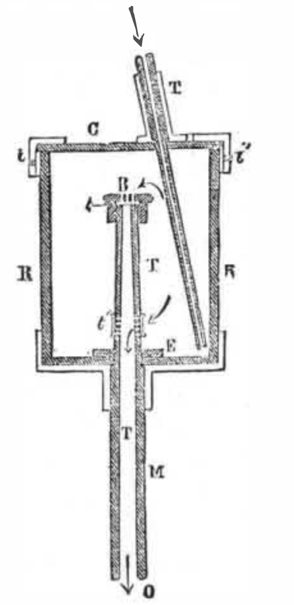
APPARATUS FOR PREPARING SOLID CARBONIC ACID.

IN the *Bulletin de l'Association des Eleves de M. Fremy*, we find a description of a new apparatus for preparing solid carbonic acid. It is due to Mr. Cailletet, and consists of a hollow cylinder closed at the base. A plug, provided with an inclined tube, is fixed to the orifice by means of a bayonet catch. This tube runs to within a fraction of an inch of the bottom of the cylinder, to which is affixed another tube designed to serve as a handle to the apparatus, and to allow the uncondensed carbonic acid to escape to the exterior.

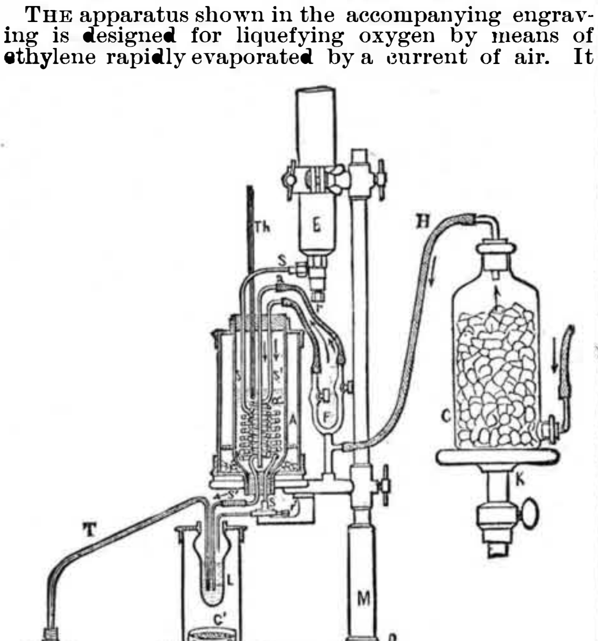
The entire apparatus is made of ebonite, which is a poor conductor of heat. Various experiments have given as a result 2 ounces of snow per 6 ounces of liquid used. A much greater yield can be obtained by adapting to the receptacle that contains the liquefied acid a copper worm of say one-eighth inch internal diameter. The lower extremity of this worm is closed by a conically pointed cock. The cock of the receiver being wide open, and the worm being cooled in a mixture of salt and ice, or in chloride of methyl, it is only necessary to open the cock of the worm in order to obtain in a few instants a sufficient bulk of carbonic snow to fill the apparatus.



This process of cooling, applied to ethylene and formene, gives excellent results, and differs essentially from the process that consists in passing partially expanded gas into a narrow tube. In the arrangement adopted by Mr. Cailletet, the worm forms part of the receiver, and the cooling of it in order to effect the condensation is precisely as if the receiver that contains the compressed gas, and is often bulky, were itself cooled in its entirety, a thing which it would be almost impracticable to do in cases where carbonic acid or ethylene is employed. When carbonic acid snow is being prepared with this apparatus, it is found that numerous electric sparks jump from the metallic pieces that surround the plug, the friction of the particles of carbonic acid against the ebonite producing electricity, as do the drops of water in the Armstrong machine.—*Le Genie Civil.*

APPARATUS FOR LIQUEFYING OXYGEN.

THE apparatus shown in the accompanying engraving is designed for liquefying oxygen by means of ethylene rapidly evaporated by a current of air. It consists of a Cailletet pump, with mercury piston, which serves to liquefy the ethylene contained in a metallic receiver, E, that is coupled to a worm, S, which terminates in a cock, r'.



APPARATUS FOR LIQUEFYING OXYGEN.

At the moment of operating, chloride of methylene is poured into the glass vessel, R A, that contains the worm, S S'. The temperature, which is then —23°, is rapidly lowered to —70° by forcing dry air into the vessel, C, through the glass tube, *a*. As the cock, *r*, is open, and r^1 is closed, the ethylene thus cooled fills the worm, S, and, when the cock, *r*, is opened, flows without perceptible loss into the vessel, L, which contains air dried by the sulphuric acid in C'. The worm, S', serves for cooling the quantity of air regulated by the cock of the bent tube, F. Through its passage into the ethylene, this air depresses the temperature to —125°, that is to say, to below the critical point of oxygen.

The oxygen to be liquefied is contained in a test glass inclosed in the pressure reservoir, B, which is connected with the force pump through the tube, T U. When the pressure to which the oxygen is submitted reaches 50 or 60 atmospheres, it is observed to liquefy under the form of a colorless fluid having a well defined meniscus. This transparent liquid fills the small reservoir of the bent part of the oxygen tube, T, that dips into the liquid ethylene.—*Le Genie Civil.*

A METHOD OF PRODUCING OZONE IN LARGE QUANTITIES.

By ANDREW H. SMITH, M.D., New York.

THE question as to whether ozone has any therapeutic value is still unsolved, owing probably in a great degree to the difficulties of production in quantity sufficient for satisfactory experimentation. An observation made by the writer in December, 1883, seems to open a way by which these difficulties may be overcome, and ozone produced with sufficient readiness to permit the study of its physiological and therapeutical action on an extended scale, and also its remedial use, if it should be found to possess curative properties.

Cotton wool, when deprived of its oil as in the preparation of "absorbent" cotton, is a sufficient conductor of static electricity to secure the diffusion of that agent through a considerable mass of the fiber placed loose between the prime conductors of a static machine. If the experiment is tried in a darkened room, the cotton assumes the appearance of a luminous cloud. A large surface of air contained in the cotton is exposed to the electrical action, and a corresponding amount of ozone is produced.

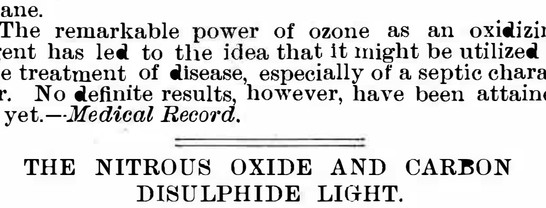
The apparatus which I have had arranged as the result of the above observation consists of a glass cylinder ten inches long by five inches in diameter, and having a narrow neck at each extremity, through which a brass rod is passed connected with the respective prime conductor and terminated by a base. On one side of the cylinder and midway in its length is an opening an inch in diameter, and provided with a lip for the attachment of the inhaling tube. The cylinder is loosely filled with absorbent cotton, and the balls attached to the rods from the prime conductors are introduced a short distance through the necks. The current is thus made to traverse the cotton, and when the machine is operated in the dark, the whole interior of the cylinder becomes luminous. The air drawn through the tubes is supplied by the openings at the ends of the cylinder, which are much larger than the rods which pass through them when a four plate Holtz machine is employed. This air is so highly charged with ozone that it must be inhaled with caution. If breathed incautiously, it excites cough and produces a disagreeable irritation along the respiratory tract, and especially at the bifurcation of the trachea, which irritation may continue for several hours. Persistence in the inhalation would, no doubt, be followed by congestion or inflammation of the bronchial membrane.

The remarkable power of ozone as an oxidizing agent has led to the idea that it might be utilized in the treatment of disease, especially of a septic character. No definite results, however, have been attained as yet.—*Medical Record.*

THE NITROUS OXIDE AND CARBON DISULPHIDE LIGHT.

By WM. THOS. JACKMAN, M.R.C.S., etc.

THE light obtained by burning a mixture of nitrous oxide gas and the vapor of carbon disulphide is well known to be very powerful for photographic purposes. It is of an intensely blue color, and very active in photographic-chemical properties, being, according to Stein,* twice as powerful as that of the oxyhydrogen flame, and three times as powerful as that of the electric lamp. This able scientist points out that when in full power it illuminates a larger surface than the same sized flame of other artificial sources. Moreover, when the cost and trouble of fixing the apparatus for this light are compared with that of the electric or of the oxyhydrogen, it seems highly probable that this form of artificial light will be more extensively used than it is at present.



The want of a reliable, cheap, and uncumbersome artificial light has long been felt by photographers; hence I am emboldened to draw attention to this source, and explain shortly the apparatus required for its use, and refer to a few of the experiments which have been made with it, hoping thereby to encourage its more genial trial in the art of photography.

An ingenious apparatus for the mixing and burning of the nitrous oxide and carbon disulphide vapor has been invented by Delachanal and Mermet, of Paris, by which a constant light can be obtained, and the danger of an explosion obviated, for it must be borne in mind that carbon disulphide vapor is very explosive under certain conditions.

The apparatus consists of a double-necked flask of about 500 c. c. contents, which is filled with pieces of sponge or pumice, saturated with the vapor of carbon disulphide. Into one mouth, A, a bent tube is fixed, through which the nitrous oxide gas passes into the flask. A second bent tube is fixed into the other mouth of the flask; this passes into a wider tube of metal, B, 20 cm. long, which is tightly filled with iron filings, the object of this being to prevent the flame passing back into the explosive vapor contained in the flask.

After passing through this tube, B, the mixture of nitrous oxide and carbon disulphide is led by means of an India-rubber tube to a modified Bunsen's burner. This burner has neither the usual opening for the admission of air nor the arrangement for regulating the quantity of gas passing through it. The nitrous oxide enters the flask through A, and after mixing with the vapor of the carbon disulphide in the flask, passes through B to the burner, where it can be ignited with safety, and with the production of a very blue flame. The size of this flame depends upon the dimensions of the apparatus. The amount of the mixed gases to be burnt can be regulated by a stopcock placed between the tube, B, and the Bunsen burner.

E. Sell, of Berlin, produced, a few years since, some excellent photographs with this light, which were exposed a shorter time than when using the electric or magnesium light, and were in every way more perfect. Riche and Bardy, of Paris, also made extensive experiments with this light, and proved it to be twice as powerful as the lime light. They further showed that the photo-chemical power of the light was due to the blue flame of the sulphur in the combination. Oxygen may be used instead of nitrous oxide gas, but the latter is recommended as being safer.

Photographers interested in the use of artificial light for their science will meet with most valuable hints on the various sources of light in Dr. Stein's new work on light, vol. i., referred to above; but I do not think they will find any more worthy of trial, or easier of manipulation, than the nitrous-oxide carbon-disulphide mixture.—*Photo. News.*

* Das Licht, von S. T. Stein.

A NEW DEPARTURE IN THE METALLURGY OF IRON.

THE first iron manufactured referred to in the oldest of all books, and the only iron or steel known down to the year 1600, was wrought iron made by a primitive process analogous to that of the Catalan forge. Cast iron was obtained by mere accident in the 15th century, the man who made it being under the impression that he could hasten the process of making wrought iron, and he was not more astonished at the result he obtained than ever was a hen on seeing a duckling emerge from an egg. For a long time people did not know what to do with the cast iron thus accidentally obtained, because this special compound of iron and carbon requires much manipulation and many appliances to bring it into any desired form, and for nearly 100 years all that could be made out of it was castings. In the year 1784, however, Peter Onions found out that, by the process of puddling or boiling, wrought or finished iron could be produced from pig iron. In 1855 Bessemer made steel out of cast iron, burning out the carbon by means of cold air forced through the molten mass, and in 1856 Siemens made steel by diluting the carbon of a bath of molten cast metal with the addition of wrought iron or iron ore.

Previous to the Bessemer process of steel making, the only commercial method for producing steel was that of Huntsman in 1740, from pure wrought iron, which was first cemented, and turned into blister steel, and then into cast or crucible steel, which made and still makes the best tool steel; but unfortunately it has the great disadvantage of being very expensive. Although the Bessemer process was a great advance on all previous methods of making steel, both as to the quantity made and the price of production, this method of making steel, although it has achieved a vast commercial success, constitutes an inversion of the natural order of its rational manufacture, inasmuch as in ordinary blast furnace practice the iron ore is first deoxidized and made into a plastic mass, and, if it were possible to stop the operation of the furnace at the stage and hammer the plastic mass to consolidate the iron and get rid of the slag, the mass would not only be wrought iron, but of much better quality than that made by the process of puddling; whereas the process is carried further and the iron is completely molten, simply to be brought back again to the plastic state by the operation of puddling. Moreover, looking at the matter in a rational manner, steel ought never to assume the condition of cast iron; but the operation ought to be stopped when the proper degree of carburization is attained, instead of having to undergo an operation which not only requires expensive plant and machinery, but also involves a serious loss of metal—10 to 15 per cent.—while at the same time, after the operation is finished, the steel is never so good as it would have been if made progressively. Siemens-Martin steel is generally regarded as superior to Bessemer for most purposes, especially ship and boiler plates, but it costs more and cannot be made so quickly, nor in such large quantities. There is reason to believe from certain statements made during the excursions held in connection with the Iron and Steel Institute meeting at Glasgow, that before long not only will wrought iron be made of superior quality and in large quantities by a direct and economical process, but also that steel will be made in an equally direct manner without having to pass through the intermediate range of cast iron, and that in large quantities and of quality equal to that by the Siemens-Martin process, and at about half the cost. Moreover, it is said that there is reason to believe that by a different method of producing cast iron and slightly altering the condition of the blast furnace, pig iron will be made with less than 18 cwt. of soft coal to the ton of pig metal produced. This new departure in the metallurgy of iron must not be regarded as quite too Utopian, when it is considered that the theoretical amount of carbon necessary to make a ton of pig metal is considerably under 8 cwt. All that is necessary to accomplish the