

WHAT ELECTRICAL SCIENCE OFFERS AS A LIFE WORK

Dr. W. R. Whitney of the General Electric Company Discusses the Possibilities of His Profession as a Career and the Opportunities It Offers the Young

BY CHARLES DUKE.

NOT long ago a magazine in this country selected by popular vote the Seven Wonders of the Modern World. They were to be the ultimate in modern human achievement. When the votes were counted it was found the palms had been awarded the wireless, the telephone, the airplane, radium, antiseptics, antitoxins, spectrum analysis and the X-ray.

Can there be anything more remarkable? Will the world achieve still greater and more useful inventions?

Today a business man in New York may talk with his partner in San Francisco as easily and as clearly as though he were in the next room. Ships of the world are in communication with each other by means of the wireless telephone, and ships in turn are guided by wireless, no crew aboard, no helmsman, no engineer in the pit. Sound is propelled completely around the world on the wireless wings of ether in one-seventh of a second. Merely above the clouds on linen wings and steel supports. They travel under the sea as Jules Verne dreamed they would do. They fly over the land in mile-a-minute all-steel "safety-first" trains or roam at will over hill and dale in house-carriages. They train the X-ray on an object through which the eye cannot see and the camera records for them what the object contains. They utilize the priceless radium in combating once incurable disease. In their gayer moments they sit back in their homes and hear the golden voices of the world's renowned singers, or go around the corner and behold the moving panorama of the world on the motion picture screen.

What next? Only the other day a passenger standing at the rail of an ocean liner bound for Europe as it wended its way through the New York narrows was startled to hear the voice of one of his business associates hurried from the roof of a Gotham skyscraper with so much force as to be heard miles away without the use of a listening device other than the human ear? No sooner had the lay world stopped gasping at this achievement before it turned to read that Thomas A. Edison was at work on a delicate apparatus which he has designed to effect indisputable communication between those whom death has removed from this earth and those who yet live!

How much further may we expect to go? Have we reached the ultimate? Read the answer of Dr. W. R. Whitney, director of research laboratories of the General Electric Company, Schenectady, N. Y. Dr. Whitney for years has been devoting his life to scientific research and he is one of those who think there are still more worlds to conquer, despite all that has gone before. As he put it to me in a recent interview, granted in the heart of his laboratories in the Mohawk valley, "the unfulfilled promises in nature's books are greater than ever."

The writer had gone to him to discuss electricity as a career for young men and women. Was it true that modern scientists had "cleaned up" everything worth while in sight? What more was there for the young experimenter to do? Wireless, fuelless, horseless—how many more "lesses" could be arrived at? It was along this line we approached the subject of an electrical career for an ambitious student.

"The regularity with which we conclude that further advances in a particular field are impossible," said Dr. Whitney, "seems equalled only by the regularity with which events prove that we are of too limited vision. Man seems to be the supremely mentally elastic organism. He develops by trying novelties and by taking new paths. No one knows to what extent he may develop; but every one knows that through acquisition of knowledge or, let me say, production of it, he may transcend any physical limits. This will not come about by continuous repetition of what we have already learned. Monkeys and parrots do as much. It will come through the continual and active appreciation of new knowledge."

"We lived in a period when the extent and rate of increase in our mental horizon is maximum, when happiness has its grandest possibilities and when human toil everywhere is being displaced and amplified by better latent energies. Never before was the individual and collective reward for new constructive effort so equitable. We are served by coal, oil, gas and water, with their countless accessories, better than ever before. Within a young man's lifetime we mined more iron, copper, coal and other ores, produced more gasoline, gas and kerosene and put into use more of materials like cement and rubber than were produced by all the former inhabitants of the globe. And still the unfulfilled promises in nature's books are greater than ever."

"What promises are yet to be fulfilled?" was my query.

"Who knows?" he exclaimed, Cicero-fashion. "Who can tell the limits of the mind when it is scientifically applied to matter? No one can answer. It is not humanly possible."

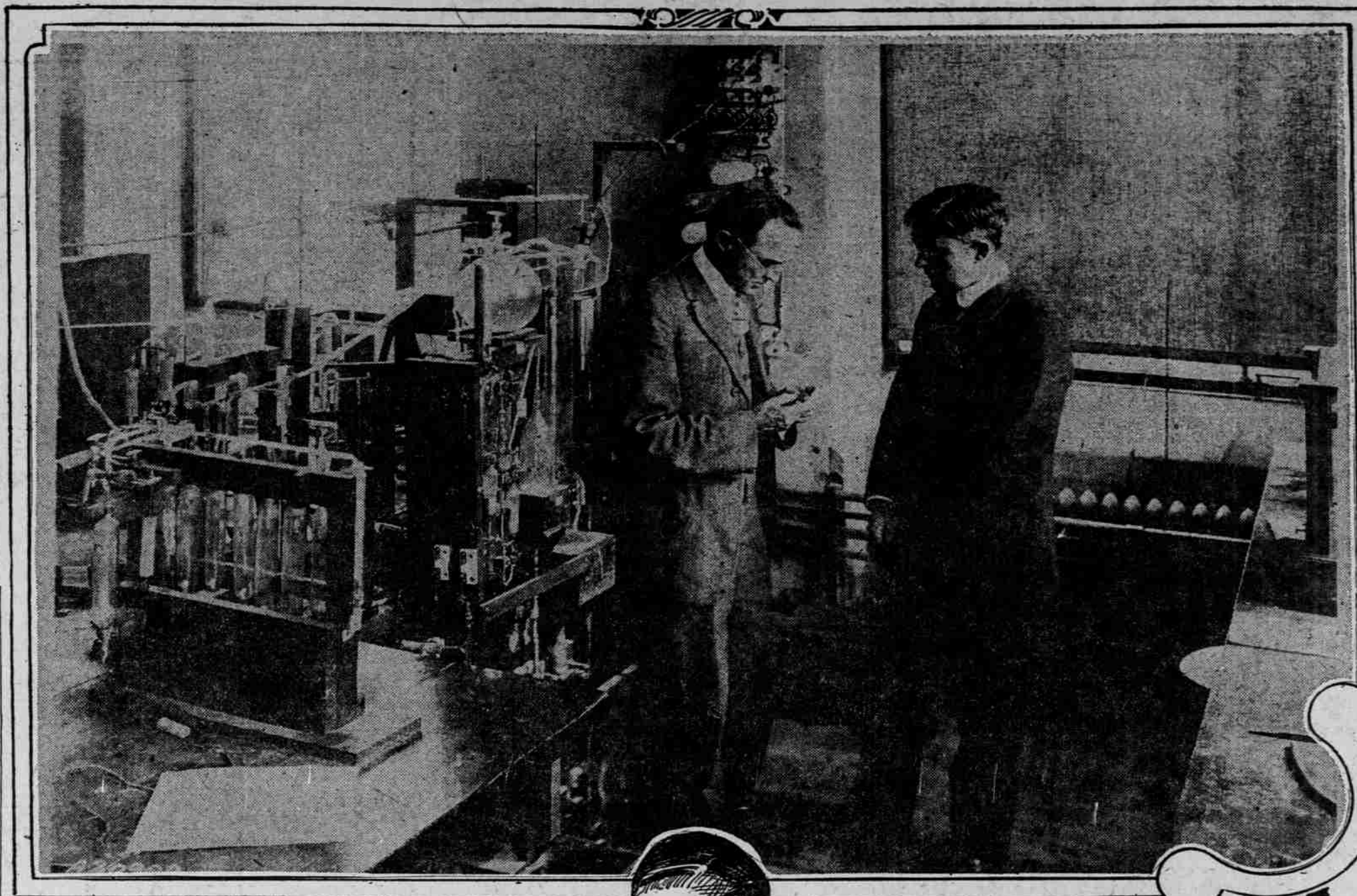
"How shall we progress into the state of newer and greater marvels?"

"By studying something new. In the advance of civilization it is new knowledge which paves the way and the pavement is eternal. While the physical structures of man are decaying the facts he has learned are ever going new service. Antitoxins will be increasing when locomotives are forgotten. Magnetic induction will work after the pyramids have blown away. We ought to see that everything distinguishing our lives from those of the Indians has come from studying something new."

"And to advance accomplishments along these lines?"

"Experimentation and more experimentation, to be sure. The great inventions of recent years were not the results of attempts to accomplish what was really attained. They were the results achieved by highly trained investigators, who followed a lead opened by an observation too insignificant to attract the attention of less trained men."

"It was a professor at Louvain who apparently started us in the use of



"Take the schoolboy back of the scenes and show him the romance of modern research," is the admonition of Dr. Whitney. If a boy actually experiments on crossing a rubber plant with a California redwood tree he may delve deeper into science than merely by being "stuffed" with book knowledge in a classroom. Dr. Whitney is here shown at work in his laboratory. He is the figure to the left. With him is Dr. Irving Langmuir, one of the assistant research directors of the company.

illuminating gas," said Dr. Whitney. "He became interested in the distillation of coal. He was not aiming to illuminate houses and his first uses gave no premonition of our present conditions. He was trying such gases in balloons, but he also tried lighting his room by this means. The engineering development of this particular discovery did not take place for ten or more years, but it was the in-

quisitive mind of the trained physicist and chemist which made the engineering possible."

Thus, many of the world's most useful modern marvels have come to pass through the efforts of geniuses of the long ago who were simply groping for general knowledge through investigation and experimentation.

"And how best are we to train our

young people for this advanced investigation—for modern research work, as the world knows it?" I asked.

The question touched on a matter close to the mind and heart of Dr. Whitney. Instead of sending boys off

to schools with bundles of books to make of their mind "a storage house for facts," he would have them share the inspiration of actual engineering work in the research laboratory of the work shop, just as in Schenectady

they take the boys from Union College right into the big electrical shops. "Give the boy teachers who are themselves investigators," he said. "Men who are not content to give their pupils merely the results of the

Talks With T. Roosevelt as Recorded in the Diaries of John J. Leary Jr.

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old man who walked with a cane. "General," he exclaimed, "this is all might good of you to come and see me! I wanted to have a talk with you. I was going to call at your home. May I call there, or will I see you at the hotel? Which is the more convenient to you?"

"I am surprised you remember me," said the old man. "It is many years since you have seen me. I will see you at the hotel."

"Come right up now. Yes, indeed, come right up with me. I am glad to see you and you must come to the meeting. I want you on the platform."

The old man the colonel introduced as General Mueller.

"He lost a leg in the Union army," he told me at the hotel. "He's the kind of man that has saved the mass of Germans in this country from the infamy of some of their number would put upon all men like him and Adolf Vogel whom you just met. The general tells me that his grandsons are all in the army and all but one of Vogel's boys are there too. That one goes next month."

"Vogel" tells me they have the largest hall in town and that it's already packed with Germans. He has no doubt as to my reception. Neither have I. But I am going to talk straight at them."

He did. Among the new notes struck was a hard drive on the teaching of German in grade schools. To my surprise this was the "hit" of the speech. I mentioned this surprise to the colonel.

"That has been a big issue here," he said.

After the meeting a young man

evidently a graduate of some German university, to judge by the duelling scars on his cheeks, told me the colonel's talk was "the sort needed."

"What the Germans here have had, in private talk at least, has been abuse," he said. "Loyal men have been abused as much as those openly disloyal. This has tended to increase disloyalty. The colonel's talk will weaken the Bergers and strengthen men like Vogel. Milwaukee is all right."

"The young man is not entirely accurate," the colonel commented when I repeated his remarks. "He is quite correct on the matter of abuse. But he is wrong in saying that Milwaukee is all right. There is a big element here that is all wrong. Milwaukee today may be 60 per cent all right, 25 per cent in the shadow zone and 25 per cent dead wrong. It cannot be all right with a socialist mayor, socialist chief of police and a socialist sheriff. Remember, the socialist party which elected these men is not an American institution."

Springfield, O., like Milwaukee, is largely populated by persons of German birth or blood. In addition to Wittenberg college, which is the commonest used term is a German school, it had 13 churches in which German was the only language used and four where both German and English prevailed. The school had suffered because of its supposed German leanings and Springfield as a whole was not pleased with the reputation that it was inclined to be pro-German.

Dr. Hecker, an aggressive type of college president, more the able ad-

ministrator than the great teacher, was very anxious to overcome the feeling that had been aroused and as one way to accomplish the desired result invited the colonel to address the school. Other interests joined in the invitation.

"I have," said the colonel, speaking of his decision to accept, "no delusions as to Dr. Hecker's self-interest in inviting me to address the school. It is natural and proper on his part. But I won't tow down one bit."

"It is just the sort of place I want to speak, but I am not going to temper my remarks to please anybody. Of course they say there is no pro-Germanism in that country and that they are poor, much abused little woolly lambs. That fools nobody. They are now trying to run straight. Very well. I will help them by giving them the cleanest-cut Americanism that is in me. They have agreed to this and they will get it."

"They have also agreed to my terms as to arrangements. I will be introduced by the president, who is a Lutheran minister of German blood, and the prayer will be by a Roman Catholic priest of German birth, Father Voltman. He is a major in the regular army, an old chaplain and a monsignor in the church. He helped immensely in adjusting the Philippine church troubles."

"I propose also to say a word to them on the wisdom of the Lutheran church making English the church language in this country. Otherwise, the Lutheran church, powerful as it now is, must go the way of the Dutch Reformed church to which I have the honor to belong. Had it changed to English, it would in all

probability be one of the leading churches in New York at least. But it stuck to Dutch too long; the younger people drifted away until, too late, English was made the church language. I would very much regret a like fate for the Lutheran church. I want it to continue, as it is today, a permanent and powerful factor in American life."

Returning east, Colonel Roosevelt spoke regretfully of the changed position the German found himself in in this country.

"I was," he said, "very sorry at the changes in Milwaukee. This was my first visit there, you know, since that madman shot me. Before, when I went to Milwaukee, my German friends were a happy lot. After a meeting I would go to their club, there would be light refreshments, singing, real good-fellowship. Now all this is changed. Men like Vogel, real Americans who are doing their full duty, are saddened by the position some Germans would put all of their kind in America in. They have no doubt of the outcome of the war—they know it must end in Germany's defeat; but, naturally, they fear the reaction on the Germans in this country. Some of them in Milwaukee have behaved very badly. I do not refer to Berger and his class. I mean a higher, and supposedly more respectable, type."

"Some few of the wealthier and more influential ones have been foolish enough to start a sort of boycott. Take 'Illustrious' Spooner. Spooner had a splendid law practice, largely with Germans here. Overnight almost, I am told, it fell away. Spooner had given offense by taking a strong American position. That, of course, is rough on Spooner, but he will survive it. The very people who tried to hurt him will be glad to go back to him and ask his help

when this thing is over. They will suffer, not he."

"The German in this country has been a good citizen. He has been thrifty and hard-working as a very general rule; he has contributed to the welfare of every community in which he lived. He has been law-abiding—in a word, has met his obligations squarely. This is particularly true of the older Germans. Properly handled there would have been very little difficulty with them."

"I have absolutely no sympathy with the over-zealous patriot who would persecute everybody here with a German name. It is all wrong. Again, in Toledo, this time before we entered the war, and while the colonel was talking politics, he found that there were many Germans in his audience. As in every other place he talked with mainly preparedness emphasized, I thought, because one of the committee expressed the hope that many Germans in it would not take offense at what he might say."

"My dear fellow," said he, "they will not take offense, because I am going to talk straight Americanism to them. They will not object to that. Why, one of the most wonderful books of the war was written by a German in your town—at least he is of German blood. It is called 'Their True Allegiance.' His name is Ohlinger. I'll be obliged to you if you will have him located for me."

"Did you notice that I offended anybody in that audience?" he asked after the meeting.

"I assured him I had not."

"I did not think you would," he replied, adding:

"Oh, for a little courage and plain horse sense in the handling of this whole German question! It would make things so much easier."

(Another installment next Sunday.)

attainments of scientists of the past, but who are themselves experimenting to learn new scientific truths and who encourage their pupils to experiment.

"The boy of today, even before he is sent to college, has received Arlington wireless time and listened to Nauen on his homemade wireless set. He knows more about airplanes and automobiles than his dad. When he goes to school, if he is sufficiently talented, he makes the football squad and takes part in a system of enjoyable effort, which is a thousand times more practically organized and attractive than the rest of the curriculum. Later, or incidentally, looks forward disinterestedly to the grind, which an inflexible system has arranged, having his eyes ever on the future stopping place, a job. He usually concludes that he does not want the kind of a job that his teacher seems to fill, and frequently wonders if he would not have been better off had he stuck around the garage."

At this point Dr. Whitney offered a series of questions that quite clearly put this point in popular style.

Would the condition above recited be true if that boy could get his hands into real experimental work with a professor who was earning \$25,000 a year as a professor?

What would be his reaction if his "prof" let him help in experiments on crossing the California redwood with the rubber plant?

Might he not at least take natural interest in De Vries and the historical primrose, or Mendel and heredity in peas?

If he assisted in diluting magnesium with chromium and saw the promise of lightweight airplane metals, might not even the freshman magnesium ribbon experiment interest him?

If he co-operated in subjecting cancerous mice or tuberculous rats to gamma rays, or watched monstrosities produced from fish eggs, might he not take part in the greatest warfare of his lifetime, the fight against disease?

If he wound a coil of wire around a space in which electrons moved, and by the magnetic field produced a new deflection, might he not keep his mental trolley on longer and go further than anyone ever went before?

"Our American engineering education is always at the training table and practically never reaches the game stage," said Dr. Whitney. "We seem to have plenty of ambitious young men, plenty of schools, infinite distance to advance and countless directions, but our engineering students are seldom practiced beyond the 'shoulder arms' stage. We Americans wish to be foremost in new constructive work. But there is something holding us back at school, and this lack of something is lack of contact with interesting work and inspiring workers. Every technical school is now overcrowded with anxious students. But every technical teacher is so swamped by his need of imparting, in wholesale quantities, accumulated knowledge that he has no time to realize the tremendous strides which science is making, much less to take any active part in bringing them about. As for mature and material inquisitiveness, it is almost absent."

"Then so far as electricity as a career for young men is concerned it is not so much a matter of getting the boys into it—for they already love it—but of getting the trained investigator as a teacher."

"Just it. Few good engineers play for the gate receipts; they are led on by the will to accomplish. To the devotee, scientific research may well become a religion, but whether he sees in the infinite possibilities of matter only the necessary results of permutation among seventy-odd decaying elements, or the hand of an all-wise Creator ever uncovering new principles to hopeful investigators, he cannot be blind to the blessings of new truth. This is not produced to order. Conventions do not establish it. It comes only with following with interest nature's devious and unexpected ways, studying irrelevant phenomena, learning by experiment, regardless of aim. And since it is important to us that pioneer effort be individualistic, wanton, clean, but vagabond, it is this rare type of teacher we must support. Our real need is the teacher who is the inquisitive searcher of nature. The boys are ready, willing and on the job—what will we do for them?"

Dr. Whitney has been director of the General Electric research laboratories since 1900. Born at Jamestown, N. Y., in 1868, he was graduated from the Massachusetts Institute of Technology in 1890, and numbers among his degrees a Ph. D. from Leipzig.

Through all his years he has been a teacher as well as an investigator, and always a very busy man, so busy that he has had no time, as he put it, for so much as a look at a game of golf. Yet he is not too busy to stop and tell you of his work. Over the door of his office in Schenectady is printed, "Come in—rain or shine."

I asked Dr. Whitney what particular problem was now engrossing his attention in the research "lab." One of the things he mentioned was the perfection of the electric light. It struck me odd for the moment, especially when one considers the modern 1000-watt or 2000-candlepower incandescent light, or the powerful searchlight that during the war revealed the menacing Zeppelin high over London or Paris. But here is a man striving to enlarge upon that which the lay world might consider now almost superfluous.

The first radical improvement in carbon incandescent filament since Edison first produced it was due to Dr. Whitney's personal work. The "gem" lamp which he developed, with its metallized filament embodying a new form of carbon, gave 25 per cent more light with the same wattage than the standard carbon filament lamp. Still greater improvements resulted in his laboratory when the drawn wire of tungsten gave us the tungsten lamp. Then came the gas-filled half-watt lamp, and finally, in arc lighting, the development of the magnetic electrodes that produced the successful arc lamp of today.