Messrs. C. and M. C. Jackson, of Denver, Col., have patented a stovepipe that may be adjusted to fit pipes of various sizes, so that one may be telescoped within the other any desired distance to lengthen or shorten the line of pipe and to make a closely fitting joint.

An improved chair brace has been patented by Mr. Floyd Heavener, of Denver, Col. This invention consists in combining with the chair two wires running from the crossbar of the back of the chair down through the seat, and thence to the front corners of the seat, and upward over these wires two other wires are strained, which pass from the two hind legs to the two fore legs.

Cement Floors.

A correspondent of the *Country Gentleman* states how he mixed cement and gravel for cellar bottoms and roads, which stand use and the weather.

In October, 1878, I put down a cement drive-way. The first coat was three and a half inches thick, seven parts of sharp, coarse sand or fine gravel, to one part of cement, thoroughly mixed in a box dry, then dampened with water. I spread it on the ground in sections or squares. As soon as it was set, I put on another coat, one inch thick, of one part of cement to three parts of sharp sand. When that was set, for a finishing coat I put half an inch thick of one part of cement and one part of sand. It will in a week or ten days do to drive over. For my cellar bottom I used five parts of clean, coarse, sharp sand (plasterers call it fine gravel) to one part of cement. This was mixed in the same manner as for the drive-way. It only requires to be damp enough to work well. It was mixed in a box, wheeled into the cellar, dumped, and spread smooth with a shovel, hoe, or trowel, about two inches thick. Take a spade or shovel, flat side, and beat it down hard and smooth. For finishing, use one part of cement to one part of sand; this is thoroughly mixed, and then watered so it is like plastering mortar. Dump it on the first coat, about half an inch thick, spread and smooth with a trowel. It will soon become as hard as stone. The cement I used is known as Portland cement, though I think the common hydraulic cement will answer if fresh.

Cruising for Icebergs.

The early appearance of icebergs in the track of Atlantic steamers, and the imminent risk which these wanderers from the north occasion to navigators and passengers, again call forth the query whether something cannot be done to diminish the hazard of them, if not to destroy them outright. Commander McKay, of the steamship Parthia, suggests that it would be a good plan to detail a government gunboat or two to follow one or more of these icy monsters to study their natural history after they have entered upon their voyage. A record of such observations, he says, would be of priceless value to the navigator, as it would help him to estimate the probable position of an iceberg, so as to avoid it after being told of its position at some previous date. This would give value to the now practically useless ships' reports, signaling, etc. He suggests, also, as has been recommended before in this paper, that gunboats might profitably be detailed to test the effects of shot, shell, dynamite, or torpedoes on these ice masses, and is disposed to think that such treatment might very much hasten the dissolution of the bergs.

For the benefit of readers who are not navigators Commander McKay adds that neither the air nor the water temperature gives the slightest help to the navigator in indicating the neighborhood of an iceberg, except perhaps when there is a fresh breeze blowing directly over it and in a line with the ship, or when there is a change of water temperature crossing its wake. But in the passages to and from America it is usual to cross their track on nearly a right angle. Consequently this last small factor as a guide to its whereabouts is lost. In the early part of last July he passed within three miles of an iceberg with temperature—air, 63°; water, 61°. In the latter part of the same month, 120 miles north and 100 miles east of the former position, he passed quite close to an iceberg with a steady temperature of air 64°, water, 60°.

Ammonia Vapor Engines.

A correspondent of *Engineering* says that one may find the theory of the subject discussed in a paper read in 1867 by M. Frot before the Société des Ingenieurs Civils (Paris), and reported in the *Mémoires* (1867, pp. 671, 688; 1868, p. 170). He might also consult with advantage the references under the entry "Moteurs," in the index to the *Comptes Rendus* of the Paris Academy of Sciences for 1865. See further, *Génie Industriel*, August, 1865 (vol. 30), p. 63, for an account of Delaporte's machine, with historical notices of other inventions; *Génie Industriel*, April, 1867, (vol 33), p. 198; Fromont's ammonia vapor pump; *Annales du Génie Civil* 1865, p. 826; A. van Waeyenberch's engine. Tellier's machine is described in *L'Invention* 1865 (vol. 21), p. 87; and in *Le Technologiste*, December, 1865, p. 149. The use of such engines for driving tram cars is mentioned in SCIENTIFIC AMERICAN, November, 1871, p. 290; *Engineer*, January, 1872, p. 23; Dingler's *Polytechnisches Journal* (vol. 203), p. 234. Joy's engine is described in *Bayerisches' Industrie und Gewerbeblatt*, 1872, p. 153. For an account of Laughland's engine, see *Engineer*, August, 1871, p. 131; *Mechanics' Magazine*, August, 1871, p. 152; SCIENTIFIC AMERICAN, July, 1871, p. 70; September, 1871, pp. 131, 199. See also the "Abridgments of Specifications Relating to Air, Gas, and other Motive Power Engines" parts, 1 and 2, in which he will find a description of all the ammonia vapor engines patented in Great Britain from the earliest period to the end of 1876.

INDIAN FAIENCE.

FAIENCE OF INDIA.

The engraving shows several examples of the curious faience of India, which is remarkable for the simplicity of its design and ornamentation, yet is truly artistic and pleasing. The ornamentation is of the character usually found in Eastern textile fabrics.

ELEGANT CHAIRS.

We give an engraving of two fine chairs from the manufactory of B. Ludwig, of Vienna. The frames are of solid mahogany or of ebonized wood, and the cushions and back are of richly embossed morocco leather.

CHAIRS UPHOLSTERED IN STAMPED LEATHER.

MECHANICAL INVENTIONS.

An improved spring brace for vehicles has been patented by Mr. George W. Cooper, of Pulaski, Iowa. The object of this invention is to brace the springs of buggies and other vehicles against the forward and rearward pitching of the vehicle bodies. It consists in constructing the braces with ball-and-socket joints to give the braces freedom of movement in every direction without employing loose joints.

A steam cock with a self-adjustable check valve has been patented by Mr. William Bronk, of Albany, N. Y. The cock has its rear end threaded to screw into the boiler, and is provided with the valve seat, to which is fitted a valve, which may be closed by the boiler steam and opened by a push pin.

An improved hose coupling has been patented by Mr. John B. Newman, of Milford, Pa. By this device hose or pipe can be coupled or uncoupled more quickly than by any of the devices in general use, and without the use of wrench, spanner, or any other special tool. The construction of the coupling is such that it cannot be described without engravings.

Petroleum and Plant Life.

At the last meeting of the California Academy of Sciences a discussion took place on the subject of the use of petroleum for destroying scale insects on rose bushes. Dr. Henry Gibbons said that two months ago he put petroleum on the trees in his garden. Since then the trees have grown better than ever before, they have grown faster than ever before, and given better roses than ever before. The petroleum seems to kill the scale insect. The handsomest rose he exhibited was from a bush which looked nearly dead a short time since. The petroleum was mixed with castor oil. It is not applied profusely and allowed to run down the roots. Perhaps in a crude state the petroleum would be bad, even on the stalks; but mixed with the castor oil it appears to be advantageous to the plant. The compound does not evaporate nor give out the insoluble portion. Therefore you have a permanent coating, acting on the entire surface of the plant.

Dr. Gibbons exhibited a large bunch of beautiful roses of exceeding fragrance and in full bloom, which he gathered from a bush in his garden which two months ago was overrun with scale bugs and nearly dead.

Now, since using the petroleum and the castor oil, no sign of any scale insect can be seen in the whole garden. He thought castor oil was the only oil that will mix with alcohol, turpentine, and the benzines. It is soluble in alcohol, and when mixed with crude petroleum forms a sort of varnish or cement, which remains on the bushes, and does not fall to the ground. Petroleum, uncombined with castor oil, evaporates swiftly, but when combined forms a useful coating to preserve the plant. Many things have been thus tried. Trees have been whitewashed with caustic potash and lime. One of his rose bushes, nearly ruined by scale insects, thus treated, has borne an unusual number of roses, and a single cactus has borne 200 flowers this season. He thought these were practical facts, and quite as valuable as theoretical ones, although he valued both, and was glad to learn of any experience having a bearing of such importance to the agricultural industries of the human family. He cautioned persons against saturating the earth with petroleum, as such a course prevents future vegetation. Like all things else, its moderate use, wisely directed, is good, and its excessive use is destructive. A grain of opium relieves pain, but its habitual use persisted in brings death.

Dr. Behr said that as the mixture was not soluble in water, if it reaches the earth, it cakes the ground and thus shuts out the air, which must permeate the surface and is necessary to plant growth. A few applications will make rose bushes grow better if sparingly applied, and kill the scale bugs, but if allowed to reach the soil it renders vegetation thereafter impossible in that spot until it is eradicated.

Dr. A. Kellogg thought a simple wash of common lye would at first be sufficient in many cases. Petroleum deteriorates ground for crops. One scale bug has sixty offspring.

Mr. Verder received a large lot of lemon trees from Australia, covered with scale bugs. He applied refined petroleum to the leaves carefully, and they all fell off, but every bug died, and fresh leaves came out, and the plants continued healthy for many years. He afterward applied it successfully to orange trees. He thinks there is a misapprehension among those who condemn its use. It should not be allowed to reach the ground.—*Mining and Scientific Press.*

PURE olive oil will saponify by combination with spirits of hartshorn.

The Largest Anvil Block in the Country.

Mr. C. T. Thompson describes as follows the casting of the large anvil block for the 17-ton hammer, built by William B. Bement & Sons, of Philadelphia, for Park Bros., Black Diamond Steel Works, Pittsburg. Its general dimensions are:

Diameter of cylinder, 40 inches; stroke, 9 feet; diameter of piston rod, 11 inches. The ram is of Krupp steel, 6 feet 6 inches long, 46 inches wide, and 2 feet 6 inches thick. Dies, 32 inches long by 16 inches wide. Weight of falling parts, 17 tons. Frame and legs are of wrought iron. The plates, which are from ⅞ inch to 1⅛ inches in thickness, are riveted together with angle iron, which is, generally, 6x6x⅞ inches. The legs are bolted to frame and bed plate; all the rest of the work is riveted together. Total weight, excluding anvil block, 190,000 lb.

In casting the anvil block there were in use five cupolas, four plain cylinders, 54 inches in diameter, and one Mackenzie. The spouts were joined together by a trough of fire bricks, in cast iron frame; these ran into a large receiver, capable of holding 30 tons. There was another reservoir, capable of holding 20 tons, to be used in case of accident to the first. These reservoirs were built of fire brick lined with fire clay. In the largest reservoir there were two openings, so that a large flow of metal could run out without any danger of not being able to plug them up. The anvil block is 12 feet 8 inches x 10 feet across the bottom; 10 feet high, 3 feet 6 inches x 6 feet across the top, with a recess for the anvil die, the size of which I am sorry to be unable to give. The mould was made so that the top of the anvil block was at the bottom of the mould, so that any dirt or slag could rise to the top, or rather the bottom of the anvil block, so giving a clean face for the die to rest on. The mould was sunk into the ground, so that the top was slightly below the level of the floor. A large plate of iron had been cast to build the mould upon. The outside of the mould was the same as in an ordinary loam casting; then, on account of the intense heat, came two layers of fire brick, and this was covered by half an inch of fire clay, and then blackleaded. The gates were six in number, at different heights, and were about 6 x 4 inches. They were connected by one slightly smaller, so that the iron would not back up and come out of a higher opening. These gates did not chill up, as it was supposed they would, from the fact of such a quantity of iron being poured each time. There were sixteen vents, about two inches square, for taking the gas from the bottom of the mould, but there was very little escape, or rather formation of gas. Around the outside of the brick mould, about a foot from each side, was a sheet iron case, riveted together, and between this and the mould sand was rammed, and then on the outside it was rammed up again, so as to make it a firm and secure backing for the mould. To dry the mould, fires were lighted around the brickwork before it was rammed up, and kept burning for about two weeks, and baskets were suspended, filled with coal. While the drying was going in, the mould was covered by sheet iron plates to keep the heat in.

The fires were started in the cupolas at 5:20 A.M.; the blast was turned on at 6 A.M.; at 6:40 the first iron was run into reservoir; reservoir was tapped about 7:20 A.M., and last run from reservoir made about 1:30 P.M.; the iron, through all the tappings, running very fluid. The mould, or rather, the casting, after having chilled sufficiently to form a skin, was covered with fine charcoal, and then sand, to a depth of about two feet, to be left for four or five months before being uncovered.

Coating of Metals.

To protect metals against the oxidizing influence of a damp atmosphere has long been an object of research of great practical importance. It is well known that a bright sheet of zinc, such as is used in covering roofs, very rapidly gets covered by a thin layer of oxide, and that this thin film becomes so thoroughly united to the metal below that it forms a firm coating and protects the metal against further oxidation. A precisely similar object has been followed by several inventors with regard to iron when they endeavored to provide it with an adhering coating of black magnetic oxide of iron. This, says *Engineering*, was done successfully in 1860 by Thirault, who employed a solution of chloride of iron, which was well rubbed upon the metal and gave it a black luster, when the artificial rust was converted in the black oxide after having been dipped in boiling water. In 1862 a similar result was obtained by Sauerwein, who used, besides chloride of iron, chloride of antimony and gallic acid, while another method was to cover the surface of iron with linseed oil and to expose it then to a dull red heat. By the process of Barff, in 1877, such a coating is obtained by subjecting iron at a dull red heat for six to seven hours to dry steam, when a black fast-adhering coating will be formed. More recently another method, of Mr. Bower, came in use, and it is now carried out on a large scale by a French company, the Société Française d'Inoxidation, which has its works at Val d'Osne. The coating of the iron articles is produced by first cleansing their surfaces and then by heating them in a furnace to a light red heat, when successively currents of carbonic oxide and carbonic acid are passed through it. In this way a bluish-black oxide of iron is formed upon either cast iron, wrought iron, or steel. This oxidized surface, on being polished with oil, takes a beautiful luster, and it is further ornamented by scraping some parts of it free from the coating, which are then either covered with a thin layer of bronze, gold, or platinum by galvanic action, after the invention of M. Dodé. Many articles made by the Société d'Inoxidation, such as statues, vases, fountains, basso rilievos, fire grates, stoves, balconies, candelabra, railings of staircases, and others, are really of a very beautiful appearance.

Teasels.

The teasels which are used in woolen mills for the purpose of raising the fiber out of the yarn when the cloth has left the loom, are a natural product, and not an artificial one, as those unacquainted with woolen manufacture might be led to suppose, and though wire cards have repeatedly been tried for this purpose, says the *Textile* (Eng.) *Manufacturer*, these teasels are still holding their place as the only suitable material for effectually raising the nap without any undue damage to the fiber.

A large amount of teasels are grown in Belgium. They are sown in spring, in August or September they are transplanted, and twelve months after this the first crop is gathered. The heads must be gathered before all flowers have bloomed, else the points are dried too much and lose their elasticity. The older and drier ones are always preferred to the fresh ones.

This plant is found growing wild in Middle Europe, but is then useless for manufacturers because in that state the points are not bent. In England the cultivated plant is grown chiefly in Yorkshire. Russia also raises a good crop in Poland and the Crimea.

The heads, after having been cut off the plant, generally pass at once into the hands of the dealers. The latter, in France, travel in July about the districts mentioned above, and buy the crops in the field, the price averaging from 25*s.* to 60*s.* per cwt. The dealer then sorts the teasels, taking out those which are crooked, too thick, or wormeaten; he removes the husks, cuts the stems to one uniform length, ranges them into first and second qualities, divides these again into eight or ten sorts, according to their length, and packs them into large casks, and sells them at so much per 1,000; a cask of the smallest size holding as many as 150,000, while one of the larger sizes only containing 10,000, but all weigh four cwt. In Russia they are sold by the cask, in other parts of Europe by weight.

As the teasel is a cultivated production of the thistle plant, it follows that its value for manufacturing purposes is enhanced by careful cultivation. The hooks, which are small bent leaflets of the flower, are generally set vertically in transposed rows, though in the French in the form of a spiral round the central cone, and closer at the bottom than the top. This leaflet has a strong rib at its back which is both stiff and elastic; the sides form, so to speak, wings, which are attached to the softer central core, and thus form an elastic spring which enables the hook to spring back in work, each hook also leans against its predecessor, so that when the force which pulls it is too strong, it turns a little sideways, and thus lets the resistance slip off. This is one of the principal qualities of the natural teasel, and has never been reproduced in artificial imitations. In the well-grown teasels the hooks are situated horizontally, and vertically to the spindle, while in the inferior ones they incline as much as 40 degrees.

The French teasels are pretty regular, the hook is horizontal, stronger, and longer than others, and dries better without losing its elasticity; the German kind is less regular or strong, but on that account is often preferred for fine qualities of cloth, which require more careful treatment. Dampness is injurious to all teasels, which soon mould and then lose much of their elasticity.

Glass Making.

A preliminary report issued from the Census Office presents the following statistics relative to the manufacture of glass in the United States for the year ending May 31, 1880, compared with the results obtained by the census of 1870:

	1880.	1870.
Number of establishments	194	154
Employes	23,822	15,367
Capital	$19,415,599	$13,826,142
Wages paid	9,112,301	7,589,110
Materials used	7,991,303	5,904,365
Value of product	21,603,464	18,470,507

The investigation into the growth and extent of this industry included only those works which manufactured glass from the crude material, and not those in which manufactured glass is a raw material, such as manufactories of painted or stained glass, mirrors, chemists' ware, etc.

A Whale Attacks a Ship.

The bark Anna lately arrived here in ballast from London to Read, Lauder & Co., after a most eventful voyage. One of the principal incidents is entered upon the captain's log-book as follows: "February 28, 3 P.M., latitude 42° 31' north, longitude 35° west, hard gale blowing and ship running under lower foretopsail and mainsail, sighted a large whale over bows. The fish bore down on us, and struck ship on the port side of the stern, and knocked the foreport into matches and kindling wood; sounded pumps, but no leak; whale went off, leaving a track of blood behind." Captain McPhail states that he was surprised at the whale dashing right into a large vessel in mid ocean. He says that when he first saw the big fish it was rolling and spouting water 15 feet high. He had not then any idea it would charge his vessel, but soon discovered that the whale meant business. As the whale came on he luffed a little to prevent it from striking the side of the vessel and ripping a plank off. It dashed by and just gave one slap with its tail that fairly knocked the cutwater of the boat off from the 11 inch mark to the keel. He thinks it was stunned and hurt.

Manufacture of Nitro-Glycerine.

E. M. Eissler, in the *Mining and Scientific Press*, gives the following information concerning the manufacture of this remarkable explosive:

The practical production of nitro-glycerine, therefore, is accomplished by the treatment of glycerine with a mixture of concentrated nitric and sulphuric acid, in which treatment the sulphuric acid plays a secondary role, and by the absorption of the eliminated water it maintains the surplus of the nitric acid in a concentrated condition.

Different chemists employ different proportions in their mixtures of nitric and sulphuric acids, and also in adding the glycerine.

In the production of nitro-glycerine there is a very strong elevation of temperature, which must be avoided, as it may lead to explosions. There are also different methods employed to avoid this elevation of temperature.

According to Sobrero, 2 volumes of sulphuric acid of 1·831 specific gravity, and 1 volume of nitric acid of 1·525 specific gravity, are mixed, permitted to cool, and into this mixture half a volume of glycerine, of a very sirupy consistency, is introduced with constant stirring. The mixture is again cooled, and after having become turbid and been separated into two layers, poured into 15 or 20 times its bulk of cold water. The oily nitro compound sinks quickly to the bottom, is freed from unchanged acid and glycerine through repeated washing with water, and hastily dried in vacuo.

Praeger & Bertram add 1 part by weight of glycerine to 8 parts of a mixture of 1 part of concentrated nitric acid and 2 parts of fuming sulphuric acid.

Liebe recommends to pour 1 part by weight of glycerine into a mixture of 2 parts of nitric acid of 1·525 specific gravity, and 4 parts of concentrated sulphuric acid, to keep the mixture below 75° F., and to dry the washed nitro-glycerine in the steam bath. There are various methods proposed, but on working on a large scale, the process is carried on as follows:

The manufacture of nitro-glycerine usually takes place in three wooden sheds of light structure, separated from one another by strong earth banks of 25 to 30 feet in thickness at their base. The walls and roof are lined with straw, and the temperature, by means of hot water pipes, is kept day and night at about 60° Fahr.

In the one shed the glycerine is brought together with the mixture of acids; in the second shed the nitro-glycerine is poured into the water, and otherwise washed; in the third shed the complete elimination of acid from the oily compound is effected, and eventually the nitro-glycerine is worked up into dynamite.

These sheds are sunk into the ground, so that their flat roofs are barely above the level of the ground; they are lit up by reflecting lamps placed outside on the roofs; the floor is covered with fine sand. At some distance from these sheds are the huts in which the cartridges are made. They, too, are separated from one another through earth banks, and so is another shed, in which the packing takes place. Quite away from all these buildings are the storehouses, sunk into the ground. There are usually also cellars for keeping the ice, which latter serves for cooling the wash water. The storing of the raw glycerine and the sulphuric acid requires no special precaution.

Nobel's arrangement for making nitro-glycerine is very perfect, as large quantities can be produced by it at a time, as much as 3,500 lb. in one operation, and to accomplish it, only a few hours are required, and under the supervision of an able man the operation can be considered comparatively safe, as he keeps his mixture cool, and avoids in this way the great danger of the nitro-glycerine igniting and causing explosions. I shall enumerate the way the nitro-glycerine is manufactured in some large establishments on the Continent.

In one of the largest dynamite factories in Europe, where the daily production is over two tons, the nitro-glycerine is prepared in the following manner: 1,300 lb. of nitric acid of the specific gravity 1·48 are mixed in four cast iron pans with 2,600 lb. of sulphuric acid; this mixture, which is left to cool for a day, serves for the treatment of 630 lb. of glycerine. The acid is drawn from the pans into a wooden cylindrical vat, of about 6 feet high and 3½ feet in diameter, lined inside with thick lead, and containing along its lining two spiral lead pipes of about 1 inch diameter, which reach from the bottom to the top. Each of these spirals, or worms, forms a system by itself through which cold water circulates, and one may serve as substitute for the other in case one gets out of order. The mixture of acids is stirred first by itself in this vat; the stirring is effected by two iron disks covered with lead, disk and covering being perforated, which glide up and down on a vertical iron shaft, the gliding motion being effected by pulling the rope attached to the disks over a pulley. The two or three workmen who perform this task stand at a distance of 30 or 40 feet from the vat, behind a strong earth bank. When the acids have been introduced into the vessel, and the agitation has commenced, water of the temperature of about 25° Fahr. is let into the worms. The temperature of the acid can in this way be maintained at about 50° Fah., as may be ascertained from a thermometer which reaches through the lead cover of the vessel into the acid. The glycerine, which is kept in a zinc tank on the roof of the shed in which the mixing vat is, is now allowed to run into the latter vessel. The flow is regulated by means of a tap, and also by letting the glycerine first run into perforated zinc boxes, placed on the lid of the mixing vat, and corking up, if occasion requires, some of the perforations. As soon as the glycerine falls into the acid the temperature rises at once, but by carefully regulating the supply of glycerine it may be kept at about 60° Fahr.

It is advisable not to allow the temperature to rise above that degree, though experience shows that a higher temperature yields a larger quantity of nitro-glycerine. It requires, according to the season and the temperature of the cooling water, two to three hours for 630 lb. of glycerine to pass into the mixing vat; the stirring must not be stopped for a moment during the process. When all the glycerine has been added to the acids, the mixture is at once drawn off through a leaden pipe to the so-called wash shed, where it passes into a tank about 8 feet high and 12 feet in diameter, which is half filled with cold water. The inlet tube carries a sieve to retain lead sulphate that may have been brought from the mixing vat. While the nitro glycerine flows in, stirring with wooden poles is begun, and continued until the nitro-compound has settled below the dilute acid. The bottom of the wash tank is slightly inclined, so as to allow a complete drawing off of the nitro-glycerine. The outlet taps are of stoneware. The nitro-glycerine is now twice washed with water, freed from acid and lead sulphate, and finally washed with water, to which some sodium carbonate has been added.

But even after this purifying process there remain traces of acid. To eliminate these the nitro-glycerine is transferred to a third shed, where it is agitated for about an hour in a rotating vessel called a butter machine, with about 50 lb. of a concentrated solution of sodium carbonate; after this time it will no more redden litmus paper. It is now separated from the alkaline solution, filtered through felt, and collected for further use in leaden reservoirs.

The yield differs greatly according to the condition of the raw glycerine, the concentration of the acids, and the temperature. The yield of nitro-glycerine falls generally below the theoretically calculated quantity. This short-coming is due to the formation of glycerides, which dissolve in the wash water. As a rule, the yielding in winter is greater than that in summer.

The above is a system employed by some continental manufactures, and, notwithstanding the precautions taken against the accidental rise of temperature during the production and washing of the nitro-glycerine, some very serious explosions during its manufacture have not been unfrequent; but Nobel has adopted a method of operation which, so far as experience goes, appears not to involve any special elements of danger if properly applied, and also presents advantages from an economical point of view, besides promoting the attainment of uniform results; and to his credit it must be said that when he made his first trial with his new apparatus he certainly exhibited a great deal of boldness and pluck, as it was a question of converting several hundred-weight of glycerine into the explosive compound in a single operation. His mode of operation is successfully carried out by the Giant Powder Company of San Francisco. The plan pursued by some of the other companies established near this city differs somewhat in its arrangement.

A series of small iron kettles, or pots, are arranged in a trough, each provided with a stirrer, which receive their movement from a common shaft, which is revolved by a man stationed outside of the building. The pots are charged with the acids, and the glycerine is supplied either from a common reservoir by small outlet pipes, or above each pot is a small vessel containing glycerine, from which the same runs in a small stream into the acid mixture.

The iron pots are surrounded by a running stream of cold water while the reaction is going on, and stirring has to be constantly kept up. After the reaction is complete the pots are taken up and their contents dumped into large tanks filled with water, where the nitro-glycerine separates and is afterwards washed.

As simple as this operation may appear, the writer earnestly warns anybody who is not experienced in the matter to undertake any trials, as there are points connected with the manufacture of nitro-glycerine which can only be acquired by practical experience, and even then it is fraught with danger.

At G. M. Mowbrey's factory, near North Adams, in Massachusetts, the nitrification of the glycerine takes place in stoneware jars. 116 of these are distributed over 9 wooden troughs, which latter are filled to within a few inches from the top of the jars with ice-cold water, or a mixture of ice and salt. Each jar receives 17 lb. of acid mixture, and into this 1 lb. of glycerine is introduced, drop by drop, from glass vessels, which are placed on a shelf just above the acid jars. Below this shelf runs an iron tube, about 1½ inch diameter, through which cold, dry air is conducted. From this tube glass pipes branch off, joined by means of India-rubber tubes, into each jar, which thus receives, during the dropping of the glycerine, a constant current of cold air, acting both as cooler and as stirrer. Very beneficial influence is ascribed to this air current, which oxidizes also nitrous acid vapors.

The introduction of the glycerine into the acid must be finished within one and a half hours. There should be no rise of temperature, and certainly no appearance of red vapors. After the transformation of the glycerine, the jars are emptied into troughs containing water of 70° Fahr.; the nitro-glycerine sinks to the bottom and remains covered with about six feet of water, for a quarter of an hour, when first the water is drawn off from above, then the nitro-glycerine from below. The latter is transferred to oscillating casks, in which it is washed three times with water, and twice with soda solution, a current of air passing through the liquid all the time. The wash waters pass into a tub, from thence into two casks, sunk into the ground, where such nitro-glycerine as had been carried away by the water is retained. (The writer considers Mowbrey's plan very good, and strongly recommends some of its features to the consideration of nitro-glycerine manufacturers.)

The nitro-glycerine is carried in copper vessels to a shed, about 100 yards distant, and poured into stoneware jars (the writer objects to the employment of stone, porcelain, or such like ware for handling made nitro-glycerine; he would recommend vessels of India-rubber or paper, or something which does not break or leak) of 60 lb. contents, and the jars placed in reservoirs filled with water of 70° Fahr., and left here three days. Impurities rise to the surface, and are skimmed off.

The nitro-glycerine is now ready for commerce. It is filled in canisters of galvanized sheet iron, coated inside with paraffine, and capable of holding 56 lb. The floor of the shed where the filling takes place is covered with a thick layer of calcined plaster of Paris, in order that any spilled nitro-glycerine be absorbed at once. The canisters are then exposed to the cold of ice and salt for the sake of freezing their contents. In this state they are stored, 30 to 40 to a batch, in magazines at least 100 yards from all the other buildings of the factory. The transport of this nitro-glycerine takes place also while it is frozen.

Nitro-glycerine is an organic poison. It produces serious consequences when taken into the system—vertigo, weakening of sight, stupor, pains in the cardiac regions; in larger doses it acts like strychnine, being fatal when more than 10 grammes are swallowed. Even mere contact with the skin produces serious symptoms, though workmen get used to it after a time. In external contact, the nitro-glycerine may be of serious consequences if it is taken into the blood; so workmen, if they have sores or wounds on their hands, must be extremely cautious in handling it.

At ordinary temperatures it is an oily liquid, clear, colorless, or yellowish, refracting light, of sweetish and burning taste, without odor, of 1·6 specific gravity. It solidifies at a comparatively high temperature—40° Fahr. In water it is insoluble, but dissolves easily in ether, wood spirit, benzole, chloroform, and hot alcohol.

Pure nitro-glycerine does not decompose spontaneously at ordinary temperatures. Up to 120° Fahr. its loss is hardly perceptible by evaporation. By gradual heating in inclosed vessels up to 212° Fahr., it can be kept in that state for several days without explosion. If the heating is continued gradually and slowly up to 400° Fahr., it commences to decompose and loses its explosive properties. A sudden and quick heating to 380° Fahr. will explode it. The gases resulting from the explosion are: carbonic acid, water vapors, nitrogen, and oxygen, and combinations of the latter two elements.

Theoretically the explosive force of nitro-glycerine as compared with gunpowder is stated to be as 1 to 10, but in practice this figure is much lower, and different experimenters give different opinions. Putting a light directly to nitro-glycerine does not lead to detonation, but it is very dangerous to set fire to it, as in bulk the fire may heat the mass to its exploding temperature and lead to disastrous results. Some writers assert there is no danger if any amount of nitro-glycerine is set on fire. They say it will burn away quietly long before it is heated to the degree at which it explodes.

If heated in a closed space it explodes violently.

If it is exposed for some time to a strong heat, like in a tropical climate, it becomes very sensitive, owing to a partial decomposition; then any concussion, increase of temperature, or strong vibration in the air, will explode it.

Electricity will explode it. By putting the two poles of an electric battery into the fluid, and passing the sparks between them for some seconds, the surface of the nitro-glycerine becomes agitated, turns black, and then it explodes.

Mr. Abel says that nitro glycerine explodes by electricity or any other influence which produces heat; only then, when the intensity of the same or the time during which the same acts, is sufficient to produce a decomposition of a portion of the liquid, and if this decomposition has once commenced, the temperature rises by accumulation of heat to such a point as to cause its explosion.

Nitro-glycerine explodes by a blow or concussion, but gradually increasing pressure is unable to explode the liquid, but if a blow is given to it with sufficient vehemence and quickness, so that the force of the stroke will produce a sufficient heating point, then the particles struck will explode.

At about 32° Fahr., nitro-glycerine becomes solid, and when exposed to that temperature for some time it becomes a hard substance. In this condition it is hard to explode, even with the fulminates (caps). Although in a frozen condition this substance is considered much safer than in its liquid state, it has still to be treated with due precaution.

Several accidents are on record where, in Europe, the frozen stuff was broken with a pick, and these accidents have proven that, although frozen nitro-glycerine is hard to explode with a cap, it will nevertheless explode easily when struck heavily with a sharp-pointed instrument. For instance, take a pick with a sharp point, of 10 lb. weight, and strike it against a hard rock with a velocity of 20 feet per second, and if there is any nitro-glycerine at the point of contact, this blow will exceed by far in intensity the concussion produced by an exploding triple-force cap, and consequently detonate the nitro-glycerine.

An Electric Railway in London.

One of the novelties at the Crystal Palace on Easter Monday was the opening of an electrical railway, constructed by the Société Anonyme d'Electricité, of Brussels, on the Siemens system. On the upper terrace of the Palace grounds, overlooking the charming scenery of Sydenham, a miniature circular line of railway, consisting of three lines of metals, has been laid down, surrounding one of the ornamental ponds, and a small wooden hut erected beside it as a passenger station. On this railway, which is about 300 meters in length, and has a gauge of about 50 centimeters, or 19 inches, between the outer rails, stands the electrical locomotive. Its length is about four feet, its breadth about a meter, its height about as much, and its weight some three-quarters of a ton. It is, in fact, a Siemens dynamo-electric machine, neatly boxed in, and mounted on a truck with four metal wheels, and provided with a brake and alarm bell for its control by the man in charge. A stationary engine of about eight horse power nominal, in a shed about thirty yards from the railway line, drives a stationary dynamo-electric machine, from which the electro-motive current is primarily obtained. Two wires are connected with this fixed dynamo machine. By one of them the current flowing out is conveyed to the mid-rail of the railway, to which it is attached by an iron plate bolted on. The second or return wire is attached to the exterior rail of the railway. The mid-rail is supported upon wood blocks, and is thus in a certain degree insulated.

Beneath the electrical locomotive a brush of iron wires sweeps the mid-rail, and the electrical current is thus taken up into the locomotive, where it passes through the mounted Siemens machine within it, the large bobbin of which is thereby caused to revolve, and the current passing away by the wheels of the truck to the exterior rails of the road, is conveyed back to the stationary dynamo-machine. As the current thus circulates, and the bobbin of the mounted machine revolves, it drives the four wheels of the truck as the locomotive moves on, hauling after it a load of nearly three tons with ease at the speed we have named. The electrical locomotive is easily managed; by applying the brake the electro-motive current is cut off as a driving power, while the wheels are at the same time mechanically skidded. By reversing the current the locomotive can be driven in either direction, as desired. The circulation of the electro-motive current from the stationary dynamo-machine to the mid-rail, and from the mid-rail to the locomotive, from it again to the outside rail, and from it back to the fixed machine, depends entirely upon the superior conductivity of the metallic wires and rails over the conductivity of the earth; and this mode of driving the electrical locomotive seems to make such a system open to difficulties upon railroad lines of any considerable length.

Cod Liver Oil.

Under the heading of "Practical Notes," Mr. R. B. Fairthorne suggests, in the *American Journal of Pharmacy*, a new method of taking cod liver oil. As the use of this remedy is at the present time more extensive than ever before, any means employed whereby it can be more readily taken without causing disgust will prove of service to sufferers who have to use it daily. Mr. Fairthorne's method consists in adding two drachms of tomato or walnut catsup to each ounce of the oil, the mixture being well shaken whenever required for use. He has found this mixture to agree with many persons much better than any other form in which cod liver oil has been taken, and this he attributes to the association of substances generally employed as additions to food, bringing into operation those digestive faculties of the stomach which might otherwise remain dormant when such incongruous substances as sugar and one of the principal ingredients of fish are introduced together into the stomach. Mr. Fairthorne also states that the following forms a not unpalatable mixture, which is readily taken by the patient: Liebig's extract, ½ ounce; extract of celery seeds, ½ fluid drachm; vinegar, 1 fluid ounce; water, 2 fluid ounces; cod liver oil, 5 fluid ounces. The extract of beef is to be dissolved in water, and the oil and vinegar to be added and shaken well together with the extract of celery.

The Horse Power of the World.

It has been estimated that, in 1878, on the 270,000 miles of railroad, there were at work 105,000 locomotives, of an aggregate 30,000,000 horse power, while the total number of engines amounted to 46,000,000 horse power. Taking the nominal horse power at an effective force equal to that of three horses, and the work of a horse as equal to that of seven men, it will be seen that the steam engines represent the force of nearly 1,000,000,000 men, which is more than double the amount of workers on the face of the globe. The steam engine, which is fed by coal, has, therefore, tripled the productive power of man.