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 ft. in thickness at theis 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 store-houses, 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 lbs. 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 lbs. of nitric acid of the specific gravity 1.48 are mixed in four cast iron pans with 2,600 lbs. of sulphuric acid; this mixture, which is left to cool for a day, serves for the treatment of 630 lbs. of glycerine. The acid is drawn from the pans into a wooden cylindrical vat, of about six ft. high and three and one-half ft. in diameter, lined inside with thick lead and containing along its lining two spiral lead pipes of about one 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 ft. 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° F. is let into the worms, the temperature of the acid can in this way be maintained at about 50° F., 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 lbs. 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 eight ft. high and 12 ft. 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. Whilst 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 sodium carbonate has been added to neutralize free acid which may be present.

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 lbs. of a concentrated solution of a 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 conditions 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 a glycerides, which dissolve in the wash water. As a rule, the yield in winter is greater than that in summer.

The above is a system employed by some continental manufacturers, 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 Co., 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 not 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.

In the next issue, Mr. Mowbrey's of Mass., process of manufacture will be given, as it has certain features worthy of note. —*Mining and Scientific Press.*

Two ingenious pieces of electrical apparatus for lighting and extinguishing lamps have recently appeared. In one of them (M. Margret's system) the oil lamp stands on a base in which is a horizontal electro-magnet. From the armature of this rise two parallel curved rods of copper, joined at the top by a platinum spiral, which is rendered incandescent by a battery current and brought in that state to the wick, when the armature is attracted. In this movement towards the wick, a small bellows is compressed, giving a puff of air through a tube rebounding on the wick. In the case of lighting the lamp, this puff has no effect, but when the lamp has been burning, and is to be extinguished, the puff produced by a momentary passage of the current blows the flame out, and there is not time for the spiral to relight the lamp. In the other system (that of M. Ranque), a platinum spiral is brought to the wick, much in the same way, but the lamp is put out by an extinguisher at the end of a curved and pivoted wire. The contrivance is such that the extinguisher is brought down to the wick, or raised from it (through attraction of the armature) according as the flame is to be put out or lit. (Both lamps are figured in *La Nature*, No. 404.)