

SCIENCE

ELEVENTH YEAR.
VOL. XXII. No. 556.

SEPTEMBER 29, 1893.

SINGLE COPIES, TEN CENTS.
\$3.50 PER YEAR, IN ADVANCE.

CONTENTS.

The Mutual Relations of Science and Stock Breeding. By Wm. H. Brewer.....	169
Note on the Buried Drainage System of the Upper Ohio. By Richard R. Hice.....	170
Corn Cane. By F. L. Stewart.....	171
The Meteorological Congress.....	174
Salt Tide Marshes of South Jersey. By John Gifford.....	174
Methods of Presenting Geology in Our Schools and Colleges. By Miss Mary E. Holmes, Ph. D.....	175
Letters to the Editor:	
An Instructive Illusion. By J. Edmund Clark.....	179
Why Not the Collections of Seeds? By George P. Merrill.....	179
Science in the Schools. Henry Edgerton Chapin.....	180
The Ikonomatic Method. By D. G. Brinton.....	180
A Curious Ear of Indian Corn. By O. H. Hershey.....	181
A Mouse Destroying Its Young. By M. L. Holbrook.....	181
Genealogical Table of Plants. By Thomas Marwick.....	181
Number-Forms. By J. McKeen Cattell.....	181

TO THE SCIENTIFIC PUBLIC.

College Professors and others will confer a favor by corresponding with us in regard to apparatus for the equipment of Physical, Chemical, Biological, Electrical and Engineering Laboratories. We are the largest makers of general scientific apparatus in the United States, and devote attention exclusively to high grade instruments, such as meet the most exact requirements.

Special bids will be submitted upon request, and interested parties should write for abridged catalogue No. 219, which will be mailed free if this "ad." is mentioned.

QUEEN & CO., Incorporated, Philadelphia, U. S. A.

World's Fair Exhibits—Electricity and Manufactures Buildings.

MINERALS. New Store. New Stock. New Departments.

Send for our "Winter Bulletin," recently issued. Minerals, Gems, Microscopical Sections, Fine Lapidary Work.

GEO. L. ENGLISH & CO., Mineralogists,

Removed to 64 East 12th Street, New York

GERMANIA A monthly magazine for the study of the German language and literature, is highly recommended by college professors and the press as "the best effort yet made to assist the student of German, and to interest him in his pursuit." Its BEGINNERS' CORNER furnishes every year a complete and interesting course in German grammar. \$2 a year. Single copies 20 cents. P. O. Box 151, Manchester, N. H.

NEW METHOD OF PROTECTING BUILDINGS FROM LIGHTNING.

SPARE THE ROD AND SPOIL THE HOUSE!

Lightning Destroys. Shall it be Your House or a Pound of Copper?

PROTECTION FROM LIGHTNING.

What is the Problem?

In seeking a means of protection from lightning-discharges, we have in view two objects,—the one the prevention of damage to buildings, and the other the prevention of injury to life. In order to destroy a building in whole or in part, it is necessary that work should be done; that is, as physicists express it, energy is required. Just before the lightning-discharge takes place, the energy capable of doing the damage which we seek to prevent exists in the column of air extending from the cloud to the earth in some form that makes it capable of appearing as what we call electricity. We will therefore call it electrical energy. What this electrical energy is, it is not necessary for us to consider in this place; but that it exists there can be no doubt, as it manifests itself in the destruction of buildings. The problem that we have to deal with, therefore, is the conversion of this energy into some other form, and the accomplishment of this in such a way as shall result in the least injury to property and life.

Why Have the Old Rods Failed?

When lightning-rods were first proposed, the science of energetics was entirely undeveloped; that is to say, in the middle of the last century scientific men had not come to recognize the fact that the different forms of energy—heat, electricity, mechanical power, etc.—were convertible one into the other, and that each could produce just so much of each of the other forms, and no more. The doctrine of the conservation and correlation of energy was first clearly worked out in the early part of this century. There were, however, some facts known in regard to electricity a hundred and forty years ago; and among these were the attracting power of points for an electric spark, and the conducting power of metals. Lightning-rods were therefore introduced with the idea that the electricity existing in the lightning-discharge could be conveyed around the building which it was proposed to protect, and that the building would thus be saved.

The question as to dissipation of the energy involved was entirely ignored, naturally; and from that time to this, in spite of the best endeavors of those interested, lightning-rods constructed in accordance with Franklin's principle have not furnished satisfactory protection. The reason for this is apparent when it is considered that the electrical energy existing in the atmosphere before the discharge, or, more exactly, in the column of dielectric from the cloud to the earth, above referred to, reaches its maximum value on the surface of the conductors that chance to be within the column of dielectric; so that the greatest display of energy will be on the surface of the very lightning-rods that were meant to protect, and damage results, as so often proves to be the case.

It will be understood, of course, that this display of energy on the surface of the old lightning-rods is aided by their being more or less insulated from the earth, but in any event the very existence of such a mass of metal as an old lightning-rod can only tend to produce a disastrous dissipation of electrical energy upon its surface,— "to draw the lightning," as it is so commonly put.

Is there a Better Means of Protection?

Having cleared our minds, therefore, of any idea of conducting electricity, and keeping clearly in view the fact that in providing protection against lightning we must furnish some means by which the electrical energy may be harmlessly dissipated, the question arises, "Can an improved form be given to the rod so that it shall act in this dissipation?"

As the electrical energy involved manifests itself on the surface of conductors, the improved rod should be metallic; but, instead of making a large rod, suppose that we make it comparatively small in size, so that the total amount of metal running from the top of the house to some point a little below the foundations shall not exceed one pound. Suppose, again, that we introduce numerous insulating joints in this rod. We shall then have a rod that experience shows will be readily destroyed—will be readily dissipated—when a discharge takes place; and it will be evident, that, so far as the electrical energy is consumed in doing this, there will be the less to do other damage.

The only point that remains to be proved as to the utility of such a rod is to show that the dissipation of such a conductor does not tend to injure other bodies in its immediate vicinity. On this point I can only say that I have found no case where such a conductor (for instance, a bell wire) has been dissipated, even if resting against a plastered wall, where there has been any material damage done to surrounding objects.

Of course, it is readily understood that such an explosion cannot take place in a confined space without the rupture of the walls (the wire cannot be boarded over); but in every case that I have found recorded this dissipation takes place just as gunpowder burns when spread on a board. The objects against which the conductor rests may be stained, but they are not shattered.

I would therefore make clear this distinction between the action of electrical energy when dissipated on the surface of a large conductor and when dissipated on the surface of a comparatively small or easily dissipated conductor. When dissipated on the surface of a large conductor,—a conductor so strong as to resist the explosive effect,—damage results to objects around. When dissipated on the surface of a small conductor, the conductor goes, but the other objects around are saved.

A Typical Case of the Action of a Small Conductor.

Franklin, in a letter to Collinson read before the London Royal Society, Dec. 18, 1755, describing the partial destruction by lightning of a church-tower at Newbury, Mass., wrote, "Near the bell was fixed an iron hammer to strike the hours; and from the tail of the hammer a wire went down through a small gimlet-hole in the floor that the bell stood upon, and through a second floor in like manner; then horizontally under and near the plastered ceiling of that second floor, till it came near a plastered wall; then down by the side of that wall to a clock, which stood about twenty feet below the bell. The wire was not bigger than a common knitting needle. The spire was split all to pieces by the lightning, and the parts flung in all directions over the square in which the church stood, so that nothing remained above the bell. The lightning passed between the hammer and the clock in the above-mentioned wire, without hurting either of the floors, or having any effect upon them (except making the gimlet-holes, through which the wire passed, a little bigger), and without hurting the plastered wall, or any part of the building, so far as the aforesaid wire and the pendulum-wire of the clock extended; which latter wire was about the thickness of a goose-quill. From the end of the pendulum, down quite to the ground, the building was exceedingly rent and damaged. . . . No part of the aforementioned long, small wire, between the clock and the hammer, could be found, except about two inches that hung to the tail of the hammer, and about as much that was fastened to the clock; the rest being exploded, and its particles dissipated in smoke and air, as gunpowder is by common fire, and had only left a black smutty track on the plastering, three or four inches broad, darkest in the middle, and fainter towards the edges, all along the ceiling, under which it passed, and down the wall."

One hundred feet of the Hodges Patent Lightning Dispeller (made under patents of N. D. C. Hodges, Editor of *Science*) will be mailed, postpaid, to any address, on receipt of five dollars (\$5).

Correspondence solicited. Agents wanted.

AMERICAN LIGHTNING PROTECTION CO.,
874 Broadway, New York City.

Science

ns-22 (556)

Science ns-22 (556), 169-181.

ARTICLE TOOLS <http://science.sciencemag.org/content/ns-22/556.citation>

PERMISSIONS <http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

Science (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. 2017 © The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. The title *Science* is a registered trademark of AAAS.