Sixth.—Hot steel should always be put in a perfectly dry place of even temperature while cooling. A wet place in the floor might be sufficient to cause serious injury.

Seventh.—Never let any one mislead you with the statement that his steel possesses a peculiar property which enables it to be "restored" after being burned. No more should you waste any money on nostrums for "restoring" burned steel. We have shown how to restore "overheated" steel. For burned steel, which is oxidized steel, there is only one way of restoration, and that is, through the knubbling fire or the blast furnace. Overheating and restoring should only be allowable for the purpose of experiment. The process is one of disintegration, and is always injurious.

Eighth.—Be careful not to overdo the annealing process; if carried too far, it does great harm, and it is one of the commonest modes of destruction which the steel maker meets in his daily troubles. It is hard to induce the average worker in steel to believe that very little annealing is necessary, and that a very little is really more efficacious than a great deal.

Finally, it is obvious that, as steel is governed by certain and invariable laws in all of the changes mentioned, which laws are not yet as clearly defined as they should be, nor as they will be; nevertheless, the fact that there are such laws, should give us confidence in the use of the material, because we may be sure of reaching reliable results by the proper observance of these laws. Therefore there is no good reason why engineers should be afraid to use steel if they manipulate it intelligently. Now, if we have wandered over a wide range in answer to the simple question, "Why does steel harden?" it was necessary to have looked at many facts before we could have an intelligent opinion of many theories; and if any are in doubt as to what is the correct answer to this momentous question, we only say that we are all "in the same boat," for if you do not know, neither do we."

APPROXIMATE ECONOMY OF GAS AND ELECTRIC LIGHTING.

It is not in every place or position that the electric light can be employed in lieu of gas; but under some circumstances, for example, in spacious apartments, where large numbers of gas lights are used, the electrical method of lighting may now be adopted with satisfactory success. Under such conditions, and with gas costing the excessively high prices that we are accustomed to pay, the superior economy of electricity over gas has been conclusively settled on this side of the Atlantic. We might cite various examples, but for our present purpose one will be enough, to wit, the Riverside Worsted Mills, Providence, R. I., where the Brush electric lights have been in regular use for about one year past—long enough to determine their actual expenses and merits.

In one portion of the above mills 1,000 gas lights were used, each of 15 candles intensity, yielding an aggregate of 15,000 candles, and costing $12.25 per hour to run them, or 0·82 of a cent per candle per hour.

We are not informed as to the exact cost of the gas per 1,000 cubic feet, but we figure it to be $2.45.

In lieu of the above 1,000 gas lights 80 electric lights were substituted, each of 2,000 candles intensity, yielding an aggregate of 160,000 candles, and costing 80 cents per hour to run them, or 0·05 of a cent per candle per hour.

If we have not been misinformed as to the above estimates of costs and intensities, it would appear that gas lighting, at the mills named, was at least sixteen times more costly than electric lighting, quantity of light produced being considered.

It may not be uninteresting briefly to compare the probable economies of Mr. Edison's new system of lighting with the foregoing results.

Mr. Edison's method has, to be sure, as yet only reached the stage of experiments. But it must be remembered that his trials have been made on an extensive scale, with full-sized electrical machines and apparatus, expressly with a view to show and determine what the practical introduction of the invention, wherever used, would accomplish. We have his authority for saying that the generous sum of one hundred thousand dollars in cash was placed at his free disposal, by his associates, to be used as he saw fit for these grand experimental demonstrations.

In a word, Mr. Edison's plan is to furnish small electrical lamps, each having the intensity, he tells us, of an ordinary gas light of fifteen candles, burning five cubic feet of gas per hour. He states that he gets ten lamps, or 150 candles, of light per hour per horse-power of engine; and that each of his new electrical machines furnishes 750 candles of light and requires five horse-power to drive it.

Applying the Edison system to the Riverside Mills and to the replacement of the 1,000 gas lights, we have the following approximate results:

Number of Edison lamps required, 1,000; number of Edison machines required to run the lamps, 20; engine power needed, 100 h. p. Approximate cost of the Edison plant, $16,000. Approximate cost of running the same, delivering 15,000 candles of light per hour, including 6 per cent. interest on the plant, $1.66 per hour, or 0·11 of a cent per candle per hour. This estimate allows no royalty to the owners of the patents. Thus the approximate cost of gas lights at the Riverside Mills is seven and a half times more than the same quantity of light would be under the Edison system. And the cost of the Edison system would, approximately, be two and one-fifth times more than the cost of the same quantity of electrical light as delivered by the present Brush machines.

Side by side the fractions stand as follows:

Approximate costs of lighting per candle per hour:

Gas Lights.	Edison Lights.	Brush Lights.
$\frac{82}{100}$ of a cent.	$\frac{11}{100}$ of a cent.	$\frac{5}{100}$ of a cent.

THE CORUNDUM MINES OF NORTH CAROLINA.

The name "corundum" is applied to all crystallized alumina. It is the hardest mineral in the world, except the diamond, and when in the crystalline form and transparent, constitutes the Oriental gems, the sapphire, ruby, emerald, topaz, etc., which are of great value, some even exceeding the diamond, because they are more rare. It is used for abrasive purposes, but as yet a sufficient quantity has never been found in this country to take the place of emery. It is much harder than emery, performing the work in less time.

Corundum occurs in the great chrysolite belt extending from the southern part of Virginia to middle Alabama, passing in a southwesterly direction through the mountainous portion of North Carolina. In the southwestern counties in the Nantahala range of mountains (one of the spurs of the Blue Ridge), and lying on either side of Buck Creek (a tributary of the Tennessee), at an elevation of from three to four thousand feet in the so-called Cullakenee corundum mine, which has been considered the largest deposit of corundum in this country. It covers an area of three hundred acres. This mine was purchased in April, 1879, by Herman Behr & Co., and has been worked since May, with what success is not reported.

In Macon county, N. C., on the western slope of the Blue Ridge, at an elevation of about twenty-five hundred feet, is Corundum Hill, formerly known as Cullasagee mine. This mine was discovered in 1872; it was afterwards purchased by E. B. Ward, and worked for eighteen months by Col. C. W. Jenks, of Boston. Rumor says that gems of exceeding great value were taken out. In July, 1878, this mine was purchased by Dr. H. S. Lucas, for the Hampden Emery Co., of Chester, Mass. They commenced mining August 20th, and up to the present time have taken out two hundred tons of corundum; also, in washing some of the dumps left there when worked by Col. Jenks, were found many fragments of the Oriental gem, perfectly transparent and of very great brilliancy. Among these is an emerald weighing 30½ carats, and several rubies of the finest color.

In the eastern part of Jackson county, N. C., at the foot of one of the highest peaks of the Blue Ridge, is what is termed the Hog Back mine. This mine was operated for a limited season by the Hampden Emery Co.

Northwest of the Pigeon, in Heywood county, N. C., is still another deposit of corundum, called the Presley mine, which has been worked since one year ago last March.

In Madison and near the Buncombe county line, in the same State, is an outcropping of chrysolite, carrying corundum, which covers an area of seventy-five acres, and has been worked for the Hampden Emery Co. for the past season.

Deposits of corundum are also found in South Carolina, Georgia, and Alabama, notices of which we intend to present hereafter.

WHY THE THUNDERER'S GUN BURST.

Our readers will remember that about a year ago a 38-ton gun on board the British ironclad Thunderer burst, killing a number of men and wounding many more. A committee, appointed to investigate the disaster, came to the conclusion that the explosion was caused by a double charge. The gun, having missed fire when loaded with a battering charge (a 700 pound projectile and 110 pounds of powder), was again loaded with a full charge, and fired with both of the charges and the projectiles in the gun at the same time. This decision having been seriously questioned, the government ordered an experimental test by loading and firing the sister gun in the manner alleged. The test was made at the proof butts adjoining the Royal Arsenal at Woolwich, February 3. The second 38-ton gun was loaded and fired with a double charge of 80 and 110 pounds of powder, one 600 pound shell and one 700 pound Palliser projectile. The gun burst as its fellow did on board the Thunderer, thus justifying the opinion of the committee of investigation as to the cause of that disaster. The muzzle of the gun and the projectiles were buried in the sand at the proof butts. The remainder of the gun, with the exception of its base, was blown to atoms.

ARTIFICIAL ICE SKATING RINK, NEW YORK.

Among the new structures lately erected in this city is a skating rink, occupying the westerly portion of the square at the junction of Madison avenue, 58th and 59th streets. The building is of brick. The central portion of the inner space is occupied by an unbroken sheet of ice two hundred feet long and forty feet wide. Surrounding the ice sheet, and on a higher level, is a spacious gallery for visitors. Altogether the establishment is a place of considerable attraction, especially for skaters; and the present winter has been a particularly fortunate one for the proprietors, for the weather has been so mild here that up to the time of this writing the lakes in Central Park and other places have not been sufficiently frozen for safe skating.

The ice sheet formed in the new rink is produced under the patents of Mr. Thos. L. Rankin, whose various inventions in the manufacture of ice and refrigerating machines have heretofore been noticed by us. We believe he was the first to succeed in artificially producing with economy large permanent sheets of ice for skating rinks. At the new rink in question the ice is formed in the following manner:

A shallow water-tight basin is first prepared, in which a network of ordinary iron pipes are laid, divided into valved sections. Water is admitted to the basin, so as just to cover the pipes. A refrigerating liquid, consisting chiefly of salt water, is introduced within the pipes, and, by means of a steam pump, forced to circulate through the pipes and through a suitable refrigerating apparatus placed at a little distance from the basin. The liquid, in passing through the refrigerating apparatus, is cooled down fifteen or twenty degrees below the freezing point, and this cold liquid, when forced through the network of pipes, soon causes the water in the basin to freeze into a solid sheet. In order to renew the surface of the ice after it has been cut up by the skaters, the surface is swept off and a thin film of fresh water put on the ice by hose pipes. This film soon congeals, and a new, smooth surface is ready for visitors. The renewals are generally made at noon time and between six and seven P.M. The rink is open during the day and evening, and is generally full of visitors and skaters, and forms an interesting addition to the various entertainments of this great city.

Test Trials of Steam Engines.

Among the interesting features of the forthcoming Millers' International Exhibition at Cincinnati, June, 1880, will be a test trial of automatic cut-off steam engines. We publish in this week's SUPPLEMENT the full code of regulations for this trial, as prepared by the Chief Engineer, Mr. John W. Hill, C.E. Every precaution which experience could suggest appears to have been adopted by the engineer in preparing the regulations to render the tests impartial and effective. These trials will doubtless yield much useful and instructive information concerning the latest improvements and economies in steam engineering.

A Belgian Prize.

The yearly prize of $5,000 (25,000 francs) offered for international competition in works of intelligence, by the King of Belgium, will be granted in 1881 to the best treatise on means of improving harbors on low and sandy coasts. Essays for competition must be submitted to the Ministry of the Interior at Brussels, before January 1, 1881. The decision will be made by a jury of seven—three Belgians and four foreigners of different countries. This competition is worthy of the attention of American engineers for its own sake, as well as for the benefits likely to flow therefrom to many of our Atlantic ports, which present problems not unlike those of the ports of Belgium.

Melting Street Snow by Steam.

It has often been proposed to use steam to fuse snow in the streets. A correspondent of *La Nature* endeavors to prove, by a few simple figures, how impracticable this idea is. He finds that every square meter of street covered with a layer 5 c.m. in thickness would require 5,000 calories to fuse the snow on it, and that the locomotive could only fuse, *at the maximum*, the snow covering 54 square meters per honr. With a width of 15 meters this represents a theoretical advance of less than four meters (13 feet) in an hour.

New Astronomical Instruments.

At a recent meeting of the French Society of Civil Engineers, M. Saubert presented several of the instruments already made, and designs of others, for the great popular observatory which has been projected. A large variety of telescopes of all dimensions, and of new modes of mounting, was exhibited. The total of instruments was about 100; more than 20 have been already made. Among the telescopes planned, one with an object glass one meter in diameter excited much interest. This is intended to project on a screen, before a thousand persons in a hall like that of the Trocadéro, an image of the sun or of the moon with much detail; also planets, groups of stars, double stars, and perhaps even nebulæ. M. Saubert is assisted in his work by several young astronomers.

A New Use for the Telephone.

Hitherto it has been a matter of some difficulty to determine the time of flight of small-arm projectiles, owing to the impossibility of seeing them strike. In a series of experiments made by the U. S. Ordnance Department this difficulty has been overcome by the use of the telephone. The telephone was connected with two Blake transmitters, one placed near the gun, the other in front of and near the target. The time between the report of the gun and sound of the ball upon the target was measured by a stop-watch. The observations, founded on a large number of experiments, never differed more than a quarter or half of a second from each other, the slight delay in starting the watch being neutralized by the delay in stopping it. It was found that the time of transit was affected by the wind, being shortened by a rear and lengthened by a head wind.

Telegraphic Communication with South Africa.

Cape of Good Hope has been brought into telegraphic communication with England by the successful completion of the cable between Aden and Zanzibar. The first messages were transmitted between Queen Victoria, the Sultan of Zanzibar, and the Governor of the South African Colonies, December 25.