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Friday, May 2nd, 1862.

LT.-COL. LE'COUTEUR, Coldstream Guards, Member of Council,
in the Chair.

ON THE USE OF CYLINDERS IN LAYING SUBMARINE TELEGRAPHIC CABLES.

By CAPTAIN J. H. SELWYN, R.N.

It so happens that no longer ago than yesterday an article was written to "The Times" on a question which is still occupying public attention, viz., that of the Atlantic Telegraph Cable, although for the moment its accomplishment seems to be rendered more difficult by the unfortunate circumstances which have plunged the American States into the horrors of civil discord.

It will be easily conceded that novelties of structure are then most useful, and are therefore generally most required, when novel operations have to be entered upon.

No enterprise of this age has greater claims to novelty than that which has sought, which still seeks, to establish telegraphic communication, by a submarine cable, between the Old World and the New.

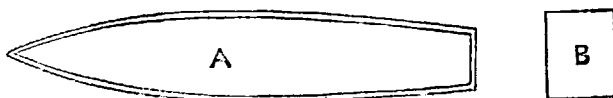
I claim, without fear of contradiction, the solution of the problem, as far as the laying of such a cable is concerned, as the birthright of the seaman; and I am now here to ask the attention, and attempt to merit the approval, of my brother seamen while I propose what I must acknowledge is a novel, and I hope they will think is a seamanlike means of performing the difficult task which I have just claimed for our profession.

Neither seamen nor fishermen will have much hesitation in granting that the best of all ways of getting a long line laid out free and clear is to run it off a reel, and our invariable practice at sea in such cases is to use reels whenever they are possible. Thus, when the question was first mooted of laying a cable, comparatively a mere thread, across the Atlantic, it is no wonder that Brunel (on being appealed to for his opinion) should have advised the use of a reel. But how to carry such a reel as would be necessary? This was held to be a fatal objection at the time, but I am now, I hope, about to show how it may be overcome. Your reel may be made in the form of a cask or cylinder, and then it will "carry itself," float, *i. e.*, with the cable reeled upon it. It will have paddle-wheels on the ends, and be set in a frame by which it may be

towed, revolving as it passes through the water. The model cylinder which you see on the two lines stretched across the platform overhead represents the form I propose. I am sorry there is here no water sufficient to float it, for seamen are generally supposed to be at their wits' end in the absence of that element; but yet, as we ought to be always ready to take a lesson from any one, I have thought I might here take a lesson from Mons. Blondin, and substitute a tightrope for the sea.* It is almost as dangerous, and therefore may in some other respects be likened to it, and it happens to answer the purpose in showing the unrolling and consequent descent of the cable moderately well.

I grant that this will have to be a big cask, but perhaps not so big or so unwieldy as would at first sight appear probable. First, what is the weight and size of the cable to be carried? I will take the late Atlantic Cable as a specimen. This weighed, in air, 1 ton per mile; in water, 14 cwt. Its diameter was $\frac{5}{8}$ ths of an inch. Suppose we have to carry 1,500 miles of such a cable, and in round numbers we will say it weighs 1,500 tons (neglecting the sp. gr.). I cannot tow my reel conveniently, as I should wish, if it is more than about $\frac{1}{10}$ ths immersed, so I want more than double 1,500 tons as the carrying power of the cask, cylinder, or reel. I find by calculation that a cylinder 60 feet long by 50 feet in diameter will have a tonnage of 3,386. Four-tenths of this is 1,354 tons, leaving 146 tons to make up the 1,500, which must be accounted for (if I do not desire to increase the size of the cylinder) by the different specific gravity of that portion of the cable which is immersed. This will easily be done if we consider that the gain from this cause will be equal to 406 tons, or there will be a diminution of the weight to that amount of the $\frac{4}{10}$ ths of the cable which will be immersed. The diagram No. 1 shows the proportion which a cylinder bears to the ship towing it. The cylinder shown there is calculated to carry a cable which has less specific gravity, and less weight, but which is one now generally approved of, and which I have little doubt must eventually be used. It is designed and constructed by Mr. Allan, and specimens of it are upon the table. That cylinder,

No. 1.



A.—Ship 300 feet long, 50 feet beam.

B.—Cylinder 50 long, 30 diameter.

therefore, has a diameter of 38 feet only, by a length of 50, which gives a tonnage of 1,628, and is fitted to carry a cable whose weight in air is 10 cwt., in water 4 cwt., and diameter $\frac{1}{2}$ inch—length now thought sufficient 1,000 miles. This for two cylinders will be 2,000 miles. The distance is 1,650 nautical miles, and this will therefore give a slack

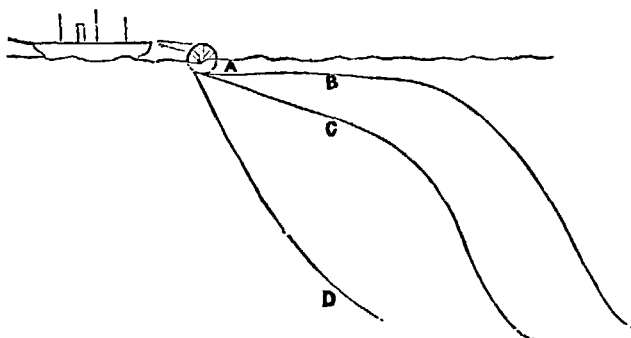
* Two lines were tightly strained across from gallery to gallery, and on these the cylinder revolved as it was drawn along, and paid off the cable below. J. H. S.

amounting to 20 per cent., which is ample. Now, as to the space occupied by the cable when reeled on. I find (referring still to the old Atlantic) that for 1,500 miles of it, $\frac{5}{8}$ ths in thickness, on a cylinder whose diameter is 50 feet and length 60, there will be in the 60 feet 1,153 turns, making one fable or layer of $31\frac{1}{8}$ miles, and that of these layers there will be 48, making a total thickness of two feet six inches only.

In no other way can you stow it as neatly or in so small a space, and you can reel it on evenly and quickly by mooring the cylinder off a wharf, and either have steam-engines on the wharf to set the cylinder in rotation or use your paddle-wheels, which, as shewn in the model, are attached to the ends to do the work. As the tide or stream passed the cylinder, it is evident that it would operate on the paddle-boards and cause rotation. The principal object of the paddles is, however, not this. You will observe that they do not move independently of the cylinder, that they are, in fact, fixed to the cylinder, and its axles, as I have explained; therefore, if subjected to the action of a current of water, they would cause the rotation of the cylinder. But what will be their action while the cylinder is being towed forward by the ship? What would be the result if they were not present? The end of the cable being once let go, or allowed to sink, the whole cable would run off unchecked, and deposit itself in a coil on the bottom. But the paddles will prevent this by beating the water and causing forward movement of the whole body. It appears then that the weight of cable is as a constant clock-weight—taking the place of steam in producing motive power—and capable of relieving the ship towing, under certain circumstances, of a portion of the work. But this action, whatever its amount, is co-existent with another. Whether, in a current, the water passes by, and impinges upon, the paddles; or whether, as in towing, the body to which the paddles are attached passes through the water, the result is the same, namely, the rotation of that body. So, as the cylinder is towed forward, the cable is thrown off, with an acceleration due to the weight of the cable, and a retardation due to the diminishing diameter of the reel, as compared with that of the paddles. There is also another compensation. As the cable is thrown off the cylinder lightens, and less resistance will be opposed by the paddles to the dragging off of the cable. But coincidently, the depth of water, and therefore the weight suspended, will have diminished, and therefore the diminution of resistance is only what would have been required. The motive-power which I have spoken of as being derived from the weight of cable suspended, was remarked upon immediately by a friend whose opinion I early sought on the subject, Mr. Gravatt, F.R.S., a mathematician whose name need only be mentioned to ensure respect for his dicta on such a point. He said as soon as he saw the model,—“Why, it will run over the ship.” It was true enough, if the ship had not had steam-power sufficient to get out of the way, but on going more into the matter, we found that this would be the action. If you could only go as fast as the cable could sink, *i.e.* about two miles per hour, then the weight of cable would assist the towing. If you went faster than this, then, owing to the angle at which the cable descended being altered, growing more astern, it would not help the cylinder forward at all at a high speed,

and less as the angle with the horizon decreased. After the angle of 15° is passed (see diagram No. 2) the backward pull exceeds the forward impulse, and *vice versa*.

No. 2.



- A**—Curves of cable when ship goes faster than cable can sink. **A B** increases in length if specific gravity is diminished or speed of ship increased.
C—Curve when cylinder is stopped on its way.
D—Catenary curve assumed when progress has been stopped long enough to allow cable to reach it.

Thus, I neither mean to propose to you that the cylinder should lay its own cable, nor do I fear that it should run over the ship, although these forces will be acting in the way I have described at certain times and under certain circumstances.

It is clear that, having no cable to carry in the towing-vessel, you can carry plenty of coals, and that the trim will not be subject to the tremendous variation between 1500 tons and nothing by way of cargo, independently of the coal consumption.

Here, then, is a reel which carries your cable in water, keeping it cool, which you cannot sink in a gale (for where ships founder casks often float), which does away with all danger to ship and crew, and which I think you will admit, in any moderate weather, would lay your cable as straight and free from kinks as possible.

I have not yet told you, what is nevertheless a very important point, that the weight of this cylinder would be about 260 tons, if of half-inch iron plate, inclusive of two double ends, two partitions, paddle-wheels, stays, frame, &c. &c., and that the total cost would be about £4,000, one-sixth of the value of a ship, if built to carry the same quantity of a similar cable.

The electrical communication which it is necessary or at any rate advisable to keep up during the towing of the cylinder and deposition of the cable is provided for by passing the inner end, in coiling the cable on, out through a pipe leading from the surface of the cylinder to the axle. Here it is allowed to revolve freely, dipping into a cup of mercury on the frame, or otherwise spring contact may be employed, and from this point

a short cable or gutta-percha covered wire is led along the towing-cable to the ship.

If we consider farther the action of the cylinder when towed, we shall see that, whether the cable is allowed to run off or not, the paddles will cause the cylinder to revolve directly, and in proportion as the ship towing moves ahead. There would be, I have no doubt, a considerable diminution of speed consequent on the towing so large a body while going out to the mid-Atlantic, and therefore not giving off cable. But it need scarcely be feared that the speed of such a vessel as the *Terrible*, which is, perhaps, the best adapted for the purpose, would be diminished to anything like half her usual rate, which is ten knots. Therefore I believe she would be able to go seven with this reel astern. A proposition has been made by some naval officers that I should add to the cylinder a false bow of iron, which might be knocked away after getting out to mid-ocean; but I am opposed to this suggestion for two reasons: First, because all unnecessary complexity is to be avoided, the most perfect machine being always the most simple that will fulfil the purpose; and, secondly, because if better water-lines and easier towing be absolutely required, the best way to get it in this instance is by increasing the size of the cylinder, and thereby making it float lighter from the beginning. However, my own impression is decidedly, that if we can do it well enough, we shall do it quickly enough. *Sat cito si sat bene* must be our motto, and if we can accomplish seven knots, or 168 miles a-day, it will, after all, only take five days to reach the mid-Atlantic, the nautical distance being half of 1650, or 825 miles only. In support of my belief that this speed would be attainable, I may mention that the *Tartarus*, of about 150 horse-power, towed the *Caledonia* three-decker at five knots, her own speed being eight, that the *Napoleon* towed two French line-of-battle ships with a diminution of only two knots of her usual speed; and lastly, that the friction, which it is known offers no inconsiderable part of the resistance to the passage of bodies through water, is here, to a very great extent, absent, owing to the revolution of the cylinder on its axis. Whatever may be, however, the force of the objection to be made as to the towing, it cannot equally apply during the process of laying cable. Then, not only will the cable aid the advance of the cylinder under certain circumstances, which I have already pointed out, but with every mile traversed the cylinder throws off a portion of the weight, rises out of the water, and offers a better shaped bottom for passing through the fluid. But I should deserve the name of a fair-weather seaman if I failed to notice the probable action of a gale, or a heavy sea, on this system of laying. Let us suppose, then, first, that a gale is encountered before beginning the laying, while each ship is towing her cylinder to the mid-Atlantic, or elsewhere. As for the cylinder itself, it is absolutely safe under such circumstances, as also the cable upon it, unless the ship, by lubberly management (which I can scarcely suppose to be likely), runs into it, then some damage might occur, either to the cable or the frame by which the cylinder is towed. I do not say it would be inevitable that such damage should occur, for I think that in many cases of contact between the ship and cylinder it would be pushed away without more injury than denting the frame which surrounds it, and which would be

made of hollow beams, constructed from half-inch plate iron. But this cause of danger, if it exist, is equally to be found in the system of laying from ships; indeed, such a case has already occurred in laying the Toulon and Algiers cable, where, on one occasion, the operation was suddenly stopped by a French steamer, charged to convoy her, running into the vessel carrying the cable. I will, once for all, remark that if, of two systems, the one can be shown to be safer, more expeditious, and less expensive than another, it cannot fairly be required that there should be no difficulties whatever in it, while that other is full of them. Laying cables across the ocean, whatever may be affirmed by landmen, can never be other than a most delicate and difficult operation, requiring most scientific seamanship, calling into action all the practical resources of the sailor, combined with whatever aids science can supply.

But to return to the case of a gale occurring. You would lie to, run before it, or keep bow to sea under short steam, just as circumstances might require. If necessary, you might even let go the cylinder, taking care to adopt such precautions as not to lose sight of it, and again make fast when the weather moderated. My own opinion, however, is, that under no conceivable circumstances could such a course become necessary.

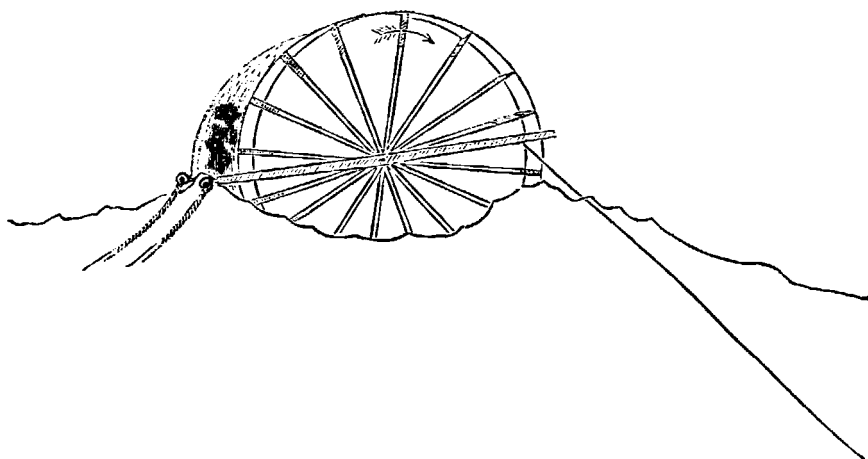
The second difficulty which may occur is, a gale during the laying. This may declare itself ahead, astern, or on either beam. If the gale be ahead a diminished rate of progression will be the result, for, if the captain knows his work, he will not attempt a high speed. "Thrashing at it" would do no good, and might do a great deal of harm. But at any rate not so much danger need be apprehended as with a ship which has the cable coiled in her hold, for several reasons. First the pitching and rolling, as you will see by the plate, are, as well as the scend, either totally absent in the cylinder or very materially modified; the rise and fall of the wave, together with its forward impulse during the short time it is passing under the cylinder, being the measure of motion imparted to the cable, which is always being steadily unrolled or paid out. There is no uncoiling in a hold or handing out packings or lashings (see Blue Book), nor any landsman superintending a brake (break?) while he himself is scarce able to stand or see, and very likely devotes one hand to his own purposes and one to the requirements of the cable, if even he is able to do that. About the orthography of this word brake (break) there is a great difference of opinion, some spelling it one way, some the other, but I am inclined to think there is great similarity in their action as applied to this purpose, for the *brake* generally breaks the cable. The most perfect brakes which I can find are the paddle wheels, for these, according to the proportion which their diameters bear to the diameter of the cylinder, will either throw off slack or apply a per-centage of strain as may be desired, the necessary alteration being accomplished by the use of very simple mechanical appliances which I will presently describe; and more, they will resist the *dragging* off of cable, never absolutely, but as the squares of the velocity with which it is sought to be done, so that any strain due to the rise and fall of a wave will be given way to; but the pulling off of cable in excess of the rate at which the ship is going through the water will be effectually resisted.

The appliance above referred to, and which is shown in the patent drawings,* consists of a clutch fixed on the fore part of the frame on each side at the spot where the centres of the paddle-floats pass during the revolution of the wheels. This is moveable on its axis by pulling ropes from the ship. If the one end be projected forward it will encounter the arms, which, like spokes of a wheel or capstan bars, are fixed on the heads of long screw radii, and these when moved cause the recession of the paddle floats to their common centre. If the other arm of the clutch, on the contrary, be the one projected, then the screws are turned in the opposite direction, and the floats, instead of being "reefed," are "expanded." But this apparatus has been contrived more in deference to the views of others than my own conviction. I do not anticipate, though it would undoubtedly fulfil its purpose, any necessity for its use while laying cable. To return to our gale and its difficulties. If the wind be astern, I do not know any limit to the speed with which the cable may safely be thrown off in the path of the vessel as it certainly will be by the revolution of the cylinder. If the gale be abeam, a current course will be shaped, or rather the leeway must be allowed for as usual, and no fear need be entertained that the cylinder will not "come after the ship" perfectly square, for we are not towing as ordinarily by the apex of a triangle represented thus. The base is the stern of the ship towing, the tow-ropes forming the sides, and the hawse-holes of the ship towed the apex, but in a totally different manner, the points at which the tow-ropes are attached to the cylinder being more widely separated than those which they leave at the stern of the towing vessel. In towing a ship, as described above, if there be a heavy sea, she inevitably sheers about, even when well steered, and from that cause, as also the heavy pitching, brings great strains on the tow-ropes if she do not even break them. The heavy pitching is caused by the fact, illustrated in the plate, that the wave continues to raise the stern until it reaches the centre of the ship's length, causing thereby a motion in a vertical direction much exceeding the height of the wave alone, in fact one due to a multiple of that height by the half length of the ship.

I may here mention that I propose to use as towing cables Manila hemp combined with steel wire, which experience has shown to be the best means of obtaining great strength and great lightness. Four of these would be used, two of which as preventers; I should prefer to shackle them to chain cables on board the towing vessel, passing them out of the hawse holes, and hanging them outside the ship with proper stoppers and quarter tackles. Also at the points of strain on the cylinder and the ship I would make use of "buffer" or spiral springs to diminish any jerking action. Counters for the number of revolutions by bell signal to the ship, lights for night work, means of locking the cylinder, and either stopping or retarding its revolution, or causing it to revolve by hand, would also probably be adopted. I think most of the ordinary difficulties which can be foreseen have now been considered, but, if a breakdown of engines or other extraordinary difficulty should occur, it may be asked how we should then act? The engine stops. If you have, as you probably would have,

* The number of the Patent is 2,884.

a consort, you may, without much danger or difficulty, change places with her. There is no shifting possible if the cable is coiled on board a ship. She may, it is true, be taken in tow, but I have already shown why it is much more difficult to tow a ship than this cylinder, not as regards the rate, but the breakage of tow-ropes. But if the tow-ropes should, with the cylinder, be unfortunately carried away in fine weather, you would of course soon make fast again, while in a gale the cable will take about two hours, or perhaps more, before the curve, which I shall presently show to exist during the laying, will have sunk sufficiently to allow of a fair strain being brought upon it. Then the cylinder will of itself turn round and ride to the cable, giving off cable slowly in answer to any strain, but



Cylinder abandoned or cast off temporarily.

resisting any rapid dragging of it off by the beating of the paddles on the water, and the ship must lie by it until the gale moderates or she can in any way get it in tow, which might not be attended with any great difficulty. But here again, with proper management, I consider that this breaking adrift is an unlikely occurrence. There is no object to be gained in forcing the ship ahead in such a way as to endanger the tow-ropes. I do not believe there would be any difficulty in having a crew of ten men or so on the cylinder frame during the whole operation if it turned out to be desirable, and would cheerfully volunteer to take charge of them myself. I know that a ship in a gale of wind may founder, particularly if she has or has had telegraphic cable coiled in her holds and on her decks, and is either, therefore, over weighed or not ballasted, while I am satisfied that this structure would be almost if not quite unsinkable by anything in the shape of wind or sea. If it should even leak, which is little to be feared in such a vessel, cask, or cylinder, proved as it might be by hydrostatic pressure, then it may be made to pump itself out by very simple means whenever it is revolving, as is done every day in our sugar refineries and other works where large cylinders heated internally by

steam have hollow axles with scoops attached inside as radii. These take up the condensed water from the bottom as they pass through it and deliver it at the axle.

If it be desired to lift cable which has already been laid, this may be done by making fast to the after-part of the cylinder frame, and towing in the reverse direction. The paddles will, as before, cause revolution, and wind up the cable. Under-running may also be accomplished in the same way by taking two or three turns of the cable round the cylinder, and towing or slowly moving the cylinder in the direction which you wish to raise. For these processes, in any moderate depth of water, say three or four hundred fathoms, the cylinder would be most valuable, while even in greater depths it might sometimes be successful where any other means would fail. In fact, any cable which would bear its own weight might be thus recovered or repaired.

As the cable is by this system not exposed to any mechanical violence, as it is always in water, and may be tested in water during the whole of the reeling on, and on the outward voyage, it becomes almost certain that a mere gutta percha covered wire *could* be laid successfully. I have recommended, and I continue to advocate, the employment of internal steel wire, to give strength, but I should not consider it indispensable for laying alone if these means be employed. Yet I am no admirer of excessively light cables, which it is now the fashion to praise. Surface currents cannot be ignored, and they are greatly more to be feared, as the specific gravity of the cable is decreased, while, as we may wish to lift the cable, or some portion of it, for repair, strength is by no means to be neglected. To place steel or iron wire outside a cable, where the salt water can get at it, after whatever lapse of time, is only to insure its destruction by chlorides or oxides. It has been sought to remedy this by means which I can only compare to those adopted by an elderly lady of my acquaintance. She bought a Turkey carpet: in order that it might not be too roughly visited by the winds of heaven, or the feet of the profane, she covered it carefully with an Indian mat; but this also was too good to be ill-used, so she finally applied a brown holland over both. So it is with a telegraph cable, we first construct the two essential parts,—the conductor and its insulator—then we set to work to combat a shadow; we ignore the reduced specific gravity and treat the wire as if it alone were to be suspended in water. Under this impression we construct an outer system of wires enveloping the cable as in the arms of death. These again we are now covering with an insulating material, and it is probable that we shall perceive that the latter will also require to be protected by something else. Unfortunately in this case the brown holland is likely to be more expensive than the Turkey carpet. One electrician, whose cables are very beautiful to look at, has really put a larger copper conductor, in the shape of sheathing, outside his cable than there is inside it, and I strongly advise him to put an insulator outside that again, if he does not desire to throw away the copper or brass outside altogether. It cannot contribute to strength, for if copper could support its own weight in water it would be as well done by the small conductor inside. It professes, I know, to save the insulator from ill-treatment by cable layers or munching by molluscs, but is ill-treatment necessary, and will molluscs, where they do exist, be

more injurious to gutta percha than salt water to copper? As for *spiral* iron or steel wires outside a soft core and a straight conductor, I can find no words sufficiently strong to express my astonishment, at such a transgression of all mechanical laws, at such a self-evident fallacy. They are unprotected from rust or metallic veins on the bottom; they compress the soft core, and at the same time elongate and bring all the strain on the copper wire which they ought to sustain. They are liable to kink, and certain to decay. They present, in short, the best possible contrivance of "how not to do it." I have been told that the iron wires always broke first in the experiments, but I am sure that, had the test been applied of hanging a weight down a well by one of such cables, we should have had a very great tendency to untwist on the part of the spiral and a corresponding elongation of the copper wire. Of course the iron would, even then, break before the copper, but you would indefinitely attenuate the conductor, which, I presume, would not be considered desirable.

But with cables I have little to do. Whatever they may be, I will undertake to lay them (D. V.) in the same state in which they left the manufacturer's hands; and more no telegraphist can expect from seamen.

I would by no means be understood to say that a cylinder should be built, and sent at once to the work of laying an Atlantic cable, without trial. There can be no reason why full and satisfactory experiments should not be made previously; but if, as I hope, the opinions of many able men whom I have consulted already, as well in the naval as in other professions, and who are nearly unanimous in their belief in the feasibility of the plan—if these opinions are still farther confirmed by the verdict of this Institution; then surely it is worth while, by the expenditure of a few thousands, to try whether a stop may not be put to those failures which have already swallowed up a million and a half sterling, and so shaken public faith in telegraphic submarine communication that no proposition which involves a recurrence to the old method of coiling in ships will ever be listened to with favour by the Government or the nation. I mentioned the expenditure, but I am prepared to show that other uses could be profitably found for such a vessel as I propose, even if it did not fulfil the sanguine expectation which my friends and I entertain of success in laying cables by its means; for the necessity of storing submarine cables after manufacture in water has led, in some instances, to the construction of tanks on purpose. Even there, the water has to be changed and, if possible, kept cool by pumping. But such a cylinder as this would, if left moored in a tideway, keep rotating, and the cable would be perfectly safe on it, whether as regards mechanical violence or raised temperature. If, in spite of every care, the testing should show a fault while laying, supposing the faulty part to have been paid-out, it would be possible to reel it up again, either by towing in the opposite direction, or by a hand-motion given to the cylinder from the frame. If the fault were discovered while still on the cylinder, as there are about thirty-one miles in each layer, the operation of laying may be stopped, and the fault be cut out whenever necessary. But faults can scarcely be expected to occur, when a cable is treated as it would be on this principle. They are more likely to exist, or be caused, where the cable, in a hold and during its coiling into it, has to be subjected to a handling which, even where every care is taken,

is too likely to be attended with accident, and which gives opportunities for wilful damage, and which have not always been passed over without harm. Here, on the contrary, nothing but water ever touches the cable after or during the coiling-on—the very coiling is, to speak correctly, now changed to a winding or reeling on, which is far less likely to injure the cable, and the difference of which any seaman will readily understand. A similar motion in unwinding or paying-out will do away with all necessity for brakes, and most of the causes of breakage.

I have now, I venture to hope, sufficiently explained a system of laying and generally treating submarine telegraph cables, which at least cannot be said to be objectionably complex; and I hope that a free discussion of its demerits or otherwise may bring out all those “No’s” which are much more valuable to every inventor than any number of “Yes’s.”

Here, as at the Naval Architects’ Institution, where I have recently been kindly permitted to read a paper on the same subject, I am fully conscious of the great competency of my hearers to judge the merits of the system; and, therefore, whilst thanking the members of the Royal United Service Institution most warmly for their goodness in allowing me thus to bring the matter before them, I have only to beg for an impartial consideration of the subject, and that I may have the opportunity of answering, if that be possible, any objections which may suggest themselves now or hereafter.

One word more and I have done. There may be objections to be made, and minor difficulties to be overcome in this as in every other novelty; but there is nothing that a seaman need fear.

On the other hand, I fearlessly maintain that, unless by a miracle, no cable could ever be successfully laid over such a stretch as the Atlantic by coiling it into a hold at the commencement; and more, that, whatever may be said, no cable has ever yet been laid, either by Messrs. Glass, Elliott, or others, which approaches such conditions as are here to be met. The Toulon and Algiers cable was only laid in pieces, so to speak. The first attempt took them nowhere; the second, as far as Minorca; and the third, from Minorca to Toulon. Is this such a success as ought to be or can be referred to, as promising another, in laying a cable across the Atlantic? Is the Red Sea a success? Is the Alexandria and Malta, laid in a continuous length across deep water? Ill-treated as it had been in a hold, they even now fear to work through it at the speed they would otherwise do.

No; if not this plan, then some better one—but let it at least be one which seamen can approve, not a clumsy attempt to overlay landmen’s difficulties with landmen’s expedients, which are discovered successively, after the cable is broken, to have been mistakes. I can compare the proceedings hitherto to nothing so well as the attempts at pulling (rowing, landmen call it) of a greenhorn in a boat. He seizes an oar—possibly even adventures on the stroke oar, if he is not speedily ejected. Then his miseries begin—perhaps he catches a crab—probably he breaks his oar—and it is always the fault of somebody or something, not himself, that he does not succeed: at length some old seaman, pitying his troubles, “double banks” his oar, and teaches him practically the value of that turn of the wrist, which seems easy enough to look at, but nevertheless takes some time to attain.

Seamen, as a body, are generally very ready to communicate their knowledge to those who come among them from the land, more so than most professions or trades, but neither their goodwill, nor even the undoubted aptness and acquisitive talent of telegraphic engineers, can make it possible to compress the learning of years into the compass of a voyage or two, lasting each a fortnight or so. Such a space of time is barely sufficient to overcome the rebellion of the stomach, or to master the mysteries of the soup plate. A very clever fellow perhaps learns, in addition, not to hold on to a slack rope, nor to seek the weather gangway on dire occasions; but the greatest progress which can be expected is, after all, as in the case before us, that the tyro should have learnt how he can *not* do it, and be willing to confess that, after all, it is a nautical question how to carry out great operations at sea, which can only receive its proper solution from seamen.

To them, therefore, as represented by this Institution I turn for approval; and if they do sanction my labours, I have no doubt that the telegraphists will join us heart and hand in carrying to a really successful issue this magnificent work, which I firmly believe is yet destined to play its part, under Divine Providence, in the spread of that universal peace—of that knowledge of Him which shall one day “cover the earth as the waters cover the sea.”