

## “KEEPING PACE” - #39

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### HOW COULD IT HAPPEN AFTER 12 YEARS?

The photograph below shows a romex-type (NM) cable in the attic of a prominent Ohio state senator’s private law office. It short circuited and melted apart 12 years after it was installed, and caused about \$100,000 fire damage. How does a cable short circuit so long after it was installed? I demonstrated some mechanical analogies of this situation earlier in [“Keeping Pace” - #16 and #20](#). Here now is my electrical theory: When the electrical conductor is installed inside the wall of a building or in the dashboard of a vehicle, the installer accidentally cuts it, bends it too sharply, or in some other manner creates a tiny crack or defect in the insulation between two conductors (see the drawing on the next page). Because there is always some humidity in the air inside that small crack, very tiny microcurrents (microamperes) begin to flow through the moisture in the defect. Those microcurrents flow for many years unabated. As the current very gradually increases, it eventually begins creating a carbon path. Finally, so much carbon builds up that a flashover, or arc occurs. Because many (common) American circuit breakers take half a second or more to open, the 6000 watts of power which are dissipated in the arc throw molten copper globules at a temperature of over 5000° F. all around, and a fire begins.



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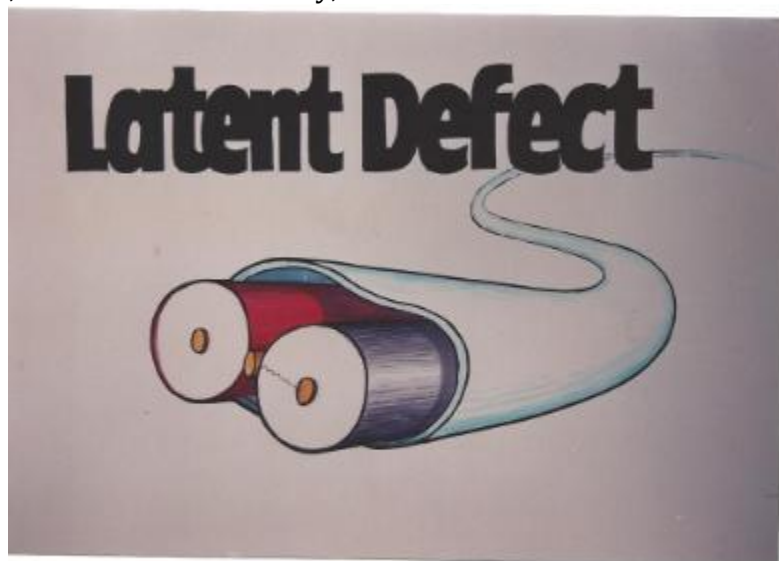
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### BUS DUCT:

The preceding phenomenon is not limited to round wires. It also occurs in bus duct. An electrical bus is simply a long, flat plate of solid copper or aluminum which is used as a conductor. It has a rectangular cross section, which is much larger than any usable round conductor. The amount of electrical current an electrical conductor can carry is proportional to its cross section, and so an electrical bus can carry very high currents. 3000 amperes is not uncommon in the service entrance of office buildings and industrial plants.

A bus duct then is simply an enclosure around the bus bars to help keep out water and dirt and to keep people from being electrocuted. Because the bus bars are energized, they must be insulated from the outside, and from each other. This is accomplished by wrapping each rectangular bus bar with an insulating medium. Again, if this is not performed properly, a defect can occur in the insulation and cause a later short circuit. The small photograph below shows a bus duct on the top of a Kroger building. It short circuited 12 years after it was installed. Once the arc began in this very high current service, the circuit breaker did not open for a long time. The arcing traveled ten feet along the bus duct, totally destroying it, as shown. Fortunately, no fire ensued.



**Moisture in crack allows microcurrents to flow for many years until a flashover occurs.**



**The arcing traveled 10' along this bussduct.**

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