The conditions which are first described when the developer is not kept in motion, and the results which are brought about, might be useful under certain conditions. In the case of an under-exposed plate, or of a plate which tended to give a hard image, there might be produced some useful result; but it will readily be seen that no effect could be brought about which might not be better effected by modifying the developer either by adding ammonia or reduction of the quantity of bromide or pyro.

It must be borne in mind that lifting the plate from the solution has much the same effect as rocking the dish, indeed agitates the solution in a most thorough manner. If, therefore, we were trusting to rest or stillness of the solution to bring about what we may style forcing, we would have to look for some other method of examining the density of our plate than lifting it out of the dish.

THE PRODUCTION OF A CONSTANT SUPPLY OF OXYGEN BY THE ACTION OF LIGHT ON GROWING VEGETABLE ORGANISMS.

SOME recent investigations of Dr. Phipson, which are published in the last number of the *Chemical News*, tend to elucidate in a remarkable manner the circumstances under which oxygen is evolved when light acts on growing plants. Dr. Phipson says:—

In almost all text-books it is stated that plants have the *power of decomposing carbonic acid* and liberating its oxygen, whilst the carbon is "fixed in the vegetable tissue." This statement is quite incorrect; plants have no power of decomposing carbonic acid into oxygen and carbon, or into oxygen and carbonic oxide. Even in the laboratory, the decomposition of carbonic acid is an arduous undertaking requiring violent methods, such as that which I showed formerly in my paper on magnesium by the action of that metal on carbonate of soda at a great heat. Plants absorb carbonic acid from water or air when it is present in the proper proportions (in large quantities it appears to poison them), and oxygen is evolved from their tissues as a consequence of this absorption; but *the carbonic acid is not decomposed*.

On a fine summer morning, when the sun has been above the horizon for four or five hours, we see the *Zygnema* and *Conferva* borne up to the surface of pools of stagnant water by thousands of minute gas-bubbles. When this gas is collected and analysed it is found to be very pure oxygen. The *Protococcus pluvialis* and *P. palustris*, which are among the simplest of unicellular algæ, I have found to be very remarkable in this respect.

Expose a saucer to the rain for a few months, or leave it, full of pump-water, exposed to air and light for some weeks, and it soon contains *Protococcus pluvialis* in abundance. Place some small dead branches of poplar in the saucer, and both *P. pluvialis* and *P. palustris* develop rapidly upon them in the course of a week or two.

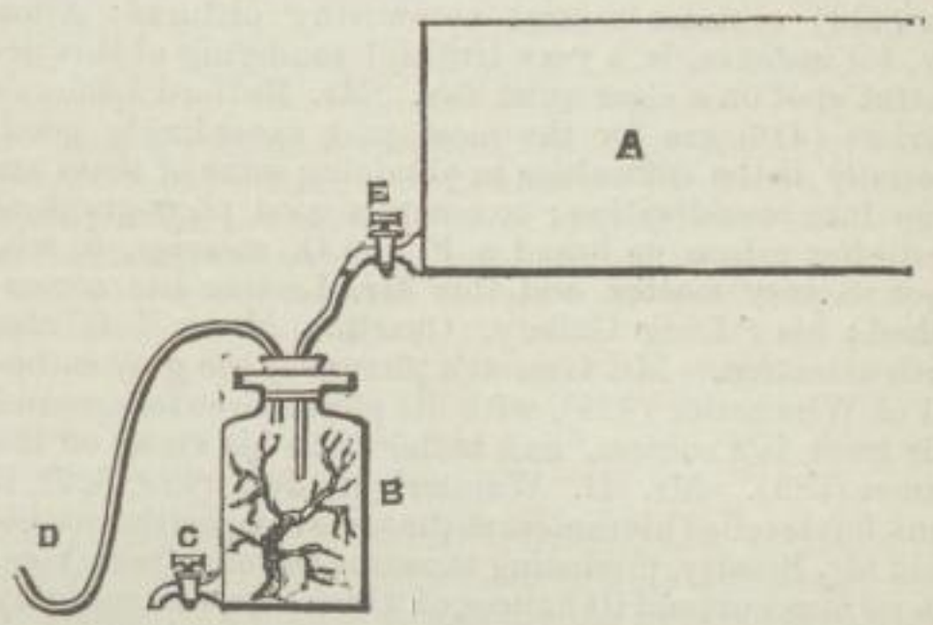
These small branches can then be placed in a flask full of pump-water, and the evolution of oxygen observed under the influence of the solar rays.

When higher plants, such as *Achillea millefolium*, are experimented on in this way, the gas accumulates at the extremities of the leaves, sometimes in bubbles of considerable size, which finally escape and come to the suface in quantities varying from the size of a pin's head to that of a pea or a bean. But with the *Protococcus pluvialis* and *P. palustris* the escape of gas is constant, and each bubble is of the minutest size. No sooner do the sun's rays strike the flask, then a series of these microscopic bubbles—veritable atoms of oxygen—commence rising in all directions, and from their great number create quite a froth upon the surface. The flask being turned upside down for the purpose of collecting and ascertaining the composition of the gas, this state of things will continue for about three days; after that time all the carbonic acid contained in the water is absorbed, and the escape of oxygen gas ceases. (A minute quantity of caustic soda will cause it to cease on the first day, by depriving the plant of carbonic acid).

When the water is renewed, the same phenomenon recommences, so that by keeping up a constant supply of pump-water, the production of oxygen may be kept up for months, and probably years together.

This is effected by means of the simple apparatus now to be described:—

The water used is pump-water (water that has been boiled or distilled will not answer, nor will the phenomenon occur if the slightest quantity of alkali of any kind be present in the water). The tank A is of *slate* or *earthenware*; it is full of pump-water on which the sun's rays cannot act on account of the opacity of the sides; it is kept filled and covered. B is a large wide-mouthed



and tubulated glass flask, in which are placed the dead branches of poplar covered with *Protococcus pluvialis* and *P. palustris*. (These microscopic plants are almost invisible, save that here and there on the dark epidermis of the branches little patches of green matter are observable.) The flask B is exposed to the direct rays of the sun. The flow of water from the tank A is regulated by the tap E, and that from the flask by the tap C, *so that the contents of the latter are completely renewed in the course of three days*; or the water in B may be completely drawn off every third or fourth day.

In these conditions any quantity of oxygen may be produced in a short space of time; *the quantity yielded in any given interval of time depends solely upon the size of the apparatus.*

The oxygen can be received in a gasometer by means of the tube D, or into a graduated tube. In the latter case, the apparatus appears capable of being transformed into an excellent *actinometer*; the number of divisions (cubic centimetres of gas) taken on the graduated tube every day from 8 to 9, or 12 to 1, giving the exact measure of the actinism for the day in question. But the present form of the apparatus is not suitable for this purpose; for, supposing there were five hundred thousand distinct individuals of *P. palustris* present in the flask on any given day, this number might be six hundred thousand or more on the following day, and so the results would not be comparable.

The small dead poplar branches form a very convenient medium for transferring the *Protococcus* from one flask to another (for instance, when the flask first used becomes dull or opaque and requires cleaning). Having been exposed to the rain for a long period of time, they are invariably covered with *P. pluvialis* and *P. palustris*, though the presence of these minute plants is not easily recognised, and when placed in pump-water, exposed to the light, the latter develop rapidly, and multiply enormously during the whole year.

Two analyses of the gas produced by *Protococcus pluvialis* and *P. palustris* in these experiments gave me:—

Oxygen 98·7 and 98·0 per cent.

THE PHOTOGRAPHIC EXHIBITION.

FINAL NOTICE.

THE pictures of Heinrich Graf, of Berlin, are on the table, and hence do not receive their fair share of attention; indeed, they get no attention at all in the catalogue. They are nevertheless a very fine collection, and most of them denote the true artist in respect to pose, lighting, and general effect throughout. The photographs represent for the most part characters from the historical processions on the occasion of the recent silver wedding of the Crown Prince of Germany which attracted considerable attention even here, it may be remembered. It was Herr Graf's