

things existing by which frequently as much as twenty per cent of the product was returned as unsalable, because the yeast had contained foreign or unhealthy organisms, and, largely from his suggestions, brewing has since become a series of precise and definite operations, capable of control at every point. Much in the same line were the investigations of Pasteur touching wine and its diseases, to the great advantage of the trade of France and other wine-producing countries.

Next in order of time came the investigations of Pasteur in relation to a plague which broke out among the silk worms in the South of France, on account of which the production of silk in that country had almost ceased in 1865. Pasteur plainly pointed out the cause of the trouble, and the means necessary for the alleviation of its effects and ultimate extermination, the latter, however, being an end which has not yet been reached. Other prominent examples of Pasteur's activity in a similar line, at once dependent on the character of microbes and their propagation, had reference to the chicken cholera in France, which he succeeded in practically annihilating, and another disease particularly fatal to cattle and sometimes to man, called splenic fever or wool sorters' disease. The latter plague had been fatal to millions of cattle, but since the adoption of Pasteur's method of inoculation for its prevention, it has now almost disappeared, and the agricultural insurance societies will not insure cattle unless they have been thus inoculated.

In a summary of the life work of Pasteur, delivered at Birmingham, England, in October of last year, Sir Henry E. Roscoe describes him as "a man devoted heart and soul to the investigation of nature, a type of the ideal man of science—whose example may stimulate even the feeblest to walk in his footsteps, if only for a short distance, whose life is a consistent endeavor to seek after truth, whose watchwords are simplicity, faithfulness, and industry, and whose sole ambition is to succeed in widening the pathway of knowledge, so that following generations of wayfarers may find their journeys lightened and their dangers lessened."

The Accident to the City of Paris.

The inquiry instituted by the London board of trade into the cause of the accident to the Inman line steamer City of Paris has been concluded, and, according to the verdict:

"The primary cause of the casualty was the extraordinary wearing down of the ring in the bracket supporting the extreme end of the propellershaft, whereby the end dropped from its proper position about seven inches, thus producing a bending effect on the shaft at its forward support coexistent with each revolution of the engine. This probably produced a rupture of the external surfaces, gradually extending inward, and finally a total fracture. The cause of the water finding its way into the engine room and other compartments was that a large portion of the low pressure cylinder fell or was driven against the condenser, tearing it away and thereby opening a large communication with the sea, through which the water rushed in such volume that before any of the inlets could be closed they became covered with water and out of reach. The water passed into the dynamo room and port engine room through the bulkheads which were broken by the ruptured machinery, and into the two compartments by the injury to the valve box in the engine room."

The court suggested, as points worthy the consideration of naval architects and marine engineers, but not as intended in any way as an adverse comment upon the vessel, the invention of a governor to control marine engines in the case of similar breakdowns, the desirability of isolating each water-tight compartment as far as possible, and the improvement of the supports of the outboard bearings of long propeller shafts.

The Importance of a Good Specification.

The necessity of having an invention well described and every novel feature of the invention defined in both the drawings and specification preparatory to filing in the Patent Office was well set forth by the late Judge Grier, one of the more distinguished of the patent law judges of the Supreme Court of the United States, when he said, "There are few things more difficult, even for well educated and practical lawyers, than to describe a new invention clearly, and point out the principle which distinguishes the subject of it from all things known before. As inventors are rarely experts, either in philology or law, it has long been established as a rule that their writings are to be scanned with a good degree of charity. But it is easy to abuse this liberality to the purposes of fraud."

A BEET sugar manufactory, with a capacity of 400 tons a day, is said to be almost completed at Grand Island, Neb. The beet has sixteen per cent of sugar, and farmers realize \$60 per acre at \$4 per ton for the root. The diffusion process of extracting the saccharine principle is used. In a fourteen-battery circuit it is claimed that the remarkable result of 99.8 per cent of the sugar can be extracted.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN.

A. E. BEACH.

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MUNN & CO., Publishers,
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NEW YORK, SATURDAY, JULY 5, 1890.

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FIRE CRACKERS.

The stock of fire crackers in this country at the present time is said to be from twenty-five to thirty per cent less than is usual at this season. This shortage is due in part to labor strikes in China, where all the small crackers and most of the large or cannon crackers are made, and also to the imposition by the Chinese government of the *lekin*, or tax, both of which have acted as a check upon manufacturers. Strikes are of frequent occurrence in China, and laborers are thoroughly organized, having what are here called unions and guilds. Strikes are sometimes attended with loss of property as well as of life.

The annual receipts of fire crackers in this country are from eight hundred thousand to one million boxes, and orders for these goods have to be sent forward one year in advance. The Chinese manufacturing year begins June 1, and this is about the date when American merchants send forward their orders for next year's supply. The usual voyage from New York to Hong Kong is 120 days, so that there are only left, after a passage to China and return, 125 days of the year. The ship *Wandering Jew* arrived in New York on April 29 with 135,000 boxes of fire crackers on board, and she is the last ship which can arrive before the Fourth of July, the *Great Admiral*, now on the way, not being due until August 1.

It is, therefore, positively known that there will be a short supply of fire crackers, and this has had the effect of advancing the price from 80c. a box, which was paid last year, to \$1.25 per box.

Crackers are made principally in Canton and in the country surrounding that city. A cannon cracker factory in the suburbs of Canton is described by an eye witness as follows:

The building is of sun-dried brick, with a tiled roof twelve feet from the ground, and this space is divided into an upper and lower apartment, each with the ceiling about six feet high. The interior of the building when visited was strewn with pieces of paper, while vessels containing powder were standing round, the contents of which seemed to be in imminent danger of being exploded, and men, women and children were actively engaged in the manufacture of the goods.

The paper needed for the cracker is cut to the required length and then weighed to see that the quantity for each cracker is exactly the same. The instrument used in weighing is of the rudest description, being a stick about two and one-half feet long, suspended from the ceiling by a string, which is attached to the center of the stick, and a stone is placed as a weight on one end and the articles to be weighed on the other. The paper is rolled into cylindrical form by means of a flat piece of wood held in the hands, and then one end is creased with a pair of pinchers and a string tied into the crease as a temporary means of preventing the powder from running out when the cylinders are placed in a perpendicular position to be loaded. The last named process is as follows:

The cylinders are bunched together like cigars turned on end, and then pinched with an awl, and into the aperture thus made the powder is poured from a tin can. Then the stem of the cracker is inserted, which consists of a piece of thin, tough paper, with just sufficient powder twisted up in it to make it burn quickly. A piece of paper is temporarily pasted over the end containing the stem for the purpose of preventing the powder from running out, as the crackers are now placed on that end.

The string placed temporarily around the pinched end is now removed and clay tamping is hammered into the aperture and then the paper is removed from the stem end and the clay tamping is applied there, which prevents any powder from sifting out.

The cracker is now ready for the thin piece of red paper which goes around the outside and completes it. The stems are then very neatly braided together, which forms the crackers into packs, and these are each wrapped in thin paper and ornamented with a red label with pictures of dragons upon it. Red is the festive color of China, and as fire crackers are used principally on festal occasions, that color is rigidly adhered to in the manufacture of these goods. The packs are placed in boxes and in the proportion of forty packs to the box. There is a regular division of labor in the cracker factory, each person having his or her special work to do, and in this they become very expert.

The above is a description of cannon cracker manufacture, but the same will apply to the small crackers. The latter, however, are generally made in the rural districts, and are brought down the river to Canton in junks.

There is a large home consumption of fire crackers, and the Chinese think that their explosion will ward off evil spirits. They are fired off on numerous occasions, but particularly on the Chinese new year, which is a variable date regulated by the changes in the moon. Foreigners residing at Canton have what they call the Canton salute, which consists in the firing off at one time of six boxes of small crackers and two or three boxes of cannon crackers, and this is given on the departure of some one of their number for home.

Of the million boxes of crackers sent each year to

this country, a number are reshipped to South America, where they are used on social occasions as well as at public fetes. They are used in the south at Christmas time, and also in Canada on May 24, which is Queen Victoria's birthday. Cannon crackers are made in this country, but the small ones cannot be produced here at anything like the price they can be furnished by the Chinese. Their product is carried half way round the world, pays duty, and is then sold for 85 cents a box. In the McKinley tariff bill now before Congress, the duty on fire crackers is placed at 8 cents a pound, which will make the tax 63 cents as against 28 cents a box, which is the rate paid now. If this provision of the new tariff bill is adopted, it will probably have the effect of stimulating the manufacture of cannon crackers in this country.

Fire crackers are of very ancient origin. Dr. Williams in his exhaustive work on China, entitled "The Middle Kingdom," says: "No evidence exists of the use of gunpowder as an agent of warfare until the middle of the twelfth century, nor did a knowledge of its propulsive effects come to the Chinese until the reign of Yunglop in the fifteenth century—a thousand years after its first employment in fire crackers."

SPEED TRIAL OF THE CRUISER PHILADELPHIA.

The new cruiser Philadelphia, built for the government by Messrs. Cramp & Sons, at Philadelphia, has been so far completed as to be able to make her four hours' trial under steam, as required by the contract. By the terms of the latter the vessel was to be capable of making a mean speed of 19 knots per hour during a four hours' run at sea. If she made less, then the contractors were to forfeit \$50,000 for each quarter knot below the standard. If she exceeded 19 knots, the contractors were to receive a premium of \$50,000 for each quarter knot in excess of the standard.

The trial took place on the 25th of June, off the southeasterly end of Long Island, a measured course of forty miles having been marked out for the purpose. The conditions of sea, wind, and tide were as favorable as could be asked. According to all the accounts so far given, the trial was a complete success. It is believed the ship made an average of 19½ knots per hour, and earned a premium of \$100,000 for her builders.

The Philadelphia is an unarmored cruiser of 4,324 tons. There are seven other ships of about the same size, but they are not all yet completed. It is not claimed that any of these vessels is able to fight a modern armored ship. The object in building these cruisers is to provide a fleet of fast vessels having speed enough to keep out of the way of ironclads and overhaul merchant vessels.

The contract price of the Philadelphia was \$1,350,000. She was built from English designs, obtained by the Navy department several years ago, and though she is a good vessel, can hardly be said to represent the latest and best type of cruisers. Her construction was authorized and bids opened in 1887. It has taken not quite three years to build and put her on trial.

A full page engraving showing a portrait of the Philadelphia, and various details representing the mode of her construction, was given in the SCIENTIFIC AMERICAN of August 10, 1889.

How Diphtheria is Spread by Corpses.

Dr. Baker, the secretary of the Michigan State Board of Health, has issued a circular stating that in March two corpses, those of a woman and child of the same family, dead of throat disease, certified by the attending physician not to be "dangerous to the public health," were conveyed from Montmorency County to Lapeer County, Michigan, where in just a week from the day the coffins were opened and the remains viewed a person who was thus exposed came down with diphtheria. Many others, says Dr. Baker, would probably have been exposed except for the action of the local health officer, Dr. C. A. Wisner, who, suspecting that the cause of the deaths was diphtheria, warned the neighbors and forbade the opening of the coffins at the funeral. He promptly isolated the first person that was attacked, and no epidemic resulted. This, Dr. Baker adds, is quite different from the result of a similar occurrence at Zanesville, Ohio, last spring, where many deaths resulted from exposure to a corpse brought from Chicago. It shows the importance of notice to the local health officer of the arrival of a corpse, so that he may take every precaution that may be necessary.—*N. Y. Medical Journal.*

BIBLICAL units have the following equivalents: A shekel of gold was \$8. A firkin was seven pints. A talent of gold was \$13,809. A talent of silver was \$538.30. Ezekiel's reed was nearly 11 feet. A cubit was nearly 22 inches. A bin was 1 gallon and 2 pints. A mite was less than a quarter of a glass. A shekel of silver was about 50 cents. A piece of silver, or a penny, was 13 cents. A Sabbath day's journey was about an English mile. An ephah, or bath, contains 7 gallons and 5 pints. A day's journey was about 23 1-5 miles. A hand's breadth is equal to 3½ inches. A finger's breadth is equal to 1 inch. A farthing was 7 cents.

Ants.

To the Editor of the Scientific American:

An India rubber tree was placed on the lawn of a house which has been inhabited several years. Till the tree was planted there no ants had been seen either inside or outside the house. Soon after locating the plant referred to, millions of ants appeared, and they have increased so rapidly that they have now become a formidable nuisance. No expense or trouble has been spared to get rid of these pests, the nuisance increasing rather than diminishing. The lawn has been resodded, but still swarms of ants infest the premises.

Can any of your numerous readers give me a remedy against this plague, and some information respecting the apparent partiality of these prolific insects for the India rubber plant? None of the adjacent lawns has been invaded, the ants confining themselves to the places on and near where the plant was placed.

C. T.

ANSWER BY PROF. C. V. RILEY.

It is difficult to answer intelligently Mr. Trench's communication in the absence of further particulars, and more especially as no specimens of the ant were forwarded for identification. If the ant is the common house ant (*Monomorium pharaonis*), it is safe to say that there is no connection between the India rubber tree and the prevalence of the insect in and about the house, except perhaps that a colony of the ants was between the roots of the tree when this was transplanted, and that the ants thus became colonized in the vicinity of the house. If the ants belong to some other species, and if it be correct that they were not present before the planting of the tree, the ants are, in all probability, attracted by plant lice or scale insects which infest the tree. In this case the nuisance could be easily abated by killing the plant lice, which is best done by spraying with diluted kerosene emulsion or strong soap suds. The destruction of the house ants, if these have once fairly established themselves in a particular locality, is much more difficult, and I cannot do better than to quote here a passage from a recent paper by myself on household pests, originally published in "Good Housekeeping," May 25, 1889, and reprinted in "Insect Life," vol. ii, No. 4, October, 1889, pp. 106-108:

THE LITTLE RED ANT. (*Monomorium pharaonis* L.)

The "red ant," as this insect is almost universally called, is another of the household pests which we owe to the older civilization of Europe, and, like other domestic pests, it has become almost cosmopolitan. It has been generally considered of North American origin and as one of the few American species which has become widespread in Europe. It is often confounded in the literature of the subject with *Myrmica molesta* Say, which is, however, a synonym. In the larger cities of Europe it is as much of a pest to-day as it is in this country. It probably received the scientific name of "Pharaoh's ant" on account of a defective knowledge of Scripture on the part of its describer, who doubtless imagined that ants formed one of the plagues of Egypt in the time of Pharaoh, whereas the only entomological plagues mentioned were lice, flies, and locusts.

Ordinarily in households this insect is not a nuisance from the actual loss which it causes by consuming food products, but from its inordinate faculty of getting into things. It is attracted by almost everything in the house, from sugar to shoe polish, and from bath sponges to dead cockroaches. It seems to breed with enormous fecundity, and the incidental killing off of a thousand or so has little effect upon the apparent number. A house badly infested with these creatures is almost uninhabitable. They form their nests in almost any secluded spot, between the walls or under the floors or behind the base boards, or among the trash in some old box or trunk, or in the lawn or garden walk just outside the door. In each of these nests several females will be found, each laying her hundreds of eggs and attended by a retinue of workers caring for the larvæ and starting out from dawn till dark on foraging expeditions in long single files like Indians on the war path.

Our first recommendation is to find the point from which they all come. They may have built the nest in some accessible spot, in which case a little kerosene will end a large part, if not all, of the trouble. If the nest is in the wall or under the floor, and taking up a board will not bring it within reach, find the nearest accessible point and devote your energies to killing the ants off as they appear. Where the nests are outside nothing is easier than to find them and to destroy the inhabitants with kerosene or bisulphide of carbon. The nests are almost always in the immediate vicinity of the house. The ants are peculiarly susceptible to the action of pyrethrum in any form, be it Persian or Dalmatian powder or buhach, and a free and persistent use of this powder will accomplish much.

A great number of remedies have been proposed in the household columns of various journals, but nearly all depend upon the use of a mixture of some sort for trapping the ants, and at the best are slow and tedious means of warfare. The best of these with

which I have had any experience consists in placing small bits of sponge moistened with sweetened water in the spots where the ants most do congregate, collecting the sponges once a day or so, soaking them in hot water and then replacing them. Small bits of bread and poisoned molasses or small vessels of lard in which a few drops of oxalic acid have been put have also been recommended, as well as the free use of borax, so often advised for roaches. The people of the Southern States suffer more from these pests than we do at the North, and a Floridian of experience (Mr. C. G. Cone, of Crescent City) recommends a mixture of borax and sugar, well mixed with boiling water, and left here and there on bits of broken crockery. If any one tries this, I should be glad to know the result. A much larger black or brownish ant (*Camponotus herculeanus* var. *pennsylvanicus*) often builds its nests in door-yards so close to the houses that it becomes a great nuisance, overrunning the rooms, and even getting into the clothes, so as to be a personal discomfort. A case was brought to my notice two years ago in Washington, where a fine old homestead was on the point of being sold on account of the annoyance caused by these ants. An investigation showed one enormous nest several feet in diameter in the back yard, and several colonies here and there in other parts of the premises. The large colony was completely destroyed by the use of bisulphide of carbon. A teaspoonful was poured down each of a number of openings, and a damp blanket was thrown over them for a few minutes. Then the blanket being removed, the bisulphide was exploded at the mouth of each hole by means of a light at the end of a pole. The slight explosions drove the poisonous fumes down through the underground tunnels, killing off the ants in enormous numbers. The main source of the trouble being thus destroyed, the nuisance was greatly lessened, and all talk of selling the old place has ceased.

Washington, D. C., June 19, 1890.

Electrical Exhibit at the Brooklyn Institute.

The first annual exhibit of the electrical department of the Brooklyn Institute occurred on the evening of June 21. There were about twenty exhibitors, some of whom had a number of exhibits, so that the hall was fairly well filled with electrical machinery and appliances.

The Edison Electric Lighting Co., of Brooklyn, exhibited a miniature electric lighting plant, showing the three-wire system complete in full operation. Samples of conduits, connections, and other details of the Edison system were also to be seen.

The Perret electric motor was shown in several forms. The Excelsior Electric Light Co., of New York (works in Brooklyn), exhibited a 3 horse arc light motor running a 50 incandescent light dynamo and a 1 H. P. motor. This exhibit illustrated the conversion of a high tension current to a low tension, by the use of a motor and a secondary dynamo. The arc light motor is provided with a very efficient governor, which maintained a uniform speed throughout the evening.

Mr. James Jones, Jr., of the firm of Pearce & Jones, N. Y., exhibited apparatus used in the fire alarm system. This apparatus clearly illustrated the working of this system.

Dr. J. F. Watts showed an improved battery based on the invention of Smee. This new battery is very constant, cleanly and easily managed.

Mr. J. P. Wintringham exhibited apparatus for use in static electricity.

Professor W. C. Peckham had a very interesting exhibit showing the action of a magnet on an electric current. A tinsel cord carrying a current was made to wind itself around a permanent bar magnet, first in one direction and then in the other, by changing the direction of the current. A novel and original experiment shown by Professor Peckham consisted in a suspended disk bearing a series of small bar magnets which were made to revolve around a conductor carrying a heavy current.

Professor P. H. Vanderweyde exhibited and explained several instruments from the large collection recently presented by him to the Institute.

Mr. J. H. Sharpe showed electric gas lighting apparatus in full operation, also a meter gauge for measuring resistances.

Mr. George M. Hopkins exhibited two forms of electrical gyroscope and two forms of Hughes induction balance.

This brief mention does not exhaust the list of interesting apparatus shown on this occasion. The exhibition was very successful, and creditable to those having the matter in charge.

THE State Land Commissioners of New York have granted the applications of the parties interested for river tunnels, namely, the Hudson River Tunnel Railway Company, now in process of construction, for right of way in New York, and the Long Island Railroad Company for right of way in New York for a tunnel to extend under the East River. The commissioners will now appraise the value of the right of way