. General Walker, in his book on wages, shows that one of the greatest hardships of labor is the enormous amount of credit exacted from the working classes by capital. This compels them in their turn to seek credit for the necessaries of life and involves them in continual loss. A manufacturing corporation which pays its hands by the month practically borrows the wages of its hands during three weeks. By what right does it do so? A newspaper which seeks to controvert the Springfield *Republican's* position says that the credit consideration is an important one. If a pay roll comes to $20,000 a month, the corporation or manufacturer gets practically a loan of $5,000 for three weeks, $10,000 for two weeks, and $15,000 for a week, and thinks that this is worth considering in these hard times. To which the *Republican* replies in the following unanswerable way: "Exactly, but whom does this credit belong to? Does it not belong to the employes whose wages are withheld for this time? Is it not 'worth considering in these hard times' in behalf of the man to whom it does belong rather than in behalf of him to whom it does not? Especially when the man to whom it does belong suffers greatly in his position as a buyer in the market for the very lack of that cash which is affording but a very trivial advantage to the employer? As a matter of fact the less a business concern runs in debt to its help, the better is its credit with other people."—*Baltimore Sun.*

California Honey.

The report that California strained honey has been largely adulterated with glucose, and accordingly condemned in English markets, naturally causes some unpleasant feeling among the bee keepers of the Pacific coast. A producer, writing to the *Pacific Rural Press*, offers the following test for detecting adulteration:

"Take a quantity of honey and add one part water, dissolving the honey thoroughly by stirring. Then add alcohol of 80° until a turbidness is formed which does not disappear on shaking. If glucose sirup is present in the honey, soon a heavy deposit of a gummy, milky mass, will form, while with pure honey there will be only a very slight milky appearance observed."

The same writer says that California honey taken in May generally candies in a few days after it is extracted. Later in the season, when the air is less humid, the honey gathered is white, very thick and heavy, weighing 12 to 12¼ lbs. per gallon of 231 cubic inches, and does not candy so readily, as some samples have been kept three years without any symptom of change. A different class of pasturage comes on in August and continues through the fall months, the air becomes more humid as the rainy season approaches, and the honey gathered is thinner, has more color and candies very soon, differing from April and May honey in flavor. In the Atlantic States all honey made through the entire season, candies upon the approach of winter; and a large dealer in Cincinnati says all good honey becomes candied during the winter in that climate.

The San Francisco dealers rule that candied honey is reduced in value from one to three cents a pound; yet of samples of California honey sent to France, complaint was made that it was not candied, as no other could be readily sold there. The magnitude of the California honey trade may be judged from the circumstance that over 300 tons of extracted honey was produced last year in Ventura county alone. A large part of this crop was shipped direct to Liverpool for the English market. Of this shipment the writer above quoted says:

"Knowing our honey to be pure and good, and knowing the character of the shipping merchants who are transacting our business, we have an abiding faith that our product will be allowed to fairly compete in these markets with like product from other parts of the civilized world. We wait with patience the results. We have the climate, the pasturage is abundant, our bee keepers are energetic, industrious, and economical men; are determined to push our products into all the markets of the world; and we warn all men who are engaged in the production of honey elsewhere, that if they cannot produce large quantities of the article that is first-class, and do not put it up in an attractive form, more so than we do, they had better stand aside and admit 'that the survival of the fittest' is a fixed fact."

Masson's Process for Deodorizing Petroleum.

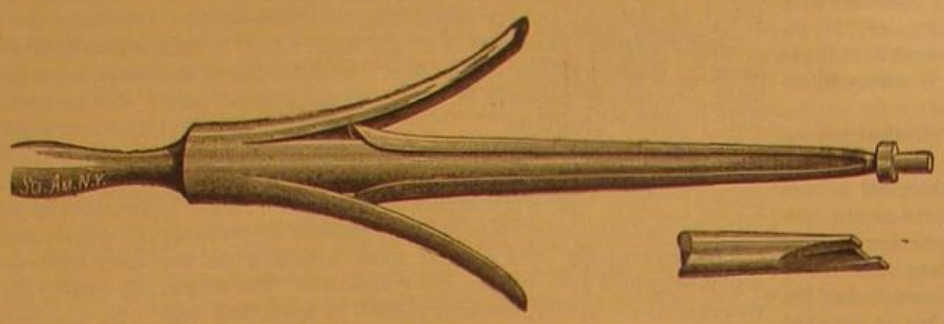
Into a vessel containing 225 lbs. of petroleum are separately introduced, by means of a long funnel, 2 ozs. each of sulphuric and nitric acid, and 1·1 lb. of stronger alcohol are carefully poured upon the surface of the petroleum. The alcohol gradually sinks to the bottom, and when coming into contact with the acids, heat is developed and some effervescence takes place, but not in proportion to the quantity of the liquids. Ethereal products of a very agreeable odor are formed, and the substances thus treated acquire an analogous odor, at the same time becoming yellowish in color. The operation lasts about an hour, after which the liquids are thoroughly agitated for some minutes with water, and, after resting for 8 or 10 hours, the purified petroleum is drawn off. The lower stratum, which is a mixture of the acids, water, and alcohol, may be used in deodorizing the heavy oils of petroleum by agitating them well for 20 minutes, and, after 12 hours' washing the oil with milk of lime, to remove the acids. Petroleum thus purified may be used in pharmacy for many purposes. All the tinctures for external use may be prepared with it, like the tincture of arnica, alkanet, and camphor, and may also be used for dissolving ether and chloroform, like alcohol; and, combined with fats or glycerine, it promises to be of great utility in the treatment of skin diseases, etc.

A NEW FORGING MANDREL.

In forging and welding sucker-rod couplings and other similar articles, consisting of two parallel or nearly parallel straps united at one end, it is customary to insert between the straps a shaping or forging mandrel, so as to secure a suitable and uniform shape and position to such straps. This mandrel is usually inserted by one workman, who forces it in endwise between the strap parts up to the point where such straps are welded together. As the mandrel is thus forced in the straps will be bent or deflected away from the stem of the mandrel, and it is necessary for another workman to grasp the straps in a pair of tongs and bend them down upon the stem, and secure them there by slipping a ring to keep over the ends, when the straps are forged to the desired shape. This operation is performed while the iron to be forged is heated and ready for working, and the delay thus incurred and the services of the helper or additional workman which are required add considerable to the expense of the finished article.

The improved mandrel is designed to overcome these objections. It consists of a mandrel stem, of suitable form, to give the desired interior shape to the straps to be forged. Near the outer end or base of this mandrel stem are secured flaring guides or wings, one on each side. These wings or guides are attached at one end only, and are arranged in line with the mandrel stem and with the flaring or free ends toward its point.

In using this mandrel the coupling, being first properly heated, is laid in such position that the workman may force the mandrel stem endwise between the straps, which he does until the point, guided by the shoulders, reaches the point where the two straps are united. In thus pushing the mandrel into place the ends of the straps come against the inside of the guides, and, sliding along the inner faces of the same, they are bent, sprung, or deflected down upon and held against the stem of the mandrel. The coupling is then manipulated in the usual way, so as to fix the straps and other parts in the desired shape. This mandrel is the invention of Mr. Alker, of Pittsburg, Pa.



ALKER'S FORGING MANDREL.

IMPROVED ICE-MAKING APPARATUS.

One of the most promising of modern industries is the manufacture of ice. It has been the subject of a great deal of research and experiment, and the process has been cheapened so that at the present time ice forms an important article of trade.

The apparatus represented in the accompanying engraving is the invention of Mr. Daniel L. Holden, of Philadelphia, Pa.

This improvement relates to the feature of an ice machine known as the "congealer," or apparatus in which the congelation of the water is effected; more particularly to the form of congealer in which receptacles containing a cold non-gealable liquid are immersed in a tank of pure water, so as to freeze upon the outside of the receptacles blocks of ice without incorporating the impurities of the water.

The invention consists in pivoting the receptacles, C, for the non-congealable liquid at the bottom, and connecting them by flexible pipes with the main inlet and discharge pipes, so that the receptacles may be slightly rocked to one side upon their bottom pivots, to permit the easy removal of the unbroken block of ice formed between any two of the receptacles.

Provision is made for subdividing large blocks of ice, which consists in freezing flat metal blades, D, in the block, and afterward striking a blow upon the blade to divide the block at the desired point. A looped cord is frozen into the block of ice, making a permanent handle.

As the circulation of the non-congealable fluid is kept up by the pumps of the ice machine, the cold fluid, which is below the freezing point, enters each of the receptacles, C, through the flexible pipes, and passing up and down around the baffle plates in close contact with the metal walls, emerges through the pipes upon the other side. The tank, B, being filled with pure water, which surrounds the receptacles, the effect of the cold traversing currents is to freeze upon the outside of the receptacles, C, films of ice, which constantly increase in thickness until the crystallizing outer edges meet in the center and unite to form solid blocks of ice.

Dissociation of Chloride of Ammonium.

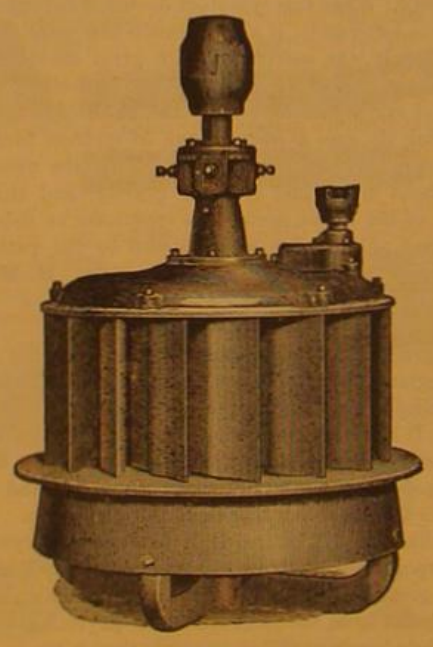
The following experiment is well adapted to class room demonstration. A little chloride of ammonium is placed in a bulb blown in the middle of a glass tube. In the ends are placed small pieces of red and blue litmus paper respectively. The bulb is now heated, while the tube is held in an oblique position, the red litmus paper being uppermost. Soon the latter will be colored blue by ammonia gas rising in the tube, while the blue paper in the lower portion is reddened by descending vapors of muriatic acid. The degree of inclination of the tube must be found by experience, as it depends to some extent on the conditions of the atmosphere.—*Chemiker Zeitung.*

THE VICTOR TURBINE.

The accompanying engraving represents a turbine water wheel, which is remarkable both for its compactness and its efficiency. It is of the "inside gate register class," and has no traps, rods, bolts, or other small parts to get out of repair.

This wheel is the result of careful investigations and a long series of thorough tests made by the manufacturers. No statement of its advantages can give emphasis to the results tabulated below.

	Head in Feet.	Revolutions per Minute.	Horse Power.	Cubic Feet of Water.	Useful Effect.
15 in. Victor Turbine Wheel, Tested March 26, 1878.	18·34	323·	29·36	973·75	·8705
	18·10	321·5	29·22	970·39	·8808
25 in. Victor Turbine Wheel, Tested October 28, 1878.	17·80	212·5	67·61	2356·54	·8533
	17·79	205·5	67·72	2362·72	·8530
	17·96	209·	68·62	2356·54	·8584
30 in. Victor Turbine Wheel, Tested October 29, 1878.	11·65	144·5	52·54	2751·87	·8676
	11·73	161·	51·41	2709·94	·8563
	11·66	147·5	51·96	2755·09	·8564



THE VICTOR TURBINE.

This report needs no comment; the useful effect of 88·08 per cent is, we believe, unprecedented among recorded reliable tests of turbines. The most important feature of this wheel is its great capacity in a small diameter, admitting of a reduced first cost for a given power, and diminishing the cost of transportation.

Another advantage gained by the peculiar construction of this wheel is that it is very economical in the use of water at part gate, and it excels in point of durability.

Further information may be obtained by addressing the manufacturers, The Stilwell & Bierce Manufacturing Company, of Dayton, O.

Another Sub-Arctic Trade Route.

Nordenskjöld is not alone in the development of schemes for new lines for northern commerce. What he is doing for Siberia, the Canadian Surveyor General, Colonel Dennis, wants to do for the smaller Siberia in North America. Col. Dennis proposes the establishment of an ocean trade route between Europe and the Saskatchewan valley by way of Hudson's Bay, the course being free from ice during July, August, and September. York Factory, the chief trading post on Hudson's Bay, is about the same distance from Liverpool as New York is; and it could be connected with Prince Albert on the Saskatchewan by a railroad 400 miles long.

This would bring the Saskatchewan valley as near to tide water as Ontario is to tide water at Quebec. For 200 years Hudson's Bay Company's sailing ships have traded between York Factory and Scotland. The straits and bay are clear of ice early in July, closing again at the end of September. Lignite coal is found in abundance at Davis Strait, and a coaling station for the projected steamship line could be established there. The Saskatchewan country contains 257,000,000 acres or 400,000 square miles of available agricultural land. It is watered by the Saskatchewan, Beaver, Peace, and Athabasca rivers, and innumerable smaller streams, and it is believed to be the best wheat growing region on the continent. Wheat of the finest quality grows at Fort Providence, on Great Slave Lake, on the fifty-eighth parallel, the extreme northern point of this vast territory. Colonel Dennis also points out that this scheme would lead to the development of the Hudson's Bay fisheries, and to the enormous pineries extending from the height of land northward of James and Hudson's Bay. He recommends that a steam vessel be fitted out during the coming season to test the practicability of the scheme.

Small Children.

There have been for some time on exhibition in this city two very small children. The larger, "General Mite," is described as 14 years old and weighing 9 lbs. He is well formed and a decided blonde. The smaller, Miss Lucia Zarate, is 10 years old, but weighs only 4¾ lbs. She is very dark, with dark eyes and hair, her parents being Mexican.

RECENT MECHANICAL INVENTIONS.

A novel hub attaching device, invented by Mr. Morris L. Green, of Londonderry, Ohio, consists of a spring hook attached to the axle and a hub, chambered to receive the end of the hook.

In pumping water, especially when two pumps are employed, discharging into the same column, there is always a jar and strain at the end and commencement of the stroke as the valves shut, so that when water has to be lifted a long distance it is not safe to use a high speed pump. Mr. M. B. Brannen, of Shenandoah, Pa., has patented a relief piston for obviating this difficulty. The patent is assigned to himself and Mr. J. L. Williams, of the same place.

An improvement in windmills, which consists mainly in constructing the vanes or blades of sheet metal stretched between two rigid heads, has been patented by Messrs. J. T. Mider and J. T. McClelland, of Wathena, Kan. The improvement also includes a novel governor.

An improved device for transmitting motion, especially adapted to windmills, has been patented by Mr. George H. Russell, of Cheyenne, Wyoming Ter. It consists in an arrangement of two cranks placed at right angles to each other on the shaft of the wind wheel, and two connecting rods which communicate motion to two cranks on the shaft below.

An improved pendulum adjustment for clocks, patented by Mr. Geo. B. Owen, of Winsted, Conn., is arranged so that it will adjust itself readily to the position of the clock without interfering with the regularity of the pulsations.

Mr. Marvin W. Freeman, of Beatrice, Neb., has devised an improved band cutting attachment for thrashing machines, which is capable of cutting straw, cord, and wire bands with equal facility. It consists of a rotating serrated cutter revolving near a stationary serrated cutter placed on the cover of the thrashing machine cylinder.

An improvement in striking mechanism for clocks has been patented by Mr. Wm. Lindon, of Brooklyn, N. Y. In this clock the quarter hours are struck or chimed, and the striking mechanism is operated by the power that actuates the time movement.

HOLDEN'S APPARATUS FOR MAKING ICE.

SPONGE FISHING IN THE ADRIATIC.—ARTIFICIAL SPONGE RAISING.

In the ancient temples of Poseidon, found throughout Greece, pictures have been discovered representing sponge fishers tearing the sponges from the ground in shallow water by means of long forks. Although in modern times various appliances and apparatus have come to the aid of the sponge fishers, there are yet some remote localities in which we can see the ancient Greek method of sponge fishing in all its simplicity. One of these spots, for instance, is the island of Krapano, situated off the Istrian coast. Its population is entirely dependent upon the proceeds of the sponge fisheries, and owns about forty small barks employed for that purpose. The crew of a boat consists of two men only, and, from the early spring till fall, these barks make extended trips along the rocky shores of Dalmatia and Illyria.

When a shallow place of from 12 to 40 feet in depth has

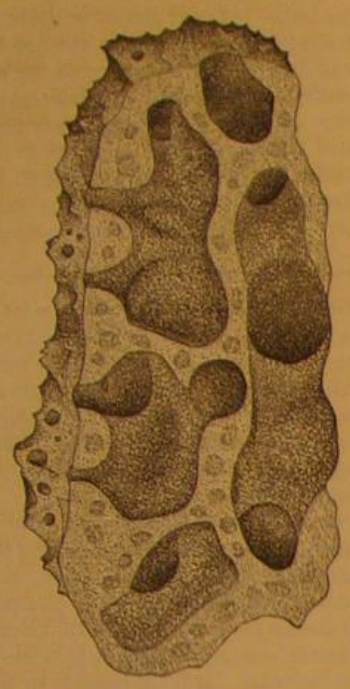


Fig. 2.—SECTION OF SPONGE, SHOWING MASSES OF EMBRYOS.

been reached, the oarsman propels the boat slowly along according to the orders of the fisher, standing in a square opening near the bow, holding a long fork, and looking sharply down to the bottom for the sponges; these appear as large black blotches between the rocks, and are easily recognized. Forks of different sizes are carried on a rack provided on the bark.

Generally the barks go out only in quiet weather, as, when the sea is rough, it is difficult to see the sponges on account of the reflected light. When the water is only slightly rippled by a light breeze, it is quieted by means of oil. For this purpose some oil and a number of small round stones are always carried along in the bark. The stones are dipped into the oil and thrown into the water. The oil adhering to them spreads over the surrounding surface of the water and causes even the slightest ripple to disappear. As the sponges abound on rocky ground, many of them are hidden from view in crevices, and the fisher must find them by feeling around with his fork, being solely guided by the touch.

The sponges are freed from the black protoplasm filling their pores by working them with hands and feet. After being washed several times with warm water, they are dried and ready for sale.

This mode of fishing sponges is very injurious to their quality, as they are frequently mutilated in tearing them from the rock. Another difficulty is that small, valueless sponges are brought up as well as the full grown, thus destroying many of the young sponges.

Sponges develop, during March, April, and May, large quantities of eggs or embryos, which accumulate in masses near the larger osculæ or openings, as indicated in Fig. 2. These embryonic organisms gradually grow and are carried out by the currents. They then swim about for some time, and finally become fixed and grow. As the fishers begin their operations as early as March, it is evident that, year after year, millions of young sponges are killed before separating from the mother sponge. This, together with the causes before mentioned, has resulted in a rapid decline of the Mediterranean sponge fisheries, only the rapid advance in the price of sponges preventing a shrinkage of the value of the annual crops. It is certain that the annual supply of Mediterranean sponges will steadily decrease as long as this disastrous system is adhered to. Thoughtful minds have long ago turned their attention to the artificial raising of sponges.

The celebrated naturalist, Brehm, was one of the first who experimented in this direction. In connection with Mr. Buccich, he procured several hundred of selected live sponges. These he cut into several thousand of small pieces, fastened them separately into perforated cases, which he then towed to the Bay of Socolizza. The small pieces were fastened by nails to a wooden framework, which was lowered at a shady spot to the proper depth. The sponges grew rapidly; in a few months they had attained the size of good natural sponges, and showed also their peculiar pitch-black color. In this way the possibility of raising sponges artificially was fully demonstrated. Brehm opened communications at once with the authorities, but although they looked favorably on the project, they did not succeed in overcoming the obstinacy and ignorance of the fishing population; after the fishers in the neighborhood had recovered from their surprise at Brehm's success, they made a raid one night on Brehm's plantation, destroyed the wooden frames, and carried off over two thousand valuable sponges. Several other attempts made by Brehm and Buccich were frustrated in the same manner, and there the matter has since rested.

The only enemy of the sponge plantation, with the exception of the enraged fishers, was a species of teredo or shipborer, which destroyed the woodwork. He substituted, therefore, for the latter copper wire, with equally good success. He also fastened the pieces of sponge to stones, and found that in a short time they became firmly attached.

In cutting up the sponges, great care must be taken not to squeeze the semi-liquid protoplasm from the pores; the knives, therefore, must be very sharp. When properly treated, about 99 per cent of all the pieces planted will grow, and be in every respect equal to natural sponges.

For different purposes sponges of special shapes are preferred, and it would seem possible, that by giving the desired shape to the pieces to be planted, sponges of any particular form could be obtained.

American sponges are of inferior quality; for our supply of good sponges we rely mainly on Greece.

It is a question whether it would not prove a profitable venture for some of our enterprising citizens to undertake the propagation of fine sponges in American waters.

Uses for Horse Chestnuts.

The common horse chestnut is capable of furnishing several useful products which are regularly manufactured in several localities in Europe. The seeds contain over 36 per cent of starch, which is easily obtained in the same manner as that made from cereals. Two hundred and forty to two hundred and fifty pounds of the seeds yield 100 lbs. of dry starch. Paste made from the latter is extremely adhesive, and is not attacked by insects; it is, therefore, particularly well adapted for the purpose of bookbinders.

This starch is also used for producing certain kinds of

Fig. 3.—SPONGE EMBRYO.

distilled liquors. For this purpose, 50 lbs. of the starch are heated for six hours with 2 lbs. of sulphuric acid and 150 lbs. of water, whereby the starch is converted into sugar; the acid is then neutralized by lime, the liquid decanted, mixed with yeast and fermented, and finally distilled. One hundred lbs. of starch yield 24 lbs. of 55 per cent spirit.—*New Remedies, from Die Natur.*

ROUND THE WORLD IN A HURRY.—The American Consul at Alexandria, in Egypt, Mr. Hars, is said to have traversed the circumference of a great circle of the globe in 68 days. He took 20 days in going from Alexandria to San Francisco, by Brindisi, Paris, London, Liverpool, and New York; 20 days also from San Francisco to Yokohama; 6 days from Yokohama to Hong Kong; 10 days from Hong Kong to Ceylon; and 12 days from Ceylon to Suez. Allowing 1,000 miles for divergencies from a straight course, or 25,000 miles as the total distance, the journey was performed at the average speed, stoppages included, of about 15¼ miles per hour. There must be a mistake in the time stated.

Fig. 1.—SPONGE FISHING.

Natural History Notes.

The Smallest Orchid Known.—Baron Von Mueller has recently announced the rediscovery, after a lapse of twenty years, of a minute creeping orchid, highly remarkable for its extremely small disk like leaves. This little plant, which grows in the vicinity of Richmond river, East Australia, has been described as *Bolbophyllum minutissimum*. Its leaves are orbicular, sessile, flat, horizontal, on a creeping rhizome, and only one eighth or one sixth of an inch in diameter. Thus this orchid has the smallest leaves of all in the whole order. Indeed, on seeing the plant creeping among the mosses the observer might take it for a species of the *Hepaticæ*. The wee red flowers, which are produced singly on peduncles hardly longer than the leaves, measure only one sixth of an inch. While thus East Australia possesses the dwarfest of all orchids known to science, it counts among its plants also the one with the minutest flowers, namely, *Oberonia palmicola*.

Bananas.—Few people who see bananas hanging in the shops of fruit dealers think of them as more than a tropical luxury. The fact is, they are a staple article of food in some parts of the world; and, according to Humboldt, an acre of bananas will produce as much food for a man as twenty-five acres of wheat. It is the ease with which bananas are grown that is the great obstacle to civilization in some tropical countries. It is so easy to obtain a living without work that no effort will ever be made, and the men become lazy and shiftless. All that is needed is to stick a sucker into the ground, and it will at once sprout and grow, and ripen its fruit in twelve or thirteen months without further care, each plant having from 75 to 125 bananas; and, when that dies down after fruiting, new suckers spring up to take its place. In regions where no foot ever reaches bananas are found in all stages of growth, ripening their fruit every day and every month in the year.

Studies on the Polypus.—M. Frederic, after a long course of study on the chemical phenomena which take place in the blood of cephalopods, has at length presented the result of his work to the French Academy of Sciences. He finds that in its oxidized state (corresponding to that of our arterial blood) this liquid is of an intense blue, and that it becomes pale on losing its oxygen. Analysis shows that it contains a substance corresponding with hæmoglobuline, and in which a metal takes the same part that iron does in the blood of the superior animals; but, wonderful to state, this metal is copper. The author calls this blue substance by the expressive name of *hæmocyanine*.

Migration of Carps.—In a letter to M. Raoul Pictet (published in the *Archives des Sciences Physiques et Naturelles*) M. Bartholoni gives an account of a singular migration of fishes observed by him. He was stationed on the banks of Lake Geneva, near a marsh which was generally isolated, but which an irruption of the waters of the Foron, about five months before, had put in communication with the waters of the lake. By the repeated action of the waves caused by violent winds, a beach again formed rapidly and shut off communication with the marsh. It was then that M. Bartholoni observed the carps leaving the marsh and seeking the lake. They took advantage of the reflux of the waves, and even succeeded in moving over the earth and crossing the newly made beach, which was about a meter wide.

The Castor Oil Plant.—Originally a native of Asia, the castor oil plant (*Ricinus communis*) is now naturalized in Africa, America, and the south of Europe. The plant has been known from the remotest ages; its seeds have been found in some Egyptian sarcophagi supposed to be at least 4,000 years old. It is singular that the oil expressed from its seeds should have been used by the ancients, including the Jews, as one of the pleasantest oils for burning and for several domestic uses, though its medicinal virtues were unknown. The modern Jews use the oil, under the name of kiki, for their religious services, it being one of the five kinds of oil their traditions allow them to burn.

A New Deep Sea Crustacean.—A very interesting matter was brought before the French Academy at its session of January 6, in the form of a paper, by M. Milne Edwards, on a crustacean discovered in the deepest part of the Atlantic Ocean. It was found December, 1877, during a scientific expedition of the American steamer Black. It was taken at the north of Yucatan in 1,500 fathoms of water, and sent to M. Milne Edwards by Mr. Alex. Agassiz. The former recognized it as an isopod type of a new family, and named it *Bathynomus giganteus*. The animal was 9 inches long by 4 inches wide. The most striking feature about it is the disposition, entirely new, of the respiratory apparatus, which consists of a numerous series of bronchiæ in the form of knots, placed between the false abdominal legs, and every piece of which, viewed with the microscope, showed itself to be a tube covered with very fine hairs. A highly developed respiratory apparatus of this kind is undoubtedly rendered necessary by the very conditions which obtain at the immense depths inhabited by the animal. One thing that would scarcely be expected in a being thus quartered in the dark regions of the ocean depths is that of power of vision; yet, strange to say, the new crustacean is well endowed in this respect, having eyes very highly developed, each of them being composed of 4,000 facets and situated at the base of the antennæ. According to M. Milne Edwards the bathynomus must live attached to algæ, and its habits are apparently carnivorous, cephalopod mollusks forming its food. It is probable, as the author observes, that a study of animals like this will throw light on the history of fossil crustaceans, and especially upon that of the trilobites.

Sir John Lubbock and his Ants.—The London *World* says that one of the best rooms on the first floor of High Elms (the residence of Sir John Lubbock) is devoted to work, and at the present time contains a menagerie of ants. Between 30 and 40 species are represented by separate nests, placed under glass, carefully shaded from light, and surrounded by water to prevent the interesting insects from escaping and overrunning the house. It is pleasant to see Sir John, arrayed in his working suit of gray stuff, gently uncovering the nests and replacing the screens quickly lest the animals should take alarm at the influx of light, and be thrown into disorganization by the thought that their nest is attacked. It is curious to observe that these tiny creatures have animals with them, which, it may be presumed, are useful to them in some way, as the ants forbear to attack them. They are mostly of the beetle race, and some, like the little *claviger*, are quite blind, possibly from confirmed subterranean habits, and are only found in ants' nests, the proprietors of which take as much interest in them as they do in their own young. Apparently ants have a considerable variety of domestic animals, among which the blind *Platyarthrus* is conspicuous, as well as the *Beckia albinos*, the latter of which was fully described by Sir John Lubbock, who suggests that perhaps these two act the part of the Constantinople dog and the turkey buzzard—making themselves useful as scavengers. A chat with the proprietor of this workroom soon dispels the illusions of the unscientific mind as to the industry of the ant. It is an industrious animal in the main—but there are ants and ants. The large red species found in Central Europe is not industrious at all, being a purely fighting aristocrat and slaveholder. She (the fighting ants are Amazons) makes predatory excursions and carries off the pupæ of another species, and brings them up as slaves. As Sir John Lubbock points out, the slaveholders present a striking instance of the degrading tendency of slavery. They can neither wash nor feed themselves. They have lost the greater part of their instincts; their art of building; their domestic habits (for they take no care of their young); their industry (for they take no part in providing themselves with food); and if the colony changes its nest the rulers are carried to the new one by their slaves. Even their structure has altered; their mandibles have lost their teeth and have become mere nippers, terrible in war, but useless for other purposes. So helpless have they become, except for fighting purposes, that if deprived of their slaves they actually die of starvation. These curious facts, which sound almost like the romance of natural history, have all been verified at High Elms by observations which confirm those of Huber in almost every case.

Amber and its Source.

Amber is a resinous exudation from an extinct species of conifer, called by Göppert *Pinites succinifer*. The source of this substance was long uncertain; by some it was considered a carbonaceous mineral.

Professor Zaddach shows that the trees which yielded the amber must have grown upon the greensand beds of the cretaceous period, flourishing luxuriantly on the marshy coast which then surrounded the great continent of northern Europe. Probably the temperature then was much higher than it is now; and this even at that epoch extended to the now frost-bound Arctic regions, a fact which has been proved by the remarkable plant-remains of temperate climes which have recently been discovered there. The amber flora of the Baltic area under review contains northern forms associated with plants of more temperate zones; thus camphor trees (*Cinnamomum*) occur with willows, birches, beeches, and numerous oaks. A species of *Thuja*, very similar to the American *T. occidentalis*, is the most abundant tree among the conifers; next in abundance, *Widdringtonia*, a great variety of pines and firs, including the amber pine. Thousands of these, it is supposed by the professor, might have perished, and while the wood decayed the resin, with which the stem and branches were loaded, might have been accumulated in large quantities, in bogs and lakes, in the soil of the forest. If the coast at that time was gradually sinking the sea would cover the land, and in due course carry away the amber and masses of vegetable detritus into the ocean, where it was deposited amidst the marine animals which inhabit it. But in the higher districts the amber pine would still flourish, and so amber still continues to be washed into the sea and deposited in the later formed greensand, and still later overlying formation of brown coal. Reboux states that at the eocene epoch the bed of the Baltic Sea was occupied by an immense forest, which spread over nearly the whole northern continent. Dredging carried on at a depth of 64 feet below the sea bottom has brought to light thereby two species of conifers, a poplar, a chestnut, and various other trees. From the conifers, the author thinks, ran the resin which, through being buried in the earth, has become changed into amber.

The largest quantity of the gum appears to have been derived from the *Pinus succinus*. More than two hundred specimens of objects have been found embedded in the fossil gum, including insects, reptiles, plants, leaves, grains, shells, fruit, etc. Amber is harder than most resins, and is susceptible of a good polish. It was known to the ancients by the name of "electron," on account of its electrical susceptibility; it was also engraved and used by them for seals, etc. It occurs abundantly on the Prussian coast of the Baltic, from Dantzic to Memel. It is also found on the coast of Denmark and Sweden, in Galicia, Poland, Moravia, the Ural, Switzerland (near Basle), France (near Paris), near London, in various parts of Asia, and in the greensand of New Jersey, and also in Japan. It is chiefly found in Prussia, however, and is not abundant elsewhere. In the latter country it occurs in the primary deposits of the coast. The amber bearing stratum, which lies partly below the sea level and partly above, is of a bluish green color, and consists of a coarse grained sand, the particles of which have a yellow coating. In this blue earth is found the amber to the amount of 2½ pounds to 20 cubic feet. The pieces of amber found are generally weathered, but have retained their original shape, showing that the sea has had but little action on them. The color is far from constant, being of all shades of yellow and brown. The amber dredging establishment at Schwartzort, on the Curish Haff (near Memel), produces about 80,000 to 90,000 pounds of amber yearly, and is still in the hands of a Königsberg firm, which keeps its transactions very secret. Four steam dredges are employed for the collection of the amber, as well as a considerable number of dredges worked by hand. The amber is found almost uniformly in separate nodules, with lignite, disseminated in the sand, at a depth of from 10 to 12 feet. Work is carried on by night as well as day, by "shifts" of workmen, laboring eight hours each. The work gives employment to about 400 persons. The amber collected is considerable, amounting to about 288 pounds per shift, and for six days work, 51,184 pounds. The sand, after being dredged up, is sent on shore, where it is washed in order to find the amber.—*Commercial Products of the Sea.*

Industrial and Manufacturing Uses of Shells.

The uses to which shells are applied, says the author of the "Commercial Products of the Sea," are more extensive than is generally supposed. The trade is growing year by year into greater importance; and there is ample scope yet for its extension with profit and advantage, alike to the merchant and importer, to the manufacturer and vender, and to the general public who are the purchasers.

The most beautiful shells come from the Pacific and Australian coasts. The sun, by the greater heat that it throws on the seas near the equator, would seem to have some effect in heightening the colors of shells produced in tropical zones, and the nature of the food of the animals probably gives them a luster and a brilliancy which are wanting in those of colder latitudes. It is impossible to enumerate all the purposes to which shells are applied, but some few may be specified. The shells of Strombus, Triton, Dolium, Fusus, Murex, etc., are used for fog horns, trumpets, lamps, vases, and ornamental borders in gardens. Those of Buscyon, Mactra, etc., by Indians for manufacture of implements. Shells of species of Mactra for ladles, spoons, and scoops, by fishermen. Those of Tridacna for vases, fountains, and the manufacture of handles and carvings. The shells of Pecten, Haliotis, Mercenaria, etc., by Indians for trimmings and ornaments. The scallop or Palmer's shell (*Pecten Jacobæus*) was used as a decoration of honor. Other Pectens are used in making pincushions and purses. The painter's muscle (*Unio pictorum*) is used to hold gold and silver colors. The shells of *Placuna placenta* are used in China as a substitute for glass. *Cytherea lusoria*, the painted shell of the Japanese, is used for playing a game. The shells of Cypræa, Rotella, Oliva, etc. (Venetian shells), are mounted as buttons and jewelry, and as shell work for ornamental book covers and frames. Calcined shells are used by dentifrice and porcelain makers. Cuttle fish bone, from *Sepia officinalis*, has various uses. The opercula of some mollusks are used as "eye stones," and polished and set as jewelry. In considering the manufacturing and useful applications of shells, they might be conveniently ranged under the following groups: (1) Nacreous shells, used for making pearl buttons and other useful and ornamental articles. (2) The pearly and iridescent shells, for ornamenting *papier mache* work, making card cases, folios, jewel cases, etc. (3) Various small shells, for making shell flowers, and different fancy articles of grouped shells, and for ladies' bracelets, head dresses, etc. (4) The shells used for carving cameos to set in brooches, bracelets, necklaces, scarf pins, for studs, sleeve links, etc. (5) Shells used for spoons, drinking vessels, lamps, knife handles; for snuff boxes, pipes, etc. (6) For making the purest kind of lime when calcined; for manure in the form of shell sand and shell marl; and for making pottery ware, and a glaze or enamel, when crushed. (7) Shells are also largely used for small monetary payments in North America, India, and Africa, and also as counters in games of chance. Lastly, they serve as studies of design, form, and color, for the sculptor, painter, and art manufacturer.

Milk as a Soporific.

According to the *Pharmacist*, it is a frequent practice in the New York Asylum for Inebriates to administer to the patients at bedtime a glass of milk to produce sleep, and the result is often found satisfactory, without the use of medicine. Medicine is there sometimes prescribed in milk. It has been recently stated in medical journals that lactic acid has the effect of promoting sleep by acting as a sedative, and this acid may be produced in the alimentary canal after the ingestion of milk. Can this, then, be the explanation of the action of milk on the nervous system after a long continued, excessive use of alcoholic drink? Sugar, also, is capable of being converted in the stomach, in certain morbid conditions, into lactic acid; and a lump of sugar allowed to dissolve in the mouth on going to bed will frequently soothe a restless body to quiet and repose.

The Dead Sea to be Utilized.

The water of the Dead Sea has long been known to be rich in mineral substances, the solid parts amounting to from twenty to twenty-seven in the hundred, according to the proximity to the mouth of the Jordan, the season of the year, and other causes. From 10 to 15 parts are chloride of magnesium; from 2 to 3 parts chloride of calcium; from 6 to 8 parts chloride of sodium; and from ½ to 1½ part chloride of potassium. There are also considerable traces of bromide of potassium and magnesium. It is said that a French contractor has just obtained a concession for the extraction of the chloride of potassium from the water of the Dead Sea. Chlorate of potash is used in the manufacture of fulminates, and consumed largely in England as an ingredient of manure. The supply has hitherto been drawn from Germany, and the salt was sold in London for 160 francs per ton. Competition reduced the rate to 130 francs, but the production ceases to be remunerative below 120 francs. The chlorate of potash procured from the Dead Sea can, it is said, be supplied in London at 90 francs, and the quantity obtainable is practically unlimited. The process of producing it will besides furnish other valuable chemical substances, such as the bromide and iodide of potassium.

THE BAWLKIN GREEN THUNDERBOLT.

Science, we are often told, is fatal to poetry and art. With every step toward the exact appreciation of the processes of nature something is lost to the imaginative and poetic faculty—the mystic is sacrificed for hard realism. As men become scientific they lose the childlike reverence for natural phenomena—the capacity to wonder at and enjoy the terrible or the beautiful in nature—which formed so large an element in human life in the unscientific past.

So say a class of critics who seem to know as little of the scientific uses of the imagination, or the marvelous expansion which scientific knowledge gives to all the faculties of the mind, as they do of the real barrenness of the intellectual condition of the common people in the days before science came in to destroy the poetry of appearances.

The accompanying engraving was made just two hundred and fifty years ago. It represents an occurrence which took place in the town of Hatford, England (eight miles from the seat of England's great university of Oxford), on the 9th of April, 1628. It is hardly necessary to add that Oxford was at that time innocent of any efforts in the direction of poetry-killing science.

The picture shows at once the condition of the art of wood engraving at that period, and the beautiful, childlike simplicity of the artist's imagination. There had been a fall of meteorites, more poetically known in those days as thunderbolts, and the chronicler reports that:

"One of them was seene by many people to fall at a place called *Bawlkin Greene*, being a mile and a half from *Hatford;* which *Thunder-bolt* was by one Mistris Greene caused to be digged out of the ground, she being an eye-witnesse, amongst many other, of the manner of the falling."

The heavy-tragedy air of the digger, who is bound to earn his penny notwithstanding the swooning of his companion through fright, is very amusing. The operations above the clouds prettily illustrate the artist's idea of meteorological processes, which science has since so largely reduced to a dreary system of exact knowledge and daily "probabilities." Nowadays the meteorologist deals with storm centers, areas of depression, humidity, barometric changes, and such like statements of prosaic facts. In the days of our engraving the chronicler of the weather could write of "miraculous Apparitions in the Ayre," "Wonders," and "Signs of Heaven's displeasure." In the pamphlet from which the engraving was copied the writer says:

"So Benummed wee are in our Sences, that albeit God himselfe Holla in our Eares, wee by our wills are loath to heare him. His dreadful Pursuivants of *Thunder* and *Lightening* terrifie us so long as they have us in their fingers, but beeing off, wee dance and sing in the midst of our Follies."

He then goes on to tell of the opening of heaven's windows, the thunder of God's artillery, and the fall of blazing stars in the midst of the elemental war.

"It is not for man to dispute with God, why he has done this so often, ... but with feare and trembling, casting his eyes up to Heaven, let us now behold him, bending his Fist onely, as lately he did, to the terrour and affrightment of all the Inhabitants dwelling within a Towne in the County of Barkshire."

That was before science meddled with the "elemental war." Now the Signal Service man telegraphs across the country: "Look for a fine meteoric display on the evening of the 12th; weather probably clear;" and all the young people sit out on the roofs to see the show. Thus the poetry of life vanishes!

DIGGING FOR A FALLEN METEOR IN 1628.

THE STRAW-NECKED IBIS.

This bird derives its name from the tuft of stiff naked feather shafts which hang from the front of the neck and breast, and greatly resemble small yellow straws. These curious feathers, with their light polished, golden surface, afford a pretty contrast to the glossy green black of the chest and wings, and the pure white of the neck and abdomen. The following description of the bird and its habits is written by Mr. Gould, in the "Birds of Australia":

THE STRAW-NECKED IBIS.

"This beautiful ibis has never yet been discovered out of Australia, over the whole of which immense country it is probably distributed, as it is more abundant in certain localities at one season than at another; its presence, in fact, appears to depend upon whether the season be or be not favorable to the increase of the lower animals upon which the vast hordes of this bird feed. After the severe drought of 1839, it was in such abundance on the Liverpool plains, that to compute the number in a single flock was impossible. It was also very numerous on the seaside of the great Liverpool range, inhabiting the open downs and flats, particularly such as were studded with shallow lagoons, through which it would wade knee high in search of shelled mollusks, frogs, newts, and insects; independently of the food I have mentioned, it feeds on grasshoppers and insects generally. The natives informed me that sometimes many seasons elapsed without the bird being seen. Where then does it go? To what country does it pass? Does there not exist a vast oasis in the center of Australia, to which the bird migrates when it is not found in the located parts of the country? We may reasonably suppose such to be the case."

The coloring of the straw-necked ibis is very conspicuous, and the lines of demarkation between the different tints are sharply drawn. The head and part of the neck are deep sooty black, which suddenly changes into a beautiful white downy plumage, clothing the remainder of the neck. From the fore part of the neck and throat hang a number of delicate fringe-like feathers. The whole of the upper surface is colored of a deep and glistening green black, "shot" with purple, and changing its tints at every variation of light. Irregular bars of the same color as the head are drawn across the back, and the entire under surface is pure white. During the life of this bird the thighs are slightly colored with crimson, but this tinting soon vanishes after death.

New and Constant Bichromate Battery.

Dr. Erck exhibited lately before the London Physical Society, a constant bichromate of potash battery. The ordinary bichromate battery soon loses power when in use, and in order to secure a powerful constant battery to drive a small astronomical clock, Dr. Erck devised the modified form shown. It consists of a narrow lead trough, 12 ins. long by 3 ins. wide and 1 in. deep, lined along both sides with the carbon plates. The zinc plate, 10 ins. long, is immersed in the solution to the depth of an inch midway between the two carbons. A continual circulation of the bichromate solution is kept up by allowing fresh solution to drop into the cell at one end, and the exhausted solution to drop away by a tap at the other end. As the space between the two carbons is only about half an inch wide, there is merely a thin layer of solution between the positive and negative poles. The internal resistance of the cell is therefore very low when short circuited, only about ¼ ohm. To obtain the maximum current, about 8 ozs. of solution per hour should be supplied. Dr. Erck also showed a battery formed of zinc and carbon circular plates mounted on an axle, which is rotated by wheelwork, thus mechanically stirring the bichromate solution.

Drawings Rendered Ineffaceable.

To render pencil drawings ineffaceable the *Papier Zeitung* recommends that the paper be prepared in the following manner:

Slightly warm a sheet of ordinary drawing paper, then place it carefully on the surface of a solution of white resin in alcohol, leaving it there long enough to become thoroughly moistened. Afterwards dry it in a current of warm air. Paper prepared in this way has a very smooth surface. In order to fix the drawing, the paper is to be simply warmed for a few moments. This process may prove useful for the preservation of plans or designs, when the want of time will not allow of the draughtsman reproducing them in ink. A simpler method than the above, however, is to brush over the back of the paper containing the charcoal or pencil sketch with a weak solution of white shellac in alcohol.

Life on Ocean Cables.

Mr. J. Munro, who spent some time with a repairing expedition along the line of the Para-Cayenne section of the Western and Brazilian Companies' cables, describes in *Chambers' Journal* the submarine life that was fished up by the cable. He says:

"We were chiefly at work off the island of Marajo in the estuary of the Amazon. The cable had only been submerged about a month; yet it came on board the ship at places covered with barnacles; at others overgrown with submarine vegetation, crabs, and curious shells, often of singular delicacy and beauty. The seaweeds were in great variety clinging to the cable, sometimes in thick groves of red and yellow algæ; slender, transparent, feathery grasses; red slimy frecoids, and tufts of amethyst moss. We found branching coralline plants upward of a foot in height growing to the cable, the soft skeleton being covered with a fleshy skin, generally of a deep orange color. Some times a sponge was found attached to the roots of the corals, and delicate structures of varied tints incrusted the stems of all these plants and served to ornament as well as to strengthen them. Parasite life seems to be as rife under these soft tepid waters as it is on the neighboring tropical shores. Many star fishes, zoöphytes, and curious crabs and crustaceans were likewise fished up on the cable. The crabs were often themselves completely overgrown with the indigenous vegetation of the bottom, and so were scarcely distinguishable from it. Others, although not so covered, were found to have the same tints as the vegetation they inhabited, and even in structure somewhat resembled the latter. Others were perfectly or partially transparent, and one most beautiful hyaline crab, new to science, united in its person several of the prevailing colors of the bottom. Its slender limbs, like jointed filaments of glass, were stained here and there of a deep topaz brown. Its snout, pointed like a needle, was of a deep scarlet, its triangular body was orange yellow, its eyes were green, and its tiny hands of an amethyst blue."

Furs Used for Ladies' Cloaks.

Frank Buckland, in *Land and Water*, gives the following information as to whence the skins used for lining ladies' cloaks are derived. Fur lined cloaks are now quite abundant and fashionable. The skins used as linings are of various kinds. The commonest of all is white rabbits'; these are not English, but imported from Lissa, in Poland, where they are dressed by the furriers, and manufactured into linings for cloaks. It is not certain whether these skins are from wild or tame rabbits. As many thousand skins are annually used, it is very probable that they are domestic rabbits bred for the purpose. Besides rabbit skins, many cloaks are lined with what are called "squirrel bellies." These are literally bellies of squirrels. These animals are skinned in a peculiar manner so as to make the most of the fur. The squirrels used for this purpose are of various kinds and prices. The most expensive squirrel is the Siberian squirrel. The general color of this is blue, some light blue, some dark blue; the dark blue are the most valuable, particularly if it is void of the red stripe down the back. These squirrels are killed by thousands in Siberia; they are mostly shot with a small bullet. Those from Sweden and Norway are caught in traps, probably pitfalls baited with food; they are also intercepted when in the act of migrating. The Swedish squirrels are very large. Some of the squirrel skins are of a red color; these are the same squirrel in the summer dress. Squirrels are also imported in large numbers, especially from Kasan, in Russia, but they are rather inferior to other sorts. There are various modes of dressing squirrel skins. The Russian skins are pickled in salt, and in consequence are apt to feel damp in wet weather. They do very well in Russia, as the weather there is always dry. In this country the skins are dressed with butter or lard, and it is a remarkable thing that the Russian furriers cannot use butter dressed skins, because in Russia the skins thus prepared become quite hard in very cold weather. For years past the trade of dressing squirrel skins has had its headquarters in Saxony, principally at the town of Weissenfels. Leipsic is celebrated for its fur market, especially at Easter, when the great fair takes place. From Leipsic furs are sent to China, Russia, Turkey, Greece, etc.—in fact, all over the world. Large numbers of common wild rabbit skins and silver grays are exported from England for use in Russia. Cats are largely cultivated in Holland, especially for their skins. The fur of the Dutch cat is very long and soft as compared to the English cat, the fur of which is hard and wiry. There is some secrecy as to how the cats in Holland are fed; it is possible that they are fed on fish. The best Dutch cats are black. A good skin of jet black color is worth half a guinea. The Dutch cat killers have a most peculiar and clever way of killing their cats. It is a fallacy to suppose that cats are skinned alive. In the first place, to skin a cat when alive would be utterly impossible; and secondly, it does not make any difference in the quality of the skin. The origin of the fallacy is probably that a cat is easier skinned immediately after death than if allowed to become rigid. It is very remarkable how fashions set by English ladies influence wild and tame animals even in the most distant parts of the world. It is fortunate that ladies have made cats fashionable, as at last some use is found for these animals, which, being untaxed, are so abundant that any night and in any weather cats—many of them half starved—swarm in the London streets, and the poorer the neighborhood the more abundant are the cats.

A New Material for Paper.

The consumption of esparto grass by paper makers in France and England is now very large, and it is yearly increasing. Sir Joseph Hooker and Mr. Ball, in their recently published journal of a "Tour in Morocco," tell us they saw immense bales of this grass being shipped from the port of Mogador, and "that it is there said that the greater part of what reaches England from Morocco is used in the paper mills that supply the *Times* newspaper." The great value of this grass as a paper making material lies in the tenacity of its fiber, and the comparatively minute quantity of silica in its composition. In these respects it would appear that we have in all wet, healthy places, moors, and damp woods throughout Great Britain and Ireland, and extending over all Europe and into Russian Asia, wherever suitable places for its growth are to be found, a similar material in the grass long known as the purple molinia (*Molinia cærulea*). It is a rather coarse, stiff, perennial grass, often growing to a height of 3 feet; the leaves chiefly form tufts and start from the base of the plant; the flowering stalk is of a greenish or purple hue. It is found over all the moorlands of Scotland and in all the boggy pastures of Ireland, and has been considered of little, if any, agricultural value; it is gradually, by cultivation, being destroyed. From an analysis of hay made from this grass by Dr. Cameron, it would appear to contain an unprecedentedly small amount of ash—only 0·85 part out of 100 parts of hay (dry weight)—and a scarcely appreciable amount of silica. In 100 parts of the ash only 0·55 of silica was found. Dr. Cameron does not suggest this grass as being of value as a paper making material, but he calls the attention of farmers to the fact that it is well worth saving as a food product, as its composition indicates a high degree of nutritive value; indeed, it appears to be quite as rich as meadow hay in all its common ingredients except digestible non-nitrogenous matters. Its analysis, however, indicates its qualities as a paper making material, as which it would have a higher commercial value than as an article of food; and, in a communication to *Nature*, Mr. Christie, of Edinburgh, states that he sent a small quantity of the grass to be operated on by Mr. T. Routledge, of Sunderland, who, after experiment, came to the conclusion that if dried properly, and put up carefully in bundles, free from weeds and dirt, its value would be probably equal to esparto grass—£5 per ton dry. It is to be hoped that some effort may be used to have an extended trial for paper making of this plant. It flowers in the late summer or early autumn, when in this country some hands could be readily spared from other work to collect it. It should cost little over the mere expense of gathering, as the ground in which it flourishes, as a rule, will pay but a minimum of rent.—*London Times.*

Pearls and Pearl Culture.

As far back as we have a history for any gems we have record of pearls; and, not even excepting the diamond, is there a jewel so often spoken of in history, sacred and profane, as this one. What are they, and where are they produced? Are they capable of being multiplied by art? In view of the great commercial value of these jewels, such queries are of considerable importance. There is scarcely a country on the face of the globe where pearls have not at some period been found, though at the present day the principal fisheries are near the coast of Ceylon, Japan, Java, Sumatra, Bahrein in the Persian Gulf, and the islands in the vicinity of Panama. Of all these, however, none equal those obtained in the Persian Gulf, in color, size, purity, and that translucency which gives this gem its great value. The pearl fisheries in the last named locality are said to yield upward of $1,500,000 annually; those of Panama reach about the same figure. Pearls have also been found in various streams of the United States, and in 1858 considerable excitement was occasioned by the discovery of some large sized ones near Salem, in New Jersey. A New Jersey pearl, over an inch in diameter, found near Paterson, was sent to Paris, where it was purchased by the Empress Eugenie for 12,500 francs ($2,500).

This gem was held in great estimation by the Romans, who paid enormous prices for fine specimens. Julius Cæsar is said to have possessed one, the value of which would now be $150,000, and Pliny states that the pearls in the eardrops of Cleopatra, and which she swallowed to the health of Mark Antony, were valued at a sum that would amount to $400,000 of our money. Tavernier mentions a pearl found at Catira, on the coast of Arabia, in 1633, which was sold to the King of Persia for $280,000. The "Peregnine," found in 1574, during some of the filibustering expeditions to America and carried to Spain (where it now remains among the crown jewels), is valued at $37,500. Pope Leo X. had a pearl that was valued at $75,000; and the crown jewels of Portugal have among them a pear-shaped one, weighing about 25 carats. A close examination of the subject reduces the great pearls of the world to a very limited number; the large examples running over 20 carats in weight, which are absolutely known to exist at the present day, do not number over a score.

Having spoken of the value of these jewels, we are led to consider the question, What are they, and how are they formed? According to an old and popular fancy, pearls are dewdrops transmogrified. Pliny asserts that the oysters rise to the surface in the night to feed upon the dews of heaven, which the sun's rays upon the water nourish into pearls. According to Boethius de Bovelt: "The mussels, early in the morning, in the gentle cleare and calme aire, lift up their upper shells and mouthes above the water, and these receive the fine and pleasant breath or dew of heaven; and afterwards, according to the measure and quantitie of this vitall force received, they first conceive, then swell, and finallie produce the pearle." At this very day, in the East, the belief exists that these gems are the drops of rain, which, as they fall into the sea, become pearls, and in that state are swallowed by the oyster. A stay was given to such a belief by Cardonus, who demonstrated that these shell fish have their homes upon the sea bottom, where they are firmly attached to rocks and other substances, and have therefore no power to rise. Still this fancy survived till the researches of Mr. Gray and Sir Everard Home proved that pearls are merely the internal nacreous coat of the shell, which, from some cause or other, has assumed a spherical form. Home's idea, however, that the pearl is an abortive egg of the oyster enveloped in its own nacre, is scarcely worthy the trouble of refutation.

A theory was started at one time that the pearl proceeded from a wound on the shell of the animal. This view was held by Linnæus, who suggested to the Swedish Government a plan for making pearls by boring holes through the shells of the mollusk. He received $2,250 for his plan, which, on trial, was unsuccessful. It was at one time thought, too, that the pearl muscle covered small particles of sand, which accident had introduced between its shells, with pearly matter for protection. That this is not the case is proved by the fact that, though numberless pearls have been split and sawed through the center, it is very seldom that an imperfection is found even of the minutest size.

The theory of Réaumur is now generally held to be the correct one; and that is, that the pearl is a concretion of the juices consequent upon a disease or rupture in the mollusk, without the introduction of any foreign matter. The pearl is simply carbonate of lime—rather harder than calcspar, of which it has precisely the same chemical composition, but with the addition of films of animal membrane between the many layers of mineral matters which go to form it. It is this animal matter which, when dry, gives the pearl its hardness. Several genera and species of bivalve mollusks secrete pearls, especially the *Avicula margaritifera*, or true pearl oyster; and among fresh water species, the *Unio margaritifera*. It is found that only the old animals produce the gems; the fishers do not look for them nor expect them from the young and smooth shelled; the more aged and distorted the shell, the greater the probability of a find of pearls.

Can pearls be produced at the will of man, or multiplied by his aid? This is an important query; for, if it be possible to do so, a way is opened for the cultivation of a valuable industry. Certain it is that the pearl muscle (or "oyster," as it is improperly styled) has the power of covering with concentric layers of nacre such portions of its shell as need strengthening, as well as objects introduced by accident or design. The Chinese and Japanese, taking advantage of this, have long practiced the art of stimulating the secretion of nacre by introducing beads made of spar, or powdered glass and varnish, or sometimes turned from mother-of-pearl; and thus they do actually succeed in forcing the animal to produce pearls at their will, although of inferior quality. The results of the few experiments that have thus far been tried in other quarters seem to be negative. One of the curious circumstances connected with the New Jersey "pearl fever," of 1858, was the discovery of a few shells showing that, many years before, some one had experimented on the pearl bearing muscle by dropping small mother-of-pearl buttons inside the shell, hoping that the animal would cover them with its secretion. The experiments proved a failure, however, the result being that the buttons became fastened to the shells by the action of the secretion, but did not develop into pearls.

Before taking leave of this subject we must refer to a remarkable discussion which has been going on for some time in the pages of our English contemporary, *Land and Water*, under the caption of "Do Pearls Breed?" It seems that some time ago a number of small pearls, of the kind known in commerce as "seed pearls," were sent to Mr. Frank Buckland from Borneo, under the name of "breeding pearls." These pearls were inclosed in a glass tube, we are told, along with some grains of rice to feed upon. The sender gravely asserted that it had long been known in Borneo that pearls when put by for some time in a box along with rice would reproduce their kind. We learn that three or four months have now elapsed since the pearls were dispatched on their journey, and that the grains of rice inclosed with them have all the appearance of being partially eaten. This astounding absurdity is being gravely discussed, and, strange to say, many of the correspondents of the journal actually maintain the plausibility of it. To find a fitting parallel for such a belief in the annals of natural history it will perhaps be necessary to travel back to the olden time when it was firmly held as a truth that the crustaceans known as barnacles gave birth to the fowl called the barnacle goose.

A Gigantic Vegetable.

At a recent meeting of the Linnæan Society, Dr. Masters read an extract from a letter received that morning, describing what is believed to be the largest plant in existence. A botanical traveler in Sumatra has found, growing near the Rafflesia, a plant belonging to the family of the Arums. The bulb or corm growing on the surface measured 5 feet in circumference. Two men endeavored to raise it; it is said they nearly broke their backs in doing it, and the root itself broke while they were lifting it. From this corm sprang a single leaf stalk, 20 feet high. At the top it divided into three branches, each as thick as a man's thigh. The leaf is divided into an immense number of segments, and measures 15 meters in circumference, or 45 feet, covering, therefore, an area of 150 square feet. The plant had done flowering when it was discovered, so that the dimensions of the spathe are as yet unknown. But seeds were obtained, which are now growing at Florence.

A New Telegraphic Conductor.

An electrical conductor of decidedly novel character has just been patented by Mr. Alberger, of Philadelphia. It consists of a conducting wire—preferably of decarbonized steel—surrounded by a vitreous substance and incased in a metallic tube. The manner of making the conductor is as novel as the article itself. The inventor produces a glass bulb at the end of a glass blower's tube, and passes a wire from a neighboring reel through the tube until its end reaches the outer end of the bulb, when the end of the bulb and the wire together are seized and drawn outward, while the tube remains stationary. The wire having the vitreous casing is now introduced into a wrought iron tube, and the whole is heated to a welding heat and reduced in size by rolling. Sections of the conductor are united at the ends by an ordinary screw coupling, the ends being first rounded off by an emery wheel to render a contact of the conducting wires certain. The conductor made in this way is protected from oxidation, and is completely insulated.

THE Berlin Academy renew an offer of a prize of about £46 for an investigation of the following questions (not yet replied to): "In what combination does lime occur in the blood of mammals and of birds, and how does the chemical precipitation of its salts in the tissues, and especially in the bones, take place?" It is desired that these questions be answered by experimental researches on grown animals, in which especially the chemical state of the blood and the bones, after long feeding with substances containing phosphorus and (separately) plant-acid salts, is more exactly determined. Papers must be sent in before March 1, 1881.

NEW BOOKS AND PUBLICATIONS.

GUIDE TO ROSE CULTURE.—The Dinger & Conard Company of West Grove, Penn., have just issued their 1879 Annual, and like their previous ones it is copiously illustrated. It not only contains engravings of the choicest varieties of roses, but also of other flowering and ornamental plants. Messrs. Dinger & Conard have been growers of fine varieties of roses and ornamental plants for a number of years, and are reliable dealers. The guide is sent free to persons inclosing, with their address, a 3 cent stamp.

Notes & Queries

(1) C. Z. S. asks for the best method of putting water grates in a locomotive fire box. How is the pipe connected with the front and back end of the fire box? A. You can either expand the pipes at the ends, or screw them in, as is most convenient.

(2) A. S. asks how many sizes of pinions will run in an internal gear of 10 inches diameter. I want to run 24, the smallest three quarters of an inch, the largest 3 inches diameter. A. FIX upon some number of teeth in the internal gear that is a common multiple of the number of teeth in all the pinions. You will see then that the number of pinions is only limited by the practical difficulties of construction.

(3) R. B. R. writes: Several journals have stated that the locomotive lately built for the Atchison, Santa Fe, and Topeka Railroad was the heaviest ever built. The weight given is 118,000 lbs. Please inform your readers if this is correct. A. The "Janus," built at the Mason Machine Works, and in use on one of the Pennsylvania coal roads, weighs 84 tons. Possibly there may be an engine heavier still, and if so, we hope some of our readers will inform us.

(4) D. P. asks: What thickness must a cast steel cylinder 8 inches internal diameter have, so as to resist a steam pressure of 250 lbs. per square inch with complete safety? A. Half an inch will answer, unless the length is great.

(5) R. S. H. asks: If I build a boiler 36 inches in diameter, and the flues 30 inches in diameter, the iron in both being the same strength, and apply the steam between the boiler and the flue, which will bear the greatest amount of pressure? A. The 36 inch shall.

(6) C. R. G. asks (1) if there is any difference in the friction of 2 equal lengths of hose, one to be laid straight and the other crooked. A. Yes, other things being equal, the difference will be considerable. 2. If water is forced into a 6 inch pipe from a 3 inch inlet, and after being forced from 500 to 600 feet and discharged from a 3 inch hose, will the water move faster in the center of the 6 inch pipe, or on the sides of the same, or will the water that is forced in act as a piston and make it all move the same? A. The action will be as described in the latter part of your question.

(7) R. E. W. asks for an explanation of the action of the wheels of a car when going round a turn or curve. One of the wheels (I think the outside) must make more revolutions in the same time than the other. How does the slower one make up with the other? A. In such a case, one of the wheels must slip, unless they are so coned that one is running on a longer circumference than the other, sufficient to allow it to pass over a greater distance with the same number of revolutions.

(8) C. H. M. H. asks: What constitutes an artesian well? My friend argues that it is necessary that the water should rise above the surface of the ground. I contend that if it reaches the surface it comes under the head of an artesian. A. It is the manner of sinking, not the nature of the flow, that makes a well artesian. The water may or may not reach the surface.

(9) J. E. F. asks: Which is the best for the Wabash, Mississippi, and Yellowstone rivers, a screw wheel, stern wheel, or side wheels? I am building a boat thirty-five feet long to carry eight persons and baggage, and I want to run good speed, for a pleasure trip up the Yellowstone river. What size should the engines be, and what should the boiler be, and would thirty-five feet be long enough, and how wide should it be? A. A screw will be preferable, if there is sufficient water. For dimensions of machinery, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(10) W. C. asks: 1. Will it take the temper out of a steel casting or weaken it, under necessary heat to "shrink it on"? A. Yes. 2. In case it does, can a casting be "shrunk on" and tempered at the same time, or under one heating? A. Yes, but at the risk of breaking it.

(11) J. A. M. asks how to soften cast iron that is too hard for filing or drilling, so that it may be filed or drilled. A. Heat it to a cherry red, plunge it into powdered quick lime, and allow it to remain until cool.

(12) W. G. C. asks: 1. How can I drill a hole in a glass plate without danger of cracking the glass? A. Use as a drill a copper tube of the size of the required hole, and as it rotates keep it charged with emery and water. 2. Is American glass good enough for the plate of a "Holtz" electric machine? A. Yes. State your other questions more fully.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. S. W.—The ore does not contain silver, but much manganese and iron oxide. Properly powdered and washed it may have some market value on account of the manganese oxide which it contains.—J. E. R.—It is a fragment of quartz, or pebble that has been rounded by attrition.—E. G. O.—Please send larger sample of your ore.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

COMMUNICATIONS RECEIVED.

On Pyrometers. By C. F. R.
Simple Electric Pen. By G. L. S.
Tide in Lake Superior. By H. J. W.
Culture of the Pear. By E. P. P.
New Patent Bill. Inventor.
On Ice Yachts. By H. B.
The Senate Patent Bill No. 300.
Patent Legislation. By W. F. S.
On the Progress of Chemistry in 1878. By E. G. H.
On Protection of Inventors' Rights. By V. B.
On Improvements in Cane Mills. By H. M. W.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 4, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park ROW, NEW YORK city.

Accordion, O. Stark 212,065
Alloy for metric gold coin, W. W. Hubbell 211,909
Alloys, etc., manufacture of, N. W. Williams 212,077
Amalgamator and settler, W. S. Shotwell 211,939
Anglometer, J. V. Capek 211,903
Automatic gate, Carter & Coppock 211,909
Axle box lid, car, J. Kinzer 211,854
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Bait hook, spoon, L. S. Hill 211,908
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Bale tie, G. T. Pittman 211,925
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Barrel trussing machine, H. W. King 211,914
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Bath tub, C. F. Wolters 212,081
Bathing apparatus, W. Wasson 211,874
Bed bottom, spring, A. Ike 212,099
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Bee hive, D. W. Smith 211,869
Binder, temporary, J. G. Smith 212,061
Bolt holder, M. Ketchum 212,073
Book cover protector, Way & Rankin 212,073
Boot and shoe heel attachment, W. L. Fink 211,982
Boot and shoe stretcher, C. D. Lakey 211,857
Boots, manufacture of, W. R. Miller 211,920
Bottle stopper fastener, W. Geist 211,987
Bottles, removable nozzle for, E. B. Requa 212,055
Box fastener, W. I. Winne 212,079
Bran, treating, R. L. Downton 211,977
Bridle winker, Cahoone & Teas 211,886
Bronzing wood, porcelain, etc., R. Boettger 211,961
Broom stock holder, D. A. Scott 211,935
Buggy seat, L. J. Annes 211,878
Burglar alarm, J. S. Ranney 212,053
Button, C. E. Bates 211,882
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Car door locker, freight, F. Cooper 211,972
Car heater, street, G. C. Bovey 211,963
Car lock, freight, B. Crawford 211,838
Car spring, J. A. Lowe 212,021
Carriage top, adjustable, North & Hubbard 211,861
Carriage window fastener, C. West 212,074
Cart, hand, M. Daley 211,889
Cartridge carrier, J. N. Reece 212,054
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Chimney holder and air distributer, G. W. Thomas 211,945
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Churn lid, G. L. Farmer 211,980
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Clock pendulum adjustment, G. B. Owen 212,045
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Clothes drier, H. M. Jacobs 211,851
Coal assorter and washer, R. Hartley 211,846
Copies of writing, etc., producing, E. De Zuccato 211,877
Corn dropper and check rower, J. O. Hall 211,904
Corpse cooler or casket, E. Holmes 211,967
Croquet scorer, W. B. Lewis 212,030
Cultivator and corn planter, Swartout & Hartley 211,871
Curtain fixture, J. K. Davison 211,890
Cut-off and valve, waste pipe, Levake & Grubb 211,917
Cutters, shaper for, J. A. Houlihan 211,908
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Draught bar for sleighs, J. C. Campbell 211,967
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Vehicle spring bolster, M. Burton	211,834
Velocipede, E. J. Blood	211,959, 211,960
Velocipede, ice, A. A. Smith	211,868
Ventilator, E. Van Noorden	211,872
Vises, pipe gripe for, J. F. Hall	211,993
Washing and bath tub, C. Koch	211,856
Washing machine, C. Thompson *et al.*	212,070
Watch and clock key, C. E. Lombard	211,918
Watch key, adjustable, M. L. Gutmann	211,992
Water wheel, turbine, A. Ball	211,829
Willow wicker work, A. H. Crawford	211,888
Wind engine, D. Nysewander (r)	8,566
Windwheel, F. W. Ingham	212,008
Window screen, C. B. Bostwick	211,962
Wire, hardening, tempering, etc., W. A. Shaw	211,938
Yeast substitute, W. Stewart	211,870

TRADE MARKS.

Bacon, hams, beef, pork, lard, and tallow, J. W. Nightingale	7,009
Baking powders, E. Guittard	6,992
Canned fruits, vegetables, and meats, San Jose Fruit Packing Company	7,000
Chocolate, H. L. Pierce	6,999
Cigars, cigarettes, and smoking and chewing tobacco, McCoy & Co	6,998
Coffee, E. Guittard	6,993
Cosmetics, L. F. Marshall	6,996
Essential oils and essences, Fritzsche Brothers	7,004
Hay and manure forks, hoes, rakes, etc., Stafford & Holden Manufacturing Company	7,010
Lard and cured meats in packages, J. M. Decker	6,990
Liquid soap, Wrigley Manufacturing Company	7,007
Lubricating cylinder oil, Backus Oil Company	7,002
Newspapers, E. S. & T. D. Carman	6,989
Medicinal preparation, N. Van Bell	7,001
Plug tobacco, Miller & Worley	6,997
Perfumery, cosmetics, hair oils, etc., Meyer Bros. & Co	7,011
Raw or partly prepared and manufactured slates, Welsh Slate Company	7,006
Roasted and ground coffees, etc., E. Guittard,	6,991, 6,993, 6,994
Smut machines and grain separators, Howes, Babcock & Co	6,995
Starch, Wesp, Lautz Bros. & Co	7,008
Whisky, B. F. Holl & Son	7,005
Writing paper, Crane & Co	7,003

DESIGNS.

Baskets, J. Schlereth	11,008
Heel plates, L. Graf	11,006
Knitted fringe, H. A. Truitt	11,015
Oil cloth, C. T. & V. E. Meyer	11,011 to 11,014
Ornamental chain links, D. S. Spaulding	11,017
Oyster plate, T. C. Smith	11,009
Road wagons, W. O. Kinne	11,007
Shawl trimming, W. Wilkinson	11,010
Statuette, G. Focardi	11,016

THIRTY-FOURTH ANNUAL REPORT

OF THE

NEW YORK LIFE INSURANCE COMPANY

OFFICE:

Nos. 346 & 348 Broadway.

JANUARY 1, 1879.

Amount of Net Cash Assets, Jan. 1, 1878, $34,452,905 29

REVENUE ACCOUNT.

Premiums received and deferred	$6,121,856 04	
Less deferred premiums Jan. 1, 1878	396,289 26	$5,725,566 78
Interest received and accrued	2,264,560 48	
Less interest accrued Jan. 1, 1878	315,895 35	$1,948,665 13—$7,674,231 91
		$42,127,137 20

DISBURSEMENT ACCOUNT.

Losses by death, including Reversionary additions to same	$1,687,675 61
Endowments matured and discounted, including Reversionary additions to same	673,051 44
Life annuities and reinsurances	231,005 29
Dividends and returned premiums on canceled policies	2,288,674 25
Commissions, brokerages, agency expenses and physicians' fees	518,809 94
Taxes, office and law expenses, salaries, advertising, printing, etc.	417,258 78
Reduction of values on United States and other stocks	88,635 00
Profit and loss account	8,568 98—$5,913,679 59
	$36,213,457 61

ASSETS.

Cash in bank, on hand, and in transit (since received)	$932,839 43
Invested in United States, New York City, and other stocks (market value $15,415,105 34)	14,791,367 72
Real estate	4,582,270 42
Bonds and mortgages, first lien on real estate (buildings thereon insured for $12,860,000 and the policies assigned to the company as additional collateral security)	14,364,158 43
*Loans on existing policies (the reserve held by the company on these policies amounts to $3,225,000)	621,984 93
*Quarterly and semi-annual premiums on existing policies, due subsequent to January 1, 1879	379,839 09
*Premiums on existing policies in course of transmission and collection (estimated reserve on these policies, $560,000, included in liabilities)	146,834 75
Agents' balances	88,036 91
Accrued interest on investments to January 1, 1879	306,225 93—$36,213,457 61
A detailed schedule of these items will accompany the usual annual report filed with the Insurance Department of the State of New York.	
Excess of market value of securities over cost	623,837 62
CASH ASSETS, Jan. 1, 1879	**$36,837,295 23**

Appropriated as follows:

Adjusted losses, due subsequent to Jan. 1, 1879	$399,486 68	
Reported losses, awaiting proof, etc	180,993 39	
Matured endowments, due and unpaid	19,601 07	
Reserved for reinsurance on existing policies; participating insurance at 4 per cent. Carlisle net premium; non-participating at 5 per cent. Carlisle net premium	32,369,353 40	
Reserved for contingent liabilities to Tontine Dividend Fund, over and above a 4 per cent. reserve on existing policies of that class	1,041,456 87	
Reserved for premiums paid in advance	14,987 18—$34,025,858 59	
Divisible surplus at 4 per cent	2,811,436 64	
		$36,837,295 23

Surplus, estimated by the New York State Standard at 4½ per cent. over $6,500,000 00

From the undivided surplus of $2,811,436 64 the Board of Trustees has declared a Reversionary dividend to participating policies in proportion to their contribution to surplus, available on settlement of next annual premium.

During the year 5,082 policies have been issued, insuring $15,949,986.

Number of Policies in force Jan. 1, 1876	44,661.
Amount at risk	$126,132,119.
Number of Policies in force Jan. 1, 1877	45,421.
Amount at risk	$127,748,473.
Number of Policies in force Jan. 1, 1878	45,605.
Amount at risk	$127,901,887.
Number of Policies in force Jan. 1, 1879	45,005.
Amount at risk	$125,282,144.

Death-Claims paid 1875	$1,524,815.
Death-Claims paid 1876	1,547,648.
Death-Claims paid 1877	1,638,128.
Death-Claims paid 1878	1,687,676.
Income from Interest, 1875	$1,870,658.
Income from Interest, 1876	1,906,960.
Income from Interest, 1877	1,867,457.
Income from Interest, 1878	1,948,665.
Divisible surplus at 4 per cent., Jan. 1, 1876	$2,499,656.
Divisible surplus at 4 per cent., Jan. 1, 1877	2,626,816.
Divisible surplus at 4 per cent., Jan. 1, 1878	2,664,144.
Divisible surplus at 4 per cent., Jan. 1, 1879	2,811,436.

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ROBERT B. COLLINS,	EDWARD MARTIN,
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JOHN MAIRS,	H. B. CLAFLIN,
DAVID DOWS,	LOOMIS L. WHITE,
HENRY BOWERS,	GEORGE A. OSGOOD,
JOHN M. FURMAN,	WILLIAM BARTON,
WILLIAM A. BOOTH,	HENRY TUCK, M.D.,
WILLIAM H. BEERS.	

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D. O'DELL, Superintendent of Agencies.
CHARLES WRIGHT, M.D., Residence, 109 East 26th St. } Medical Examiners
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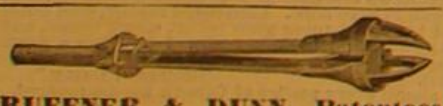

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