caps that were used at the Balakhani wells were completely destroyed in this manner. Messrs. Nobel Brothers have one at their office at Baku preserved as a curiosity, which was worn into holes in a few hours, although 3 inches thick. It was this circumstance that led to the invention of a special kind of cap fitted with sliding valves. As might be imagined, when a fountain spouts as high as the Monument it forms round about the mouth of the well immense shoals of sand, which extend sometimes to the distance of a hundred yards from it. Houses are not infrequently completely buried in these mounds, and the mouths of neighboring wells covered for a time, involving heavy claims for compensation.

As soon as the oil ceases to spout, pumping is resorted to. The cylinders used are 10 feet long by 10 inches broad, and have at the bottom a valve which opens on touching the ground, and closes when the tube is lifted. About a couple of minutes are required to lower and lift the tube, which brings about fifty gallons of oil to the surface each stroke. When the supply begins to grow thin, boring is again resorted to. The wells are never torpedoed, because the borers are almost sure to reach a fresh supply lower down. On attaining the surface the oil runs through wooden pipes to channels outside the derrick, whence it makes its way to ponds. These, as often as not, are simply natural hollows in the ground with a rough sand embankment around them. After standing a while to rid itself of the sand, the oil is pumped into iron reservoirs, and then is piped to the refineries, eight or ten miles distant at Baku. Some of these ponds are so large as to merit the appellation of lakes. They often contain many million gallons, wasting their goodness on the desert air. The whole expanse of the Balakhani plateau is dotted with them.

At present there are eight pipe lines in operation conveying the oil from the wells to the refineries. The aggregate length of these is over sixty miles. They are quite a modern institution, having only been introduced by Nobel Brothers during the last few years. Previous to that, the oil used to be conveyed in barrels down to the coast.

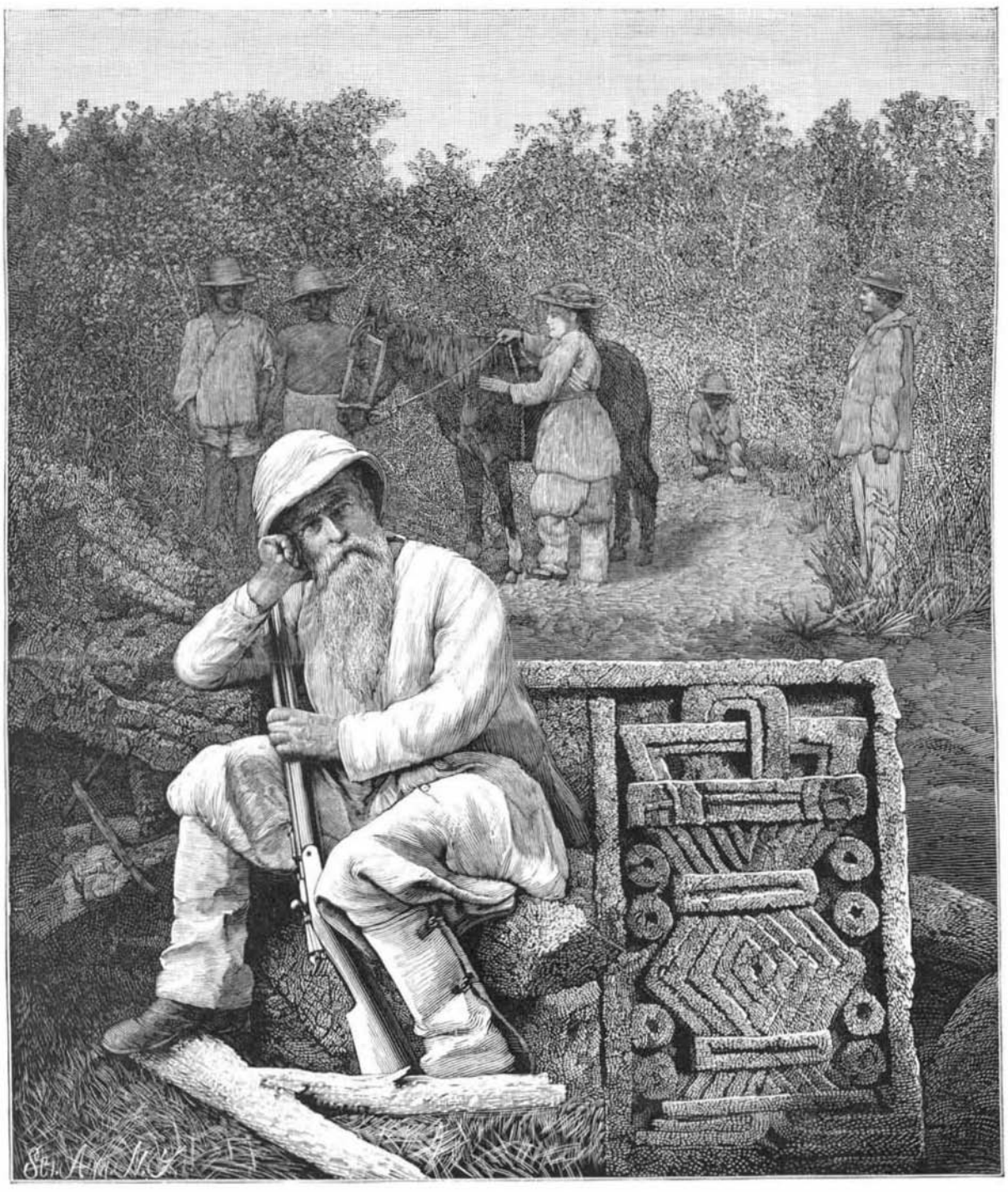
Various schemes are constantly being discussed for conveying the oil to Europe. One of these, in favor several years ago, was a pipe line a thousand miles long, to run from Baku across the Caucasus to the railway system in Southeast Russia. Another extended from Baku to the Black Sea to Poti or Batoum. This may be regarded as the most practical, and if any pipe line ever be laid down from Baku, this will inevitably be the one. At present there is a deal of talk of running a pipe line from Baku to the Persian Gulf, with the idea of securing Baku the exclusive control of the markets of Asia.

The refining operations are carried on at what is known as the Black Town (*Tchorni Gorod*) at Baku, which was illustrated in SCIENTIFIC AMERICAN a few weeks ago. Baku is situated on a magnificent bay, with deep water close inshore. An island, lying across the mouth, serves as a breakwater, and renders the bay safe for shipping in the roughest weather. It is hardly necessary to remind the reader that the southern part of the Caspian is never frozen over, as is the case with the ports at the mouth of the Volga. From the Shakhoff peninsula to Sultan Point the Bay of Baku has an extent of nearly fourteen miles of waterside, of which more than six miles are already taken up by the Black Town, Baku itself, the quarantine port, and the dockyard. The Baku section is fronted by more than a mile of limestone quaying, reminding one of the Thames embankment. Handsome buildings and well stocked shops are rising along this quay, at the back of which extend the best quarters of the town, the old Persian fortress, the municipal offices, and the numerous native bazaars. South of it is the quarantine port, with numerous piers, where the steamers unload their cargoes from the Volga and the ports of Persia. An astonishing amount of trade is transacted here. Beyond lies the handsome dockyard, a very extensive establishment more adapted for the maintenance of a regular fleet than the insignificant gunboat flotilla Russia now keeps up in the Caspian Sea. This, and the stone barracks of the garrison, etc., complete the southern side of the bay.

The northern side is taken up with the railway terminus and wharf and the 200 refineries, the latter of which form quite a town of themselves. As the name implies, the Black Town is a filthy, dirty hole, consisting of greasy stone buildings, surrounded by high stone walls and divided, the one property from the other, by regular quagmires of mud and oil. From nearly all of the refineries dense clouds of smoke rise and blacken the atmosphere. Nobel Brothers' establishment is about the last along the bay, from Baku, excluding two or three others lying some distance away from the Black Town, farther in the direction of Shakhoff Point.

From our brief description it will be seen that Baku is a very extensive town with a large population, and possesses all the resources of civilization. An idea of its shipping may be formed from the fact that 7,000 vessels enter and leave the port every year. Passenger steamers run regularly between it and the towns on the Volga, particularly to Tsaritzin, of which point we give a view showing Nobel Brothers' vast depot.

The distance from Baku to Astrachan, at mouth of Volga, is 560 miles, and from Astrachan the product is transported up the river to Tsaritzin, whence it is carried by rail to the interior of the empire.



DR. LE PLONGEON AND HIS PARTY.

Marble Pictures.

Dr. Hand Smith has been engaged in studying the movement of colored particles within marble, ivory, and other dense substances; and the result is a process of developing paintings and designs below the surface of marble, thereby combining the two arts of painting and sculpture. Through the use of metallic oxides, worked in a special medium and fixed by a special treatment, designs in every shade and tint are produced within the stone. It is a peculiarity of the method that every hue penetrates at right angles to the surface without spreading laterally. Samples of the new art are now being exhibited at Piccadilly Hall, London, and include decorative designs and delicate paintings of autumnal foliage. The process will be applicable to statuary, pottery, and mural tablets, as well as architectural decoration.

DR. LE PLONGEON AND HIS PARTY.

The interesting architectural remains of Yucatan which have been illustrated in the past few numbers of the paper testify so clearly to the civilization and taste of peoples and races who were extinct before this country was discovered, and have elicited so much attention from all who are at all interested in architecture as an art and archæology as a science, that we give in the accompanying engraving portraits of Dr. and Mrs. Le Plongeon, who have for ten years been occupied in prosecuting these researches in the forests of Chichen Itza, and to whom much praise is due for their untiring effort and indomitable perseverance. Dr. Le Plongeon is seated in the foreground, with his head resting wearily upon his hand. Mrs. Le Plongeon, who has accompanied the worthy doctor in all his wanderings is represented in the middle of the picture, ready to mount her Indian pony. Two native attendants stand at the left of the picture by the pony's head, and Lieutenant Alcoeer, chief of the escort, stands at right of the group. In the foreground is seen a curious symbolical stone which had its meaning among the Maya priesthood, and which was discovered in a mound near the monument of Chaacmol.

Cure for Nitric Acid Burns.

Prof. A. Irving writes as follows to the *Chemical News*: Some weeks ago, in experimenting with "brown fuming nitric acid," I happened to splash a portion of this powerfully corrosive liquid upon the skin of the face. The pain caused, I need hardly say, was very acute, and in a few minutes an enormous blister arose upon the part affected. Copious application of cold water, then of such powerful bases as ammonia, potash, and lime in water, had no perceptible effect upon it, except perhaps to increase the violence of the inflammation. After a few minutes, however, I luckily bethought me to try the effect of a dilute solution of sulphurous acid, of which I had a good supply made but a short time previously. Assuming that the action of the strong nitric acid was an intensified process of oxidation, I cast about for a reducing agent which might safely be trusted to be innoxious, even if it did not afford much relief. The effect of its application was astounding. In a very few minutes the blister was reduced; the oxidizing process of the strong acid was completely arrested, without having reached the roots of the hairs on the face; the painful irritation was completely removed, and in an incredibly short space of time the wound healed.

Submarine Electric Lamp.

Recently, some very interesting experiments in submarine electric lighting were conducted on the Clyde, at Greenock, Scotland. The Tilly, a vessel built by Messrs. Hanna, Donald & Wilson for the fisheries at Batavia, has been fitted with machinery to supply current for a 15,000 candle power lamp, which it is intended to lower into the sea for a depth of ten fathoms or less, as the exigencies of the drift net fishing require. The whole of the electrical apparatus, as well as the gearing for raising and lowering the lamp, have been supplied by Messrs. Paterson & Cooper, the current being supplied by one of their No. 4 dynamo machines, coupled directly to a Gwynne high speed vertical engine, and running at 650 revolutions a minute. The lamp, which is inclosed in a flint glass cylinder 9½ inches diameter, is suspended from a davit over the vessel's side, and the two conductors consist of finely stranded copper cord inclosed in India rubber hose. These conductors pass over pulleys on the end of the davit, and the lamp is raised or lowered by a winch fitted to the bottom of the davit. The trial lasted for four hours, during which time the lamp was submerged, and kept alight with the full current of 60 amperes through it.

The Artificial Alizarine Patent.—An Important Decision by the Supreme Court of the United States.

Justice Blatchford recently delivered the opinion of the court in the appeal case resulting from the suit of the Badische Company *vs.* Cochrane *et al.* This was a suit in equity brought in the Circuit Court of the United States for the Southern District of New York by Badische Anilin und Soda Fabrik, a corporation organized under the laws of the Grand Duchy of Baden, in the Empire of Germany, against the appellants, for the infringement of reissue letters patent No. 4,321, granted to Charles Graebe, of Frankfort-on-the-Main, and Charles Liebermann, of Berlin, Prussia, April 4, 1871, for an improvement in dyes or coloring matter from anthracine. The original patent (No. 95,465) was granted to the same persons October 5, 1869, for an improved process of preparing alizarine. It was reissued on two separate amended specifications, Division A and Division B. No. 4,321 is Division B.

The Judge says:

"Inasmuch as the defendant's article is produced from anthracine, or its derivatives, by some method, and is a dyestuff called 'artificial alizarine,' it is contended that the sale of it infringes No. 4,321. The articles in market, called 'artificial alizarine' at the present day, are substances all of which are made from anthracine; but they vary all the way from nearly pure alizarine made by the monosulpho acid process through the products of the bisulpho acid process, which contain combinations of alizarine and anthrapurpurine, up to an article of pure purpurine, free from alizarine. All of these are used as dyestuffs, according to the shade of color and other qualities desired. The specific article put in evidence in this case as an infringement contains about sixty per cent of anthrapurpurine. It is claimed by the plaintiff to be the artificial alizarine described in No. 4,321, and to be physically, chemically, and in coloring properties similar to that. But what that is is not defined in No. 4 321, except that it is the product of the process described in No. 4,321. Therefore, unless it is shown that the process of No. 4,321 was followed to produce the defendant's article, or unless it is shown that that article could not be produced by any other process, the defendant's article cannot be identified as the product of the process of No. 4,321. Nothing of the kind is shown. On the other hand, the defendant's article is made abroad and by a process different from that of No. 4,321. It therefore cannot be the product of that process. If the words of the claim, 'by any other method which will produce a like result,' mean any other method which will produce the only product mentioned in the description, namely, alizarine, as then understood, having the formula $C_{14}H_8O_4$, the defendant's article is not that product, for it contains other dyeing ingredients which the alizarine of the patent does not contain. If the words of the claim are to be construed to cover all artificial alizarine, whatever its ingredients, produced from anthracine or its derivatives by methods invented since Graebe and Liebermann invented the bromine process, we then have a patent for a product or composition of matter which gives no information as to how it is to be identified. Every patent for a product or composition of matter must identify it so that it can be recognized aside from the description of the process for making it, or else nothing can be held to infringe the patent which is not made by that process."

In brief, the Supreme Court holds as follows:

The claim in reissue letters patent No. 4,321, granted to Charles Graebe and Charles Liebermann, April 4, 1871, is: "Artificial alizarine produced from anthracine or its derivatives by either of the methods herein described, or by any other method which will produce a like result." Unless it is shown that the method described in this patent was followed to produce the defendant's article, or unless it is shown that that article could not be produced by any other process, the defendant's article does not infringe the patent.

While a new process for producing the old article (alizarine) was patentable, the product itself could not be patented, even though it was a product made artificially for the first time, in contradistinction to being eliminated from the madder root. Calling it "artificial alizarine" did not make it a new composition of matter, and patentable as such by reason of its having been prepared artificially for the first time from anthracine, if it was set forth as alizarine, a well known substance.

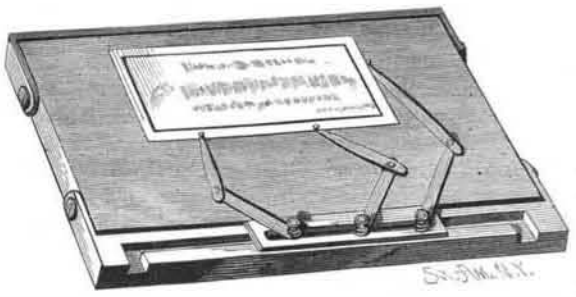
The reissue patent certainly is for a different invention from that described in the original patent, unless the product claimed in the reissue is precisely that product, and no other, which the process described in the original patent produces.

A Magnificent Palace Car.

The private coach recently built for Mr. E. H. Talbot, of the Chicago *Railway Age*, is one of the most luxurious affairs, says Mr. Pullman, ever put upon a railway track. It runs on twelve wheels, six of which were made in Germany by Krupp. The observation room at the end of the car is finished in oak, with plate glass windows extending to the floor, velvet carpets, and embossed leather furniture, including sofas. The bedroom is finished in maple and amaranth, and opening from it is the parlor, the most elegant apartment of the car. It is finished in solid mahogany, with inlaid panels and carvings of rare and costly woods from all corners of the earth, including the Holy Land. The butler's pantry, kitchen, and the sleeping apartments for the servants are models of elegance and comfort. To duplicate the car would cost $75,000—it was a present to Mr. Talbot.

FEED GUIDE FOR PRINTING PRESSES.

Secured by thumb screws and adapted to be shifted along a slot are three fingers made of thin, flat spring metal. To each finger is attached an extension by a joint connected by a small thumb screw having a pointed end. On the outer end of each extension there is a point; these points are set in the tympan sheet at the edges of the paper as shown in the engraving, and the points at the joints are set wherever they may happen to touch, to stay the end points. From the



SMITH'S FEED GUIDE FOR PRINTING PRESSES.

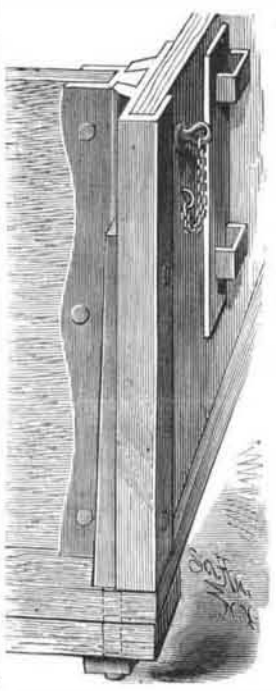
joints the fingers spring downward a little in order to press the end points down.

The attachment needs no screw driver or wrench for adjusting it, as the joints are secured by small thumb screws; the fingers spring sufficiently to allow the points to be raised and carried around, and to keep them pressed down.

This invention has been patented by Mr. W. B. Smith, of Orlando, Florida.

WAGON BODY.

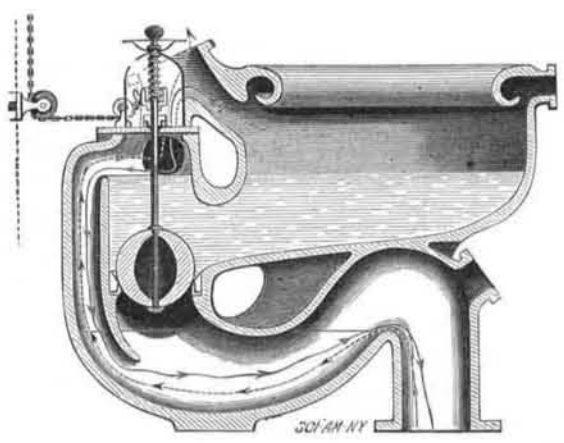
At each corner of the bottom of the wagon box is secured a standard, having a U-shaped cross section, provided with a short and long shank between which pass the ends of the lower side board. Riveted to the outer surface of the long shank is a metal bar which terminates in a screw that passes through the bottom board and a cross bar, and receives a nut. By this means the standard is held in place. On the outer surface of the long shank is formed a dove tailed groove, in which fits a tongue formed on a U-shaped casting held on the end edge of the end board. A locking pin passes through the side board and long shank into the edge of the tongue. The side board is held to the standard by pins. The lower side board is provided with loops for receiving stakes for holding the upper side boards. As the standards hold the end board, no cleats need be nailed to the end of the side boards for holding the end board, neither are cleats on the end board necessary.



This invention has been patented by Mr. C. F. Folsome, and further particulars may be obtained from Messrs. Folsome & Dillon, of Atoka, Indian Territory.

WATER CLOSET.

The accompanying illustration represents one of the latest inventions in water closets, and which is worthy of study, as the inventor claims that it contains all the elements of success needed to make it perfect. It is made of crockery,



WATER CLOSET.

and is simple in operation and compact in form, having no parts where matter can lodge. Raising the pull rod lifts the hollow rubber ball on its lower extremity, and pulls the chain admitting the water, which, as the engraving shows, is not permitted to immediately enter the body of the bowl, but is guided round the crown so that every portion is thoroughly washed. The rod passes through a stuffing box in a brass plate, so that all foul gases are excluded from the room. The rubber ball cushions on a brass thimble cemented to the crockery and finished to a smooth surface with a tool. By means of an encircling spring near its upper extremity, the force required to raise the rod can be adjusted to a nicety, adapting its use to children or adults, as may be necessary.

Particular attention has been paid to ventilation. Emanations from the sewer pass to the lower water line, which bars their further progress. If from any cause this trap should fail to seal, then the gases would take the direction shown by the dotted line, and pass out through the pipe attached to the side of the top of the bowl. In case of siphonage from the exterior, the air would enter the bowl and go through the closet as indicated by the noted line to the sewer. The coupling for uniting the metal pipes to the crockery of the bowl consists of an externally threaded ring, divided into longitudinal sections, which is put round the branch of the bowl. The ring is slightly larger than the collar of the branch, in order that the screw nut which holds the parts together may pass over. The screw nut of the coupling screws on to the split ring, bringing the parts together against a rubber packing.

Communications relating to this patent should be addressed to the Nason Manufacturing Co., 71 Fulton Street, New York.

The Indicator Diagram of a Gas Engine.

At the last meeting of the Physical Society a paper was read by Professor W. E. Ayrton, F.R.S., and Professor J. Perry on the above subject. It was intended to teach practical engineers a method of studying gas engine diagrams. The most recent results obtained by the use of Dowson gas were given by the authors, and it was suggested that before long gas engines will be employed for the propulsion of ships. A large wooden model of an Otto engine enabled the operations going on during a cycle of the engine to be understood by the meeting. Tables were given of the constituents of coal gas and Dowson gas and the air required for combustion, and the heat of combustion and specific heats, to enable the characteristic equation of the fluid used in the gas engine to be determined.

An easy method of obtaining an empirical formula to represent all the diagrams which can be obtained from an engine with different quantities of gas was described, and its results compared with observation. The effects of vibration of the indicator spring in the various parts of the diagram were discussed, as well as those of the explosion. Three practical methods for determining the rate q of gain of heat by the fluid during the forward stroke were given, and a diagram was shown in which this rate could everywhere be compared with the rate of doing work. If W is the indicated work in one cycle, it was shown that 5·64 W is the total energy of combustion of one charge, and this is expended as follows: 1·45 W is the work done in the forward stroke, 2·22 W is given to the cylinder by radiation in the forward stroke, 1·5 W is carried off through the exhaust pipe, 0·47 W is given to the cylinder as heat after the exhaust valve opens. The rate at which the loss 2·22 W by radiation occurs at every point of the forward stroke was shown on a diagram obtained from a knowledge of the temperature at every point in the stroke, and when the ordinates of this diagram were added to the q diagram previously described, a diagram was obtained showing at every point of the stroke the rate at which combustion was going on. This diagram was specially important as showing the effect of dissociation in the gas engine.

Large Grape Vines.

Capt. W. G. Phelps has a grape vine that is now believed *to be the largest in the United States. In 1867 the large* vine that was famous in Southern California was cut down and exhibited at the Centennial Exhibition. It measured 14 inches in diameter. This vine of Captain Phelps' is 25 years old and is 13 inches in diameter. It is of the Mission variety, and it has never received the benefits of irrigation. It stands near the house, south of Stockton about two miles, and it covers about 4,000 square feet of ground. If it had been permitted to run where it wished it would have covered a much larger area, but it was found necessary to cut it back in order to save the roof of the house. The largest crop that grew was two or three years ago, when, after selling a ton and a half by actual weight, the remainder was estimated at two tons and a half.—*Pacific Rural Press.*

(In the *Bulletin of the Torrey Botanical Club* for January, 1882, Prof. C. E. Bessey reports finding in Wayne County, Ohio, a colony of grape vines, supposed to be *Vitis labrasca*, L., the trunks of which were, some of them, over a foot in diameter. In a subsequent number of the same journal, Mr. H. W. Ravenel, of Bluffton, S. C., states that in March, 1881, while in Darien, Ga., he rode out to Baisden's Bluff on the coast, some twelve miles northeast of Darien, to see a celebrated grape vine. It was just in leaf, and, from the wood and bark, appeared to be *Vitis æstivalis*. On measuring the trunk at 8 feet from the ground, Mr. Ravenel found that it had a circumference of 44 inches. This rather beats the grape vine of the land of the "big trees." Another large vine, although of smaller dimensions than those noted above, is reported by Mr. N. L. Britton (*l. c.*) as growing near Egbertville, on Staten Island, N. Y. This vine (*Vitis cordifolia*) has a circumference of 25½ inches at a point three feet above its base, "completely covers three cedar trees, each at least 30 feet high, and is a very beautiful plant.")