when, in view of the enormous interests involved, Congress should appropriate funds for the institution of such a plant, in which tests, even as costly as these, could be carried out? The testing of large-sized bridge members would form only a part of the work which such a plant would accomplish. The rapid development of concrete construction, for instance, has brought in its train a number of problems which call for immediate investigation. Evidence of this is afforded by the many failures of armored concrete which are continually occurring. It is positively appalling to think of the number of buildings, factory chimneys, bridges, etc., which are being rushed up all over the country, and contemplate the fact that no small percentage of them embody inherent weakness either of design or construction, which may bring about their ultimate collapse. In the field of concrete-steel alone, a government plant of this kind would yield invaluable results. It is true that the government is doing, and has done, a large amount of work of this character in plants of limited capacity, but the plan we advocate would call for a thoroughly comprehensive, well-equipped plant, presided over by a corps of civil engineers, permanently assigned to their positions, who would thus acquire that store of cumulative knowledge and proficiency which continued service in a special line such as this can alone insure.

HOW TO PREVENT FAILURE IN CONCRETE CONSTRUCTION.

The many failures which have recently occurred in concrete constructions emphasize the necessity for a revision of some of the current methods of design and erection, and the formulation and strict enforcement of building laws of a thoroughly searching character. As we have frequently pointed out in these columns, there is no material of construction that offers such inducements to cheap and fraudulent work on the part of the unscrupulous contractor as armored concrete. As throwing a great deal of much-needed light on this subject, we direct attention to a voluminous paper read before the Western Society of Engineers by Dr. W. Michaelis, Jr., and published in the current issue of the SUPPLEMENT. The author of the paper deals at great length with the merits and limitations of cement and concrete and the causes of failure in concrete construction, and suggests means for the prevention of such failure. While, on the one hand, manufacturers exaggerate the advantages of cement, on the other hand the engineer and architect make unreasonable demands, and misinterpret the failures in concrete construction that so often occur. The best way to establish confidence in this modern building material would be to minimize the danger of failure by establishing proper building ordinances, which would compel the contractor to handle the material in the prescribed way, and to make proper tests of it while the building is in course of construction. The principles governing modern concrete construction are thoroughly understood, according to the author of the paper, by comparatively few; and this explains the divergence of opinion on many points pertaining to this branch of the building industry. While some engineers are careful to specify concrete of ample strength, others blame such "over-cautious" builders for making use of an excessive factor of safety. In reply to the statement frequently made by engineers that cement is not sufficiently uniform at present, and that if it could be so manufactured as to give as uniform results as steel, it would be possible for the engineer to reduce the larger factor of safety now demanded for concrete over that required for steel, the author of the paper answers that such a statement is entirely without foundation. Steel is a well-defined chemical compound rolled into the desired shape, while concrete is the sum of a number of factors. The calculation of a steel girder and that of a reinforced concrete girder can never be based on equal safety factors, no matter how much the properties of cement may be improved in the future; and it will not be improved in the future for the reason that we have arrived at the limits of its good qualities. In the opinion of Dr. Michaelis, the author of the paper, failures of concrete steel can be materially lessened, if not entirely prevented, by making it compulsory to use concrete of specified proportion of crushed stone, sand, and cement, and to use the proper kind of reinforcement in each case, and the necessary amount of it. Certain standard rules should be laid down by a Board of Building Examiners, and certain types of reinforcing material should be excluded where they are not in their proper place. Moreover, the erection of the building should be accompanied by continuous tests of the concrete that goes into the construction, and the builder should be compelled to inform himself of the strength of each column, girder, beam and floor slab before striking the forms and placing the load upon them.

THE ELECTRICAL SHOW AT MADISON SQUARE GARDEN.

The exhibitions of electrical devices and apparatus held each year at Madison Square Garden afford the public an excellent opportunity to study the progress of electricity in various branches of its development. To be sure, exhibitions of this sort are not intended for the purely technical man, and as a consequence do not include many improvements of a strictly technical character, but show largely those with which the general public is immediately concerned. Naturally, those devices and appliances which are adapted for use in the household claim the greatest popular interest. At this year's show, which has just been brought to a close, the advantages of an electrically-equipped household were strikingly set forth in the exhibition of a model apartment. This comprised a living room, parlor, bedroom, dining room, kitchen, and butler's pantry, equipped throughout with all the latest electrical improvements. Here the spectator had an opportunity to examine in real life many of the appliances which, from time to time, he has seen illustrated and described in the columns of the SCIENTIFIC AMERICAN. Naturally, the kitchen, which is the housekeeper's workroom, afforded the best opportunity for the display of inventive ingenuity. Here an electric range was installed, furnished with oven, broiler, griddle, and three "stoves." This was large enough to do the cooking of a family of six. Other apparatus consisted of a meat chopper, a coffee grinder, an electric dish-washing machine, electric irons, etc. The cleanliness of electric cooking has made it possible to do some of this work in a small way on the dining-room table. The dining-room set comprised a chafing dish, coffee percolator, waffle iron, dish warmer, and the like. In the bedroom were the various devices of the toilet, heating pads, foot warmers, milk warmers, and electric lamps which could be turned low to give a dim light at night. In the parlor, aside from the artistic arrangement of the lights and the electrically lighted and heated grate, was a piano automatically played by a Tel-Electric player, and, whenever desired, orchestral music furnished by the Telharmonic system could be had by closing a switch. Electrical appliances for the household were not confined to this exhibit, but were also to be found in other parts of the building. There were various massage apparatus, hair driers, clothes-washing machines, portable vacuum cleaners, also laundry machinery, potato parers, meat choppers, and silver cleaners, made to do the work on a large scale for hotel use.

A feature of the show which aroused great interest was the operation of the cow-milking machine. Every afternoon at milking time a number of cows were milked by means of a vacuum milker operated by electricity. In this exhibit there were included a number of dairy machines, all electrically driven.

Many of the exhibits were very instructive. In one there was a section of a full-sized manhole of an electric main. This gave the public an opportunity to learn something about these mysterious chambers under our streets, and note the methods of splicing the huge electric cables. The method of manufacturing incandescent lamp bulbs was illustrated in practical form, the entire process being shown in actual operation. A lesson in the value of various lights was also given by showing a number of colored fabrics under different electric and gas lights. The introduction of electricity in the factory was shown by the large variety of machines and machine tools driven by electric motors. An elaborate exhibition of testing apparatus was a feature of the show which, if not of particular interest to the general public, was appreciated by the practical electrician. During the exhibition wireless telegraph messages were sent from one part of the building to the other. Altogether, the exhibition was a very successful one, and an improvement on that of last year.

THE SO-CALLED HYPNOTIC INFLUENCE OF SNAKES.

BY THOMAS C. HUTTEN.

It is a popular belief that serpents have the power of capturing their prey by casting a mysterious spell over the victims. Even scientists have seriously considered this supposed mesmeric power over birds. Cuvier ascribed it to narcotic effluvia; Audubon to the self-sacrificing audacity of nest-birds; Bonpland to the "instincts of curiosity and maternal devotion"; Russel Wallace to "optic influences, akin to hypnotism." The latter theory is the most generally accepted, and in the rural districts, both of Europe and North America, bird-charming snakes are classed with such indisputable phenomena as fish-deluding anglers. Contemporaries of more than average intelligence will describe the glaring eyes of a rattlesnake that paralyzed a youngster on his way to school, and maintain that they saw it charm down a squirrel from the top of a walnut tree.

An opportunity was afforded me last summer of disproving the snake-charm theory. The pharmacist of a medical college had procured a number of live serpents for experiments with certain antidotes, and, during the summer vacation, boarded his pets in a suburb of Bennington, Vt. They arrived in a moderate-sized drygoods box, and, with the owner's permission, my neighbor transferred them to a roomy outhouse, with a close-fitting door and a wire-screen front. Through a glass window their movements could be watched in spite of two bundles of straw and other aids to comfort. Cold weather lethargized them; but on warm afternoons, four of five out of ten rattlesnakes and six moccasins were generally in motion.

Were they trying to get out? Their conduct rather suggested a sanitary penchant for moderate exercise and sun-baths. And there seemed no doubt that they had a memory for meal-times. General revivals repeatedly preceded the gong by a minute or two. The owner's signboard, "Dinner at 3 P. M.," attracted rather a surplus of sightseers; and when it became known that our experiments promised to solve a problem of ages, catering, too, became superfluous: volunteer gifts of rats and blackbirds arrived in excess of our needs. Before the summer was over our visitors had settled the snake-charm controversy. Twenty-eight out of thirty intelligent witnesses agreed that there is no hypnotism about it.

Our first doubts were aroused by the complacency of birds and small mammals, and their absolute indifference to the presence of their formidable fellow-captives. Within two feet of a coiled rattler, a blackbird would alight on the rim of the drinking trough, and adjust the defects of his toilet, splashing water in the very face of the reptile that watched him with piercing eyes. Then, after repeated sips, he would condescend to notice the crawler that had uncoiled by that time, and would finally hop aside just far enough to avoid a dispute about bathing privileges, but still within easy reach of a strike. Nor had the restlessness of rats anything to do with the dread of immediate danger. They were trying to gnaw out, but, in the intervals of such efforts, were apt to run straight into the pile of straw that formed the favorite rendezvous of the serpents. The snakes, indeed, were in no hurry to abuse that confidence. When they did get ready, they scorned hypnotic artifices. A gradual elevation of the head, a noiseless approach with a short halt in reach of the bird that was picking crumbs in his feeding corner, then a slow contraction of coils, a snap-like dart, and a leisurely retreat, as from a task accomplished. The bird had taken wing, thoroughly alarmed, now, and fluttered about the wire screen in the desperate hope of finding a loophole of escape. In less than thirty seconds the poison began to take effect. The bird clutched at the screen, with his head hanging further and further back, then relaxed his grip, dangled by one foot for a while, and came flopping down on the floor. It was not dead yet, but dazed, looking this way and that, and fluttering about in a strange aimless fashion, and more than once right toward the destroyer, who at last began to manifest an interest in its antics. Once or twice the serpent, coiled near the center of the floor, seemed strongly tempted to risk a conclusive spring, but drew back again, fully aware, perhaps, that a better chance would be only a question of a moment.

The bird was still on the floor, staggering to and fro, when a sideward collapse marked the beginning of the end. Its foe watched it with lifted head. The chance had come. No risk of a rough-and-tumble fight now; the victim had ceased to flutter, and the old rattler quickly dragged it off to the straw pile. A full hundred experiments repeated this same sequence of maneuvers in all essentials.

The poison-fangs of a snake have no proper roots, but terminate in a virus-bag, and are attached to the jaw by means of ligatures that make them movable to the extent of erection and retraction. This arrangement makes it difficult, and rather superfluous, for the snake to secure his victim at the first spring. The fangs are adapted only for a snap-bite, but their owner can afford to bide his time. The virus that has been known to overpower strong men in half an hour, lethargizes birds and small mammals in half a minute. Wherever stricken, they are apt to collapse in sight, if not in direct reach of their assailants, whose keen eyes detect the slightest commotion in the neighboring weeds, but who would find it a very long time between meals if they had to rely on the hypnotic power of those eyes.

Aluminium is increasingly used in machine construction, as in crank cases and gear boxes for motor cars, for paneling insides of underground railway cars, for electric wire, and for new alloys, pigments, and metal plating; and the aluminium cell as a lightning arrester has proved to be a valuable addition to lightning-protecting devices. During recent years the price of tin has been very high, and since adequate new supplies of ore have not been discovered, substitutes for tin must be used in manufactures. Aluminium is regarded as probably the most available substitute for tin in the great majority of uses to which that metal is put, owing to the diminution in the price of aluminium, the practically limitless supply of the raw material, and the favorable physical properties of the metal. As the production of aluminium is cheapened, so will the uses for it increase. The demand steadily keeps ahead of the supply.