EXPLOSIVE COMPOUNDS FOR ENGINEERING PURPOSES.

NO. III.

During the year 1866, a new kind of blasting powder, which promised to supersede gunpowder in mining operations, was introduced to public notice in England. This was the invention of M. Gustave Adolph Neumeyer, of Taucha, Saxony, and to which the term "inexplosive" may appropriately be applied, inasmuch as there is no possibility of its exploding, either during its manufacture, storage, or manipulation. Not until the proper moment of ignition arrives, when it is well rammed home and prepared to do its work, is its energy developed. Then, and only then, it manifests a power, when used weight for weight, considerably in excess of that possessed by gunpowder. M. Neumeyer, all his life connected with the management of quarries, and himself the possessor of a quarry near Taucha, had his attention forcibly drawn to the distressing accidents, which are of such frequent occurrence in blasting operations, and he conceived the idea of producing a blasting powder which should combine the desired degree of strength, with perfect safety when in work. After a long series of trials and experiments, he succeeded in effecting his object, by the invention of a powder which unites in itself the above important qualities. Within two years from the date of his discovery, M. Neumeyer was manufacturing this powder on a large scale; extensive mills with steam power having been erected for its production in the city of Altenburg, and in two other places in Germany.

Although Neumeyer's powder differs in color as well as in action from gunpowder, in that it is slow burning instead of violently explosive when in contact with air, it is composed of precisely the same materials as ordinary gunpowder. To these no other substances are added, the whole secret of the extraordinary result arising simply from the method of proportioning and compounding the ingredients. A reduction is made in the amount of sulphur employed, by which means a much smaller quantity of the noxious vapors is evolved on its ignition than is produced by the combustion of ordinary gunpowder—a point of great importance in underground mining operations. Some difference is made in its preparation, according to the use for which it is required, whether for military or for mining purposes. As a consequence, there results, in the former case, a powder which, when hermetically confined, explodes at the same temperature as ordinary gunpowder, while when prepared and charged for blasting purposes, it requires a somewhat higher temperature. This, so far from being objectionable, is positively advantageous, inasmuch as it makes the possibility of accidental ignition more remote. Bickford's safety fuse, which is now so extensively used in our own and continental mines, is best adapted for the ignition of this powder. Another important feature in Neumeyer's powder is, that although no coating or glaze is imparted to it in manufacture, it is not more hygrometric than ordinary gunpowder, while, if wetted and dried, it is said to retain all its good qualities in full force. Ordinary powder is more powerful as the size of the grain is increased, but Neumeyer's powder, when in a condition of fine dust, is equally if not more efficient than the other. From what has been said, it will be seen that the new gunpowder embodies safety in manufacture, in transport, and in handling, preparatory to actual use; while it has been proved to be superior to ordinary gunpowder, in point of effective power, so that it may fairly be said to be a safe and efficient substitute for our old powder.

In support of the above assertions, both of its inexplosiveness and explosiveness, the author would observe that he has made some trials, which proved conclusively that Neumeyer's powder possessed both those qualities. But as a greater value attaches to trials made publicly, and the results of which have been placed publicly on record, the author prefers to give these in place of his own limited experience of this powder. First, then, as to its inexplosiveness. This was proved by several experiments made in the grounds of the Crystal Palace in December, 1866. The most conclusive test of this quality of the powder was the following:—A small house, 5ft. square, built of brick and roofed with slate, and having two chimneys made of 5-inch drain pipes, was constructed, and in it 35lbs. of Neumeyer's powder, half blasting and half gunpowder, were placed. On firing this mass an immense body of flame issued through the openings in the roof, but the powder simply burned, and moved neither brick nor slate. On 3lbs. only of ordinary gunpowder being placed in the same structure and ignited, a violent explosion took place, which rendered the building a mere wreck

With regard to its explosiveness, the author has a number of authenticated reports of numerous and varied trials illustrative of this quality. A few are selected which have been made in mines and quarries in England. The first trials to be noticed were made on the 4th of December, 1866, at the Bardon Hill and the Markfield Granite Quarries, situated near Leicester, and owned by Messrs. Ellis and Everard. The rock at Bardon Hill, which is of a very hard and stubborn character, was rent and cracked in a most satisfactory manner, and a large quantity of material was thrown down, the results being considered highly successful. At the Markfield Quarry one hole was bored horizontally at the foot of an unbroken face of a large extent of solid rock; others were bored vertically. On firing the horizontal hole, the face of the rock was blown out to a considerable extent in every direction, and an unusually large amount of stone was displaced. The vertical shots proved equally successful, and the results generally were highly satisfactory, the quantity of the new powder used being less than that of ordinary powder required for the same amount of work. In a hard, compact rock, too, such as at Bardon Hill, the effect produced by a given quantity of the new powder is much greater than that produced by an equal quantity in a soft or loose rock. It may be as well to mention here, that, bulk for bulk, Neumeyer's powder, when well tamped, is equally as strong as if not stronger than ordinary powder; while weight for weight, Neumeyer's powder is the stronger of the two. In point of weight, the new powder is one-sixth lighter than the old, which, supposing we take them at even prices, gives over 15 per cent advantage to the former, owing to the fact that bulk for bulk (or one-sixth less weight) gives an equal, if not a superior result, to the best ordinary power.

Having seen the successful action of the powder upon granite, we will now notice its behavior in slate quarries. On the 11th of December, in the same year, five shots were fired at the quarries of the Welsh Slate Company, Rhiwbryfdir, Carnarvonshire. The first shot was in hard rock, the hole being 2ft. 6in. deep, and 1¼in. in diameter; 21in. of the new powder were used, and found to do more work than the same bulk of ordinary powder. The second shot was fired in a hole of the same diameter as the last, but 3in. deeper, cut in the same description of rock; the same depth of powder was used, the result being similar to that obtained with the first shot. Shot No. 3 was in a hole 3ft. 6in. deep, by 1¼in. in diameter, the material bered being pure slate or pillaring rock; the powder filled the hole within 1in., which was occupied with the tamping. The result of this shot was the discovery that the powder was much too powerful—a fault certainly on the right side, and one easily remedied. The next hole was in the same rock as the last, and was 5ft. 8in. deep, with 4ft. 6in. of powder and a light tamping; this gave exceedingly satisfactory results. In another 1¼-inch hole, 4ft. 6in. deep, 2ft. of powder were used, with 2ft. 6in. of hard tamping; the result of this shot was decidedly good, the rock being shattered. On the following day three more experiments were made at the same quarries. With 2ft. 6in. of powder in a 1¼-inch hole, 3ft. 6in. deep, the shot proved much too strong. The second shot was highly satisfactory; but in the third too much power was again developed

The general result of these experiments is to prove that, bulk for bulk, Neumeyer's powder is much stronger than the powder in ordinary use at these quarries, and which was of the very best description. The question, therefore, arose as to how the strength was to be reduced when pillaring. It was proposed to have paper cartridges of much smaller diameter than the holes, and which would hold only about one-third or one-fourth of the present charge of powder. These cartridges, it was believed, would answer the purpose exceedingly well in the pillaring rock, where it was desirable to cleave the slate without fractnre, and would beside produce a very considerable saving of powder.

A few days after the foregoing experiments, a series of trials were made with the new powder at the slate quarries of Messrs. Matthews & Sons, at Festiniog, Merionethshire. Here two holes 2ft. deep, in a hard rock of an underground chamber, each half filled with Neumeyer's powder, and two similar holes in a slate rock, were fired with perfectly satisfactory results. Two more shots in the hard rock of the tunnel were not quite so successful; but it was owned that the tamping had been imperfectly rammed, the man having fired them before they were inspected. The two next shots were stated to have done as much with 11in. of Neumeyer's powder as with 15in. of ordinary powder. In another hole, in very hard rock of the tunnel, the result was completely successful, it being stated that with ordinary powder two holes would have been necessary, or the shot would not have succeeded in effecting the required detachment. A 1¼-inch hole, 8ft. deep in hard rock in the open air, was charged with 4ft. 6in. of powder. This shot was considered very successful, for although not much rock fell, an enormous bulk was loosened, which was readily brought down with a small blast of ordinary powder placed in the rent. Experiments have since been made in various collieries to test the capabilities of this powder in the working of coal, and the results have been exceedingly satisfactory, and have fully borne out the expectations formed. Experiments in the copper mines of Cornwall have also given similar results.

THE EFFECT OF LIGHT ON MINERAL OILS.

Herr Geotowsky, at a recent meeting of the Society for the Advancement of the Manufacture of Mineral Oils, in Halle-on-the-Saal, Prussia, made some remarkable communications on a new property of photogenic hydrocarbon oils, discovered by by him. In exposing various kinds of such oils to the rays of light in glass balloons, he invariably found that the oils absorbed oxygen and converted it into its allotropic condition, ozone. It was found that the air was even ozonized in well-corked vessels, the effect being to some degree also dependent upon the color of the glass. The respective results were marked down after the space of three months. Before enumerating them, it is perhaps appropriate to remark that by "photogen," oil from peat or bituminous coal is meant, which distills between a temperature of 212° and 550° Fah., and is of a specific gravity of from 0·795 to 0·805. The term "solar oil," is given by the Germans to oils having a specific gravity of from 0·830 to 0·835 and distilling above the temperature of 550° Fah. The former is burned in lamps adapted for that object, the latter in Argand or Carcel lamps. The observations of Herr Grotowsky are the following:

1. Photogen and solar oil stored in barrels and cisterns, lined inside with iron, remained free from ozone and burned faultlessly.

2. Photogen and solar oil kept in balloons of white glass, wrapped up in straw, showed traces of ozone but burned well otherwise. Both the color of the oil and that of the cork were were found to be slightly changed.

3. Photogen and solar oil in balloons of white glass, which were painted black, exhibited traces of ozone, but the oils were less changed than in experiment No. 2. The corks were not bleached

4. Solar oil and photogen in unwrapped and white glass balloons, which had been kept outside, gave very strong indications of ozone. They burned very badly, charred the wick, and nearly extinguished the flame, after burning for six or eight hours. The solar oil was turned to a deep yellow, and showed an increase of 0·003 in its specific gravity.

5. Solar oil which had been exposed to the light in unwrapped balloons of green glass, gave also strong indications of ozone, though the wick charred it burned well. The color had been little changed.

6. Solar oil in green balloons, painted black, proved to contain some ozone. It burned, however, perfectly well.

7. Solar oil in green balloons, wrapped in straw, gave indications of traces of ozone; it burned like the former. Color slightly bleached.

8. American kerosene, which had been exposed to the light in white and unwrapped glass balloons, had become strongly ozonized, so much so that it scarcely burned. The originally bluish white oil had assumed a vivid yellow shade of color, and the specific gravity was found to have increased for 0·005.

9. American kerosene, which had been kept in the dark for three months, did not show any ozone and burned perfectly well.

The oils had been exposed from April to July, 1868. Those which had become strongly ozonized smelled otherwise than before, and the corks had become bleached as if attacked by chlorine, while those of the unaltered oils had also remained unchanged.

Though the experimenter favors the opinion that the oxygen of the air, in being absorbed by the oil and converted into ozone, does not effect any chemical change, but remains simply absorbed, it cannot be seen why such oils should deposit carbon when burned. They should, on the contrary, burn better. According to Dr. Ott, of this city, there is only only one case possible by which we may account for the decrease in the illuminating power; it is this: The ozone seizes a part of the hydrogen and forms water therewith, while a higher carbonated oil remains. Vohl, a German chemist, expressed the opinion, years ago, that the depositing of soot is invariably caused by an admixture of carbolic acid. If this is taken for granted, it would have to be admitted that a part of the hydrocarbon is directly oxidized by the ozone. This, however, is impossible, as any chemist will admit who is acquainted with the chemical constitution of carbolic acid. Dr. Adolph Ott gives a ready means for ascertaining whether a photogenic hydrocarbon oil will deteriorate in time or not. This test is based upon the property of nascent chlorine gas to act in the same manner as ozone does, which action, however, takes place in a much shorter space of time. In order then to test the oils, it is prescribed to measure equal quantities, say ten ounces of each. Take as many flasks as you have samples of oil, cover the bottom of each, when flat, to the length of one-tenth of an inch with black oxide of manganese, or take otherwise a corresponding quantity of it. Add now so much of strong muriatic acid as will cover the manganese to twice the hight indicated. Fill, finally, the flasks with the oils, and set them on a heated sand bath or in some other warm place, until the generation of gas ceases. Separate now the oils from the residual manganese, and shake them well with warm water before applying them to the burning test.

India-rubber Soles for Boots and Shoes.

A method of making india-rubber soles for boots, etc., has been patened, and consists in applying to a linen cloth india-rubber dissolved in naphtha, camphine, or other suitable solvent. With this india-rubber solution is mixed whiting, sulphur, litharge, or white lead, calcined magnesia, lampblack, and clay, in the following proportions: Four pounds of rubber, two pounds of whiting, one pound of sulphur, one pound of litharge, one-half pound of magnesia, one-half pound of lampblack, and two pounds of clay. When sufficient of this compound has been applied to the cloth, it is passed between rollers, the surface being sprinkled with French chalk to prevent adhesion. Patterns can be imprinted in this manner by the use of an impression cloth, or the surface can be simply roughened. The sheet should be exposed for three hours and a half to a temperature of 60° Fah. The impression cloth is then removed from the surface of the india-rubber. The cloth on which the india-rubber was first spread can be removed, by moistening it with warm water, naphtha, or camphine. The sheet of prepared rubber can be then cut into any desired forms

India-rubber Tubing.

Ordinary vulcanized india-rubber tubing becomes saturated with gas, which again evaporates at its outer surface, causing a most disagreeble smell. An invention for the prevention of this, by coating the india-rubber tubing with a varnish, has been made in England. The chief novelty in it is that the varnish is easily made, and it renders the substance of the tube impervious to gases. The varnish is composed of linseed oil, fine litharge, or white lead, in the proportion of one quart of oil to one pound of litharge. These substances should be well boiled together until brought to a proper thickness or body, and while hot the composition is applied by running it through the tube to be coated or lined. The varnish for the outside is made by mixing one quart of linseed oil with half a pound of litharge, and by adding to the same about a gill of gold size, these ingredients should be well boiled together, and while hot should be applied with a brush or a sponge.

IF a shaft springs in running one of three things is certain to occasion the difficulty; either a too small diameter of the shaft for its weight and velocity, a set of unbalanced pulleys, or an unequal strain on either side by the belts. Either of these may be remedied.