MAGNIFIED MODELS OF INSECT PESTS.

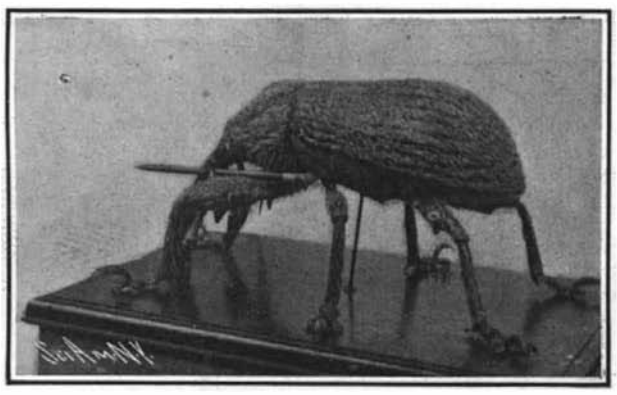
BY DAY ALLEN WILLEY.

One of the most unique and interesting industries in this country is the reproduction of minute forms of life by means of models of such size that the anatomical features of each creature can be observed and studied by the naked eye without the aid even of the common magnifying glass. This industry has been so perfected that each part of the insect or other form of life reproduced is so faithfully copied that it is absolutely true to nature.

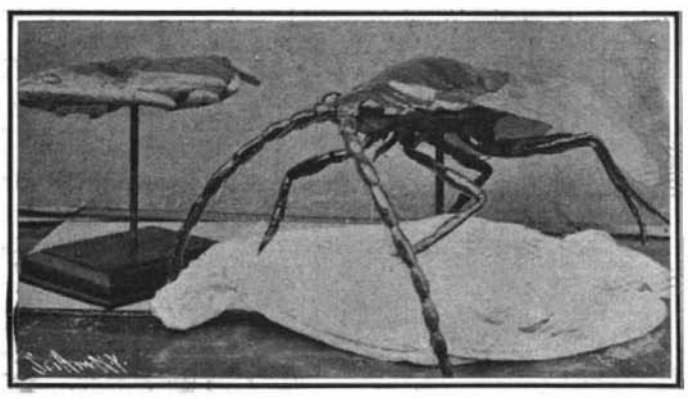
In recent years the discoveries in science have indicated clearly the damage done, especially to farm crops, by various types of insect pests, but besides these there is a number of insects, either harmful or annoying to human beings, of which we have been furnished much valuable information. The importance of having likenesses of these for the purpose of study is obvious, and this is one reason for the construction of the models to which we have referred. The maker of these mammoth representatives of insect life is a woman, who has devoted herself to entomology, and thus has become familiar with the subject. For a period of years Mrs. Otto Heidemann has made collections in various parts of the country, in association with her husband, who is one of the entomologists connected with the Department of Agriculture at Washington. From continued study of her specimens Mrs. Heidemann became expert in insect anatomy, and familiar not only with the general appearance of the body, but also with the shape and object of portions so small as to be invisible except under a powerful microscope.

To reproduce a leg, a wing, an eye, or some other part on a scale which may be several hundred times as large as the original, and reproduce it accurately in shape, is no small achievement, and furthermore, it may possibly have to be colored to resemble the insect's natural hue. Then it must be composed of material which will retain the shape into which it has been fashioned by the modeler. When we think of even the mosquito or house fly, with the position of their legs, the curves of their wings, the conformation of their heads, it is evident that the worker must have a variety of materials in order to make a successful reproduction. Mrs. Heidemann has not only utilized wire, thread, celluloid, *papier maché*, and rubber, but has been obliged to devise compounds of various substances to suit her needs. The nature of these compositions is known only to herself.

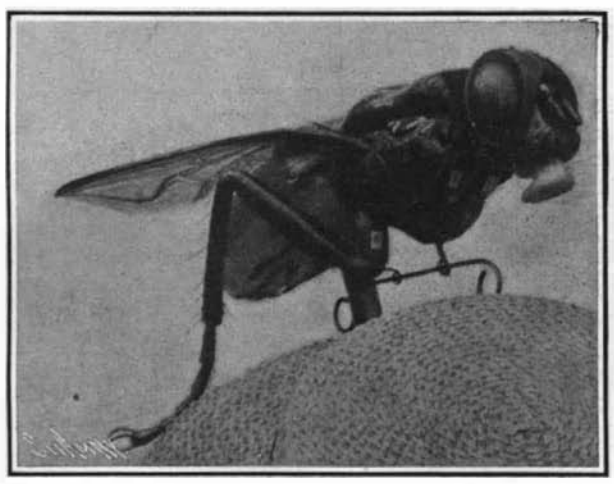
In fashioning an insect model, the skeleton of the body is of course one of the most essential features. In many cases this can be made of steel wire, which not only retains the proper shape, but is also strong enough for the purpose, and has the necessary lightness. The covering of the skeleton depends on the nature of the insect. Some have the surface of the body covered with microscopic hairs. Others have smooth bodies. *Papier maché* is suitable for many of the models, but occasionally something else must be substituted such as celluloid. Usually, wire forms the "bones" of the leg, but if it must be made thicker in some portions than others, Mrs. Heidemann coats it with one of her compounds. She proportions the leg properly while the material is plastic; when it hardens it assumes a permanent form. The wings of most of the designs requiring them are composed of celluloid of the proper thickness. Occasionally wire may be needed around the edge or beneath to strengthen the wing, but as a rule the material is sufficiently stiff and strong to be used without any reinforcement. Even the minute hair is imitated with fine silk threads, while Mrs. Heidemann has also suc-



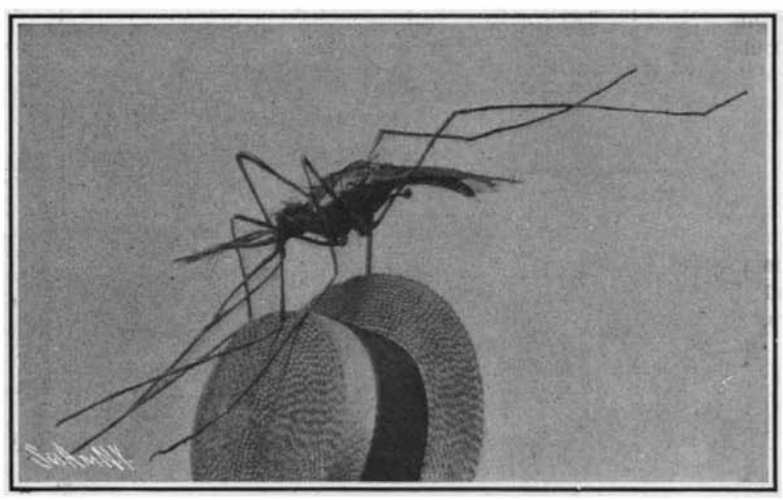
Gigantic Model of the Destructive Cotton Boll Weevil.



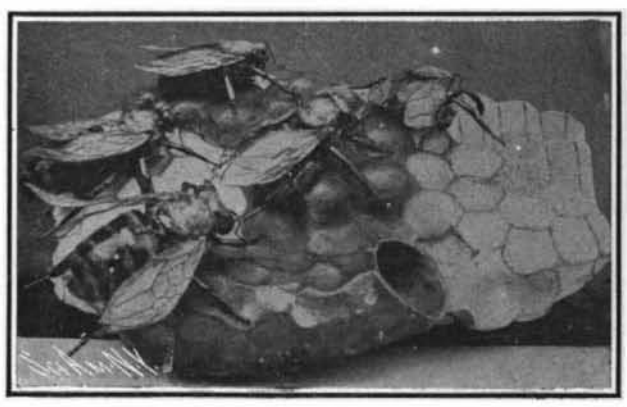
The Full-Grown San Jose Scale and Its Larva (at the Left).



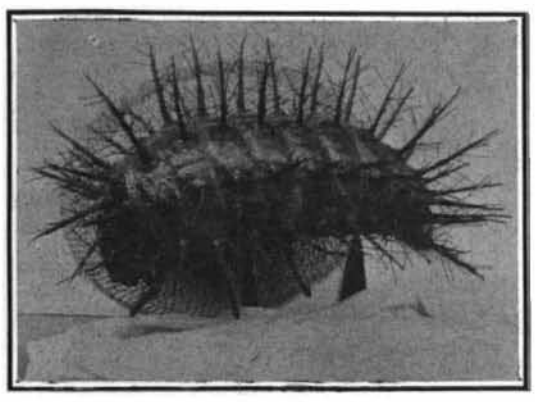
The Common House Fly is Fortunately Smaller Than This Model.



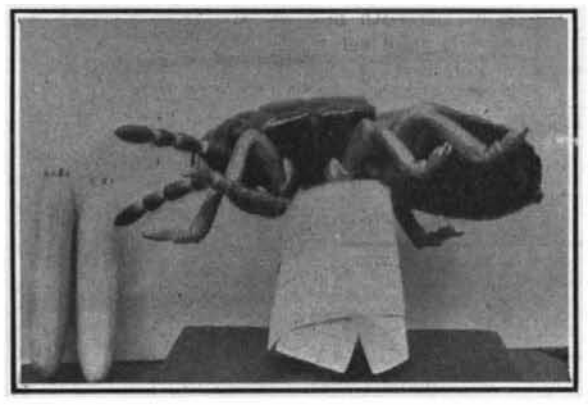
Reproduction of the Anopheles Mosquito; a Good Example of the Naturalness of the Work.



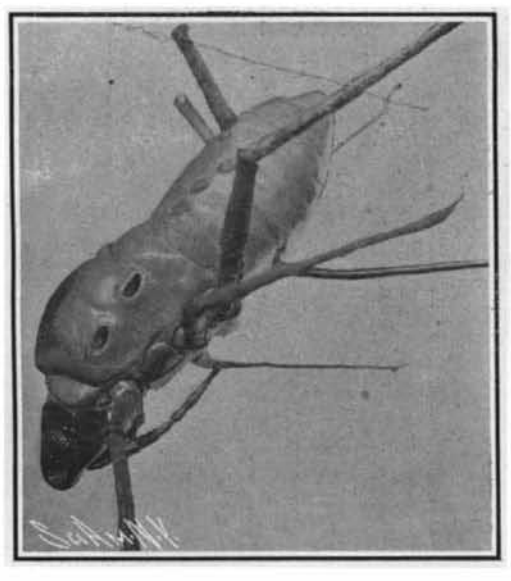
A Model of Honey Bees Filling the Cells of a Comb.



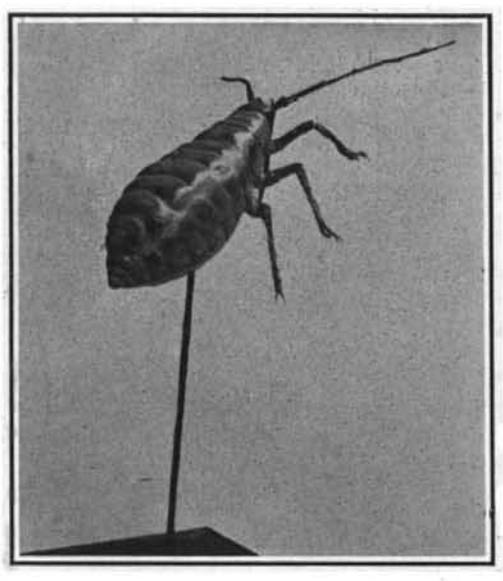
The Repulsive Larva of the Lady Bug.

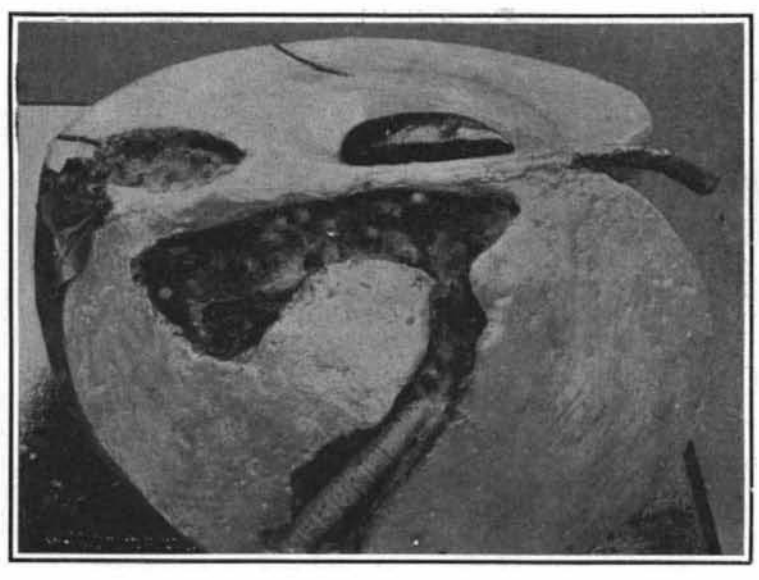


The Chinch Bug and Two of Its Eggs.



The Plant Louse. The Models Are Nearly as Large as a Page of the Scientific American.





Huge Model of an Apple, Showing a Worm and the Ravages It Has Committed.

MAGNIFIED MODELS OF INSECT PESTS.

ceeded in devising a substitute for the covering on moths, which so strongly resembles feathers when seen under the microscope.

In making one of these giants of the insect world, the body, the wings, or the legs may be made first according to convenience, but before beginning operations Mrs. Heidemann executes a working drawing. This is indispensable in order to attain the proportions. In short, the creature is literally mapped out on paper before any part of it is finished. The drawing is always done with the aid of the microscope. After the specimen to be modeled is placed under the lens, the instrument is properly adjusted. Mrs. Heidemann next singles out a portion, and carefully scanning it as it appears enlarged, traces it on the paper. Then selecting another portion, she repeats the process until she has traced what might be termed an anatomical outline. The paper on which the drawing is made is carefully measured and divided into squares of equal size. In this way the exact proportions of the enlargement are more easily obtained.

With the drawing before her eyes, it is necessary only to select the part to be made first and begin the work. The tools of the modeler are few and simple. Pincers, scissors of various sizes, needles, and several knives comprise most of the outfit, but though the equipment is not elaborate, the various processes require so much time that a model may be several weeks in finishing. Mrs. Heidemann does not work continuously on a single specimen, however, but may have several under way in her curious laboratory, finishing a part of one, then of another, as may be most convenient to her. The occupation also produces such a nervous strain, that she is obliged to desist frequently and rest from it. The Division of Entomology of the Department of Agriculture contains a very interesting collection of these gigantic facsimiles of minute animal life. The collection has been arranged under the supervision of Dr. L. O. Howard, Chief of the Bureau, and is not only interesting but highly instructive as well, especially to all interested in agriculture. It includes the cotton boll weevil, which has inflicted such damage to the staple crop of the South and which the Bureau of Entomology is vigorously striving to eradicate. As seen thus magnified, the weevil slightly resembles an enormous spider with a long snout. This snout is the most closely studied of all parts of the weevil, and with good reason, for the creature uses it in boring into the boll, thus destroying or damaging the contents.

By means of the models the distinction between the various species of mosquitoes can be clearly traced with the eye unaided. The specimens in Dr. Howard's collection include the variety supposed to carry the germs of fever, the comparatively harmless singing mosquito, and the kind which is believed to spread malaria. It would be difficult for even an expert to detect the difference in the actual insect unaided by the microscope, but as already stated, the models make the distinction plain. As a matter of fact, the more harmless of the series might be considered the most dangerous, for it is much uglier in appearance than the others, with its spotted legs and scraggy body. The anopheles, which has such an evil reputation for its bite, is the most harmless in appearance. An idea of the many times which the insects have been magnified can be gained when it is stated that the smallest mosquito is more than twice the length of an ordinary straw hat measured from the ends of its fore legs to the ends of the hind ones. The chinch bug, almost invisible in life, is reproduced in the collection much larger than a pair of cuffs, while its eggs, microscopic in their natural proportions, are as large as shotgun cartridges.

One of the curious results of this magnified modeling is the repulsiveness and ugliness of some of the insects least dangerous to us, and the attractiveness of some of the most harmful ones. Perhaps the most common winged creature which we know is the house fly. It is found everywhere—on the table, sometimes in the food—and it has a most annoying habit of alighting on the person and sometimes preventing sleep. We are so accustomed to it, that we brush it away without further thought. Nervous people might shudder were they to see the specimen in Dr. Howard's collection, for it is one of the ugliest of all. Its legs end in sharp claws that might easily tear one's flesh if the fly were of this size, while the head with its great eyes and what seems to be a protruding jaw adds to its savage appearance. In decided contrast to it is the codling moth, really a beautiful creature with its many-tinted coat of "feathers." This, however, is the bane of the fruit grower, for from it comes the worm that bores into the heart of the apple, and often destroys most of the fruit before it works its way to the surface. One of the most interesting parts of the collection is a huge apple made principally of *papier maché*, showing the worm done in plaster, feeding in its interior. The homeliest specimen in the collection is one of the greatest friends of the horticulturist. This is the variety of beetle known as the lady bug or lady bird. It is probably the greatest enemy to the San José scale which has thus far been discovered. It is needless to refer to the great damage done to peach orchards in various parts of the country until the lady bug was introduced and fed upon the pest. As seen magnified, the beetle looks like a land turtle with its thick rounded shell. It is large enough to hold a cigar in its mouth, which gives a further idea of the enormous size of the reproduction. On the other hand, the body of the scale is quite graceful in form and its wings resemble lace, so delicate are they in appearance, but the long legs and huge eyes of the creature cause it to bear a slight resemblance to a lobster. The ugliest specimen of all, however, is a design of the larva of the lady bug, which looks like a worm from whose skin project sharp spines resembling miniature tree trunks. This was one of the most difficult models to complete, while the plant louse has so few legs and feelers that it is one of the easiest specimens to reproduce. Yet as is well known this living mite is one of the greatest foes of the farmer, since it gets into the green kernels of wheat and other grain, and kills them by absorbing the moisture. It is estimated that the louse has destroyed $10,000,000 worth of cereals in a single season.

While these models have undoubtedly been of great value in giving agriculturists and others, who have visited Washington and seen them, an idea of insect structure and habits, all have had an opportunity to become familiar with the best methods for eradicating those which are pests. But such is the interest manifested in insect study, that there is a constant demand for the models from the managers of State fairs and other rural displays, and they are frequently sent out for the purpose of exhibition. The idea of utilizing illustrations of the models, prepared on the same scale, for instruction, is also finding favor among the agricultural colleges, and there is no doubt that already they have been of much benefit in educating the rural classes in a very important topic to the farmer.

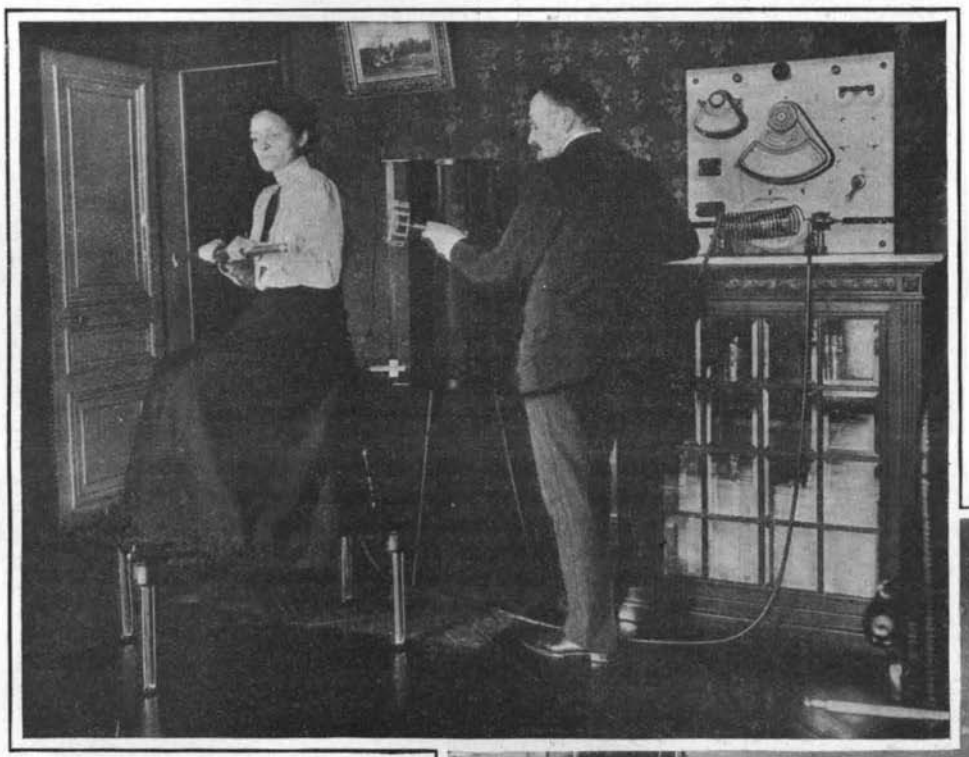
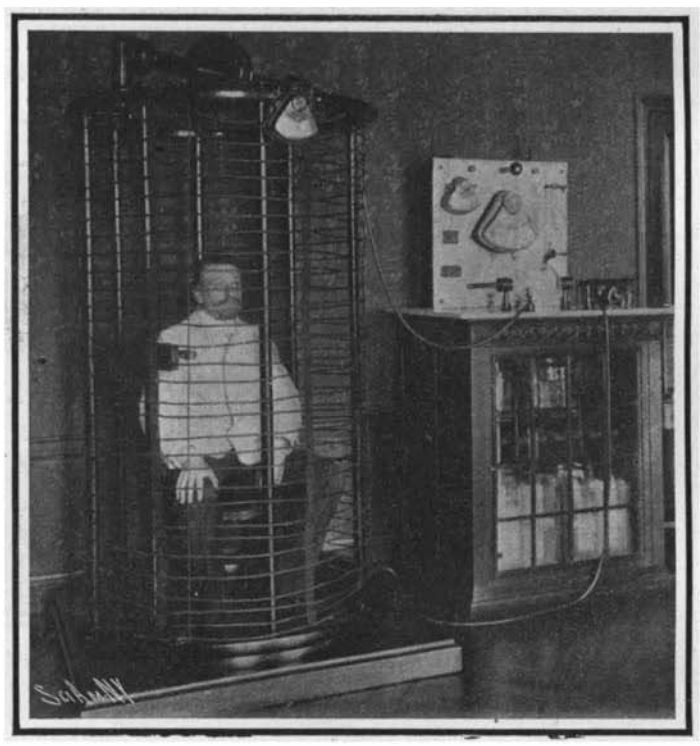


Fig. 3.—APPLICATION OF HIGH-FREQUENCY CURRENTS IN THE FORM OF ELECTRIC SPRAY IN CASES OF EXCESSIVE ARTERIAL PRESSURE.



ig. 1.—DR. MOUTIER'S APPARATUS FOR THE REDUCTION OF TERIAL PRESSURE BY MEANS OF HIGH-FREQUENCY CURRENTS.

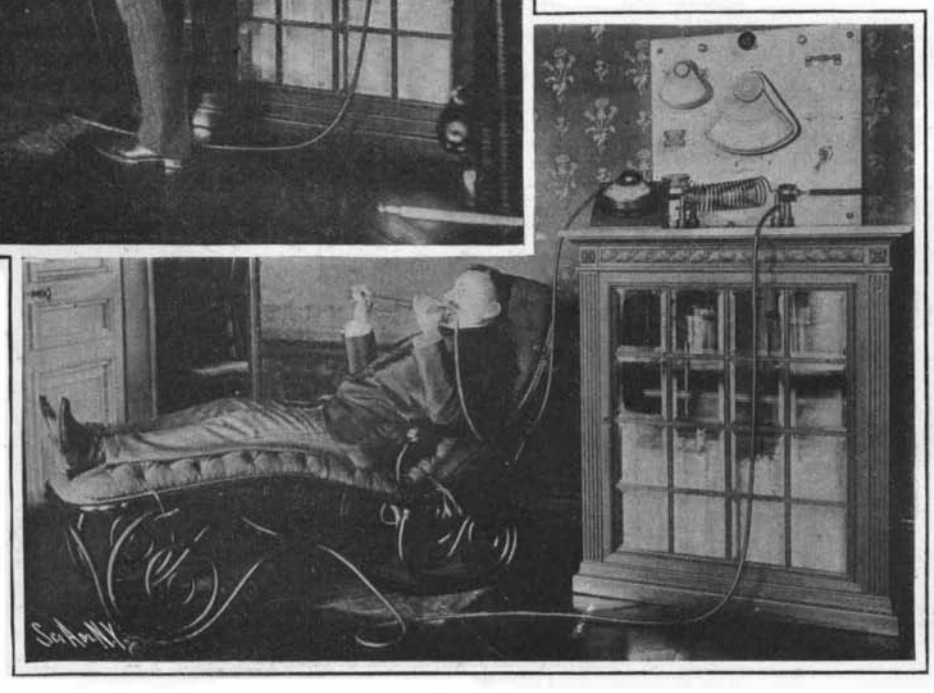


Fig. 2.—CONDENSER BED.

EMPLOYMENT OF HIGH-FREQUENCY CURRENTS IN THERAPEUTICS.

BY JACQUES BOYER.

The arterial blood pressure, which is equivalent to about 6 inches of mercury in health, rises to 10 inches or more in certain diseases and falls to 4 or 5 inches in other diseases—neurasthenia, for example. Excessive arterial pressure is a common symptom of arteriosclerosis, or hardening of the arteries. It is easily detected by the sphygmometer, but until very recently no method of arresting the progress of the disease was known.

Now, however, arteriosclerosis appears to be curable by the method of Dr. Moutier, which is based upon Prof. d'Arsonval's discovery that the blood pressure is instantly reduced by the action of high-frequency currents.

The patient is seated on a chair inside of a spiral coil of wire which is traversed by high-frequency currents. (Fig. 1.) The cabinet shown at the right of the photograph contains a transformer, which gives to the alternating current a tension of 40,000 or 50,000 volts and a frequency of 500,000 or 600,000 alternations per second. This treatment, continued for five minutes, reduced the arterial pressure from 10 to 7 inches. In a second treatment, given to the same patient a few days later, the arterial pressure, which had risen during the interval to 8 inches, was brought down below 7 inches in a few minutes. Repeated applications gradually reduce the arterial pressure to its normal value of 6 inches. In Dr. Moutier's very interesting experiments, the rapidity with which the pressure was lowered appeared to have no relation to the age or gravity of the case, or the degree of hypertension, but to depend chiefly on the state of digestion.