THE DUFAUX FLYING MACHINE.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The experiments which were recently made at Paris with the new Dufaux flying machine seem to prove that a considerable step in advance has been made in this direction. Up to the present we can scarcely point to an apparatus which is able to rise in the air by the force of its propellers alone, driven by a gasoline motor, and carry a reserve of energy necessary to continue its flight in the air. Such a machine has been built by two young engineers of Geneva, Henri and Armand Dufaux, who are already known by their invention of the motosacoche, or gasoline motor outfit applied to a bicycle. After working for some time, they have succeeded in building a *helicoptere*, or "propeller flier," which will rise in the air as long as there is any gasoline in the reservoir, and the supply can even be increased, seeing that the flier will carry a dead weight of 15½ pounds outside of its own weight, which is 38½ pounds. At the Aero Club it is considered that the Dufaux apparatus will no doubt aid greatly in solving the difficult problem of the "heavier than air" type of flying machines.

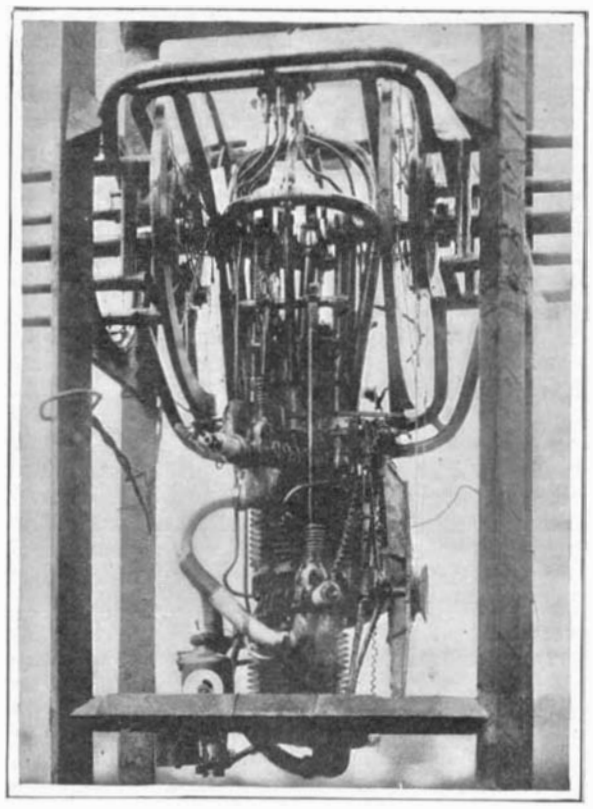
The complete apparatus is represented diagrammatically in the accompanying drawing, showing the arrangement of the propellers, *H H H' H'*, carried by the steel tubular frame, *B B'*, and driven by the motor, *M*. The extensions of the frame are hollow rods, *A A'*, carrying at each end two plane silk surfaces, *S S S' S'*, placed above one another and affording a total surface of 11 square meters (118.4 square feet). The triangle, *A*, is a rudder fixed in front of the apparatus. The total weight of the whole outfit is only 23 kilogrammes (50.7 pounds).

In order to insure the stability of this combined flying machine, the longitudinal axle, *A A'*, is made free to rotate round the transverse axis, *B B'*, and the point of application of the motive force, that is to say, the crossing of the axes, *A A'* and *B B'*, is nearer to the front aeroplanes, *S*, than to the rear aeroplanes, *S'*. The motor, *M*, and the dead weight, *N*, moreover, are always kept vertical under the influence of gravity, while the axis of rotation of the screws may be inclined with regard to the motor until they become horizontal.

As constructed at present, the apparatus is intended simply to demonstrate the principle which the inventors are bringing out. Once this point is proved successfully, the next step will be to build a complete flying machine of 100 horse-power. One of the interesting points about the apparatus is the motor, which is claimed to be a step in advance in the way of gasoline motors for flying machines. It has been specially designed for the purpose by Messrs. Dufaux, and is of the two-cylinder, air-cooled type. One of the views shows the motor along with the different parts of the transmitting mechanism. The motor is of the double-acting type. It has two superposed cylinders having a combustion chamber at each end and one between the two. The three inlet pipes from the carbureter, which is a new one of the constant-level type, can be seen in the cut of the motor, as well as the three separate spark plugs for the ignition. The carbureter is placed at the bottom of the motor on the left. It is especially light, being made of aluminium and copper. The high-tension ignition current is produced by a single Dufaux induction coil with vibrator. This current is commutated to the different spark plugs. On the right is a fan with vanes made of wood frames covered with silk. It is driven from the motor shaft above, and has a good effect in cooling the cylinders. The gasoline reservoir is formed of two aluminium caps which are soldered together.

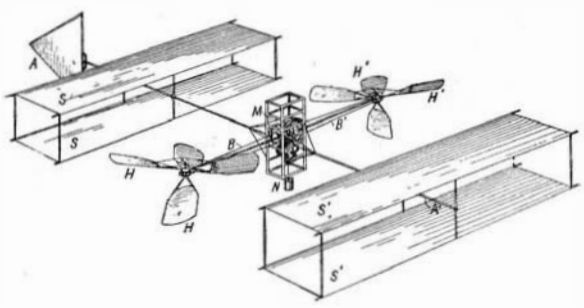
One of the main ideas has been to make the motor as light as possible, and most of the different parts, such as the valves, rods, and shafts, are made hollow. In this way the inventors have succeeded in building a motor which weighs only 4.5 kilogrammes (10.1 pounds) for an output of 3 1-10 horse-power at 1,500 revolutions per minute. The weight given above includes the carbureter, gasoline tank, piping, flywheel, and all the working parts, and is quite a remarkable result in the way of a light gasoline motor, as it means a weight per horse-power of only 3.3 pounds.

A speed of 250 revolutions per minute is usually given to the propellers. Each one weighs 450 grammes (1.01 pound). The method of constructing them is claimed to be one of the best which has yet been found for securing lightness and rigidity. The frames are made of thin strips of pine wood assembled together and fastened to the silk by gluing. The curvature and pitch of the propellers were modified after different experiments until the inventors reached the best results as to power, combined with a good equilibrium.



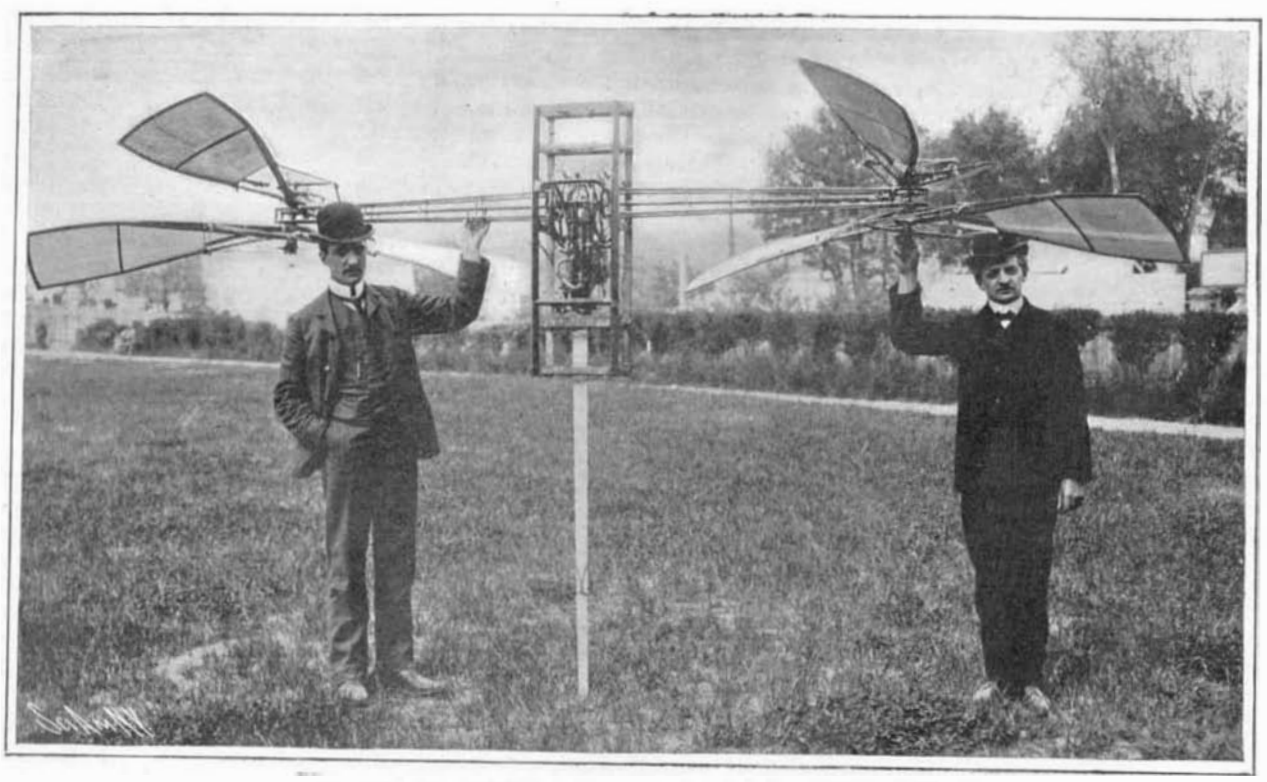
The Motor of the Dufaux Flying Machine.

The tests of the new apparatus were made at the large balloon shed of the Aero Club, in the suburbs of Paris. An endless cable was mounted so as to run upon four bicycle wheels, two in the ceiling and two upon a beam on the ground, thus forming a quadrilateral of which the longest side was some 35 feet high, and formed a guide for the rise of the machine. The latter was attached loosely to the cable by the framework containing the motor. As soon as the motor was started up, the machine rose by the force of the propellers and mounted in a vertical and well-balanced flight up to the roof of the shed, which was as far as it could go, as it was retained by a trail-rope. In the open air, there is no doubt that it would have risen to a considerable height. This experiment was made several times, with equal success. Many experienced aeronauts, and especially those who are interested in the aeroplane method, were present, and they were greatly impressed with the way the new machine acted. As at present constructed, the apparatus is only one part of a complete flying machine and will be used for the lifting movement. Afterward the inventors are to add an aeroplane which will provide for the horizontal movement. Messrs. Dufaux are now engaged in building a complete aviator on the same lines, but this is to be a large machine and will carry an aeronaut. It is to have a motor of 100 horse-power.



Arrangement of Planes and Driving Mechanism of the Dufaux Flying Machine.

The aviation committee of the Aero Club consider that the Dufaux machine is a great step in advance in the question of flying machines of the aeroplane type. This is owing to the excellent performance of the apparatus and its good balance in the air, a point which is very difficult to obtain with a motor-driven flier, and one in which very few inventors have been able to accomplish anything up to the present. The second point is the question of lightness of the machine compared with the motive power, or how much weight it can lift outside of the dead weight of the apparatus. This is an essential point in the matter of aviators, and one which it is not easy to solve. It is considered that the present experiments go a great way toward a solution of this problem for motor-driven aeroplanes, seeing that we now have an apparatus of great lifting power compared with its weight, and no doubt Messrs. Dufaux will soon succeed in building an apparatus which will lift an aeronaut by means of its propellers.



THE DUFAUX BROTHERS AND THEIR NOVEL FLYING MACHINE.
This view shows the motor and the four two-bladed propellers. The aeroplanes were added subsequently.

Effect of Cold on Cellular Life.

In a paper recently presented to the Académie des Sciences, M. Paul Becquerel describes some experiments relating to the action of extreme cold upon cell-life. It has been maintained by different scientists that grain or seeds when cooled down as low as —40 to —250 deg. C. by liquid gases have their vital phenomena entirely suspended. The living matter can be thus preserved as long as it remains at these low temperatures and keeps its vital property, being again restored as soon as it comes back to the normal state. Such an opinion seems to be in contradiction with the ideas which biologists hold as to the continuation of vital phenomena. Accordingly, M. Becquerel was led to make the following experiments in order to throw some light upon the question. The seeds or grain were divided into four series. The first series includes natural dried grain, such as wheat, corn, peas, beans, etc. In the second lot the grains are naturally dried, but are decorticated, including rice, corn, peas, gourd seed, etc. The third lot is dried *in vacuo* over caustic baryta until no more water is given off, while the samples of the fourth lot were swelled up in water for 12 hours. All the specimens were cooled in liquid air for 130 hours, then they were taken out and one part was planted in earth, while the second part was reserved for examination. After a few days, M. Becquerel made the following observation: As to the first lot, some of them grew as usual, while others did not succeed as well. The grains which contained a great deal of water had all been frozen. Of the second lot, which had been decorticated, only three succeeded in growing. All the dried grains of the third lot were found to grow, while the process of swelling in water seemed to be fatal, and the grains were killed. He examined some of the grains which had been killed and finds that this is due either to sudden variations of gas pressure in the tissues or else to the freezing of the contents of the cells. Some of the grains show cracks, which indicates a gas pressure. This is noticed in the case of the gourd and the castor bean. But he also observed the freezing of the cells and found all the phenomena which indicate a gas by Matruchot and Mollard. He concludes that the resistance of the grain to the action of cold depends on the amount of water and gases which it contains. The cold may disorganize the

protoplasm and make all return to life impossible, but if the protoplasm has already reached its maximum concentration by drying, and consequently its minimum of action, it escapes the action of the cold and does not freeze, thus retaining the germinating principle. The above experiments seem to show, at least as far as they have gone, that the argument in favor of a suspension of life in the grain will not hold.

INTERESTING REPAIR WORK ON A GERMAN STEAMSHIP.

BY DR. ALFRED GRADENWITZ.

A highly interesting repair work on the aluminothermic process was recently carried out at the Bremerhaven imperial docks. The steamship "Friedrich der Grosse," of the North German Lloyd, the sternpost of which had to be repaired, had lost one of her propeller blades on sailing home from Australia to Bremen. As a consequence of the resulting inequality in the working of the propeller, the Siemens-Martin steel propeller shaft bracket had been broken.

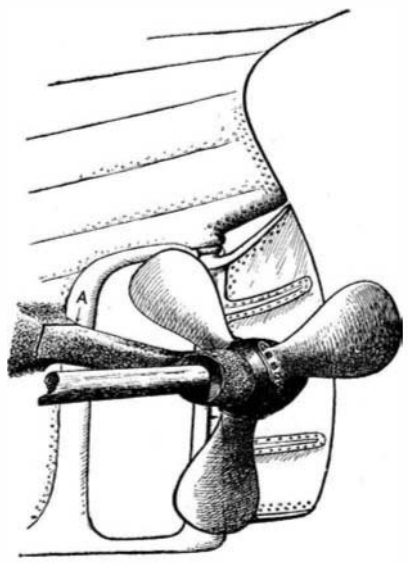
The position of the fracture will be seen from the diagram. In order to obtain access to this point during the welding operation, the plating of the hull had first to be removed to the necessary extent, after which the fracture was widened by 30 mm. (0.12 in.) to make room for the intermediary thermite iron casting. In order to avoid any displacement of the propeller shaft bracket during the operation, it was maintained in the proper position by heavy steel struts and chains.

The mold used is seen in one of the views. As horizontal displacements of the molding box had to be provided for, it was placed on a small sliding way. In order to avoid any leakage of the thermite iron, due to a defective tightness of the mold, the latter was surrounded by an external casing, the intermediary space being tamped in strongly with sand. Besides the admission funnel and the ascension funnel, the mold was provided with a third opening, through which any ashes penetrating into the mold could be blown out. This opening had obviously to be closed entirely before the casting was commenced. A dry sand core was introduced to this effect, the aperture in the walls of the molding box being fitted with a blind flange.

During this preparatory operation, a preheating furnace of sufficient size was erected, and an electrically-driven fan (a so-called sirocco blast) was placed in position. The fire gases for preheating the fracture were allowed to enter through the ascension funnel and to issue through the admission funnel and the aperture just referred to.

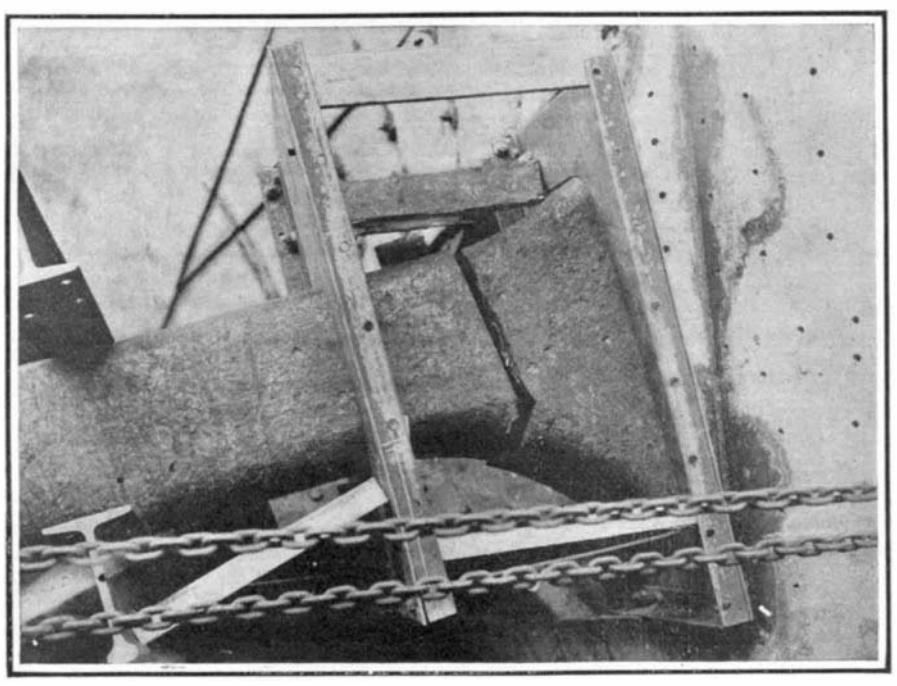
The crucible was surrounded by another sheet-metal jacket, the intermediary space between this and the crucible being filled in with moist sand, thus avoiding the risk of the mold being burned through or the thermite iron escaping. After four hours' preheating the furnace was removed and the crucible placed in position, being held in a ring attached to the ship. A casing, lined with chamotte, was provided, to receive any escaping slags, and the crucible was filled with 350 kilogrammes of thermite, 75 kilogrammes of small shot, and 3½ kilogrammes of powdered manganese, and the mixture was ignited.

The ensuing reaction was quite normal, as expected; and for a full description of this welding process reference is made to articles published in the SUPPLEMENT of January 5, 1901, and September 26, 1903. In this process the mixture of metallic oxide and pulverized aluminium in the crucible was ignited, and the temperature of reaction of about 3,000 degrees reduced the oxide and gave a pure metal, which welded the fracture. About 50 kilos (110 lbs.) thermite was filled in gradually after the casting into the ascension funnel. On the next morning the mold was struck off, when the surrounding thermite iron casting was found to be free from any defects, while the ascension funnel struck off the mold showed a fracture surface of perfect density.

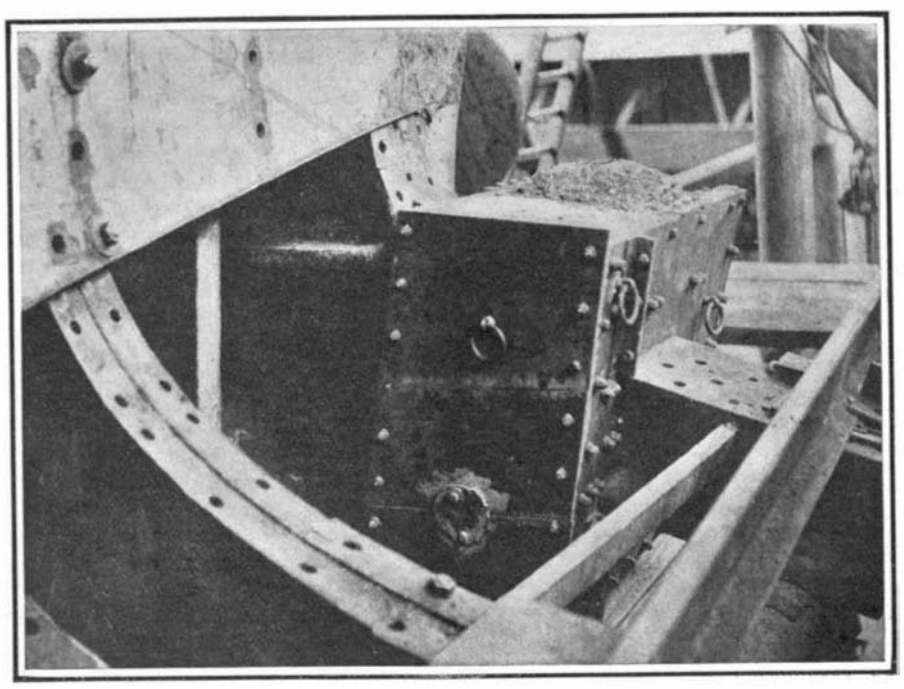


Where the Break Occurred.

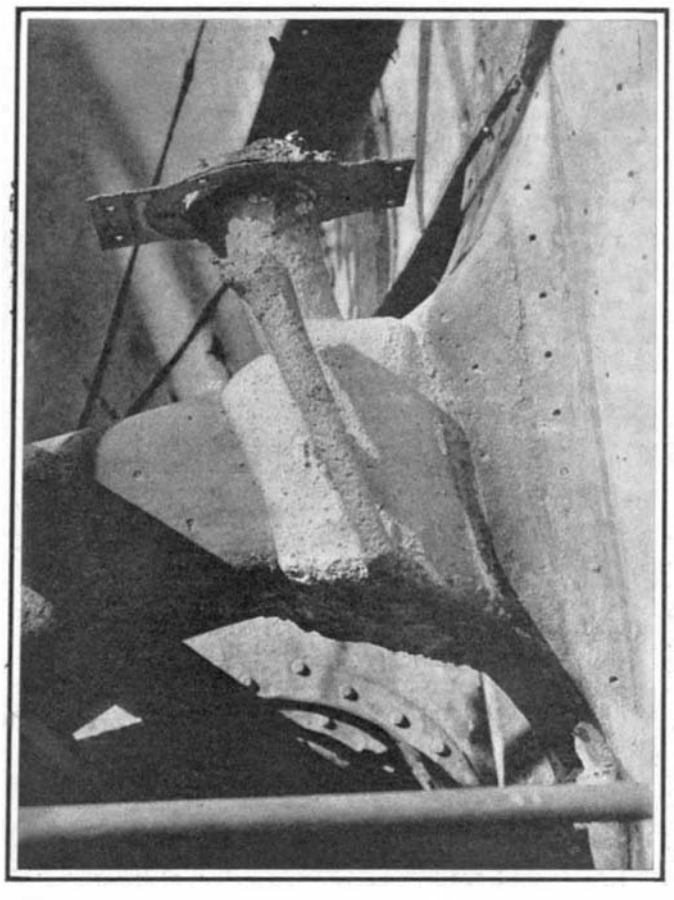
By using the thermite process in connection with this repair work, the North German Lloyd was enabled to place the ship in commission again after a relatively short time, whereas an interval of some months would have been required to prepare a new propeller bracket and to fit it ready for operation.



Sternpost of the "Friedrich der Grosse" Before Welding. The Fracture Has Been Widened 1.18 Inches. The Molding Box is Half Completed.



The Mold Attached to the Fractured Post.



Welded Fracture, Showing Iron Cast Around the Break. The Admission and Ascension Funnels Have Been Left in Position.

Care of Hair and Scalp.

One of the most sensible articles on what the "tonsorial artist" calls the "hirsute adornment" of man has appeared in the American Physician and is from the pen of Dr. George W. Spencer. The doctor says:

"With our environments the question of cleaning the hair and scalp is one of great importance.

"Women have an excellent method of washing the hair; this is made necessary by the fact that its length and thickness do not permit of a rough and unsystematic rubbing and scrubbing.

"On the other hand, boys and men think they have to have their scalps and hair scrubbed with soap and water and then dried by violently rubbing with a rough towel, or submitted to a most wonderfully beneficial preparation, called a shampoo, which leaves the scalp in a tender and congested condition favorable for infection and sensitive atmospheric changes.

"The cleaning of the scalp should be very carefully and tenderly performed, using warm water with a mild soap, rubbing in gently and with the ends of the fingers, then rinsing with tepid water and drying by gently pressing the hair and scalp with a very dry towel, continuing until thoroughly dry; or, still better, dry it by fanning. If any application is necessary to bring hair thus dried into shape, dampen with a bichloride of mercury solution 1-2,000.

"Ordinarily this thorough cleaning need not be done oftener than once a week and in the interim the hair needs only to be brushed with a soft brush without allowing the brush to scratch the scalp.

"The stiff brush, and especially that most injurious of all brushes, the military brush, which is frequently used for months several times daily until it becomes filled with dirt, can only be of great injury to the scalp, because of the vigorous scratching, as well as breaking the hair. All brushes should be destroyed and only blunt-toothed combs used to dress the hair, and these should be thoroughly cleaned after each using; and no two persons should ever use the same comb.

"The practice of barbers is a fruitful cause of diseased scalps. They use the same brush for all customers; before combing or brushing the hair, they rub the scalp violently with the ends of the fingers, thus rubbing out other than the hair that, physiologically, is being shed all the time; by this rough usage they injure the scalp and aggravate any pathological condition that may exist, however slight.

"Much injury is done by the use of lotions and dressings for the hair. It would be impossible to mention the many articles used for this purpose. The mixture called 'bay rum' is one of the most common and injurious of those used. Oils of different kinds, highly perfumed (to cover their nastiness) were at one time extensively used, but are now, fortunately, falling into disuse. Normal hair has all the oil needed; the addition of some doubtful article will result in decomposition and consequently be poisonous. Even when the scalp is affected with that most common and little noticed disease, dandruff, the above instructions apply to the care of the scalp. The only lotion that need be used is pure water, unless some disturbance is indicated by slight itching, then a bichlor-