

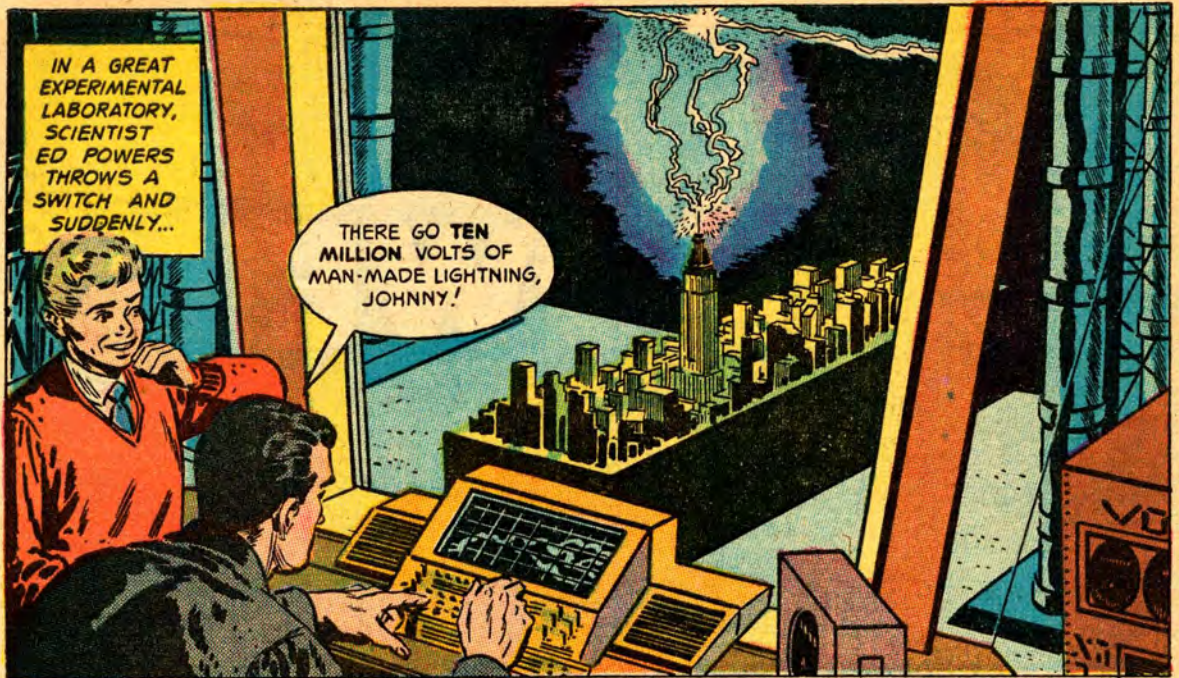
NETWORK OF POWER

ADVENTURES IN
SCIENCE SERIES

GENERAL  ELECTRIC

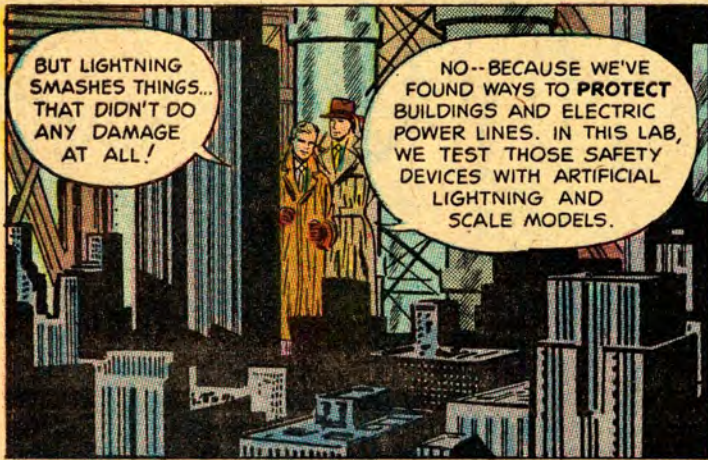
ACROSS ALL AMERICA SPREAD THE GREAT TRANSMISSION AND DISTRIBUTION SYSTEMS WHICH CARRY ELECTRICITY TO FACTORIES AND HOMES, STORES AND SCHOOLS, CITIES AND FARMS. SPANNING WIDE RIVERS, DEEP CHASMS, BROAD PRAIRIES AND TOWERING MOUNTAINS, ELECTRIC POWER LEAPS TO YOUR SERVICE IN A FRACTION OF A SECOND AS YOU FLIP A SWITCH OR PRESS A BUTTON.

HERE IS THE STORY OF
***THE DISTRIBUTION
OF ELECTRICITY***



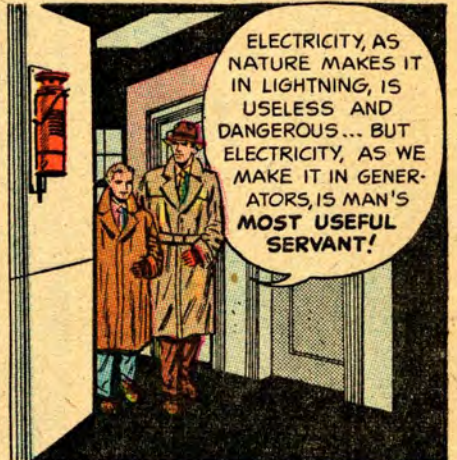
IN A GREAT EXPERIMENTAL LABORATORY, SCIENTIST ED POWERS THROWS A SWITCH AND SUDDENLY...

THERE GO TEN MILLION VOLTS OF MAN-MADE LIGHTNING, JOHNNY!



BUT LIGHTNING SMASHES THINGS... THAT DIDN'T DO ANY DAMAGE AT ALL!

NO--BECAUSE WE'VE FOUND WAYS TO PROTECT BUILDINGS AND ELECTRIC POWER LINES. IN THIS LAB, WE TEST THOSE SAFETY DEVICES WITH ARTIFICIAL LIGHTNING AND SCALE MODELS.

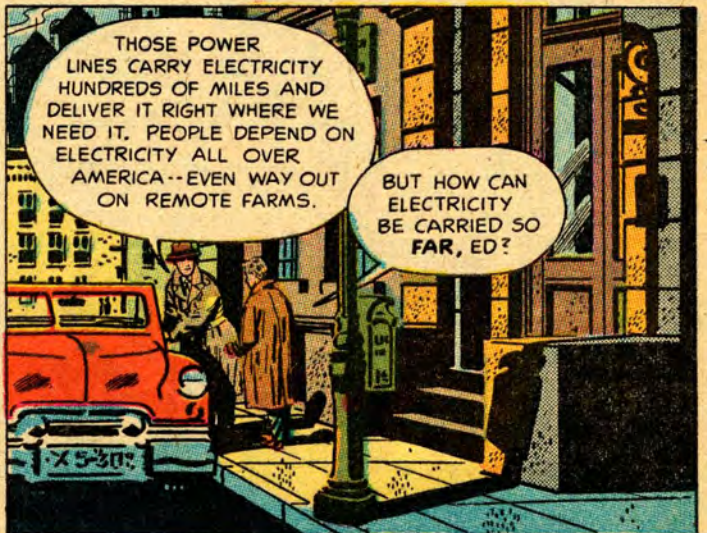


ELECTRICITY, AS NATURE MAKES IT IN LIGHTNING, IS USELESS AND DANGEROUS... BUT ELECTRICITY, AS WE MAKE IT IN GENERATORS, IS MAN'S MOST USEFUL SERVANT!



BECAUSE ELECTRICITY IS SO IMPORTANT IN OUR LIVES, WE'VE HAD TO FIND WAYS TO PREVENT DAMAGE TO POWER LINES.

I CAN SEE WHY THAT'S IMPORTANT!



THOSE POWER LINES CARRY ELECTRICITY HUNDREDS OF MILES AND DELIVER IT RIGHT WHERE WE NEED IT. PEOPLE DEPEND ON ELECTRICITY ALL OVER AMERICA--EVEN WAY OUT ON REMOTE FARMS.

BUT HOW CAN ELECTRICITY BE CARRIED SO FAR, ED?

"IT COULDN'T, JOHNNY-- UNTIL TRANSFORMERS WERE DEVELOPED. YOU SEE, BACK IN 1886, LONG AFTER FARADAY DISCOVERED HOW TO GENERATE ELECTRICITY, WILLIAM STANLEY ESTABLISHED A LOCAL LIGHTING SYSTEM..."

THAT WATERFALL RUNS OUR GENERATOR-- SO THAT WE CAN LIGHT THE WHOLE TOWN OF NIAGARA FALLS.

IF WE USE A TRANSFORMER TO RAISE THE VOLTAGE, WE CAN DELIVER ELECTRIC CURRENT ALL THE WAY TO BUFFALO.

WE WOULDN'T HAVE THESE LIGHTS IF WE WERE ANY FURTHER AWAY. OUR LOW-VOLTAGE ELECTRICITY CAN'T BE CARRIED FAR WITHOUT WASTE.

"THEN, WHEN COMMERCIAL TRANSFORMERS WERE DEVELOPED IN 1894, WE FOUND A WAY TO RAISE ELECTRICITY TO HIGHER VOLTAGE..."

WHY, THAT'S 26 MILES FROM NIAGARA FALLS! WONDERFUL!



THAT WAS THE FIRST "LONG-DISTANCE" COMMERCIAL POWER LINE. NOW THEY COVER THE COUNTRY... MANY OF THEM HUNDREDS OF MILES LONG.

LOOK-- THERE'S ONE UP AHEAD OF US!



HMM-- LOOKS LIKE WE'RE HEADING INTO A STORM. THAT'S REAL LIGHTNING!



WOW! RIGHT INTO THOSE WIRES!

JUST ONE, JOHNNY... THE TOP WIRE... ONE OF THOSE SAFETY DEVICES I WAS TALKING ABOUT... YOU SEE...



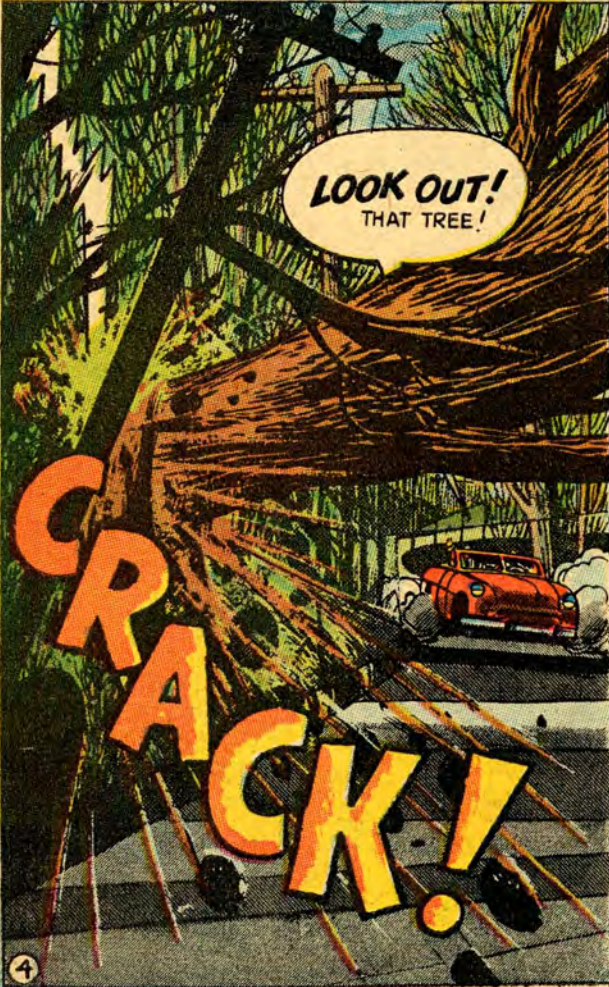
LIGHTNING IS ATTRACTED TO THE HIGHEST OBJECT THAT WILL CONDUCT ELECTRICITY ... SO WE PROTECT OUR TRANSMISSION LINES BY PUTTING AN EXTRA WIRE ABOVE THEM.



THEN, WHEN LIGHTNING STRIKES, IT'S LED HARMLESSLY TO THE GROUND THROUGH THE STEEL TOWER OR A GROUND WIRE.

GEE, IT'S GETTING DARK, ED... YOU CAN HARDLY SEE THAT HOUSE OVER THERE.

IN THE NEXT FEW MOMENTS, THE GALE HOWLS WITH GREATER FURY AND SUDDENLY...

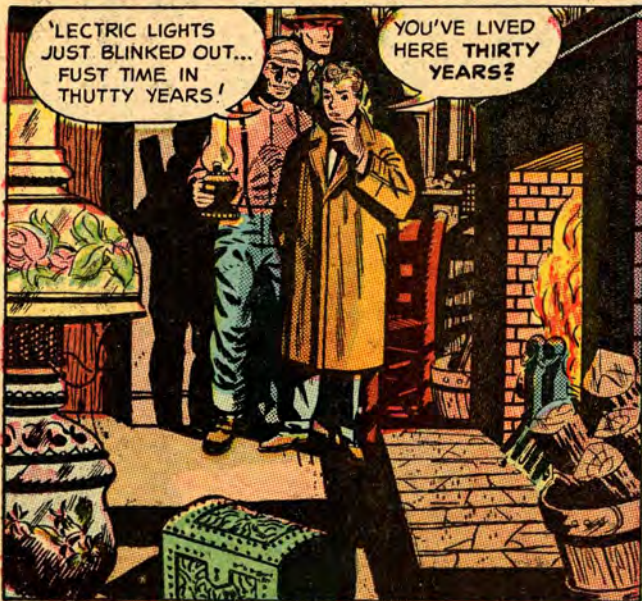


LOOK OUT! THAT TREE!



WHEW! THAT WAS CLOSE! THE TREE JUST MISSED US -- BUT IT TORE DOWN THOSE ELECTRIC WIRES...

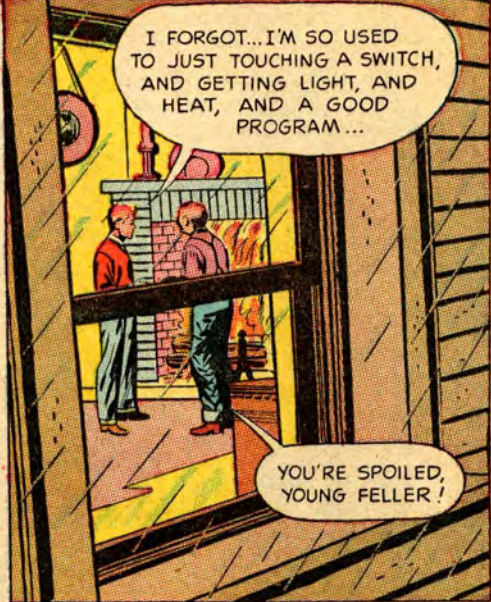
YES, IT'S TOO BAD -- BUT IT HAPPENS ONCE IN A WHILE. C'MON, LET'S PUT THE TOP UP AND RUN FOR THAT HOUSE WE JUST PASSED.



Y'KNOW, ED, IT'S KIND OF SPOOKY IN HERE-- DARK... 'N COLD... 'N QUIET! COULDN'T WE TURN ON THE LIGHTS... AND THE RADIO... AND THAT ELECTRIC HEATER OVER THERE?



WE COULD-- BUT THEY WON'T DO US MUCH GOOD WITHOUT ELECTRICITY!

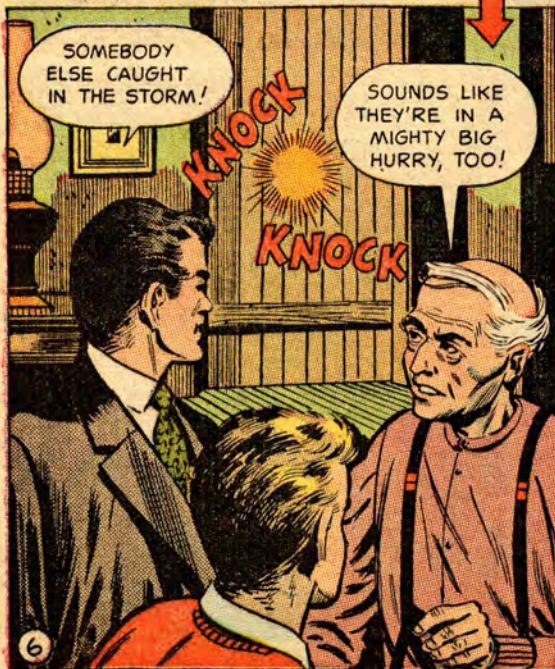


I FORGOT... I'M SO USED TO JUST TOUCHING A SWITCH, AND GETTING LIGHT, AND HEAT, AND A GOOD PROGRAM...

YOU'RE SPOILED, YOUNG FELLER!



NO, HE'S JUST USED TO THE CONVENIENCE OF ELECTRICITY... NOTHING WRONG WITH THAT!



SOMEBODY ELSE CAUGHT IN THE STORM!

SOUNDS LIKE THEY'RE IN A MIGHTY BIG HURRY, TOO!



SORRY TO INTRUDE. I'M DR. SHAW... I'VE A VERY SICK MAN--AND HIS DAUGHTER--IN MY CAR. MAY WE TAKE SHELTER HERE?

SHORTLY...

THIS FELLOW NEEDS IMMEDIATE SURGERY! WE WERE ON OUR WAY TO THE HOSPITAL WHEN WE FOUND A TREE BLOCKING THE ROAD...

IS THERE ANYTHING WE CAN DO HERE UNTIL YOU CAN GET THROUGH?

THIS IS AN EMERGENCY... AND I'M AFRAID THERE ISN'T MUCH CHOICE. I'LL HAVE TO OPERATE AT ONCE!

IT'S PRETTY RISKY UNDER THESE CIRCUMSTANCES... THE LIGHT IS SO POOR, AND--

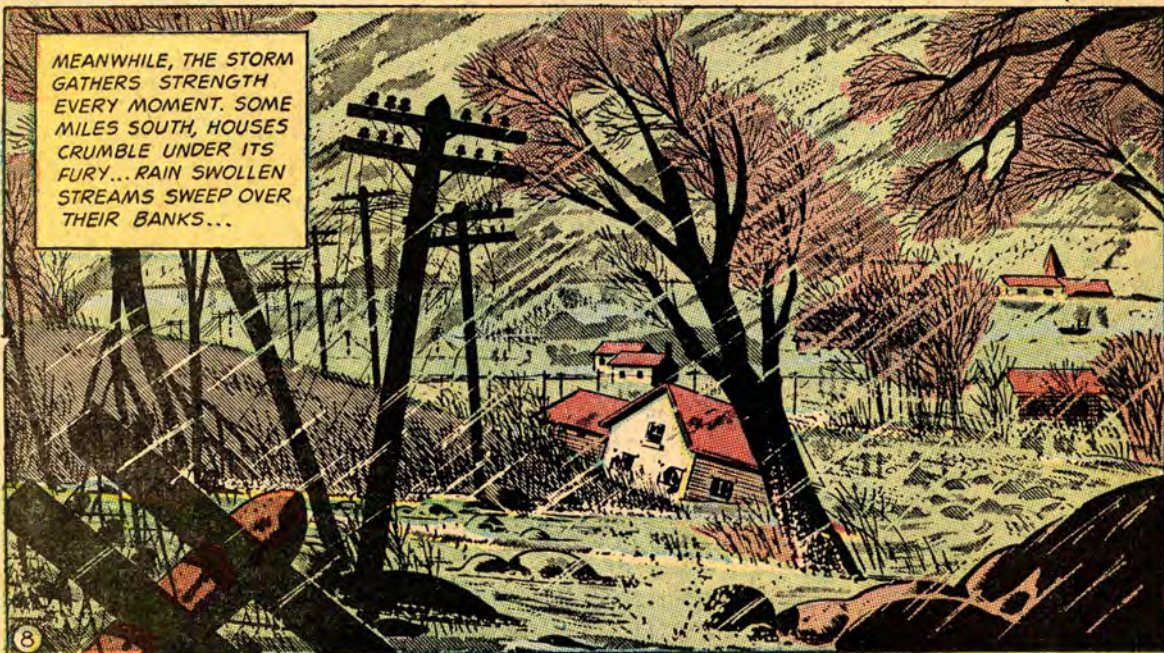
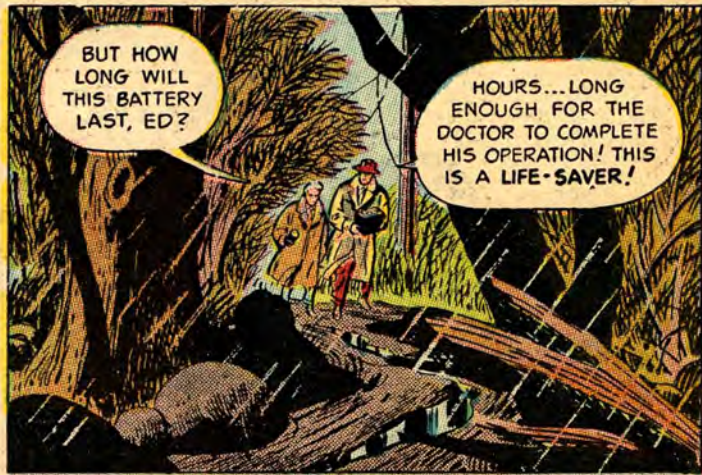
THERE MUST BE SOMETHING I CAN DO ABOUT THAT. LET'S SEE...

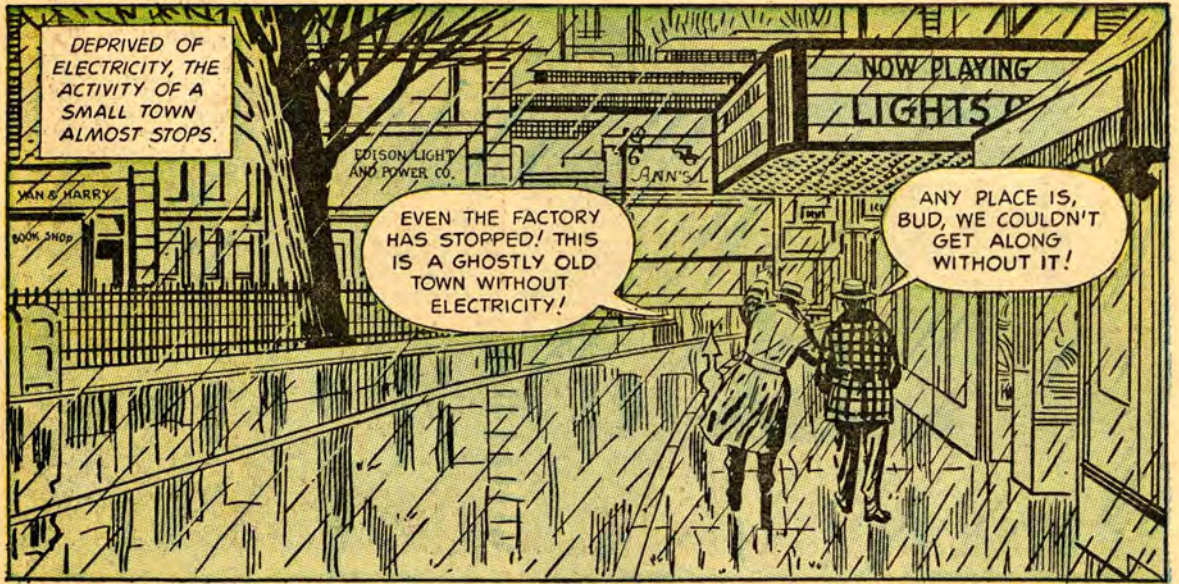
GEE, ED, COULDN'T WE FIX THOSE WIRES THAT WERE BROKEN WHEN THAT TREE FELL ACROSS THE ROAD?

NO, JOHNNY, HANDLING A "HOT" WIRE WITHOUT SPECIAL TOOLS AND EQUIPMENT IS TOO DANGEROUS... THAT JOB IS FOR THE POWER COMPANY...

...AND THEY'LL HAVE A REPAIR CREW HERE IN NO TIME. BUT I'VE GOT AN IDEA IN THE MEANTIME! C'MON, JOHNNY!

WE'LL BE BACK WITH AN ELECTRIC LIGHT FOR YOU BY THE TIME YOU'VE GOT YOUR PATIENT READY, DOCTOR!





UNAWARE OF THE WIDESPREAD DEVASTATION THE STORM IS CAUSING, ED AND JOHNNY CONTINUE THEIR RACE AGAINST TIME ...



AS THEY AWAIT THE OUTCOME OF THE DOCTOR'S FIGHT TO SAVE A LIFE ...



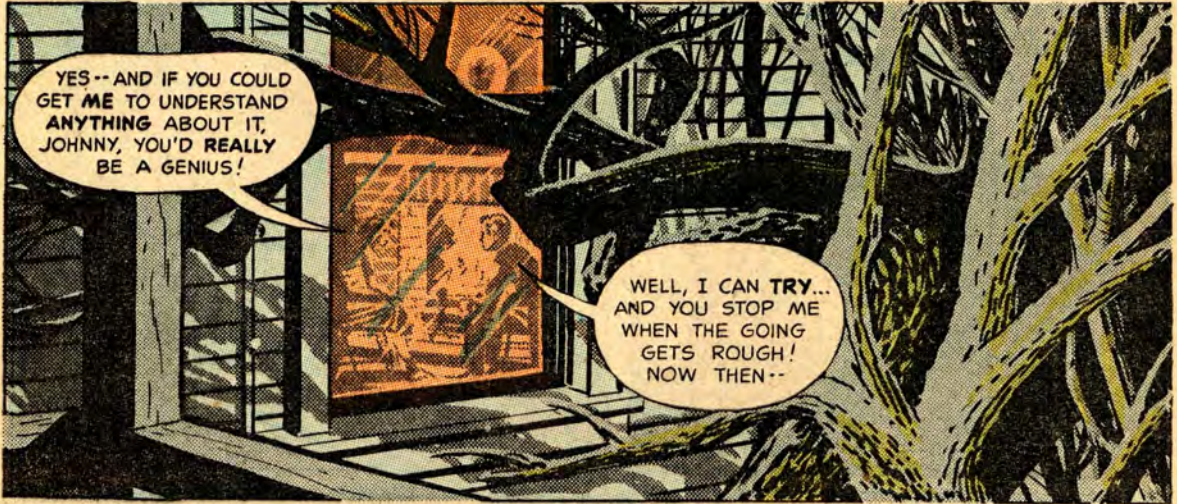


DR. SHAW SAID HE'LL NEED LOTS OF ICE-PACKS AFTER THE OPERATION BUT THE REFRIGERATOR'S CUT OFF, TOO, AND --

BY THAT TIME, I'M SURE THE POWER COMPANY'S MEN WILL HAVE THE REGULAR HOUSE CURRENT GOING AGAIN.

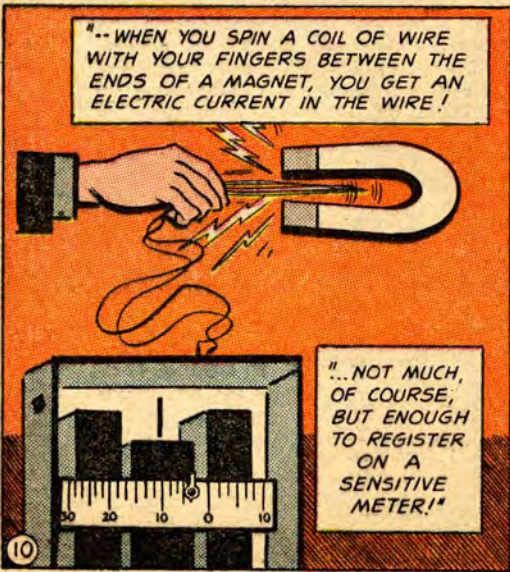


APPEARS TO ME YOU KNOW A WHOLE OF A LOT ABOUT ELECTRICITY FOR SUCH A YOUNG FELLER! ER--DON'CHA THINK SO, MISS?



YES-- AND IF YOU COULD GET ME TO UNDERSTAND ANYTHING ABOUT IT, JOHNNY, YOU'D REALLY BE A GENIUS!

WELL, I CAN TRY... AND YOU STOP ME WHEN THE GOING GETS ROUGH! NOW THEN--



"-- WHEN YOU SPIN A COIL OF WIRE WITH YOUR FINGERS BETWEEN THE ENDS OF A MAGNET, YOU GET AN ELECTRIC CURRENT IN THE WIRE."

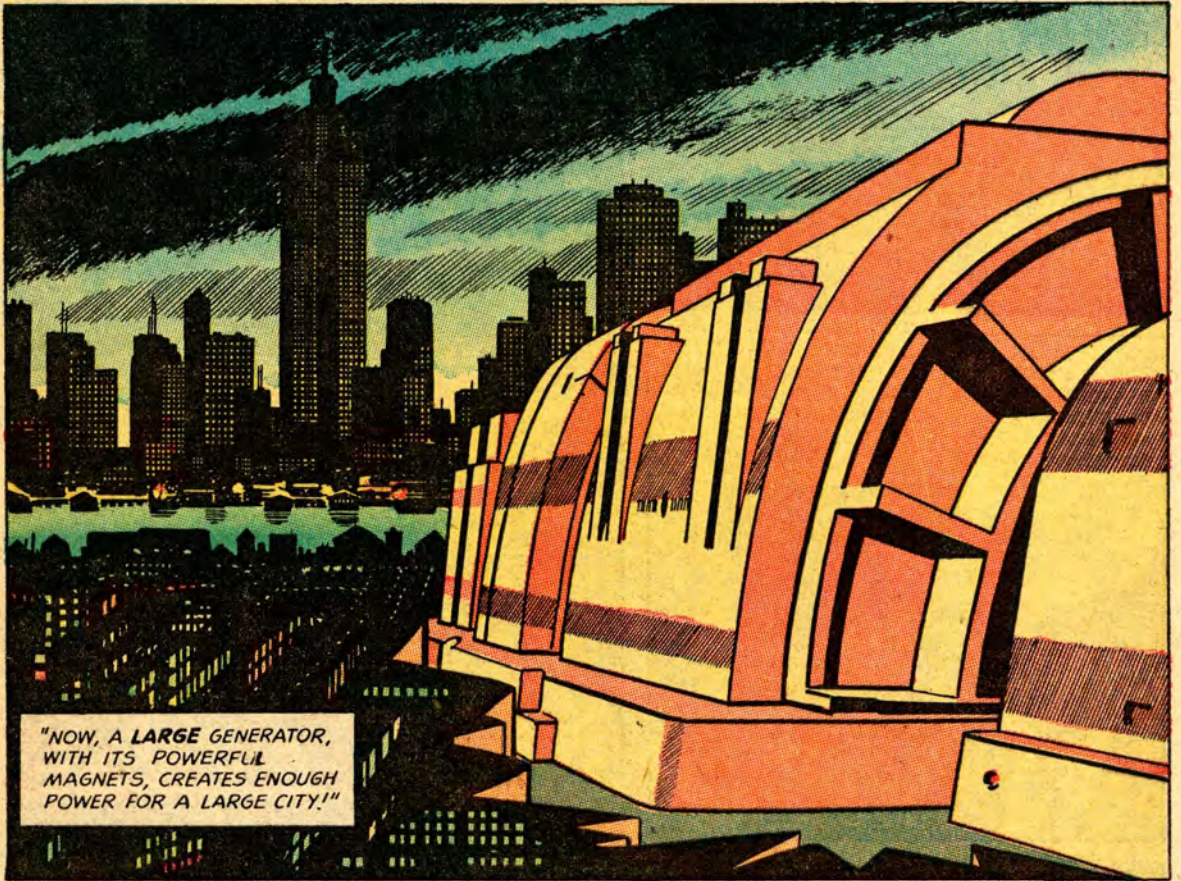
"... NOT MUCH, OF COURSE, BUT ENOUGH TO REGISTER ON A SENSITIVE METER."



"YOU SEE, IN THE WIRE ARE BILLIONS OF TINY ELECTRONS WHICH ARE ALWAYS QUIETLY SHIFTING AROUND"

GEE, IT'S PEACEFUL HERE.

"...BUT WHEN THEY'RE MOVED NEAR A MAGNET, IT 'EXCITES' THEM--SENDS THEM RUSHING IN ONE DIRECTION THROUGH THE WIRE. THAT'S WHAT MAKES AN ELECTRIC CURRENT IN THE WIRE."



"NOW, A LARGE GENERATOR, WITH ITS POWERFUL MAGNETS, CREATES ENOUGH POWER FOR A LARGE CITY!"

IT'S AS SIMPLE AS ALL THAT!

AND I DIDN'T HAVE TO STOP YOU ONCE--GENIUS!

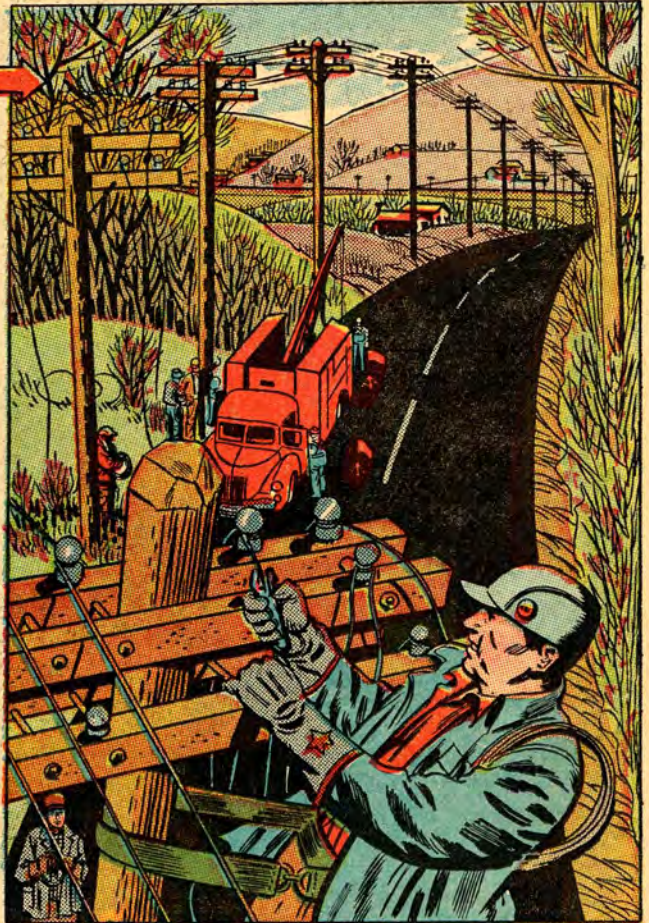
SUDDENLY...

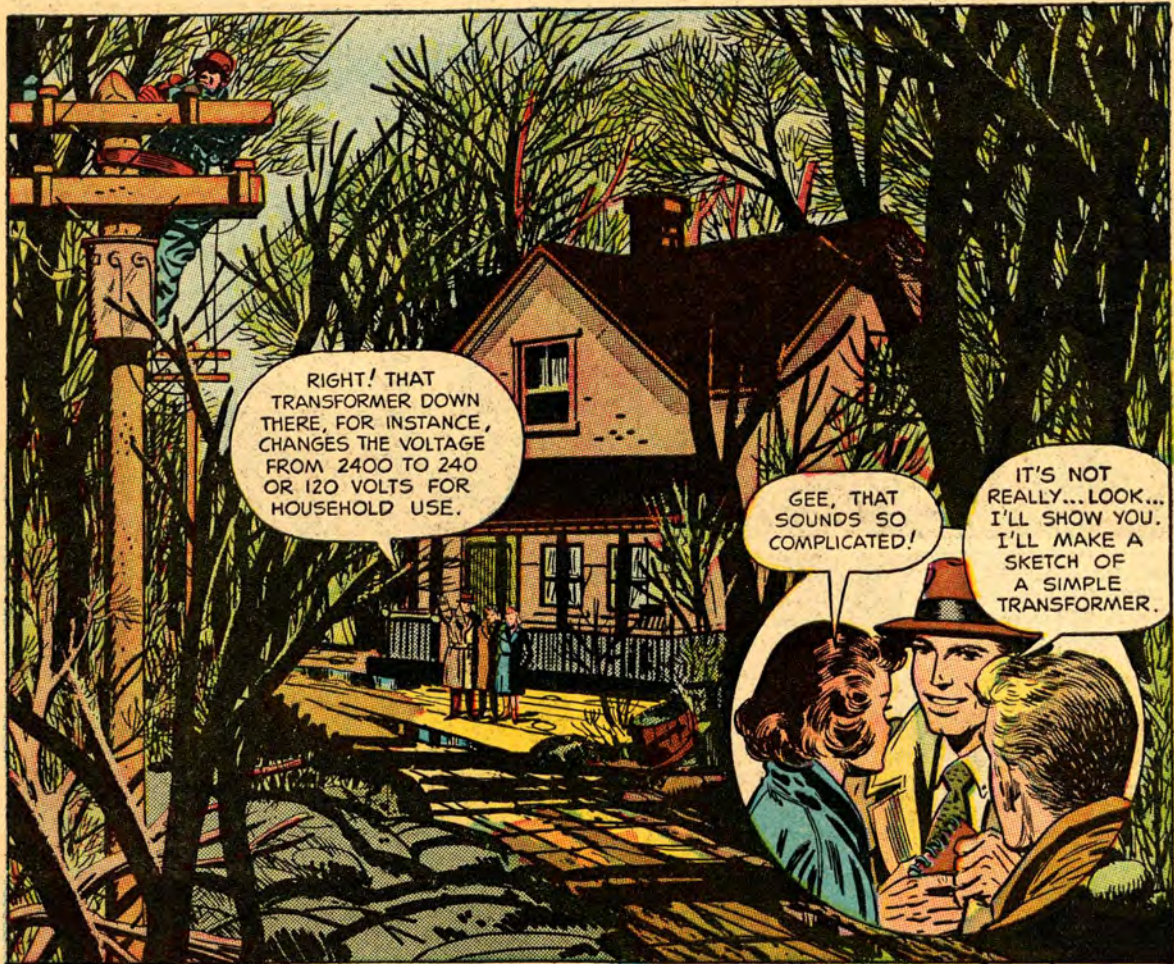
OH... AT LAST!

THE OPERATION IS OVER... AND A SUCCESS! ALL WE NEED NOW IS THE REGULAR HOUSE CURRENT TO MAKE ICE IN THE REFRIGERATOR.



THE POWER COMPANY'S CREWMEN ARE ON THE JOB...
REPAIRING THE BROKEN WIRES...

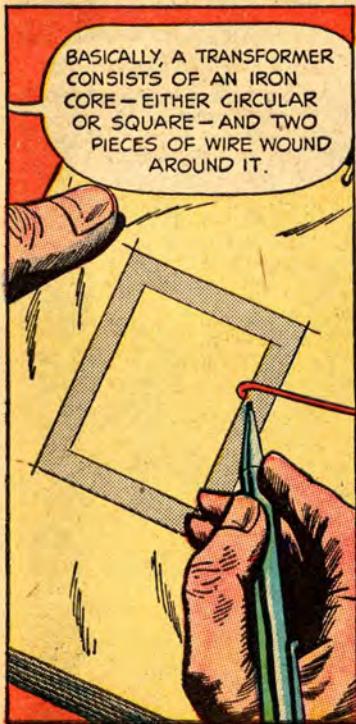




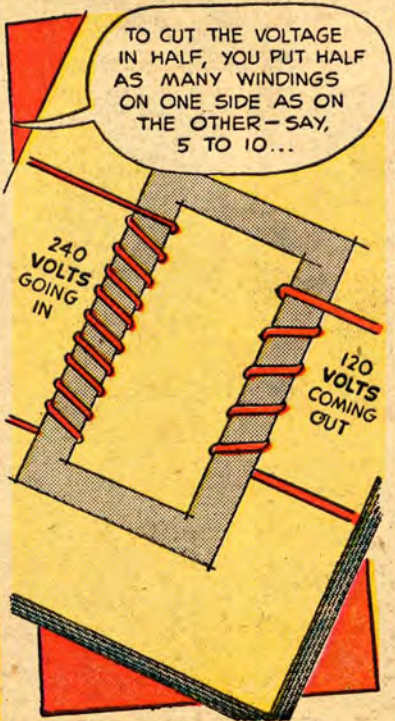
RIGHT! THAT TRANSFORMER DOWN THERE, FOR INSTANCE, CHANGES THE VOLTAGE FROM 2400 TO 240 OR 120 VOLTS FOR HOUSEHOLD USE.

GEE, THAT SOUNDS SO COMPLICATED!

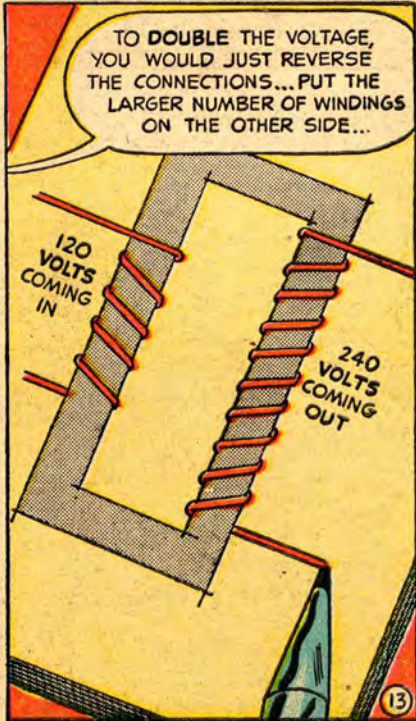
IT'S NOT REALLY...LOOK... I'LL SHOW YOU. I'LL MAKE A SKETCH OF A SIMPLE TRANSFORMER.



BASICALLY, A TRANSFORMER CONSISTS OF AN IRON CORE - EITHER CIRCULAR OR SQUARE - AND TWO PIECES OF WIRE WOUND AROUND IT.



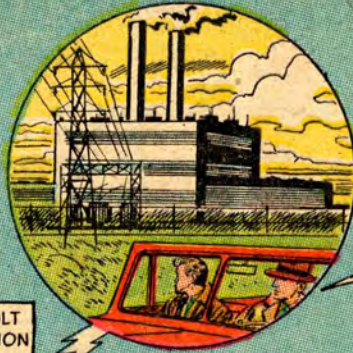
TO CUT THE VOLTAGE IN HALF, YOU PUT HALF AS MANY WINDINGS ON ONE SIDE AS ON THE OTHER - SAY, 5 TO 10...



TO DOUBLE THE VOLTAGE, YOU WOULD JUST REVERSE THE CONNECTIONS...PUT THE LARGER NUMBER OF WINDINGS ON THE OTHER SIDE...

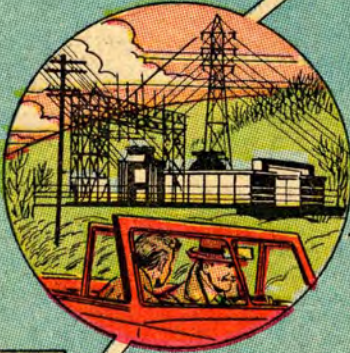


AND SO, AS JOHNNY
AND ED DRIVE ALONG...



THAT BIG POWER STATION
WE JUST PASSED GENERATES
ELECTRICITY AT 13,800 VOLTS...
AND TRANSFORMERS "STEP UP"
THE VOLTAGE TO 69,000
FOR LOW-COST, LONG
DISTANCE TRANSMISSION.

69,000 VOLT
TRANSMISSION



THEN, FOR SHORT-RANGE
TRANSMISSION AND FOR USE
BY BIG INDUSTRIAL PLANTS,
TRANSMISSION SUBSTATIONS
"STEP DOWN" THE POWER,
BACK TO 13,800 VOLTS.

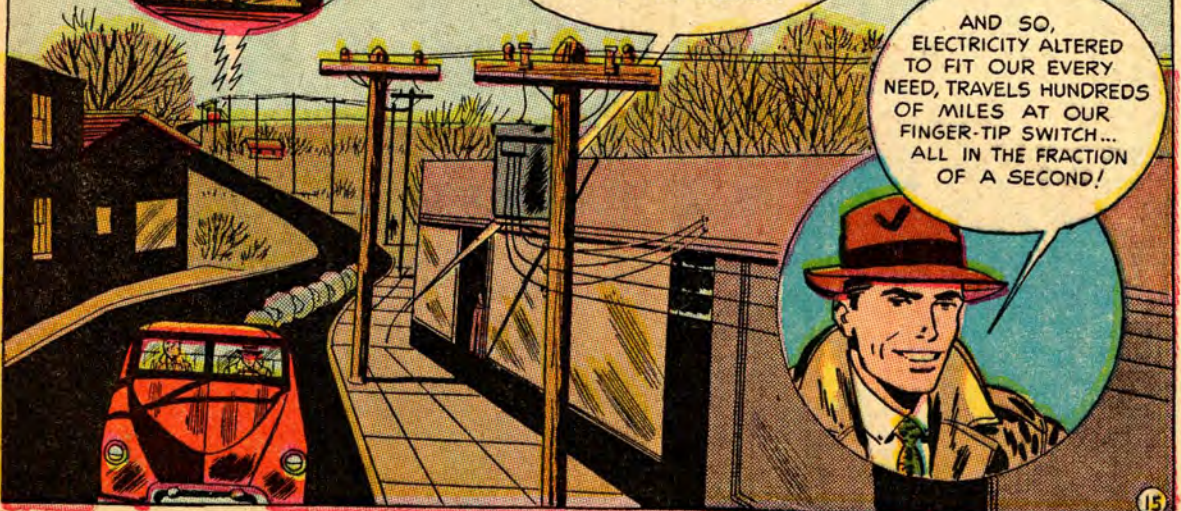
13,800 VOLT
TRANSMISSION



LOCALLY, AT **DISTRIBUTION**
SUBSTATIONS, TRANSFORMERS
LOWER THE VOLTAGE STILL
FURTHER TO 2400 VOLTS--STILL
HIGH ENOUGH FOR SMALL
INDUSTRIAL USERS...

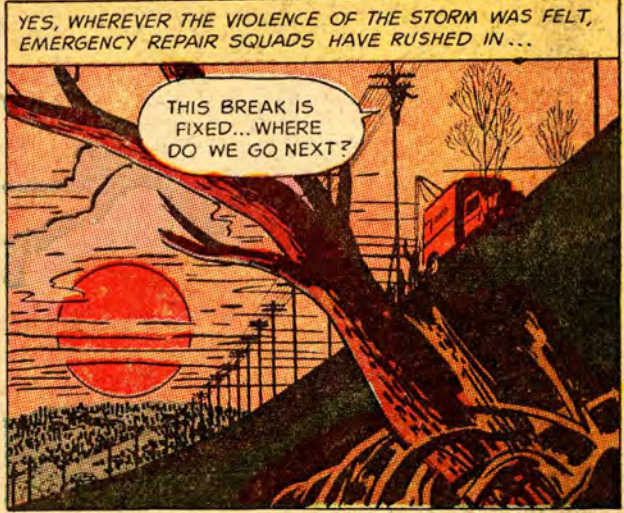
AND, FINALLY, SMALL
TRANSFORMERS MOUNTED
ON POLES STEP DOWN THE
VOLTAGE TO 120-240 VOLTS
FOR CONVENIENT USE IN
HOMES AND STORES.

AND SO,
ELECTRICITY ALTERED
TO FIT OUR EVERY
NEED, TRAVELS HUNDREDS
OF MILES AT OUR
FINGER-TIP SWITCH...
ALL IN THE FRACTION
OF A SECOND!



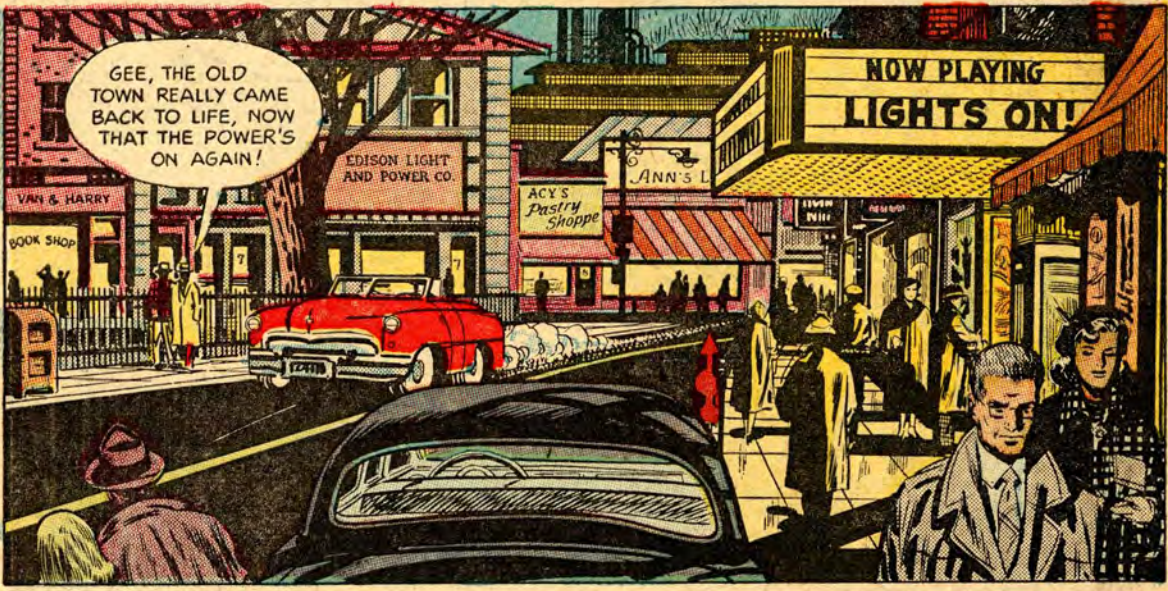


AND THE REPAIR CREW IS ALMOST AS FAST... WHY, I'LL BET THE LINES ARE ALREADY BACK IN OPERATION EVERYWHERE!

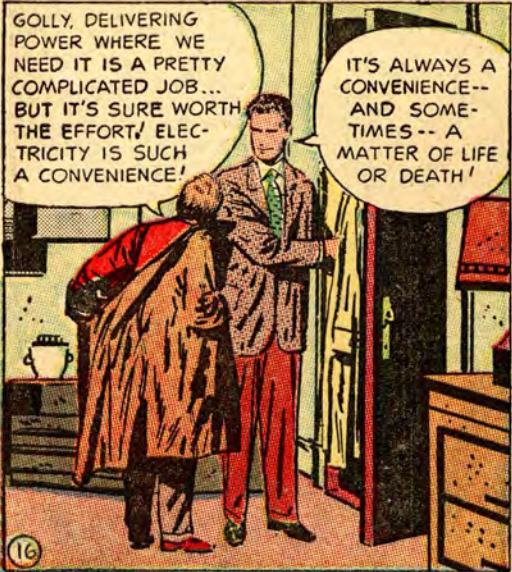


YES, WHEREVER THE VIOLENCE OF THE STORM WAS FELT, EMERGENCY REPAIR SQUADS HAVE RUSHED IN...

THIS BREAK IS FIXED... WHERE DO WE GO NEXT?



GEE, THE OLD TOWN REALLY CAME BACK TO LIFE, NOW THAT THE POWER'S ON AGAIN!



GOLLY, DELIVERING POWER WHERE WE NEED IT IS A PRETTY COMPLICATED JOB... BUT IT'S SURE WORTH THE EFFORT! ELECTRICITY IS SUCH A CONVENIENCE!

IT'S ALWAYS A CONVENIENCE-- AND SOME-TIMES-- A MATTER OF LIFE OR DEATH!



YES, I LEARNED THAT TODAY... BUT EVEN MORE IMPORTANT, I LEARNED THAT WE DON'T REALLY APPRECIATE WHAT WE HAVE UNTIL WE HAVE TO DO WITHOUT IT FOR A LITTLE WHILE!

H1997.2323A6
NoH. 889-1044.2E