CLASSICS TO GO

AMAZING STORIES

VOLUME 70

POUL ANDERSON

Amazing Stories

Volume 70

Poul Anderson

Content

Snowball

Simon's new source of power promised a new era for Mankind. But what happens to world economy when* any*one can manufacture it in the kitchen oven?... Here's* one *answer!

It did not come out of some government laboratory employing a thousand bright young technicians whose lives had been checked back to the crib; it was the work of one man and one woman. This is not the reversal of history you might think, for the truth is that all the really basic advances have been made by one or a few men, from the first to steal fire out of a volcano to $E=mc^2$. Later, the bright young technicians get hold of it, and we have transoceanic airplanes and nuclear bombs; but the idea is always born in loneliness.

Simon Arch was thirty-two years old. He came from upstate Massachusetts, the son of a small-town doctor, and his childhood and adolescence were normal enough aside from tinkering with mathematics and explosive mixtures. In spite of shyness and an overly large vocabulary, he was popular, especially since he was a good basketball player. After high school, he spent a couple of tedious years in the tail-end of World War II clerking for the Army, somehow never getting overseas; weak eyes may have had something to do with that. In his spare time he read a great deal, and after the war he entered M.I.T. with a major in physics. Everybody and his dog was studying physics then, but Arch was better than

average, and went on through a series of graduate assistantships to a Ph.D. He married one of his students and patented an electronic valve. Its value was limited to certain special applications, but the royalties provided a small independent income and he realized his ambition: to work for himself.

He and Elizabeth built a house in Westfield, which lies some fifty miles north of Boston and has a small college—otherwise it is only a shopping center for the local farmers. The house had a walled garden and a separate laboratory building. Equipment for the lab was expensive enough to make the Arches postpone children; indeed, after its requirements were met, they had little enough to live on, but they made sarcastic remarks about the installment-buying rat race and kept out of it. Besides, they had hopes for their latest project: there might be real money in that.

Colin Culquhoun, professor of physics at Westfield, was Arch's closest friend—a huge, red-haired, boisterous man with radical opinions on politics which were always good for an argument. Arch, tall and slim and dark, with horn-rimmed glasses over black eyes and a boyishly smooth face, labelled himself a reactionary.

"Dielectrics, eh?" rumbled Culquhoun one sunny May afternoon. "So that's your latest kick, laddie. What about it?"

"I have some ideas on the theory of dielectric polarization," said Arch. "It's still not too well understood, you know."

"Yeh?" Culquhoun turned as Elizabeth brought in a tray of dewed glasses. "Thank'ee kindly." One hairy hand engulfed a goblet and he drank noisily. "Ahhhh! Your taste in beer is as good as your taste in politics is moldy. Go on."

Arch looked at the floor. "Maybe I shouldn't," he said, feeling his old nervousness rise within him. "You see, I'm operating purely on a hunch. I've got the math pretty well whipped into

shape, but it all rests on an unproven postulate about the nature of the electric field. I've tried to fit it in with both relativity and quantum mechanics and—well, like I said, it's all just a notion of mine which demands experimental proof before I can even think about publishing."

"What sort of proof?"

"It's this way. By far the best dielectric found to date is a mixture of barium and strontium titanates. Under optimum conditions, the dielectric constant goes up to 11,600, though the loss rate is still pretty high. There's a partial explanation for this on the basis of crystal theory, the dipole moment increases under an electric field.... Well, you know all that. My notion involves an assumption about the nature of the crystalline ionic bond; I threw in a correction for relativistic and quantum effects which *looks* kosher but really hasn't much evidence to back it up. So—uh—"

Elizabeth sat down and crossed trim legs. She was a tall and rather spectacular blonde, her features so regular as to look almost cold till you got to know her. "Our idea suggests it should be possible to fit a crystalline system into an organic grid in such a way that a material can be made with just about any desired values of dielectricity and resistivity," she said. "Constants up in the millions if you want. Physically and chemically stable. The problem is to find the conditions which will produce such an unorthodox linkage. We've been cooking batches of stuff for weeks now."

Culquhoun lifted shaggy brows. "Any luck?"

"Not so far," she laughed. "All we've gotten is smelly, sticky messes. The structure we're after just doesn't want to form. We're trying different catalysts now, but it's mostly cut and try; neither of us is enough of a chemist to predict what'll work."

"Come along and see," offered Arch.

They went through the garden and into the long one-room building beyond. Culquhoun looked at the instruments with a certain wistfulness; he had trouble getting money to keep up any kind of lab. But the heart of the place was merely a second-hand gas stove, converted by haywiring into an air-tight, closely regulated oven. It was hot in the room. Elizabeth pointed to a stack of molds covered with a pitchy tar. "Our failures," she said. "Maybe we could patent the formula for glue. It certainly sticks tightly enough."

Arch checked the gauges. "Got a while to go yet," he said. "The catalyst this time is powdered ferric oxide—plain rust to you. The materials include aluminum oxide, synthetic rubber, and some barium and titanium compounds. I must admit that part of it is cheap."

They wandered back toward the house. "What'll you do with the material if it does come out?" asked Culquhoun.

"Oh—it'd make damn good condensers," said Arch. "Insulation, too. There ought to be a lot of money in it. Really, though, the theory interests me more. Care to see it?"

Culquhoun nodded, and Arch pawed through the papers on his desk. The top was littered with his stamp collection, but an unerring instinct seemed to guide his hand to the desired papers. He handed over an untidy manuscript consisting chiefly of mathematical symbols. "But don't bother with it now," he said. "I blew us to a new Bach the other day—St. Matthew Passion."

Culquhoun's eyes lit up, and for a while the house was filled with a serene strength which this century had forgotten. "Mon, mon," whispered the professor at last. "What he could have done with the bagpipes!"

"Barbarian," said Elizabeth.

As it happened, that one test batch was successful. Arch took a slab of darkly shining material from the lab oven and

sawed it up for tests. It met them all. Heat and cold had little effect, even on the electric properties. Ordinary chemicals did not react. The dielectric constant was over a million, and the charge was held without appreciable leakage.

"Why doesn't it arc over?" wondered Elizabeth.

"Electric field's entirely inside the slab," said Arch absently. "You need a solid conductor, like a wire, between the poles to discharge it. The breakdown voltage is so high that you might as well forget about it." He lifted a piece about ten inches square and two inches thick. "You could charge this hunk up with enough juice to run our house for a couple of years, I imagine; of course, it'd be D.C., so you'd have to drain it through a small A.C. generator. The material itself costs, oh, I'd guess fifty cents, a dollar maybe if you include labor." He hesitated. "You know, it occurs to me we've just killed the wet-cell battery."

"Good riddance," said Elizabeth. "The first thing you do, my boy, is make a replacement for that so-called battery in our car. I'm tired of having the clunk die in the middle of traffic."

"Okay," said Arch mildly. "Then we see about patents. But—honey, don't you think this deserves a small celebration of sorts?"

Arch spent a few days drawing up specifications and methods of manufacture. By giving the subject a little thought, he discovered that production could be fantastically cheap and easy. If you knew just what was needed, you had only to mix together a few chemicals obtainable in any drugstore, bake them in your oven for several hours, and saw the resulting chunk into pieces of suitable size. By adding resistances and inductances, which could be made if necessary from junkyard wire, you could bleed off the charge at any desired rate.

Culquhoun's oldest son Robert dropped over to find Arch tinkering with his rickety '48 Chevrolet. "Dad says you've got a new kind of battery," he remarked.

"Uh.... Yes. I'll make him one if he wants. All we'll need to charge it is a rectifier and a volt-meter. Need a regulator for the discharge, of course." Arch lifted out his old battery and laid it on the grass.

"I've got a better idea, sir," said the boy. "I'd like to buy a *big* piece of the stuff from you."

"Whatever for?" asked Arch.

"Run my hot rod off it," said Bob from the lofty eminence of sixteen years. "Shouldn't be too hard, should it? Rip out the engine; use the big condenser to turn a D.C. motor—it'd be a lot cheaper than gas, and no plugged fuel lines either."

"You know," said Arch, "I never thought of that."

He lifted the ridiculously small object which was his new current source and placed it inside the hood. He had had to add two pieces of strap iron to hold it in position. "Why a regular motor?" he mused. "If you have D.C. coming out at a controlled rate, you could use it to turn your main drive shaft by a very simple and cheap arrangement."

"Oh, sure," said Robert scornfully. "That's what I meant. Any backyard mechanic could fix that up—if he didn't electrocute himself first. But how about it, Dr. Arch? How much would you want for a piece like that?"

"I haven't the time," said the physicist. "Tell you what, though, I'll give you a copy of the specs and you can make your own. There's nothing to it, if your mother will let you have the oven for a day. Cost you maybe five dollars for materials."

"Sell it for twenty-five," said Bob dreamily. "Look, Dr. Arch, would you like to go into business with me? I'll pay you

whatever royalty seems right."

"I'm going to Boston with just that in mind," said Arch, fumbling with the cables. "However, go ahead. Consider yourself a licensee. I want ten percent of the selling price, and I'll trust a Scotch Yankee like you to make me a million."

He had no business sense. It would have saved him much grief if he had.

The countryside looked clean, full of hope and springtime. Now and then a chrome-plated monster of an automobile whipped past Arch's sedately chugging antique. He observed them with a certain contempt, an engineer's eye for the Goldbergian inefficiency of a mechanism which turned this rod to push that cam to rotate such and such a gear, and needed a cooling system to throw away most of the energy generated. Bob Culquhoun, he reflected, had a saner outlook. Not only was electricity cheaper in the first place, but the wasted power would be minimal and the "prime mover"—the capacitor itself—simply would not wear out.

Automobiles could be sold for perhaps five hundred dollars and built to last, not to run up repair bills till the owner was driven to buying a new model. The world's waning resources of petroleum could go into something useful: generating power at central stations, forming a base for organic syntheses; they would stretch out for centuries more. Coal could really come back into its own.

Hm ... wait. There was no reason why you couldn't power every type of vehicle with capacitors. Aircraft could stay aloft a month at a time if desired—a year if nothing wore out; ships could be five years at sea. You wouldn't need those thousands of miles of power line littering the countryside and wasting the energy they carried; you could charge small capacitors for home use right at the station and deliver them to the consumer's doorstep at a fraction of the present cost.

Come to think of it, there was a lot of remote power, in waterfalls for instance, unused now because the distance over which lines would have to be strung was too great. Not any longer! And the sunlight pouring from this cloudless sky—to dilute to run a machine of any size. But you could focus a lot of it on a generator whose output voltage was jacked up, and charge capacitors with thousands of kilowatt-hours each. Generators everywhere could be made a lot smaller, because they wouldn't have to handle peak loads but only meet average demand.

This thing is bigger than I realized, he thought with a tingle of excitement. *My God, in a year I may be a millionaire!*

He got into Boston, only losing his way twice, which is a good record for anyone, and found the office of Addison, his patent attorney. It didn't take him long to be admitted.

The dusty little man riffled through the pages. "It looks all right," he said unemotionally. Nothing ever seemed to excite him. "For a change, this seems to be something which can be patented, even under our ridiculous laws. Not the law of nature you've discovered, of course, but the process—" He peered up, sharply. "Is there any alternative process?"

"Not that I know of," said Arch. "On the basis of theory, I'm inclined to doubt it."

"Very well, very well. I'll see about putting it through. Hm—you say it's quite simple and cheap? Better keep your mouth shut for a while, till the application has been approved. Otherwise everybody will start making it, and you'll have a devil of a time collecting your royalties. A patent is only a license to sue, you know, and you can't sue fifty million bathtub chemists."

"Oh," said Arch, taken aback. "I—well, I've told some of my neighbors, of course. One of the local teen-agers is going to make a car powered by—"

Addison groaned. "You would! Can't you shoot the boy?"

"I don't want to. For a person his age, he's quite inoffensive."

"Oh, well, you didn't want a hundred million dollars anyway, did you? I'll try to rush this for you, that may help."

Arch went out again, some of the elation taken from him. But what the hell, he reflected. If he could collect on only one percent of all the capacitite which was going to be manufactured, he'd still have an unreasonable amount of money. And he wanted to publish as soon as possible in all events: he had the normal human desire for prestige.

He got a hamburger and coffee at a diner and went home. Nothing happened for a month except an interview in the local paper. Bob finished his hot rod and drove it all over town. The boy was a little disappointed at the quietness of the machine, but the interest it attracted was compensation. He began to build another: twenty-five dollars for an old chassis, another twenty-five or so for materials, tack on a hundred for labor and profits—the clunk might not look like much, but it would run for a year without fuel worries and would never need much repair or replacement. He also discovered, more or less clandestinely, that such a car would go up to 200 miles an hour on the straightaway. After selling it, he realized he could command a much bigger price, and set happily to work on another.

The physics journal to which Arch sent his manuscript was interested enough to rush printing. Between the time he submitted it and the time it came out some five weeks later, he found himself in lively correspondence with the editor.

"College will soon be letting out all over the country," said Elizabeth. "Stand by to repel boarders!"

"Mmmm ... yes, I suppose so." Arch added up the cost of entertaining a rush of colleagues, but his worry was only a flicker across a somewhat bashful glow of pride. After all—he

had done a big thing. His polarization theory cut a deep swath into what mystery remained about the atom. There might even be a Nobel Prize in it.

It was on the day of publication that his phone rang. He looked up from his stamps, swore, and lifted it. "Hello?"

"Dr. Arch?" The voice was smooth and cultivated, just a trace of upper-class New York accent. "How do you do, sir. My name is Gilmer, Linton Gilmer, and I represent several important corporations in the electricity field." He named them, and Arch barely suppressed a whistle. "Dr. Bowyer of the *Journal* staff mentioned your work to one of his friends in an industrial research lab. He was quite excited, and you can understand that we are too. I believe I have some good news for you, if I may come to see you."

"Eh—oh. Oh, sure!" Visions whirled across Arch's eyes. Money! It represented a hi-fi set, a three-penny black, an automatic dishwasher, a reliable car, a new oscilloscope, a son and heir. "Come on up, b-by all means—Yes, right away if you like—Okay, I—I'll be seeing you—" He set the receiver down with a shaking hand and bawled: "Betty! Company coming!"

"Oh, damn!" said his wife, sticking a grease-smudged face in the door. She had been tinkering with the lab oven. "And the house in such a mess! So am I, for that matter. Hold the fort when he comes, darling." She still didn't know who "he" was, but whirled off in a cloud of profanity.

Arch thought about putting on a decent suit and decided to hell with it. Let them come to him and accept him as he was; he had the whip hand, for once in his life. He contented himself with setting out beer and clearing the littered coffee table.

Linton Gilmer was a big man, with a smooth well-massaged face, wavy gray hair, and large soft hands. His presence

seemed to fill the room, hardly leaving space for anyone else.

"Very pleased to meet you, Dr. Arch ... brilliant achievement.... We borrowed proof sheets from the *Journal* and made tests for ourselves, of course. I'm sure you don't mind. Thank you." He seemed just a trifle shocked at being offered beer rather than Johnny Walker Black at four o'clock in the afternoon, but accepted gracefully. Arch felt excessively gauche.

"What did you want to s-see me about?" asked the physicist.

"Oh, well, sir, let's get acquainted first," said Gilmer heartily. "No rush. No hurry. I envy you scientific fellows. The unending quest, thrill of discovery, yes, science was my first love, but I'm afraid I sort of got steered off into the business administration end. I know you scientists don't think much of us poor fellows behind the desks, you should hear how our boys gripe when we set the appropriations for their projects, but somebody has to do that, ha." Gilmer made a bridge of plump fingers. "I do think, though, Dr. Arch, that this hostility is coming to an end. We're both part of the team, you know; scientist and businessman both work inside our free enterprise system to serve the American public. And more and more scientists are coming to recognize this."

Arch shifted uneasily in his chair. He couldn't think of any response. But it was simple to converse with Gilmer: you just sat back, let him flow, and mumbled in the pauses.

Some data began to emerge: "—we didn't want to trouble you with a dozen visitors, so it was agreed that I would represent the combine to, ah, sound you out, if I may so phrase it."

Arch felt the stir of resentment which patronizing affability always evoked in him. He tried to be courteous: "Excuse me, but isn't that sort of thing against the anti-trust laws?"

"Oh, no!" Gilmer laughed. "Quite the opposite, I assure you. If one company tried to corner this product, or if all of them went together to drive the price up, that would be illegal, of course. But we all believe in healthy competition, and only want information at the moment. Negotiations can come later."

"Okay," said Arch. "I suppose you know I've already applied for a patent."

"Oh, yes, of course. Very shrewd of you. I like to deal with a good businessman. I think you're more broadminded than some of your colleagues, and can better understand the idea of teamwork between business and science." Gilmer looked out the French doors to the building in the rear. "Is that your laboratory? I admire a man who can struggle against odds. You have faith, and deserve to be rewarded for it. How would you like to work with some real money behind you?"

Arch paused. "You mean, take a job on somebody's staff?"

"Not as a lab flunky," said Gilmer quickly. "You'd have a free hand. American business recognizes ability. You'd plan your own projects, and head them yourself. My own company is prepared to offer you twenty thousand a year to start."

Arch sat without moving.

"After taxes," said Gilmer.

"How about this—capacitite, I call it?"

"Naturally, development and marketing would be in the hands of the company, or of several companies," said Gilmer. "You wouldn't want to waste your time on account books. You'd get proper payment for the assignment, of course—"

Elizabeth entered, looking stunning. Gilmer rose with elaborate courtesy, and the discussion veered to trivialities for awhile.