MALLET'S METHOD FOR OXYGEN.

This method is based upon the property of water to retain the oxygen of the air in preference to the nitrogen. Atmospheric air, as well known, is composed of 20·55 parts oxygen and 78 16 parts nitrogen, by volume, the remainder being carbonic acid and vapor of water. The air dissolved by rain water of a temperature of 50° Fah. has been found to consist of 33·76 parts oxygen, 64·47 parts nitrogen and 1·77 parts carbonic acid, by volume, showing thus an increase of 13·21 parts oxygen and a decrease of 13·69 parts of nitrogen. One quart of water, according to Dalton, is capable of dissolving 2·44 cubic inches of air. This dissolving action of water is correspondingly increased by pressure, and Mallet has made use of it in the following manner and by the apparatus represented in our engravings. There is a series of chambers, A, B, C, etc., eight in number, consisting of strong sheet iron, almost entirely filled with water. There is also a series of double acting air compression pumps, a, b, c, used in connection with the chambers as shown. The pistons and slide valves of these pumps are all moved by the same shaft. Piston of pump, a, in its descent presses atmospheric air at p into chamber A. m is a perforated plate, so arranged that the air may be divided and pass up through the water in fine streams. In its passage through the same a part of the oxygen is absorbed and retained in the water, while the air, deprived of oxygen (the nitrogenized air) rises to the upper part of the chamber. When the piston of pump, a, descends, piston b ascends, and *vice versâ*, and when stopcocks, E, E, E, are opened, those at their right are closed, and *vice versâ*. This latter operation is performed by hand and by the system of paralellograms indicated. For the better understanding of the working of the apparatus, we will suppose that the pumps have been in operation for a short time. The first, third and fifth chamber, etc., in the position of the pistons as indicated, will contain nitrogenized air in their upper portions; in each succeeding one, the portion of nitrogen is less than in the preceding chambers. The second, fourth and sixth chambers contain, on the other hand, in their upper portion an oxygenized air, the air being more highly charged with oxygen the more chambers it has passed through. When the first piston descends, the nitrogenized air from the top of chamber A is carried over through pipe C to the upper side of the piston in cylinder a; simultaneously the nitrogenized air in the top of chamber C is drawn into pump c. This air is drawn into the cylinder when the piston goes down, and is discharged therefrom at the arrow into the surrounding air, when it rises. In its descent, fresh portions of atmospheric air are driven into chamber A. Now as to piston C, it is evident that, when it rises, an exhaustion takes place in chamber A; hence the oxygenized air, which, up to this moment, has been dissolved in the water, is caused to escape and is drawn over below cylinder b. When piston b descends this air is forced through pipe C into the water of chamber B. In its passage through the water, oxygen is again absorbed and retained, while the air deprived of oxygen rises to the upper part of the chamber. While piston b descends, this air is drawn through C in the direction of the arrow into the cylinder, which it aids to press downwards, and when piston b rises, it escapes in the direction of the small arrow into the surrounding atmosphere.

The same operation repeats itself in the succeeding chamber C. In the positions of the pistons, as represented, the of pump b, however, is charged with nitrogenized air. Chambers A and C hold nitrogen in their top portions. The oxygenated air in cylinder of pump c is forced over into chamber C, and so forth. To the last chamber a simply acting pump is attached for the purpose of drawing the oxygen, now almost pure, into the gas holder, in which it is retained for use. The air, after having passed through eight chambers, consists of 97·3 volumes oxygen and 2·7 volumes nitrogen, the presence of this amount of the latter gas, for most technical purposes, being quite unimportant. The machine described has been in use in Frankfort-on-Maine for more than two years, and the oxygen produced by it is used by Philipps in his new system of illumination, which consists in the combustion of a highly naphthalized fluid (carboline) by means of oxygen in a lamp constructed for the purpose. The inventor uses only air of 53 per cent oxygen, and claims that it gives the same intensity of light as pure oxygen. The light of this lamp is equal to one hundred candles or to ten ordinary gas flames. It is bluish white, and is very similar to the magnesium or electric light.

THE APPLICATION OF CHEMICAL FERTILIZERS TO HORTICULTURE.

M. Jeannel, says *Les Mondes*, has made a series of experiments in the Jardin d' Acclimation in Paris, in the use of chemical fertilizers in the process of horticulture. It has been found that plants can receive, in solution with the water with which they are irrigated, the mineral constituents necessary to their organism, and which manure does not furnish until decomposed in the soil. The following results are given of three specimens of potted plants:

First series: Plants cultivated in sand watered with ordinary water; plants cultivated in mold similarly irrigated; plants cultivated in sand supplied with common water and receiving weekly a portion of mineral manure in solution. The truly extraordinary success, says the author, of the latter mentioned specimens can hardly be imagined. They became doubly developed, more green, and flowered far more profusely than the plants raised in mold. Naturally, he adds, the plants cultivated in sand without the aid of the fertilizer proved puny and miserable. Second series: Two specimens of each plant were placed in pots of exhausted earth, one receiving ordinary water, the other a weekly supply of the mineral manure. The latter flourished with a most luxuriant development of both floral and foliaceous organs. Soil watered with these mineral ingredients, it is stated, never becomes exhausted. The constituents that the plant abstracts are daily returned. M. Jeannel has produced a *Tradescantia virginica* in a two liter pot, the earth of which has not been changed for fifteen months. The plant forms a tuft of exquisite green over 1·6 meters in length and ·6 meter in diameter. The proportions and ingredients of the chemicals used are as follows:

Nitrate of ammonia	400
Biphosphate of ammonia	200
Nitrate of potash	250
Chlorhydrate of ammonia	50
Sulphate of lime	60
Sulphate of iron	40

Pulverize, mix, and preserve away from moisture. The method of employing the above compound is quite simple. It suffices to dissolve 4 grammes of this mixture in a liter of common water, and to give to each plant weekly 25, 50 or cylinders of pumps a and c hold oxygenated air; the cylinder even 100 grammes of the solution independently of the ordinary waterings. It is recommended to place the pots on plates and to regulate the quantity of the fertilizer applied by the size of the former and the development of the plants. The cost of the compound should not exceed three francs (sixty cents) per kilogramme; so that one liter of the solution, serving for forty weekly waterings, need not cost more than one fifth of a cent to replenish.

This fertilizer is but moderately useful for leguminous and is hurtful to saxifrageous and bamboo plants; it retards the germination of the latter and hinders the growth of the young shoot.

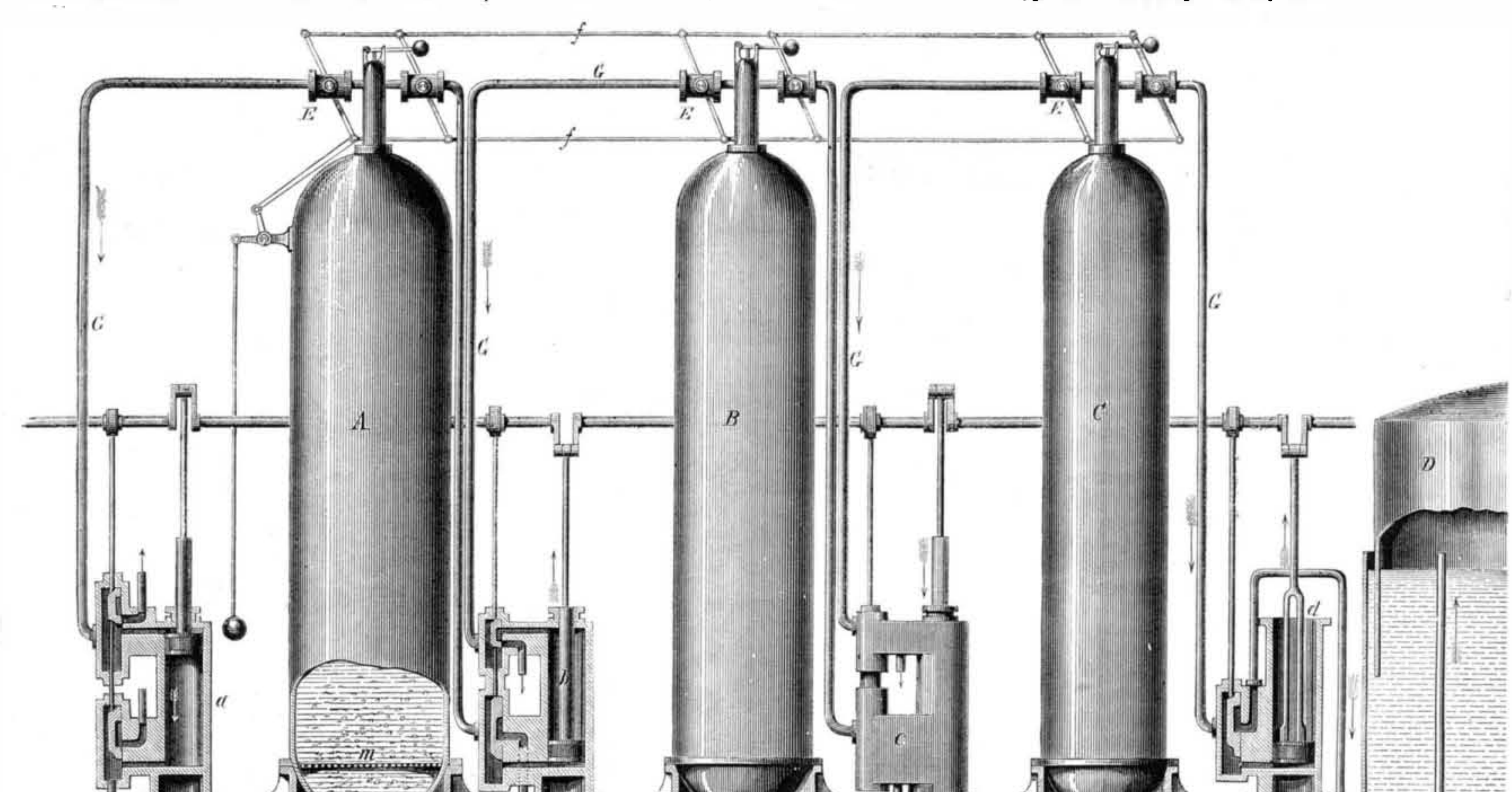
Prussian vs. English Guns.

Many of our readers have, no doubt, noticed in the papers, says the *Engineer*, statements, quoted from the *Börsenzeitung*, as to the startling results recently obtained at Berlin with the new 11 inch Krupp gun against iron plates in August last. According to the *Börsenzeitung*, the 11 inch gun, with a success exceeding "all expectation," has driven its shot through a "12 inch solid plate, a wooden backing of 26 inches, and an inch plate or skin," after which it had "a considerable amount of force left in it." We do not hear at what range this took place, which is an important element in the question, but we understand that 100 yards is the one generally adopted, and report says that a charge of about 70 lbs. was employed. We speak, however, subject to correction; we have accepted the facts as represented by our German contemporary, and proceed to give the results obtained here most nearly bearing on the question.

Our own 11 inch gun about July, 1871, fired four rounds against a structure known as No. 33 target, at Shoeburyness, consisting of 8 inches iron, 6 inches wood, 5 inches iron, 6 inches wood and 1½ inches of skin. The range was 200 yards. Three rounds were fired with charges of 85 lbs., and the last with 75 lbs. of pebble powder—one shell and three shot being used. In every case the projectile completely penetrated the target and passed on, and this being so, we presume we may safely add, in the words of our German friends, that "it had a considerable amount of force left in it." Indeed in one instance we can speak more definitely, for a deep indentation was made by the shot's point in a plate some distance to the rear and in the line of fire.

We are next informed that the Krupp 10 inch gun is expected to penetrate the same target as the 11 inch. This is, however, only an expectation, based on the assumption of an increase of charge not yet determined, to which is added as a crowning triumph that the 12 inch Krupp is expected to drive its 660 lbs. projectile through plates from 15 inches to 16 inches thick. Our readers will find recorded in the *Engineer* of June 28th the actual effect produced by our 12 inch 35 tun gun against the above mentioned No. 33 target strengthened by a front plate 4 inches thick, on June 20th last. We may here state briefly that the projectile, fired with a charge of 110 lbs. of pebble powder at a range of seventy yards, drove its head and shoulders through 18½ inches of iron and 12 inches of teak. As a shell the effect was less, but the conditions of the question were complicated by the introduction of an air space.

CAUSTIC LIME, freshly slaked, is often an excellent preparation for a crop on a clay soil.



MALLET'S APPARATUS FOR OBTAINING OXYGEN FROM ATMOSPHERIC AIR.