Correspondence.

How Water May Flash into Ice.

To the Editor of the Scientific American:

Three times during the winter I have seen water instantaneously converted into ice. I have read that water could be reduced to a temperature lower than 32° F., and still not form ice, and have seen water raised above 212° F. which, when agitated, suddenly exploded with such force as to nearly empty the vessel containing it. The instantaneous formation of ice I saw in a large tin pail partly filled with water. There was ice on the floor, cups partly filled with water held thick coverings of ice, but the water in the pail was as clear as crystal. Intending to dip a cupful, I accidentally struck the edge of the pail, and quick as a flash of light there shot from the sides of the pail, toward the center, long, slender needles of ice, beautifully marked on their edges. These needles in a few seconds grew until the water, for an inch or so below the surface, was closely packed with these delicate shoots, which, when my cup reached them, easily shattered.

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[The peculiar phenomenon of the spasmodic setting of crystals is well known and familiar to chemists. It is beautifully shown in microscopic crystallization. Under the microscope the crystallic needles are plainly seen to shoot out like the arrow from a bow. In some species of fungus the same spasmodic effect is noticed in the development of the spores.

Its cause probably lies in the power of the attraction of cohesion, which in this class of phenomena is a resisting power to a change of condition.—ED.]

The Nature of Electricity.

In two lectures recently delivered before the Royal Institution, Prof. O. J. Lodge, F.R.S., endeavored to explain to crowded audiences the modern views of the real nature of electricity. It was often said, he remarked, that we did not know what electricity was, and the statement was still largely true, but it was not so true as it was twenty years ago. Some things were beginning to be known about it, and though modern views were tentative, and might well require modification, nevertheless some progress had been made, and it was not unsuitable at the beginning of a new year of progress and discovery to try and set forth the position of thinkers on electrical subjects at the present time.

It had been discovered by Faraday and Clerk-Maxwell how like the behavior of electricity was to that of an incompressible fluid or liquid. One was not thereupon justified in asserting that electricity was a liquid, but it was perfectly certain that it behaved in many respects exactly like one, and it was, therefore, a step necessary to be made to understand and grasp the analogy between electricity and a liquid—in other words, to develop a liquid theory of electricity. Let them imagine a fish in the deep sea; he was surrounded and permeated by water, but must be completely unconscious of its existence. For a fish near the surface even to postulate the existence of water from the effects of currents and waves would be an act of scientific discovery analogous to our discovery of the existence of the atmosphere; but for a fish in the serene depths of the ocean the discovery of water would be an almost impossible one.

Now, we were living immersed in electricity in precisely the same way, but we were in a more favorable position for discovering its existence, because it behaved for the most part more like a liquid entangled in some elastic medium or jelly than like a freely moving liquid. Substances in which it could freely move about were called conductors; substances in which it was entangled were insulators or dielectrics. Conductors must be regarded as holes and tubes in the jelly, permitting storage and transfer. The jelly was such as only to resist the motion of electricity; it permitted the free locomotion of ordinary matter. The existence of these two classes of bodies, conductors and insulators, had enabled the human race with difficulty at length to discover the existence of this all-permeating liquid. An electrical machine was to be regarded as a pump which could transfer the fluid from one cavity to another; thus charging one conductor negatively, the other positively. Charge was to be regarded as either excess or defect from the normal supply of fluid, causing a strain.

Electrical attraction and repulsion were all explicable by the strains thus set up in the surrounding elastic medium or jelly. The increase of the capacity of a conductor by bringing an earth-connected body near it was accurately representable by thinning the elastic coat surrounding a cavity; and a hydrostatic model of a Leyden jar could be easily made with an elastic bag inside a rigid vessel, with pressure gauges for electrometers; this behaved in all respects exactly as a Leyden jar—exhibiting discharge by alternate contacts and everything. Discharge was typified by a relaxing of the strain and by twisting of the dielectric medium in some place. Certain phenomena connected with discharge suggested obscurely that what we called negative charge was not merely a defect of supply, but was a supply of something of an opposite kind—that there were, in fact, two electricities, positive and negative, which combined together into a neutral liquid. It might be that the other was then composed, and that what we called an electric current was really the simultaneous transfer of the true components of this liquid in opposite directions, and that strains in dielectrics were due to attempted shear of the other. The phenomena of electrolysis strongly suggested and supported this view.

Was any other motion possible to a liquid? Yes, a whirling and vibrating motion. By coiling up a conductor so as to get an electrical whirl, we discovered that we had produced a magnet, and all the phenomena of magnetism could be developed on the hypothesis that magnets consisted of such electrical whirlpools. One whirl had the power of exciting another in neighboring conductors, and these so excited whirls were repelled. In this way could be explained the phenomena of diamagnetism. A disk of copper at the end of a torsion arm was repelled by a magnet until the current induced in it had died away, which was very soon in that particular case; but currents in molecules might, for all we knew, last for ever until actively destroyed. Atoms were already endowed with perfect elasticity—why not with perfect conductivity too?

Finally, electricity in vibration, if rapid enough, constituted light; and it was easy to see that on this hypothesis conductors must be opaque, and that transparent bodies must insulate, which agreed with observation. If a ray of light were passed along a line of magnetic force, it ought to be twisted, as was shown by the pertinacious experimental power of Faraday before the fact could be understood and before the scientific world was ready to receive it. The profound significance of this fact was first perceived by Sir William Thomson, and stated by him in a most powerful and remarkable note, and upon this Maxwell founded his electrical theory of light.

"I have endeavored," added the lecturer, "to give you pictorial and mechanical representations of electrical phenomena, and thus to lead you a step in the direction of the truth; but I must beg you to remember that it is only a step, and that what modifications and addenda will have to be made to the views here explained I am wholly unable to tell you."

Power for Wood Working Tools.

BY WM. LEE CHURCH.

I recently had occasion to make some indicator tests of power in planing mills. As there is a very general misapprehension of the actual power consumed by wood working tools, some of the results may be instructive. The power given is in every instance the *net power of the tool itself*, exclusive of the friction of the shafting. The power for wood working tools is usually a vague estimate from the belt transmission, and is liable to great error. The following results are, on the contrary, actual measurements under the conditions obtaining, and may be relied on as such, however much at variance with preconceived ideas.

The first test was made at the mill, and by the courtesy of Anson Eldred & Son, Fort Howard, Wis. Power: One 14 x 14 inch Westinghouse engine, 280 revolutions.

Total friction of shafting and engine	21·00
No. 38 Sturtevant exhaust fan, 1,000 rev	18·06
14 inch rip saw, cutting 1 inch stuff	5·33
14 inch matcher, on 6 inch pine	21·25
60 inch circular re-saw, splitting 12 inch pine	5·38
24 inch matcher, on 10 inch pine	7·66
Edger, 18 inch saws, one cut, in 2 inch pine	7·68
24 inch circular re-saw, splitting 6 inch pine	5·30
Double siding planer, rabbeting and surfacing two 6 inch pine strips, both edges	11·20
30 inch double surfacer, dressing 24 inches wide	17·00
12 inch moulder sticking one piece 2½ inch ogee batten	12·33

It will be noted that the 24 inch matcher, on 10 inch stuff, required less power than 14 inch matcher on 6 inch stuff. The reason of this lay in the fact that the feed was slower on the larger machine.

The following results were from the mill of F. Blakesley, Schenectady, N. Y. Power: One 10 x 10 inch Westinghouse engine, 339 revolutions:

	Horse Power.
Friction of engine and shafting alone, net	8·97
One No. 31 Sturtevant exhaust fan	8·64
12 inch matcher, on 6 inch spruce	15·21
Same running empty	10·01
24 inch single surfacer, dressing 24 inch spruce	9·75
Roger's No. 2 four side moulder, sticking 2 x 1¼ inch pine	7·28

The following small tools were taken in a group in actual operation:

One 12 inch rip saw, one 16 inch cross cut saw, one 3 side sticker, one tenoning machine, one dovetail and boring machine, one band saw, one gig saw, one 12 inch cross cut saw	aggregate net 7·02

A further experiment was made to determine the power required to start a planer from a state of rest. The engine, shafting, and blower were first indicated alone, showing 8·97 horse power; the belt was then shifted on a 24 inch double surfacer, and a continuous curve taken until full speed was obtained. The maximum power required to start the planer was 31·2 horse power net, the difference of 18·72 horse power being the amount of power required to develop the speed of the tool over that required to maintain the speed when reached. The above test was, of course, made with the planer running empty.

The above line of experiments indicates that more power is absorbed in driving ordinary planing mill machinery empty than is required to actually dress the lumber.—*Wood and Iron.*

The Band Saw.

A writer in the *Northwestern Lumberman*, who claims to have had fifteen years' practical experience in using band mills, says:

We have been using the band sawmill for sawing logs for the last fifteen years with unvarying success, and at no time have we used a band mill—and we have used nine or ten of them—that had not a sawing capacity of 20,000 feet of 1 inch boards per day of ten hours, and at times we have sawed 30,000 feet of soft wood in ten hours. As to its average capacity, we sawed 6,000,000 feet in one year with one machine, running part of the time day and night.

It has been a great wonder to me that the live, shrewd Northwestern lumbermen have gone on from year to year, for at least the last ten years, without seeing and testing the advantages of the band saw in the manufacture of lumber economically, as regards both the lumber saved and the power required to manufacture a given quantity of boards from a given quantity of logs—scale measure—in a given length of time.

A 60 horse power engine will run three band sawmills with a capacity of 20,000 or 25,000 feet each, per day, with a surplus of power to run the necessary edgers and cut-offs to trim the lumber. Take this as a starting point, then say the mills average 20,000 feet each, and you have 60,000 feet per day of ten hours. On this amount you save in saw kerf—the band saw taking only one-twelfth of an inch—over the ordinary circular saw in use, at least 2,000 feet on each 10,000 feet sawed, which would make 12,000 feet, or one-fifth more lumber from what goes into sawdust, for which in some cases furnaces are erected to burn, the "hells" costing more than one band sawmill.

This 12,000 feet destroyed would at least be worth $10 per thousand, or $120, which is lost per day—or $24,000 in a season's sawing of 200 days. This $10 per thousand is a low estimate for first-class pine lumber, as a considerable proportion would be uppers worth 50 per cent more, which would make it at least $30,000 lost (or saved) in 200 days' sawing.

For instance, say three mills cost $6,500—put up and started, exclusive of power; you would still have a nice little margin of $23,000 on 200 days' sawing, and also have your mills.

To the mill men who value the lives of their men—and we know both the humane and thrifty do—we say we know of fifty band sawmills in use that have never, for the last ten years, fatally injured a man.

Another advantage in the use of band sawmills in pine or any other kinds of lumber: you can saw a taper log or a partly rotten log, and get all the good lumber out of it there is in it, which you cannot do with a gang saw.

Disinfecting Rags by Steam.

Importations of rags are now permitted where the rags are subjected to a process of disinfection. The process, as conducted by the Paper Stock Disinfecting Company of New York, is as follows: The apparatus consists of a large air-tight box, into which each bale of rags is drawn by means of five screws, which at the same time make five perforations from end to end of the bale. When this is completely inclosed in the box, the opening is closed, and superheated steam is injected through the screws, which are hollow and perforated with holes which permit jets of steam to penetrate through the rags in every direction. An escape in the upper part of the box is provided with a bath intended to intercept the passage of any disease germ into the air. Most germs of life are killed at a heat of 212 or 215 degrees, but the steam employed in this process is raised to 330. An exposure of four or five minutes to this degree of superheated steam heats the bale so that it takes two hours for it to fall below the germicide point of 212. The actual effect of this operation has been recently proved in a most satisfactory manner under auspices which give the results obtained a scientific value. The experiments were conducted under the eye of Major Sternberg, U. S. A., with disease germs (cholera and smallpox) brought by him from the Johns Hopkins University. They were inserted in the interior of two bales of rags, one of which, for the sake of making a comparative test of sulphurous acid and superheated steam, was subjected to treatment in the same apparatus with the former agent, and one with the latter. The germs were then collected, and returned to the Johns Hopkins University, where Major Sternberg found by inoculation of rabbits that the germs treated by superheated steam had been killed, and did not communicate disease, while those treated with sulphurous acid were fatal to the subjects inoculated.