thought of the suppression of mob violence by military force, but a question of the utmost difficulty of practical politics lies back of it all. How are strikes with incidental riots and destruction of property and idleness of thousands of workmen to be prevented in future.

The evils of a strong government for the repression of riots on the one side are confronted with the evils of a weak government unable to cope with the evil-disposed classes. In the United States, by general consensus, the Federal power is recognized as the strong element, one to be called on as seldom as possible, and whose direct intervention is looked on with disfavor and as an unfortunate necessity. The individual States are less powerful and less arbitrary in their governmental actions. Both have united in coping with the rioters. But until strikes of the magnitude and evil effects of the present one are made impossible, until the paralysis of a country's business by enforced idleness of workmen supplemented by rioting becomes a matter of history never to be repeated, the laws of the country will not be perfect.

We may object to being too much governed, but a comparative despotism is preferable to a condition of things involving the calling out of soldiery to cope directly with what should be a peaceful populace of workmen. War with a foreign power is held to be a not unmixed evil; civil war, and fighting with mobs, are bad in every sense—in cause, in prosecution and in results.

To-day millions of people are suffering from the strike. Its consequences may last for many months to come. Pittsburg is still paying for the damages done during the riots of 1877. Expediency calls for the prevention of such occurrences, and an evasion of the strict laws of logic may be excused if such prevention can be brought about by a law, even if it be one of expediency only.

LAYING AN ATLANTIC CABLE IN TWELVE DAYS.

On the 2d of July the Faraday completed the laying of a new Atlantic cable, the actual time occupied in the work of laying the deep sea portion being but twelve days. When the Great Eastern, in 1866, completed the laying of the first successful Atlantic cable, the entire world joined in congratulations. The event was justly looked upon as marking an era in the progress of the world. Since that time, however, the making and laying of ocean cables has become a practical, everyday business, and the new cable was not only laid in the shortest time, but is a much better cable than any of its predecessors, having the largest copper conductor and being the speediest ever laid for its length.

Although the Faraday left Woolwich on June 12, she did not, owing to unfavorable weather, reach the vicinity of the previously laid and buoyed shore end of the cable, off Waterville, Ireland, until the 18th, and then, the buoy rope, having been wrenched off by a passing propeller, had to grapple for the cable itself, at a depth of about 250 fathoms. Such work now presents no substantial difficulties. The heavy grapnel, attached to 600 fathoms of chain and rope, was three times dragged across the cable's path, when the cable was hooked and hauled up, two miles inside of the end that had been buoyed. The end communicating with the shore was at once tested and spliced to the cable in the tanks, the other piece hauled aboard and the buoys picked up, when, at 10:30 A. M. on the 20th, the vessel was ready to start on the actual work of laying the deep sea cable. At the rate of about seven knots an hour the cable passed up round the core in the center of the tank, along the troughs and directing sheaves, under the sheave of the strain-measuring dynamometer, and sank to the ocean's bed. For several hours the depth varied from 250 to 500 fathoms, when a great declivity was reached and 1,000 fathoms were indicated, followed by a varying bottom, nearly three miles deep in places. Thence it gradually rose to 1,600 fathoms, dropping subsequently to over 3,000, as hill top and valley in the ocean bottom were passed, until the shallow water of the Newfoundland Bank was reached, some seventy-five miles from the buoyed end of the previously laid shore end on the American side, 502 miles from Canso, Nova Scotia. During all this time communication was constantly kept up with the Waterville station, the news of President Carnot's assassination being received on the Faraday the evening of its occurrence. When at 1,585 knots' distance from the Irish coast, and the soundings indicated a depth of 891 fathoms, the lighter deep sea portion of the cable was spliced to a shallow water type, which was continued to the still heavier Canso shore end. Fogs, icebergs, and bad weather prevented the finding of the buoy on this shore end, but after a good deal of dragging the cable was hooked and drawn aboard on the 30th, just ten days from the actual start on the other side, although the final splice was not completed until the morning of July 2.

The new cable was laid for the Commercial Cable Company, being the third cable of that line. It was manufactured and laid by Messrs. Siemens Brothers & Co., who have very extensive works at Woolwich, England, for the manufacture of electrical appliances. The Faraday was specially constructed by the Siemens Brothers for the work of cable laying, and has three large tanks for the storage of cable, with many ingenious appliances to facilitate the paying out, grappling, and hauling up and making all the delicate tests required in all stages of the work. The new cable has a much greater weight of copper conductor or core and of gutta percha insulation than any of the cables previously made. The shore ends and intermediate sections of the new cable comprise about 700 nautical miles and the deep sea portion is nearly 1,600 nautical miles in length.

Eight Hours in England.

The forty-eight hours week has lately come into operation in all the British government works, and new regulations have been forwarded to the works. A careful examination of these, says *Engineering*, indicates that in making the concession the Admiralty have withdrawn many privileges, which in great measure counterbalances the less number of hours worked, and by this means at least they bring the dock yards into line with the private establishments throughout the kingdom. The men will still have the four public holidays as hitherto without loss of pay; but the half holidays on the occasion of a launch, or of a visit of the Lords of the Admiralty, are to be discontinued. Nor will a half holiday be given for a parliamentary election, since the polling booths are now open until eight o'clock. Hitherto three minutes has been allowed the workman to go from the yard entrance to his work every time he enters the works, which meant thirty-three minutes per week. This is discontinued, and the men must be at the pay ticket box close to their work at the time of starting. The five minutes allowed to get to the pay table is discontinued. Hitherto an hour was granted in the morning or evening without stopping of pay in the event of urgent family affairs. No such excuse can now be accepted, while grant of leave without loss of pay to attend Confirmation is also to be discontinued, and blacksmiths will not now have ten minutes to wash each time they leave the works. Again, overtime pay, *i. e.*, time and extra, will only be granted after the men have worked a full 48 hours in the week. It frequently happens that a Saturday precedes or follows a public holiday—Good Friday, Whit Monday, etc.—and on such occasions the men used to work overtime before the holiday to make up the time to be lost on Saturday when not infrequently the machinery was running as usual. This is not to be allowed in future, even if the works are closed on the Saturday, the desire being to meet the men's demand for no overtime, except, of course, where the exigences of the service urgently require it. In this one almost recognizes an Admiralty Roland for the workmen's Oliver. As to the hours fixed, these vary to suit the seasons of the year, the day being shortest in the winter months, 7¼ hours, and longest in the summer and early autumn, 9 hours. On Saturday the duration is 5 hours throughout the year. The earliest start is 7 A. M., and from December to March it is 7:30 A. M., and the hour of closing the work is 4:15 to 5:30 P. M., 1½ hours being allowed at midday for dinner. These are the hours for Portsmouth, Chatham and Sheerness, while for Devonport and Pembroke, which are further west, they are a quarter of an hour later. The hours are for the beginning and starting of work, no allowances being made. The variation in the hours involved the readjustment of the day pay ratings to bring the 48 hours pay to the same as the 51 hours pay; but no change is made in overtime rates, so that in the latter case the same work must be done in the 48 as in the 51 hours week to earn the same sum. The writing staff will continue to work 45 hours, but overtime rates will only be paid after 48 hours have been worked, instead of after 51 hours work as heretofore. Enginemen, stokers, and furnacemen will work longer hours, as at present, to have the plant ready for the workmen.

Spontaneous Combustion.

When charcoal which has been allowed to absorb as much sulphureted hydrogen as it can take up is introduced into oxygen gas, the charcoal will burst into flame, owing to the energy of the action of the oxygen upon the sulphureted hydrogen.

This fact is stated in most text-books on chemistry, but no description that I have ever seen of this experiment is calculated to bring about the effect with certainty. The following is a simple method for illustrating this reaction upon the lecture table, which I have never found to fail:

A few grammes (from five to ten) of powdered charcoal are introduced into a bulb which is blown in the middle of a piece of combustion tube about twenty-five centimeters long. A gentle stream of coal gas is then passed over the charcoal, which is heated by means of a Bunsen lamp until it is perfectly dry. This point may be ascertained by allowing the issuing gas to impinge upon a small piece of mirror, and when no further deposition of moisture takes place the charcoal may be considered to be dry, and the heating may be stopped. The charcoal is then allowed to cool in the stream of coal gas until its temperature is so far reduced that the bulb can just be grasped by the hand, when the coal gas is replaced by a stream of sulphureted hydrogen. The sulphureted hydrogen should be passed over the charcoal for not less than fifteen minutes, by which time the bulb and its contents will be perfectly cold, and the charcoal will have saturated itself with the gas. (In practice it will be found convenient to prepare the experiment to this stage, and allow a very slow stream of sulphureted hydrogen to continue passing through the apparatus until the experiment is to be performed.) The supply of sulphureted hydrogen is then cut off, and a stream of oxygen passed through the tube. Almost immediately the charcoal will become hot, and moisture will be deposited upon the glass. The supply of oxygen should be sufficiently brisk to carry the moisture forward from the charcoal, but not so rapid as to prevent it from condensing on the glass tube beyond the bulb. In a few moments the temperature of the charcoal will rise to the ignition point, when it will inflame and continue to burn in the supply of oxygen. —*G. S. Newth, in Nature.*

A Coloring Matter for Grapevine Leaves.

The green portions of plants contain besides chlorophyl, as a rule, only a yellow coloring matter, called carotin, chrysophyl, or erythrophyl, which is insoluble in water. Several investigators find, however, that some kind of leaves give aqueous extracts of a more or less impure yellow color, an observation which is explicable from the fact that in most of these instances mature leaves were used. Young leaves yield an almost colorless extract. Yellow autumn leaves, however, contain considerable quantities of soluble coloring matters. Thus the authors found that fallen beech and horse chestnut leaves give deeply colored aqueous extracts. They have also succeeded in isolating a yellow coloring matter from vine leaves, the investigation being suggested by the use of these leaves for dyeing purposes in Persia. Like most vegetable coloring matters, this substance is a glucoside. It can be prepared by the addition of lead acetate to the decoction of the finely powdered leaves, treatment of the precipitate formed with sulphureted hydrogen, and subsequent extraction of the dried lead sulphide with boiling alcohol. The residue, obtained by evaporation of the alcohol, is freed from sulphur by means of carbon bisulphide, the glucoside remaining as an indistinctly crystalline brownish yellow substance. By boiling with dilute sulphuric acid it is split up into a sparingly soluble brown body and glucose. This coloring matter may, after washing with water, be purified by adding to its alcoholic solution an alcoholic solution of lead acetate and treating the previously washed and dried bluish green precipitate with ether containing hydrochloric acid, by which the impurities are taken up. The remaining coloring matter is then dissolved in alcohol and precipitated from this solution by the addition of water. It forms a reddish brown powder, soluble in alkalies with a brown color. Its aqueous solution produces upon chrome mordanted wool fine brown shades, and dyes wool mordanted with tin a fine yellow. The coloring matter may possibly be of practical value. The vine leaves were also found to contain up to two per cent of potassium hydrogen tartrate.—*E. Schunck, E. Knecht, and L. Marchlewski.*

Sugar as a Promoter of Muscular Power.

The subject of sugar as a food producing muscular power has been discussed by Dr. Vaughan Harley. During a twenty-four hours' fast, on one day, water alone was drunk; on another, 500 grammes of sugar were taken in an equal quantity of water. It was found that the sugar not only prolonged the time before fatigue occurred, but caused an increase of 61 to 76 per cent in the muscular work done. In the next place, the effect of sugar added to the meals was investigated. The muscle energy producing effect of sugar was found to be so great that 200 grammes added to a small meal increased the total amount of work done from 6 to 39 per cent. Sugar (250 grammes—about eight ounces) was now added to a large mixed meal, when it was found not only to increase the amount of work done from 8 to 16 per cent, but increased the resistance against fatigue. As a concluding experiment, 250 grammes of sugar were added to the meals of a full diet day, causing the work done during the period of eight hours to be increased 22 to 36 per cent.

Vaselone.

Vaselone is a substance introduced as a substitute for vaseline. According to an analysis by Villon, it is a solution of stearone and margarone in neutral mineral oil. Stearone is prepared by distilling stearin with lime. Margarone is prepared in a similar way from beef suet. Vaselone consists of 15 parts of margarone and 5 of stearone in 100 of thoroughly purified and odorless mineral oil. The fatty product obtained, after cooling, resembles vaseline, but is not as transparent. It is white, odorless, neutral, and not affected by acids and chemical reagents.

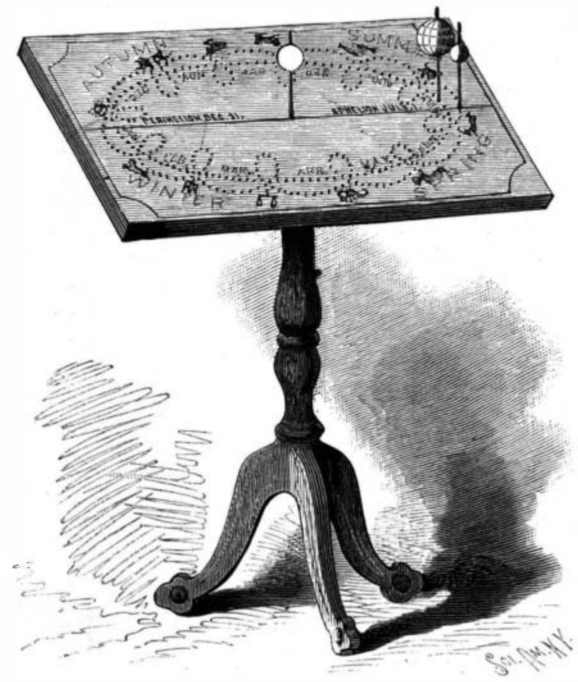
Utilization of Garbage.

The process of garbage disposal is, according to the *American Architect*, probably carried on now with greater perfection in St. Louis than anywhere else in the world. In the new establishment just completed there, at a cost of nearly a quarter of a million dollars, by the company which holds the contract for disposing of the garbage of the city, the carts bringing the material ascend an inclined plane to the third story of the receiving building, where they discharge into enormous vertical cylinders, which are surrounded by steam jackets. Superheated steam is forced into the jackets, and the water, which constitutes from 75 to 80 per cent of the garbage, is thus evaporated, or rather distilled off, the vapor being condensed, and the condensed water, which is perfectly harmless, and even drinkable, allowed to run off to the sewer.

At a certain stage of the drying, naphtha is pumped into the cylinders and allowed to remain there for thirty or forty hours. This dissolves out all the fats, oil, and grease from the mass. Other chemicals are said to be mixed with the naphtha, but this is probably for the sake of mystification, the naphtha alone being quite sufficient for the purpose. After the proper time has elapsed, the naphtha, with its dissolved oil, is pumped out again into stills, where it is distilled by steam heat, the volatile naphtha being allowed to run back from the condensers into the storage tanks, while the fat, which is left in the stills as a brown, oily mass, is drawn off into barrels. It may be bleached, so as to be perfectly white, and it is said that the pure and delicate Ivory soap, which has gained such popularity all over the country, was originally made of refined garbage grease, before it was found advisable to use cottonseed oil instead. After extracting the grease, the residuum in the cylinders is dried a little more, the last vestiges of naphtha being driven off in the process, and is then removed through a door at the bottom. It is now a brown mass, free from all unpleasant odor, and apparently dry, although it still contains 5 or 6 per cent of water. As it has not been heated sufficiently to cause destructive distillation of the solid portions, it contains practically all the nitrogen of the fresh garbage, with, of course, all the alkalies and phosphates; and, after grinding coarsely and packing in barrels or bags, it commands a ready sale all over the United States. The dealers usually analyze a sample and fix their price mainly in accordance with the proportion of nitrogen found in the sample; but the St. Louis "garbage tankage," as it is called, readily brings in New York and Boston from nine to twelve dollars a ton, and the demand for it far exceeds the supply.

AN IMPROVED TELLURIAN.

This tellurian is more especially designed for use in schools, to show without much trouble, and in a very effective manner, the causes of the seasons and the



NICHOLS' TELLURIAN.

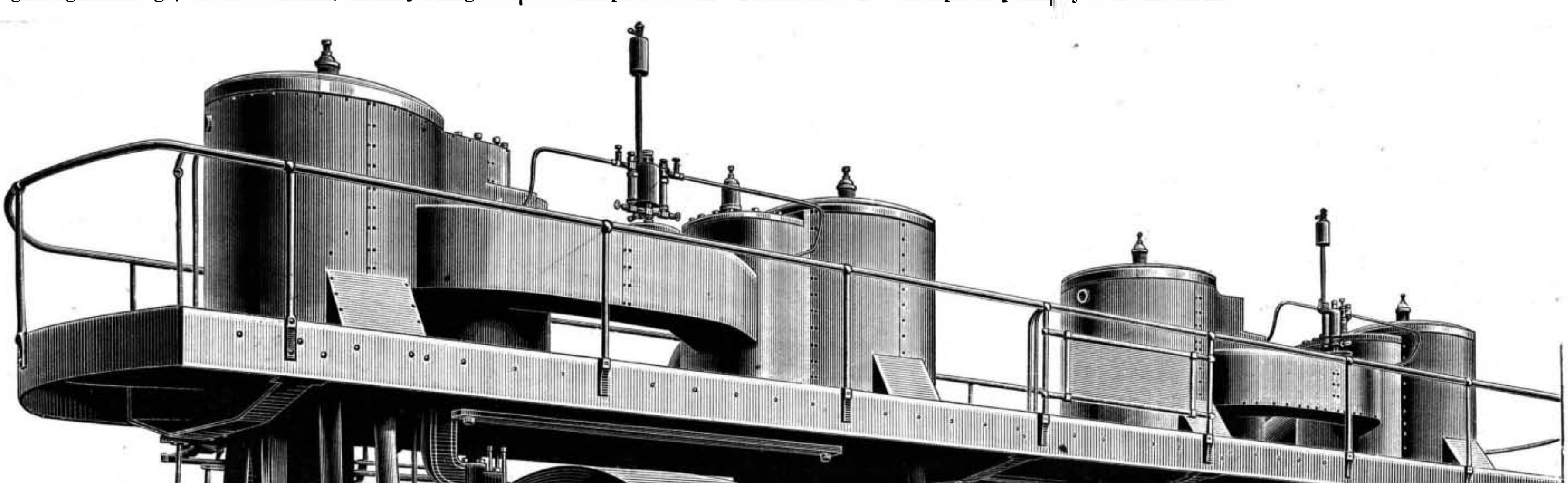
relative positions of the sun, earth, and moon. It has been patented by Mr. Grant B. Nichols, of Wapakoneta, Ohio. It comprises an inclined table on a suitable stand, with a central recess, in which is a rod carrying a ball representing the sun, around which is a series of 365 apertures, made in the surface of the table in an ellipse, representing the path of the earth around the sun. These apertures are preferably numbered according to the days in the month, the names of which appear at their respective places, and a vertical rod carrying a globe representing the earth is designed to be placed in one of the apertures. Another series of apertures, also preferably marked or numbered, represent the path of the moon relative to the elliptical path of the earth, a rod carrying a ball representing the moon being placed in one of these apertures. The rod carrying the ball representing the earth may at any time be inserted on the proper date in the aperture provided for it, the rod carrying the moon being likewise placed in correct position, when the relative positions of the different bodies will be practically illustrated. The apertures for the rod carrying the ball representing the earth are all of the same depth, but those in the path of the moon are of different depths, so that the moon's orbit about the earth is not so much inclined as the earth's orbit about the sun, the moon being thus always represented in the proper position relative to the earth and sun.

ELECTRIC LIGHT ENGINES, MANCHESTER CORPORATION.

We illustrate the engines constructed by Messrs. Galloways, Limited, for the Manchester corporation. We are indebted to the *Engineer*, London, for our engraving and the following particulars:

The engines are arranged at either side of a gangway, this gangway giving access to the upper staging of all the engines in the installation. The steam pipes below are in duplicate, as also are the steam valves on the boilers and the stop valves on the engines, so that either series may be used at will. The lower pipe over the gangway is the water supply from the tank over the boiler house; this pipe supplies the Korting ejector condensers. The engines have high pressure cylinders 17 inches diameter, low pressure 34 inches diameter, with a piston stroke of 3 feet, and they are intended to run at a varying speed of from 75 to 90 revolutions per minute. The admission of steam is controlled by expansion valves arranged in accordance with Messrs. Galloway's plans, the gear consisting of a block working in a slotted link directly in connection with the governor. The governor is of the parabolic type adopted by Messrs. Galloway some years ago with unequivocal success, but in this case a portion of the center weight has been removed and a spring substituted to give a varying load. Both cylinders are steam jacketed, and a receiver is formed round the jacket of the high pressure cylinder, so that the two cylinders have apparently the same diameter.

THERE are 11 American cities that spread over more territory than Paris, while Berlin is exceeded in area by 17 of our cities.



IMPROVED COMPOUND ELECTRIC LIGHT ENGINES.