tion by Mr. Viquier, of Shanghai, China, by which dispatches are sent not only in the Chinese language but printed in its intricate characters. The automatic plan in the United States is proving quite successful, and in public tests has accomplished some remarkable feats in rapid telegraphing.

With regard to batteries, in spite of the improvements in those of Grove, Bunsen, Leclanché, May, Davy, and others, it seems that we as yet have none that is absolutely constant, though it may be that future modifications of the secondary batteries of Planté will lead to such a result.

Sir Richard Glass, Sir Francis Ronalds, and Auguste De la Rive, all prominent in the history of telegraphy, have died during the past year.

ROBERT L. THURSTON.

We notice with sincere regret the death of Mr. Robert L. Thurston, one of the oldest manufacturers of Providence, R. I., and father of Professor R. H. Thurston, of the Stevens Institute. Mr. Thurston began as a machinist, at a very early age, and had but attained his majority when he became interested with John Babcock, Sr., in the building of an experimental engine and a tubular boiler, which were placed in a small ferry boat used near Fall River. The performance of this craft induced her builders to construct two more vessels, the Babcock and the Rushlight, which, plying between Providence and New York, created a sensation equalled only by that occasioned by Fulton's Clermont. In 1830 Mr. Thurston embarked in business in Providence, R. I., and, after several changes of firm, ultimately formed the well known concern of Thurston, Greene, & Co., the first manufacturers who ever built a standard form of expansive steam engine. Mr. Thurston was not fortunate in monetary matters, and at the begining of the war incurred heavy losses, which, coupled with his advancing age, led to his retirement, from active business life, during the summer of 1863.

The subject of this brief sketch will be widely lamented, not only by the large number of work people with whom, during his long and useful life, he has been brought in contact, and who have experienced his uniform kindness and benevolence, but by all generally, as one of those representative men whose name will always be linked with the material growth and prosperity of the country.

STEARIN CANDLES.

The hard white stearin candle of today is quite a different article from the tallow dip that our grandmothers used to make, and which was then a vast improvement over the pine knot of the preceding generation. Tallow dips were made directly from the tallow, which was obtained by melting beef suet and straining it to remove animal fiber and impurities. Stearin candles are also made from tallow; but in this case it is first separated into its constituents, some of which are solids and others liquids, and only those melting at a temperature above the ordinary summer heat are employed.

Tallow is a mixture of stearin, palmatin, and olein, compounds of glycerin with stearic, palmitic and oleic acids respectively. Oleic acid and glycerin are both liquids at ordinary temperatures, and hence it is desirable to remove them from the tallow before employing it in the manufacture of candles. To accomplish this, several methods are in use. The simplest and one of the best is that invented by Wright and Fouché, and consists in decomposing the fat with superheated steam.

The apparatus employed is called a digester, and consists of two copper boilers, placed one above the other and connected by two pipes, one of which reaches nearly to the bottom of the lower vessel and ends at the bottom of the upper one. The other is fixed to the cover of the lower one and enters the upper one near the top. The melted fat mixed with an equal quantity of water is run into the digester, which is not completely filled and is heated for 15 hours under a pressure of eleven atmospheres. By the end of that time the glycerin becomes separated from the fatty acids, and is dissolved in the water. The contents of the digester are then blown into large vats where they are allowed to settle, and the fatty acids, being specifically lighter, rise to the top, the glycerin water settling to the bottom. As soon as this has taken place, the glycerin water is drawn off into a tank below and heated by a steam coil to evaporate the water, the evaporation being kept up until the glycerin acquires a specific gravity of 25°. At the proper moment, when all the glycerin water has been drawn off, the mixed fatty acids are run into large lead-lined vats. Here they are mixed with a small quantity of oil of vitriol to purify them, and heated by a steam coil. Then the liquid flows into a much larger vat beneath, from which it is run into pans, about 10 inches wide by 18 long and resembling huge cakes of chocolate. These pans are arranged on racks and the acids allowed to crystalize. The fat now solidifies, but it still has distributed through it the oleic acid. To remove this, the cakes are wrapped in strong cloth, usually hair cloth, and submitted to the action of a powerful hydraulic press, whereby a large proportion of the oil is squeezed out.

When no more oil can be pressed out, the pressed cakes are taken directly from this press and, without being unwrapped, are placed in a horizontal press between plates of iron and heated by steam pipes, where still more of the oleic acid is removed. The pressed cakes, although nearly pure, are again melted, treated with dilute sulphuric acid, and subjected a second time to hot pressure. This furnishes a very solid, perfectly white substance, consisting principally of stearic acid, improperly called stearin, with some palmitic acid. From this, the candles are molded in the usual manner

The oil which is pressed out consists of oleic acid holding in solution more or less of the solid acids, which it is desirable to save. For this reason, it is taken back to the tanks where the acids are melted, and mixed with them to be worked over again. It is finally sold for washing wool, softening leather, or making soap.

Another method of separating stearic acid from the glycerin and oleic acid, formerly much used, consists in saponification by means of lime. When lime is added to melted tallow and heated, the fatty acids combine with it to form an insoluble lime soap, the glycerin remaining in solution. The lime soap thus formed is decomposed with sulphuric acid, sulphate of lime being precipitated, and the melted fatty acids rise to the surface. The latter are transferred to lead-lined tanks, treated with oil of vitriol, drawn off, cooled, and pressed cold and hot, as in the other processes. If superheated steam is employed, a much smaller quantity of lime is required. At a pressure of ten atmospheres, with 2 or 3 per cent of lime, saponification and decomposition are complete in seven hours. This process, invented by De Milly, is a combination of both the above, and effects a saving in time over the first, and a saving in lime and acid over the second.

A fourth method, quite different from any of the above, was introduced by Dubrunfaut in 1841. Unlike the other processes, it can be employed to decompose very impure fats from slaughter houses, bone and marrow fats, kitchen stuff, residues from refining fish oils, and the like. Oil of vitriol is added to the molten fat, a moderate heat applied, and the mass stirred for 15 or 20 hours. The neutral fat is thus converted into a mixture of sulpho-fatty acids and sulpho-glyceric acid. These are decomposed by running them into large wooden tanks lined with lead and one third filled with water, and heating to 212° Fah. After the fatty acids separate, they are purified with water; the water evaporated, and the acids carefully distilled by means of superheated steam, at a temperature of 500° Fah. to 650° Fah. According to De Milly's new process, the tallow is heated to 248° along with 6 per cent of oil of vitriol, and the action limited to 2 or 3 hours. It is thereby possible to obtain 80 per cent of the solid fatty acids in a condition at once fit for making candles without redistilation, only 20 per cent having to be distilled.

SCIENTIFIC AND PRACTICAL INFORMATION.

BLACK PHOSPHORUS.

M. Ritter considers that the color of the variety of phosphorus known as black is due solely to the presence of metals or foreign metalloids. Arsenic in commercial phosphorus causes the appearance of the phenomenon, on account of a separation of phosphuret of arsenic. No allotropic modification exists.

OIL SPOTS ON FINISHED GOODS.

It is an exceedingly aggravating occurrence to find a piece of cloth, perfect in every other respect, ruined by oil spots. They are most frequently due to sheer carelessness and neglect of cleanliness in oiling the machinery. Workmen should be instructed to watch for them, and, as soon as one is discovered, to hunt up the cause and remedy it forthwith. Cloth thus injured should not be left in folds, or, if such disposition is absolutely necessary, pieces of thick paper should be placed between to prevent multiplication of the defects by the oil spots coming in contact with the clean portions.

The *American Textile Manufacturer* says that the simplest and surest process for extracting oil spots is to saturate the spot with benzine, then place two pieces of very soft blotting paper under and two upon it, and press well; in some cases a hot iron is necessary; in others a high pressure, say 100 lbs. per inch, without heat is sufficient. By this means the fat is dissolved and entirely absorbed by the paper. To rub the oil spot with a sponge saturated with turpentine or benzine only spreads the grease.

A HUGE AEROLITE.

A correspondent of the *Chicago Times* says that an enormous aerolite recently fell in the vicinity of Farmersville, Livingston county, Mo. The shock of its impact with the ground is stated to have been like an earthquake, and the molten mass is described as fully twenty feet high above the soil, and some twenty-five feet in diameter. It presents the usual appearance of such bodies, being a black, shining mass of meteoric iron. Its size is unprecedented.

RUMFORD'S DETERMINATION OF THE MECHANICAL EQUIVALENT OF HEAT.

Professor R. H. Thurston recently submitted a note to the American Society of Civil Engineers, in which he presented a *résumé* of the history of thermodynamics as given by Professor Tait in his work on the subject. In this, Professor Tait places the services of Count Rumford as second in importance to those of Davy, as well as in the actual influence upon the growth of the science, and does not apparently consider them comparable to those of Joule.

Professor Thurston considers that, as it is well known among engineers that the ordinary unit of measurement of horse power is much too high for application in estimates of animal power, it would be more correct to consider the horse power of Rumford as 25,000 instead of 30,000 foot pounds per minute. In such case the mechanical equivalent, as deduced by the latter, would be 782·8, differing by only 1·5 per cent from the value now accepted, as determined by Joule half a century later, which is nearer the probably correct value than the result of any other investigation, and is even far more accurate than many results obtained by Joule himself. Professor Thurston thinks that we may claim for Benjamin Thompson, of Concord, N. H. commonly known as Count Rumford: 1. That he was the first to prove the immateriality of heat and to indicate that it is a form of energy, publishing his conclusions a year before Davy. 2. That he first, and nearly a half century before Joule, determined, with almost perfect accuracy, the mechanical equivalent of heat; and 3, that he is entitled to the sole credit of the experimental discovery of the true nature of heat.

HYDRATE OF CHLORAL AS A PRESERVING AGENT.

M. Personne reports that, beside the strong alkalies, all the weak ones, magnesia, the alkaline salts, including borax and phosphate of soda, all the animal alkaline liquids, such as blood and white of egg, transform chloral into chloroform when the mixture is heated to 104° Fah. Fresh blood to which chloral has been added, and which is retained at normal temperature, coagulates completely, keeping its red color, and remains without alteration. A piece of muscle plunged in a chloral solution of 10 per cent, became slightly pale in tinge and deposited a sediment; but after a few hours immersion, it dried rapidly and became sufficiently friable to be pulverized.

It is believed that chloral solution of the above strength may be used for preserving the most alterable animal matters. The author states that he has thus kept a cerebellum for more than a month in perfect condition. He recommends the addition of glycerin to the solution, to prevent the articles preserved from becoming rigid and dry.

THE CHILI INTERNATIONAL EXPOSITION.

The Republic of Chili has, through its representative, formally notified our government that an international exposition will be held at Santiago, to open in September 16, 1875. Some valuable general concessions are to be made to exhibitors at the exposition. There will be a reduction of fifty per cent in the price of freight from Valparaiso to Santiago and on lines belonging to the government. Articles, excepting such as relate to dress fabrics, furniture, house decoration, jewelry, glass, earthenware, and similar products of manufacture, together with those of mining industry, will be admitted free of duty. Those excepted will not be charged in case they are reshipped. Forty dollars will be allowed for the payment of the passage of any special workman or mechanic in charge of, conducting, or directing exhibited machines or industries, such workmen to be duly accredited with passports certified by the Chilian Consul at the port of their embarkation. A reduction is also to be made on the freight of goods on the way to the exhibition from the different lines of steamers running to Valparaiso, the amount of which will be made known shortly.

A BOILER EXPLOSION.

A correspondent, G. F. A., writes from Peoria, Ill., enclosing a newspaper slip which describes a disastrous boiler explosion at that place, on January 31. The boiler was new, having just been completed, and was undergoing a test by steam pressure. It had no safety valve, nor any means of relieving the pressure other than by a rupture. A steam gage was attached; and when this indicated a pressure of 139 pounds per square inch, the boiler exploded, killing one of the bystanders and severely scalding another, the person who was killed being completely dismembered. The boiler was broken into fragments, which were thrown to great distances. It appears that the correctness of the gage was doubtful, so that it was impossible to tell what was the actual pressure when the boiler exploded. Judging from the above facts, this was a case of reckless engineering, calling for the sternest censure.

We are greatly obliged to our correspondent for sending us an account of the explosion, as we believe that giving publicity to proceedings of this kind is one of the surest means of inaugurating more careful management. Will not our readers in all sections send us information on matters of this kind, enclosing extracts from the local papers? In this way they will render us valuable assistance in our endeavors to bring about a more enlightened system among those who are entrusted with the care of steam machinery.

TO NEW SUBSCRIBERS.

All subscriptions to the SCIENTIFIC AMERICAN will be commenced with the year, unless persons, at the time of remitting, request to the contrary. Nearly all subscribers preserve their numbers for binding; and in most cases where subscriptions are received during the first quarter of the year, if the back numbers are not sent, they are subsequently ordered. To save both the subscribers and ourselves trouble, the back numbers from January 1 will be forwarded, unless we are advised to the contrary. This course will be pursued till April 1, after which date the paper will be sent from the time of receipt of remittance; but subscription may commence at any time, at the request of the subscriber. The above regulation applies only to those who give no instructions, at the time of remitting, as to when they desire to commence.

Death of Three Eminent Scientists.

Max Schultze, the great German professor of anatomy, is dead. He was in the prime of life, and had just experienced the satisfaction of seeing his laboratory at Bonn, the most ample and elegantly constructed in Europe, finished under his immediate supervision. His death is a great loss to biological science.

WE regret to learn the premature death of M. Fernand Papillon, to whose interesting papers on phenomena of life (in *Revue des Deux Mondes* and other journals) we have repeatedly directed attention. The death is also announced of Dr. Legros, of Paris, who was poisoned in the course of his histological researches.