

which it has the most liberty. The center of the solid metal, between the hole and outside, is the strongest section; and taking that as a line, the outside metal is forced outwards in all directions, expanding the metal outside of that line, while inside of the line it is compressed. The diameter of the hole is reduced in order to make room for the expansion. There must, however, be two such sections or lines, one the center of the strength lengthwise of the metal, and the other the center of the strength diametrically of the piece. If our piece of work had no hole in it, all the expansion would take place externally.

In turning bolts in the lathe many workmen make an allowance for swelling in hardening, and they hit the mark remarkably successfully as a rule, though I never heard of any rule to go by, for it is different in different diameters. Care must be taken to allow little enough, because a hole too small may be lapped out, whereas one too large is a proportionately spoiled job. Small work swells by hardening more in proportion than larger work. What the proportion is, and whether it all increases uniformly, I have never kept any notes to indicate. Wrought iron work acts the same as steel, except that in small work I believe the enlargement to be greater than in large work. Here, however, I may say that by small work I mean work that is three inches and less in diameter, and about six inches long. By large work, say six inches in diameter by about ten inches long, or longer than this measurement.

MACHINIST.

## ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

## Positions of Planets for August, 1877.

## Mercury.

On August 1, Mercury rises at 6h. 3m. A.M., and sets at 7h. 56m. P.M. On the 31st, Mercury rises at 7h. 52m. A.M., and sets at 7h. 20m. P.M. Mercury is small and will not be easily found, but should be looked for after sunset, and late in August, south of the point where the sun sets.

## Venus.

Venus is so much brighter than Mercury that it can be seen all through the month of August for a short time after sunset.

On August 1, Venus rises at 6h. 57m. A.M., and sets at 8h. 23m. P.M. On August 31, Venus rises at 8h. 6m. A.M., and sets at 7h. 44m. P.M.

## Mars.

On August 1, Mars rises at 9h. 19m. P.M., and sets at 8h. 09m. A.M. of the next day. On the 31st, Mars rises at 7h. 15m. P.M., and sets at 5h. 49m. A.M. of the next day.

Mars is coming into better and better position for evening observation, and will, by the latter part of August, be very conspicuous in the southern sky. Saturn and Mars rise and set nearly at the same time all through the month, Saturn being some degrees above Mars when on the meridian.

## Jupiter.

On August 1, Jupiter rises at 4h. 22m. P.M., and sets at 1h. 23m. of the next morning. On the 31st, Jupiter rises at 2h. 23m. P.M., and sets at 11h. 23m. P.M. The best time to look at Jupiter during August will be from 7h. 0m. to 9h. P.M.

On August 1 the largest satellite (according to the *Nautical Almanac*) will make a transit across the disk of Jupiter during these hours, and will not be seen; Jupiter will seem to have but three moons. On the 4th the moon nearest to Jupiter will not be seen because it is behind the planet at the hour from 8 to 9 P.M. On August 9 the smallest of the moons will not be seen until 9 P.M., because it passes in front of the planet. On August 12 the largest moon will not be seen until near 8 P.M., having been in the planet's shadow, and the first or nearest to Jupiter will not be seen until after 9 P.M., having been passing across the face of Jupiter. This same moon is not seen on the 13th until near 8 P.M., because it is in the planet's shadow; again, on the 27th, it is not seen after 8 P.M., because it is behind the planet.

The smallest satellite disappears on the 16th a little after 8 P.M., by coming in front of the planet, and on the 25th it disappears by getting into Jupiter's shadow.

On August 19 the largest satellite will disappear by going into the shadow of Jupiter, and on the 26th it will not be seen between 8 and 9 P.M., being behind the planet.

## Saturn.

On August 1, Saturn rises at 9h. 3m. P.M., and sets at 8h. 19m. the next morning. On the 31st, Saturn rises at 7h. 1m. P.M., and sets at 6h. 10m. the next morning.

Saturn and Mars rise at nearly the same time during the month. They are much higher in the southern sky, when they come to the meridian, than Jupiter. On the 2th, Saturn will be at meridian passage (12h. 57m.) directly above Mars, and have an altitude above the southern horizon of 41°. In the latter part of August, Venus, Mars, Saturn, and Jupiter can all be seen early in the evening.

## Uranus.

Uranus can rarely be seen without a glass, but an ordinary telescope will show its disk—it is not at present well situated.

On August 1, Uranus rises at 6h. 13m. A.M., and sets at 7h. 57m. P.M. On August 31, Uranus rises at 4h. 21m. A.M., and sets at 5h. 59m. P.M.

At this time Uranus will be very near the star Regulus. It will not be easy to see it, as its diurnal passage is almost wholly made during the light part of the twenty-four hours.

## Neptune.

Neptune rises on the 1st at 10h. 53m. P.M., and sets at 12h. 23m. P.M. of the next day. On the 31st, Neptune rises at 8h. 55m. P.M., and sets at 10h. 25m. of the next day.

## The Visual Purple of the Eye.

We have several times alluded in these columns to the so-called visual purple, or *seh-purpur*, as the German physiologist, Boll, terms it. This visual purple is a colored sheet at the back of the retina of the eye, and becomes impressed by light in the same way as a photographic film. The light must, however, be very intense to make an impression, and it was only by exposing a rabbit's eye in a dark room to the action of a ray of light coming through a shutter for three minutes that any image could be produced.

It has been a question how long the visual purple remains after death. Boll found that a rabbit's eye immediately after death was in a position to receive an image quite as readily as when alive, and he asserted that he believed the visual purple to remain unbleached and photographic many hours after death. The German physiologist has been lately able to prove that in the human being such is the case for two hours and three quarters after death, at any rate. The subject in this case was a criminal who was executed in Vienna on the 5th of March last, at a quarter past seven in the morning. The execution occurred in a badly lighted yard, surrounded by high walls, and immediately after death the executioner, as is customary, closed the eyes of the body. Other means were then taken to keep light from the retina, and after an interval of a couple of hours an examination was made by Boll of the eye. A microscopic inspection at once showed the existence of the visual purple, so that the eye still possessed photographic properties, but no trace of an image was to be observed on the retina of the dead man. But even had a slight impression been bleached upon the purple film, say that of the prison wall, this would, nevertheless, have disappeared again, since the membrane behind the retina possesses all the properties of a re-sensitizer, and would have restored the purple color again in a very short time. That the visual purple does not lose its properties till some time after death may now be taken for granted.

So far as regards the possibility of an image existing on the retina after death, so as to be discovered some hours subsequently, we may safely decide in the negative, judging from what we know of the *seh-purpur*. It is only, as we have seen in the case of the rabbit, where the object is very bright, or it is steadily reflected upon the eye for some time, that an image appears; and then the latter must be immediately fixed in alum, as otherwise the mucous sensitizer does its work, and the purple color is restored. No doubt when the eye looks upon a very light object—the sun, for instance—and the vision remains persistent for some minutes, or seconds, afterwards, our eye has received photographic impression, but this not likely to occur just before death. Only under such circumstances would it appear possible to secure a photograph upon the *seh-purpur*, or visual purple of the eye.—*Photographic News*.

## A New Fire Cistern.

A new fire cistern, by Mr. R. T. Scowden, City Engineer, was lately tested at the corner of Thirteenth and Magazine streets, Louisville, Ky., and proved to be entirely satisfactory. This cistern is entirely different from any fire cistern ever used before. It is constructed to hold three hundred barrels of water; the body of the cistern instead of being perpendicular is horizontal, lying parallel with the course of the street, cylindrical in form, the walls being of brick and cement, thirteen inches in thickness. The tank is sixteen feet long and ten feet in diameter, with the crown twenty-four inches below the surface of the street, the two outlets being near the ends. The idea of this plan of cistern is to obtain more than one outlet, which is impossible in those now in use, so that a great number of engines can be operated from one receptacle. Another advantage claimed for it is that the cistern, from the nature of its construction, cannot be crushed in from the street above. Every one who saw the test were much pleased, and were ready to acknowledge the superiority of this cistern over those now in use. It is likely that they will be extensively adopted in the future.

## Methylated Spirit.

*Methyl alcohol*, wood spirit or wood naphtha, is one of the volatile products obtained by the destructive distillation of wood, sawdust, spent dyewoods, etc. It is used in a variety of chemical operations, and in the manufacture and preparation for use of certain artificial coloring matters. It having, fortunately, a very disagreeable taste, it is never used for drinking, and hence it may be manufactured, sold, and employed in the arts without any excise interference.

*Methylated spirit*, however, is a very different article. It consists of ordinary (so-called *ethyl*) alcohol mixed with about five to ten per cent of the true methyl alcohol just mentioned, and is, therefore, not a definite chemical compound, but a mere mixture. The origin and history of this "methylated spirit" may be briefly stated as follows: Methyl alcohol (wood spirit), though very useful to the chemical manufacturer and color maker, cannot be used as a substitute for common alcohol (spirit of wine), but produces different results. It was also found that many chemical operations which require spirit of wine could not be carried on as cheaply in England as on the Continent, where spirit is much cheaper on account of the smaller duty payable on its manufacture. Government was therefore petitioned to

grant some relief to manufacturers by remitting the duty payable upon alcohol used in the arts. The result was the concoction of the mixture known as "methylated spirit," which was supposed to be undrinkable, and which, under certain conditions, was to be sold duty free to dyers, etc. Unfortunately the mere addition of wood spirit to alcohol did not seem to the authorities a sufficient precaution. Except a manufacturer or dyer was able to give security in £1,000 not to use or allow to be used the "methylated spirit" for drinking purposes, further additions were insisted upon. One of these consists in dissolving in the spirit a small quantity of shellac. This addition was proposed in the interest of the varnish makers, who it was erroneously supposed would be the main consumers of methylated spirit, and to whom the presence of shellac would be no detriment. In this state the spirit is sold under the name of "finish." This addition, for the color maker and dyer, is one of the most unfortunate that could have been devised. It makes all colors come up flatter, and gives reds especially a dull bluish tone. To detect shellac in methylated spirit it is merely necessary to add a spoonful of the suspected sample to a large glass of pure water, say condensed steam water, and stir up well. If shellac is present it will be precipitated, and occasion a white turbidity or milkiness in the liquid. Sometimes instead of shellac a small quantity of some aniline color, blue or red, is added to the spirit. Whatever color is selected will, of course, in certain cases prove objectionable.

We should suggest that if any further addition to the methylated spirit is really needful—which we doubt—something of an intensely nauseous flavor would be much better than colors or resinous substances.

On the Continent ordinary alcohol is cheaper than wood spirit, and hence purchasers of the latter sometimes find it more or less adulterated with the former. To detect this fraud Riche and Bardy heat the suspected sample with sulphuric acid, dilute with water, and distil. They then mix the distillate with peroxide of manganese and sulphuric acid, thus converting the ethylic alcohol into aldehyde, and add a solution of hyposulphite of soda, and finally some magenta. If common alcohol is present, even to the extent of one tenth per cent, the magenta takes a violet color.—*Chemical Review*.

## Blasting by Electricity.

Blasting by electricity, one of the latest practical developments of science, is being generally utilized. The advantages are great saving of explosives, safety, and protection of life, economy of capital and time, and overcoming obstacles that nothing else will, such as firing under any quantity of water, sinking or driving in soft sandstone, granite splitting, rooting up trees, blasting slag, etc.

On Saturday, June 16, a gigantic explosion was arranged in the granite quarries of Messrs. Ellis and Evrard, at Bardon Hill, near Leicester, by Messrs. Atkin and John Harris, of Nobel's Explosive Company; six holes being put in, averaging a depth of 20 feet, each hole being charged with 15 lbs. of dynamite, and exploded with Capt. Brain's electric fuses. The machine used to fire them was Capt. Brain's American Improved, a most compact and simple article, being only some 14 lbs. in weight, which may be used by the ordinary working men, giving an electric spark 2 inches in length. The firing of these six holes had a most marvelous effect, the whole quarry having the appearance of being rent as by an earthquake. Huge blocks of granite were tumbled out, and upon careful examination and measurement it was computed that 14,500 tons had been dislodged and thrown into the bottom of the quarry. This practical demonstration of the effect of simultaneous blasting with a powerful explosive in connection with quarry works was most satisfactory to the proprietors and other gentlemen present, it being generally acknowledged that such successful results had never been known in the district before.

The Electric Blasting Apparatus Company, Cinderford, Gloucestershire, have also just very successfully laid down a set of blasting apparatus at South Kirkby Colliery, near Pontefract, where shafts are being sunk to a depth of 700 yards. The advantages of the system are so apparent in collieries already using this apparatus in the district that its use is becoming more general. At the Houghton Main Colliery, near Barnsley, two 15 feet shafts are each firing 16 holes at once, and raising 70 tons of *clébris* from a shot, an increase of 50 tons a blast on the old system—a practical demonstration of the great advantages of simultaneous blasting.—*Mining Journal*.

## The English Iron Trade.

The statistics of the iron trade for last year show that out of 4,970,000 tons of pig iron produced in the Cleveland district, 2,828,000 were retained for home consumption, and 2,041,000 tons were exported; and in 1874, 3,543,000 tons of the 5,991,405 produced were retained for home consumption, whilst only 2,587,000 tons were exported. In 1863 the quantity of pig iron made in the North of England was 838,400 tons; last year it reached 2,075,000.

## Casualty by Lightning.

The Salem (N.J.) *Standard* states that recently Mr. Henry White, a well-known resident of Lower Penn's Neck, was killed by lightning as he stood in his own doorway. He went to the door to look at the clouds, and as he looked out he placed his hand upon the water conductor, and was instantaneously struck by the electric fluid, which, it is supposed, was at that moment passing down the spout.