

Protection from Lightning.

THE desirability of protection from lightning was recognised from the earliest times. The earliest attempts consisted of exorcisms by priests, the wearing of charms, the ringing of church bells, and even the burning of witches. It was not until about 1750, when Franklin proved that a lightning flash was an electrical phenomenon and could be guarded against by suitable conductors, that these superstitions began to die away. Still, it is only of recent years that, mainly owing to the work of Lodge, the true function of these conductors has begun to be understood by physicists. Engineers are now putting into practice what they learn from theory and discover from high voltage experiments. Finality, however, is still far from being attained. We welcome, therefore, the new Code¹ for protection against lightning, which has recently been issued by the U.S. Bureau of Standards and the American Institute of Electrical Engineers.

In this book instructions are first given to guide the conduct of persons during thunderstorms. Then the methods of protecting buildings and miscellaneous property are described, and finally how structures containing inflammable liquids and gases can be safeguarded. In the appendix an account is given of various kinds of 'lightning' discharge and a brief notice of various recent theories.

So far as the rules given for personal conduct during a thunderstorm are concerned, we think they are reasonable. There is no shutting of windows, pulling of blinds, and lighting of candles, customs still adhered to in some places. Neither are nervous people told to go and lie in an empty metal bath, although the advice may be psychologically sound. Lightning fatalities are very rare, and only about ten per cent of them happen to persons who are indoors. All one has to do, therefore, is to stay indoors and keep away from fireplaces, stoves, and other metal objects.

If one is out-of-doors, the following shelters in order of preference are given: (1) Large metal or metal-framed buildings, (2) dwellings having lightning conductors, (3) large buildings or (4) small buildings. If one has to remain out-of-doors, keep away from (1) small sheds and shelters in an exposed position, (2) isolated trees, (3) wire fences, or (4) hilltops and wide open spaces. If one is in the 'wilds', seek shelter in (1) dense woods, (2) a grove of trees, (3) a cave, (4) a depression in the ground, (5) a deep valley or gorge, or (6) the foot of a steep or overhanging cliff. These rules are, of course, not perfect, but their brevity and generality should make them acceptable.

In specifying lightning conductors, we were interested to see that it is apparently immaterial what metal or alloy is used in their construction or what is the shape of their cross section. Instructions are given in the methods used for preventing them from deteriorating. If they are subjected to the direct action of chimney or other corrosive gases, the useful advice is given that they should be protected by a continuous covering of lead not less than one-sixteenth of an inch thick. We are told that the use of glass balls as ornaments on lightning rods is not objectionable. We suppose that this means that the lightning rod is just as efficient when a glass globe is placed on the top of it. We remember being told that

during the South African war, British soldiers used to put empty bottles on the top of their tent-poles in the hope that this would prevent their tents being struck by lightning. The methods described of earthing the conductors are quite satisfactory, and no undue stress is laid on the ohmic resistance of the 'earth'.

During the War, several cases occurred of captive balloons and airships being struck by lightning. Fires also were caused by the long sparks which sometimes take place between the airship and the earth at the landing place. These experiences are reflected in the rules. Captive balloons are now earthed through the metal cable and winch by a pipe or tube driven six feet into the ground. Free balloons and airships are provided with an effective earthing wire which is lowered just before landing. It makes contact with a good earth and thus the electrical charges which may have accumulated on them when in the air are conveyed harmlessly to the earth.

In the United States, the protection of valuable or historic trees from lightning by means of conductors is being done on a rapidly increasing scale. In general, a single conductor is run from the highest part of the tree to the earth connexion. If, however, the tree has large branches, conductors are extended to their extremities. Somewhat elaborate arrangements depending on the size of the tree are used for earthing. A shallow network is used to collect the current near the surface of the earth so as to protect the roots of the tree, which experience has shown are as likely to be damaged as the tree itself. It is an excellent plan also to put lightning conductors on trees the neighbourhood of which is frequented by livestock. Full instructions are given for mitigating the dangers arising from wire fencing. Fences are earthed by means of iron posts or, more cheaply, by driving lengths of galvanised iron pipe at least three feet into the ground and attaching it by ties of galvanised wire to the fence. In addition to earthing the fence, its electrical continuity should be broken by breaking the wire at intervals of about a thousand feet and joining up the breaks by insulating material.

Full details are given of excellent methods for protecting structures containing inflammable liquids and gases from lightning. All-steel gas-tight tanks with vents adequately 'flame-proofed' are considered to be completely protected. So also are tanks with floating roofs, which prevent the accumulation of explosive mixtures, provided that there is provision for minimum exposure of the contents.

In an interesting appendix the origin, characteristics, and effects of lightning are described. An ordinary flash of lightning is called streak lightning. In rocket lightning, the growth is so slow that it reminds one of a rocket. In bead lightning we have a string of luminous globes separated by darker intervals. There are other forms such as sheet and globular lightning and St. Elmo's fire.

A brief résumé is given of Simpson's and C. T. R. Wilson's results, and an excellent photograph, taken by a moving camera, is shown, which proves that a flash can be rapidly intermittent. Instructive data taken from U.S. Weather Bureau publications show the frequency of thunderstorms in various places in the United States. A sequel to this code will deal with electrical apparatus and power lines, and it will be of great interest, as there are considerable divergencies in American and Continental practice.

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¹ Department of Commerce: Bureau of Standards. Miscellaneous Publication, No. 92: Code for Protection against Lightning. Approved April 4, 1929, by the American Standards Association. Pp. xiii+114+2 plates. (Washington, D.C.: Government Printing Office, 1929.) 25 cents.