Protective Habit in a Spider.

MR. R. I. POCOCK's interesting paper in your issue of November 16, leads me to place on record an observation I made last summer in the island of Arran. Sitting by a little clear pool in the granite of Glen Sannox, I noticed a spider whose web was spun in the heather which partly overhung the stream. On disturbing her, she dropped on to the granite a few inches above the water, and running rapidly down, entered the pool and hid under a tuft of weed. After remaining thus hidden for 2½ minutes, she returned to the surface and, reeling herself up by her thread, regained the web. Disturbed again, she repeated the action, remaining under water 1¾ minutes. A puff of tobacco smoke sent her down a third time, when she remained hidden for 2¼ minutes. In each case she hid in the same place, and in each case regained the nest by her thread.

I have placed the spider in Mr. Pocock's hands. He informs me that the species is *Epeira cornuta*, or possibly *patagiata*.

University College, Bristol. C. LLOYD MORGAN.

THE LOSS OF H.M.S. "VICTORIA."

FOUR weeks ago the Admiralty issued a minute upon the proceedings of the Court-Martial appointed to inquire into the loss of H.M.S. *Victoria*; and also a further minute upon the construction and stability of the ship, and a report by Mr. W. H. White, the Director of Naval Construction, upon such parts of the evidence given at the Court-Martial as throw light upon the causes of the foundering or capsizing of the ship.

In the first-named minute the Admiralty concur with the finding of the Court-Martial, as regards the causes of the collision with the *Camperdown*, and the distribution of blame among the officers concerned:—matters with which we shall not now attempt to deal. The other two relate to the construction, buoyancy, and stability of the ship, and discuss facts and questions relating to these points, which demand the careful attention of all who are interested in the efficiency of the Navy. These minutes deal with matters for which the Admiralty is felt to be responsible, and to be, to some extent, upon its trial. The question of Admiralty responsibility for the efficiency of the *Victoria*, and her power to withstand such a blow as she received, has been hitherto treated and discussed as though it were merely one of who designed the ship. In this case, the circumstances are somewhat peculiar, for her original designer, Sir N. Barnaby, retired from the Admiralty service in 1885, immediately after the vessel was ordered to be built, and before she was even in frame. Many alterations were afterwards made during the progress of construction, and everything considered necessary for safety or efficiency was done by others, during the five years that passed before she was finally completed. Whether the early design were good or bad, the responsibility for the ship as she was completed and commisssioned, and passed into the Navy as a first-class battle-ship in 1890, surely rests with those whose duty it was to watch her construction, and to ultimately certify to her fitness for the class in H.M. service in which she was placed. The question of who was responsible for the design of the *Victoria* as it first stood, has now little more than an historical interest. That of the responsibility for completing and fitting her out for sea, and passing her into the Navy as a first-class battle-ship, is the only one of real practical importance at the present time, if it be thought necessary to discuss the matter.

This being the state of the case with regard to the question of responsibility, we can only regard the minutes relating to the buoyancy and stability of the *Victoria* as the best defence of the ship that is possible. It may be a perfectly good defence, but it is obviously *ex parte*, and can only rightly be judged as such. Had a Committee of Inquiry been appointed, these minutes represent the case that would have been laid before it by the Admiralty, and would have been examined from various points of view, and adjudicated upon. The Admiralty has preferred to treat the public as competent judges, and to lay their case before them in a form which bears the outward semblance of a judicial decision. The minutes are, however, upon some points more in the nature of a pleading than a judgment; while they are, at the same time, much too technical and complex for any but the most competent experts to judge. It is to be regretted, in the interests of the Navy and the country, that the facts and opinions thus put forward are not referred to a competent and impartial body for examination and report.

Mr. White's report summarises the evidence respecting the behaviour and movements of the *Victoria* after she was struck by the *Camperdown*, and gives the results of calculations respecting the effect of filling compartments in the neighbourhood of the blow, which appear to agree, in the main, with the reports of observers. The calculations employed are, as he states, quite simple in character; and no one who knows the Construction Department of the Admiralty, or the men in it who perform this class of work, could doubt their substantial accuracy. An important point in connection with them is, however, the assumptions upon which they are based. Some of these may be more or less open to question; while nothing is said as to the information the officers had respecting the rapidity with which the *Victoria* might be sunk if rammed. It appears evident that no one on board imagined the ship could sink, after such a blow as she received, without giving time to close the water-tight doors; and it appears, also, that some of the water-tight doors could only be closed by going into compartments into which the sea first obtained access.

These questions, and the more general one of the light that is thrown upon the efficiency of other ships of the same class by this sad disaster, respecting which the Admiralty minutes say nothing directly, though they imply that nothing unsatisfactory is indicated, appear deserving of close and careful consideration. The following remarks will be devoted to an attempt to describe how the matter, and the light thrown upon it by the recent Admiralty minutes, strikes one who is intimately acquainted with the ships of the Navy, and has studied the technical questions which have been raised, from time to time, respecting them.

The subjects treated of in the two minutes now under consideration may be classified as follows:—(1) The nature of the blow received by the *Victoria*; (2) her after-movements and behaviour up to the moment when she capsized and sank; (3) the extent to which water found access into the ship; (4) the effect of the water thus admitted upon the line of flotation and the stability; and (5) the lessons that are taught by various circumstances attending the loss that have come to light.

1. *The nature of the blow received by the "Victoria."*—Before the commencement of the manœuvre that immediately preceded the disaster, the ships of the squadron were steaming in two parallel lines, about 1200 yards apart, at a speed of about 8¾ knots. The course was ordered to be reversed by turning the ships inwards between the lines. The *Victoria's* helm was put hard to starboard, at an angle of 35°, and the *Camperdown's* helm was put over to port, at an angle of 28°. With these helm angles the *Victoria* would turn in a circle of 600 yards diameter, and the *Camperdown* in a circle of 800 yards diameter. A collision was therefore inevitable with both ships continuing at the same speed. When both had turned through eight points, or a right-angle, they were end-on to each other, at a distance apart which was estimated at 400 to 500 yards. It was then seen that a collision was imminent, and the port engines of the *Victoria* and starboard engines of the *Camperdown*

were ordered to be reversed at almost the same instant, about one minute before the collision, in order to make the ships turn more quickly. Orders to go astern with both sets of engines followed immediately in each ship.

The *Camperdown's* speed on striking the *Victoria* was estimated at 5 to 6 knots, and appears to have been rather less than 6 knots. The *Victoria's* speed ahead at the same time was about 5 knots. The blow was struck at an angle of about 10° abaft the beam of the *Victoria*, and at a distance of about 65 feet abaft the stemhead. The vertical portion of the *Camperdown's* stem penetrated 5½ to 6 feet into the side of the *Victoria*, and the point of the ram, which projects 7 feet beyond the vertical portion of the stem, penetrated 9 feet within the bottom plating at a depth of about 12 feet below water. The breach thus made in the side of the *Victoria* appears to have been 220 or 230 square feet in area; of which over 100 square feet was below the water-line. It extended vertically downwards 28 feet from the upper deck, and 18 feet from the water-line, and was 12 feet wide at the upper deck, and 11 feet wide at the water-line. The ships were locked together for over one minute, during which time their sterns swung together through an angle of 20°. As the blow was struck just before a water-tight transverse bulkhead, it appears probable that the water-tightness of the division thus formed was destroyed, either by the first shock or by injuries subsequently received, as the sterns of the two ships swung towards each other, while they were locked together.

2. *The movements and behaviour of the "Victoria" after being struck, up to the moment when she capsized and sank.*—Mr. White gives a clear description of this, which agrees with the evidence of officers on board other ships, who observed carefully what was happening to the *Victoria*. The force of the blow given to the bow of the *Victoria* caused it to move over at first 60 or 70 feet to port. The two ships remained locked together about one minute,[1] and as the *Camperdown* moved astern and cleared the *Victoria* settled down rapidly by the bow, and heeled towards the starboard side. The bow sank 10 feet during the first four minutes after the collision. Two minutes later the water had risen so high on the forecastle, which was originally 10 feet above water, that the men working there had to be called away. In nine to ten minutes after the collision the sea was entering the open turret ports, 100 feet from the bow and 14 feet above the original waterline. The upper deck right forward was then 13 feet below water; the armour-door in the bulkhead at the fore end of the upper deck battery, which was open, was partly under water; and the two foremost gun ports on starboard side, also open, were awash. The forward part of the upper deck was thus submerged for nearly half the length of the ship, and the stern was lifted about 8 feet. Simultaneously with this rapid depression of the bow and elevation of the stern, the ship was continuously increasing her heel to starboard up to about 20°, and when this position had been reached, nine or ten minutes only after the collision, she gave a lurch to starboard, turned bottom up, and sank by the head. When the lurch began the vessel was steaming slowly ahead with both screws, and the helm was hard over to starboard.

The speed ahead, due to an attempt to steam slowly towards the land, and the helm being over to starboard, tended somewhat, as Mr. White points out, to increase both the depression of the bow and the heel to starboard. Even a very low speed would have a serious effect, after the fore end of the upper deck became submerged, in forcing it still deeper below water, and in driving water into the interior of the ship through the openings on and above the upper deck. The helm was kept over because the hydraulic steering gear ceased to act very soon after the collision, when it was in that position. The failure of this steering gear is attributed to the inflow of water consequent upon the collision. Alternative hand-steering gear, which was available in a convenient position abaft the portion of the ship that was flooded, could not be brought into operation, owing to the short time the ship remained afloat.

3. *The extent to which water found access into the ship.*—A very large portion of Mr. White's report is devoted to a detailed discussion of the state of each compartment in the forward part of the ship, and the probability of water finding access into it; and, although the results thus arrived at are, doubtless, right upon the whole, it is not certain that they are correct in every particular. He appears to go too far in asserting that the evidence given before the Court Martial, respecting the compartments which were flooded, is exhaustive; while this is inconsistent with the list, given in Table II. of his report, of "Compartments shown by the evidence to have been probably or possibly filled through doors, hatches, &c." Two items in that list, at least, are quite doubtful, as judged by the published evidence, viz. the water-tight compartment in hold on port side, between frame stations 12 and 22, and the port ejector tank; which would hold 108 and 35 tons of water respectively. Neither does it appear right to claim, with absolute certainty, upon the evidence as it stands, that the submerged torpedo room was flooded, although it is probable that it was. This is a point upon which further examination of the witnesses might have converted reasonable doubt into something approaching to certainty.

There are, however, no scientific or practical questions relating to the case that would be seriously affected by proving absolutely that one compartment, or another, about which there might be any doubt, was or was not flooded. Events proved that sufficient water found its way into the fore-end of the ship to submerge the bow to the extent that was observed, and to ultimately cause her to capsize and sink. She would probably have kept afloat if all water-tight doors and scuttles had been closed, and if the entry of water had thus been limited to the compartments that were directly opened up by the breach made by the collision. The ultimate submersion and capsizing was apparently caused by the entry of water into compartments that were not damaged by the collision, through open doors and scuttles; and the circumstances and causes of the catastrophe can therefore be thoroughly discussed whether Mr. White be right or wrong in his conclusions as to the precise number and positions of the compartments that were flooded.

It thus appears, adopting Mr. White's figures in the aggregate—which must be fairly correct in order to account for the facts—that the weight of water which entered the ship was approximately as follows:—

(1) Into compartments that would have been flooded, in consequence of the collision, if all water-tight doors and hatches had been closed: 75 tons above the protective deck, 330 tons upon the platforms under the protective deck, and 271½ tons in the hold, being 676½ tons in all. (2) Into compartments that were subsequently flooded through doors, hatches, &c., that were left open: 33½ tons above the protective deck, 353 tons upon the platforms under the protective deck, and 47 tons in No. 7 coal bunker and shoot. (3) Into compartments which may have been flooded, but as to which the evidence is doubtful: 322 tons above protective deck,[1] 200 tons upon the platforms under the protective deck, and 143 tons in the hold. In addition to the above about 100 tons of water must have entered the boatswain's and carpenter's stores above the protec-

[1] Some observers thought two minutes.

[1] The compartments into which this 322 tons of water may have entered are the air-compressing room, sail room, chest room, torpedo room, and turret support, and it is pointed out in a foot-note to Mr. White's minute that these compartments are within the limits of the armour belt. We do not understand how this affects any of the points in the case.

tive deck, through the riding bitts on the upper deck, after the tops of these became submerged.

We thus obtain a total of 1,110 tons of water which entered the ship through the breach made by the collision and passed into other compartments, besides those directly laid open to the sea, through open doors, hatches, &c.; a further amount of 100 tons that entered after the tops of the riding bitts became submerged; and 665 tons about which there may be doubt as to the precise positions of the compartments it entered.

4. *The effect of the water thus admitted upon the line of flotation and the stability.*—The 1,110 tons of water above mentioned would, according to the Admiralty calculations, considering its position at the fore-end of the vessel, depress the bow to the extent of 21 feet, and raise the stern 8 feet. This change of waterline is considered to have necessarily flooded the other compartments, respecting which the direct evidence is doubtful; and certainly to have filled the boatswain's and carpenter's stores through the riding bitts. The turret ports, and also the door on starboard side, and the ports, in the upper deck battery, would thus be brought under water, and the position of the ship be rendered hopeless.

Mr. White states, with regard to the stability, that as the *Victoria* floated before the collision, she had a metacentric height of 5 feet—*i.e.* the centre of gravity was 5 feet below the point at which its righting effect would be *nil*—and that after the collision, when the bow had sunk deeply and she had heeled considerably—by how much is not said—the metacentric height was reduced to about eight-tenths of a foot. When water had entered the battery and turret through the open door and ports, as observed when the fatal lurch began, the metacentric height had become altered by the changed condition to *minus* 1·8 feet; and the final capsize was inevitable.

A consideration of the fifth subject treated in these minutes, which is the lessons taught by circumstances connected with the loss—the most important of all for the future—will require an article to itself, and must therefore be postponed till another week. The points mentioned in this connection are: the effect of longitudinal bulkheads upon safety in such circumstances as are those under discussion; whether the closing of the battery doors and ports would alone have been sufficient to save the ship; whether the closing of all water-tight doors and scuttles would have done so; whether the water-tight doors fitted to the ship were the best for the purpose; the value of an armour-belt at the ends for the purpose of resisting damage; and whether the blame rests wholly upon the officers of the *Victoria* for not knowing how rapidly the ship would be likely to sink when damaged as she was, and for not taking steps sooner to close the water-tight doors and scuttles and prevent the final catastrophe.

FRANCIS ELGAR.

JUPITER AND HIS RED SPOT.

JUPITER is now, with his northern declination of 18° and an equatorial diameter of 48″, a very fine object visible above our horizon during more than 15 hours at a time. Thus, on December 1 he rises at 3h. 7m. and sets at 18h. 23m., shining nearly throughout the long nights now prevailing from a position about 6° south-south-west of the Pleiades.

As an object for telescopic study Jupiter is undoubtedly the most interesting planet of our system. The activity apparent everywhere on his surface, the number and variety of the forms displayed, and the comparative ease with which they may be observed, attest that this object is practically without a rival, and that the investigation of his phenomena is certain to be productive.

The present time is eminently a suitable one for studying his surface markings, and redetermining their proper motions. As the planet's rotation period is less than 10 hours, the times of transit of the same spots may sometimes be obtained twice on one night, for if a marking crosses, say, 3 hours after the planet's rising, the same object will again reach the central meridian about 2½ hours before the planet sets.

It is well known that the visible surface of Jupiter consists of a number of light and dark zones interspersed with irregular forms which exhibit great differences in their rates of velocity. Certain white spots, bordering the equator, move very swiftly, and complete a rotation in considerably less time than the red spot. Some dark spots, which have appeared at various times on a double belt about 25° N. latitude, have moved more rapidly still, and shown a rotation in seven minutes less time than the red spot. But it is a peculiar feature of the different markings that they do not maintain the same rate of motion during their existence; in fact, a lengthening of period seems to generally affect them. Thus the red spot in 1880 gave a rotation of 9h. 55m. 34s., while in recent years it has been about 9h. 55m. 41s. The equatorial white spots, which thirteen years ago had a period of 9h. 50m. 6s., have been gradually moderating their speed until in the last few years their period seems to have been 9h. 50m. 30s. It is certain that the various markings are carried along in atmospheric currents, and are subject to remarkable differences, of which we do not comprehend the cause, though we may readily trace the effects.

The red spot situated in Jupiter's S. hemisphere, and on the boundary of the tropical and temperate zones of the planet, is still perceptible, and it is highly probable that the spot existed long before it first came conspicuously into notice in July, 1878. During the last fifteen years there has been little change either in its oval shape or in its dimensions, though its colour and visibility have suffered some trying viscissitudes. It has been successively presented as a brick-red spot, as a faint pink ellipse, as a grey shading, and it is now so feeble that only the outline of its following side can be distinguished, the preceding part of the spot having apparently lost its definite outline. In fact, there seems a prospect of losing the object temporarily if further decadence goes on, but in view of past experience and the probability of recurrence in the Jovian markings, we may certainly expect the spot to reappear, and to present a more conspicuous aspect than it does at the present time.

The following are some eye-estimates of the transits of the spot during the present apparition; they were made by Mr. A. Stanley Williams, of Brighton, and by myself at Bristol:—

Date, 1893.	Red spot at transit. h. m.	Marth's zero meridian. h. m.	Red spot precedes, m.	Observer.
Aug. 9	14 5	14 13·6	8·6	W. F. D.
14	13 15·5	13 22·1	6·6	A. S. W.
16	14 52·2	15 0·6	8·4	,,
16	14 55		5·6	W. F. D.
Sept. 4	15 31	15 41·8	10·8	A. S. W.
14	13 52·2	13 57·5	5·3	,,
Oct. 8	13 35·8	13 43·0	7·8	,,
18	11 50·4	11 58·0	7·6	,,
30	11 45	11 50·0	5·0	,,
Nov. 6	12 29·2	12 34·9	5·7	,,
23	11 25	11 33·9	8·9	W. F. D.

The spot therefore transits a few minutes before the zero meridian based on the daily rate, 870°27′ (=9h. 55m. 40·65s. for one rotation), System II. in Mr Marth's ephemerides (*Monthly Notices*, May, 1893).

Mr. Williams writes me that he has recently been able to make out the whole outline of the red spot except the preceding end, and on one very favourable night,