Varnish for Patterns.

A varnish has been patented in Germany for foundry patterns and machinery which, it is claimed, dries as soon as put on, gives the patterns a smooth surface, thus insuring an easy slip out of the mould, and which prevents the pattern from warping, shrinking, or swelling, and is quite impervious to moisture. This varnish is prepared in the following manner: Thirty pounds of shellac, 10 pounds of Manila copal, and 10 pounds of Zanzibar copal are placed in a vessel, which is heated externally by steam, and stirred during four to six hours, after which 150 parts of the finest potato spirit are added, and the whole heated during four hours to 87° C. This liquid is dyed by the addition of orange color, and can then be used for painting the patterns. When used for painting and glazing machinery, it consists of 35 pounds of shellac, 5 pounds of Manila copal, and 150 pounds of spirits.

The Probert Process.

We glean from the *Mining and Scientific Press*, of San Francisco, the following details of this new process for separating gold and silver from arsenide and sulphites of iron and copper by the use of litharge or lead when in a state of fusion in a certain manner which Mr. Edward Probert, of Eureka, Nevada, has patented, including a method of stirring or agitation of the molten matter by the steam developed in the action of that mass upon certain substances in the following way:

Iron pots, of a conical shape, about thirty inches deep, thirty inches wide at top, and rounded off at the bottom spherically to about twelve inches in diameter, each capable of holding fifteen cwt. (more or less) of the substance to be treated, are coated with a lining of refractory material, composed, preferably, of decomposed or pulverized lava, pumice, or other volcanic rock, but when this is not obtainable, of silicious sand, with a certain admixture of finely pulverized limestone or calcareous marl, to which has been added a sufficiency of clayed water or milk of lime to work the whole into a paste. After laying on this internal coat of refractory material (intended primarily to protect the pot from corrosive action) to the thickness of about three-quarters of an inch, a further portion of a specially prepared composition, consisting of coarsely crushed limestone, dolomite, siderite, or other suitable carbonate, mixed with a sufficient quantity of ordinary composition with which pot is lined to give it consistency, is laid on the bottom of the pot to the thickness of one inch, more or less.

The pots thus prepared are placed in a suitable oven or chamber, or a small fire is placed inside each pot, to dry coating, which, however, is not to be baked so as to expel the last portion of moisture, but only so far as to remove excess of water. When required for use, pots thus lined and partially dried are placed in succession under spout of smelting furnace containing substance to be treated in a state of fusion, which is then tapped into them, while at the same time, or immediately afterward, a charge of lead or litharge, preferably granulated, is fed into each pot from a hopper conveniently placed above.

First effect of molten substance tapped from furnace into pots, is to convert small amount of moisture contained in protective lining of pots into steam, which, rising upward from bottom and the sides, causes a brisk ebullition of molten material. This treatment is insufficient in itself to effect the thorough stirring and blending of the contents of the pot necessary to assure a successful result; but no sooner is this first ebullition, due to the escaping steam, over, than the limestone, dolomite, or other carbonate fixed in the bottom of the pot, as well as the calcareous matter in the whole lining, begins, under the intense heat of the molten charge, to undergo calcination, and streams of carbon dioxide are sent off, which, rising upward through the molten matter, produce the effect of a small geyser. This keeps the charge in a state of ebullition and agitation for a period of time proportionate to the quantity of mineral carbonate or other source of carbon dioxide originally used in preparing the pot, and thus effecting such complete blending and intimate admixture of the ingredients as cannot be attained in any other way.

Duration of ebullition, and consequently stirring process, may be regulated to any required number of minutes, from five upward, or as long as the molten material continues hot enough to exercise a calcining effect on the limestone, etc.; and inasmuch as the carbon dioxide produced comes off in a steady stream without sudden bursts, as from the vapor of water, there is never any danger to the workmen from explosions. After ebullition is over, the pot with its contents is set aside to cool, when the lead settles to the bottom, carrying down with it the precious metals, and, when solidified, the mass of alloy can be detached from the waste matter and treated by cupellation in the usual way for the separation of the silver and gold. It will thus be seen that the stirring is effected partly by steam, which, however, can never be made to do the whole work, being too violent in its action, and causing trouble when too much moisture has been left in the composition, but chiefly by the carbon dioxide ("carbonic acid," so called) developed during the calcination of the limestone or other carbonate employed as the source of gas or vapor.

Railroad Subsidies in Mexico.

A contemporary says that the Mexican press do not look kindly upon the granting by government of subsidies to railroads, and one of them says, what the press might with one accord say here, that "all railway lines which are worth building ought to be able to command private capital to carry them into execution. If they cannot do this, they should not be built at all. It is the height of folly to cover the country with a net-work of 'wild cat' railways which traffic prospects for a half century to come will not justify. Several of these lines might be mentioned, which through their subsidies are in reality built by the government and made a present to the owners."

CHOLERA MORBUS.

The ingenious artistic combination represented in our engraving, is the original drawing of the Italian artist Gallieni; seen at a little distance, it represents a fleshless skull

CHOLERA MORBUS.

with its black eye sockets and grinning teeth; a nearer view of it shows two beautiful children who are playing with their infant toys and caressing the faithful dog, and whose heads occupy the central part of a window.

Gallieni has given to his composition the fearful title of cholera morbus, and he explains it in brief words as follows: Fear increased by the imagination is the best friend of the guest of the Ganges.—*Ilustracion Espanola.*

Luminous Paint.

Luminous paint continues to make slow but steady progress in its application to innumerable useful purposes. Among its most recent applications may be mentioned tapes for field use at night by the Royal Engineers' department. Starting from a given point toward the front, the men leave a trail of luminous tape on their track, and on reaching a given point they mark the contour of the earthworks to be executed by the same means, paying out the tape as they return toward the camp. The working party then follow the outward trail, execute the work, and return to camp without having discovered a single ray of light to the enemy. The German War Office authorities have experimented with the paint for purposes of night attack, and Lieutenant Deppe, of the Belgian School of Gunnery, is investigating its merits in the same direction. Our own government, says the *Building and Engineering Times* (London), are also using painted framed glasses, or Aladdin's lamps, as they are called, for internal boiler inspections. General Lord Wolseley also took with him a luminous compass for the Nile expedition. It has also been applied in some large establishments to the fire buckets, which are thus easily found in the dark. A South-Eastern Railway third-class carriage has the interior lined with the paint on the back of glass.

Fishing in Jalisco, Mexico.

Consul Lambert, of San Blas, gives the following account of the methods employed in fishing in Jalisco. The fibrous roots of a small shrub called *varbasco*, which grows wild in the neighborhood, are procured, and after being well broken up, they are placed in the bottom of the canoes. At high tide the fishermen proceed to the mouths of the *esteros* (small creeks), and erect a wooden fence. They then partly fill their canoes with water, which produces an intensely white liquid from contact with the root. Arriving at the source of the *estero*, or in some shallow places beyond which the fish are not likely to go, the preparation is thrown into the water, which also turns perfectly white. The effect of this is that the fish are blinded, and in a very short time they are found floating on the surface of the water at the fence erected at the mouth of the *estero*. The larger ones are then gathered into the boat, and taken to market.

Another method which is more fatal in its effects, though it is performed less frequently, is the employment of the milk of the *ava* tree. This tree yields, when tapped, a white liquid very much resembling the juice of the India rubber tree. It is used in the same manner as the *varbasco*, and not only blinds, but kills the fish instantly. Fish killed in this manner have to be used immediately. In neither case is there any visible sign of the manner in which the fish have been killed. There is a law in existence against the use of poisons in procuring fish for market, but it is practically inoperative and void, for the reason that there is no defined method for determining the death of fish by these liquids, and the natives who take them in this manner are careful that each fish shows a spear hole in the back before landing it; and in the absence of any method of detection, the spear hole is *prima facie* evidence that they are not poisoned. Consul Lambert says that, as far as he has been able to ascertain, no bad effects from eating fish killed in this way appear to be known.

A Powerful Gun.

M. Dupuy de Lome recently called the attention of the French Academy of Sciences to a new piece of ordnance of superior power which has been constructed by the Societe des Forges et Chantiers de la Mediterranee for the Spanish Government. It is a naval gun of 16 centimeters caliber, having a *bouche a feu* made according to the designs of General Honoria of the Royal Spanish Naval Artillery, and on the principles which the Societe des Forges et Chantiers have laid down to prevent unbreeching. The caliber of the piece is 161 millimeters; the diameter of the powder chamber, 200 millimeters; the length is 5,890 millimeters; the weight, 6,200 kilogrammes; and the weight of the projectile is 60 kilogrammes; the charge of powder is 32·5 kilogrammes; the velocity of the projectile at the muzzle, 632 meters per second; the maximum pressure with the powder used, 2,250 atmospheres; and the maximum thrust along the axis measured at the widest part, 706,000 kilogrammes. The kinetic energy of projectile at the muzzle is 1,222 tonneaux meters, and the ratio of the kinetic energy of the projectile to the weight of the cannon is 197, whereas with the 16 centimeter piece of the French Marine this ratio is only 168, that of the six inch British No. 3 is 168, while the Krupp 15 centimeter gun gives 153 for the same ratio. The recoil lasts for 0·21 of a second, as measured by Sebert's velocimeter, and is limited to 70 centimeters.

A Water Pipe Shock.

A singular occurrence, which is stated to have recently taken place at Ithaca, N. Y., illustrates the dangers attendant upon the universal introduction of electricity. As a lady was turning on the water from the faucet over the sink in her kitchen, using her right hand, her left hand being in contact with the iron lining of the sink, she was suddenly prostrated by a severe shock. Her impression was that she had been stricken with paralysis or apoplexy, but a physician who was summoned found that the inside of the thumb of the left hand had been blistered in several places. This led him to believe that she had received a strong electric shock from some source. A few minutes subsequently the lady's daughter, in drawing water from the same faucet, was similarly affected, though not so severely. The family then became convinced that the trouble existed in the water pipe and sink. The manager of the Telephone Exchange, after a brief examination of the premises, found the secret of the trouble. The residence was connected with the Ithaca Hotel by a "dead" private telegraph wire. This wire had been crossed with the electric light wire. The "dead" wire was connected with the metallic roof on the dwelling house, which in turn was connected by a tin water conductor with the water pipe leading to the sink. When the dynamo machine of the electric light company was in operation, the current passed over the "dead" wire to the tin roof, and thence to the water pipe. It needed only the completion of the circuit by some person drawing water.

Egotism in the Shop.

The opinionated man is likely to be a disturbing force wherever he may be placed, but nowhere is he more objectionable than in the factory or shop. There he is a bar to progress, a foe to improvement, unless perchance the progress or improvement lies in the direction of his own inclination or belief. Every man is entitled to a wholesome respect for his own opinions, but it is stating a self-evident fact to say that no man should consider that he is master of all information on any one given subject. A machinist may be a most excellent workman, and yet there are those who can tell him many things about his work that he never thought of before. An inventor may be very ingenious and have a quite fertile brain, but it is not unlikely that he could find men "within a stone's throw" who could offer him suggestions that would materially aid in perfecting his invention.

It is wonderful how little success will satisfy a man. As soon as certain mechanics are enabled to accomplish a portion of their work with reasonable skill, they at once conceive the erroneous idea that they have nothing more to learn, and assume by this very attitude that they are masters of their art. Upon observing such workmen we are forcibly impressed with the belief that "a little learning is a dangerous thing."

But if egotism is deleterious in the workman, how much more is it so in the manager of an establishment! If the workman is old fogyish he need not necessarily impart his antiquated notions to his colaborers, but if the head of the establishment is such, the whole institution will be more or less influenced by his peculiarities.

The machine shop is a bad place for a man possessing an inordinate bump of self-esteem. He, like the bull in the china shop, is likely to do a great deal of harm. A machinist, above all others, should be a man of enterprise and of broad comprehension. He should be a many-sided man, with a keen observation, and a power to grasp new ideas and make them valuable to himself But when the machinist is a man of one idea, he is likely to stand in his own light and to bar the progress of others who depend upon his judgment An inventor once went to a machinist for assistance in perfecting a new mechanical device. As is generally the case in such an undertaking, grave difficulties were encountered The inventor, at the time when they were attempting to overcome an important obstacle, suggested a somewhat novel way out of their trouble The machinist opposed this course strenuously, because it was one which he had been taught was erroneous He would not listen to reason, and by his persistence caused the inventor to follow his plans, to the former's loss. After experimenting for a long while, the machinist was at last forced by sheer necessity to adopt the inventor's suggestions. Had he been willing to give the hints named a fair investigation, he would have saved the inventor anxiety, labor, and money.

The president of a large manufacturing establishment was showing the same to some visitors, one of whom suggested to him in a spirit of kindness that the design of a part of the plant which was then in process of erection might be improved in a material particular. This suggestion was haughtily rejected with the curt saying that he thought the men in charge knew what they were about. This might be so, but as the suggestion was an important, if not vital, one, the part of prudence would have been to have looked into the matter to see whether a mistake was not actually being made, the party making the criticism being an expert in the business. The manufacturer, it is claimed, by his stubbornness failed to avail himself of a suggestion that would save his company many thousands annually. His self-reliance in that instance cost some one dearly

One should be willing to receive instructions from any reliable source. The adage, "We are never too old to learn," is a good one. In this era of progress, when old theories are daily being shattered, and new ideas enthroned in their place, the man is indeed blind who says that there is none capable of teaching him. Such are not the real master spirits of the age They are the fossils, who only seemingly live. Really progressive minds are as different from them as day from night.—*The Industrial World.*

Increased Duration of Life.

The stage to which we have at present attained may be stated thus: Compared with the period 1838–1854 (the earliest for which there are trustworthy records) the average of a man's life is now 41 9 years instead of 39 9, and of a woman's 45·3 instead of 41 9 years, an addition of 8 per cent to the female life and 5 per cent to the male Of each thousand males born at the present day, 44 more will attain the age of 35 than used to be the case previous to 1871. For the whole of life the estimate now is, that of 1,000 persons (one-half males and one-half females) 35 survive at the age of forty-five, 26 at fifty-five, 9 at sixty-five, 3 at seventy-five, and 1 at eighty-five. To put the case in another way, every thousand persons born since 1870 will live about 2,700 years longer than before. In other words, the life of a thousand persons is now equal in duration to that of 1,070 persons previously; and 1,000 births will now keep up the growth of our population as well as 1,070 births used to do. This is equivalent in result to an increase of our population, and in the best form, viz., not by more births but by fewer deaths, which means fewer maladies and better health. What is more, nearly 70 per cent of this increase of life takes place (or is lived) in the "useful period"—namely, between the ages of twenty and sixty. Thus of the 2,700 additional years lived by each thousand of our population, 70 per cent, or 1,890 years, will be a direct addition to the working power of our people.

It is to be remembered that there might be a great addition to the births in a country with little addition to the national working power—nay, with an actual reduction of the national wealth and prosperity—seeing that, regarded as "economic agents," children are simply a source of expense, and so also are a majority of the elderly who have passed the age of threescore. On the other hand, as already said, only one-quarter of the longer or additional life now enjoyed by our people is passed in the useless periods of childhood and old age, and more than one-third of it is lived at ages when life is in its highest vigor, and most productive alike of wealth and enjoyment.—*Cornhill Magazine.*

THE HARDEN HAND GRENADE FIRE EXTINGUISHER.

In our issue of July 12 we referred to this hand grenade, and gave an account of an exhibition showing its practical efficiency, witnessed by a representative of the SCIENTIFIC AMERICAN. It is at once so simple, cheap, and effective, particularly in the incipiency of a conflagration, that it can hardly be wondered at that it has been imitated by others, and this has caused the company to adopt a patented form of package, besides their former patents on the liquid and solid salts which furnish the fire extinguishing properties.

This new form is represented in the accompanying engraving, showing a bottle with a star in medalion form. The manner in which it is used is, as has been before stated, to simply break the grenade, generally throwing it by hand, "in such manner that the contents will be liberated into the flames." One or more of them may also be hung up around

THE HARDEN HAND GRENADE FIRE EXTINGUISHER.

workshops, factories, or offices in places where any danger of fire may be apprehended, as it takes very little direct heat of the flame upon them to explode the bottles and liberate the fire-extinguishing gases. All managers of fire departments lay great stress upon the importance of checking a conflagration in its incipient stages, and a liberal use of these stationary grenades through buildings generally would undoubtedly prove most efficient in this direction, while those thrown by hand are far more efficient and easily available than any number of buckets of water would be.

In accordance with an order from the Navy Department, Chief Engineer Isherwood made tests of this grenade and reported thereon with great detail in most emphatic commendation of its excellent qualities He says

"The department may have entire confidence in the ability of these grenades to extinguish flame and in very large masses, incipient fires, that is to say, fires just commencing, in which the mass of flame is not great and with not much solid combustible in ignition can be extinguished almost instantaneously and with very little material For the protection of valuable papers and other combustible matter in fireproof buildings, I am of opinion that every room should be supplied with these grenades, and that a proper number should be kept conveniently in the corridors ready for instant use by the watchman There is no doubt the mixture within the bottles will retain its efficiency undiminished during an indefinite period The carbonic dioxide and ammoniacal gases developed from the liquid by heat are the best that modern chemistry can furnish for the extinction of flame"

The New England Fire Insurance Exchange, of Boston, and the Insurance Exchange of Providence, R. I., have practically examined the working of this grenade and highly recommended its general adoption, as have also the officers of a large number of the fire insurance companies of New York and other leading cities.

Combustion of Explosive Gas Mixtures.

Experiments in regard to the flashing temperature of explosive gases, and the velocity with which the flame is transmitted, have been made by Mallard and Le Chatelier.

1. The flashing temperature of explosive gases composed of hydrogen and oxygen being at 550° C., carbonic oxide and oxygen at 655° C., and that of marsh gas and oxygen at 650° C., on adding of a large volume of indifferent gases to a volume of marsh gas and oxygen, the flashing point becomes but slightly altered, while addition of an equal volume of carbonic acid to a mixture of carbonic oxide and oxygen raises the flashing temperature from 655° to 700° C. Marsh gas and air or oxygen intermixed with a neutral gas can be heated for ten seconds at a temperature above the flashing point; the retardation of the ignition increases with the amount of indifferent gas added, and is a maximum at temperatures little above the flashing point.

2. The velocity with which the flame is transmitted depends upon various conditions, the ignition is either conducted from one stratum to one above and below, transmission by contact, or is propagated by means of high pressure, transmission by an explosive wave.

This latter conduction of the flame has been investigated by Berthelot and Nieille The two transmissions correspond to the combustion and explosion of liquid and solid explosives like nitro-glycerine and dynamite Intermediate between both are numerous other modes of transmitting the flame, which depend on accessory conditions and unknown influences. The velocity of transmission by contact probably never exceeds 20 m per second, which has been verified by numerous experiments. The maximal conducting power of a mixture composed of 40 per cent hydrogen and oxygen, the equivalent quantity of hydrogen being 30 per cent, is equal to 4 3 m per second, a mixture of marsh gas and air transmits the flame with a velocity of 0·6 m.; illuminating gas and air with such of 1 25 m., and the gaseous explosive of carbonic oxide and oxygen with a velocity of 2 m. per second. The quantity of oxygen employed in these measurements has been less than its chemical equivalent, and the product of combustion was thus intermixed with a portion of the inflammable gas. The conducting power increases with the initial temperature, and depends upon the width of the tube; by using narrow tubes in the examination of explosive gases with great conducting power, the transmission of the flame is accompanied by irregular oscillations and, when these oscillations follow each other very rapidly, cause diminution and finally extinction of the flame It is at first communicated with uniform velocity, and assumes after some time, which depends upon the conductive power of the explosive gases, a vibratory motion, the report of the flame becomes louder before and after each vibratory period, and, traversing gases of high conducting power, is extinguished before it has reached the final vibratory period.

When the transmitted pressure caused by vibratory motion and extension of the burned gas is equal to that produced by heating the explosive gases to the flashing temperature, the combustion is propagated with a velocity of the compressed wave, we have then a transmission of a flame by an explosive wave

The Influence of Magnetism on the Development of the Embryo.

Prof Carlo Maggiorani has recently read an account of some experiments on this subject before the Academia dei Lincei.

During the process of artificial incubation the author exposed a number of eggs to the influence of powerful magnets. A similar set of eggs, being hatched in the same manner, but kept away from all magnetic action, served as a check. Cases of arrested development were four times more numerous in the first group than in the second. Analogous facts had been previously published in the *Natura* (Florence, 1878). Microscopic examination showed that the sterilization of these germs was probably due to an intense vascularization of the yolk sac.

After the birth of the chickens this increased mortality continued, deaths being three times more numerous in the magnetized group. All the counter test chickens reached their full development, while of the 114 of the first group 60 presented notable imperfections. Their movements were also abnormal. There were three cases of paralysis and two of contractions.

Six of these chickens arrived at maturity. Of these, two were cocks of a splendid stature, and endowed with an insatiable reproductive appetite. With the four pullets it was quite the contrary. One of them never laid at all, and the three others generally produced merely minute eggs (the heaviest weighing only 30 grms.), without yolks, without germinal spot, and, in a word, sterile.

The magnetic influence upon the embryo is therefore evident, and its action upon the structure and the functions of the germ is still manifest when the latter is arrived at maturity.

May we not, to explain this effect of the magnets, suppose an interference between the magnetic vibrations and the heat vibrations which animate the molecules of the fecundated germ, and impel them toward a new condition of organic equilibrium? This influence generally prevents, and more rarely retards, the development of the embryos (hypertrophy in the two cocks, and atrophy in the four hens), and, as interference implies analogy, may we not infer that the vibrations which impel the germ toward its development are analogous to the magnetic vibrations?—*Jour. of Science.*