THE FORTH BRIDGE.

It will be remembered that during the last winter a mishap occurred to the large caisson which will occupy the northwestern corner of the Queensferry main pier of the Forth Bridge. It had been launched, and towed successfully into position, but some short time afterward it became flooded, and partially sank, sliding forward at the same time until it took up a tilted position in the bed of the river. The displacement was about 15 ft., and the angle of slope 25 deg. To remove this enormous mass, which weighs about 4,000 tons, and is 70 ft. in diameter, has been a work of considerable difficulty. At first it was thought that it could be raised by adding plating to the submerged side until it was clear of the water; and after the interior had been properly strutted, by pumping out the water it was hoped that the caisson would be floated. This method, however, did not prove successful, as, in the course of pumping out the caisson, it gave way in a weak place. It was then determined to encase the caisson in a complete system of timbering, while the interior was carefully strutted throughout. When this had been completed, the water was pumped out, and the caisson floated. Owing to its tilted position, not only was the work of surrounding it with timber tubing rendered very difficult, but the stresses on the strutting were much exaggerated. The determination of the stress involved problems of some intricacy, but the engineers left nothing to chance, but met every stress by a strut or tie of adequate strength. It was impossible to predict whether the caisson would gradually right itself as the water was pumped out, or whether the "stickage" of the mud filling the "working chamber" at the bottom would prevent the hydrostatic head taking effect upon the caisson till all the water was pumped out. It was necessary, therefore, to provide for the worst condition, and this implied an unbalanced pressure of 1,240 tons taking effect on the northern or deepest side of the caisson. To resist this a circular steel girder, with four raking steel struts, was

cylinder being placed over the medium cylinder. In other respects these engines were made as nearly as possible like those already referred to. Steam at 110 lb. pressure was supplied from a double-ended boiler 12 ft. 9 in. in diameter and 15 ft. long, having a total heating surface of 2,270 square feet, and identical in design with the boilers of the other vessels. The propellers were also alike and the ships were alike, so that a fair comparison could be made.

One of the ships fitted with the ordinary compound engines was named the Kovno, that with the triple compound engines the Draco. Their dimensions were as follows:

	Ft.	In.
Length between perpendiculars.....	270	0
Breadth.....	34	0
Depth of hold.....	18	3
Gross tons register ..	1,700	tons.

They were ordinary cargo boats built of steel, having a raised quarter deck and long bridge amidships. The Kovno was loaded with 2,400 tons dead weight, and sailed in January, 1883, for Buenos Ayres; and the Draco, having on board 2,425 tons dead weight, was dispatched in the following March to Bombay, the distance in both cases being about 6,400 miles. The ships were ordered to steam about the same speed, and in order to accomplish this it had been found by experience that a consumption of about 12 tons in the case of the Kovno was required, and 10 tons for the Draco. During the voyage each ship had average weather, and care was taken to get the best results. The average speed of the Draco was 8.625 knots, the engines making 57.5 revolutions, while the Kovno did 8.1 knots with 55.5 revolutions. The coal was ordinary South Yorkshire, and the indicated horse power in each case about 600. The total coal burnt on the Draco was 326 tons, while the Kovno consumed 405 tons. This shows an advantage to the triple compound system of 19.5 per cent. in fuel burnt with, an increase of speed of 6.5 per cent. Taking the results of another of the

RIGHTING A CAISSON—FORTH BRIDGE.

provided, besides strong timber struts and chains, as shown in the engraving above. The timber sheathing consisted of whole balks beveled into each other, with strips of felt at the joints. To make a water-tight joint with the ironwork, recourse was had to grouting, oakum, and sailcloth. Two 18 in. Gwynne pumps fixed at different levels effectually dealt with the water inside the caisson, and a 12 in. mud-pump and Batho dredger removed enough of the bank on the south side to form a fairly level bed for the caisson when floated again into position. It proved that the tendency of the caisson was to right itself inch by inch daily if the water were kept some feet lower inside than outside. By encouraging this tendency its position was materially improved before the final operation of pumping out and floating took place. The designing and carrying out of the operations for raising the sunken caisson was the joint work of Messrs. Fowler and Baker, the engineers, and Mr. Phillips, one of the contractors. Great credit is due to the foremen and workmen employed, especially to the divers, who had to fix all the tubing and heavy steel strutting, piece by piece, beneath the chilly waters of the Forth.—*Engineering*.

TRIPLE COMPOUND ENGINES.

AT a recent meeting of the Institution of Naval Architects, London, Mr. A. E. Seaton read a paper which gave some recent experience with this class of machinery. This contribution comes opportunely at the present time when triple compound engines are attracting so much attention. Mr. Seaton commenced by describing four vessels recently built by the company he is connected with (Earle's Shipbuilding Company). Three of these ships were fitted with engines having cylinders 25 in. and 50 in. in diameter and 45 in. stroke, steam being supplied, in each case, at 90 lb. pressure from one double-ended boiler 13 ft. 9 in. in diameter by 15 ft. long, having a total heating surface of 2,310 square feet. The fourth boat had a triple compound engine with cylinders 21 in., 32 in., and 56 in. in diameter by 36 in. stroke, the high pressure

vessels mentioned, the advantage was yet more strongly marked in favor of the triple compound engines.

Further results were obtained by means of the Yeddo, another vessel belonging to the same owners, Messrs. T. Wilson, Sons & Co. She had been working with ordinary compound engines at a pressure of 70 lb., the shafting not being calculated for heavier work. As the boiler was within the limits required for 100 lb. pressure, a third cylinder was placed on the top of the original low-pressure cylinder, and the ship dispatched to Cronstadt. The consumption of fuel was reduced from 17 tons to 13.5 tons per day. In this case it was the same ship, boilers, propellers, and crew, and the same engines only altered in the way described. So far all the trials had been made with two-crank engines, so it was now decided to construct another set of engines for 150 lb. pressure, having a crank to each cylinder. These engines had cylinders 20½ in., 33 in., and 58 in. in diameter by 36 in. stroke, and were fitted into the screw steamer Rosario, whose dimensions are 275 ft. 3 in. between perpendiculars, 34 ft. 3 in. beam, and 19 ft. 2 in. depth of hold, 1,862 tons gross, and the dead weight capacity 2,550 tons. In March last year she was loaded with 2,530 tons dead weight, and made the voyage to Bombay at an average speed of 8.6 knots on a consumption of 10.5 tons per day of South Yorkshire coal, or 347 tons on the voyage. This result is superior to that of the Draco when the size of the ship is taken into account, but not so much so as might have been anticipated from the increase of pressure and the rate of expansion, which was 14.4 in the Rosario and 12 in the Draco.

Another set of engines was made from the patterns of those of the Draco, but with the high pressure cylinder 20 in. in diameter; steam at 150 lb. pressure being supplied from two single-ended boilers, having a total heating surface of 2,200 square feet. They were fitted in the S.S. Finland, a cargo boat 270 ft. long, 35 ft. beam, by 18 ft. depth of hold, and 1,954 tons gross register. In January she was loaded with 2,500 tons dead weight, and sailed for Rangoon. The average speed attained was 8.42 knots per hour, or 202 miles

per day, on a consumption of 10.3 tons of Welsh coal per day, the rate of expansion being 12. All these ships were fitted with steam steering gear, so that, in comparing these results with those of vessels not so fitted, an allowance should be made. The consumption of water per indicated horse power calculated from the high pressure indicator diagrams was 14.1 in the Draco, 13.2 in the Rosario, and 13.16 in the Finland, or taking the medium pressure diagrams it was 12.2, 13.0, and 11.95 respectively. Comparing two other ships with triple expansion engines, of about 600 indicated horse power, the water consumed in a three-crank engine was 12.93 lb. against 13.0 lb. in the two-crank engine, but the former drives its ship half a knot faster than the latter. Mr. Seaton has now quite given up the double crank in favor of three-crank engine, on account of the more even wear of the brasses with the latter, due to the impossibility of equally dividing the work.

The largest engines Earle's Company have yet made have been for the Martello, having cylinders 31 in., 50 in., and 82 in. in diameter by 57 in. stroke. They run at 60 revolutions, with 150 lb. pressure, and indicate at sea 2,400 horse power. The consumption of Yorkshire coal averages 37 tons per day.

ON THE GENERATION OF A VOLTAIC CURRENT BY A SULPHUR CELL WITH A SOLID ELECTROLYTE.*

By SHELFORD BIDWELL, M.A., LL.B.

SO far as I am aware, there has never yet been constructed a voltaic cell having a solid electrolyte which, at least at ordinary temperatures, would produce the smallest indication of a current in the most delicate galvanometer. Sir William Thomson has described† a cell consisting of a piece of flint glass between plates of zinc and copper. After the glass had been warmed to 50° C., the plates were found to give indications of the existence of an electromotive force when connected with an electrometer. Profs. Ayrton and Perry have made similar experiments,‡ using paraffin wax, gutta percha, India rubber, and shellac. But it is needless to say that with electrolytes of such enormous resistance as these no current could be generated which could be detected in the ordinary way by any galvanometer, however sensitive.

The present paper contains an account of some experiments with cells in which the electrolytes consisted of sulphides of silver and copper between plates of the same metals. In nearly every case these arrangements were found to be capable of generating sensible currents, which sometimes, indeed, measured several thousand micro-amperes, and were capable of producing deflections in coarse galvanometers with pivoted needles. Some of the results obtained are curious, and even opposed to what might have been expected, but they will, in general, be given without any comment or attempted explanation. The copper and silver plates used were in every case 3 cm. square.

1. A cell was made by compressing a thin layer of powdered silver sulphide between plates of silver and copper. When connected with a shunted reflecting galvanometer, this cell produced a deflection indicating a current of about 30 micro-amperes. The direction of the current was from copper through sulphide to silver. On the following day, the circuit having been open in the mean time, the cell generated a current of only four micro-amperes. The copper plate was found to have acquired a purple color; the silver was untarnished.

2. The same cell was charged with equal parts of silver sulphide and sublimed sulphur mixed together. It now gave a current in the same direction of about 1.5 micro-amperes.

3. A layer of precipitated copper sulphide was placed between plates of copper and silver, which were squeezed together in a screw-press. When connected with the galvanometer (unshunted), this arrangement produced no deflection whatever.

4. The cell was recharged with a mixture of two parts of copper sulphide with one part of sulphur, and when connected with the galvanometer, it was found to give a very small current from silver to copper, indicated by a deflection of two or three scale divisions. The deflection was reversed as often as the connections with the binding screws of the cell were reversed, and the existence of a small electromotive force was undoubted. The internal resistance was 0.088 ohm.

5. Sufficient sulphur was added to the mixture to bring the resistance up to 2,700 ohms. The cell when remade produced a galvanometer deflection which was at first about 100 divisions (indicating a current of 0.8 micro-ampere), but soon increased somewhat irregularly to 250 divisions. The direction of the current was as before, from silver to copper through the cell.

6. A plate of copper was heated, and upon it was spread a mixture consisting of five parts of sulphur and one of copper sulphide. A plate of silver, previously heated, was laid upon the melted mixture, and the two plates pressed together. The thickness of the sulphur mixture between the plates was 0.3 mm. When this cell, after cooling, was connected with the galvanometer, the spot of light was at once deflected off the scale. Dr. Fleming was kind enough to make a very accurate measurement of its electromotive force by comparison with one of his standard Daniell cells. It was found to be 0.0712 volt, and its internal resistance was 6,537 ohms.

7. A similar cell was made with a mixture of equal parts of sulphur and copper sulphide. Its internal resistance was much lower, being only 13 ohms, but its electromotive force was also lower, being 0.007 volt. This result agrees with those of 3, 4, and 5, in showing that the electromotive force is diminished when the proportion of sulphide to sulphur is increased.

8. Another cell was made in the same manner as the two last described, but the sulphur was mixed with silver sulphide instead of with copper sulphide. This gave a strong current in the same direction as that produced when copper sulphide was used, and opposite to the direction of the current generated by the cells 1 and 2. This reversal of the current may be accounted for by the fact that copper sulphide is formed when the

* A paper read before Section B, British Association, Aberdeen meeting.

† *Proc. Roy. Soc.*, 1875, xxiii., p. 463.

‡ *Proc. Roy. Soc.*, March 21, 1878, p. 222.

melted mixture of sulphur and silver sulphide is brought into contact with the hot copper plate.

9. In order to ascertain whether sufficient sulphide to maintain a current could be formed entirely in this manner, pure sulphur was melted on a clean plate of copper, and, when just liquid, a warmed plate of silver was laid upon it, and pressed down by a weight until cold. The cell gave a strong current from silver through sulphur to copper.*

10. Thinking that the function of the free sulphur (without which, as has been seen, copper sulphide is incapable of generating a current) might be to form silver sulphide by contact with the silver plate, I constructed a cell as follows: A thin layer of copper sulphide was laid upon a plate of copper, a polished steel plate was laid upon the sulphide, and the whole was strongly compressed in a vise. The steel plate was then removed, and a thin layer of silver sulphide was spread upon the smooth surface of the copper sulphide. The cell was completed by pressing a silver plate upon the silver sulphide. It gave a current of 240 micro-amperes through an external resistance of 3.5 ohms, the direction through the cell being from silver to copper. This form of sulphide cell seems to be exactly analogous in its action to a Daniell cell, consisting of plates of zinc and copper in solutions of zinc sulphate and copper sulphate. The quantity of the copper sulphide would be gradually diminished, copper being deposited upon the copper plate, while the quantity of silver sulphide would continually increase with consumption of the silver plate.

A similarly constructed cell, with plates 2½ in. by 2 in., gave a current of 2,500 micro-amperes through an external circuit of 0.5 ohm.

11. Certain indications led me to believe that the cell last mentioned was short-circuited, and it appeared possible that this might be due to the penetration of particles of copper sulphide through the silver sulphide. The silver plate was therefore removed from the cell, and after being brushed over with a weak solution of sulphur in bisulphide of carbon, it was heated over a gas flame, and soon became covered with a perfectly uniform and continuous coating of sulphide. The heating was continued until all the free sulphur was driven off. When the cell was remade with this prepared plate, it generated a current of 6,800 micro-amperes through an external circuit of 0.2 ohm. The cell was found able to produce deflections in a roughly made galvanometer with a pivoted needle. Its electromotive force was 0.05 volt, and its internal resistance, therefore, was about 7 ohms.

Experiments with other metals would probably lead to the construction of a sulphur cell of greater power than any of those described in this paper. Silver may, indeed, be the best or only possible metal for the positive plate, but it is by no means certain that the copper of the negative plate might not be advantageously replaced by some other metal.†

PALMIERI'S CONSTANT DRY PILE.

In a recent article on the Vesuvius Observatory ‡ I spoke of Mr. Palmieri's dry pile, with the intention later on of furnishing some details as to its construction.

It has for a long time been recognized that the energy of dry piles depends much upon the hygrometric state of the atmosphere and the temperature. This inconvenience, which need not be taken into consideration in certain applications of secondary importance, such as the setting in motion of the toy rope dancers, etc., that figure in all treatises on experimental physics, constitutes a serious defect in applications of a purely scientific nature. As this kind of pile, owing to the construction of the Bohnenberger electrometer, has acquired a peculiar importance, it has become of interest to obtain models of as constant energy as possible. With such an object in view, Mr. Palmieri has succeeded in regulating the variations of the Zamboni pile in a very simple way. As well known, the paper and tin-foil disks in the styles of dry pile usually employed are superposed by hundreds in glass tubes, which are closed by metallic caps that form the poles. On account of this arrangement, it often happens that, as a consequence of the deposit of atmospheric vapor upon the outer surface of the tube, the polar tensions are in great measure neutralized.

Mr. Palmieri, in the dry pile that he has devised, employs, as usual, a series of paper disks, covered on one side with tin foil and on the other with peroxide of manganese fixed with milk; but, instead of introducing these with slight friction into a glass tube, he superposes them according to the axis of a flint glass cylinder whose internal diameter exceeds that of the disks by several fractions of an inch. The result is that a cylindrical layer of air separates the pile from its protecting envelope, and no longer permits of a direct contact, that is to say, of an easy loss. The column of disks thus formed rests upon a piece of metal, and at its upper part is compressed by a copper disk held by a screw, K, whose nut is provided with three arms, b, b, b, to which are attached three silk threads that are fixed to as many pins, m, m, m.

Owing to this arrangement (which the annexed figure sufficiently explains), the pile, whose pressure can be regulated at will, preserves a remarkable constancy for years. It is scarcely necessary to dry the silk threads, even at long intervals.

In speaking of dry pile electroscopes, Pouillet says that these apparatus always seemed to him inconstant, because of the motions of the air in the glass, and the electrification of this air by the two poles. He relied upon the fact that the gold leaf at times takes on spontaneous motions, particularly when the apparatus chances to be exposed to the direct rays of the sun. But it is to be remarked that such effects occur even

when the fixed conductor is touched with the finger, and that consequently we can scarcely allow that they are due to electrical tension.

Pouillet might have said as much of index electroscopes, since in this class of instruments the needle has many times been seen to oscillate spontaneously under the action of the solar rays, or when a lamp has been left near the apparatus for some little time. However this may be, Mr. Palmieri has judged it well to remedy the inconstancy of dry piles to as great a degree as possible, for the reason that they are very convenient instruments for ascertaining at the first glance whether the electricity under observation is positive or negative.

Dry piles assuredly weaken in time, but their duration is positively remarkable. One of the first that Zamboni constructed gave him evidences of activity for twenty-six years, and Mr. Palmieri has one in his possession (also of Zamboni's make) which, after a period of nearly fifty years, has not yet lost all its energy. These facts alone suffice to show that, however modest their role has remained up to the present,

PALMIERI'S DRY PILE.

dry piles perhaps are worthy of attracting the attention of electricians more seriously.—P. Marcillac, in *La Lumière Electrique*.

INFLUENCE OF ELECTRICITY UPON A LIQUID FILM.

A FURTHER account of the experiments of Professors Reinold, F.R.S., and Rucker, F.R.S., as to the influence of an electric current in modifying the rate of thinning of a liquid film, has recently been published in the *Philosophical Magazine*. One of the primary objects of this investigation, of which a description was published in *Proceedings of the Royal Society* in 1877, was the determination of the electrical resistance of films. A Wheatstone bridge was employed for this purpose, and a current was passed through the film only at a moment when observation was required. It was then seen that the films became black, and measures of their resistance while displaying this color were successfully obtained. Afterward continuous currents were employed, and the difference of potential between two fine wires thrust into the film was measured by an electrometer, and compared with the resistance between two other points in the same circuit, separated by a known resistance. The results obtained was not altogether of a satisfactory nature; but the later experiments are interesting as showing the behavior of the films and the nature of the colors evolved under the influence of the electric current. The liquid employed consisted either of a solution of potash, soap in water, or of *liquide glycerique*, containing a certain portion of niter to increase its conductivity. The films had the form of vertical cylinders; the upper and lower ring supports being of platinum, and about 33 millimeters in diameter. The cylinders were, as a rule, from 30 to 40 millimeters in length, but occasionally other lengths were under examination. Three films were observed simultaneously, two of them being in one glass box, and the third in a separate glass box. The two that were together were supported by platinum rings identically alike, and sharply beveled at the edge; the edges of the supports of the third were much thicker, and were rounded. It could thus be ascertained whether any difference in the behavior of the films was due to the form or thickness of their supports. No such difference was observed. Each of the film boxes was placed in the center of a water tank with glass sides, in order to prevent rapid changes of temperature. In all cases the films were surrounded with air saturated with the vapor of the liquid of which they were made. The constancy of the hygrometric state of the air and that of its temperature were indicated respectively by a hair hygrometer and a thermometer inside the glass case. The films were blown with air, which was first dried and then passed over some of the soap solution in a wide tube. The state of the air inside the film was thus approximately the same as that on the outside. The current employed was generated by a Siemens dynamo, and passed through a sensitive reflecting galvanometer, the deflection on the scale measuring approximately the strength of the current. This varied from about 100 micro-amperes to 0.5 of a micro-ampere. Under these conditions it was seen that in less than a minute after the adjustment of the film (potash-soap solution, without glycerine, 40 millimeters) to the cylindrical form, narrow rings of color appeared, and white of the first order of Newton's rings was soon seen at the top,

generally bordered by a deep band of blue of the second order. The colored portion of the film extended only 10 millimeters from the top. In from eight to fifteen minutes from the moment of formation of the film, a black film appeared, and slowly extended downward. The behavior of the films under the influence of the current was now observed. With a solution of potash-soap and a film 40 millimeters long, through which the current was passed from the moment of its formation, it was found that broad bands of color formed and spread with great rapidity, soon occupying the whole area of the film. After six minutes the current was 2.6 micro-amperes. In eleven minutes there was a ring of black, which increased in three minutes to 3 millimeters. Next, a film of 40 millimeters was taken, which had thinned until 2.5 millimeters of black were formed. Following the black was a band of deep blue. A downward current of 5.18 micro-amperes was applied. The blue changed to white, the black not being altered. After nine minutes the black was still of the same breadth, and the white had increased to 16 millimeters, the current being 4.06 micro-amperes. In two minutes after breaking the circuit the white had changed to black, the extent of which had become 19 millimeters, or nearly the whole length of the film. This and similar observations showed that a downward current had the remarkable effect of swiftly thinning that part of the film which was thicker than the black, but did not necessarily affect the latter. The film, however, was put into such a state that, on the cessation of the current, the development of the black proceeded at a rapid rate. With a downward current of 6.2 micro-amperes the black entirely disappeared after one minute, being replaced by white; and the current rose to 6.5 micro-amperes. The latter had the effect of destroying the black and increasing the conductivity of the film. With a film 30 millimeters long, to which a downward current of 24 micro-amperes was applied from the beginning, the white extended more than half way down, after ten minutes, and the current fell to 2.5 micro-amperes. The circuit was then broken, and the white turned to black so rapidly that the entire transformation was effected in less than one minute. Under the influence of the upward current the black was always destroyed, and, where previously existing, replaced by white; the current generally increased in intensity up to a certain limit. At certain stages of the film's existence a very feeble current was sufficient to destroy the black. One very interesting experiment was performed upon two films, each 30 millimeters long, which were formed side by side. The current was divided, and passed up one and down the other film. The effect was most striking. In twelve minutes, when one of the films broke, there were 15 millimeters of black in the one, while the other was thick and colorless, and liquid was streaming from the top of it.

ST. MARY'S (R. C.) CHURCH, LEEK, STAFFORDSHIRE.

WE give on page 8291 views of the design for the above church, prepared by Mr. Albert Vicars, Somerset Chambers, 151 Strand, London, for the Rev. Alfred M. Sperling. The foundation stone was laid on the 15th inst. by the Right Rev. Edward Hiley, D.D., Bishop Auxiliary of Birmingham. The edifice is already erected some feet higher than the church floor level, which is about 10 ft. above the street, and will be in the decorated style of architecture. The plan consists of nave and two aisles, chancel (arranged for surpliced choir), two side chapels, baptistery, confessional, recessed in wall of aisle, opening into a small room, for priests, fitted with a fireplace; nuns' choir for the use of the adjoining convent; priest's sacristy, with heating chamber under; and working sacristy, surmounted by a very effective tower and spire 140 ft. high. The organ gallery is at the west end; the chancel and side chapels at the west end. The interior length of the chapel is 104 ft. long by 50 ft. wide, and the height to the apex of the barrel roof ceiling of the nave and chancel will be 53 ft. 6 in. The exterior elevation of the roof from floor to ridge is to be 64 ft. The columns and responds of nave and chancel arcading, the shafts supporting principals of roof, also the exterior shafts, columns, and bands on spire, will be of red Scotch stone. The rock-faced ashlar is to be of local Hazelhurst stone, and the dressings of Douling stone. Messrs. Barker & Son, of Birmingham, are the contractors, and Mr. Peter Shaw the clerk of works.—*Building News*.

DUCHESS'S BEDROOM.

DERWENT Hall, belonging to the Duke of Norfolk, is situated near Sheffield, and the work a few years ago carried out there was done under the direction of Mr. J. F. Hansom, the architect. Our present sketch, on page 8291, shows the apartment known as the "Duchess's Bedroom," celebrated for its magnificent bedstead of elaborated Jacobean workmanship, while the other furniture of the room is also very good in style and equally interesting.

This bed, however, is an uncommonly fine one, more particularly on account of its beautiful detached posts or columns supporting the very rich canopy or tester. The foot-board, too, is specially refined and elegant in the detail of its ornamentation, almost Italian in some of its carvings. The well-known beds at the King's Arms Tavern, Lancaster (figured in the "John o' Gaunt Sketch-Book"), are in someways like it; and in connection with them are the bedsteads still to be seen at Hampton Court, Hatfield and Hardwick Halls, as well as at Wroxton Abbey, Oxfordshire. Abroad, instances crowd on the memory of high beds and wonderfully carved bedsteads, particularly those of the time of Francis I. Several have caryatides for posts, as in the bedroom of Diana de Poitiers at Chenonceaux, where the bedstead has a solid box carved plinth on all sides; and at the foot, over the cornice and draped frieze, occurs a rather curiously treated semicircular pediment quite in character with the style. At Azay le Rideau is another bed of the same type, but more elaborate and less admirable. These both contrast more favorably with each other than they do with our present Old English piece of work from Yorkshire, which, though so rich in style, has a quiet, homely dignity about it. In the center of the ceiling is a pendant enriched with

* A thin layer of sublimed sulphur was compressed between cold plates of silver and copper, which were connected with the galvanometer. A deflection of three divisions was produced, indicating a minute current from silver to copper. The experiment was repeated several times with the same result. (Moisture in the sulphur would have caused a current in the opposite direction.) This effect can, I think, only be explained by supposing that sulphides were formed in small quantities and diffused through the sulphur; but little importance can at present be attached to it.

† In a paper recently communicated to the Physical Society, which will be published in its *Proceedings* and also in the *Phil. Mag.*, experiments are quoted showing that the action of light diminishes the current generated by these sulphide cells, while heat increases it. Some very curious polarization effects are also described.

‡ SUPPLEMENT, p. 8178.