hour after being coated. I never noticed the exact proportions used, but had it mixed, and tested it by putting a little on the wall, and added any of the necessary ingredients till it answered the purpose intended.

New York City. P. H. VANDER WEYDE, M. D.

### Saws and their Capabilities.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN of November 2d, 1867, Mr. Emerson, in answer to some remarks made by Mr Lamar Foss, concerning the power necessary to cut lumber, says that one horse power will cut 1,000 feet of lumber in ten hours running. It appears to me that Mr. Emerson takes exception to a general rule; claiming to do that amount of work with nice, clear, soft, and picked timber. Such is not generally the case; a mill must cut good, bad, and indifferent, hard and soft timber; and I would have supposed that Mr. Emerson would have aimed at giving us a unit power, if I may say so, for cutting 1,000 feet of lumber in a given time, answering the wants of the country at large, instead of making it a sectional affair. The first statement made about that big saw was such that it would induce the reader to believe that fifty horse power would drive it four hundred revolutions in a minute, with six inches feed, through a cut forty-one inches deep. Such a thing is impossible. At that rate, 50,000 feet of lumber in ten hours, with such a speed and feed, would be a very poor day's work. If 50,000 feet of lumber is considered a good day's work, such a big saw is not necessary. I am now running a fifty inch saw, and can cut 50,000 feet of Oregon fir (Douglas pine) in ten hours. One filing lasts us from four to six hours. My rule for applying power to circular saws is the following, the result of experience:

Taking seven-eighths of an inch for maximum feed for each single tooth, and two horse power being the power necessary to drive such tooth through a bolt six inches in thickness, at the rate of 500 revolutions a minute, it would follow that if I wanted to run a saw at such a speed and feed through eighteen inches, using sixteen teeth, or two inches feed, I would have $16\times2\times3=96$ horse power, to be directly applied to the saw. If more or less feed is required, more or less power must be applied in proportion. From the foregoing rules, if the charge of applying power to that big saw was entrusted to me, and if it was really expected from me to run it with the feed and speed before mentioned, allowing only 36 inches cut, I would want $48\times2\times6=576\times4=460\frac{80}{100}$ horse power; and with suitable timber as regard to size and length, I would expect to cut over 200,000 feet of inch boards in ten hours, if the whole could be handled fast enough.

As a last remark, I would say that I believe, from my observations, that it requires fully three horse power to cut 1,000 feet of lumber in ten hours; two for the main saw, and one for the edger, that I have supposed to be at hand for the purpose. These conclusions come from trials made, where a dynamometer was used to ascertain the amount of the motive power, and the timber used was Oregon fir, which I suppose might be considered of average hardness as regards timber generally. It would be well for those engaged in manufacturing lumber to know rather than guess, and a few communications through your valuable paper, no matter how contradictory they might be, would not fail to throw more light on a subject that is yet not well understood. It would be well, if any communication is made, to have the motive power tested, and that on the saw mandrel. J. A. LESOURD.

Oak Point, Washington Territory.

### Electrical Phenomenon.

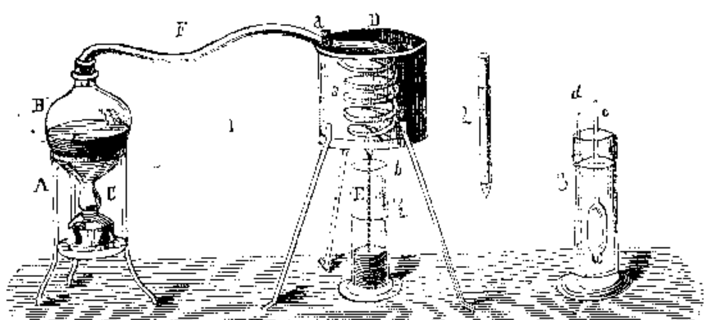
The Rochester *Union* says that one of the most beautiful electrical phenomena imaginable was lately witnessed in the office of the Atlantic and Pacific Telegraph Line. Wire No. 1 of this line was down between this city and Syracuse. Suddenly it was discovered that neither wire would work. A continuous current of electricity was then observed to be passing over the wires through the several instruments, and this while the batteries were detached. The current seemed to be of the volume of a medium-sized pipe stem, and it gave the several colors of the rainbow, beautiful to behold. With the key open, the current flowed in waves or undulations, and from the surcharged wire it would leap over the insulated portions of the key and flow along the wires beyond. The same phenomenon was observed at Buffalo and at Cleveland. The gas in the office here was lighted without difficulty by holding the end of a wire within an inch or two of the gas burner. The current was intense enough to shock one holding the wires or instruments—indeed, one of the employés of the office had his fingers scorched by the current. With closed keys the current was continuous, as before stated.

The theory advanced by an experienced electrician is this. The electrical equilibrium of the atmosphere had become disturbed by the sudden and extreme cold of the past two days—and we may say here that this phenomenon has never been witnessed except when cold weather prevails extensively—the electricity, instead of descending to the earth as in a thunder storm or in warm weather, ascends in the atmosphere, thus destroying the equilibrium and producing these magnificent displays. The broken wire spoken of, which rested on the ground, was the point of communication for the current from the earth. The electrician advances the theory that Aurora Borealis is produced from the same causes, and we submit that it is not an improbable theory. Every one has seen, undoubtedly, the wavy or undulating motions of the Aurora Borealis, and the wavy motions of the current last night with the batteries off and the key open were precisely the same.

Here we may notice one thing not generally known. A portion of the Irrepressible Conflict speech of Wm. H. Seward in this city, a few years since was telegraphed to New York and from Boston to Portland by the electrical influences of the Aurora Borealis—all the batteries on the line being detached. This feat, it is said, has never been repeated.

### APPARATUS FOR DETERMINING THE AMOUNT OF ALCOHOL IN FERMENTED LIQUORS.

For the quantitative determination of alcohol in simple alcoholic mixtures the specific gravity plan is generally made use of. This method being based upon the difference which exists between the specific weights of the liquids, recommends itself for correctness and simplicity, and is therefore most applicable for practical use. For liquids, however, in which the alcohol is associated with several substances, this method cannot be employed, for the alcoholic strength bears no distinct relation to the specific gravity of the same. But as it is of great importance for wine and cider manufacturers, as well as for brewers and distillers, to be enabled to determine at any time, during and after the process of fermentation, the exact amount of alcohol of the respective liquids, a practical method for obtaining this end must be considered as of great value, and such appears to be the form




of apparatus first described in the "Chemistry of Wine," by Dr. F. Mohr, of Coblenz, Prussia, and represented in the annexed cut.

A brass frame, A, supports a glass reservoir, B, having a capacity for holding about seven liquid ounces. In the brass water receptacle, D, is a coil of cooling pipe, connected with the glass reservoir and terminating just above the cylinder, E.

To ascertain the proportion of alcohol in any liquor, the cylinder, E, is filled with it, full up to mark, *b*, and this entire quantity being emptied into receptacle, B, heat is applied beneath. Cooler, D, having been filled with cold water, the vapors conducted through pipe, F, are condensed, and drop into the cylinder, E.

The distillate having collected therein precisely up to mark, ½, the alcohol lamp is to be extinguished, and cold distilled water or rain water added thereto, up to mark, *b*. In order not to transgress said mark, the pipette, Fig. 2, is used, by which the water can be added by drops. If then the indications of the hydrometer (Fig. 3) and the thermometer are marked down, the tube accompanying the apparatus will show the precise alcoholic strength of the substance distilled. The table is simple and easily understood. We are informed that Henry Guth, optician, 104 Delancey street, New York, furnishes these apparatus.

### Car Wheels---Their Composition and Causes of Breakage.

With the frequent accidents caused by the breaking of car wheels, we know, says the *American Railroad Journal*, of no subject connected with railways demanding greater attention on the part of engineers than the use of the strongest wheels.

In most treatises on iron, the texture of cast iron is said to be granular, it is in fact crystallized as found by chemical experiment and microscopic investigation. Crystals of gray iron being octahedral, their maximum limit when cubic, being $\frac{1}{15000}$ of an inch in linear dimension, and about $\frac{1}{2000000000}$ of a grain in weight; crystals in white or chilled iron are smaller, and most frequently occur in six sided prisms, sometimes connected in fascicles by their ends, at other by their sides, in a sort of stellated or radiated arrangement, as may be readily observed in a fragment from the tread of a chilled wheel.

The density of cast iron is from 7.1 to 7.5 of a porous nature, under hydraulic pressure water having been forced through four inches of metal. By remelting in an air furnace, its strength has been increased up to twelve meltings, though the same result has not been found with the cupola.

The purer the iron is from foreign particles the greater cohesion its crystals have with each other, which constitutes the difference between strong and weak irons. So great is its affinity for other substances, that its ores are seldom found pure, and as the foreign matters form the quality of the metal smelted from the ores, it is evident that each peculiarity of the ore is imparted to the iron made from it.

The best qualities of charcoal pig iron give, by analysis: Iron, 96,992 per cent; carbon, 2,800; silicon, 0,208, with traces of manganese and copper. The tensile strength of the pig, from 18,000 to 28,000 pounds per square inch. Remelted iron from 31,000 to 41,000 pounds.

Charcoal, the fuel with which the ores are smelted. when new and pure, consist of carbon 97 parts, ashes 3 parts. When old, carbon 85 parts, water 12 parts, ashes 3 parts. The best qualities of ores and the fuel show an entire freedom from either sulphur or phosphorus.

The effect of sulphur on iron is to cause brittleness at all temperatures, red shortness when hot, to such a degree that experiment has shown that even $\frac{1}{30000}$ of sulphur is enough to produce brittleness, and $\frac{1}{10000}$ red shortness.

Phosphorus imparts the quality of shortness at low temperatures, and there are but few irons in which a trace of this substance cannot be found. One per cent of phosphorus rendering iron to be of a very bad quality and of limited use.

In the manufacture of car wheels, the pig metal is melted with anthracite coal in the cupola. Anthracite coal contains carbon 88.50 parts, volatile matter 7.50 parts, ashes 4.00. Average specimens of white ash anthracite coal from Pennsylvania contains in 100 parts sulphur 0.91 per cent. All varieties of hard coal contain sulphur in a more or less degree, combined with iron in the form of iron pyrites, disseminated through the coal. Anthracite iron, or iron smelted with anthracite coal, from its want of strength owing to the sulphur and other impurities in it, is never used for car wheels.

Having noted the peculiarities of the best charcoal irons, and charcoal, as compared with anthracite iron and anthracite coal, it becomes a matter of much importance to inquire how far these elements effect the car wheels as generally supplied to railroad companies.

But few, if any, railroads would be willing to risk the use of car wheels made from anthracite iron, even if a proper chill could be put on them to insure wear. The general practice is to remelt the old car wheels with anthracite coal, using from one third to two thirds of new metal. With each remelting the affinity of the iron for foreign substances absorbs the sulphur from the coal, resulting, with each remelting of the old wheels, in a weaker iron, and thus the process goes on from year to year.

How near the mixture thus made, claimed to be pure charcoal iron, is the genuine article, can readily be conjectured; but with this process comes poor wheels, breakage, and loss of life.

Cast iron, when in constant vibration, as in a car wheel in use under express cars, soon wears out, or "become tired," the granular formation is disturbed by the repeated jar of continued motion, as is evident by the failure of wheels under express cars, with less mileage than wheels under cars or engines with frequent stops or long periods of rest.

Another great cause of breakage is due to the extreme pressure used in pushing the wheels upon the axle; a pressure of 10 to 12 tuns per wheel holding it fast, as well as 30 or 40 tuns as is frequently used, which strains the wheel, ending in a cracked wheel after a short time in use.

With a knowledge of these facts one year ago, an extensive car wheel works was established at Ramapo, N. Y., on the Erie railway, for the purpose of making wheels entirely of pure metal from the Richmond and Salisbury mines.

The Richmond iron, famous for ordnance—the United States Government having used not less than twelve thousand tuns for guns—and recently so successfully tried in the Rodman Gun trial at Shoeburyness, England, having a tensile strength of from 31,000 to 41,000 pounds per square inch, has proved itself to be one of the strongest of cast irons for guns.

To ascertain its relative strength in car wheels, experiments were made by the Pennsylvania Railroad Company, July 17th, 1867, in comparison with the wheels in use on this road as follows:

| No. | Maker. | Size. in. | Weight. lbs. | *Blows on each wheel. | | | Total No. of blows. |
|---|---|---|---|---|---|---|---|
| 1 | Omitted | 33 | 496 | 49 | 24 | 13 | 86 |
| 2 | " | 32 | 631 | 21 | 21 | 45 | 87 |
| 3 | " | 33 | 546 | 9 | 7 | 23 | 39 |
| 4 | Ramapo | 33 | 519 | 59 | 152 | 80 | 291 |
| 5 | Omitted | 33 | 549 | 36 | 28 | — | 64 |
| 6 | " | 32 | 513 | 51 | 43 | — | 94 |
| 7 | " | 33 | 510 | 20 | 9 | 12 | 41 |

* Each wheel was tested in three places, if not destroyed by previous blows.

By the first set of blows given, all of the wheels, with the exception of the Ramapo wheel, were entirely destroyed, the subsequent blows being given to test various portions of the remaining plates.

The Ramapo wheel, with each trial, was only dented or crushed in, and after many repeated blows on the rim, a portion was broken out to show the texture of the iron.

As to the wearing qualities of the Ramapo wheel, the Erie Railway Company report them equal to any in use. On the Morris and Essex railroad out of 700 wheels in constant use over nine months, with a constant load of 10 tuns per car, running 400 miles a week, but one wheel has failed, and that caused by accident. Similar results are reported from other roads using them. The cost is somewhat higher than the ordinary class of wheels, but the wear and great security amply repay it.

### Action of Ozone on Sensitive Photographic Plates.

Dr. Emerson Reynolds stated before the Dublin Chemical and Philosophical Club that he had been performing some experiments upon the above subject, and that he had found that when the latent image (i. e., the image before it was developed) was submitted to the action of ozone it was completely obliterated—not only was it impossible to develop the image, but a second image might be retaken in the camera upon the same plate. The author remarked that this was against the theory which might be called the mechanical theory of photographic images, and proved conclusively that it was due to chemical change in the sensitive film. He also thought that many of the disputes in connection with the length of time dry plates might remain sensitive, was probably owing more or less to the quantity of ozone present in the air.

The ozone used in these experiments was in some cases procured by passing atmospheric air over phosphorus, and in others by the silent discharge, viz., by attaching one of the platinum wires of the reservoir to the prime conductor of a machine, and turning it slowly, the other wire being in communication with the ground.