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## Improved configurations of lightning rods and air terminals

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### Abstract

Franklin invented lightning rods with the hope that they would dissipate thunderstorm electricity and thus prevent lightning from striking. His invention was based on his findings that sharpened metal needles would allow electricity to flow silently through the air, away from highly charged objects. When his rods were used, however, instead of preventing lightning, they were sometimes *“struck”* and became part of a lightning path to earth. An analysis of the physics involved suggests that:

1. (a) The flow of electricity from sharpened conductors at the earth's surface does not dissipate thunderstorm electricity sufficiently to prevent lightning.
2. (b) The ionization and point discharges around the tip of a sharpened lightning rod limit the strength of the local electric field and reduce the probability of a lightning strike to the rod. The sharpened rod thus acts to protect itself against lightning discharges, but its protection does not extend to other objects in its vicinity. While a sharpened rod does not provide a preferred lightning path to

earth, it can be used if no better paths are available.

3. (c) Elevated, blunt rods or horizontal conductors, suitably connected to earth, can provide better lightning paths to earth and therefore, better protection to structures in their vicinity than do sharpened rods.
4. (d) The connections from elevated conductors to earth need to be the most direct possible, with no abrupt changes in direction; impedance discontinuities created in down conductors at sharp bends cause reflections of lightning transients and may produce side flashes to other objects in their vicinity.



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Excerpt from "A Study of Lightning Protection Systems", prepared for the Atmospheric Sciences Program of the U.S. Office of Naval Research, October, 1981.

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