LIQUID AIR AND ITS USES.

THE EXPERIMENTS NOW BEING MADE BY OSCAR P. OSTERGREN.

He Is the Engineer Who Designed the Swift Launch Ellide and the Torpedo Boat Bailey—Now He Is Making Liquid Air and Has High Hope of Its Possibilities in Many Fields of Usefulness.

If Engineer Oscar P. Ostergren succeeds as well in his latest endeavor as he has in his earlier work since he came to this country, there will soon be a plant running in this city which will make liquid air so rapidly that it will gush from the outlet pipe of the machine as mountain streams gush from clefts in the native rock. In two runs, preliminary to a regular time trial, the liquid air has been made at the rate of 1,500 gallons a day, and upon the occasion of the first trial it was demonstrated that it was possible with the same machine to reduce the temperature of the liquefied air to about 400° below zero and to freeze it into snow. That result was disastrous, however, for it clogged the machine in such a way as to restrict the circulation of air within it, bursting that part of the machine in which the air was frozen and destroying it.

Mr. Ostergren's successes in other directions have been notable, and, as he is still a young man, there is good reason not only to believe that he will bring liquid air into commercial use for many purposes, but that he may add in other ways to the remarkable inventions which have made this the most wonderful age of the world. He came to this country from Sweden seven or eight years ago, and is now about 33 years old. The first work that showed his exceptional ability was the designing of the steam launch Ellide, which made a world's record when she was sent out for a preliminary trial trip on June 18, 1897, running a measured mile at the rate of 30⅞ miles an hour, and this speed she is said to have exceeded by three miles an hour upon her later trials.

Almost up to the time of the first trial of the Ellide the best speed that had been obtained on the water was about 30 miles an hour, and few persons were sanguine enough to expect materially higher speed except by gradual advances. But in the spring of 1897 the world learned of the wonderful performances of the 100-foot long, steam turbine driven boat Turbinia, built by Charles Parsons of Great Britain. Even after it was known that she had obtained a speed of 37¾ miles an hour, it was not expected that any boat driven by the older type of engines could reach any such speed. Suddenly, however, the Ellide made her appearance, and, with a length on the water line of only 80 feet, she soon passed the record. Since that time one other boat, the Hai Lung, a torpedo-boat destroyer, built by the Schichau works at Elbing, Germany, for the Chinese Navy, has exceeded the speed of the Ellide, making at the rate of 35.2 knots, or 40.8 miles, an hour, but she is the only one, although there are a number now building which are intended to do even better.

When E. Burgess Warren of Philadelphia gave the order to Charles H. Mosher for the Ellide it was with a proviso that made the designing of the little vessel a most interesting problem in naval engineering. Mr. Warren had spent considerable time fishing on Lake George and had become annoyed at having a large number of other persons run past him in launches faster than his own. He determined to have something which could show its heels to any other craft. Mr. Mosher had already won a reputation for fast launches, and Mr. Warren went to him for the new boat. The Feiseen was Mr. Mosher's fastest production before the Ellide came out, and she was credited with a speed of 30 miles an hour. After talking over what Mr. Warren wanted, it was decided that his craft should be about 75 or 80 feet long and as fast as Mr. Mosher could make her, with a guarantee that she should make at least 30 miles an hour. For this the contract price was $30,000, and Mr. Mosher was to get $1,000 premium for each mile of speed which she developed beyond 30 miles an hour. This was the form in which the problem came into the hands of Mr. Ostergren, who was at that time in Mr. Mosher's employ as engineer and designer. So far as general design of hull was concerned, there was not much to be done except to adopt the lines already marked out, which are accepted to-day as the best, as they were then.

A hull 80 feet long on the water line and 8 feet 4 inches in beam was decided upon, and then came the problem of getting everything down to the lightest possible weight and combining with this the greatest possible driving power in boiler and engines. Speed, with other conditions equal, depends upon driving power, and the amount of this power to each ton of weight carried increases with great rapidity as the speed is increased. If it takes 100 horse power to drive a certain boat ten miles an hour, it will take 800 horse power to double the speed. When the Ellide was finally ready she weighed, complete, only sixteen tons, and in strict measurement she got down to fourteen tons, and her boilers and engines could develop 800 horse power, or more than 50 horse power to the ton of displacement. Her boilers and engines weighed only twenty-five pounds to the horse power, and the whole boat in being trim only thirty-five pounds to the horse power.

While Mr. Ostergren was with Mr. Mosher he designed another boat, which, he says, he has never yet heard of in performance, but which was intended greatly to exceed the Ellide both in speed and comparative lightness. This boat was for Francis P. Magoun of this city, and was to be only 40 feet long, while intended to attain a speed of between 40 and 50 miles an hour. The entire boat was to weigh two tons and was to have 400 horse power, and ready for service would weigh only three tons, or fifteen pounds per horse power. She was to carry steam at 600 pounds pressure to the square inch, and to use this through a quadruple expansion engine, which was so delicately designed that it would weigh only two pounds per horse power. Ordinary yacht engines weigh about fifteen pounds per horse power, and those for big steamers weigh double that. Mr. Ostergren says that this boat would have been three pounds to the horse power lighter than Maxim's flying machine. After Mr. Ostergren left Mr. Mosher's employment he designed the United States torpedo-boat destroyer Bailey for Charles Sonbury & Co. The Bailey is 208 feet long, 19 feet beam, and of 245 tons displacement, and is intended to attain a speed of 32 knots. She has 6000 horse power. Mr. Ostergren says that the Bailey is novel in design throughout, being the first of the United States torpedo boats or destroyers not built after European designs.

Mr. Ostergren declares that the limit of speed for vessels driven by steam has been nearly reached, but that he expects to see vessels driven in other ways built before many years to make sixty miles an hour, and that he hopes to take up that problem himself before long. Future progress, he says, lies in the use of liquid fuels. If gasoline were burned under a boiler it would give double the steam-making result, pound for pound, that coal does, but that would only be a step in the right direction.

"I would do away with steam engines and steam boilers altogether," he said, "and in their place use valve engines burning liquid fuel. The amount of weight saved would not only be that of the boilers and water, but also that got by doing away with the auxiliary engines of the steam engine, which weigh ordinarily as much as the main engines. I would use three or more shafts revolving at high speed, and upon each of these would be a cluster of small propellers instead of one large screw. Then instead of one large engine to drive each shaft I would divide the power production into small units, extending these small engines for a long distance within the ship, by doing this the vibrations would be broken up by the mutual interference of their waves, and I think it would be possible to get power enough to drive a boat at the rate of sixty miles an hour across the ocean."

A proper hull for a sixty-mile ship, he said, would in theory have to be about thirty times as long as she is wide, but this would be out of the question. He thinks it might be possible to modify the present ten to one proportions for express steamers so that a length of fifteen or sixteen to one in breadth could be obtained. Such boats would carry only a limited number of first-class passengers and mail or express matter. Mr. Ostergren says that he has been greatly misquoted as regards the possibilities of liquid air for commercial uses. "Our plant," he said, "is not intended for any direct commercial purpose. It is being built in order to demonstrate the possibility of producing liquid air in great quantities at a low cost, to enable us to arrive with certainty at its cost and then—through having at hand large quantities of liquid air—to learn how it can be best handled and perhaps to develop uses for it if such can be found."

At present Mr. Ostergren figures that a gallon of liquid air can be made with the expenditure of 2½ horse power hours and that a fair price at which it may be retailed would be 10 cents a gallon. That it can be used for cooling and refrigerating purposes there is no question, but Mr. Ostergren says that for producing temperatures from zero up its use would not be nearly so economical as the use of ordinary refrigerating apparatus. Still, there are places, such as fruit storage houses, where its higher cost might be more than offset by its purity and dryness, and Mr. Ostergren believes it could be used to great advantage for ice-cream freezing and also by undertakers. For cooling houses, too, it may have a use. According to Mr. Ostergren's figures a gallon of liquid air at 312° below zero will expand to 800 times that bulk or to about 100 cubic feet in the gaseous form, and still be at the same temperature. It would then be capable of cooling thirty-seven times its own bulk of other air 10°, from 70° to 60°. He is now making a cooling fan for a room which will have a reservoir for liquid air and be driven by the air as it escapes. Mr. Ostergren suggests that it would be possible to supply cool air for the household by connecting such a fan with the ordinary hot air pipes of a house and having it drive cold air into the rooms through the radiators, or that special pipes could be built into houses for this purpose.

The fact, however, that by reducing air either to the liquid point or near that makes it possible to separate it mechanically into its constituent gases opens a field which to Mr. Ostergren's mind is fully as important as that laid open by the making of liquid air. Air consists of about three parts of nitrogen to one of oxygen, and at ordinary temperatures the specific gravity of both is so nearly the same that they remain intimately mixed. But when their temperature is brought down to about the liquefying point the difference becomes perceptible, and Mr. Ostergren says that it is possible to separate them by gravity in a centrifugal machine, as cream is separated from milk, or the oxygen can be liquefied, leaving the nitrogen free. If pure oxygen can be produced at a low cost there are many uses already known for it in the arts and many others would develop. It can be used to refine sugar, to turn wool fat and other foul greases into valuable oils and to purify sewage. It is the pure oxygen which can also be used in connection with carbon or a hydrocarbon, such as alcohol, to take the place of gunpowder as an explosive for guns or shells.

Mr. Ostergren has already applied for patents for a gun and shell, in which alcohol or charcoal and liquid oxygen are to be used for the charges. In the gun alcohol would be used because it makes no smoke, while in the shell charcoal would do, for the more smoke made about the enemy's position the better. By this system a plant in a fort or aboard ship would produce the liquid oxygen as it is needed, and pipes would take the charge of oxygen and alcohol to the breech of the gun. The turning of two cocks would charge the gun after the shell was inserted, while the loading of the shells would be equally easy.

Another idea which Mr. Ostergren is developing is the use of liquid air as a means to facilitate the long-distance transmission of electric currents. The great bugbear to-day in distributing electric power is the resistance of the conductors, which either requires the use of extremely high voltages, which have again to be reduced for use, or the use of great quantities of expensive metal in the conductors. It is a well-known fact that pure metals, at the temperature of liquid air, have almost no electrical resistance. Mr. Ostergren has designs for an electric conductor, which shall be kept at this low temperature by liquid air under conditions which he believes would be both practical and economical. Such a conductor, he thinks, would enable a current to be transmitted as readily from Niagara Falls to this city as from the Falls to Buffalo.

"These," said Mr. Ostergren, "are but suggestions as to the possible uses of liquid air and the other products of the liquefying process. Other uses may be developed and they may not. The thing of value which we are doing now is to make the liquid. After that hundreds of persons will come forward to develop the uses for it. It is possible, also, that the free nitrogen, after it is separated from the oxygen of the air, may be used to produce ammonia. If this were accomplished it would solve another of the great problems of the world toward food production, for the worn-out fields only need ammonia to make them all bloom again and become productive."

SHAVE OR TRAGEDY?

Some Uncertainties About the Sole Barber Doing Business at Apia.

Considering its remoteness and insignificance, Apia has a respectable population of men who have been in New York. Their recollections range even as the men vary. The manager of the German firm has a brother in this city. The doctor of the same commercial enterprise used to come to Hoboken a score of years ago as surgeon on a North German Lloyd liner, and from Hoboken he sometimes came to the town over the river. In the remote parts of Savaii is a former tenor of German opera who is no more now than a copra buyer; but he recalls the pleasures of New York. There is a political grocer and impresario of freaks, who brags of his ability to go into any newspaper office in New York and "sit down and write two or three columns for the boys, and they tumble all over themselves to print it." So on down the scale range the recollections on the Apia beach of those who know New York. As interesting as any are the reminiscences of the local barber, who never tires of telling how he always boarded in New York at a very nice place on Cherry street, near Catharine Market. "Perhaps you know where it is, ma'am, for I never could abide that Sailors' Home, where you can't have so much as a glass of beer after a long voyage." His New York horizon seemed bounded by memories of the Five Points and the City Hall and sitting on the pierhead fishing, with always some reference to that glass of beer over which he felt nothing to be taken immediately after a long voyage. It must have been a very long voyage which brought him to Samoa, for he is chronically in search of anything from beer to square-face, thereby impairing his usefulness as a barber.

If one's friends were discovered with beards of two or three days' start there was no need to apologize. The mere statement "That barber's off again" conveyed all the explanation necessary. A generally unshaven appearance in Apia was the signal to keep a watchful eye open for the barber, who might be maudlin or might be noisy, but was always a person to avoid. In these exploits he was always aided and abetted by the harnessmaker, who lived across the street. If one got drunk the other was surely involved in his downfall, and that meant two men making night hideous. Possibly they might have been arrested for intoxication or some sort of breach of the peace, but they were too swift to escape the net. They knew that the police force went off duty at 8 every evening and left the peace of Apia to the care of the lamplighter, who had no power to make arrests and whose highest function was to keep a list of all persons seen on the street by night, which was solemnly read aloud in the police court every morning.

These vagaries of the barber bore less heavily on women than on men. While it would have been very pleasant to have the services of a hairdresser and all that, yet it was possible to wait for the coming of the mail steamer and have really good service while the boat stopped to give the tourists their six hours toward the solution of the Samoan question. But with the men it was different. They might just as well grow beards and be done with it as wait a month between shaves. That threw the men entirely on the local barber, and there seems to have been any number of narrow escapes.

There were several dangerous elements which might be playing themselves singly or in combination when he combinated the business of getting a shave until it was hazardous. The particular elements of danger were the barber's white bull pup, the chance that the barber was drunk, and the liability of the barber to fits. The combination of all three was equivalent to a suspension of business. The sight of the drunken barber having a fit in his back yard with his thumbs rigidly turned into his palms, and with the white pup ready to chew the person who should interfere, was evidence that beards would have to grow for a few days until the barber was himself again. Even the barber recognized that the combination could not be beaten. A mere fit, he said, was nothing. Just sit down and read a paper until he got over it and then you wouldn't lose your turn to be shaved. The dog was the first obstacle. It was common to see the leading citizens and the resident or naval officials halt at the gate to the barber shop and click the latch in order to develop the dog in force. The savage brute lost no time in dashing out with fierce barking and a general rare-beef effect about the mouth and the large section of throat that was in sight. If the barber were in a condition to do business he would sally forth and thrash his canine foe into peace with any convenient razor strop. The terrors of the bull pup and the outdoor fits were to be seen by any passer along the road to Savaiaio. The other perils were encountered only by men, for no woman had ever dared the hardihood to venture on the employment of the barber's skill. The men spoke of it with a thrill as of the successful accomplishment of some dangerous amusement. There was so much uncertainty, they said, that it was exciting. There was the chance that the barber would fall right, or he might be intoxicated, or he might be seized with a fit. The doctor tried to reason it out that there was little or no danger to the man being shaved if the barber should have a fit. The well known symptom of the seizure of the thumb was to be relied on to turn the razor away from the throat. The science of it was perfect, but the explanation would have carried more conviction if the doctor had not worn a beard and left the cutting of his hair to his wife with the clippers. It was the joke of the male population; there was only one accident known, and that was not very grave. In one of the seizures the barber cut a slice out of Tom Meredith's cheek. Old Tom did not mind that, and after the place healed over was just as regular a customer as ever. Old residents became habituated to the vagaries of the barber; it was only the newcomers who were affected by the uncertainty as to whether they were to have their hair cut or their throats cut.

The Squash Bird.

A humorous object seen at a street fruit stand was a specimen of the yellow squash bird suspended by a string from the ridgepole of the awning support, the squash bird being a small, crookenecked yellow squash, hung with the neck bending over and down in front to form the neck of the bird, and with three stray feathers from a feather duster sticking out from the squash at the other end to form the tail.

GETTING THIN BY SYSTEM.

WAYS OF REDUCING ONE'S WEIGHT WITHOUT DISCOMFORT.

No Heroic Sacrifice Is Necessary—A Certain Method Is to Diet Strictly—Substitute for Forbidden Foods—What One Must Avoid to Obtain Complete Success.

The man who went without food for four weeks accomplished his purpose because he lost thirty pounds, and that was what he set out to do. The end may satisfy him so well that he feels no regret at the heroic method he adopted. But it is not likely that even his satisfactory results will lead many persons to follow his example. The reduction of flesh is too easily accomplished now to make it worth while for anybody to adopt such a stringent measure as temporary starvation. The simple means necessary need do no more than inconvenience the person who adopts them. Every day the task is made easier.

One cause for reasonable complaint in the reduction of flesh used to be the necessity of foregoing sugar. A substitute has been found for that, and persons who are able to afford the rather expensive indulgence may now enjoy preserves and other sweets during the progress of the strictest reduction cure. This is made possible by recent formulas which give all the delights of eating sweets with none of the disadvantageous consequences. Even abstinence from bread is no longer absolutely necessary. Substitutes for that have been found, although they must be eaten in moderation, and never take wholly the place of bread. They are a very agreeable alternative for it, particularly when one considers that there are none of the evil results commonly associated with the use of bread. The best of these preparations is a French bread resembling the thin, salted sticks served at the Italian table d'hôte restaurants. But it is never likely to be served there. It is expensive enough to tax the pocket of any but the wealthy. Its lack of any fattening effect is due to the fact that the bread is cooked until all substance that has that power has been cooked out of it. It is extremely palatable to the taste, not unlike the so-called beaten biscuits popular in the South. There are similar English productions that are equally agreeable as a substitute for bread and very much cheaper than the French sticks. These two advantages would not be found without some corresponding drawback. That is the possession of some capacity for causing fat which the more expensive bread lacks completely. Even with this drawback, the English biscuits are not nearly so fattening as ordinary bread.

The two greatest drawbacks to a system of reduction by diet are now removed by the enterprise of the bakers and grocers. Resignation to these substitutes may not be continued. Some persons say that after two weeks the biscuits become unpalatable to them when they are eaten regularly in place of bread, and others are never able to accustom themselves to saccharine in place of sugar. But those must be weak stomachs as well as weak determinations. It is rarely desirable that a reduction cure should continue for more than four weeks. That is no very long period of the abstinence which the treatment compels. To the majority of persons this can be undertaken more readily in the summer, as the interruption of social diversion is not likely to be so frequent at that time. These breaks can vitiate the effect of otherwise conscientious treatment if they happen frequently enough. The alcoholic accompaniment of dinners and weddings, for instance, is one of the things most strictly forbidden. That can do more than anything else to destroy the effects of rigid observance.

The man who has grown too fat too stout for his own looks or convenience from a lack of sufficient exercise, or because he eats too much of the foods that fatten him, can lose twenty pounds in a month by following the rules laid down for him here. It is probable that he will not come back for more if he continued the treatment for another month. But he would be able to get rid of from ten to fifteen pounds without trouble. The first twenty that go leave quickly, for it is they that have value, not the fifteen. Then they melt away under the first discouragement, and the last pounds that stick stubbornly and yield only after the attack has been somewhat prolonged. This was the experience of the burlesque actress who decided to return to the stage and was well enough pleased with her old manager with an important condition in her contract. That committed her to the loss of thirty pounds before the opening of the season. The leisure of retirement had brought her up to 180, an impossible weight in view of her height. She started in with the reduction cure diversified later and got down to 152. Finally, she lost the two which would have given the manager the right to rescind the contract whether he wanted to or not. "It was easy enough," she said, "to get the extra pounds down to his office to report in the autumn, 'getting off the first twenty-eight pounds. But the last two were——' They probably were, but by persistence they went, too.

Few persons who set out to get thinner are even moderately particular about this small difference in weight unless they be prizefighters or burlesque actresses. But all will find that the flesh goes most rapidly at first. Probably one thing that makes this most noticeable is the fact that any reduction shows first in the face. Even persons inclined to be broad and full in the face will show the effects of any reduction there before it can be detected in any other part of the body. It is this which leads women to shun any attempt at reduction, because they think it makes them look old. Loss of much flesh has been lost it may have that effect. Anything that gives an appearance of haggardness naturally would. But any woman too stout for beauty may be assured that she will never show signs of age unless she already has them until a great many pounds have disappeared.

The man who wants to lose thirty pounds at this season of the year will, in nine cases out of ten, be able to do it by following certain rules for about six weeks. The amount of exercise he takes, his physical condition and his size will produce necessary variations in the result. But, generally speaking, it will come out as indicated here. As the things to be avoided are so much less in number than those he is able to eat it is best to eliminate them first. The cardinal principle of his diet should be absolute avoidance of bread, sweets, pastry, cakes, or anything in the making of which flour or starch is utilized. He should as rigorously refuse all forms of sugar, and the vegetables to be selected are peas, beets and potatoes, tempting enough at this season of the year, but easy to dispense with after a few days of self-denial. The sugar in most fruits forms such a small part of them that enjoyment of them seems permissible enough. Strawberries, which are the most delicious, do the most harm, disappear quickly enough, and this year no longer trouble the patient, if he is to be called that, very seriously. All kinds of meat and fish are permissible. Sometimes salmon is excluded, but that is an unnecessary stringency in view of the infrequency with which a person is likely to eat it. Fat does not harm. Cream, unless taken with meals, is not likely to increase weight. Milk is to be avoided. So is water with meals, and the best rule is to avoid drinking it until about half an hour after eating. Then and at other times between meals it can do no harm. Coffee and tea without sugar, but with its acceptable substitute, are permissible. The question of drinking does not end, unluckily, with these simple rules. Beer is an unknown quantity in the diet of the man who wants to lose thirty pounds in a