Fog-Signals in Fleets

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Evening Meeting.

Monday, February 6th, 1871.

REAR-ADMIRAL A. P. RYDER, in the Chair.

NAMES of MEMBERS who joined the Institution between the 31st January
and the 6th February.

ANNUAL.

Cochrane, H. S., U.C., Major, 7th Fus.

Daniell, E. S., Lt.-Col. 102nd Regt.

Rutley, J. Lewis, Capt. 2d Midx. Art. Volunteers.

FOG-SIGNALS IN FLEETS.

By Commander H. W. BRENT, R.N.

Sudden changes of temperature, or rather the fact of the existence in one district of a high temperature, while close by, the weather is cold, is the cause of fog, which, occurring at sea, and enveloping a ship, reduces that ship to the state of a man, walking in the noonday along the high road, suddenly struck blind, leaving the other senses in full force, and it may be quickened by the calamity. A dense fog at sea is not an alarming thing, but shutting out all that can be seen, you so suddenly become dependent on different means of finding your way, that it naturally causes anxiety to those in charge of ships, and every means that can be found, should be made use of to lighten that anxiety. At sea in a fog, being primarily dependent on the sense of hearing, noise of some sort to attract attention naturally takes the most prominent place to assist a ship in her movements; a blind man feels his way literally as he goes along, but a ship cannot actually do that, although in sea phrase the term "groping her way" is applied to a ship in a fog; this is figuratively doing the same as the blind man on shore, and consists in listening attentively, going slowly while uncertain, sounding often when near the land, and noticing also most attentively the speed and the time occupied in going certain numbers of miles.

I purpose this evening to speak on "fog-signalling" as regards Her Majesty's Navy only, more especially that part of it which relates to a fleet; for a fog enveloping a fleet that has a certain object in view, is of more consequence than to a single ship. The Orders in Council for preventing "collisions at sea" lay down what a single ship is to do to warn others of her approach, and how she may tell generally what is approaching. A fleet has not only these Orders, but that part of the

night signal-book which refers to fogs for guidance; these fog-signals come therefore within the scope of this paper.

Although everyone who has been at sea, has been frequently in a fog, yet they do not occur sufficiently often for Officers and men to be familiar enough with fog-signals; a fleet itself may also be so seldom in a fog that the fog-signals are but little studied; the day, and now night, signalling requiring so much attention, fog-signals are left until they are wanted, when it is expected that everything will be found clear and simple, and that the most ordinary individual will have not the slightest difficulty in either making or understanding the signals, or following the instructions laid down.

Fog-signalling should of all others be most distinct, regular, and simple, depending as it must entirely on sound; it should not be too quick, nor too slow, but made in a uniform steady way, always at the same rate, and in the same style; its instructions should be clear and distinct; the most simple means of communication that can be found should be used, at the same time taking care that the best instruments are supplied for making the signals, that even the ignorant may find the work so ready to their hands, and so easy of understanding, that the most stupid of them cannot fail to know, not only how to make the signals, but also understand the signals made in return.

In the fog-signals as at present laid down, signals by guns only, are in use, but since the introduction of the flashing night-signals by Captain Colomb, the same principle, with long and short sounds on the steam-whistle and fog-horn, has been much used. The loudest and most distinct noise being wanted, the firing of guns at regular and good intervals is of course the best method, as a gun, if the charge is sufficiently heavy, can be heard farther than any other noise at present made afloat, but there being a limit to gun signals, the flashing-signals by the steam-whistle, fog-horn, or bugle are a necessary, and I think a sufficient adjunct. I believe the present fog-signals, with the assistance of the flashing-signals, both somewhat altered, to be quite sufficient for all the wants of our fleets, my reason for saying so is from the experiments I have made, and the information I have received, both of which I intend to lay before you this evening.

Gun-fog-signals coming first, and knowing there were some difficulties connected with the present system, through the intervals at which the guns were fired, namely the preparative guns at intervals of 5 seconds, and the signal guns at intervals of 30 seconds, when at Portland, in June, 1869, by permission of Sir Thomas Symonds, then in command of the Channel Fleet, I sent two boom-boats lashed together, each carrying a 12-pounder Armstrong gun, outside the Breakwater, and went with a party of signalmen to the opposite side of the hill, to listen to the guns; the signalmen of the "Minotaur" on board their own ship, by order of Captain Goodenough, also listening and taking notes.

The experiments were to try the best intervals for distinguishing easily the guns fired, whether the present system of 5 seconds was not too quick and the 30 seconds too long; if so, what intermediate time would be better. Twenty-five series were tried, and both parties agreed in opinion regarding the intervals. The series were as follows:—

EXPERIMENTS at Portland, 20th July, 1869.

	Guns.	Interval.	Guns.	Remarks.
1	2 guns at 5 seconds.....	Interval of 30 seconds....	1 gun.....	Not understood.
2	2 guns at 5 seconds.....	Ditto	3 guns at 30 seconds ..	1 gun missed.
3	3 guns at 5 seconds.....	Ditto	2 guns at 30 seconds ..	Interval missed.
4	3 guns at 5 seconds.....	Ditto	3 guns at 30 seconds ..	Sounded irregular.
5	2 guns at 15 seconds	Ditto	2 guns at 5 seconds....	Sounded irregular.
6	3 guns at 15 seconds	Ditto	4 guns at 5 seconds....	
7	1 gun.....	Ditto	3 guns at 5 seconds....	Very quick.
8	2 guns at 5 seconds.....	Ditto	2 guns at 30 seconds ..	Badly fired.
9	2 guns at 20 seconds	Ditto	2 guns at 8 seconds....	
10	1 gun.....	Ditto	3 guns at 30 seconds ..	Not made out.
11	3 guns at 20 seconds	Ditto	3 guns at 8 seconds....	4 guns only heard.
12	1 gun.....	Interval of 60 seconds....	3 guns at 5 seconds....	Lost last part.
13	2 guns at 5 seconds.....	Ditto	2 guns at 5 seconds....	First 2 guns only heard.
14	3 guns at 5 seconds.....	Ditto	1 gun.....	1 gun missed at 5 seconds.
15	4 guns at 5 seconds.....	Ditto	4 guns at 5 seconds....	4 guns not heard.

22nd July, 1869.

1	2 guns at 10 seconds	Interval of 20 seconds....	2 guns at 10 seconds ..	Short interval good; the long hardly sufficient.
2	3 guns at 10 seconds	Ditto	2 guns at 10 seconds ..	Guns fired badly.
3	3 guns at 10 seconds	Interval of 30 seconds....	2 guns at 10 seconds ..	Good intervals, well marked.
4	2 guns at 10 seconds	Ditto	3 guns at 10 seconds ..	Good intervals, well marked.
5	2 guns at 7 seconds	Interval of 40 seconds....	2 guns at 7 seconds....	Fair interval.
6	3 guns at 7 seconds	Ditto	2 guns at 7 seconds....	Fair interval.
7	2 guns at 7 seconds	Interval of 60 seconds....	2 guns at 7 seconds....	Long interval too long.
8	2 guns at 7 seconds	Ditto	3 guns at 7 seconds....	Long interval too long.
9	2 guns at 7 seconds	Interval of 30 seconds....	2 guns at 7 seconds....	Very distinct.
10	2 guns at 10 seconds	Ditto	2 guns at 10 seconds ..	Very distinct.

The result we arrived at was that the 10 second interval was better than either the 5 or the 7, no guns being missed; also that the 30 second interval was so distinct a difference to the 10 second interval, it was unmistakable, besides not being so long as to appear as if it did not belong to the signal made like the 40 and 60 second interval.

With gun fog-signals there is of course a limit, until some one can invent a system whereby the firing of not more than 6 guns will give combinations for many thousand signals, at the same time making each one so distinct that it cannot be mistaken for another. Provided the length of time in making the signal should be of no object, of course if 10 guns could be used, any number of signals might be made, but the difficulty of the number of guns is very much increased now with the broadside and turret ships, those composing our fleets, as they carry but few and heavy guns, which guns should be used when possible; if not possible, the boat guns must be substituted. The principal signal makers in a fog, the flag ships, can use the guns they have for saluting purposes, which, taking into consideration their being used in a fog, ought to be 32-pounders.

After the experiments at Portland, Charles Brewer, the chief signalman of Her Majesty's ship "Minotaur," gave me a scheme for gun fog-signals, which I think the best I have met; taking the intervals we agreed on, he applies them very simply in the following way: all guns to form a number to be fired at intervals of 10 seconds apart, but in the case of a double number like 12 or 54, the interval between the integers to be 30 seconds. As an example 23, two guns with 10 seconds between them, an interval of 30 seconds and then three guns at intervals of 10 seconds, so that on hearing the guns a signalman can count 1, 2, these being fired with 10 seconds between; he then finds a much longer and well-marked interval, waits, and counts again 1, 2, 3, having also 10 seconds between, and knows the signal to look for is 23, turning to it at once. The great advantage of this is that the number of guns fired, gives the number of the signal made; now, in the present arrangement, one of the greatest difficulties, really I think the worst part, is that the number of the guns fired gives you no clue whatever to the signal made, that is to say No. 3 signal may be made by firing only two guns, No. 6 by three guns, No. 5 by four guns, No. 7 perhaps also is made by firing four guns, of course at different intervals to No. 5. Nos. 8 and 12 may both be made by firing five guns, hence the number of the guns fired, gives you no key to the number of the signal made, and the difficulty is so great, that it is no common thing for there to be many opinions as to the actual signal.

As I said before, there being a limit to the number of guns to be used—otherwise with 10 guns by Brewer's scheme any number might be made, provided the element of time was of no consequence—the number of guns and time being considered, five was taken as the largest number that should be used. Practically five is a large number, and all signals having the five in them should be those seldom necessary. The following numbers are composed by five, 1 to 5, 11 to 15, 21 to 25, 31 to 35, 41 to 45, and 51 to 55, giving 30 signals in all, against, I think, the 14 or 15 now in the signal-book.

To make any of these signals three guns at least are necessary; with the 12-pounder breech-loaders with which the experiments were made at Portland, two were sufficient, but with the larger broadside guns, four at least would, I think, be found requisite.

In dividing these 30 signals, 1 to 5 should be the important ones made under somewhat different instructions to the others;

- 11 to 15 relating to altering course;
- 21 to 25 to steam;
- 31 to 35 to tacking and wearing;
- 41 to 45 to hauling to the wind;
- 51 to 55 to be left blank.

Of course in selecting 30 signals for use in a fog, out of the thousands in the signal books, there will be much difference of opinion in a service like the Navy; but the necessary signals can always be arrived at by taking the opinion of the well known best Officers. I merely put these in as simply my own idea, to show the way I think the 30 signals might be divided.

Of the present few fog signals, it is quite time that some alteration were made. They were first selected for sailing fleets, and have been handed down with but very slight additions, and although perfectly sufficient for a fleet with the wind as the only motive power, and therefore as the wind is generally light in a fog, obliged to move very slowly and naturally likely to keep together, yet the case is quite altered as regards a steam fleet, something more being required. Even in the signals themselves, some are annulled by Act of Parliament, two still remaining to distinguish tacks,—a system abolished,—sailing ships being ordered to use a fog-horn, steam ships the steam-whistle, and ringing a bell distinguishing ships at anchor.

Time being an important element in the making of gun fog-signals, having fixed on the period to elapse between the guns fired, it is now necessary to fix on the period between the repetitions of the signal, and also between the different signals. There must always be a doubt of the bearing of a noise heard, especially when it is on either beam; ahead or astern the range is narrowed, therefore the leaders of columns only should repeat. This order of repetition is laid down in the present signal book, and one cannot do better than adhere to it; the guns to form a signal always to be fired from the same side, otherwise some guns might not be heard. The leaders of columns to repeat in the order of their divisions, allowing two minutes to be left between the last gun of the signal and the first of the succeeding repeater, should four minutes elapse without a repetition, the next in succession should repeat, and after the last repetition, four minutes to elapse, and then the signal to be carried into effect.

Having made a gun-signal in a fog, fresh signals should not be made too quickly, and unless actually necessary, generally speaking, ten minutes at least should be left from the last gun of one signal before the Admiral commences another. All the times mentioned both for firing the guns, and between the repeaters, should be the subject of much care, and be conducted with the greatest regularity, the firing

would then catch the ear at the right moment, causing no uncertainty as to the number of guns fired.

I mentioned, when selecting the numbers of the signals to be made by the five guns, that 1 to 5 should come under somewhat different regulations to the others, I will now take each one separately. No. 1, or one gun, to be Admiral's position, and answer to signals made, Admiral's answer I mean corresponding to the affirmative by day; this signal requires a note to say that the Admiral will fire his position-gun immediately he is overtaken by a fog, and after that, at the hours and half hours during the fog. In the present book there is a difficulty about this position-gun, for this reason I would put in the note. As it stands at present, it orders ships to continue under the same sail, but is only ordered to be fired every half hour, one Admiral fires his first gun half an hour after the fog commences, and continues to fire it at half hours from that time; another will fire his first gun with the first bell that strikes after the fog comes on, and continue to do so with each bell; a third fires immediately he is enveloped in a fog, then perhaps at half hours from that time, or perhaps when the bell strikes the hours and half hours—as I think it should be, and have in consequence put in the note. These differences of opinion are very bad, especially on this signal; the half hour gun being the main guide to the fleet, they are following their Admiral.

No. 2, or two guns, with the ten second interval between them to be the preparative, which preparative is to be made before all signals, except 1 to 5. One of the greatest objections to the present arrangement is that there is nothing to call attention; the first guns heard, though called preparative guns, not only being a preparation for the signal, but also the signal itself, having to be counted as a part of it, and being fired at the quick saluting time of five seconds, are continually being missed, and the purport of the signal is entirely changed. No. 2, the preparative, should stand alone, made and repeated in order by the leaders, two minutes after the last repeater the signal itself of which it has been the preparer, should then be commenced, every one would be on the *qui vive*, no noise, watches ready, and the signal with such elements of success, be taken in without doubt or hesitation.

No. 3, or three guns, at intervals of ten seconds, to be a signal to denote having shoaled the water suddenly; it can be seen why the two former need no preparative, and as this would principally be made by a private ship to the Admiral, who would answer it with his one gun, it would of itself be so out of the common as to cause immediate attention being paid to it, and indeed would be the only gun signal I would place in the book for a private ship to make.

No. 4, or four guns, at intervals of ten seconds, would also be better without the preparative, and should be entered as "Anchor instantly," this signal to be carried out immediately it is heard. Whenever it might become necessary to anchor a fleet in a fog, if you knew where you were, the signal should not be made until the right moment; if suddenly in soundings, the signal would be made and carried out immediately they were heard by every ship. Ships in a fog are not going very fast, especially in pilot water, they can almost instantly

drop their anchors, and should then commence to strike their bells as ordered.

No. 5 I would leave blank for filling in as senior officers may deem necessary while in command.

Although I advocate the advantage of a preparative before making fog-signals, yet the last three signals, following No. 2, the preparative, as they do, would, I think, be so different, requiring different action, the advantage of having them would be lost if they had to wait for the preparative, with all the time that must be passed in consequence; I therefore leave them by themselves, adding, they should be repeated as necessary.

Regarding the answering of gun-signals; hitherto the answer to most of the signals has been muskets in quick succession *after* the signal has been complied with. This is really no answer at all, besides muskets are not loud enough to be heard. Others had to be answered by denoting the tack a ship was on, when the different tacks were ordered by Parliament to be distinguished, so that I take it the answers to signals were practically nil. In my opinion there should be no answer to gun fog-signals, for if made with a preparative, and with a given time for carrying out the signal, the fewer the guns fired, the better. In a large fleet with only three repeating ships, if every ship fired a gun in answer—remember a gun is the only noise that can be heard from one end of a line to the other—it would lead to such confusion, that it is better to trust entirely to the care and vigilance of those in the ships, than for the flag ship to be in an uncertain state of worry and excitement as to how many ships have or have not answered, and perhaps hesitate in performing what she had already ordered to be done.

As at present there is a limit to gun-signals, something is required in addition, for of the many thousand signals necessary for day and night, surely thirty will not be sufficient for all the exigencies of a fog.

This want can be supplied by the flashing-system applied to sound, using the steam-whistle, fog-horn, or bugle, enabling both general and vocabulary signal-books to be used intact, making as many signals in a fog as in clear weather.

Since the establishment of the "flashing-signals" by Captain Colomb, the harbour fog-signals, made in the same manner as the fog-signals for sea, have been entirely superseded by the use of the fog-horn on the flashing principle, and at sea it has been used at times on the steam-whistle and fog-horn; but there are no regulations as yet except such as Admirals in command of squadrons have made from time to time, and lately I have not seen the system so much used in a fog as in Sir Sydney Dacre's fleet, between 1863 and 1865; it is, however, a firm basis for fog-signalling, and should be carried out to its full extent.

We require, however, a more powerful noise than we have at present. The steam-whistle is not good enough, the fog-horn, or bugle not loud enough for a fleet at sea. The steam-whistles of all the marine engines I had ever seen, except high pressure boats, having been failures, generally commencing with a rush of water and ending in the faintest

possible scream, I made enquiries amongst engineers and engine-makers about the steam-whistles of our engines, as to why they were so bad? I found that as a rule they were not made as carefully as the delicate parts of the engine, but that it had been found out by some careful experiments that the distance from the cup to the dome must be in proportion to the diameter of the whistle; when made very carefully a powerful scream could always be obtained.

On my writing to Messrs. Penn, the engine-makers at Greenwich, saying I wished to find out the best steam-whistles, they very kindly lent me two for trial, one with a sharp scream, and the other with a deep tone; these I had fitted to the steam-whistle pipe of the "Bellerophon," and although water as usual came up first, still I was satisfied the deep toned one was the best.

Captain Goodenough, of the "Minotaur," one day pointing out to me a notice in the "Engineer" of a "Steam-Roarer," by J. Bailey and Co., Albion Works, Salford, Lancashire, I wrote to them, saying I was making some experiments, would they lend me a "Steam-Roarer" for trial; this they most kindly did, I had it also fitted, but in consequence of the pressure in the "Bellerophon's" boilers being very much reduced there was not power enough to develop its use, but trying it on the steam launch's engine in Malta Harbour, it produced such a scream as to startle every one. The chief peculiarities of Mr. Bailey's "Steam-Roarer" may be described as follows:—

1st. The latest one is adjustable, and can be made to exert its highest power, for either high or low pressure steam, if used on a boiler with 15 lbs. pressure, lower the dome and diminish the distance

from A to B, and increase the distance as greater pressure is used. Altering the distance from A to B is done in a simple manner, by loosening the lock-nut at G, and turning the dome round.

2ndly. The steam-way of the instrument is large, and instead of using a cock or plug tap, a full-way inverted valve is used, which is kept tight by the pressure of the steam, and the moment it is opened, the full pressure is on the instrument. By the peculiar lever arrangement on the top, a weight may be placed at one end, so that if necessary to fix it at any height the weight will close the valve on ceasing to pull at the chain or wire.

3rdly. There are very few parts in this instrument, and it is not likely to get out of order.

Since the "Bellerophon" paid off, I have been in communication with Mr. Bailey, telling him what is wanted, the result is the instrument just described, which, after being adjusted for the steam pressure, makes the sound as loud at first as at last, and is the very thing wanted for flashing-signals in a fog; it is used in some merchant steamers, and I hope Mr. Bailey will soon have it tried in the Channel Fleet.

There is yet, even with good steam-whistles, something to be done with the pipe from the boiler; the opening valve should, I think, be close to the boiler, instead of the whistle, but the handle still to be on deck, and there should also be a small cock for letting off any water there may be inside the pipe from condensed steam.

To be able to make flashing-signals on the fog-horn, Captain May, in the "Northumberland," the other day hit on a very ingenious plan. He had the steam launch's boiler filled with air by the air-pump of the diving apparatus, getting easily 15 lbs. pressure, and more if necessary; he then fixed on a fog-horn, and was able to get a good loud sound, sharp and well defined.

It will be seen by this that, having got the "flashing-system" for signalling, people require a good instrument to make the signals; and as some are turning their attention to it, I have no doubt ere long our ships will be able to communicate with one another in this manner easily from one end of a fleet to the other. Flag ships in particular ought to be first of all well fitted with steam-whistle or roarer, and fog-horn. In making a flashing-signal in a fog, it can be used either by itself or in conjunction with a gun-signal; in harbour it should only be used, the ships being much closer together. At sea all signals from the general and vocabulary signal-books, except the thirty selected for gun-signals, should be made by the flashing-system, and when good instruments are supplied, an Admiral may make sure his signals are as well understood as if made in clear weather with flags. When the Admiral makes a flashing fog-signal, ships nearest to him should answer first, the rest in succession, repeating for safety, all signals from the general signal book, and answering only all signals from the vocabulary signal-book. Should a ship notice that her next astern, does not answer, she should repeat again, if necessary with her pendants. The leaders and regular repeating ships of a squadron need not repeat "flashing-signals" except in the manner just mentioned. If the squadron

is in a single column, it is a very good plan to repeat the signal, whatever it may be, down the line, and then repeat the answer from the sternmost ship back to the Admiral; by that means the Admiral knows that all the ships understand his signal. These signals should be governed exactly by the same rules as "flashing-night-signals," but in case of ordering an evolution, for commencing which at night the Admiral shows position lights, or burns a short signal-light, he should in a fog, when all ships have repeated, fire his position gun, then, four minutes from that time, the evolution is to take place.

By the Order in Council for "Preventing Collisions at Sea," sounds on the fog-horn denote being under sail, on the steam-whistle being under steam, and ringing the bell being at anchor. Nothing is laid down as to the particular sounds to be made, so those most conducive to order and safety can be used. At present it is the habit for each ship to sound her pendants on the flashing principle; but as ships wish to communicate by the same principle, there is a difficulty. According to the rules, the ship making the signal has to commence and end her signal with the pendants of the ship spoken to, causing some confusion to other ships, which might only hear the pendants part of the signal. And in case of ships in different lines signalling to one another, it would exactly seem as if they had changed places, the ships astern or ahead of each, would at once think they had by some unaccountable means got over to the other line, and if commanded by anxious men, try, as they thought, to hark back; they would get hopelessly involved, and unless the fog lifted, would end in their losing the fleet altogether.

If my memory does not fail me, when the late Lord Lyons took one of the Kertch expeditions, I think the second, with the Turks embarked, we were all one day in a fog, and the few large ships in the little squadron ringing their bells, struck the number of their seniority, the Admiral's ship striking 1, the "Hannibal," 2, the "Algiers," 3, and so on. This struck me as being such a good way of distinguishing ships in a fog, that I would direct ships in a fleet in a fog, whether they use steam-whistle, fog-horn, or bell, always to sound their fleet numbers; by this means, while acting in accordance with the Regulations for Preventing Collisions at Sea, there would be no confusion in making another ship's pendants when wishing to communicate.

It is a matter of some importance to be able to communicate freely with another ship in a fog. In the "Bellerophon," in August, 1869, with one of Messrs. Penn's steam-whistles, lent to us, we were able to find out from the "Hercules," at least 10 cables off, the direction of the Admiral, and although not in his line, we easily picked up the wake of our next ahead, the "Northumberland," which ship had fast hold of the leader of our line; thus when the fog cleared off we were in our place.

There is one case, however, in which I think special sounds on the fog-horn or steam-whistle should be laid down, and that is in passing from one tack to another, whether under sail alone or under steam and sail. It is then more important to know what tack an approaching ship is on, than what particular ship she may be; directions should be given that during this evolution *only*, ships on the starboard tack, should make a series of long sounds, and ships on the port tack, a series of short

sounds, referring back to their fleet number when the evolution is over, of course using the fog-horn for sail only, and the steam-whistle when under sail and steam. By these means I think perfect signalling may be maintained in a fog. There should also be some instructions that Officers may not only easily find out how the "fog-signals" will be made, but also what they have to do in a fog themselves. The Order in Council for "Preventing Collisions at Sea" being paramount, its directions must be carried out in the signal-book. The speed is laid down by the Order, and is not to be more than from three to four knots. It is a safe speed, as it enables a ship to stop easily and quickly, and should of course be used under ordinary circumstances; but in the exigencies of our naval service, it may often be necessary for a fleet to proceed faster, and arrangements must be made in order to meet a greater speed. It should also be laid down when the Admiral will reduce speed if going fast at the commencement of a fog; should he even wish to continue at the same speed, it would be better as the fog came on, to fire his position gun as directed, and four minutes after the last repeater, reduce to the regulated four knots. The fleet would then close up, and by steam-whistle he can state the speed, or the number of revolutions he intends to proceed at, but under ordinary circumstances, of course the fleet is bound to proceed at the laid down speed.

Whenever there is appearance of fog and it is practicable, the fleet should be formed in single column in line ahead, and in close order.

Firstly. Because in line ahead there is less danger of fouling.

Secondly. Station in a fog can be so much better kept in line ahead.

Thirdly. Signal communication can always be kept up, and

Lastly. The fleet can go at a greater speed if required than four knots, with more certainty of keeping together.

The most easy position in which you can be placed at sea to keep clear of another ship, is when coming up astern, whether in day time, at night, in a fog, or thick weather. This, I believe, no one can gainsay; by putting the ships in single column in line ahead, all ships are coming up astern of one another. Keeping station in a fog when in line ahead is always much easier than in any other formation, for the reason that even in so dense a fog the ship ahead cannot be seen, as there is generally but little wind and smooth water, the very wake of the next ahead can be seen and steered in. By putting the ships in close order in line ahead, there can be no doubt on the part of the Admiral that all ships in turn understand his signal, and should a ship be missing, which would be known by her not repeating or answering the signal made, it can be reported to the Admiral by her next ahead; this will give him greater confidence if he wishes to alter course, increase or decrease speed.

The single column formation, having all the above advantages, enables the fleet to proceed at any speed that may be necessary for the fulfilment of orders; that I am not advocating this without experience, I must relate an incident in the life of the Channel Fleet.

In September, 1865, when that fleet was commanded by Sir Sydney

Dacres, on its way from Spithead to Bantry Bay, a little outside the Nab Light,—being then formed in single column in line ahead,—the ships became enveloped in a fog. It was in the evening when this fog commenced, lasting nearly 36 hours, the Fleet steamed down channel at more than 5 knots speed; one ship was known to be missing before the fog lifted, and when it did lift, the ships, with the one exception, were in their stations. Signal communication had been kept up the whole time, and no land was seen from leaving Spithead until the Mizzen Head was sighted on the coast of Ireland. The easy and admirable way in which the "Hector," next astern of the "Edgar" kept always just in sight, I shall never forget; at times she was within 20 yards of her leader's stern, and then would drop until almost out of sight, but with pride those in the "Hector" may, I believe, say, they never really lost sight of their leader in that fog.

It is, I think, a wise precaution that during a fog, the fleet if under sail, should always maintain the same order, and continue on the same tack as when the fog came on, even if the wind changes its direction, until it is ordered by signal to do otherwise; this removes any question of doubt that might arise in the minds of officers in command of ships; also in the case of a breeze springing up after a calm, which would prevent the fleet proceeding as before; the Admiral would first come to the wind by signal, on the most advantageous tack, and then, if the wind be favourable, after he is sure all the ships are on the tack ordered, keep away to the course intended. This seems a roundabout way to get to a certain course, but as to all ships when under sail a certain number of points are shut, on the principle of "the longest way round being the shortest way home," it will be easier and safer for all ships to get on one tack first, and then bear away to the required course in succession. In tacking under sail in a fog, great care will have to be taken, in noting particularly the time of the last repeater, making sufficient sail to ensure tacking, and then in reducing sail again as soon as about, so as to proceed at the proper speed, and to signal carefully the tack the ship is on. Although in a fog, such few evolutions as may be performed, should be carefully carried out, as laid down in the signal book.

I speak of evolutions, but am perfectly aware they must be of the most simple description, and of such a nature as to cause the least possible risk to the ships in their performance; care should be taken to make them successive, and not simultaneous, for the reason that risk of collision is lessened when following a ship. What the evolutions actually should be, must depend on the signals at command and the circumstances of the case; it is a subject on which no rules can be laid down, but must be left to the ability of the Admiral, aided by the intelligence and activity of his captains.

On a ship of the fleet discovering any danger, she should immediately fire guns in quick succession, and if necessary to make a movement to avoid the danger, she should fire a position-gun at intervals, to show how she is standing to avoid it; if a ship should actually strike the ground, besides firing guns while ashore, she should also fire rifles, beat drums, sound fog-horns or steam-whistles, making all the noise

she can in fact, so that every one may be attracted by her unusual proceedings, and avoid closing nearer the sounds heard.

In case of it becoming necessary to anchor a fleet, as the ships drop their anchors they should strike their fleet numbers on their bells, and continue to do so until all the fleet has anchored.

After all it will be seen that I advocate no new principles in the "fog signals" for the Navy, but believing that those now in use, have certain shortcomings, and are not sufficient for the wants of the present day, and having noticed that as the matter stands, the signal staff of ships appear to partake of the nature of the surrounding atmosphere, never seeming quite clear, for what they should look out—a gun being fired, causing them bewilderment—also, having seen Officers turn to the signal-book expecting to find everything ready to their hand when *in* the fog, I think the Navy requires a very clear and simple "fog-signal-book." Of course both Officers and signalmen should know the "fog" as well as other signals in use; when they do not do so, they feel their ignorance, and are in consequence wanting in that self-confidence which ensures promptness of action. This evil is lessened as the signal-book is clear and simple, but it is much increased as the thing stands at present, there not being clear and concise information of what is to be done and how ships are to act; and on any gun-signal being made, particularly from the quickness of the guns fired at first, there is very often some difference of opinion as to the actual number fired, and therefore of the signal made; in consequence Officers in command fear to make a decisive movement, the fleet becomes scattered, and if the fog lasts, some ships are missing at its close.

Advocating no new principles, nothing is required except that the old signals should be simplified, modernized, and extended, and the "flashing-signals" ordered to be used.

I would add a few more instructions, and think it would be a benefit if the signal book stood thus:—

1. Instructions relating to fog-signals.
2. Instructions for the conduct of a fleet in a fog.
3. Gun-fog-signals.

The instructions relating to "fog-signals" should describe and direct the different methods of signalling, commencing with the gun-signals as the most important, and ending with the "flashing-signals" by the steam-whistle, bugle, or fog-horn. The instructions for the conduct of a fleet speak for themselves; in them I would embody all that I have before stated, to enable a fleet to keep together however long a fog may last. The "gun-fog-signals" should indicate some few selected signals, leaving all else to the "flashing system," pre-supposing every care has been taken to furnish the ships with the best instruments.

No fog-signal books are complete without one of Admiral Ryder's markers; a small board with two divisions, in each division holes, and a peg at each end, the first or left hand division marked "Preparative guns at five seconds," the right hand division marked "Signal guns at thirty seconds."

For every gun heard at the various intervals, you place the peg in a hole, and when the signal is finished, you have the number fired

before you. This board can be made on board any ship, and should be kept in the bridge-house; Captains will find it useful to keep one handy in their cabins. Whatever intervals may be fixed on, can always be adapted to this marker, with what I propose, the board would be in three divisions, the right and left with holes for the "guns at ten seconds," and the centre being merely marked "interval of thirty seconds."

After the signal is made, with this method, you would see before you the number of the signal to turn to, instead of having by the present arrangement to look through all the signals to see the number that has been made; this is perhaps a small matter, but it tends to settle the doubt of how many guns have been fired, and gives confidence to carry out a signal.

Whatever fog-signals may be established, and there has been a committee lately which will shortly give the service the results of its labours, no books or systems are of much use unless the fog-signals are practised when the fleet is not only in harbour but at sea.

I hear in future that the signals for a fog are no longer to be called "fog-signals," but "gun-signals," to let people know that they need not necessarily wait for a fog to use them; this is an exceedingly good idea, as it will tend to familiarize signalmen with this means of signalling. To exercise the "fog-signals," the Admiral should inform the fleet what he is about to do, making not only gun but flashing-signals, and every ship should send in to him on paper what they had taken in; this would prevent the startled effect a "fog-signal" now produces.

However perfect a signal-book may be made, there is a part which may be called the seamanship of the question, which cannot be laid down, but must be left to those in charge of our ships. I am quite aware that in a fog suddenly coming over a fleet, great caution must

be displayed, and the most vigilant look out kept, but I do not think in a well-ordered service, with the means now-a-days at command, a fog should cause the slightest fear or hesitation, all should know exactly what to expect, the system and modes of signalling to be employed, that the movements ordered are imperative at the right moment, *that on seeing one of the fleet, she should never be lost sight of again*, however close it may be necessary to hug her, and that it should be the pride of every one to emerge from a fog in exactly the same order as they were in when it enveloped the fleet.

The question of ships keeping close to one another when seen in a fog, being one of the matters of seamanship, can have no direct orders in the signal-book, and is left to those who may have charge of ships. There is no hint even of closing on your next ahead, and the tendency is rather to go slowly and open from her, indeed I have often noticed a decided desire on the part of Officers to get away from and lose sight again of any ship that might approach near enough to be seen. This ought not to be, as the ships are under steam almost as a rule in the large squadrons. As fogs principally come on when the wind is so light that the ships are quite unmanageable, they generally cruise with fires banked, if not regularly steaming at the time; every Captain therefore would immediately have steam ready, so that in treating of a large fleet in a fog, it may safely be presumed it is a steam fleet. It was in a steam fleet that I noticed the desire to open from anything seen, instead of hugging close the next ship, and as she can see a little farther than you, it may at least be hoped that she sees another ship of the squadron, and so on. I hold that there is never an excuse for a ship getting away from her next ahead; the very wake of a ship can be seen and steamed after in confidence, and no ship of a line, ought ever to be out of the line, however long a fog lasts. The other part of the seamanship question consists in the care taken on board the ships; the look-out should be vigilant, generally low down, but it is as well at the same time to have a man at the masthead. I have known instances when the mastheads of other ships could be seen from aloft, and some when a man slung in a bowline close down to the water could see their hulls. There should be more than one look-out man, and the water should be carefully looked at, as it enables you to see if you are following a ship. Perfect silence should be kept on deck; if any of the ship's artificers work there, they should cease in their work; as many of the signal staff as possible should be on deck, one of them with the fog-horn or by the steam-whistle; and a careful Officer be ready holding a watch with a second hand and the marker, to note the guns and the intervals at which they are fired. The speed should be carefully attended to, and if under steam, the engineer officer of the watch warned to stand by his engines as the ship is in a fog. Above all I would impress on every one the great necessity the instant a fog comes on, or better still if seen coming on, to close on the next ahead, and having once caught sight of her, if it entails the jib-boom literally over her stem, never once losing sight of her again, stick to her; it is right in the first instance to allow nothing to throw you out of your place in a fleet, it is creditable to preserve it under all circumstances, and it gives a confi-

dence and pride in the ship to all on board to see that whatever happens, she emerges from the trial, in close contact with her consorts. These are things which no signal-book can lay down, they rest entirely on Officers, on whom lies the responsibility that the fleet shall not get scattered.

Before concluding, let me read to you a summary of fogs reported from Penzance, Plymouth, Portsmouth, and Yarmouth, for the years 1868 and 1869. Writing to Mr. Robert Scott, M.A., of the Meteorological Office, on the subject of fogs, he most kindly had copied out and sent me the wind and weather log, when fogs occurred during the two years above mentioned. From this log I am able to give you the following :—

In 1868

There were—

At Penzance, 13 fogs.
At Plymouth, 17.
At Portsmouth, 7.
And at Yarmouth, 9.

Of these the following numbers occurred during calms :—

At Penzance, 3.
At Plymouth, 13.
At Portsmouth, none.
And at Yarmouth, none.

The greatest force of wind in these fogs was—

At Penzance, 7, with an average of 2·9.
At Plymouth, 5, with an average of ·5
At Portsmouth, 2, with an average of 1·2.
And at Yarmouth, 3, with an average of 2·6.

The months of January and November had each 7 fogs between the above places, but in May none were reported from either place.

The fogs in 1868 seem not to have been of many hours' duration. There were fogs reported of 2, 3, 4, and 5 hours, but only one of 24 hours, at Penzance, on the 7th March. Besides the above times, it was twice noted as foggy in different parts of the British Isles.

In 1869

There were—

At Penzance, 23 fogs.
At Plymouth, 31.
At Portsmouth, 12.
And at Yarmouth, 19.

Of these the following number occurred during calms :—

At Penzance, 3.
At Plymouth, 19.
At Portsmouth, 9.
And at Yarmouth, none.

The greatest force of wind in these fogs was—

At Penzance, 6, with an average of 2·3.

At Plymouth, 2, with an average of ·5.

At Portsmouth, 2, with an average of ·3.

And at Yarmouth, 5, with an average of 2·2.

There were 20 foggy days in November, but May and June had only two foggy days each, between the above places. 1869 may be taken as a very foggy year. The longest fog occurred at Penzance, commencing at 7 p.m., of the 9th October, and lasting until 2 p.m., of the 12th; 67 hours with no wind at its commencement, the wind gradually freshening, until it was registered 3 as the fog dispersed. Penzance had besides this, on the 8th and 9th of April, one of 48 hours; on the 11th and 12th of April, one of 36 hours; on the 16th of July, one of 24 hours; on the 8th of July, one of 12 hours; and on the 18th July, another of 12 hours.

Plymouth had on the 15th March one of 10 hours, and on the 11th of October, one of 24 hours.

Portsmouth had one long fog, on the 18th and 19th of November, of 38 hours, otherwise the fogs were not so long.

Yarmouth had, on the 7th and 8th of January, one of 31 hours; on the 21st and 22nd of January, one of 31 hours; on the 28th and 29th of January, one of 36 hours; on the 18th and 19th of November, one of 22 hours; on the 25th and 26th of November, one of 33 hours; on the 28th and 29th of November, one of 31 hours; and on the 10th of December, one of 10 hours; beside the above times there are twelve notifications during the year of fog being prevalent at times in parts, and at others over the whole British Isles.

It may be said I have made too much out of a small matter, bringing forward nothing very new, and that in spite of such fogs as I have just read of, no accidents can be remembered that have occurred amongst fleets in a fog, although "fog-signals" have for many years formed so small a part of our signal-books. I grant all this, but knowing that some Officers have been wishing for something more in the way of "fog-signals" than we have at present, and that the means of communication between ships in a fog have improved, I have turned my attention to the matter, and think the alterations I should like to see made, if compiled and issued to the service, would be an advantage; at the same time in point of printed matter, there would be very few pages in excess of that now in use, while, for simplicity and usefulness, the service would be the gainer.

Let me ask you to turn your attention to the great war now raging on the Continent, and we see that the conquering power has been the one that I may say, has descended to small matters; everything is arranged, even to the most minute details; not a thing forgotten, and by this very means the German nation has ascended to a power and might unparalleled in history. Belonging as we do to the greatest maritime nation, we must not let the lesson pass us, but enter into all minute points, see all small matters as well arranged in their way as large; for a fog might some day prove a very serious matter to us.

Let me put a case: two squadrons, from two different naval ports, are required to meet as day breaks at some appointed spot, ready to strike a necessary, well-timed, and effective blow at an enemy; one of these squadrons encounters fog, and by not being well instructed and prepared for such a thing, goes slowly, perhaps stops, and ends in becoming scattered, with some ships missing. This squadron cannot arrive at the proper time, and the operation is worse than useless, for your opponents have seen something of your strength and strategy; or take a case worse still, viz., that of a squadron sent in haste to prevent some attack on ourselves, through being scattered in a fog, arriving at its destination too late. May the fall of the great military power of France, considered until now the first in Europe, and corresponding to the naval power of England, be a warning to us that we cannot take too much trouble with our Navy in all its points.

Admiral Lord FREDERICK KERR: May I ask our friend if he knows the duration of the fog which he alluded to in 1865.

Captain BRENT: About thirty-six hours.

Lord FREDERICK KERR: I happened to be in that fog, and I should like to make an observation in confirmation of what Captain Brent has said, or rather to enlarge upon the point. You remarked that the fog fell upon the ships *after* rounding the Nab, when they were in single line, I think. The fleet *was* in single line, having left Spithead with a bright sunny sky. It was one of the most beautiful days ever seen; yachts were sailing about in all directions. No signal had been made for rendezvous, as we had been sent to sea under sealed orders, not knowing our destination or rendezvous. We left in line-of-battle, the lee column, or port division, being in rear of the starboard division. There were six or seven ships, and we were about three miles from the Nab, having just passed through St. Helen's, when the fog fell suddenly on the ships so thickly, that we could not see the next ship ahead. It was then a critical time for the use of fog-signals. We had to judge our distance, and the right moment for rounding the Nab, for we were going down Channel. No signals had been made for rendezvous. The difficulty would have been lessened *after* rounding the Nab, and I may mention this to point out the circumstances in which signals might be advantageously used. I was the leader of the lee line, consequently I was in the centre of the line when in line-of-battle. When, as we concluded, we had reached the Nab, and it was about our time for rounding, it was reported to me that there was a whistle on the starboard bow. Gentlemen probably know the position; the Nab is on the starboard side, and the whistle was on the starboard bow. We concluded it was the Admiral's whistle to signal that he had altered his course and had rounded the Nab. Accordingly, we also altered our course, supposing we were following our leader. The ships were about two cables apart when the fog came upon us, or perhaps more. After altering course and proceeding in this direction for about five or ten minutes, having rounded the Nab, the look-out man called out, "there's the splash of a screw on the port bow!" so there was something not very far off on the port bow; no other sound was to be heard. The order was given to "ease;" at the same moment I looked, and I saw the jib-boom of a ship plainly in the fog, just hanging over our port quarter. By porting the helm in time the ship cleared us. We were at a loss at the time to know how we got into that position, but it turned out that the whistle we had heard was not the Admiral's, but of some casual passing steamer, and by altering our course so much sooner than our leader, it led eventually to our cutting through the line between the Admiral's ship and his second astern. Having overcome that difficulty, very shortly afterwards occurred another circumstance which I will mention to show on the other hand the advantage which has been derived to the Service from Captain Colomb's flashing signals as applied to steam. We had not then had any orders to practice with these signals, either with fog-horns or with steam. Some experiments had been made with fog-horns, but to the best of my recollection this was the first time experiments were

made with the "Flashing Signal Code," by steam. Signal was made by the Admiral first to "form two columns," and in the next place to "rendezvous off the Lizard" (or off Scilly), and giving the course down Channel. The signal was given with the steam-whistle, and it was repeated by ourselves as the leading ship of the other division. We formed the two columns, and we were kept together by 15 minute guns, from the Admiral, repeated from the leading ship of the lee line, for we never saw anything of each other until we got down nearly off the Eddystone, going six knots all the time. There was only one ship missing, which had thought it right to leave the line and go in shore. I mention this to show how much the service is benefited by Captain Colomb's signals not only in the night time in clear weather, but in their application to the steam-whistles of ships in times of fog.

Captain COLOMB, R.N.: I must express my regret that I did not bring down with me a book which I intended to have brought. It is the "Experimental Night and Fog Signal Book," which I believe is now issued to the Channel and Mediterranean fleets for trial. In that book by far the greater part of Captain Brent's suggestions have been adopted. The suggestions were, on the face of his reports, so absolutely necessary, and their necessity was pointed out so clearly, that the Committee, of which I was a member, adopted the greater part of them without any dissent whatever. But there were certain parts which were not adopted, and I think the questions as to those parts still remain open. Captain Brent suggested that the best interval at which the signal guns should be fired was ten seconds between the first guns; then an interval of thirty seconds, and ten seconds between the second series of guns. The Committee, however, thought that as we had only those experiments before us, that we should not be justified in making a change from the interval so long established in the Navy. My own wish would have been that further experiments should have taken place, because the circumstances, as Captain Brent has pointed out, under which gun-signals are now made, are very different from what they were at the time those intervals were established. We have now to deal with ships such as the "Monarch," with four heavy guns. Those heavy guns must be used for the "fog-signals," because, as the lecturer has pointed out, you do want the very loudest guns you can use. It follows that it is almost impossible to conduct your signals at intervals so short as five seconds, which, if my memory does not deceive me, is still the established short interval. I think these remarks embrace nearly all that can be said on the spur of the moment as regards "gun-fog-signals." As regards "flashing-signals" when used in fogs, I think nearly the whole of Captain Brent's suggestions were adopted in the Experimental Book. But I agree with him that that branch of the subject is still quite in its infancy. I cannot doubt that it ought to be possible in these times to have a sound flashing instrument, which would be capable of conveying signals between two columns, situated at their ordinary cruising distance apart. As we stand now, when a fleet is in two columns, they are cut off from one another; one column is cut off from the Admiral, except in respect of the few gun-signals which can be made. I see no reason why if inventors' attention were sufficiently turned to the subject, we should not have "flashing-fog-signals" capable of traversing the distance between the two columns, and so keeping up that complete communication which is so necessary in fleets. I do not think that any naval Officer will imagine that the subject which Captain Brent has treated of, is a small subject. To my mind the safety of the country may at any moment depend upon a fleet being kept together in fogs, and being properly under command of the Admiral. And when one comes to think what is on the other side, what is against our having a fleet so in hand, and so kept together, we shall see that it is worth investigation. Practically, no experiments in "fog-signals" have ever been tried, except those stated on the board before us. I never heard of any having been tried myself, and I never met with anybody who ever tried any "fog-signals." We generally say, "Oh, the thing has answered very well for so long, and it will answer very well for so much longer;" and we go no further in the matter. The history of the thing is that the fleet never gets into a fog on any occasion without mistakes being made; and sometimes those mistakes lead to very great misfortunes, such as the separation of ships. I cannot at the moment give a case where this has happened in fogs, but I can give a case where it happened respecting the old "night-signals." It became my

business, when I was commencing the study of the subject, to find out really where it was that the old "night-signals" failed, because I thought when I arrived at that point I might know what was wanted. Therefore I made it my business to go on board every ship in the Channel fleet whenever I could, and wherever I could. On many occasions I found that the first answer given to me was, "Oh, there's no difficulty at all, the thing answers perfectly well." "There were no mistakes then?" "No." But I never found on any occasion when I pressed the question home, that mistakes did not occur, and that quite recently. On board the "Donegal," in Plymouth harbour, I went just after the Channel fleet had arrived. I said to the signal officers, "What about the night-signals—have you any fault to find with them?" "Oh, no; they answered perfectly well." I said, "Don't you know of any mistakes having been made at all?" "No, none at all; they answered perfectly well." I said, "Let us look at your signal-log." They got the signal-log. I said, "That signal, for instance," pointing to one made two days before, "was that right?" The answer was, "No, that was not right; it was a signal to get steam up, and we took it to be a signal to steer south-west, and we parted from the fleet in consequence." The fact is, that in the Navy we seldom take note of mistakes once they are passed; and until we establish something like systematic experiments, such as we have before us, we shall not succeed in getting a perfect system of fog-signals, nor in fact succeed in getting a perfect system of any kind.

The CHAIRMAN: Before returning Captain Brent our thanks, I should like to make an observation or two. In the tropics we very seldom have any fogs at all. The fogs are confined very much to the Channel, the North Sea, and the Baltic; although of course they occur elsewhere. It is only since the Channel Fleet has become an institution that we have thought much about the fogs, at least in my recollection. Two instances were mentioned just now as cases in point, where the Fleet was in a fog a long time and was kept together. I can give an instance where we were separated in an hour in a fog. We were six or seven ships off Lisbon. A fog came on very rapidly. Signals were made by the Admiral to take the ships out of danger. The signals were so entirely misunderstood, that when the fog cleared two hours afterwards, the Fleet was scattered about in all directions. That was entirely owing to the guns that were used for fog-signals being quite incompetent. Formerly, we used to employ 32-pounders, which had a charge of 6 lb. of powder, and with the 6 lb. of powder we could hear well from one column to the other. But these guns were supplied with a charge of 1 lb. 8 oz., at all events so small a charge that we could not hear them distinctly. It was with the very greatest difficulty, by making everybody quiet, and by putting your hand to your ear, that you could hear at all, owing to the blocks and ropes rattling about. I think the mistake arose from the guns being *too small* for the purpose. If we are to have *gun-fog-signals*, we must have proper guns for them. In the case of ships with only a few guns of from 9 to 25 tons' weight, I believe it will be impossible to fire fog-signals, remembering that many of the guns in some cases consecutively have to be fired at five seconds intervals. This is perfectly impracticable, especially as the guns must be fired on the same side of the ship, and with great accuracy. If we are to have *gun-fog-signals*, guns must be supplied for the purpose, and they must have charges of at least 6 lb. I believe that is at the bottom of the whole question. But to secure effective signals, we ought to have a proper screamer. At present the Admiral has no power to speak to an individual ship, however much he may wish to do so. I have suggested a method by which the Admiral might with the *gun-fog-signals* ascertain how many and which of his ships, if any, are in company with him, and the approximate bearing and distance of each. At the end of say every two hours, viz., at two, four, six, eight, ten, and twelve, let the Admiral, if he wishes to ascertain the position of his ships, fire four minutes after the half-hourly fog-gun the following guns, viz., two guns with a minute interval. Each ship has now a fleet number, the Admiral is No. 1, the ship astern of him No. 2, the leader of the lee line No. 5 if there are four ships on the weather line, and so on. Then if the ship whose fleet number is 2 fires her answering gun at exactly two minutes after the Admiral's gun is heard, the ship whose fleet number is 5, exactly five minutes after the Admiral's gun is heard, and so as the Admiral will, by the interval in minutes, know the ship, by the direction

of the report know her approximate bearing, and by the number of seconds over and above the minutes know the approximate distance for this number of seconds; halved and multiplied by $4\frac{1}{2}$ will give the miles; in distance, the whole fleet's position may be plotted on paper, although none can be seen. If, however, the Admiral wants to send a ship on any particular duty, or to call a small ship to him, he has no means of doing so by the ordinary gun-fog-signals, for they only speak to all the ships at once. If we had proper screamer-whistles, the Admiral would be able to speak to any ship he likes, by long and short screams, as in the flashing-signals. The reason why we cannot have efficient *steam-fog-signals* is because the steam has not enough pressure. We have only about 30 lbs. pressure; in a locomotive you have 100 lbs. pressure, and then you get a good whistle. Until we take the thing properly in hand, and have something like a high pressure steam, or, what is much better, compressed air acting under a pressure of 100 lbs., I am sure we shall never get a proper whistle to serve as a signal. Admiral Inglefield's hydraulic engine might easily, when fitted for steering purposes, be adapted for compressing air for fog-signals when requisite. I beg to return our thanks to Captain Brent for his exceedingly instructive paper.

The CHAIRMAN: Will you now reply to the questions?

Commander BRENT: I think the questions have been nearly all answered. The fog which I referred to lasted about 36 hours. I believe if there had been an instrument like the steam-roarer in the fleet, there would have been no difficulty in making out anything; any signal could have been made out. The thing is to get a good steam-whistle, something that will make a good scream. Mr. Bailey's is the nearest to it that I have seen yet; it is much louder than any steam-whistle.

The CHAIRMAN: The same pattern?

Commander BRENT: It is the same description. I wish we could get some of these tried in the Channel Fleet; it would soon settle the question.

Captain BURGESS: What is the pressure required?

Commander BRENT: You can use any pressure. I used 40 lbs. at one time in a steam launch, and the sound was most startling. This was in Malta Harbour. But with the low pressure of 15 lbs. it was nothing. I agree with what Captain Colomb has said about experiments. It is a pity there are not more experiments. I believe if people would make experiments they would arrive at the ten seconds and thirty seconds interval. The reason is, that the thirty seconds is divided by the ten, and it fell on our ears so distinctly that we took to it at once. I was, unfortunately, Commander of a ship at the time. I say unfortunately, because I had a little difficulty in getting the boats to make the experiments. It was a little out of my regular duty, and I was very glad, when we arrived at the intervals that we agreed to as best, to say, "I will do no more." But I think other people should make experiments. I am convinced that if they did they would fix upon the ten and thirty seconds interval. I have not a doubt about it. I have nothing more to say, except that I return my best thanks for your attention.