A READER'S DIGEST REPORT TO CONSUMERS

A Little Box That Stops Electric Shock

By Edward Fales, Jr.

Rain flooded the streets of Cherry Hill, N.J., one day last August. By 5 p.m. Norman E. Toothman was worrying about his neighbors' basement. They were away, and he had promised to keep an eye on the place. He crossed the street to check.

An hour later, when he had failed to come home, his wife went to the neighbors' looking for him. She found an extension cord plugged into a kitchen outlet and leading down the basement stairs. There, lying in an inch of water on the floor beside a sump pump, was her husband, dead—electrocuted, the coroner later said, when with wet hands he plugged the cord into the pump. Current shot through him to the wet floor and into the ground.

Electric shock kills about 1000 Americans each year, nearly 300 of them in or around their homes. Thousands more will be injured, with burns or broken bones.

In Taylorsville, N.C., not long ago, the Rev. Wayne Hendren was electrocuted while using a drill to repair his boat; he was sitting on an inner tube in the water. In New Hampshire, a woman died when she climbed out of her backyard pool to connect the electric water filter to an extension cord, which ran from her house. In Pierce, Neb., 15-month-old Maureen Uecker died when her tiny fingers touched the prongs of a loosely inserted light plug as she crawled across a metal furnace register. The current ran through her via the furnace to the

ground. According to U.S. Public Health Service estimates, 30,000 people are injured each year by mishaps with wall sockets and extension cords alone.

Now, several companies are manufacturing an ingenious little box that can go a long way toward ending electric shock around the house, and even outdoors. It's called a ground fault circuit interrupter, or GFI. Suppose that you touch a faulty appliance and electricity starts to flow through your body to the ground: the little box senses the flow instantly and switches off the current. You may feel a slight shock, but it's not enough to hurt a healthy person.

How do the GFIs work? When you plug an appliance in and turn it on, the current flows in and out of the appliance over two wires, one "hot," the other "grounded" or neutral. If you touch the hot wire, or if it is in contact with the metal frame of the appliance, electricity will try to leak off through you to the ground. The amount that goes through you depends on how good a contact you make. It may be only a slight shock if you're dry-handed or standing on a dry rug, for dry skin has high electrical resistance. But if your skin is wet, or if you're standing on damp floor or touching a gas pipe or something in contact with the ground, the current will flash through your body and into the ground—and you may be electrocuted.

It takes very little current to hurt you. For example: a flow of more than 15 amperes is necessary to blow the average household fuse; but it may take only .01 ampere to .03 to produce muscular contractions so violent that an adult cannot let go of the power source. Such shock, if long continued, can lead to asphyxiation, heart fatigue and, ultimately, death. It may take only .05 to .15 ampere to produce ventricular fibrillation, and a relatively small amount can also paralyze respiration. Larger amperages flowing through the body can produce fatal burns in internal organs.

Fuses and circuit breakers can never detect such small runaway currents. A properly built GFI can. It constantly monitors the amount of current flowing in a circuit. If there is a leakage—even a few thousandths of an ampere—the GFI's complicated electronic circuitry senses the difference and switches the electricity off. It acts within a few thousandths of a second, less than a single heartbeat, before any damage can be done.

Thus, once inserted into a circuit, a GFI can hover like a guardian angel over small children who poke forks into toasters and wives who wear an electric hair drier while washing dishes. A GFI could have saved 14-year-old Dean Holder of Costa Mesa, Calif., who was electrocuted as he sat in a metal chair in his backyard playing his electric guitar. And Mrs. Jennie Rhinehart of Ord,

Neb., who touched the inside of the light socket in her refrigerator while cleaning the box. And Mrs. Harold Johnson of Haven, Kan., who stepped on a furnace grating while using a vacuum cleaner.

GFIs don't protect against the simple "line to line" short circuit—as in a frayed iron cord that sizzles and "shorts out." But in these cases, current is flowing from one wire to another in such volume that the standard household fuse or circuit breaker should blow, preventing further damage. And GFIs aren't ordinarily needed if electrical tools and appliances are properly grounded in some other way—if their cords have three-pronged plugs (the third prong being a ground connection) and these are inserted in grounded three-prong receptacles. Even here, however, a GFI can give backup protection.

Demonstrations of what these boxes can do are so dramatic that they make electrical experts wince. Safety experts insist that no one should ever deliberately create a hazard—it could mean death if a component in the GFI should fail. Nevertheless, an Indiana manufacturer demonstrates his company's GFI by grabbing a live wire from a GFI-protected circuit and jumping with it into a swimming pool. A Salem, Mass., manufacturer demonstrates his by dropping a plugged-in, playing radio into a bathtub in which sits his swimsuited 24-year-old daughter—certain death for her, were it not for the GFI.

The search for a GFI that would be effective for American conditions started a decade ago, when people began to build home swimming pools with underwater lights, electric pumps and filters, and poolside barbecues. Soon many swimmers were getting shocks, and the National Electric Code Committee, which sets the guidelines for municipal safety standards, began getting casualty reports.

By coincidence, several makes of GFI were developed at almost the same time, all born of near-tragedy. On a vacation trip, manufacturer-inventor A. Lee Moore of South Bend, Ind., hooked his auto trailer to the electric system in a trailer park. Some insulation had rubbed off a wire inside, exposing it to the metal trailer, and when Moore's eight-year-old granddaughter touched the door, she was knocked unconscious for two hours. Moore resolved to invent a device that would prevent shock.

In Lincoln, R.I., a young engineer, J. P. Marino, was hurled across his basement while using an electric drill. He lived, but was astounded at the violence of electric shock. "It was like being run over by a truck," he says. He, too, began developing a shock-preventing device.

Meanwhile, at the University of California, Prof. Charles F. Dalziel was also working on a GFI. His interest dated back to 1920. As a Boy Scout he had built a two-mile, five-party telephone line. Somehow 120-volt electricity got into the system.

It gave Dalziel a shock. And when he attempted to cut the wire, he found himself frozen to it. He tore free, but never forgot the terrible experience.

Dalziel's GFI was the first to hit the market. About 3000 of the units developed by him have been sold in the past three years, mainly for use at swimming pools. A number of companies plan to market some sort of GFI this year, ranging from large industrial units down to shoebox-size portables that can be carried anywhere you want protection—say outdoors with electric barbecues, hedgetrimmers or Christmas lights, or with electrical tools in home workshops, garages, boatyards and marinas. One aircraft company now has 100 GFIs in its plant. A camera company has ordered several hundred. Among other users are Consolidated Edison, Procter & Gamble, International Business Machines, Remington Arms, Hershey Chocolate. The U.S. Navy is using several dozen in large ships.

Because GFIs are so new, they haven't been shaken out in the marketplace yet. The most objective rating available comes from the nationally recognized Underwriters Laboratories, Inc., which has been setting up standards for them. Recently it gave its listing and prized UL label to two models made expressly for swimming pools. Further testing is under way, and two more models have just been given an "eligible for listing" rating. They should receive full listing before long.

One of these two is a portable 15-ampere model. It weighs eight pounds, will retail for $174.50. You simply plug this GFI into a standard outlet, then plug the appliance into the GFI. The other model is a larger, stationary 30-ampere unit, designed to be wired permanently into the house at the main electric panel, to protect one or more circuits: kitchen, bathroom, basement, outdoors or whatever. Still larger units to protect the whole house are coming soon, manufacturers say.

The handwriting is on the wall. Quite possibly, GFIs will soon be required protection in homes, factories or anywhere else electricity is used.

Rampage

OUR SUPERMARKET has a conveyer belt beside each cashier to move the groceries on to the bag boy. The other day, while we were checking out, there was a startled scream from the cashier next to us. She was staring, horrified, at her conveyer belt, which was making loud crunching and slapping sounds.

After several seconds, she exclaimed incredulously to the customers who had gathered around: "It ate a loaf of bread!"

—Contributed by Helen and Mary Sliker