ARKANSAS-MISSOURI POWER CORPORATION *v.* POWELL.

4-5886 139 S. W. 2d 383

Opinion delivered April 8, 1940.

1. APPEAL AND ERROR—VERDICT BASED ON SPECULATION—ABSENCE OF SUBSTANTIAL EVIDENCE.—Where plaintiff was awarded damages on the theory that defendant power company was negligent in permitting 2,300 volts of electricity to enter a building wired for 110-220 volts, and physical facts, mathematical calculations from known bases, and recognized laws of science refute deductions predicated upon speculation, the judgment will be reversed.
2. EVIDENCE—RES IPSA LOQUITUR.—When there is testimony tending to show that an accident may have resulted from several causes, one of which did not involve negligence by the defendant, the doctrine of *res ipsa loquitur* does not apply.
3. EVIDENCE.—Testimony of plaintiff that he was burned when an electric circuit was completed by reason of a "ground," and passage of 2,300 volts through his body, and that in order to close the circuit a spark traversed or "jumped" two-tenths of an inch in an open switch, the fact that 4,260 volts are required to create the arc renders plaintiff's testimony speculative as being in conflict with known factors.
4. APPEAL AND ERROR—BINDING EFFECT OF EVIDENCE—JURY'S VERDICT —SPECULATIVE ELEMENTS.—"To accept appellee's theory of a leaky transformer, an open switch, the green cypress sill, his position as a human conduit through which 2,300 volts of electricity passed, his so-called 'test' with an untested meter which was immediately discarded, his asserted knowledge that more than 750 volts of deadly electricity were uncontrolled within the community hut, and that he calmly and silently walked away without revealing the danger—these physical transactions, acts of behavior, and speculative conclusions are contrary to human experiences, recognized laws of science, and applied mathematics. Hence, the evidence is not substantial."

Appeal from Randolph Circuit Court; *John L. Bledsoe*, Judge; reversed.

C. M. Buck, H. L. Ponder and *H. L. Ponder, Jr.*, for appellant.

W. A. Jackson and *Richardson & Richardson*, for appellee.

GRIFFIN SMITH, C. J. The question for determination is whether there was substantial evidence to support the jury's finding that the power corporation was negligent when it installed a transformer, or in failure there-

after to inspect. Appellee's hands and "possibly" his feet were burned from an electric contact. His testimony was that only a breakdown in the transformer could account for the result. The rule of *res ipsa loquitur* is sought to be invoked.

Appellee had been working on a community hut at Pocahontas. It was constructed as a Works Progress Administration project. He was foreman in charge of electrical work during February and March, 1937. The injury occurred on Monday, March 22.

Appellant supplies electricity for power, lighting, heating, and other purposes at Pocahontas, and prior to March 22 had been requested to install the outside equipment and to make necessary connections preparatory to serving the hut. Inferentially the testimony is in conflict as to whether an old transformer or a new one was installed. One of appellee's witnesses was questioned about it. He did not know what a transformer was and inquired if the attorney had reference to "that big black thing." He then replied that it had been in place during the time he had worked: "They had a fair out there and the old pole had been there and what you call that thing up there—that was there all of the time. It was dirty and black looking. A new one would be black, I guess, until the dust or rust colored it like that."

Another witness testified that the transformer was hung on a pole and "looked old."

Appellant's defense is three-fold: (1) It did not connect outside wires with the switch panel; (2) the transformer was of standard make, factory-tested, and new; (3) when the transformer came from the manufacturer in August, 1936, it was inspected by one of appellant's electricians, and tested.

It is agreed that primary wires leading from the power source to the transformer carried 2,300 volts.

Appellee says he noticed the transformer and meter were in place when he reported for duty March 22. He

went into the hut and got a wire, the opposite end of which was connected with the switch panel on the main stage in the auditorium. The panel carried one large switch and twelve smaller ones. The main switch, when thrown, disconnected the switch panel from leads to the transformer. The smaller switches provided means for breaking the circuit between the house load and the bus bar leading from the main switch.

Appellee testified he first made an inspection and determined that the small switch with which he was concerned (across which 110 volts of electricity would normally be impressed when installation had been completed) was "open"—that is, its position was such that had the wire with which appellee was working been connected with a light socket the circuit would have remained incomplete, thus assuring safety in handling the wire.

Although appellee repeatedly mentions "the wire," or "wires," there is the explanation that two insulated wires were contained in a flexible metal cable, or conduit.

In going to the attic appellee's grasp of the conduit or "wire" was two or three feet from the end. He had gone about forty feet "when the current struck." There is this testimony: "It doubled me up. I couldn't move or turn it loose. I called for the men down stairs to cut the main switch. Three wires ran into the building from the transformer and on to the main switch. Two were 'hot' and one was neutral. I had the 'hot' wire up there and it was connected on *this* side of the switch box, but the switch that turned the electricity on the wire I had hold of was turned off, and the electricity that came in on these wires from the transformer 'arced' the small switch on the wires I was installing."

Another switch connected wiring in the basement, but its relation to the controversy is material only in considering testimony on behalf of appellant to the effect that the trouble originated on this circuit where porcelain in a light receptacle was broken. In consequence, it was contended, the wire entering the receptacle

was in contact with the "box" to which the receptacle was fastened. The "box," in turn, was tied to the "BX" cable that ran upstairs to the panel. The "short" was occasioned by the "ground" on the cable or by one of the "hot" wires touching the "BX" cable.

Appellee says that several days after the accident he removed the small switch. It was a Frank Adams make—"one of the best made."

When asked if the current came on gradually, appellee replied: "It hit me hard and then got worse, and then apparently died down when they turned off the switch. It 'built up' at first . . . I could see my hands blaze fire all over. As far as doing anything about it, I could not. . . . It was about forty seconds or a minute before the main switch was thrown."

Appellee was helped to a car by two workmen and taken to a doctor's office: "I was terribly sick and it shook me up all over. . . . My hands were burned to the bone. You can see that part of the bone was taken out of this thumb."

Other less serious burns on the hands were described.

Appellee further testified that when he took his shoes off the night of March 22 his left foot was burned where shoe tacks came through. When asked how this occurred, he replied: "The joist I was standing on was green cypress, and moisture in the timber caused some 'ground'—It caused the current to go through my entire system. It made contact with my hands and out through my feet. . . . Insulation on the wire and cable I had in my hand was burned—fused together. The wire was built to withstand 600 volts of electricity without injury to insulation."

"Q. Do you know what condition the wiring in the basement was in? A. That is one of the things I had the men to do—tear it out. It was fused together. It would take 1,000 volts to break it down. The W. P. A. supervisor and I made a meter test to determine what voltage was on the wire. The meter we used registered

up to 750 volts and burned up. We threw the meter away and one of the men took it home for his kids to play with."

It was appellee's opinion that a charge of 110 or 220 volts would not burn a person, although it might kill. Twenty-three hundred volts would prove fatal, but the voltage received by appellee was reduced, he thought, to 30 per cent. of 2,300—this because of partial insulation between point of contact and the ground.

Appellee testified that exhibit "A"—the switch—was burned: that is, the excessive voltage caused an arc, the effect of which on contact points is clearly shown. It would require 2,300 volts to induce the arc. The day was fair and windy.

Ira Lewis, maintenance man for the power corporation, testified that the transformer in question was of standard make; it was new, and was installed two weeks before March 22. Another transformer had been on the pole, but had been sent to Walnut Ridge.

In October, 1937, the transformer was taken down and opened for inspection when a former trial of this cause was being conducted. It was then sealed in the presence of two witnesses.

John Wilson identified the transformer by its number. When it was taken from the pole, witness inspected the connections and found them to be correct, with approved grounding. Excess voltage entering the transformer (or if the transformer became defective) would go to the ground instead of going into the building. There was no burn around the meter box. Burns would have been inevitable if the current had grounded; and inside the transformer there would have been burns where the current arced. There are fuses on the primary side of the transformer to protect against excess current. In view of the installation, if 2,300 volts had gone from the primary to the secondary side of the transformer the charge would have gone to the ground. The building was poorly wired. At the panel board several of the

metal cables were cut too short. The board was not grounded, as it should have been.

While testimony relating to the method of wiring the building was being heard, one of the attorneys for appellee admitted that all wiring in the building was improperly installed. This admission was withdrawn by another attorney for appellee. Photographs were introduced showing defective conditions. Appellant did not wire the building.

There was this testimony by Wilson: "Assuming that appellee dragged an armored cable across the attic, that he stepped on green cypress joists and received burns through his hands, in my opinion this could have been caused from the faulty condition of the wiring. Any time you take an armored cable and cut it across with a hack saw, sharp edges are left; and if you do not use proper bushings to protect the insulation, the sharp edges will cut into the wires. If this happens they are the same as naked wires. They are then in contact with the armor, and in a three-wire system this would give 220 volts of current. From 220 volts you can receive a very severe burn. I investigated the wiring in the basement and found a ground. This caused one of the circuit-breakers or switches on the panel board to kick off whenever it was thrown on. . . . If 2,300 volts had entered the building, I doubt very much if it would have reached the panel board. The wires leading into the building to the panel board are only built to stand 600 volts. If it had reached the panel board it would have blown the fuses out. The panel board is built to stand only 600 volts, and 2,300 volts would have broken down any part that it went into. If the plaintiff had received a charge of 2,300 volts, it would have killed him instantly—burned him up.

"I examined the installation of the panel board and found that the main switch was bottom-side-up. In other words, it showed that it was on when actually it was off, and showed that it was turned off when actually it was turned on."

On cross-examination the witness said: "In this type of transformer there are two coils to step the voltage down, and these are protected by oil, which is a kind of insulation. If the transformer were filled with water it would more than likely burn up. Electricity is a thing that nobody can exactly define, but you can see what it has done and then you can tell why. . . . The transformer I took down was properly installed. It was working properly and at the time we took it down there was a current of 112 volts coming through it and going into the building. If 2,300 volts ever passed through the transformer we could not have found it working properly as we did on that day. It would have burned the insulation and gone to the ground."

There was other testimony to the effect that the transformer was in good condition.

Terry Bott, an electrician with nineteen years of experience, testified: "Assuming that no more than the correct voltage of 110-220 went into the building, the plaintiff could have been injured in the way he says he was."

Another witness testified that the transformer remained in use at the community hut from March until shortly before October; that it was not repaired in any way, and that it functioned properly.

In *Oklahoma Gas & Electric Company* v. *Frisbie,* 195 Ark. 210, 111 S. W. 2d 550, recovery was denied under the *res ipsa loquitur* doctrine where appellee's intestate was killed while working under a building. He came into contact with electricity of sufficient voltage and amperage to produce death within a very short period of time. As in the case at bar, the primary wires leading to the transformer through which electricity was supplied to the house under which Frisbie was working carried 2,300 volts. Frisbie was lying on his back on wet or moist ground and accidentally made contact with exposed wires while attempting to use a screwdriver. The tool was burned, and there was testimony that not less that 1,000 volts would have been required to produce the fused condition.

The defendant showed that other residences and the administration building of the public school system were served from the transformer and there was no interruption of service.

In the instant case it is shown that the "Y." hut continued on the transformer; that there were no repairs, and that the voltage when tested shortly after the accident was 112.

In the Frisbie Case, Herzog's Medical Jurisprudence is quoted as asserting that from 55 to 110 volts alternating current have frequently produced death, and may be regarded as dangerous.

While appellee says he made a volt test of the wiring where he was injured, he did not warn anyone of the dangerous condition, but was content to walk away and leave exposed and undisclosed a veritable death-trap. The obvious purpose of this testimony was to fortify his assertion that 2,300 volts passed through the transformer at the time he was injured, and that the same condition existed thereafter.

It must be remembered that appellee's theory of the accident placed him in position where his body completed the circuit; and, except for the physical resistance thus interposed, the full charge of electricity alleged to have penetrated the transformer passed through him. The force was sufficient to "arc" the open switch and to leave fused evidence of what occurred.

It becomes necessary, therefore, to consider the switch. Unfortunately, no test was made to determine what voltage would be required to force the current across the break between electrodes; that is, to produce an arc and complete the circuit when the switch was open. But, by actual measurement the opening is slightly more than two-tenths of an inch.

"Dielectric" is the term denoting nonconducting material, so called because the lines of force of an electrostatic field will pass through it, thereby making it the seat of the strain.

The Standard Handbook for Electrical Engineers, published by McGrow-Hill Book Company, Inc. (6th ed.) § 4, par. 461, defines dielectric strength as "the ultimate strength of insulation at breakdown. It is usually expressed in terms of the voltage gradient, as volts per mill, k. v. per c. m., etc. . . . It is a property which varies with many factors, such as thickness of the specimen, size and shape of electrodes used in applying stress, form or distribution of the field of the electric stress in the material, frequency of the applied voltage, rate and duration of voltage application, fatigue with repeated voltage applications, temperature, moisture content, and possible chemical change under stress."

The authority, after making other technical observations, discusses needle-gap spark-over voltage in air, and shows tabulations from which results may be mathematically ascertained under stated conditions. *Ib.* § 4, par. 776-780.

Appellee says, in respect of the weather, "It was a fair and windy day." We may assume, therefore, that a condition abnormally unfavorable to appellee's theory of the arced switch—excess humidity—did not exist. Resolving all factors in appellee's favor, and basing conclusions upon known factors and tabulations shown in the Handbook, 10,000 volts are required to arc over a space of 1.19 centimeters, or approximately 21,300 volts to traverse a space of one inch. Thus, assuming in appellee's favor that the opposing electrodes or points were needle-shaped and that they were two-tenths of an inch apart, the arc would have occurred at 4,260 volts. As a practical matter the switch contacts do not resemble needle points, and a much greater potential, or voltage, would have been necessary to produce the alleged flash-over.

It is a matter of record that 2,300 volts are applied at Tucker Death House in electrocuting condemned persons. This produces a current of from six to ten amperes.

The switch through which a current of 2,300 volts is claimed to have passed when the arc occurred has

been examined by the court and necessary measurements have been made. To accept appellee's theory of a leaky transformer, an open switch, the green cypress sill, his position as a human conduit through which the leak from 2,300 volts of electricity passed, his so-called "test" with an untested meter which was immediately discarded, his asserted knowledge that more than 750 volts of deadly electricity were uncontrolled within the community hut, and that he calmly and silently walked away without revealing the danger—these physical transactions, acts of behavior, and speculative conclusions are contrary to human experiences, recognized laws of science, and applied mathematics. Hence, the evidence is not substantial.

The jury could not have arrived at its verdict without engaging in speculation. The judgment must be reversed, and the cause dismissed. It is so ordered.

Mr. Justice HUMPHREYS and Mr. Justice MEHAFFY dissent.