

## OXYGEN AND HUMAN ENERGY.

BY JOHN B. HUBER, A.M., M.D.

Oxygen is the life-maintaining gas; it is the most useful and the most abundant of all the elements, as we still call them. Its combination with other substances—oxidation—makes heat; and that is why the sentient body is generally warmer than the atmosphere about it. All animal and vegetable life depends upon oxygen; under the sun's benignant influence the plants give out this gas which, thus freed, is respired in animal life. And by the term respiration in the physiological sense we mean not only the series of acts known as breathing, but also that in respiration oxygen is carried from the lungs by the blood, through the minutest capillaries, to the uttermost cells and the most microscopic tissues of the body, giving to it strength and warmth and life.

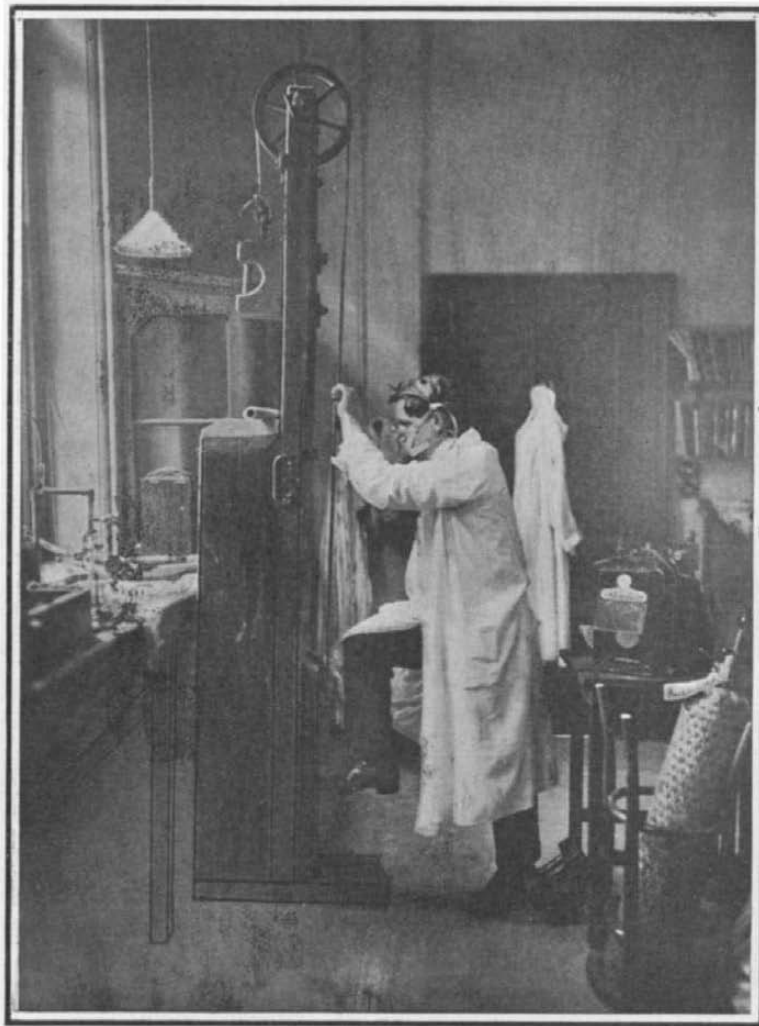
In point of fact, life itself, in our present knowledge, is inconceivable without oxygen, which is much more important than food to the human economy. Without the latter, one may exist for months; without the former, one must die within a few minutes. Consider also metabolism. Normal metabolism is the perfect chemical transformation of oxygen, fluids, and food stuffs into healthy tissues. The process is a never-resting, an ever-changing one. Respiration provides the oxygen; ingestion provides the fluids and the food stuffs. And in that infinitely complex laboratory, the animal body, these substances are combined in the constant manufacture of fresh cells and tissues, to take the place of those which are as constantly dying and being removed by way of the lungs (carbon dioxide and watery vapor) and the excretory organs.

We are thus able to appreciate one of the most valuable dicta of the evolutionists: that "normal living is the right adjustment of internal relations to external relations"; again, "whatever amount of power an organism expends in any shape is the correlate and equivalent of a power that was taken in from without." In our physical life—as also in our psychic, for that matter—we are absolutely dependent upon a wholesome environment for wholesome existence; and by far the most essential and the most beneficent element which our environment affords us is oxygen. It is here very important to note that nature does not vouchsafe us this oxygen pure; she has tempered it for our use by combining about one part of it with about four parts of nitrogen (an inert component). Oxygen pure is irritating; and ozone—a form of oxygen in which three atoms are considered to be condensed into two—has, in experiments, been found so caustic as to produce pulmonary inflammations. The safest and the only good and right form of oxygen inhalation for normal creatures is in combination, as it exists in the atmosphere; for this is the form to which during many ages the race has become adapted. It is possible that in other æons creatures respired oxygen under a different combination than that which now obtains; but in those æons there were no human beings—only such creatures as ichthyosaurs and the dodo. No; we can live most advantageously, most wholesomely, and with the best human results only in conformity with natural laws as we find them, and with due respect and regard to our environment.

There are, however, abnormal states of the human body in which oxygenation is deficient, by reason of disease processes; and in these diseases it is sought to administer oxygen in greater proportion than obtains in the ordinary atmosphere. We give it thus when oxygenation of the blood is interfered with, as in dyspnea, emphysema, asthma, croup, whooping cough, asphyxia, tuberculosis, and pneumonia; and when the oxygen proportion in the blood is poor, as in anemia, diabetes, and chlorosis (the green sickness). Here Hayem's findings are, I believe, authoritative. In such diseases as those just mentioned, oxygen mixed with a determinate quantity of air, energizes to a considerable degree the nutritive functions, increases the appetite, slightly elevates the temperature, stimulates the cardiac movements, and augments the bodily weight; the number of red blood cells is increased, and their organic activity is stimulated; "although this action

is not constant, the effects may become so by the greater nutritive changes that are thus promoted."

Observe now the portion of Hayem's statement which I have italicized. In point of fact, even in disease we do not, as we could not, administer oxygen pure; moreover, the nurse in administering holds the tube in such manner between the parted lips that some admixture of air takes place; this admixture is essential if the oxygen is to be respired at all. Nor have I, for my



Apparatus for registering work performed after inhaling oxygen.

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part, been always sure of the efficacy of oxygen in such diseases as pneumonia. I have felt that pure atmospheric air—the colder the better its tonic properties—has been as efficacious as oxygen in cases in *extremis*. Some physicians, indeed, go so far as to declare that the appearance of the oxygen tank connotes the beginning of the end for the unfortunate patient.

Nor does the oxygen tank supplied for use in the sick room contain pure oxygen. One of the firms which supplies this gas for the sick room informs me that their purest oxygen is 90 per cent, the remainder being nitrogen; that in half the cases physicians prefer and call for tanks containing "oxygen compound," which is made up of 60 per cent oxygen, 30 per cent nitrous oxide (laughing gas), and 10 per cent nitrogen.

I find it now very *apropos* to present certain physiology. (Concluded on page 16.)



AN APPARATUS FOR PRODUCING LOCAL HEAT PENETRATION.

## ELECTRICAL HEAT PENETRATION.

BY DR. ALFRED GRADENWITZ.

When fever was recognized as a natural process by which the body endeavors to expel invading microbes, the idea was suggested to effect artificially a local increase in the temperature of those parts of the body which are affected by disease, thus assisting the human organism in its struggle against the morbid process. In fact, an artificial heat supply is obtained by the familiar methods of treatment which have been in use from time immemorial. However, there was so far no possibility of really permeating the body with heat, any effects being merely superficial, resulting at most in a general heating of the whole body, the excess of which is known to be counteracted by abundant perspiration and fixation of heat through evaporation.

The process described in the following paragraphs allows any part of the body to be heated to any temperature desired, producing locally fever temperatures of say 100 degrees to 104 degrees F., in order thus to increase blood circulation and to accelerate and intensify all those vital processes which are instrumental in defeating the disease. The local heating is effected by means of electric currents.

Though almost any galvanic action is attended by the production of heat, the amount of heat generated by ordinary currents is insignificant. Any attempt to produce an appreciable heating effect by the application of electricity would further have been frustrated by the small amount of energy supplied to the human body in the form of ordinary currents, while any really important increase would have resulted in a violent stimulus of the nervous system and the electrolytical destruction of tissues. Intensities of 50 to 100 milliamperes thus constituted the extreme limit, even in the case of small current densities, whereas twenty to fifty times as much current would have been required for the production of an adequate heating effect.

High-frequency currents, as lately used in connection with wireless telegraphy, afford a means of applying enormous amounts of current energy to the body without any risk of injury. In fact, these currents perform vibrations of such rapidity as to exceed the limits of excitability of our nervous system. The alternations in current direction also exclude any electrolytical effect.

The electrical vibrations generally used are too strongly damped to yield an appreciable effect. As in two communicating tubes a liquid removed from its position of rest will oscillate to ever-decreasing distances from its position of rest, so electric waves, starting from a spark gap, become smaller and smaller, and only after an interval, about two hundred times as long as those vibrations, will a new discharge take place, and generate a new set of vibrations. In order to increase the effect of these vibrations, the intervals should be reduced to about the same duration as the vibrations themselves. Their effect would then be entirely equivalent to those undamped waves which have recently been generated for the purposes of wireless telegraphy, by means of highly sensitive apparatus.

A Berlin firm has recently constructed an outfit for generating high-frequency vibrations, thus making heat penetration accessible to medicine, as a new therapeutic method.

The most important part of the outfit, viz., the apparatus used to generate the vibrations, consists of two substantial copper electrodes separated by a small distance, between which the electrical discharges pass in an inclosed compartment. These discharges are produced by the high tension of an electrical generator connected with the electrodes, and a vibratory circuit connected up in parallel with it, and consisting of a condenser and a self-induction coil arranged in series. The condenser is charged suddenly as the apparatus is inserted, and the discharge, which ensues immediately, takes the shape of a rapidly extinguished spark between the copper electrodes. In a similar manner, as an object fixed to an elastic rubber string on falling drops beyond its point of rest, the condenser in fact exceeds its normal condition, during its charge, thus assuming an opposite charge,

which is soon compensated by a reflux, which in its turn exceeds the normal condition, and so on. Hence the processes in the vibratory circuit are comparable to an elastic pendulation.

So far from being applied directly, the vibrations generated by the condenser circuit are at first raised by induction to a convenient tension, which is graduated by shuntings from the secondary coil. The current is supplied by means of conductors to the electrode plates, to be applied to the body after first passing through an ammeter.

This thermo-penetration outfit can be operated by direct connection with an alternating-current circuit, the tension being raised by a transformer before entering the generator. When continuous current is used, a small converter, resembling an ordinary electric motor, serves to convert it into an alternating current.

#### AN AUTOMATIC APPARATUS FOR PROJECTING PICTURES.

BY JACQUES BOYER.

Radiguet and Massiot of Paris have patented an automatic projecting lantern, which they call the "Circus." It consists of an electric lantern provided with an endless chain of slide holders, which are brought successively between the condensing and projecting lenses by a double system of hooks. During the movement of the slides, the light is automatically cut off by a shutter, so that the image does not appear on the screen until it has become motionless.

The lamps are self-regulating and designed for tensions of 7, 15, and 20 volts. The position of the arc is rigorously fixed and the carbons are inclined, producing the maximum illumination. The focal length of the condensers is about 5 inches. The projecting lens can be focused by a rack and pinion, and covers a screen 3 yards square at a distance of 9 yards. The mechanism is operated by an electric motor of 1/40 horsepower, placed in the base of the apparatus. The apparatus is set into operation by moving a single key and the projection of pictures then continues—or may continue—as long as the carbons last, or about 8 hours, although the 100 slides which the apparatus accommodates are run off in from 30 to 45 minutes according to the speed to which the mechanism is adjusted. The automatic projector saves the expense of an operator and should interest all proprietors of projecting apparatus, and lecturers in general. In the theater it will replace advertisements painted on the curtain, in railway stations it may be employed to show the scenery along the line, and in newspaper offices it will prove more useful and effective than written bulletins or projecting lanterns of the ordinary type.

#### THE SCIENTIFIC AMERICAN TROPHY.

The year 1909 has closed with only a single trial for the SCIENTIFIC AMERICAN Flying Machine Trophy. That the publishers are disappointed in this lack of interest in the sport goes without saying. Up to the present time Mr. Glenn Curtiss, to his credit, is the only American aviator who has displayed an interest in a prize which the publishers of this journal donated at considerable expense for the purpose of encouraging the development of an art which, thanks to Langley, had its scientific genesis in this country. Were Curtiss our only aviator we could understand why he alone should present himself as a contestant. There are at least three other American flying-machine pilots in the field, with whom Mr. Curtiss would surely have coped with pleasure. The conditions under which Mr. Curtiss won the Trophy for the second time last year were by no means onerous. The deed of gift to the Aero Club of America provided for an annual competition by heavier-than-air machines only, with the understanding that the conditions governing the contest were to be changed from time to time so that they would keep pace with the progress made in the designing and handling of flying machines. In this way it was hoped that not only aeroplanes, but all types of flying machines, such as

helicopters and beating-wing machines, would receive encouragement. The conditions required at first were a straightaway flight of one kilometer (0.621 mile) in a straight line. On July 4th, 1908, Mr. Glenn Curtiss carried off the Trophy by covering somewhat more than a mile in the "June Bug." In view of the flights which were then being made by French aviators, the conditions were changed for 1909 to 25 kilometers (15½ miles) in a closed circuit; in other words, 5

His achievement is remarkable, because he flew double the distance required in the Bennett Cup Race.

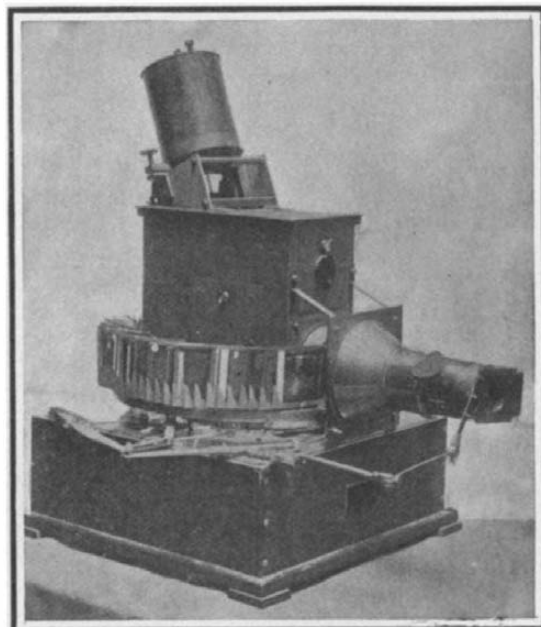
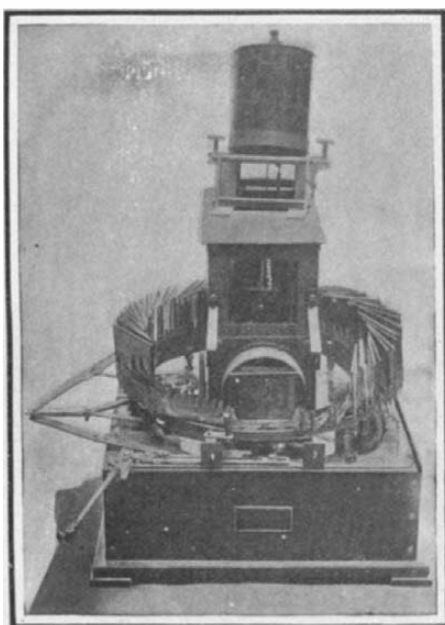
The lack of entries for competition during 1909 was certainly not due to formidable conditions, as the Aero Club, in establishing the rules for the year, endeavored to make them so easy that any aspiring experimenter would feel that the Trophy would be well within his reach. The discouraging fact remains that during the past year, in spite of the notable achievements of Curtiss and the Wrights, very few new men have come into the field. Reports reach this office from various parts of the country that machines are being built, but successful flights are few and far between. In France, during the past year, the science of aviation has advanced by leaps and bounds, as was witnessed by the successful flights at Rheims and Juvisy, and by the almost daily reports of successful trials of new machines or long cross-country flights by well-known aviators. There are fortunately a number of men in various parts of the country who are making serious experiments, and it is to be hoped that great strides will be made during the year 1910, and that the competition for the Trophy will bring into the field a large number of new experimenters.

Possibly the present lack of progress is due to the fact that in America at least the aeroplane is not as yet what may be called a commercial product. It was not until the automobile had become a serious competitor of the horse-drawn vehicle, that the Bennett and Vanderbilt cups and other automobile racing trophies were earnestly competed for. Perhaps the history of aeronautic sport may be the same, and that when aeroplanes are manufactured wholesale, the flying machine will hold a recognized position in the sport of the country. In France we believe there are no less than a dozen establishments actively engaged in the making and selling of aeroplanes. This placing of the flying machine upon a commercial footing undoubtedly has played its part in popularizing the monoplane and the biplane among Frenchmen. For all that, however, there must have been popular enthusiasm before the industry could have been started—an incentive which was not that of making money. We hope that in 1910 Mr. Curtiss will again be a competitor, that he will pit himself against men who are worthy of his steel, and that a contest will be inaugurated which will arouse in this country something like the enthusiasm which was evinced at Rheims.

The conditions which will govern the contests for the cup in 1910 will be announced later. They will be so drawn as to keep pace with the progress made last year.

A table prepared for the Archiv für Eisenbahnwesen, states that at the commencement of 1908 the total railway mileage of the whole world was 594,842 miles, divided as follows: America, 302,928; Europe, 199,346; Asia, 56,284; Africa, 18,518; and Australia, 17,766. The cost of construction per mile has been highest in Great Britain and Ireland, where it averaged \$271,000 per mile. In Belgium the cost was \$172,900; France, \$122,000; Germany, \$108,500; Italy, \$125,300; Russia, \$79,600 per mile. In the United States the average cost has been \$68,800; in Canada, \$58,000; in New Zealand, \$60,300; and in Queensland, Australia, it is as low as \$34,200.

The boring conducted by the Prussian Department of Mines at Czuchow in Silesia had to be discontinued recently upon reaching a depth of 2,240 meters, in view of the fact that the cost of drilling at this depth in hard sandstone was out of proportion to the obtainable results. Like the boring at Paruschowitz in Silesia, which had to be abandoned at a depth of 2,003 meters on account of the drills breaking, the Czuchow boring was undertaken for scientific purposes only, since mining operations are of course entirely impossible at this depth, even if no account is taken of the rapidity with which the expense for hoisting increases with depth.



AN AUTOMATIC APPARATUS FOR PROJECTING PICTURES.

kilometers (3.1 miles) more than required in the International Contest for the Bennett Trophy. Under the 1909 rules the winner for any year is the aviator who makes the longest and best flight in a closed circuit during that year. In 1909 Mr. Curtiss was the only competitor who came forward. He easily complied with the conditions, and accordingly he must be regarded as the winner of the Trophy for the year 1909.



SCIENTIFIC AMERICAN TROPHY.

Won in 1908 and 1909 by Glenn H. Curtiss.