RECONSTRUCTION IN CONCRETE OF DRY DOCK No. 2, NEW YORK NAVY YARD.

The reconstruction of Dry Dock No. 2 of the New York navy yard, Brooklyn, affords a striking object lesson as to the defects of wood and the advantages of masonry in this kind of structure. The choice of timber in dry dock construction was determined entirely by considerations of cheap first cost; for not even the most sanguine advocate of wooden dry docks has suggested that they would compare in economy of maintenance and repairs with the stone docks.

Dry dock No. 2 was built in 1890, and after a useful life of only nine years, it has failed so completely as to render its entire reconstruction desirable. Compare this with the record of the adjoining dry dock No. 1, a granite structure, which is just as good to-day as when it was opened over half a century ago.

On more than one occasion we have described the constructive features of wooden dry docks, and the reader is referred to the illustrated article in our issue of February 20, 1897, describing the big dry dock officially known as No. 3.

Apart from the serious objections to wooden dry docks on the score of their rapid decay and the need of constant renewal, either in part or in whole, their construction is such that they are but poorly adapted to withstand the heavy hydrostatic pressure to which they are subjected when dry. The floor and walls of the wooden dry dock are nothing more than a comparatively thin shell of wood, bolted down upon a mass of piling which has been driven over the whole area of the dock; and while they are fully able to withstand the outward pressure due to the weight of a ship when the dock is empty, or of water when it is full, they are entirely unsuited to withstand the inward thrust of water which may get in behind the altars and beneath the floor when the dock is pumped dry. In the case of a large dock 30 feet in depth, the hydrostatic pressure tending to burst in the floor and lower walls will approximate one ton to the square foot. Such a disaster is guarded against by driving several walls of sheet-piling entirely around the dock; but it frequently happens that carelessness in driving the piles, or the presence of obstructions underground, will cause a break in the continuity of the sheet-piling, and permit the accumulation of water behind the altars.

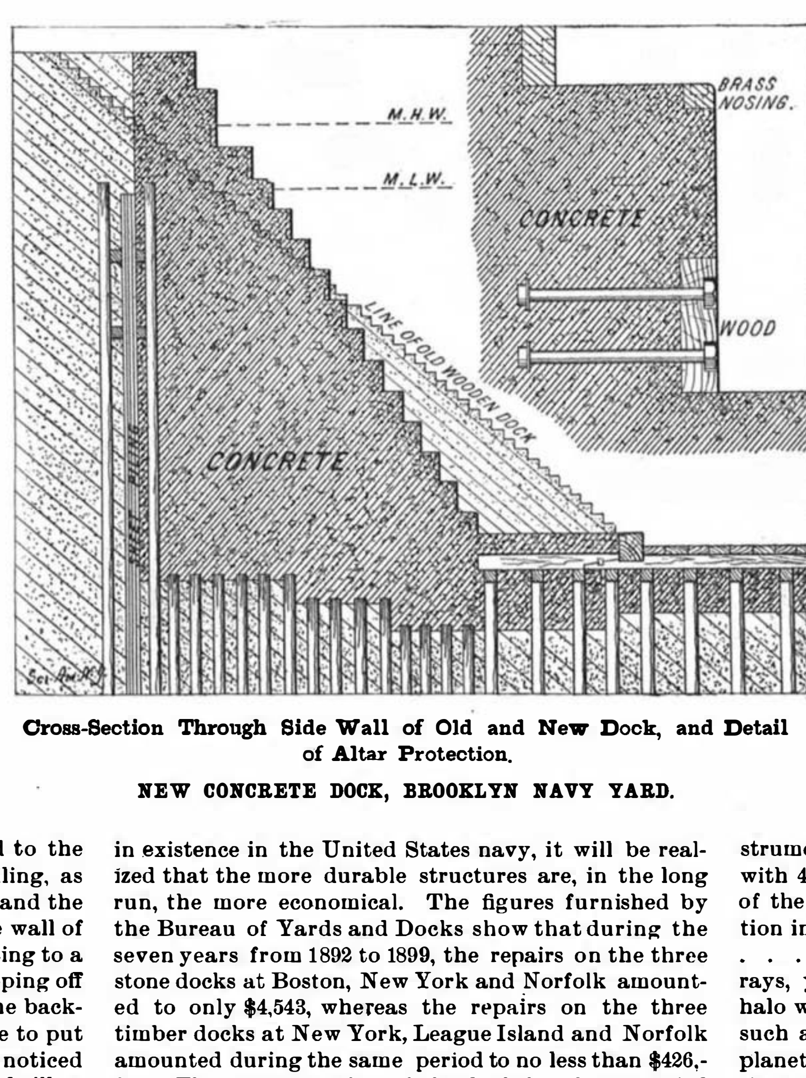
In the case of the dock now under consideration, it seems that during a heavy and prolonged rain storm last year, the culverts proving insufficient to carry off the storm water, it flowed over the surface of the navy yard and collected behind the walls of the dock, which proved unequal to the strain upon them, and bulged out at the point shown in one of our first page illustrations, to the extent of several feet, breaking off the 12 × 12 caps, and generally wrecking the structure over a considerable portion of its area. It was decided that the most satisfactory way to repair the damage would be to reconstruct the walls of the dock in concrete.

In carrying out the repairs, the steps, or "altars," as they are called, were first stripped to the level of the lower guide-wales of the sheet-piling, as shown in the lower engraving of our first page, and the backing was excavated to the same level. The wall of sheet-piling was then driven, the piles penetrating to a depth of 54 feet from the ground level. The stripping off of the timber structure and the excavation of the backing was then carried down until it was possible to put in position the shoring timbers, which will be noticed extending from the longitudinal wales to the old sill or bottom altar at the floor of the dock. The excavation was then carried down to the floor level and round piles were driven over the whole surface, the distance from center to center of the piling being 2 feet. The piles were then cut off about 6 inches above the ground, as shown in the accompanying transverse section of the dock. On this foundation, as thus formed, was built up the concrete monolith, its outer face abutting against the wall of the sheet-piling and its inner face being stepped into altars. It was originally intended to build the altars of granite; but to avoid the delay that would be caused by waiting for the delivery of the granite, it was decided to build them of concrete. To protect the altars, 1½ by 2¼-inch brass nosing-strips were laid along their edges, and 3 by 12-inch pine fender-strips were let into the risers, as shown in the accompanying drawing.

It will be noticed that the slope of the side walls of the concrete dock is considerably steeper than that of the old structure, the two being in the ratio respectively of 2 to 3 and about 1 to 1. The result is that the new dock has a form which is very much better adapted to the docking of ships, inasmuch as it gives more room (22 feet on the floor) where it is greatly needed, and brings the upper edges of the dock closer to the sides of the ship—advantages which greatly facilitate the handling of material and the general operations connected with dry dock repairs. The old floor of the dock was left undisturbed between the side sills, but the transverse timbers were extended beneath the concrete for the full width of the new floor, in order to give increased transverse strength to withstand the upward thrust due to hydrostatic pressure.

The concrete monolith will be extended entirely around the dock to the inner of the two grooves provided for receiving the caisson gate. Here the timber groove will be replaced by one in granite. It is fortunate for these repairs that the dock was designed with outer and inner grooves, since by placing the caisson at the outer groove and shoring it from the floor of the dock, as shown in one of our first page illustrations, it was possible to build the new granite groove without any further preparation. Had it not been for this circumstance, it would be necessary to build a heavy coffer-dam across the entrance channel, whose cost would have added greatly to the total cost of the reconstruction. Advantage has been taken of the opportunity offered by the construction of the new groove to build a new caisson and enlarge the entrance to the dock, the enlarged caisson affording an entrance 72 feet wide on the bottom as against 53 feet, while a gain in width of 5 feet has been made at the coping, and a gain of 6 inches in the depth over the sill. The result of these changes is that the reconstructed dock will be capable of accommodating any ship in the United States navy.

When it is stated that the cost of these repairs will be about $600,000, it might seem that the advantages which we have outlined above were purchased at a rather dear figure; but when we consider the relative cost for repairs of masonry and timber docks already in existence in the United States navy, it will be realized that the more durable structures are, in the long run, the more economical. The figures furnished by the Bureau of Yards and Docks show that during the seven years from 1892 to 1899, the repairs on the three stone docks at Boston, New York and Norfolk amounted to only $4,543, whereas the repairs on the three timber docks at New York, League Island and Norfolk amounted during the same period to no less than $426,073. The reconstruction of the dock has been carried out under Capt. P. C. Asserson, C.E., to whom we are indebted for courtesies extended in the preparation of this article.



Cross-Section Through Side Wall of Old and New Dock, and Detail of Altar Protection.

NEW CONCRETE DOCK, BROOKLYN NAVY YARD.

A New Use for Fogged Plates.

Dry plates that have been fogged before exposure in the camera by some means or other, can be utilized for the production of transparencies. Take the fogged plate and expose it to lamplight for a few minutes, in order that it may be fogged evenly all over. Then immerse it in the following solution:

Copper chloride	350 grains.
Potassium bromide	42 "
Water	16 ounces.

The plate should be left in this bath for about ten minutes, and then thoroughly washed in water. The whole of the operations may be performed in orange light. When dry the plates are comparatively insensitive. To print, the plate is placed behind the negative in the printing frame in the usual manner, and with a negative of average density an exposure of from twenty to thirty seconds may be given in diffused daylight; or from two to five minutes at a distance of about twelve inches from an ordinary lamp or gas burner. Any developer may be used, but care should be exercised to use rather a large proportion of bromide.

Correspondence.

The Color Screen for Astronomical Telescopes.

To the Editor of the SCIENTIFIC AMERICAN:

The article on the subject of the color screen in the issue of the SCIENTIFIC AMERICAN of September 22 contains some statements which are not in accord with the historical facts in regard to its development, and some conclusions in regard to the results which are premature, if not erroneous. I am glad, in the interests of scientific and historical accuracy, which the SCIENTIFIC AMERICAN always aims to serve, to give fuller information in regard to the facts of the case. The color screen for the purpose described can hardly be called an invention, but an application to visual telescopes of a device well known in photography, but used for a somewhat different effect. Its use on the 26-inch equatorial of the Naval Observatory was the result of successful experiments made by Prof. See and Mr. Peters to remove the violet-blue halo caused by the secondary spectrum, which is a source of annoyance in all large achromatic refractors. While its use for this purpose is effective, it ought not to be inferred that it causes a decided improvement in bad definition of the image due to atmospheric condition. It would also be premature to assert that the experiments show such decided effect in the reduction of the diameters as are indicated in the article in question, until further measurements shall have been made by other observers both with and without the color screen, in order to remove the probability of systematic personal error to which all observations of this kind are peculiarly subject.

At the time of the publication in the Astronomische Nachrichten, in April, 1900, of the description of the color screen and the preliminary results obtained by its use on the great equatorial of the Naval Observatory, it was thought that the matter was entirely new. The editor of that journal, however, in an editorial foot-note, called attention to a previous successful investigation of the same character as follows:

"Concerning earlier successful attempts to eliminate the secondary spectrum, compare M. Mittenzwey, Astronomische Nachrichten, 2523 and 2524, 'On the Absorption of the Secondary Spectrum in Large Refractors.'"

These earlier investigations do not appear to have been generally known, and the use of the color screen does not appear to have been carried beyond the experimental stage or practically tested by use on an instrument of large dimensions. A reference to Mittenzwey's communication on this subject in the Astronomische Nachrichten, 1883, shows, however, that he fully appreciated its advantages, as will be seen by the following brief quotation:

"A thorough spectroscopic investigation of the absorption of a large number of colored media has finally resulted in an extremely simple method, by which the secondary spectrum in the achromatic telescope is so far removed as to be imperceptible in an instrument of 6 inches aperture and 60 inches focal length with 400 magnifying power, while the brightest colors of the spectrum suffer thereby no perceptible diminution in intensity. The image of a bright star is shown . . . as a little disk surrounded by a few diffraction rays, yet completely free from the strong violet-blue halo which in instruments of large dimensions forms such an objectionable feature. Upon the disks of planets, details of delicate markings are rendered distinct which otherwise are seen only with difficulty.

"The contrivance consists of a capillary fluid cell of blue-green fluorescent derivative of resorcin, fluorescein, which is inserted in the cone of rays close to the ocular system.

"A very weak alkaline solution of the same in glycerin, which will not dry up, was inclosed in a capillary cell of two plane parallel glass plates, and this cell in turn was fastened onto the plane surface of the field lens by a film of oil, or else to the cap of the eye-piece."

By giving the above statement due publicity you will greatly oblige S. J. BROWN,

Prof. of Mathematics, U. S. N. Astronomical Director.

Washington, D. C., October 9, 1900.

AT Altoona, Pa., the Edison Electric Illuminating Company strings its wires with the aid of an electric motor, which is carried by a truck. The current for the motor is obtained by tapping the company's three-wire system. The motor drives an ordinary stonemason's crab. The speed is reduced by a counter-shaft, which gives a rate of rope travel of 40 feet per minute. A ¾-inch rope is used and a small four-jaw home-made clutch, to which the wire is fastened. The wiremen have no difficulty in pulling up 3,000 feet of large bare copper wire a day on street work, says The Electrical World.

Science Notes.

The Rothamsted experimental station, which was established by Sir John Bennet Lawes, was given to the nation before his death.

Lieut. Amsdrup's polar expedition has just returned. He examined and charted the region from Cape Dalton to Aggas Island, and thus obtained a chart of the whole coast of East Greenland from Cape Farewell to Franz Josef Land.

The failure of the "Windward" to return from the Arctic regions is thought to denote the fact that the explorer will not attempt to return this year. It is probable that the season was an open one in the far North, and if this was the case Lieut. Peary may have taken the "Windward" into some high latitude, hoping to use the vessel in an expedition next season.

Helen Keller, the interesting blind and deaf mute, has passed the entrance examination to Radcliffe College. She has chosen the French, English, and German courses, and in addition the course in history. The examination papers were made out, using the raised point system, and she wrote the answers upon a typewriter. At the lectures she is accompanied by Miss Sullivan, who sits close behind her and gives her in the manual language whatever the instructor may be saying.

Prof. Robert Koch, the famous bacteriologist of Berlin, has returned to Europe. He has been conducting scientific investigations in the German colonies for a year, and has now reached Hong Kong. He states that he has discovered means for preventing the spread of malaria in malarial districts, and has found means of extirpating it. His experiments in this line were conducted in New Guinea, where large numbers of natives die yearly of malaria. He prescribes a medicine the chief ingredient of which is quinine. It is said to be both curative and preventive. He also found it necessary to expel the parasites of malaria. Details are not given as to how this is accomplished, but it is known that he has carried on investigations upon the transportation of the malarial germ by mosquitoes. He considers that in temperate climates it will be more easy to stamp out malaria than in tropical climates. His investigations will be completed in his laboratory at Berlin.

When O. Lehmann announced his discovery of liquid crystals, ten years ago, he was greeted with a chorus of doubt and disapproval, but he has since succeeded in proving that all the characteristics of crystallization which his liquid crystals do not possess cannot logically be made part of the definition of a crystal. The only general characteristics of crystals are that they are not isotropic, and that they possess a molecular directive force which governs their shape and the distribution of accretions. The directive force is preserved by means of the surface tension, and crystals may, therefore, be liquid or solid, but they cannot be gaseous. Liquid crystals may be produced by depositing solid crystals from a mother liquor on the cover glass of a microscope and gently heating the latter until the fusing point is exceeded. Their optical properties can then be conveniently studied. Their double refraction and dichroism indicate a difference in the dielectric constant and the electric conductivity respectively in different directions, but these differences cannot be placed in evidence owing to the electrostatic rotations which free crystals immersed in a liquid undergo in an electrostatic field. In a magnetic field, however, the crystals show a distinct tendency to place their axes of symmetry normal to the lines of force. The author expects to obtain valuable results by applying this discovery to living cells.—O. Lehmann, Ann. der Physik.

Two Frenchmen, M. Balsan and M. Godard, recently made an ascent in a balloon at Vincennes with a view to reaching the greatest altitude that could possibly be obtained. They did not succeed in lowering the record, however. During their journey they kept a record of their impressions and sensations at various heights. They first began to experience the nauseating effects of the rarefied air at 18,200 feet, when their temples ached and their vision was blurred. At 20,150 feet M. Balsan was rendered so ill that he could neither speak nor reach his bag of oxygen, and had to be attended by his companion. Shortly afterward the latter was somewhat paralyzed and could only move with difficulty. But with the application of oxygen they were restored, and they were but little inconvenienced. At 21,450 feet they described the cold as being intense, and that their beards were covered with ice. When 22,400 feet was attained, they were rendered so helpless, and the pain was so great, that they could hardly gather sufficient strength to open the valve of the balloon. When they reached the ground, they were in a very exhausted condition. Dr. Berson, in company with Mr. Arthur Spencer, ascended some months ago from London to a height of 27,500 feet, while Messrs. Coxwell and Glaisher ascended to the height of 35,000 feet, at which altitude one of the travelers was rendered unconscious, while the other only just succeeded in opening the valve by pulling the rope with his teeth.

Engineering Notes.

At the new Orleans station, at Paris, a most elaborate system of traveling ramps has been devised for the transportation of baggage about the building. The pieces are taken from the low level of the tracks and are hoisted to the baggage room, where they are discharged at sorting tables.

There have been several instances in steel works of workmen being poisoned by water gas, which consists largely of carbon monoxide. The only remedy hitherto known has, we believe, been the transfusion of blood, but another is now announced by M. A. Mosso in a note to the Comptes Rendus of the Paris Académie des Sciences. Unfortunately, the remedy is not an easy one to apply, as it consists in putting the victim in an atmosphere rich in oxygen and under pressure. Thus, of two monkeys, both poisoned by carbonic oxide, the one left to its own resources died, while the other, being placed in an atmosphere of oxygen at a pressure of 30 pounds per square inch, recovered completely in half an hour.

In the course of the additional forthcoming trials by the English Admiralty with the old hulk of the "Belleisle" the naval authorities will endeavor to ascertain the resisting qualities of Krupp armor under varying conditions. One side of the vessel will be armored for a length of 20 feet with 6-inch Krupp armor, and on the other side a similar plating of 4-inch Krupp armor. Projectiles will then be fired at these plates from the different guns of a first-class battleship, at varying ranges, and the results will be carefully observed by the representatives of the Admiralty watching the tests. The work of plating the vessel for these experiments is now in progress, and it is estimated that two or three months will elapse before she will be ready.

In a letter to The London Times, Sir W. B. Richmond, president of the Smoke Abatement Society, states that there are about 18 million tons of coal consumed annually in London, costing some 16 millions sterling, of which probably 3 million tons are consumed by gas and other manufactories. About two-thirds of the heat produced by the combustion of coal is lost in the ordinary grates by passing up the chimneys, and the loss thus incurred is about 8 millions sterling a year. It has been proved beyond dispute that factory furnaces can be quite easily rendered smokeless, and at a saving to their owners of from 10 to 20 per cent of the fuel consumed. With the use of the automatic feeder cheaper coal than anthracite can be adopted. The technical committee of the Coal Smoke Abatement Society has examined and approved grates which, while they maintain the open fire, consume all the carbon, and hence no appreciable quantity of smoke ascends the chimney.

The magnitude of potentiality of the maritime prosperity of Great Britain has been graphically illustrated during the past few months, owing to the state of affairs in China. When England went to war with South Africa, the whole of her 230,000 troops were dispatched from England in their transports without any appreciable interference with her mail services to the various parts of the world. True, some of the larger, more commodious, and fleeter vessels were commandeered to accelerate the passage of the troops to the seat of war, but their places upon the mail services were easily filled by other boats, and the international traffic has been carried on in its usual manner. Indeed, it was difficult to believe that the country was at war, since everything was accomplished so smoothly and without the slightest hitch. But the same cannot be said in connection with the maritime commerce of other nations. The transportation of the troops from Germany to China was such a tax upon the young country that its ordinary maritime traffic was in danger of being absolutely dislocated. The solution of the difficulty was the chartering of English vessels, which were readily obtained. Russia was placed in the same dilemma, and when France was embroiled with Madagascar, the French troops were conveyed to the scene of operations in English vessels. Gigantic though the maritime commerce of Great Britain is, it is still rapidly increasing. At present that country's foreign trade is equal to one-fifth of that of the whole world in value. According to Lloyd's Register of shipping for 1900–01, no less than 7,020 steamers, aggregating 11,513,759 tons, and 1,894 sailing vessels, representing a tonnage of 1,727,687 tons, are owned by various companies throughout Great Britain. Then the various colonies own 910 steamers of 635,331 tons and 1,014 sailing vessels equal to 384,477 tons between them. Therefore, it will be seen that the grand total for Great Britain and her colonies is as follows: 7,930 steamers, aggregating 12,149,090 tons; 2,908 sailing vessels, aggregating 2,112,164 tons; grand total, 10,838 vessels, aggregating 14,261,254 tons. According to Lloyd's, the whole of the world's over-sea traffic, with the exception of the smaller insignificant states, is carried on with 28,422 vessels of all kinds, representing a gross tonnage of 29,043,728 tons. Therefore, it will be seen that Great Britain and her colonies own about one-third of the world's vessels, amounting to nearly half the world's gross tonnage.

Electrical Notes.

Mr. H. Edmunds, of London, has devised a means of insulating cables with paper. His idea consists of thoroughly impregnating paper with a mixture of resinous material and oxidized oils, which are reduced to a thin consistency by the application of heat. The paper is then immersed in this solution, and allowed to become completely saturated with the mixture. When it is withdrawn from this bath, the permeated paper is wound spirally round the conductor. The inventor claims that the paper when immersed in the resin and oil bath soaks up a sufficiency of the solutions to form a layer between the folds of the paper, between the conductor and the paper, and also outside the paper. These operations are conducted while the paper is still warm and the solution fluid. He then permits the treated conductor to cool. Instead of treating the cable in the above mentioned manner, strips of paper saturated with an oily matter or lubricant which is free from moisture and of good insulating qualities may be wound round the conductor alternately with the resin impregnated paper. The inventor, after he has covered the conductor with this paper, winds round an outer wrapping of braiding or some other material, such as jute or cotton, which has previously been immersed in a hot bath of a mixture such as diatrine.

The most economical light is that whose spectrum is confined to the visible rays, and which does not involve the simultaneous emission of either infra-red or ultra-violet rays. Electric light marks in this respect a distinct advance on the older methods of lighting, and electric luminescence decidedly so. But no form of light hitherto produced equals that of the glow-worm in efficiency. The light of luminous organisms only contains an infinitesimal amount of heat. R. Dubois has been exhibiting some "photo-bacterial" products at the Paris Exhibition, and he now gives some particulars of the liquid medium which best suits their development. The liquid exhibited at the Palais de l'Optique consists of water containing sea salt, glycerine or mannite, and either peptone or asparagine, with an addition of some phosphorated compound like nucleine, phosphorated lecythine, or potassium phosphate. The author gives no information concerning the species of bacteria used. He says that the permanence of the light varies with the purity of the ingredients and the ventilation and agitation of the liquid. It may last six months. A room may be lighted up with a luminosity like that of the full moon. It may be that these photo-bacteria will acquire the industrial importance of the yeast fungus, but that will probably be eclipsed by some purely physical method of generating cold light.—R. Dubois in Comptes Rendus.

Mr. H. Bremer, of Neheim on the Ruhr River, has been conducting some exhaustive experiments with a view to obviating the blue color of the electric arc light. He has prepared some special carbon impregnated with salts of calcium, silicon, and magnesia, especially with calcium, the reddish yellow flame proceeding from which considerably softens the color of the light. The oxide of calcium covers the inside of the globe with a thin coating of a white deposit which serves to diffuse the light in all directions, in the same manner as if a frosted glass globe were employed. By this means the glowing point of the carbon is not seen, neither are there any of those shadow lines upon the upper half of the globe and practically darkness beneath the lamp, but the globe is bright all over. Photometer tests have been taken of lamps supplied with these carbons, and they prove all that the inventor claims for them. With an arc lamp taking 12·3 amperes at 44·5 volts, the light was constant, over 6,000 candle power in the cone between 45° and 90° with the horizontal, and 1,000 candles on the horizontal itself. The electric current consumption of the lamp was 0·196 watt per candle without a globe and 0·196 watt per candle with the globe to yield a hemispherical intensity of 4,300 candles. The inventor places his carbons in a vertical position, but slightly out of alignment. The arc is flattened out so that the light emission may be improved. The inventor states that his carbons are especially valuable in misty weather, owing to the yellow nature of the light. One of these arc lamps with four arcs has been suspended at a height of 312 feet from the Eiffel Tower in the Paris Exposition, so that their various advantages and potentialities may be estimated. The four lamps are arranged in two series, and take together 55·8 amperes at 89·3 volts. Tests were carried out with these lamps at a height of 26 feet above the ground, first without a globe and then when fitted with the globe. In the first instance the light intensity was 80,000 candles, corresponding to a current consumption of 0·1 watt per candle, that is, with the hemispherical intensity estimated at 49,730 candles. But when the globe was fitted, the hemispherical intensity was reduced to about 26,900 candles, which is equal to a current consumption of 0·17 watt per candle. There is one drawback, however, to these carbons, and that is that they are consumed in about half the time it takes the ordinary carbon to burn.