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Discussion On Mr. Brooks'S Lecture On The Defence Of Portsmouth

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Evening Meetings

Monday, July 8, 1861.

Captain E. G. FISHBOURNE, R.N. C.B. in the Chair.

Names of Members who joined the Institution between the 24th June and 8th July, 1861.

Annual.

Chetwynd, Hon. C. C., Capt. Unatt. 11.	Latour, W. Y., Lieut. Gren. Gds. 11.
Collins, W. L., Capt. Victoria Rifle Vols.	Lew, A., Paymaster R.N.
Festing, E. R., Lieut. Royal Engineers, 11.	Paget, G. E., Cornet Royal Horse Gds. 11.
Fuller, F. G. A., Lieut. Royal Horse Gds.	Scott, C. H., Capt. 71st Highland Lt. Inf.
Home, Hon. W. S. D., Lieut. Gren. Gds. 11.	Slacke, W. R., Lieut. Royal Engineers.

DISCUSSION ON MR. BROOKS'S LECTURE ON THE DEFENCE OF PORTSMOUTH.

The CHAIRMAN.—Perhaps you will be kind enough to state the information upon which you ground your idea with respect to the tides. Gentlemen would like to have a little information upon that point to help them in the discussion.

Mr. BROOKS.—The information with respect to the set of the tides has been drawn from the able chart of Captain Sherringham, R.N. The data given there satisfactorily convince us that the body of the tide, which has the most powerful effect in determining the course of the channel, and in creating the eddies or sites of the banks lying off Portsmouth, comes from the westward. The first four hours' tide runs stronger than the last three. The first four hours' tide from the westward comes from the Needles, and, after passing the point at Cowes and at Osborne, is thrown against the Gosport shore; and then again deflected to the southern shore, or the north-east points of the Isle of Wight. The course of the current throws the part eastward of Gilliker point into an eddy, and consequently creates the Great Spit Sand. The same influence of tide extending to the south-east, there is a large space abreast of Southsea also thrown into an eddy; and that originates the great shoal called the Horse Sand. The formation of these sands, by the way in which they tail, shows that the westward tide is the strongest. On the fifth hour the tide begins to come from the south-east round St. Katherine's Point at the back of the Isle of Wight. For that hour the current is nearly stagnant; still that is the course of it. The sixth hour the current runs three-quarters of a knot per hour, and the seventh, it is a little more than one knot per hour. Along the coast east of Portsmouth the tide is sluggish, and opposite Chichester Harbour the supply tide comes directly from the south.

It may be argued by some, that putting this great Mole from Langston Harbour into the sea may offer some impediment to the flood-tide entering Portsmouth Harbour. That I say is impossible; because the great body of the tide is directly from the westward; therefore, if the Mole has any influence at all, it must be that of heaping up the waters, and creating a greater flow and a greater rise of tide in Portsmouth Harbour. I do not say that it would have much effect in this respect, but that is the effect it must produce. Against the body of the tide which comes from the south-east it is impossible that any obstruction can be raised. If the supply tide came from the eastward, then it would be a fatal objection to the formation of the Mole; and it might be said at once, "Here is an obstruction to the flow of the tide into Portsmouth harbour."

The CHAIRMAN.—While you are upon that point, can you state what is the difference between the time of high water in the harbour at Portsmouth and at Spithead?

Mr. BROOKS.—There is very little difference, I believe.

The CHAIRMAN.—I am under the impression that there is a considerable difference.

Mr. BROOKS.—Not much. Now, the tide that flows up Langston Harbour goes clean through the harbour; and on the return of the tide, you have the advantage of a good deal of the water which previously enters Chichester Harbour. My proposal is to make a communication between the pool of nine feet low water in Langston Harbour, and the same depth in Chichester Harbour, so as to be able to transfer block-ships or gun-boats from one harbour into the other. The certain result of making Langston Mole of a concave form would be to scour out a deep channel of not less than six fathoms at low water; and with this debouching into a strong tide-way, no bar could possibly exist. I feel sure there will be no bar, and this deep-water channel would enable our gun-boats and line-of-battle ships to deliver over the crest of the Mole an effective fire upon an advancing squadron. The Mole could be carried to the level of high-water at spring tides, or it could be carried to a higher level if necessary, so as to mask ships at high water.

One great feature of utility in this plan of mine is, that it would have the effect of keeping hostile vessels of war at such a distance that they would not be able to shell Portsmouth Dockyard. It carries out what I believe to be the intention or the wishes of the Royal Commission on National Defences. There was a desire manifested, and they got estimates for it, to make a breakwater from the proposed fort on the Horse Sand to Cumberland Fort on the west side of Langston Harbour. That must have had the effect of silting up and ruining Langston Harbour itself and the approach to it. That was the principal objection to it. Now, it is not attempted to be argued by me that making use of these forts and constructing these works will supersede the necessity for vessels of war to defend the channel south of the Mole-head. Nobody attempts to say that. Both are necessary, forts and ships of war; but the works I propose would enable our squadrons to lie in safety, and would relieve the country from any alarm as to our great naval station being in danger of destruction from an enemy.

Commander ROBERT SCOTT, R.N.—Before Mr. Brooks sits down, I should like to ask him one question with respect to the high water in Portsmouth Harbour. From which direction does the harbour receive its water? That seems to me to be an important point in connection with his proposed breakwater.

Mr. BROOKS.—For the first four hours the tide comes from the westward through the Solent; the fifth hour receives the addition of the coast tide from the south side of the Isle of Wight; and at the sixth and seventh hours the tide is from the same source, entering Spithead from the south-east. That is shown by Captain Sherringham's chart.

Commander SCOTT.—Does it not become high water in Portsmouth Harbour with the first of the ebb, sweeping down past Selsea Bill, then coming in against the Isle of Wight and filling Portsmouth Harbour? I have cruised a great deal about there, and it seems to me to be so.

Mr. BROOKS.—As an engineer, I should say an ebb tide cannot produce high water. The tide that really fills Portsmouth Harbour comes from the Channel round the back of the Isle of Wight. It does not come from Selsea Bill; it could have no effect. If the tide is falling at Selsea Bill it must be falling in every other place.

Commander SCOTT.—Owing to the entrance being so narrow at Hurst Castle, the flood tide does sweep up in the way you have defined, but enough water does not come through to fill up Portsmouth Harbour and make it high water there. The consequence is that the first ebb coming down sweeps past Selsea Bill. It is confined in a narrow space; it flows in between the Isle of Wight and the Hampshire coast during the ebb tide, and the water in Portsmouth Harbour rises considerably.

Mr. BROOKS.—I believe that the tide comes round from the back of the Isle of Wight. The ebb tide, that you are speaking of, does not run by the Solent at all, it has a much more easy course round the back of the Isle of Wight.

Commander SCOTT.—The Isle of Wight is an obstruction. It is just in the place to shelter Southampton Water, Portsmouth Harbour, Langston Harbour, and Chichester Harbour. The consequence is, that the flood is deflected, and it does not fill those harbours, for the Needles entrance is not large enough. When, however, the tide has changed, it runs down first in-shore. Of course, the ebb tide commences first to the eastward. It then sweeps down along the coast of Sussex, comes past Selsea Bill, falls against the Isle of Wight, and fills Portsmouth Harbour, and Southampton Water afterwards.

Mr. BROOKS.—I believe that the supply comes from the back of the Isle of Wight. High water is always earlier on the shore than it is in the offing. You have a greater height of water on the coast at high water than you have out at sea. It is high water at Spithead, Portsmouth, and Langston, before it is high water on the shore and harbours

of the Channel above Selsea Bill, and therefore the supply to Portsmouth must be through the Solent and by the coast tide round the back of the Isle of Wight.

Commander SCOTT.—It is high water below Hurst Castle long before it is high water at Dúnnoose, and it is high water at Portsmouth two hours afterwards. If you refer to the Sailing Directions of the Isle of Wight, you will find it there laid down as clearly as possible, that on the ebb a great mass of water falls, and is divided by it against the Isle of Wight; and, as a necessary consequence, some portion would run into Portsmouth Harbour, Langston Harbour, and Southampton Water. This really is the case.

Mr. BROOKS.—I differ from you. The Admiralty chart shows it to be high water at Portsmouth before it is high water at Hurst, and, if the body of the tide came down from the Channel in the direction you point out, it would not flow up towards Southampton Water, but would throw itself into a complete eddy. If your view were correct, you would find all shoal water between Selsea Bill and Chichester Harbour. There would be a mass of shoal ground there in Brackenbury Bay.

Mr. PARIS.—Does not Captain Sherringham make some observation with regard to the tides? It has been, I think, already ascertained; and Captain Sherringham has given all the particulars that can be obtained from repeated observations.

Mr. BROOKS.—If you look at the Admiralty Chart you will find it beautifully defined for every hour of the tide.

Commander SCOTT.—Having been inspector of the Ryde district, and having had a cutter there and sailed over the place repeatedly, my impression is, that what I am mentioning is a fact.

Mr. BROOKS.—I must dispute the fact. I do not believe there is any supply to Portsmouth by the ebb tide. The ebb tide is a falling tide, and cannot give it.

Commander SCOTT.—If you will allow me, I will turn to the question of the shoals outside Portsmouth Harbour. You know perfectly well that where you can secure a great run of tide you always have deep water. Now, the cause of the deposit outside is the mud and other things brought down from Portsmouth Harbour. They are not brought in from the sea. It is really the deposit from the land, which is continually being drained off the land and brought down. It forms a deposit on the Spit Sand, and on the opposite space, where there is no clear line of current to carry it away. In the same way, the Mole, stretching along the line proposed, will certainly prevent the free ingress of the water from the east. It must lessen the amount of it; and by so doing it will lessen the velocity through that channel, and have a tendency in the course of time to cause Portsmouth Harbour to silt up. Instead of being an advantage, I should imagine it would be a great disadvantage. The pier can be no protection to Spithead. If you look at the great sea that comes in with the south-east wind, the Mole proposed would not be of the slightest use as a protection to the shipping; nor would it be of any great use as a protection to Portsmouth Harbour. If you notice the tail coming from the end of the Horse Sand you will see it is inclined to the eastward, in precisely the same direction as you say the Spit Sand lies, with the tail to the eastward, which shows that it is brought down from Portsmouth Harbour, the eddy causing a deposit. The obstruction caused by the Mole, instead of decreasing the eddy, would not allow the water to spread fairly, and it would occasion eddies within the turn marked on the map, which would gradually back up inside the breakwater, and spread out into a shoal beyond.

Take again the expense of the Mole. Mr. Brooks sets it down at half a million. Supposing the works marked CCC are not carried out on Portsdown Hill, where will the chalk or other material be procured to form that immense breakwater?

Mr. BROOKS.—You can still get it from Portsdown Hill.

Commander SCOTT.—It seems to me, from the experience we have had with our other breakwaters, that the cost would be considerably more than half a million of money. In every work of the kind it should be considered whether an advantage is gained proportionate to the money laid out. Now, in laying out the breakwater under consideration, it certainly can only be considered as an experiment; and I think it will be a most costly experiment. As to the same causes which have produced these shoals not continuing to act, I confess I cannot see how you can remove them; I do not think you will. On the contrary, I think you will rather add to the existing obstructions. Several times attempts have been made to deepen harbours, under the idea that, having once deepened them, the water will take that direction, and the channel be kept deep afterwards. Such is not the case generally. It has been tried in the West Indies in two or three cases. It was tried by Lord Dundonald, a most energetic man, and he failed in the case in which he

tried it. The only possible way of removing the sands is to have a larger space inside for the water to deposit itself; then, having a larger basin, you would have a greater flow of water, which would carry the silt and other deposits further away to sea, until it got into the fair run of the tide. If you can do that to Portsmouth Harbour, you may then raise it from being a second-class into a first-class harbour. I believe the only way to accomplish this effectually would be to cut through and connect the heads of Chichester and Langston Harbours with that of Portsmouth, so that the water coming through these cuts into the head of Portsmouth Harbour would thoroughly scour out the mud and carry it out into the tideway. Any work placed upon the sands would, it seems to me, produce an entirely different effect.

As to the value of the Mole as a fortification, that is a point I will not go into. My own impression is, that as a fortification it will be of little actual value. Nor do I consider the connecting of the two harbours of Chichester and Langston alone, would be of any practical value. I do not think this would preserve the channel under the lee of the breakwater; I think it would fill up, unless you built an open breakwater: otherwise it would have the effect of raising the sand close against the breakwater, and of causing the bank to extend further out to sea, closing up Spithead.

Mr. BROOKS.—With respect to the last point, that the sands would accumulate under the lee of the breakwater, Captain Scott is perfectly correct. It would accumulate, there is no question; and land would form there from the stoppage of the run of the current.

The CHAIRMAN.—Of the ebb-tide?

Mr. BROOKS.—Of the flood-tide; of what is called the governing tide.

The CHAIRMAN.—It would be on the other side from the flood.

Mr. BROOKS.—That would be counteracted by the vast body of water coming out of Langston Harbour. The triangular space occupied by the Horse Sand would also become land.

The CHAIRMAN.—Do you not think there is an eddy already? There is a formation on that Horse Sand; and by stopping the current that exists now the eddy would be still greater, and there would be a still greater deposit on that sand from the flood-tide. And if there was any ebb on the other side, then there would be a deposit from that.

Mr. BROOKS.—It is quite clear.

The CHAIRMAN.—Captain Sherringham shows a current running across both ways with the ebb down channel. He shows a current running across at right angles to that Mole. The current which exists now is very sluggish; it is only a knot and a knot and a half to two knots. That would cease.

Mr. BROOKS.—The current of the ebb shown by Captain Sherringham is the first of the ebb out of Langston and Chichester Harbours, when it is *also* ebbing out of Portsmouth Harbour and setting through the Solent. There is only a knot and a half in Spithead Roads. Now, Captain Scott began with an observation that he believed the Horse Sand was formed by the tide coming out of Portsmouth Harbour. No doubt, there is some formation. But this is a marine deposit. Its chief origin is, the eddy created by the flood tide being deflected from the point off Gosport to the south shore, or the north-east side of the Isle of Wight. The same fact causes the whole of that shore to be comparatively in an eddy, and to be almost useless for harbour accommodation. Chichester Harbour is larger than Portsmouth Harbour, and Langston Harbour is equal to it; yet we find only two feet on Langston Bar, and two feet at low water on Chichester Bar, because the tide is so sluggish. If Captain Scott be correct, that the tide sets so strongly along the coast from the eastward, then you would not have this shoal water existing; it would be all a deep-water channel. All the tidal observations show that the weight of the current is from the west; the other supply is from the south-east; and this Mole offers no obstruction to one tide or the other, except to accumulate the head of the water and throw it into both harbours. And in that respect it would be rather beneficial than otherwise. It would create a shoal on the east side of the Mole, and I should wish it to become shoal. It would be so much the better, because it would prevent gun-boats getting near that coast and shelling Portsmouth. The next observation which Captain Scott made was, that this Mole would have no effect in tranquillising the waves from the south-east. It would have so much, that a wave entering between the Mole and the Warner would immediately spread and settle, and it must have the effect of tranquillising the water within.

Commander SCOTT.—I think you misunderstand me. What I intended to say was, that the erection of a Mole would create an eddy on both the ebb and flow of the tide, and occasion a deposit of sand and mud on each side of it; but, before the effect of such an erection could be estimated, it would be necessary to examine what changes were

taking place, for the Isle of Wight seems to have been once joined to the main land and the channel to have become gradually enlarged by the wash of the tides. By building the Mole you would check the tides and encourage a deposit. As to the Mole tranquillising the water inside, your great sea is from the south-east, and your narrowing the space which is shoal water would have scarcely any effect. Your shoal already breaks the water; and the Mole would do very little more for the anchorage of Spithead. It might tranquillise Portsmouth Harbour a little. But what I wish to point out is, that this Mole could have no more influence as to deepening the water over Portsmouth Bar than it could over that of Chichester. You have spoken of the comparative areas of Portsmouth and Langston Harbours. But you have not taken into consideration the depth. There is considerably more deep water in Portsmouth Harbour; there is a constant stream coming into this harbour which keeps up the depth. Were it not for this large stream coming into it, Portsmouth Harbour would be filled up in the same way that Langston and Chichester Harbours are. On reflux this large volume of salt water joined with the fresh water rushes out with great velocity, and carries the mud out into the main tide; but every obstruction does, by creating an eddy, occasion a deposit, and tends to do harm to the main channel.

Mr. BROOKS.—There is really no disagreement between us. In one part of my paper it is plainly stated, that the Horse Sand would fill up and become land. I think it would be an advantage rather than a disadvantage. If the Horse rises to a greater height, it will have the effect of removing the real bar of Portsmouth Harbour, where there is now only four fathoms of deep water; you will have the bar pushed further out, and, instead of having only four or four-and-a-half fathoms, you will have no bar at all. That I feel positive of. The same works will also have the effect of extending the Spit Sand. That is a bank in the best direction. It is an advantage to Portsmouth Harbour that there is over its bar a stronger current than now exists at Langston and Chichester bars.

Captain BLAKELY.—I have got the sailing directions for the entrance into Portsmouth Harbour. It is as Captain Scott says. The tide runs from the south-east to north-west for eight hours; that is from the rocks due south of Selsea Bill. The tide runs up to Spithead for eight hours, and the other way only four hours.

The CHAIRMAN.—Part of the high water at Portsmouth is due to the first of the ebb down channel two hours.

Mr. BROOKS.—It is ebbing down channel at the time, but the supply does not come from that direction.

The CHAIRMAN.—Coming down channel the water cannot escape at the Needles. The bell-shaped entrance below Spithead will receive a much larger quantity of water than can escape at the Needles; and the necessary consequence is, to have a flow into Portsmouth Harbour until the water has fallen so much outside that the ebb would set in on both sides of the Isle of Wight. It does not ebb both ways round the Isle of Wight at the same moment of time; it does not commence at the same time.

Commander SCOTT.—I would make one more remark, just to sum up what I have said. By carrying out the Mole proposed, you must narrow the passage for the water. The tide coming down the channel along the coast would strike against the Mole; and a large portion of the water that now goes into Portsmouth Harbour, increasing its depth, and on return keeping it clear, would be deflected, and never go into Portsmouth Harbour at all. And, not only that, but the Mole would injure Southampton Water. In fact, the wider you can keep the passage between the Foreland and Cumberland Fort, the better you will preserve both Southampton Water and Portsmouth Harbour.

The CHAIRMAN.—There is a flood that comes in both ways, and an ebb that comes in both ways. That is to say, the flood flows in through the Needles, and it flows in at the east end of the Isle of Wight. The tide also ebbs both ways.

Mr. BROOKS.—It does; but the first of the ebb goes away to the west; and the last of the ebb goes round by the Isle of Wight.

The CHAIRMAN.—But the first of the ebb coming down channel is to flow into Spithead.

Mr. BROOKS.—That I must beg to dispute. Captain Sherringham's chart shows the very reverse. Nothing on this chart shows that there is eight hours' ebb going down that coast by Selsea Bill. Parties mistake for the ebb a current which is created simply by an eddy. Great mistakes are often committed in this way. If you refer to Captain Sherringham's chart, you will see that the ebb tide makes a very different set from what is pointed out. It shows the ebb-tide setting bodily to the south, and the flood-tide, opposite Chichester Harbour, setting away to the north. On the first hour of the ebb there is a current going away to the westward; but that is only the eddy created under Selsea Bill; that is not

the true ebb. The second hour it is the same. Afterwards it returns again to the south. Captain Sherringham is very explicit as regards the supply that fills Portsmouth Harbour. The first four hours it comes from the west, and the remaining three hours from the south-east; certainly not coming from down the channel. I think the mistake originated from the fact of its being ebb-tide in the channel. It is not a channel current that fills Portsmouth Harbour; it is the tide that comes round from the back of the Isle of Wight. No ebb-tide can have the effect of raising water. I never knew it in my experience, at all events.

Captain BURGESS.—Suppose the works on Portsdown Hill marked CCC are carried out, what would be the expense? And what would it be, supposing they are not carried out?

Mr. BROOKS.—If carried out the expense would be under 500,000*l*.

Captain BURGESS.—Would that include making the railway down from the foot of the hill to the shore?

Mr. BROOKS.—That is rather a question for a Committee of the House of Commons.

Captain BURGESS.—Would that sum of 500,000*l*. include the whole?

Mr. BROOKS.—600,000*l*. is my estimate. It would of course depend upon the nature of the construction. If you make the pier 60 feet wide at the surface, instead of 20 feet wide, you of course add to the cost very greatly. An observation has been made about the contraction of the sea-passage by the Mole. Why, the width is 14,000 feet between the Mole and Nettlestone Point; while at Hurst Castle it is only 4,000 feet. There is ample width of water to fill the place, and the width of Portsmouth Harbour entrance is about 600 feet.

Captain NOLLOTH, R.N.—Do not you think that money expended upon clearing out Portsmouth Harbour to get a greater volume of water, and therefore a greater scour at the ebb, would have greater effect in clearing the entrance?

Mr. BROOKS.—The first part of my paper has reference to the removal of the inner bar at Portsmouth. That is quite a distinct work from this: it is merely to give a proper direction to the discharge of the water from Portsmouth Harbour.

Captain NOLLOTH.—But you would get a greater scour if you got a greater body of water in the harbour, than if you scoured at the ebb. Would not 500,000*l*. do more towards getting a scour, by getting a greater body of water, than if you scoured out at the ebb?

Mr. BROOKS.—I have known worse bars than that removed. 14,000*l*. would remove that. They have been very properly dredging it lately, in the absence of any works to remove the cause of the deposit.

The CHAIRMAN.—Then what reference has the Mole to the deepening of the channel into Portsmouth?

Mr. BROOKS.—As I have explained, the only way in which it would have the effect of improving the sea-channel would be by this very deposit in front of Southsea shore. That would enable the waters which are discharged from the harbour to be more concentrated than where they are now diffused over the Horse Sand.

Captain NOLLOTH.—It would be compelled to take this channel?

Mr. BROOKS.—The same as if you were to take a wall down from Southsea; that would have the effect of deepening the channel into Portsmouth.

The CHAIRMAN.—The present channel is deeper than the bank on either side?

Mr. BROOKS.—Considerably more.

The CHAIRMAN.—Then the action of the scour to deepen that must be the last water of the ebb, and that is already confined between the banks.

Mr. BROOKS.—You have all the benefit of the scour from high water. Many parties imagine that the greatest scour takes place at the last of the ebb. In experience I find that not to be the fact. The greater the depth of water the more scouring power you have to maintain a deep channel.

The CHAIRMAN.—It is obvious that the first part of the ebb cannot scour; it is at the top.

Mr. BROOKS.—If you have a body of water to discharge which is twenty feet in depth, it will have much greater effect in scouring out the bottom than if you had only eight. Therefore, if this space opposite Southsea were raised by a deposit, you would have a stronger action upon the channel.

Captain BLAKELY.—I think there can be little doubt in a military point of view as to the defence of Portsmouth Harbour. I do not know whether it would be worth the expense, but the Mole would certainly have the effect of keeping ships off, which now might lie almost with impunity and shell Portsmouth, because six miles is nothing of a range; I do not believe that any works that can be constructed will make it unassailable.

By the time any works are made, guns will be made that will disregard them. In the meantime, as people are determined to spend ten or twelve millions, I think that would not be a bad way of doing it.

Mr. PARIS.—I believe it has always been found that just as the water is slipping off the mud, then is the time it goes fastest, and then is the time when the scour would be greatest. At Langston Harbour—I do not know so much about Portsmouth—the time when the water goes fastest is just after it has slipped the mud, where there is about from two to three feet of water.

The CHAIRMAN.—That is nearly low water.

Mr. PARIS.—No. The rise of the tide in the channel is from fourteen to sixteen feet, but it is only from two to three feet on the mud banks. Just on the first of the tide going away it is very slow indeed; but after it is just slipping the mud then it increases in speed very much. The idea has been suggested that by having a dam on each side so as to confine the water in a narrow neck, it would scour out the channel. I believe something of the kind has been done at Dunkirk. If a bank were formed as proposed by Mr. Brooks it would act upon Portsmouth Harbour in the way I have described. The water being confined would scour out the channel and make it deeper than it is at present. That, I believe, is the object Mr. Brooks wishes to obtain. There is plenty of water in the harbour, seven, six, and five fathoms; but the shallow water is off the entrance, and the more you confine the flow the more you would deepen the channel there. The great thing is to get ships in at all times of the tide. You were speaking about the expense of making this breakwater. It is contemplated to make a railway from Portsdown Hill to the ferry at Hayling Island. Therefore, the material can be brought down from Portsdown Hill; but I very much question whether it will be necessary to fetch it from there, because there is some very high land in Hayling Island, and plenty of earth can be obtained for the purpose of making the Mole. If that railway were made it would materially decrease the expense, because it would be in conjunction with the railway from Havant.

The CHAIRMAN.—We are much indebted to Mr. Brooks for having brought forward this subject. It is a very important one. But I must confess I do not see my way clear. It is, perhaps, not quite in keeping with my position as chairman to offer any comments upon the plan. Still, Mr. Brooks is anxious to have the thing discussed. It is quite true that on the Horse Sand there would be an increased deposit, because of the Mole. It would stop what little current exists there already, and there would be a deposit on each side of it. But in the immediate vicinity to the westward, Mr. Brooks says that the scour from Langston Harbour would keep that passage open. No doubt it would keep it open to the extent of that scour. How far it would be effective in producing a satisfactory channel there, of course it is difficult to say. So far as it produced a deep channel and a sufficiently wide channel it would afford anchorage for vessels, and afford them better protection than they have at Spithead. The size of the vessels would of course depend upon the depth and width of the channel to give them room. To pass on to the question of Portsmouth Harbour: Mr. Brooks admits that there would be a deposit upon the Horse Sand to a greater extent than there is now. Mr. Brooks would not like it to extend, but he would like it to be raised over the existing sand. Now, once you stop the current and increase the eddy, the question is whether you will not form the Horse Sand right across the entrance of Portsmouth Harbour. You will certainly alter the direction of the channel. Undoubtedly, it will narrow it upon the east side of the bank; and the tendency would be to make the outflow from Portsmouth Harbour cut through the Spit Sand. Mr. Brooks might say, that that would be more direct. It is possible it might be so. It is possible there would be a more direct flow in, and a more ready outflow, and that the channel would scour better. There might also be a certain advantage from stopping the current that now passes from the ebb coming down channel, which would be intercepted, and the effect of which up to the present moment is to check the ebb-tide coming out of Portsmouth Harbour at the first quarter ebb, preventing a certain measure of scour that would arise from that. So far that Mole would have a good effect. But then, as I said before, it seems to me a problematical question. There is a danger of putting a harbour of such importance as that in peril by an experiment that one does not know exactly might be successful, at the same time involving so large an expenditure to do it. I contend that the fortification is out of the question altogether. It would be a very serious question to shut up Portsmouth. I do not think we could accept the fortification as a compensation for shutting up Portsmouth Harbour. As that

Mole is so far from Portsmouth Harbour it would be very difficult to say what would be the precise effect as to that. Of course, it would afford considerable protection. I think the great danger to Portsmouth Harbour would not be from vessels coming to shell it; the great danger would be, I apprehend, from vessels coming over with a flotilla carrying troops and making Portsmouth the basis of their operations. There is no doubt the Mole proposed would intercept a flotilla that might be running in to land troops in that direction, and be a protection against deep draught vessels. So far it is an advantage. But then it cuts off your trade there. There is some trade, not much perhaps, but it has its value. As Mr. Brooks has dwelt a little upon Captain Sherringham's testimony, I think I ought to say I have had a conversation with Captain Sherringham, and he tells me that Mr. Brooks has rather misunderstood his remarks on the subject, and his chart on the subject also. He rather disagrees with Mr. Brooks's premises, and, of course, if the premises are not quite right, the principle upon which Mr. Brooks proposes to carry out his work would not be strictly correct. I am a thorough believer in the great value of little groins and little adjustments in directing the current. I have seen interesting results arising from it. I recollect the port of Natal. The water on the bar was 12 feet at low water. By placing wicker-work to arrest the deposit and catch the current, the depth of water in the channel was increased from 12 feet to 18 feet. Nothing could be more simple than that: I do not know whether wicker-work could be employed here. I recollect seeing the case of a river in Ireland showing how much could be done in that way. It was a railway bridge over a river, and this bridge was constantly being undermined. When it came to be inspected, the engineers immediately suggested, "Why, it is no use underpinning this bridge and wasting your money in re-building it. What you should do is to go a little up stream and throw a quantity of stones in there, so as to turn the current of the river and make it shoot through the arches, and all your labour and expense will be saved." No doubt the principle is a good one. The only question is whether it is employed exactly in the right direction here. That is what we are just at issue about; and that turns upon the question of tides. I must say that the last of the flood into Portsmouth comes from the eastward—that is, it is the first of the ebb that flows in there, just as it was described by Captain Scott. It comes down by Selsea Bill, and part flows inside and continues to flow inside until the channel is quite gorged. It cannot escape by the Solent on account of the small opening there is at the Needles; and the consequence is that the ebb runs out round the other side of the Isle of Wight.

Mr. Brooks.—Supposing the coast line extended three miles to the southward, would any one say there would be any difficulty in the water getting into Portsmouth either from the east or the west? or, even supposing the whole of the supply came from the east, would there be any difficulty in the water getting into the harbour?

The CHAIRMAN.—If that was land above water at high-water it would offer an obstruction to the water entering, no doubt. Still, there would be water that would enter that had passed in close to the Isle of Wight. But the case is not so. The land is not uncovered till half-tide, and the consequence is that the first of the ebb flows over it.

Mr. Brooks.—We are now speaking of the obstructions. Suppose the tide is coming from the east to the west, or the strength of it is coming in that direction, and supposing the line of coast extended three miles to the southward, would any difficulty exist to the passage of the flood-tide into Portsmouth? I think it would enter easily.

The CHAIRMAN.—You mean the first quarter ebb-tide would enter.

Mr. Brooks.—Yes. Supposing the ebb-tide fills Portsmouth Harbour, I say that, if the line of coast assumed the formation I have described, the ebb-tide would pass more easily into Portsmouth than if you have to encounter the eddy which must be created at the back of Selsea Bill.

Commander Scott.—If the Horse shoal were solid land, it would cut off a large quantity of the water that now flows between Cumberland Fort and Nettlestone Point into Portsmouth. Now there is from 12 to 14 feet rise of tide, because there is a large entrance. At Southampton Water there is only 9 feet rise of tide, because there is not width for so large a body of water as that which flows up to Portsmouth. This is, I think, an answer to your theory, and from it we may conclude that the more you narrow the entrance the more you prevent the flow of water inwards, and the more you deflect the current in another direction.

Mr. Brooks.—If this were all land, you would still have a width of 14,000 feet; and it would be impossible to say there would not be sufficient facility for the tide to enter Portsmouth Harbour, whose entrance is only 600 feet.

Mr. PARIS.—Supposing the Mole were made, the water would still run in and find its way into Portsmouth and Langston Harbours, on the principle that water will always find its level.

The CHAIRMAN.—The object is to have a direct inflow; a rapid scouring current in, and a rapid current out, in a straight line.

Mr. PARIS.—If there is a rapid current in, it clears the channel out. What I was going to observe is, that if the water cannot get along the coast into Portsmouth Harbour, it will go round by the Mole and get in. It will find its level. If the tide is down-flowing, there will be the same level of water in Portsmouth that there is in Langston, because they are both connected. It may be longer coming in, but you get the same level of water.

The CHAIRMAN.—These things are a question of time; and the great scour requires that there should be a quantity of water at the right time. It will not do that if it has to pass in through a narrow channel and to come out through a wide channel.

Mr. PARIS.—You think the water would not get in rapidly enough; that the tide would turn before Portsmouth was filled?

The CHAIRMAN.—There is a difference of time; it will ebb at Chichester Harbour before it does at Portsmouth. What is the plan you propose with respect to deepening the harbour and more immediately getting rid of the bar?

Mr. BROOKS.—The ebb-tide from Portsmouth striking against the quay of Portsmouth is thrown on to the Spit Sand, and is then deflected to the opposite shore. If by any means you can give that a true course down by throwing it into the channel, by that means you get rid of the bar. The most scientific way to go to work would be to make the work inside the harbour to throw the tide away to the westward, and not allow it to run to Portsmouth quays.

The CHAIRMAN.—You would run a dock-wall outside where merchant-vessels lie now, inclosing right up to the dockyard wall?

Mr. BROOKS.—Exactly. That would have the effect; that is the most useful way of doing it.

The CHAIRMAN.—It would be very desirable.