Re: Expressing fractions

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From: Paul J Kriha (*paul.nospam.kriha_at_paradise.net.nz*)
Date: 01/05/05

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Date: Wed, 5 Jan 2005 21:34:33 +1300
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Don A. Gilmore <eromlignodNOSPM@kc.rr.com> wrote in message
news:34080nF45lfqoU1@individual.net...
> "Javi" <poziNOSPAMyo@hotmail.com> wrote in message
> news:3402jcF44n2c5U1@individual.net...
> > Harvey Van Sickle wrote:
> > > On 03 Jan 2005, Don A. Gilmore wrote
> > > >>The problem with higher voltages is that they are more dangerous
> > > >>if you come in contact with them and, if large enough, can present
> > > >>arcing problems if conductors are not spaced and/or insulated from
> > > >>each other enough.
> > >
> > >
> > > The use of 220V for standard appliances −− like table lamps −−
> > > frightened me a bit when I moved to the UK, as I'd only ever seen that
> > > voltage used for things like electric cookers/stoves.
> >
> > The use of a higher voltage implies that less intensity is necessary for
> > the same power (wattage). A high voltage is not necessarily more
> > dangerous than a lower voltage, usually it is the opposite. What kills
> > people is high intensity, not high voltage, and 220V needs half the
> > intensity than 110V for the same wattage. When I was younger and had a
> > small motorbike that needed frecuently spark−plug cleaning, I sometimes
> > received a electric discharge from the spark−plug when testing it, and
> > that was around 4000−5000 volts; it hurt a bit, but did not kill me.
>
>
> Intensity?? That's a new one on me.

Mistranslated "current"?
(a lame attempt to keep this on a language related topic :−)

> Voltage is indeed what you must avoid.
> There is an often−misunderstood statement that "it's the current that kills
> you", citing that as little as 0.1 amperes can cause death. This is
> technically true, but such a statement is very misleading to those who don't
> understand the elementary principles of electricity. What does it take to
> *produce* 0.1 amps of current through your body?

>
> The electrical outlets in your home can essentially be treated as "ideal"
> voltage sources. In other words, the outlet provides a constant 120 volts,
> regardless of the load attached to it. The amount of current that results
> from the connection is a result of what appliance is connected to it.
>
> A 60−watt bulb (in the US) is designed to require 60 watts of power when
> connected to a 120−volt circuit. That means that it will draw a current of
> 0.5 amps. If you replace this bulb with a 120−watt one, it will pull 1.0
> amp. The 120−watt bulb has a filament that has a lower resistance to
> electricity and can withstand more current and dissipate more energy in the
> form of light. If you plug a 1200−watt space heater in, there will be 10
> amps of current in the line.
>
> So what happens when you plug your fingers into the socket? Well, that
> depends on how much the part of your body that you plug into it resists the
> electricity, just like any other appliance. It also depends on what the
> electricity passes through. If it passes from the forefinger to the middle
> finger of your right hand, there will be less resistance than through your
> whole body, so more current will pass. But since there aren't really any
> vital organs in your hand, it probably won't kill you. In fact you could
> survive a pretty high voltage through just one hand. With really high
> voltages, it might even vaporize your hand, but this is arguably a
> survivable injury.
>
> If you grab two wires, one in each hand, or grab a hot wire while standing
> in a pool of water that is grounded, then you are passing current through
> vital organs. The lethality still depends on your resistance and what
> voltage we are talking about.

Where do the mechanical engineers learn this stuff? :−)
What you are saying in your post is mostly spot on. I have only
a teeny weeny correction(s) here. The lethality depends on
the current (and frequency, but that's another rather complex
issue, let's not go there today). The current depends on the
voltage and resistance of the _complete curcuit_, that is
your resistance plus resistance of all conductors and contacts
and the internal resistance of the voltage source (which gets
often forgotten).

For example, so called "soft" voltage sources that have
high internal resistance may deliver voltage of many
kilovolts while they are not loaded, but when you touch
them you get harmless shock, because the voltage
(and consequently delivered current) immediately drops
to harmless levels.

I know, you said you look at the domestic supply as a near
"ideal" source. However, even when you directly touch
the conductors of such hard voltage source the internal
resistance of your body plays only very very minor part

in the overall resistance of the whole circuit. (see farther down).

> *Your body's resistance can vary a lot due to*
> *how hydrated you are, your salt content, the humidity, etc. If it takes 0.1*
> *amps through your heart to kill you and you grab onto 120 volts, then you*
> *would need a minimum resistance of 1200 ohms, which is possible, but*
> *extremely low for living tissue and thus unlikely. I have grabbed 120 and*
> *240 many times in my career and have lived to tell the tale.*
>
> *Incidentally, I just took my ohmmeter out of my desk drawer and I measure*
> *about 700,000 ohms between my left and right hands.*

Most of the resistance you measured is in your hand−conductor contacts and is highly variable. If you firmly grip large surface contacts with sweaty (wet + salty) palms you can get the overall resistance down to hundreds of Ohms. If you touch AC contacts just as it swings well above 120V (which it does in the US 120 times a second) _and_ during the critical time of your heart cycle you can manage to stop the heart dead. Or you may find the muscles in your hands contracting involuntarily and gripping the conductors. Then you may fry slowly and it may take a little while for you to die.

What's more, there is a reason why your ohmmeter will give you misleading resistance figures. Resistance of the metal−hand contact is _voltage_ dependent!!! Your ohmmeter performs the measurement in wrong condition. I guess it has an internal batery of 1.2/1.5V. To measure the resistance it employes a Winston bridge curcuit. The actual measurement voltage applied to your hand(s) will be only a fraction of that voltage. The metal−hand transition behaves to some extent as a semi−conductor and at low voltage it exhibits significantly higher resistance. To correctly measure the resistance you need to use the real domestic voltage :−) If you measure currents flowing through your body while you steadily increase the voltage you find that at some point (tens of volts) the voltage suddenly breaks through the palms' resistance barrier and current increases by as much as order(s) of magnitude. Youch! Youch indeed!

When you have to repair or test equipment under current the trick is never to work with both hands, the golden rule is to keep always one hand behind you back. That way you keep the heart out of "the loop" and most serious injuries you suffer are cuts and bruises caused by your hand hitting adjacent equipment's sharp edges when your muscles involuntarily contract. Youch again, but you live to youch another day. :−)

> *Don A. Gilmore*
> *Mechanical Engineer*

> *Kansas City*

Paul JK
El. Engineer

P.S.
I wish I knew as much about mechanical engineering
as you seem to know about electricity.