"Electrical Overload in Aging Buildings and Fire Prevention"

OBJECTIVES

- Statistics
- Building Construction
- Types of Electrical Systems and Components
- Challenges Faced
- Building Codes
- Fire Prevention Methods and Programs

What are the facts?

- Over 992 electrical fires reported in Mississippi for 2020.
- 69 civilian fire deaths.
- In 2020, the number of electrical fires were down from the previous year, but the number of fire related deaths were up by 1.
- Over 1025 electrical fires in 2021.
- 87 civilian fire related deaths in 2021.
- Every 23 seconds, a fire department in the United States responds somewhere in the nation.
- Nationwide, 7.5% of the fires that occurred, which resulted in a fatality were caused by an electrical malfunction.
- Nationwide, 7.9% of the fires that occurred, which resulted in a injury were caused by an electrical malfunction.
- Nationwide, 6.8% of all residential fires were caused by an electrical malfunction.
- A fire occurs in a structure at the rate of one every 64 seconds, and a home fire occurs every 89 seconds.

What are the facts?

From January 1, 2022 until May 31, 2022

- We have had over 358 fires that resulted from an electrical malfunction.
- 35 civilian fire deaths.
- 5 calls that were classified as electrocution or potential electrocution.
- 3 calls that were classified as electrical rescue or other.

Turn of the Century Homes

- Began to see rectangular shaped homes, with gabled roofs and columns.
- Homes had one or two stories, less than 1,000 square feet and two or three bedrooms.
- Indoor plumbing was sporadic and electricity was not common.
- Many framers began to use "Balloon" framing, with smaller, lighter boards installed in repetition to add strength.

Early 20th Century Homes

- Still saw homes with less than 1,000 square feet but began to reflect changes in the industry.
- Builders began using concrete footings or reinforced cement foundations.
- Indoor plumbing was still sporadic and electricity was not common.
- The modern platform frame method using horizontal wall plates for fire separation and strength, also appeared.

Mid 20th Century Homes

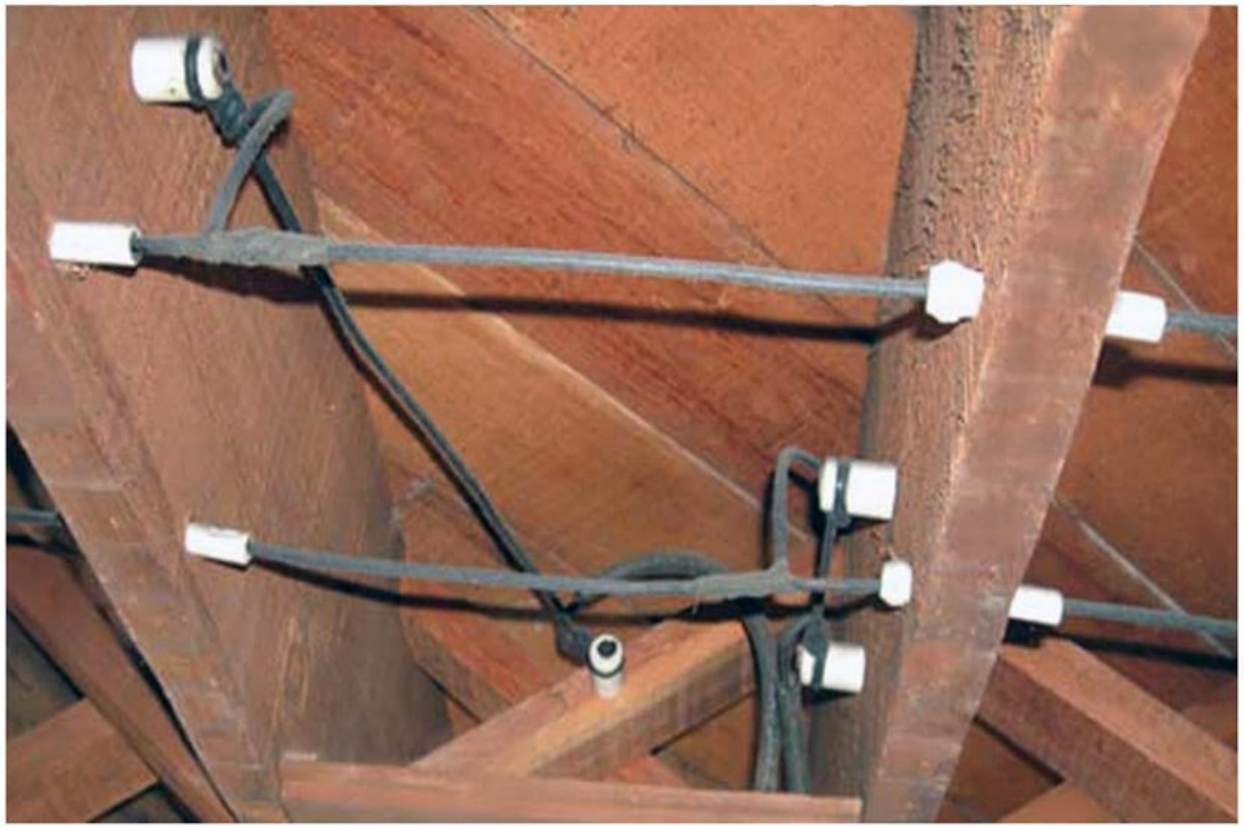
- The 1950's saw the standardization of building materials and methods.
- Grading of lumber and the use of standard sizes became common after the Federal Housing Administration developed a minimum building code.
- Electrical service and indoor plumbing became the norm.

Types of wiring and Insulation.

- Paper wire insulation. Paper was impregnated with oil. Used from 1810 to 1910.
- Began using copper conductors from 1913 to present.
- Asbestos insulated wire. Used 1920 to 1988.
- Rubber insulated wire. Used 1922 to 1950. Vulcanized rubber insulation on a copper conductor covered with a fabric sheath.
- Cloth or fabric woven wire insulation. Used from 1933 to present.
- Aluminum electrical wire was used from 1965 until 1973.
- Copper-clad aluminum wire was used from 1972 until 1975. Has an aluminum core.
- Plastic insulated wire (Romex). Used from 1950 to present.

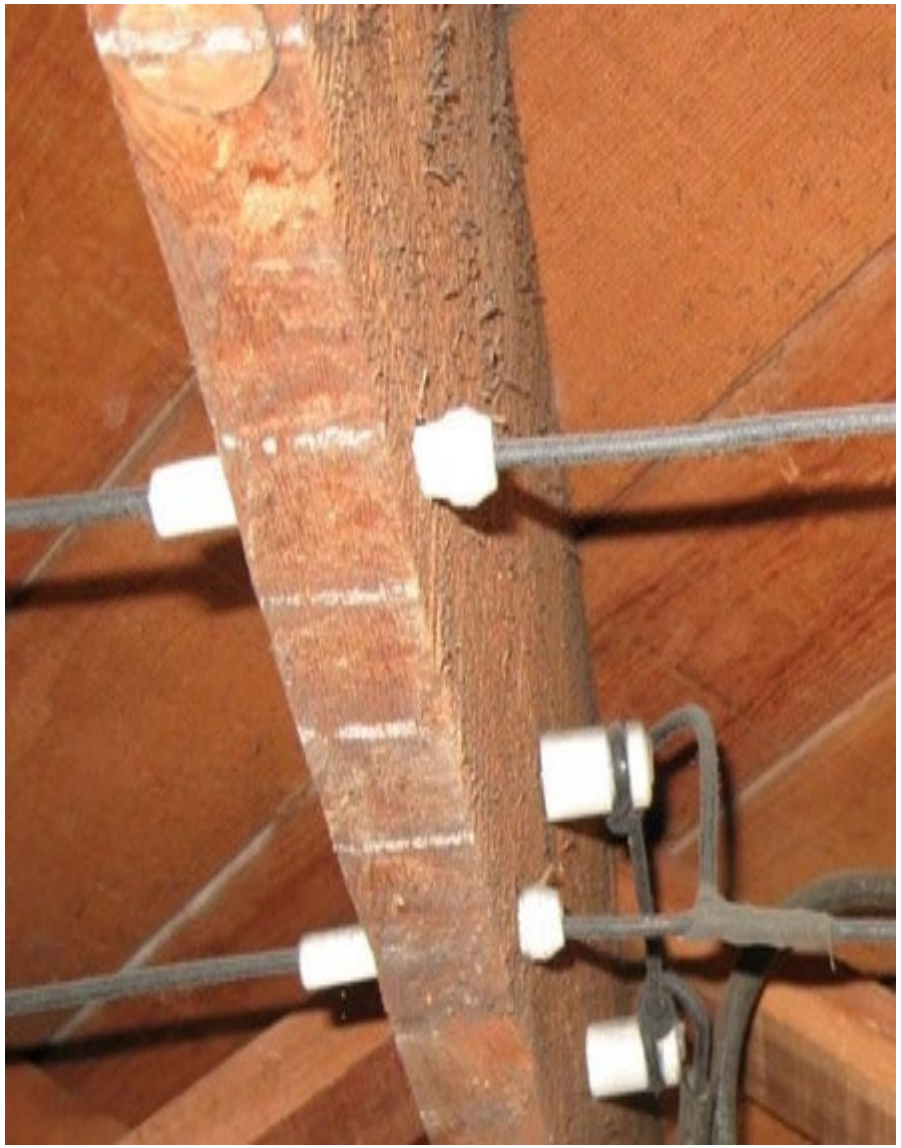
From 1880 to 1950's—knob and tube was the go-to wiring system for **homes powering the occasional toaster or living room lamp**.

- This system consisted of two wires, one black or hot wire and the other white or neutral to create a circuit. The two single wires were held in place with ceramic knobs and tubes.
- Used a cloth or fabric woven insulation over a copper conductor.
- Widespread use declined after 1940.



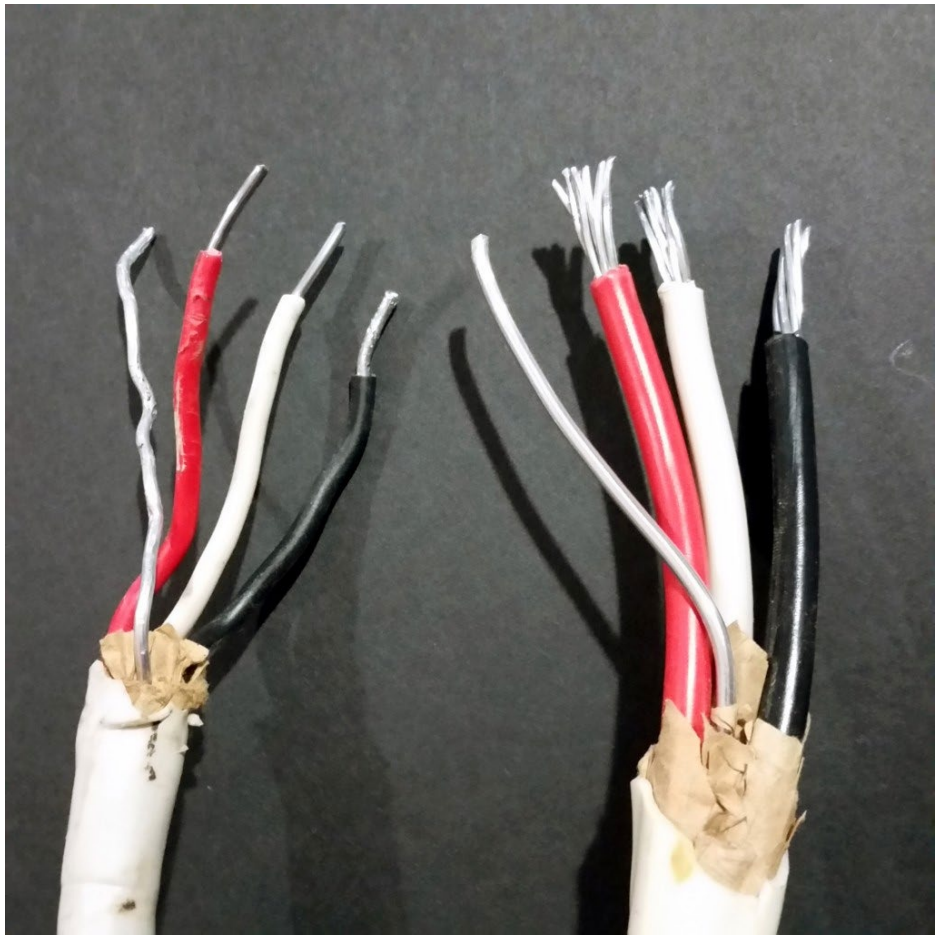
- Knobs were used to clamp the wire to the structural member.
- Over time the wires could sag and contact structural members and metal piping.
- Typically see rodent activity, chewing on the fabric insulation.

- Tubes are placed in holes in the structural members to prevent the wire from chafing.
- Over time the wires can sag and contact structural members or other building components.
    - This can result in a fire or electrocution.



- In the mid-1960s, when copper prices were high, aluminum was commonly used as a material for electrical wiring.

- Residential installations between 1965 and 1974 sometimes used wires that were solid aluminum, or aluminum covered with a thin layer of copper.



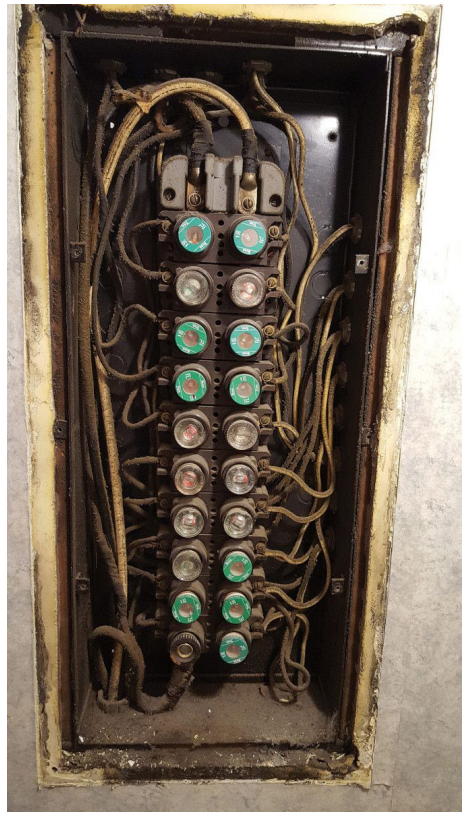
Old Fabric-Insulated Electrical Wire

- The exterior insulation on fabric-insulated NMC (Non-Metallic Sheath Cable) electrical wires are often black, silver, or white but may also be brown.
- The individual conductors within the cable may be insulated in rubber or fabric-covered rubber.
- Are commonly found cracked, frayed or missing the fabric insulation.

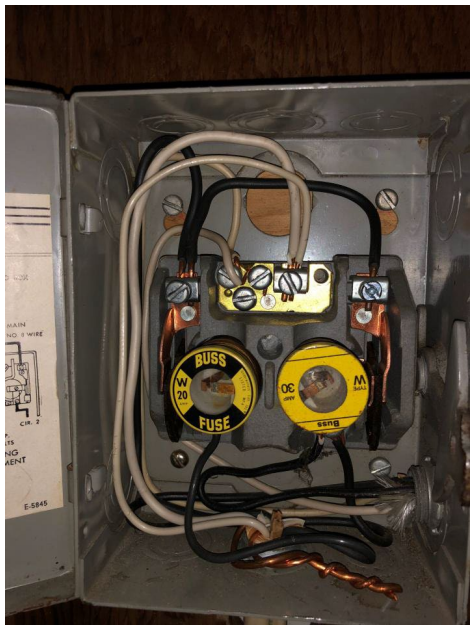
Largest currently-operating producers of electrical cable, world-wide.

- Far East Cable - (China)
- Furukawa Electric - (Japan)
- General Cable - (United Stsates)
- Groupo Condumex - (Mexico)
- Hengtong Optic Electric - (China)
- Jiangnan Group - (China)
- Nexans - (France)
- Polycab Group - (India)
- Prysmian Group - (Italy)
- Quingdao Hanhe Cable - (China)
- Southwire - (United States)
- Sumitomo - (Japan)
- Walsin Lihwa - (Taiwan

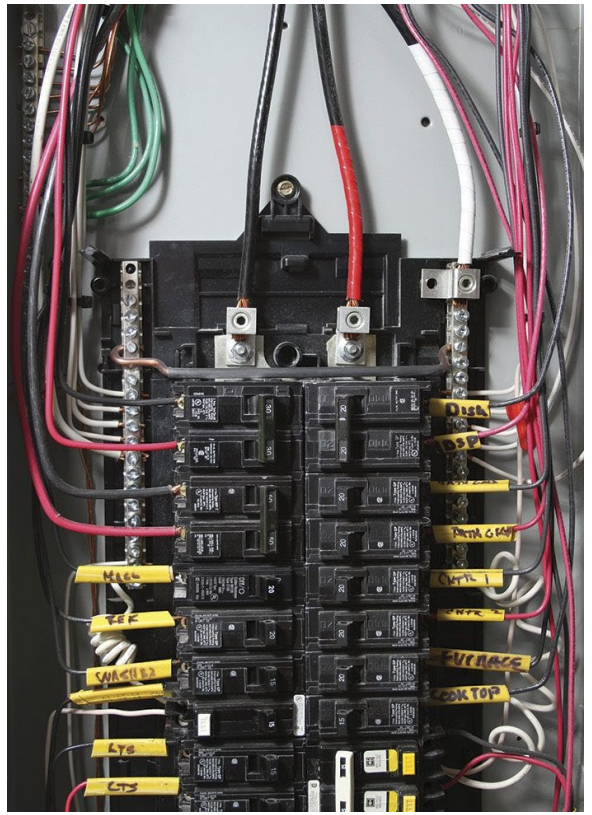
Types of Service panels



Fuse Panel



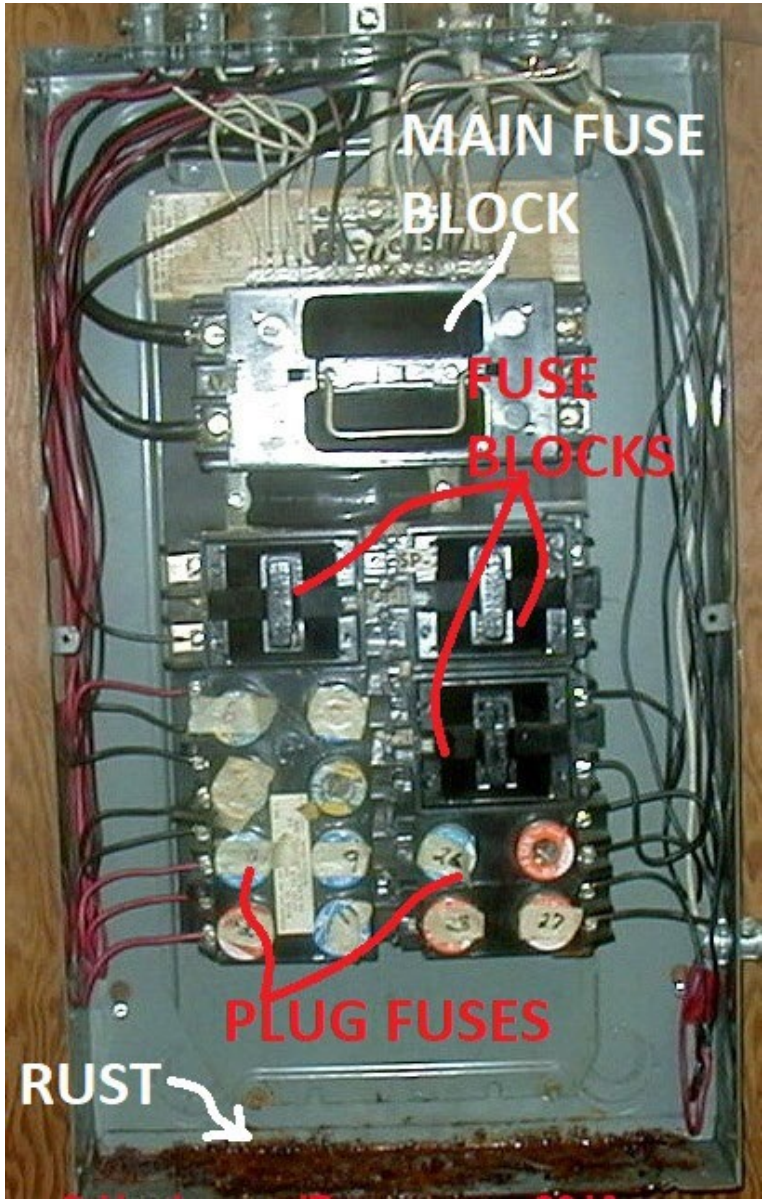
Sub-Panel's



Circuit Panel

Fuse Panel

- Panel has a "Main Fuse Block".
- Also has smaller fuse blocks for larger circuits.
- Fuse panel with rust forming on the bottom of the enclosure.
- Fuse panel's in the early 1900's were typically rated for 60 amp's.
- Fuse panel's in the Mid 1900's were rated for 100 amp's.
- Sub-panel's were used to expand the undersized sized fuse panel's.



Overcurrent Devices…

- Any device that will automatically open an electrical circuit during a short circuit.
- Protect circuits from excessive heating by opening the circuit automatically in event of excessive current flow from accidental ground or overload.
- Examples include:

Circuit Breakers

Cartridge Fuse

Blade Fuse

Plug Fuse

Possible causes of a "Blown Fuse".

1. An overloaded circuit: - Most common occurrence in older homes.

2. A Short Circuit: - A short circuit is a type of electrical fault. Faults, in general, occur when an electrical current strays beyond its intended path. The result is a weak connection between the two conductors supplying electrical power to the circuit.

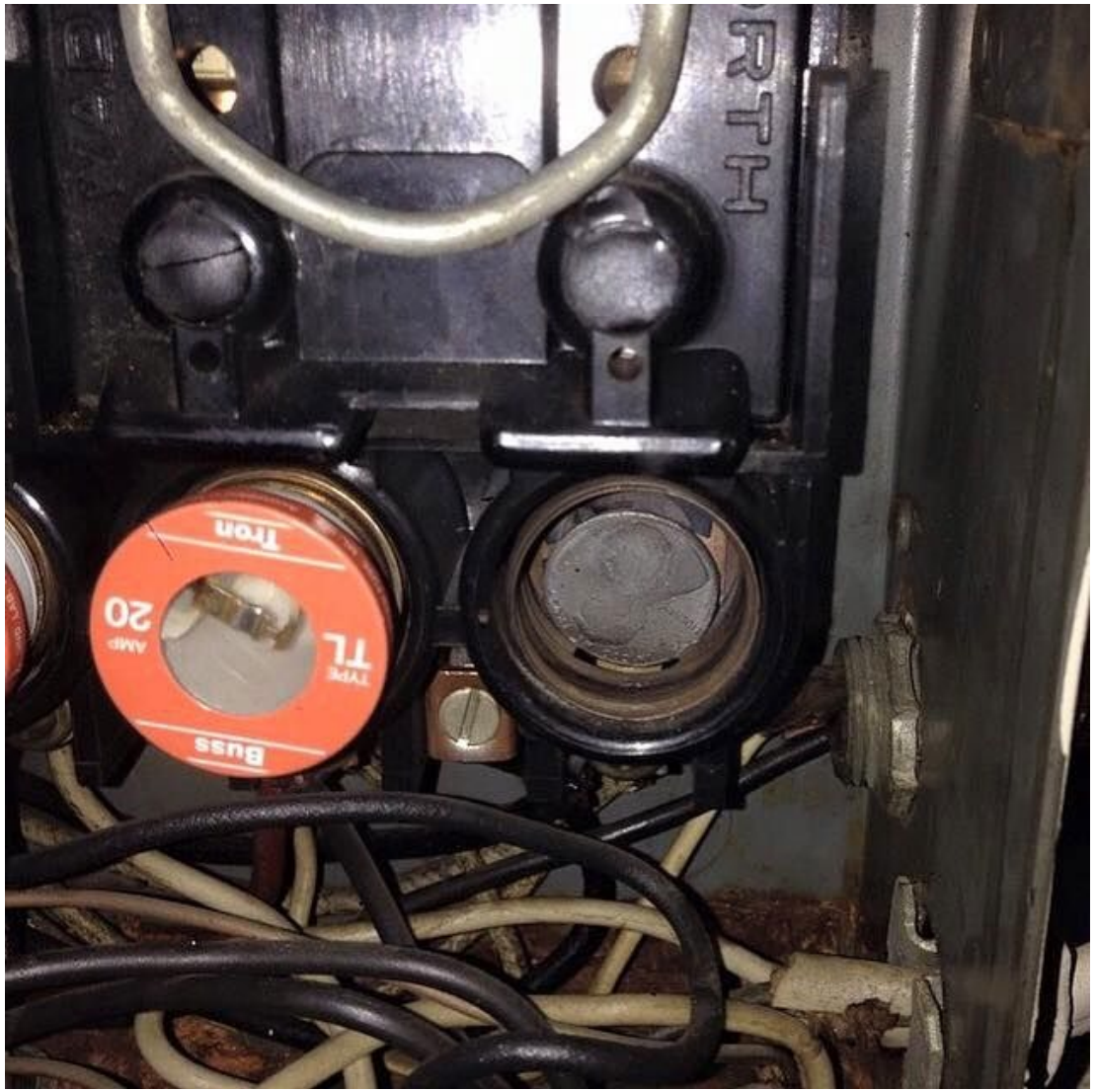
3. A Ground Fault: - is a specific type of short circuit in which the unintentional pathway of the electrical current flows directly to the earth (ground) or touches a grounded part of the system.

4. An Arc Fault: - Arc faults result from problems with wiring and terminal connections–for example, a loose terminal screw.

What not to do!

- A penny is copper and an excellent conductor of electricity, so this appears to "fix" the problem with the fuse.

- We can't overemphasize how dangerous this is. The problem is the penny will allow any amount of electricity through the circuit, rather than burning out like a fuse to protect the circuit.



Substituting a larger fuse for a smaller one is never a good idea.

For example, a 13 Amp fuse can take 20 Amp indefinitely without blowing.

If 100 Amps were to flow through a 13 Amp fuse, it will blow somewhere between 0.01 and 0.3 of a second.

If 50 Amps were to flow through the 13 Amp fuse, it will take somewhere between 0.1 and 11 seconds to blow.

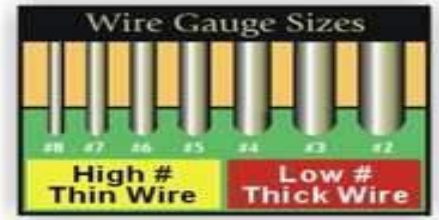
Fuses are there to protect against large overcurrent's due to faults and short circuits. Overloading a fuse by a small amount can lead to dangerous overheating as can be seen on the left.

Electrical Overloads

A hazard exists when a conductor is too small to safely carry the current.

Example: Using a portable tool with an extension cord that has a wire size that is too small for the tool.

- Tools draw more current than the cord can handle = overheating, possible fire without tripping the circuit breaker
- Circuit breaker could be the right size for the circuit but not for the smaller wire extension cord



Electrical Protective Devices

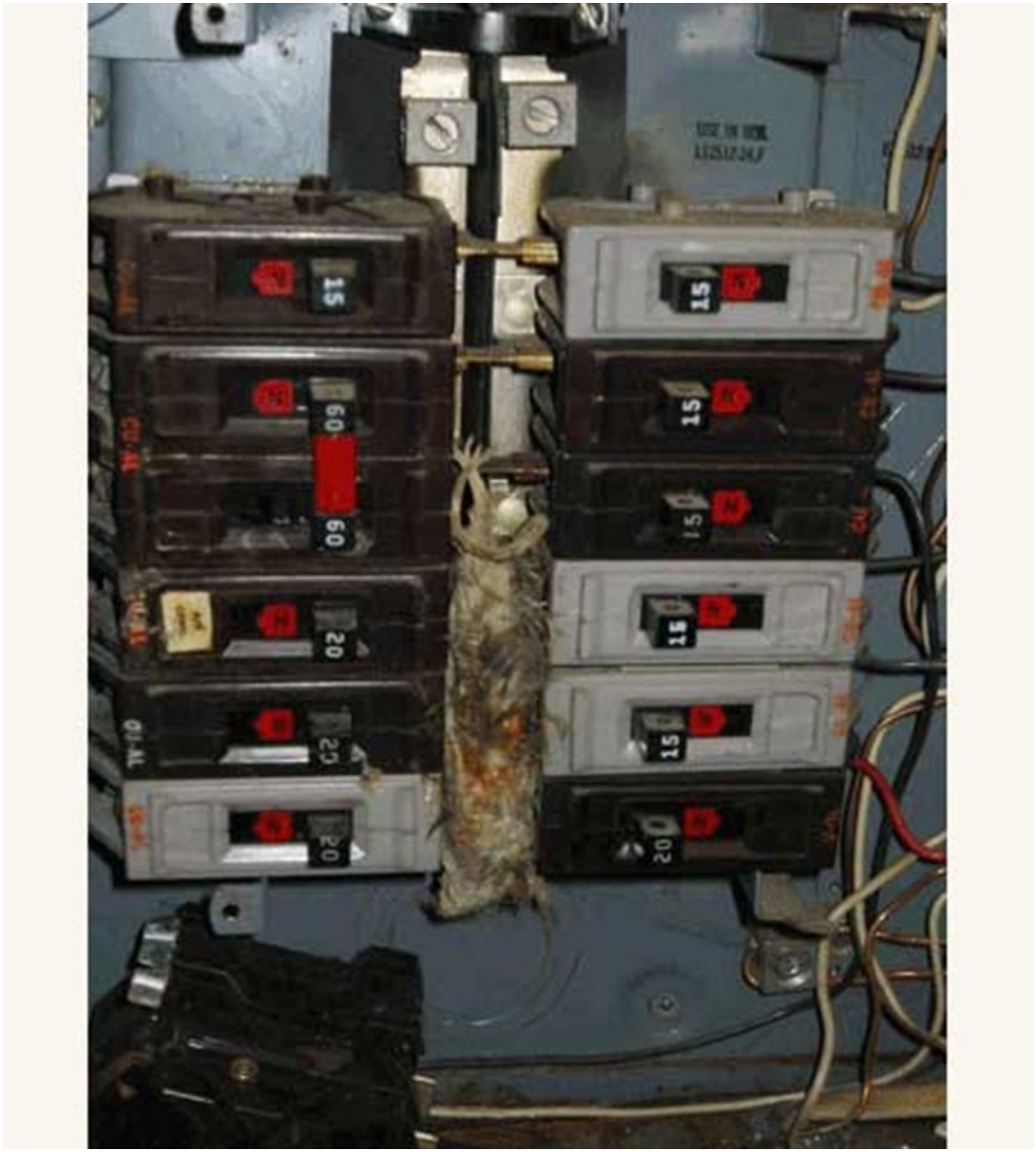
- **Too many devices plugged into circuit.**
  - Wires heat to very high temperatures, which may cause a fire.
- **Wire insulation melts.**
  - Arcing may occur, Which can cause a fire in the area where overload exists (even inside a wall).

This is a bathroom outlet.

Some people believe in those GFCI's (Ground Fault Circuit Interrupters) but they take up a lot of space and cost a lot.

Smell a Rat?

It's a good idea to cover all unused knock-outs.



RECYCLE

Clever idea for recycling that old jockstrap.

Dryer Wire

Here is the latest in electrical wiring techniques for dryer hookups. No box required.

They could have at least used a piece of duct tape over the connections.

Challenges faced today.

- More people are buying older homes and renovating them.
  - Not replacing all of the fuse panel's.
  - Replacing the panel and not upgrading the wiring.
  - Replacing the electrical wiring that is visible, but not hard to reach areas.
  - Not replacing other electrical components, such as electrical receptacles.

Challenges faced today.

- **A lot of the problems seen could be resolved with the adoption and Enforcement of Building Codes.**
  - Perceived by many as a challenge.
  - At the jurisdictional level, where regulations are adopted and enforced, there is usually an argument against building codes. (Typically smaller jurisdictions – could be attributed to cost)
  - Less than half of the counties in the State enforce building codes.
  - Approximately 45% of counties and municipalities have adopted and enforce building codes.

Control of most electrical hazards is neither difficult or expensive, but ignoring them can cause serious consequences!

How do we mitigate the problem?

Building Codes

- Educate the public on the importance of building codes.
  - The adoption and enforcement of building codes can reduce your insurance fire rating, which then reduces insurance premiums.
  - Opens the door for more Federal funding.
- Work with our counties and municipalities to promote and enforce building codes.
- The State Fire Marshal's Office can assist with any questions regarding building codes.
- Building codes exist to safeguard the public, from fire or other hazards attributed to the building environment.
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How do we mitigate the problem?

Fire Prevention.

- Most local jurisdictions have some form of fire prevention program.
- We have done a great job of teaching fire safety to the residents of Mississippi, but its not enough.
  - We need to also target the older generation.
  - Get involved in the fire prevention programs.
  - Use social media platforms to promote fire safety.
  - The State Fire Marshal's Office can assist with any questions regarding fire safety.

Other fire prevention methods include:

- Heat and/or smoke detectors.
- Automatic fire sprinkler systems.
- Building codes and materials.
- Flame retardant furnishings and materials.

"Through promotion and enforcement of fire safety regulations, training, building code provisions, and arson investigations, the State Fire Marshal's Office helps reduce the loss of life and property by fire"

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