OXYGEN AT HOME.

BY EMILE GUARINI.

For some years past oxygen has been employed for numerous industrial, medical, and hygienic purposes; but, up to the present, one of the drawbacks to its use has been the cost of the gas in a compressed state, due in great part to the expense of transportation. This difficulty, however, has been recently overcome by the invention, by M. G. F. Joubert, of a solid product styled "oxylith," which disengages absolutely pure oxygen through a simple immersion in water. Every one, therefore, may have at home a supply of latent oxygen, just as the bicyclist and automobilist has a supply of carbide for the manufacture of acetylene.

The boxes of oxylith are even so arranged that they can be directly utilized as gas generators in case of necessity. It suffices to puncture the bottom of the box with a drawing pin, and, after this has been done, to remove the strap that holds the plug, and then to unscrew the latter, and replace it with another provided with a nozzle. The box is then ballasted by means of a weight, and upon the nozzle is placed a rubber tube with which is connected a glass washing bottle provided with a filter of hygroscopic cotton, which completely arrests the water. The box is then submerged in a pail of water, and the disengagement of oxygen begins. Each box furnishes one cubic foot of chemically pure oxygen. In order to further facilitate the immediate and extended use of oxygen, the Société Française pour les Applications de l'Oxygen, which is exploiting the Joubert process, and which owns in the department of Isère a factory utilizing a 10,000-horse-power head of water, and has a capacity of producing 5,000 tons of oxylith a year, has devised a life-saving box (Fig. 1) for the use of physicians, pharmacists, and firemen, and for use in mines, gasworks, blast furnaces, public baths, etc. This box measures 10 x 5.5 x 10 inches and weighs 7 pounds. It contains all the necessary apparatus for the use of oxygen in cases of asphyxia, viz., three boxes of oxylith like those mentioned above, a washing bottle, drawing pins, a ring of lead for ballasting the box, a rubber tube, a plug with glass tubes, a tube for nasal insufflations, a device for effecting rhythmic tractions of the tongue, and a collapsible rubber pail for the submersion of the boxes of oxylith.

Fig. 3.—Large-Sized Oxygen Apparatus.

In addition to the rudimentary apparatus that we have mentioned, the Société, which has a branch house at Paris, is manufacturing gas generators of various types for domestic uses. Figs. 2 and 3 represent the types giving a small, medium, and large discharge. The small discharge generator (Fig. 2) which is entirely of glass, except the upper part, is designed especially for pharmacists and chemists. It may be employed also for rendering the air of apartments wholesome. It consists essentially of a large glass flask with a nickel-plated cap and is capable of producing 2.6 cubic feet of oxygen, without recharging. For charging the apparatus, the metallic upper part is unscrewed and raised in such a way that the central tube and the basket may be removed from the oxygenator. Some oxylith is placed in the basket and the water is renewed if need be. The water that has been used, diluted to one-tenth, constitutes a good wash liquor for domestic purposes.

The apparatus giving a medium discharge (Fig. 2 at the left) differs from the preceding only in size. It is adapted for supplying oxyhydrogen, oxyetheric, and oxyacetylic blowpipes, and for the purification of the atmosphere of large halls. It is of enameled iron plate and produces about 5 cubic feet without being recharged.

The portable apparatus of maximum discharge (Fig. 3 on the right) is adapted for large magic lantern exhibitions. It consists of several parts that screw together and are packed in a small case. The apparatus presents the advantage of being easily carried on a voyage. It produces about six cubic feet without being recharged. It includes two reservoirs, one of them for holding the water, which attacks the oxylith, from above, in a perforated basket.

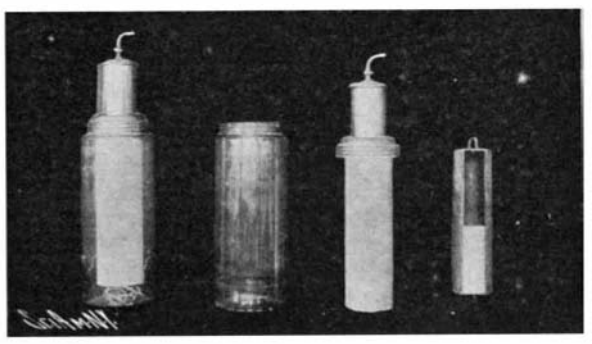


Fig. 2.—Small and Medium-Sized Oxygen Apparatus.

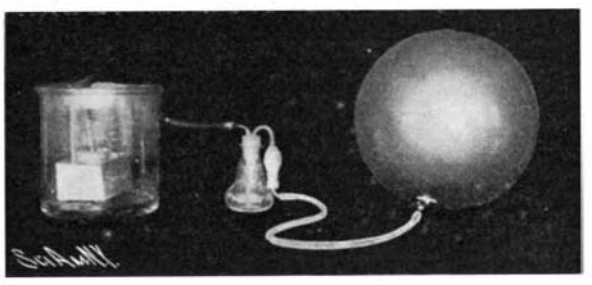


Fig. 4.—Box of Oxylith Used as a Gas Generator.

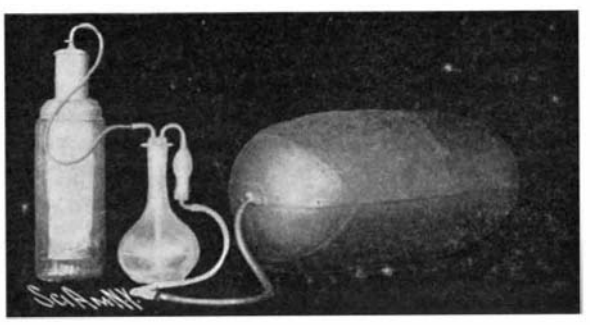


Fig. 5.—Small Apparatus Used as a Gas Generator.

OXYGEN AT HOME.

The oxygen produced in the different manners above described is under a slight pressure. If it is necessary to increase the pressure, it is stored up beforehand in a gas bag. The method of procedure is represented in Figs. 4 and 5. Fig. 4 represents a case in which the box of oxylith is used as a gas generator, and Fig. 5 that in which the gas generator of small discharge is employed. In order to fill the gas bag, the latter is affixed to the tube of the washing bottle and the cock is opened. At the end of ten minutes, the bag will have been filled. After this, the cock is closed and the bag is separated from the apparatus. Its capacity is about a cubic foot. The washing bottle contains nothing but water. It is also interposed as a saturator between the gas bag and the inhaler. If the inhalation is completed by a volatile substance, such as bromoform, terebinthine, thymol, menthol, etc., such substance is poured upon the filter of cotton wadding. As may be seen from what precedes, M. Joubert's discovery has made of oxygen a convenient and cheap agent that is within reach of every one.

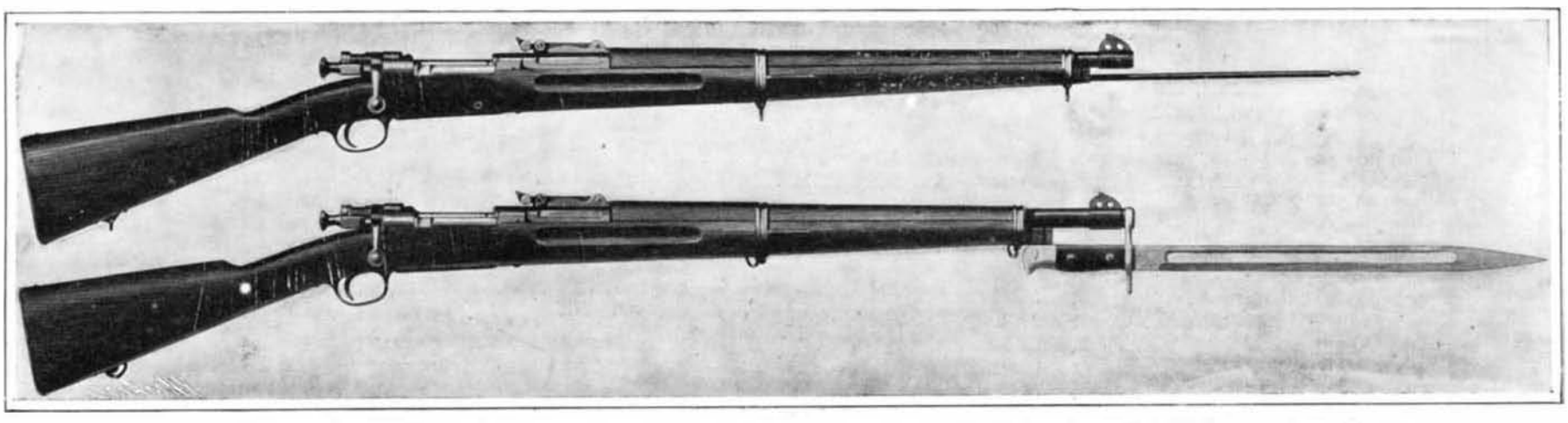
THE RENAISSANCE OF THE BAYONET.

How greatly wide of the mark academic discussions of military matters may lead us, has been well illustrated in the matter of the United States army bayonet. The increased range and great accuracy of the modern rifle, and the good use of it made by the Boer sharpshooters in their late war, had led to the belief that in future wars fighting would be carried out at so great a range that the bayonet would seldom be brought into use. It was considered that the losses by an attacking party would be so great that they could never, or at least very rarely, hope to take intrenchments by storm and turn the enemy out by hand-to-hand fighting. Our own ordnance officers were so much impressed with these supposed facts, that in the new Springfield army rifle, which was being manufactured at the time of the opening of the Russo-Japan war, the bayonet was practically abandoned and a small, round steel rod, about a quarter of an inch in diameter, substituted in its place. The rod was a perfectly useless element in the rifle, being too weak for hand-to-hand fighting—indeed, its existence in the rifle at all must be looked upon as a concession to long-established habit.

The Russo-Japan war has taught us that the bayonet is by no means an obsolete weapon. In the fierce fighting at Port Arthur it was used freely both by day and night. Positions were taken, retaken, taken again, to be retaken once more, and in every case the work was done in hand-to-hand fighting, and with the bayonet. The estimate as to the losses that attacking troops will stand before they break and retreat, has been shown, at least in the case of Japanese troops, to be entirely at fault. An attack that lost twenty-five per cent of its forces was supposed to end in failure; but the Japanese have lost twice and three times that number in the face of a most murderous machine gun and rifle fire, and the remnant has swept on to turn the enemy out of the trenches at the point of the bayonet. The evolution of the United States army rifle, during the past two years, is shown in the accompanying illustrations. The original pattern of the new Springfield army rifle, designed to replace the Krag-Jorgensen, was built with a 30-inch barrel and it was provided with a ¼-inch-diameter round steel rod, which took the place of the ordinary bayonet of sword or triangular shape. This piece had a velocity of 2,300 feet per second, and it fired a 220-grain bullet with a charge of 43.3 grains of powder. In addition to having the highest velocity, it was the lightest of the best-known military rifles. Since the rifle was light and its energy unusually high, with such a heavy charge the recoil was, of course, excessive; and this was one of the objections urged against the new type. The wear on the rifling is also very severe. The ballistics of the piece, however, are exceptionally fine, its maximum ordinate for a 1,000-foot range being only 20.6 feet, as against 25.8 feet for the Krag-Jorgensen.

Fig. 1.—Portable Oxygen Apparatus.

Five thousand of the Springfield rifles with the 30-inch barrel were ordered for trial in the field; but while these were under construction, the Ordnance Board decided to design one that could be issued to both branches of the service, cavalry and infantry. Accordingly they cut off 6 inches from the barrel, reducing it to 24 inches, or 2 inches longer than the cavalry carbine. They carried the hand protection from the middle band, at which it stopped in the 30-inch barrel type, up to the second band, thus practically covering the whole barrel. This piece also had the



The New Springfield Army Rifle, Showing the Discarded Rod Bayonet and the Formidable Sword Bayonet Which Has Been Adopted.

THE RENAISSANCE OF THE BAYONET.

rod bayonet, which was carried permanently below the barrel in the position occupied by an ordinary ramrod in the old muzzle-loading musket. The rod, it should be mentioned, was provided with a catch, which enabled it to be drawn forward until several inches of it projected beyond the muzzle for use as a bayonet.

The five thousand 30-inch barrel rifles were never issued except for purposes of test. The manufacture of the 24-inch barrel type was commenced, and over one hundred thousand were made, and were to have been issued on the first of January, 1905. But the reports received from our army officers detailed to observe the Russo-Japanese war spoke so favorably of the good work done by the bayonet that a committee was appointed to consider the whole question, with the result that the type of sword bayonet shown in our illustration was adopted. The bayonet which has finally been adopted, is 16 inches in length. This adds to the total length of the gun, from butt to point of bayonet, the 6 inches which were lost when the barrel was reduced from 30 to 24 inches in length. The bayonet is made of a quality of steel which will take and hold a fine edge, and it is supposed to be kept sharp at all times. The front of the blade is sharpened throughout its entire length, and the back is sharpened to a length of 5 inches from the point of the blade. There can be no denying that the general appearance of the gun is greatly improved, to say nothing of the great increase in its efficiency by the substitution of the sword bayonet for the old ramrod type.

START OF THE OCEAN RACE.

The positions of the yachts soon after the start of the 3,000-mile ocean race for the Kaiser's cup, which took place under gloomy skies and in a raw and chilling east wind, seemed to the eye of many of the yachtsmen who witnessed it to be prophetic of their position at the finish. There was a light head wind and a decidedly lumpy sea, which served at once to demonstrate the relative ability of the contesting yachts under two very material and important conditions; for while the wind was about the worst possible for the square-rigged vessels, it showed the fore-and-aft yachts to their best advantage; whereas the short, steep seas, which did not bother the big fellows, were particularly trying to the smaller craft, and especially to such as carry the spoon-shaped bow that has become so fashionable in late years. The starting line at the Sandy Hook lightship was laid so that the yachts had to go over on the port tack. At the preparatory gun the schooners and the one yawl entered in the race were grouped conveniently near to the line, with the big "Valhalla" a quarter of a mile to the northeast, and "Sunbeam," "Fleur-de-Lys," and "Apache" yet further away, the last-named having fully a mile and a half to cover before she crossed. "Valhalla" and "Utowana" went over on the wrong side of the committee boat and, of course, were recalled, and the big ship had to pay the penalty of losing something like three-quarters of an hour in the light air before she finally got across between the lightship and the committee boat.

There was but little of the preliminary maneuvering which is one of the interesting features of an "America" cup race, the skippers evidently realizing that in a 3,000-mile race, which might last anywhere from fourteen to twenty-one days, or even longer, the mere question of weather position at starting was not worth consideration. The first to cross the line was the "Ailsa" at 12.15, and close at her heels, but to leeward, was the schooner "Hildegarde." Half a minute behind was the stately three-masted schooner "Atlantic." A minute later came the record-holding schooner "Endymion," and half a minute behind her was the schooner "Hamburg," on which the hopes of Germany are centered. The "Thistle" crossed about three minutes behind the "Ailsa," and these five boats formed a division by themselves. The little "Fleur-de-Lys," which essayed to sail from Sandy Hook to the starting line, was nine minutes behind the "Thistle." Five minutes later the veteran "Sunbeam" made a charming marine picture, as she swept over the line, and three minutes astern of her came that handsome bark, "Apache." "Utowana" and "Valhalla," which would have crossed close at the heels of the schooners had they been on the proper side of the committee boat, did not get across until twenty to thirty minues later, the "Utowana" going over the line at 12:55 or forty minutes behind the "Ailsa;" and the "Valhalla," which went into irons in returning for a true start, did not get across until five minutes past one.

The "Ailsa," with a new racing mast several feet longer than her old mast, evidently was wearing her old mainsail, for there looked to be six or eight feet between the jaws of the gaff and the hounds. She spread a jib-headed jigger, and her small jib-headed topsail wanted many feet of reaching her topsail halyard block. Altogether, she looked to have a very snug spread of sail for the trip, and should she be caught in a blow, by using her long gaff at the foot of a storm trysail, and a storm jib, she should be able to take the worst that comes her way. She pointed high and slipped along very sweetly, pulling out rapidly ahead of "Hildegarde." But the big "Atlantic," carrying what is practically her full racing rig, was just astern, and closing up steadily on the leaders, she quickly passed to windward of the "Hildegarde," drew through the lee of "Ailsa," and footing surprisingly fast in the light air, and looking fully as high as the yawl, she began to demonstrate that her reputation for fast work to windward was well earned. A few cables' length astern of these three were the "Endymion" and "Hamburg," and there was much speculation as to how the Watson schooner, probably the best boat of any kind the late designer ever turned out, would do against the well-tried ocean racer. The question was not long in doubt, for in spite of her greatly reduced rig, the long, lean craft, rising and falling to the seas with an easy rhythmical motion that won the hearts of the yachtsmen on the accompanying tugboats, caught and quickly passed the "Endymion" and began rapidly to cut down the lead of the "Ailsa." She seemed to be making even easier work of it in the short seas than was the "Atlantic." She pointed as high, and at times seemed to hug the wind even closer, and she warranted the statement, recently made to the writer by Mr. Gardner, the designer of the "Atlantic," that the Watson boat was the "Atlantic's" most dangerous competitor. The New York Yacht Club tugboat, from which we watched this most interesting start, followed the yachts until they had made about fifteen knots on their first leg. The tug finally steamed up abreast of the leader, the band playing the national anthem, and wished her godspeed on her long passage. She then dropped back to the "Atlantic's" German rival, and the "Hamburg" was bid adieu to the strains of the German national anthem. As the yachts vanished in the mist, it was seen that "Atlantic" was in the lead by about a quarter of a mile, and that "Hamburg" not only seemed to be just about holding her own, but was pointing higher. A steam yacht which followed the "Atlantic" all night reported that at 7:45 the "Hamburg" was leading and one mile to windward of "Atlantic." A few cable lengths astern of "Hamburg" was "Ailsa," with "Hildegarde" footing about as fast as the yawl, but far to leeward. "Thistle," whose owner is largely responsible for the revival of interest in ocean racing, did not seem to be doing so well to windward in the light air and choppy seas. Her turn, however, will come when the wind freshens and sheets can be started in a reaching breeze. "Endymion" was the first of the yachts to break tacks, which she did soon after being passed by "Hamburg," being soon lost to sight in the haze over toward the Long Island shore. The little "Fleur-de-Lys," which carries the only lady in the race, the daughter of the owner of the yacht, was holding up so high, and footing so well, and withal taking the sea so comfortably, as to augur well for her ocean passage. The New York Yacht Club boat picked up every one of the racers in turn, treated them to some national air, three hearty cheers, and a hearty godspeed. "Sunbeam," "Apache," and "Valhalla," hugging the light air as closely as their sharply-braced yards would allow, but heading nevertheless for the South African coast, were the last to be spoken, and as the strains of "Rule Britannia" were wafted over to the stately "Valhalla," she vanished in the mist, the last at the start, but not by any means necessarily to be the last at the finish of this splendid ocean contest.

The Current Supplement.

The English correspondent of the Scientific American concludes his interesting discussion of the Hydraulic Power Works on the River Glommen, Norway, in the current Supplement, No. 1534. Excellent illustrations accompany this last installment. Fifteen years ago many engineers looked askance on the use of concrete. Nowadays there is hardly a structure which does not depend in some way upon the use of concrete, or concrete reinforced by steel. An excellent article on the wide use of reinforced concrete will, therefore, be read with considerable interest. Mr. Dugald Clerk's recent course of lectures on the gas engine is abstracted. Lead pencils we use every day are described and illustrated. Karl F. Kellerman writes on copper as an algicide and disinfectant in water supplies. The limits of sensibility of odors and emanations is discussed by M. Berthelot. Frederick V. Coville writes interestingly on desert plants as a source of drinking water. The printing telegraph invented by John C. Barclay of New York, and experimented with successfully last December, is fully described.

The steamship "Terra Nova" has been dispatched from London to relieve Anthony Fiala, head of the Ziegler North Pole Expedition. She will go to Franz Josef Land in search of the expedition headed by Mr. Anthony Fiala of Brooklyn, N. Y., on board the steamship "America," fitted out by Mr. William Ziegler, of New York, to attempt to reach the North Pole by way of Franz Josef Land.

The "Terra Nova" is coaled and provisioned for eighteen months. Drs. Samuel Jackson and Frederick M. Mount are among those on board. The crew are mostly Scandinavians.

Electrical Notes.

Continuous Current of Seventy Thousand Volts.—French electricians have prided themselves on attaining a voltage of 60,000 volts in alternating current for industrial establishments. Now, it seems that M. Renethury has attained 70,000 volts in continuous current. Three dynamos coupled in series give under this voltage a power of 70 kilowatts, the current having an intensity of 1 ampere. The difficulty he encountered in avoiding sparks, owing to the difference of potential, 500 volts, between two segments of the commutator, was overcome after various experiments and trials by placing a condenser after each segment. Many experiments were also conducted for determining the most advantageous insulator. This is not M. Renethury's only feat. He originated the hydro-electric installation of Lausanne, in which 5,000 horsepower is transmitted under the tension of 25,000 volts in continuous current.

The state railroads of Prussia are to use De Laval steam turbines combined with dynamos for lighting a certain number of express trains. The turbine and dynamo are built together in a compact group, which is then mounted upon the locomotive boiler. The turbine is said to give 20 horse-power and run at 20,000 revolutions per minute. The dynamo which is used here will furnish 180 amperes at 68 to 90 volts. Each car of the train is provided with a battery of 32 storage cells. The incandescent lamps used for lighting the train will run at 48 volts. The difference in voltage is absorbed by an iron wire resistance on the same principle as the resistance used in a Nernst lamp, so that the tension at the lamp remains constant in spite of the variations in the battery during the charge and discharge. Generally, the dynamo and battery are run in parallel, and a special device consisting of a red lamp placed in the motorman's cab is used. The lamp lights up whenever the voltage of the storage battery becomes equal to that of the dynamo, and indicates the moment when the charging of the latter is to be stopped.

In a paper presented to the Academie des Sciences, M. Einthoven describes a new form of sensitive galvanometer which he has devised, together with some experiments which he carries out by applying this very sensitive method of measuring electric currents to the study of the electrical condition of the human body. In the latter case it is especially the electric effects produced by the heart which he observes. The new galvanometer is one of the most sensitive which is known, and at the same time very precise, so that the smallest variations of current can be measured, down to 10^{-12} ampere. It is formed of a silvered quartz fiber which is stretched like a violin cord between the poles of a powerful electro-magnet. When a small current passes in the wire it is deflected perpendicular to the lines of the field and the deflection can be measured directly by means of a microscope carrying a micrometer. The sensitiveness of the instrument can be regulated by adjusting the length of the wire, so that it will measure in the region of 0.001 down to 10^{-11} amperes. The movement of the wire and its variations can be registered by the photographic method. The image of the middle of the cord, magnified 600 diameters, is projected upon a slit which is placed perpendicular to the image. In front of the slit is a cylindrical lens whose axis lies perpendicular to the slit. A photographic plate receives the image which is thus concentrated to a point, and by moving the plate a curve is obtained which corresponds to the current variations. The image of a scale is projected on the plate at the same time in order to measure the curves. The new instrument allows of making measurements which could only be observed heretofore with the electrometer. One of these is the study of radium, which is now made with a gold-leaf electrometer. It will prove especially useful in physiological work for studying the nerve currents. In the case of the frog we observe the currents of the sciatic nerve, for instance. The electric action of the human heart has been observed heretofore with the Lippmann electro-capillary instrument. The muscular shocks of the heart-beats are known to produce variations in the electric potential of the organism, and this was brought out by Waller in 1899. The currents are registered with the Lippmann instrument, but this has many disadvantages, owing to the inertia in the oscillations of the mercury column. The present instrument is more sensitive and works more quickly, as the light quartz fiber, in spite of its length, has but little inertia and can register the variations of current more exactly, and again, the displacement is proportional to the current. M. Einthoven has obtained a series of curves in the shape of regular waves which correspond to the heart beats and show how the electrical effect varies. The effect is, in fact, quite considerable and indicates the great variations of electric potential in the different parts of the body which accompany the muscular shock of the heart. The waves he obtains are similar in form to those of the Marey cardiograph register.