SESSION 1909-1910

PAPER OF TRANSACTIONS NO. CLXV.

The Care of Ships' Electric Installations.

By Mr. T. R. STUART (Member).

READ

Monday, January 31, 1910.

CHAIRMAN : Mr. Wm. Watson (Member).

CHAIRMAN : As we all know electrical gear is becoming much more used on ships than it was a few years ago, and there is no doubt the engineers will have to accept a good deal of responsibility for its maintenance, therefore we welcome a paper on the subject before us. Unfortunately, Mr. Stuart is unable to be present this evening, and Mr. Adamson consented to read the paper on his behalf.

The authors and critics of recent papers on electrical subjects read before the Institute have frequently made disparaging remarks on the electric equipment of ships.

It is likely that in the near future the uses of electricity will be greatly extended. I think, therefore, that it will be profitable to consider some of the causes of breakdowns in connexion with electrical machinery and fittings, and how they may be avoided.

All large insurance companies dealing with property ashore or afloat have a list of rules and regulations for an electric installation ; they are usually loosely worded and on the whole they combine in demanding that it must all be good and satisfactory work. They are designed to give great freedom to electrical engineers when introducing new designs. There

are, however, many cases where " should " might be changed to " must " with advantage. On the whole the system works well, and I think the rules are kept in spirit as well as in the letter.

A large insurance company in their book of rules and regulations for an electric installation prints the following.

" The principal sources of danger are :—

" (1) Bad materials and workmanship, especially bad joints.

" (2) Conductors of inadequate size.

" (3) Perishable and inferior insulating materials.

" (4) Neglect of frequent test and inspection.

" (5) Moisture.

" (6) Dust and dirt.

" (7) Undue heating."

I would add for marine work, the absence of facilities for the experience of marine engineers to be conveyed to the manufacturers of electrical plant and fittings.

No. 2 does not apply to marine work to any great extent, the conductors are usually of ample size when new, the workmanship on new work is usually quite satisfactory so far that fittings and wires are put up conscientiously. There are, however, many fittings installed by eminent electrical firms of great experience that are always a source of annoyance and frequently of danger. I have seen the same parts fail so many times, that I conclude that although quite electrically sound when new, they contain many undesirable features.

Nos. 3–6 are all likely to be found on any ship ; the keynote of their prevention is frequent inspection.

Those who have carried rubber stores down the Red Sea and through a monsoon have a good idea of what rubber is like after the ordeal. Many rubber goods, although they readily stand the required 180° F. without softening, crack or become pasty under continued heat. The rubber insulation of wires in hot places usually becomes quite hard and loses all its rubber qualities, including flexibility and watertightness after a few voyages. You can easily imagine that in this condition fine cracks abound, then follows a monsoon when everything is dripping, and salt spray everywhere soon finds out the copper wire, corrosion follows—usually a slow process. All the moisture that did the damage has probably dried up, leaving the wood casing like tinder. The reduced wire becomes red hot, and finally, after days of charring, the

wire parts with a flash and ignites the wood which has been so carefully prepared. I have seen many instances of this; sometimes the fire speedily goes out, and sometimes the smell of burning attracts attention to it and it is put out, but I think that it is not sufficiently realized that while these conditions exist there is always a danger of fire. We cannot always look for such a happy ending, and at some time one of these small fires may develop into serious proportions before discovery.

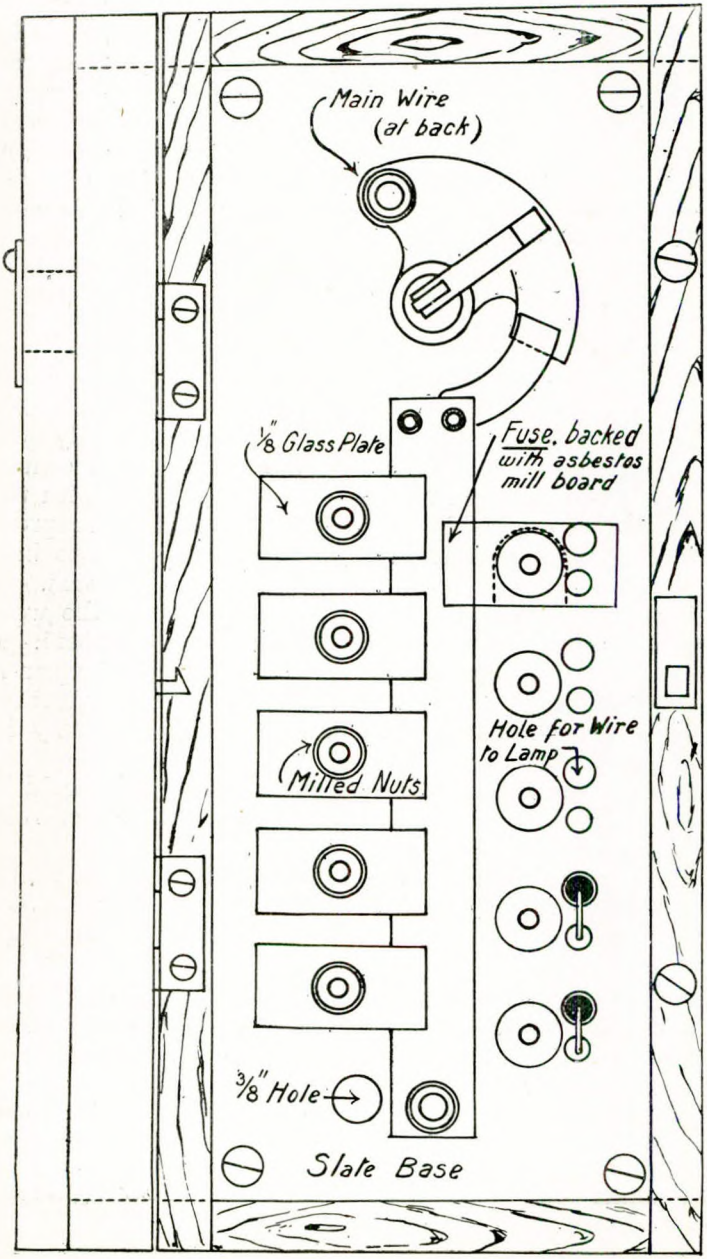
It is when a wire fails and is repaired hurriedly or carelessly that the bad workmanship occurs. Marine engineers are, early in their career, imbued with the instinct of " Keeping things going." If an important wire fails, a temporary wire is run up, the ends twisted together and roughly insulated. These temporary measures are always risky and should only be resorted to when really necessary, and a thoroughly good job should be made as soon as possible. A bad contact speedily gets worse, and the old trouble is renewed, with this difference—the original insulation is to a great extent fireproof, but the rubber tape and black cotton insulating tape both burn readily, as you may test by applying a match. In looking for a remedy the first thing is to discard the wood casing; it only hides the wires without protecting them. If the existing wires were open to view they could be frequently varnished and kept watertight, and any deterioration noticed at once. Armoured or lead sheathed wires are necessary for all damp places.

Fuses are the safety valves of the system, and should be respected accordingly. The following are extracts of rules concerning them.

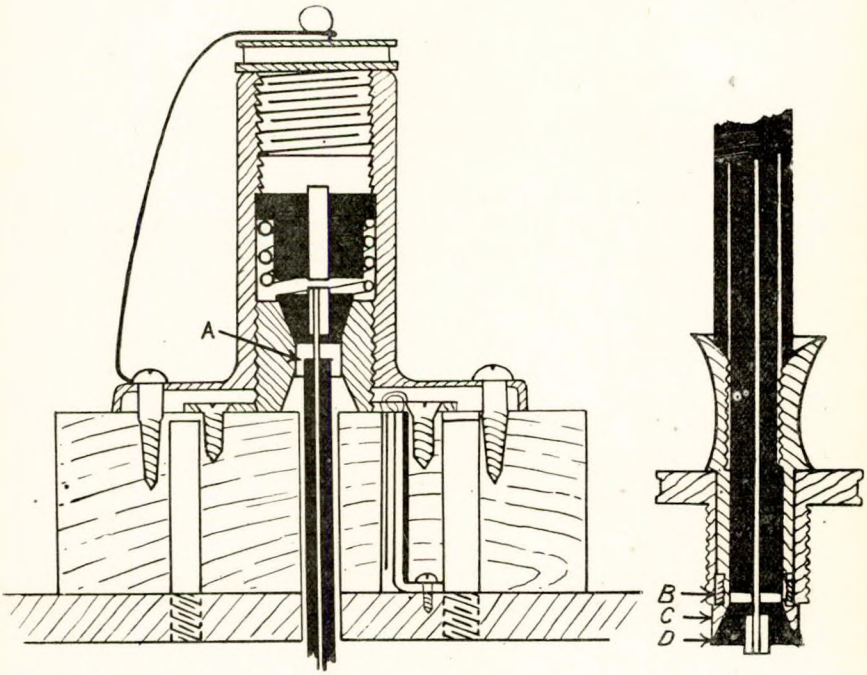
" They should be mounted on slate or other incombustible bases, and be arranged so that the fused metal may not be a source of danger, and where fitted with covers these should be incombustible. The fuses for each cable should be made of standard dimensions, so that a large fuse cannot be used for a small cable by mistake, or if wire fuses are used permanent instructions should be fitted, giving particulars of the proper size of fuse for each circuit.

" In damp places all lamp switches and cutouts should be of a strong watertight pattern."

The sketch shows a fuse box frequently fitted; it contains many points open to criticism. It is of no use having a slate


Main Wire
(at back)
1/8" Glass Plate
Fuse, backed
with asbestos
mill board
Hole for Wire
to Lamp
Milled Nuts
3/8" Hole
Slate Base

base pierced by large holes allowing fire, water and dirt to have a free passage. These boxes are usually full of ants or cockroaches, they are easily opened by people who should not have access to them—any knife blade will do it. There is no limit to the strength of fuse that may be put in. I have seen one fuse carrying three lights and two fans, others with seven 16 c.p. lamps. The fuses are of a very poor design, the distance across the narrow bridge is very small, the central screw is just where it should not be, as an arc once started is readily carried on by it. When a fuse melts, the wire end



is often burnt where it leaves the box through the slate base. The frames would be better if metallic and watertight; these boxes are fitted in alleyways where the paint is washed down with abundance of water, and are certainly "damp places." They should exclude vermin and be accessible to the electrician only. The size of fuse should be strictly limited to suit the circuit. Before renewing a fuse, the lamp and wire leading to it should be examined for intermittent breaks,

partial earths, etc. If the lamp glows for a few minutes and then the fuse melts again, it should not be renewed till the cause has been ascertained. The most frequent breakdowns occur in that part of the installation used for portable cargo clusters. When new, everything appears to be good and well insulated, but troubles soon develop, the wood speedily shrinks or warps and lets in water back and front.

The wire is bared at (*A*) and you will see that there is only about $\frac{1}{8}$-inch gap between the positive and the nipple acting as negative, and this is often filled with water during a shower. The brass caps are nearly always lost. I do not see what useful part the wood base takes as the brass base can be screwed to the iron plate as easily as the wooden one, neither do I see any use for the spring or distance piece; they do not give a quick break or serve any useful purpose whatever. The wire terminal makes no pretence at being watertight, and certainly never is. Another small but important point is, that the fine thread (*B*) is unscrewed when the terminal is screwed in place owing to the friction at collar (*D*); this often pulls off the nipple (*C*). On a ship having ten of these cargo lights it is quite common for six or eight to fail during a heavy shower. The cables, too, are not strong enough for the rough treatment they receive. I have seen them sparking and spitting fire; this only wants to occur in a hold full of cotton to start a big blaze. The chief trouble with these portable wires after dampness is that they get kinked and that cuts the inner insulation and allows the wires to come together.

Navigating lights are the most important of all, and no effort should be spared to make them reliable. There are usually one or two 16 c.p. lamps fitted into a lantern designed for an oil burner, and ventilated accordingly. I have seen them half filled with water and, of course, the lights go out just on the rough night when an oil lamp too gives most trouble. These lamps should be simple copper boxes having a lens as required, glands where the wires pass and rubber joints on the door, with a good cable leading to a switch and fuse in a sheltered place. Any electrician could make a good job of it if not bound by precedent. I remarked that the fuse boxes should be kept locked; the same principle should apply throughout. The installation should be treated seriously and irresponsible persons not allowed to interfere. Temporary cabin lights hooked on to bared wires, amateur

wire heaters, and second-hand non-descript fans should be prohibited, and any interference with any electric fitting viewed as a serious offence.

Steps should be taken to remove the slur cast by shoddy electric work, otherwise it will not be long before it is added to the list of parts to be regularly surveyed in detail. From an underwriter's point of view, it is bad finance to underwrite a ship that may be totally lost through any of these trivial causes. In conclusion, I would ask Members who have control of such gear to consider their own position if loss of life or property occurs through improper work by any of their staff.

Mr. W. McLaren : I must congratulate the author on the short crisp paper he has given, although taking it right through he seems to have had more trouble than I have experienced either on land or on board ship, and I should think the installation he has been used to is not a very good class. In the first paragraph the author alludes to the disparaging remarks on the equipment of ships by electrical engineers. I have never been able to solve the mystery as to how they run their wiring when they get to a switchboard. The wires are in a complicated tangle instead of being laid in some methodical way, and no doubt that may be one of the author's grievances. Then he tabulates the principal sources of danger, the first one being " bad materials and workmanship, especially bad joints." As to bad materials, I cannot say that I can support his remarks ; on the majority of ships I think the materials are fairly good, and the same remark applies to workmanship. With regard to bad joints, if it applies to the work of the amateur, the trouble arises because it is such a convenient source of energy to be tampered with, but I cannot see why either the mechanical or marine engineer cannot get over that difficulty. Steps should be taken to see that the juniors have fair opportunities of getting that kind of work put into their hands, and of making a satisfactory job, and a man who can handle his tools well would not have much trouble. With regard to the inadequate size of conductors, I have had one experience of this on shore, but no doubt similar cases are met with at sea. If lamps are being continually added, and this again is where the amateur is at fault, there is no doubt trouble will be experienced. The experience I

mentioned, however, was with an eminent firm who put in what they termed 15 c.p. lamps, at least they were supposed to be 15 c.p. but they were really 16. The people who took charge of the premises afterwards, instead of being content with 16 c.p. lamps put in 32's. The engine did not work up to its rated power, and it was a good thing too, for the whole plant might have been fused or burnt. With regard to perishable and inferior insulating materials, I have used gutta-percha for wiring strung round the boiler casing, and if that class of material is adapted for submarine work, surely it could be adapted for deck work or hull work. In the instance I referred to, it was used round the boiler casing and the fiddley casing ; so far as I know it may be there to-day, but at any rate it was under my care for about three years, and there did not seem to be anything the matter with it. About every six feet they were strung through wooden insulators, and that kept the wiring away from the bulkheads. Mr. Stuart also refers to neglect of frequent test and inspection. That is a very serious matter to consider, because in some of the olden ships the system of wiring was adopted before it was known exactly what troubles were generated by it. He refers also to moisture. As I have mentioned, gutta-percha insulation if the wires were not bared seemed to stand well in submarine work, and if that is the case I do not see why it should not stand in this work, provided the ends which are bared are well insulated before the wire goes into a switchbox or use-box or for distribution. If it is well looked after and well housed I see no difficulty. Of course, if a hose is played over it, it depends on whether the box is made of wood or cast iron. If the holes were sealed up with composition there should be no trouble. The tightest box made, even with wood or cast iron, cannot keep out vermin. Opposite London Bridge there is a sign running controlled by clockwork which is always giving trouble in the clock from that cause. No doubt undue heating is caused by moisture or in some cases through overloading. Most probably, moisture is getting in contact with the wires. In one case of fire on a steamer, whether from a defective joint or not was not known, but the wiring fused and fired and had gone right through the casing and through the deck. It was supposed to be a question of moisture there. Of course the fuse ought to have revealed that. Surely engineers are posted up or know that it is only

a mere calculation that is required for the size of safety fuses. With regard to his remarks on the candle power, at the present time with these metallic filament lamps there is great confusion. We talk about 16 c.p. lamps listed 17 watts, therefore I think we ought to take them at their watt consumption. Instead of being 17 they may be 20, or as high as 24 watts. I have had so-called 16 c.p. lamps tested, and they went up to 24, which affects one's coal bill. In considering the consumption of energy the candle power ought to be deleted, and the quantity consumed referred to in watts. The last item I would speak of is in reference to the cargo lights. I do not quite understand this fitting, of which a sketch is given, and I do not see the necessity for a spring. Of course you can get three, four, five, up to eight little fittings, and the wire is jointed up in a careful way, so that there should be no trouble. There is no trouble with the lights outside the shops on shore, and they are left there swinging in all kinds of weather. This is an odd fitting I have never come across before, but I think that at the present day you will generally get a very good job made.

Mr. W. E. Farenden : I quite agree with the author that the material and workmanship should be of the very best quality for all the electrical installations on board ship, also that the plant should be fitted in a dry place free from moisture. With regard to the motors, it seems to me that they should be of the enclosed type to keep them dry and free from dust and dirt. This is most necessary for efficient running and also lengthens the lifetime of motors. The author advocates armoured or lead sheathed wires, and of course these are invaluable in the engine and boiler spaces, and are usually fitted in modern ships. I am pleased that this paper has come from one of our marine members, because it is an indication of the great attention our sea-going engineers are giving to this subject.

Mr. R. J. Elmhirst : Mr. Stuart in his paper calls our attention to the various likely sources of trouble. He has got his information practically speaking from the insurance companies, which is a very good source. I agree largely with what has already been said with regard to the points of bad materials and workmanship, but with regard to bad joints, in a modern

vessel or in a modern installation ashore or afloat joints are practically abolished, the use of junction boxes is so universal that the old-fashioned joint is a thing of the past. Of course the reference to temporary wiring is quite correct; it is a very bad practice. I do not think we have much trouble with conductors of inadequate size in modern installations, as the greatest care is taken in this respect. It is usual to adopt 1,000 ampères to the square inch of cross section, which is a perfectly safe measure. I do not think any one need be frightened about the size of the wiring in that case and that is the usual practice. Mr. Stuart adds an eighth to the seven causes of danger given by the insurance companies, and says there is another trouble, " the absence of facilities for the experience of marine engineers to be conveyed to the manufacturers of electrical plant and fittings." I do not agree with Mr. Stuart—emphatically I do not. There are hundreds of electricians nowadays who have been to sea in their earlier days and who are now scattered all over the world holding good appointments in electrical firms. They have every opportunity of letting the manufacturer know what the requirements are, and I think it is being done, because the materials now are infinitely better than those of twenty years ago when I first went to sea. I quite agree with the author in his remarks on the temporary coupling up to wires. It never should be done. If it is unavoidable there is no reason why a sufficiently good joint should not be made at once; it would only be a matter of a few seconds longer being taken over the work. " A bad contact speedily gets worse; " that is undoubtedly true. With regard to the statement that the original installation is to a great extent fireproof, whereas the temporary is inflammable, I am afraid I do not quite agree with that. The original material is just as liable to burn as the new. I would like to say a few words with regard to the fuse box of which a sketch is given. Mr. Stuart says this is " frequently fitted." I do not think it is frequently fitted; it is rather an unusual form, although one I know very well indeed. He speaks of it having a slate base; as a matter of fact it is invariably made with a glazed porcelain base, which of course is very much stronger and more permanent. Of course I agree with him that all these fuses should be kept perfectly free from being tampered with by the amateur. The question of ants I do not think there is much trouble with, because this would

only occur in boxes situated in hot places. The majority of the boxes never get either ants or cockroaches in them in the ordinary way, although in occasional cases they might. With regard to putting seven 16 c.p. lamps on the one fuse, I presume he means the ordinary carbon filaments. Of course it is bad to keep overloading. But for the particular box in the sketch the fuses are made varying from 2 to 5 ampères, and if it is a 5-ampère fuse it would be safe enough for seven 16 c.p. lamps, as they were made to carry that. I have seen thirty-two 16 c.p. lamps with carbon filaments running on 16 b.w.g. for a period of six months. He complains of the design of the fuses and says "the distance across the bridge is very small, the central screw is just where it should not be, as an arc once started is carried on by it." There is absolutely no danger of any arc starting between the live part of the fuse box and the screw, because the screw is embedded in the porcelain base. In the course of twenty years I have never seen any signs of such sparking. He says: "When a fuse melts, the wire end is often burnt where it leaves the box through the slate base." If that happens you will be certain of one of two things, either there is a bad contact between the wire and the fuse, or the fuse is too heavy. I do not agree with him where he says metal would be better than wooden cases. I am in favour of the latter, and I think in passenger ships a nicely varnished wood looks very much better than cast-iron, and the more one can do away with unsightly objects the better. With regard to the cargo terminals. This is rather an unusual type of fitting, and one I know particularly well as I have come in contact with it for the last twenty years, and I do not think the terminal justifies the remarks Mr. Stuart makes. In the first place he says there is only about $\frac{1}{8}$ inch clearance between the positive and the nipple. As a matter of fact I measured one this morning, and I found there was $\frac{7}{32}$ inch, which is very much better. Instead of being bell-shaped it is perfectly straight through the brass-work below the insulator. Where marked on the sketch with an arrow, there is a space of nearly $\frac{1}{8}$ inch below the insulator, while as a matter of fact the bottom part of the insulator is hollowed out $\frac{1}{16}$ inch so that the insulation is allowed to enter the part which comes immediately above it in the sketch. Then again, the sketch is wrong in connexion with the clearance between the upper and lower insulators.

In place of $\frac{1}{16}$-inch gap with the spring extended, in reality the space invariably given in this fitting is $\frac{3}{4}$ inch. The spring has a very great use. As the author says, it does not allow for a quick break, but it serves a useful purpose. The quick break is obtained by having a switch. The object of the spring is to have an internal break in the terminals, so that when the spring is expanded the external contact is absolutely dead. With regard to having seen ten of these cargo lights fail, I have been many years at sea and should have been sorry to see ten break down in one night. Of course this is a concentric cable, as you will see by the sketch, and a kink in a concentric cable always gives trouble. The only thing that happens when there is a kink is that the fuse goes and everything is practically as safe as you can get it, because the outside sheathing is too heavy for any danger to arise. With regard to the navigation lights, I think Mr. Stuart has made a slip. He says there are usually one or two 16 c.p. lamps fitted in a lantern designed for an oil burner. If there are two lamps, both of these lamps cannot by any means be in focus at the same time. And the Board of Trade surveyors are very emphatic in seeing that only one lamp shall be burning at a time. Some ships have two lamps with an arrangement so that if one goes out the other one can be turned on to the live contact straight away. Of course with regard to the lantern being designed for the oil burner that was the only thing that could happen years ago when the oil lamp was just abandoned. Superintendents did not go to the expense of fitting up new lamps entirely but converted the old ones simply by having the electrical lamps fitted in them. Since electricity has become used universally, it is very usual to have a special lantern made which is practically watertight. I was rather amused to see the author's remark about these lanterns being half full of water, because there is an ample amount of ventilation to get the smoke out and holes at the bottom for inlets, and if the water came in at the top it would go out at the bottom. I agree very strongly with what the writer says about the amateur interfering with the installation on board ship. The weird and wonderful things one sees, such as a fire brick with wires twisted round it and used as a cabin heater, are sources of infinite danger, and should be strictly forbidden. Mr. Stuart refers to the necessity of removing the slur cast by shoddy electrical work, but I sincerely hope there is no such

slur to be removed. I do not think there is much shoddy work, and if there is it is solely due to want of supervision, because electrical engineers are just as wishful to have good work done as any other engineers. I must thank Mr. Stuart for his paper; it is a most interesting paper indeed.

CHAIRMAN: I think Mr. Stuart has performed a very necessary work in drawing our attention to the need of supervision and the maintenance of electrical gear on board ship. I also think he might have gone a little further and given us his experience with the dynamo and motors, etc. However, there is no doubt that electrical gear is subjected to more deteriorating forces than the other auxiliaries on board ship, which are generally placed under more favourable conditions, and I think the only way to secure continuity of supply, where there is any suspicion of dampness or salt in the atmosphere, is to make the whole system watertight. I think lead covered cable with glands into the fuse box would be a good system. Another way, of course, would be to run screwed tubing and fill it up with compound. Of course this means expense, but in my own experience on shore we found that to be the best way of ensuring a decent life for the cable. As regards lights used in unloading cargo, hatchway lights, I think they ought to be twin wire enclosed in flexible metallic tubing. Such are on the market, but they are not used to any great extent, mainly on account of the expense, but I believe the Admiralty has taken them up and is well satisfied with them. Of course a good deal might be said in connexion with the maintenance of dynamos at sea. The windings need to be very carefully looked after, and of course the bearing also, because, if the bearing wears down you get the armature touching on the pole piece magnet fields, and off goes the binding wire, and the whole thing has to be shut down. With a reasonably good dynamo, and proper attention given to it in the way of cleaning and removing the carbon dust and copper dust from the commutators there should be little trouble. In fact the running of electrical machinery, as far as I can see, is principally in seeing that there is absolute cleanliness. Some have the idea that electrical machinery needs no attention whatever. All gear such as dynamos and motors must get a certain amount of attention and must be well looked after.

Mr. ELMHIRST : I kept carefully clear of the subject of generators for the reason that generators are not mentioned in the paper, but what the Chairman has said is most important. With regard to ship work, however, the greatest trouble with generators is neither dust nor dirt nor salt, but water blown from glands. If the marine engineer gets an engine guaranteed not to blow off water over the electrical machine when the vessel comes into port, he has something to be grateful for. That is a very great source of trouble, water blown from the low pressure engine when exhausting to the atmosphere. With regard to the cable, I think the cable you speak of would be too heavy for marine work because they have to be so long, 30 to 40 yards long in some cases. The ordinary length is 20 to 30 yards, and if it is metallic armoured on the outside, of course it would be very heavy and clumsy. Otherwise the metallic covering would be very good. If the cable is not good enough, of course a better one can be got.

Mr. JAS. ADAMSON (Hon. Secretary) : There are one or two points I might add. I think Mr. Stuart proves the converse of one of his own propositions; the writing of a paper such as this is one of the means by which the marine engineer can show what the requirements for marine work are and are not. I think, however, his experience has been unfortunate and singular, as I have found that as a rule the installation is in pretty good order to start with. But there is no doubt some of his remarks are quite *a propos*. With regard to the fuses ; we have heard of the engineer putting a man to sit on the safety valve lever to get more pressure without blowing off steam, and that is pretty much what happens sometimes in connexion with fuses giving out. A heavier one is put in and afterwards a heavier one still, and the result is what Mr. Stuart describes in his paper. With regard to the extra lights, put on in connexion with the cargo clusters, I daresay it is not unknown that the stevedore sometimes takes a single lamp out when the fitting admits of it being done, and adds a cluster, with the result that the fuse or something is sure to go, unless there is a large margin. There is no doubt extra lights are added on from time to time to an installation after the first outfitting. In Mr. Veysey Lang's paper he indicated that the dynamo was very often put in merely to the bare requirements, and after a ship had been running for a few

months it was found necessary to add to the lights. We have all had experience of that, and there is hardly a ship, say with seventy to eighty lights, but has them supplemented by another twenty or thirty, until the dynamo is running at its ultimate load. There is another matter not referred to by Mr. Stuart ; that is, where a ship is carrying explosives with the wires carried through the hold. The surveyor requires that there shall be no live wires in that portion of the ship containing the explosives, and the usual way is to cut out the section, from the switchboard or from the junction box, and carry an overdeck wire to any necessary part of the ship beyond by an overdeck cable. Some arrangement should be made to obviate that necessity which arises from time to time in steamers where the wires are carried in the cargo spaces and an explosives magazine has to be fitted. There is another practice often found, that is, carrying the wires through the coal bunkers, and a good deal of trouble is experienced when this is done, chiefly through the excessive heat and the habit the coal trimmers have of hanging up their lamps under the wooden casing ; possibly that may be some of the wooden casing referred to by Mr. Stuart. He doubtless refers to the carbon filament lamps in stating the c.p., as I do not think many ships have been fitted with the metallic filament, although there is an indication that they are on the market and on trial in one or two lines of steamers, with a view to their adoption. With regard to the wires, instead of being carried through the cargo spaces they are sometimes carried on deck through pipes. Whether this has been altogether successful or not is a question, I have heard a good deal both in favour of and against this method to avoid the cargo spaces and the bunkers. Of course there is the obvious disadvantage of something going wrong with a wire in the pipe and the difficulty of locating it. Then there are questions which arise from single wired ships ; the use of the concentric wire and the difficulty of making joints when it becomes necessary to add connexions for extra lights, fans, etc., all points worth discussing. I know of one steamer which has been running now for over twenty years regular service with the same engine and dynamo, —one of Parsons' turbo motors. It is still running and doing good work without giving trouble. I do not think, as a rule, we have much trouble with the dynamos, if they are carefully attended to. I noticed the remark of Mr. Stuart with reference

to the two lights in the one lantern, but presume he only means two lights so that either could be switched on to suit requirements. Obviously, as has been pointed out, only one lamp can be used at a time. Of course it was only natural that the oil lanterns should be adapted for the electric light, with the necessary alterations to comply with the Board of Trade requirements.

Mr. W. McLaren : I had hoped to hear something of the experiences of members with regard to cotton-laden ships and the fires that occur on them, also on the subject of the appalling catastrophe we had on land at Clapham a short while ago, and the divergent opinions expressed as to the cause of these fires. The origin of fires on cotton ships seems to be rather mysterious ; we have had them before the introduction of electric light, but they seem to have been more frequent of late.

Chairman : As regards cotton ships I think the cause of fire originating in the hold is generally attributed to spontaneous combustion. With regard to the unfortunate fire at Clapham I think it has been proved to have been due to an electric lamp, at any rate the experiments of the experts representing the insurance companies satisfied them that the fire could originate in the manner alleged.

Mr. McLaren : It was a metallic filament lamp that was used, I believe.

Chairman : If a metallic filament lamp is brought within a distance of four inches from cotton wool, which is a highly inflammable substance, the cotton wool will burn, and it was proved that it was possible for the fire to take place in that way, although whether it did so happen no one could say.

Mr. E. Shackleton : This is an interesting paper and no doubt, as Mr. Adamson has said, it shows a variety of troubles that perhaps we outsiders do not quite appreciate entirely as far as electrical installations go. What, I think, might be done in the near future, although of course this is a matter that would have to be well planned out, would be to have a larger adoption of electrical meters. It seems to me that this would be productive of good, especially on passenger ships, if a practicable meter were brought out. If, say, ten meters

were installed, and the records duly recorded, there would soon be some indications of earths, bad lamps and various other troubles which arise from the failure of electrical installations. In the case of meters I think they would be valuable indicators as to the state of efficiency generally, but whether an electrical meter could be made to work satisfactorily under marine conditions is another matter. The engineer does his best to keep up with the requirements, and various people on the ship are simply doing their best to use up the electricity, through carelessness and in other ways, and considering that every unit wasted means a black mark against the unfortunate engineer, I think it is only fair that he should have a chance to show how the electricity is being used in the ship generally.

Mr. FARENDEN : Mr. Adamson referred to instances where electrical wires and cables were led through holds and bunkers. I do not know whether this is done to any great extent, but it should be specially mentioned in new specifications that on no account are the cables to be passed through cargo spaces or bunkers. If the wires are led through pipes or casings, or along the decks, they can always be got at and repaired, but once they are placed in the cargo holds one never knows what is going to take place.

Mr. ADAMSON : The difficulty is to deal with them otherwise in many cases.

Mr. ELMHIRST : I am strongly of opinion that it is bad practice to put live wires in cargo spaces at all. The wires are right down, two or three decks down, and almost invariably on the ship's side. If anything goes wrong, tons of cargo have to be displaced, whereas if the wire is taken along the deck, it is comparatively easy to get at it. I strongly agree with Mr. Farenden that it is a dangerous and bad practice to put it in the hold. With regard to meters I think I am fairly safe in saying that they have never been adopted on board ship. Possibly they may have been used in yachts, where cost is not an item to be considered, but otherwise I do not think they have been used, and I really do not think they would be of very much service. The difficulty would be to get a meter to work properly under marine conditions. That difficulty may be overcome some day, but it has not been overcome yet ; there is not a meter on the market that I know of that I

would care to instal. I do not think there would be any great utility merely in having the meter to register the amount of consumption. The meter would tell when the current was wasted, but you could not get a meter which would tell you who was wasting it.

A vote of thanks was accorded to Mr. Stuart on the proposal of Mr. W. McLaren seconded by Mr. Ross. The meeting closed with a vote of thanks to the Chairman on the proposal of Mr. Farenden.

Mr. Stuart's reply: I wish to express my thanks to the Hon. Secretary for reading the paper in my absence, and to the Chairman and members for the interest taken in it. In opening the discussion Mr. W. McLaren stated that I had found more trouble than he would have expected; in view of this and subsequent remarks of a similar nature I wish to explain that taking up the position of counsel for the prosecution I recorded the faults in electrical equipment that have presented themselves to me on several ships during several years' observation. I did not mention any freak accidents, but only failures which have occurred so often that I have now become accustomed to look for them as a natural sequence to the wiring and fittings that I have described. Several members are of the opinion that everything electrical aboard ship is in good order. The best criterion of perfection or otherwise is the frequency with which fuses have to be renewed. It is the constant cry of ships' electricians of my acquaintance for whisky capsules to replenish their stock of fuses, and I have known sixty fuses to be renewed during a three months' voyage in a ship with dynamos of 20 k.w. capacity, and allowed to pass without serious comment, and certainly without completely overhauling the wiring or testing the insulation resistance. That is the state of things to which I endeavoured to call attention.

I do not think that gutta percha is an ideal substance for insulation; it is likely to crack where it is exposed alternately to wet and heat, although it may do very well for submarine work. Neither do I agree with Mr. McLaren on his remarks *re* "exclusion of vermin." In the Navy all fittings are watertight; so are all mine fittings, and if similar fittings were used on merchant ships I think they would be absolutely free from vermin. Throughout the paper I referred to ordinary

carbon filament lamps; I have had no experience with metallic filaments at sea, but understand that they are extremely fragile—perhaps some of our electrical friends could give particulars of their average life at sea.

My thanks are due to Mr. Elmhirst for the compliment of his extensive criticism. I must recognize, nevertheless, that on several points we hold widely different views. It is with a few of these that I now propose to deal. I think he has somewhat misread my remarks *re* bad joints. I stated that everything was a good job originally, and had only repaired and additional wires in mind when writing about bad joints. Junction boxes are used by the contractors, but I have never seen a spare one in an electricians' outfit. I have, however, seen many disgracefully bad joints. I have a few specimens which I think would establish my statement about shoddy work. I must also repeat my statement about the relative inflammability of the original insulation and the repairing tape; a piece of new wire in a flame glows, chars, and flames slightly, but goes out when removed from the flame. Repairing tape, however, burns freely; there is no reason why this should be if the manufacturers gave the matter a little thought; household goods like lace curtains and flannelette are now made so that they are now very difficult to ignite. Before dealing with Mr. Elmhirst's criticism on cargo terminals and fuse boxes, I wish to say that I made the drawings from new fittings; they are not accurately to scale in detail as I sacrificed that for the sake of clearness. I only wished to point out that neither the bulkhead fitting nor the cable end make any pretence at being watertight. I regret that Mr. Elmhirst should be amused at the fact of side lights getting full of water. I can assure him that it happens to this day, and it does not enhance the reputation of the electrical profession to allow such an evil to exist for years. Even if an old lantern is used it could easily be made watertight. I can give the names of several ships with two lamps in their navigating lights, so that he can verify my statement in that respect.

When discussing the wire end being burnt in fuse boxes Mr. Elmhirst said "either there is a bad contact with the fuse or the fuse is too heavy." I quite agree with him; instances of both are common, but Mr. Elmhirst misses the main point. A fuse box in which it is possible to have a bad contact, or a fuse too heavy, and in which the wire can be burnt

where it leaves the box and comes in contact with dirt and dust behind, is a dangerous and improper fitting.

Messrs. Adamson, Farenden and Elmhirst all join in emphatic denunciation of taking wires through holds. I quite agree with Mr. Elmhirst that it is a "dangerous and bad practice," but if electric wires are so dangerous in holds, are they very much less dangerous in other places, viz., linen stores, pursers' stores, mail sorting room and lamp room, and if so does it not call for serious steps to remove the danger? Fuses are no protection against a fire caused by a wire breaking or a short circuit; the flash occurs, and if anything extremely inflammable is present it catches fire, therefore all wires should be as strong as possible, mechanically and electrically. Wood casing, while affording some mechanical protection, does not assist electrically, indeed in exposed places it does more harm than good. Wood impregnated with sea water never loses the salt, although the water may be evaporated, the salt always remains ready to absorb moisture from a damp atmosphere. The briny surface it then presents to the wire is the worst possible thing for rotting the fabric of the insulation. If wood casing is considered indispensable for decorative purposes it should be fitted over properly protected wires, i.e. lead sheathed or wires run in iron pipes.

Reflecting on Mr. Adamson's remarks *re* taking wires through pipes along the deck, I think I have only once seen them fail, and then all the after lights gave out; the pipes had evidently been damaged by the gangway in this case. On the whole I think iron pipes answer very well; there is a point, however, which occurs to me in this matter. I have seen several wires for portable cargo clusters cut on the hatch coamings. It would be very easy to provide for their safe passage to the deck on which they are required.

If meters were installed as suggested by Mr. Shackleton, it would certainly secure full credit for all current generated, and the chief engineer would be greatly benefited thereby. The meters, however, are costly, and the frequent calibration necessary would be a continual expense for which no monetary return would be visible, therefore I do not think we are likely to have them at sea.

When writing the paper I left generating machinery alone in order to confine the issue to the distribution of electric current. There is scope for a volume on the design and care

of electric machines for marine use. If one is ever written, each page should be headed Cleanliness—for that is by far the most important factor in their maintenance. I conclude with thanking you all for your attention.

Correspondence

The following communication has been received from Mr. F. J. Kean, B.Sc. (Member), Chief Assistant to the Professor of Engineering at Leeds University—

I have read with interest the paper by Mr. Strohmenger, F.C.S., on Boiler Coverings. I think the Author rather confines his remarks to *pipe* coverings, instead of boiler coverings. As the subject is of great interest to marine engineers I might say that, at the suggestion of Professor Goodman, we made some tests on our semi-portable locomotive type of boiler here when the covering had all been removed for inspection purposes. Some years ago when the boiler was *covered* (plastic covering), the radiation loss was found to be 3·36 B.Th.U. per minute per degree difference of temperature between the steam and the air, for the complete boiler. When the boiler was entirely *uncovered* the radiation loss was found to be 7·92 B.Th.U. per minute per degree difference in temperature between the steam and the air.

The average temperature in the boiler house when the boiler is covered is generally about 80° F., but this rose to 100° F. when the boiler was not covered. The thermal efficiency of the boiler was about 4 per cent. less without its covering than when fully covered.

With reference to Mr. Walker's question, it is quite easy to *calculate* the radiation loss for any given covering, provided its coefficient of thermal conductivity is first determined by careful experiment.

The question of protecting deck pipes from the action of sea water and the hose pipe has often occurred to me as an interesting problem. Could this not be done quite well by enclosing the whole pipe when covered in a light galvanized iron pipe, the sections of which could be electrically welded together in place and made quite watertight ?

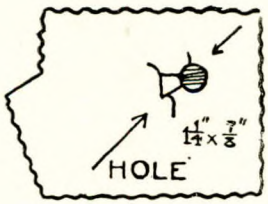
P.S.—I have the details of our tests on the boiler, but do not think they are of general interest in the present discussion.

F. J. K.

Dear Sir,—I beg leave to present to the Institute, a piece of a furnace, which I had cut out at a Spanish port some time ago. This crack was first seen on a voyage to Genoa. Knowing that it could not be repaired there in time, I decided to clean it well, and cover it with a layer of Portland cement on the waterside ; this held out very well till we got to Huelva, a run of 4½ days. When we left Genoa the crack seen on the fireside was not so open, but quite as long. At Huelva, and ample time in port, I had this bad part cut out, and a riveted patch ⅜ inch thick secured with 14 ⅝-inch hand-made rivets on the fireside.

There is one great disadvantage in trying to keep this patch tight ; being on the line of firebars, one half of it is far warmer than the other, thus causing it to leak badly at times. Caulking a patch on the fireside, and especially on the line of firebars, I never do, as I do not believe in it, for better results are got by renewing rivets and rebedding the patch.

After leaving Huelva, and on our way to Liverpool, we had another experience of the end plate of the same boiler; this I noticed leaking badly, running freely through the lagging. On examining it found that the plate and the nut were badly corroded. This was located on the combustion chamber of the same furnace which had the riveted patch put on. It was leaking so badly that I decided to work the steam off, and blow the boiler down; this was rather a hard trial to the new patch. When the pressure was off, and water all out, I cleaned it well, and on sounding it with a hammer, a hole was made as per sketch—



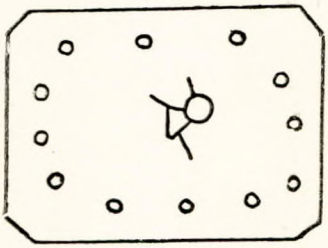
The lines running from the stay and hole indicate further cracks.

We were now going under one boiler only.

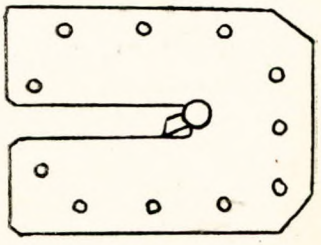
The description of repair made was as follows—

The first part was to get the nut off, and luckily it came off

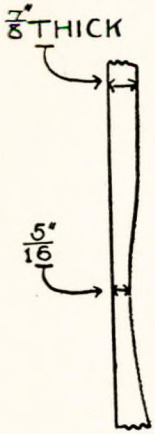
without splitting, as I wanted to keep it ; then the stay was cut flush with the boiler end and patches were made and fitted as shown by the sketches.



SKETCH OF OUTSIDE PATCH.



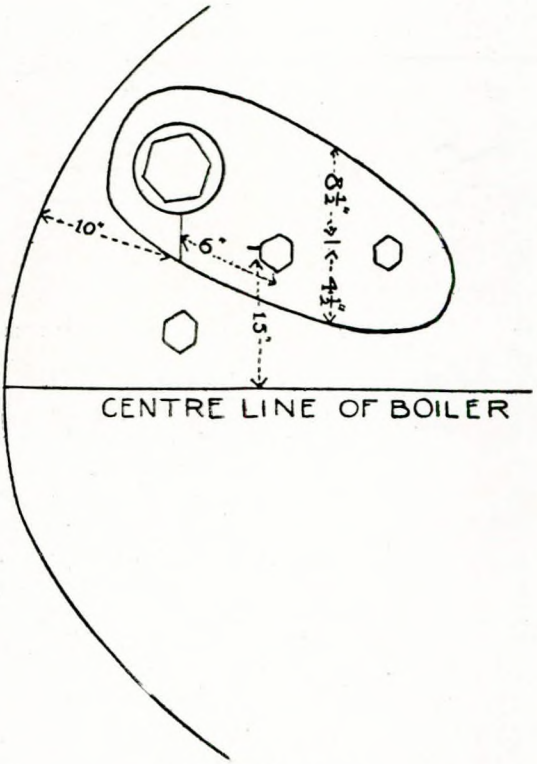
SKETCH OF INSIDE PATCH.



The outside patch was made by one plate $\frac{1}{4}$ inch thick ; the inside by two plates $\frac{1}{8}$ inch thick, making $\frac{1}{4}$ inch thickness each side of boiler plate, secured with 12 $\frac{5}{8}$-inch bolts, also you will notice by another rough sketch that the plate was eaten away, and was only $\frac{5}{16}$ inch thick, by external corrosion. On the water side I used asbestos cloth only for jointing. On the outside, no smooth-on cement being in the ship, I filled the hollow part with manganesite paste, and then jointed it with asbestos cloth, and it held very well, giving no immediate trouble. I may mention that it was leaking a little through the nuts; this was stopped by placing a box shape of wood filled with oatmeal around the patch, the oatmeal taking the water in, and drying quickly helped it to salt up. We went home at reduced pressure (130 lbs). Expansion full out, doing our ordinary speed, and all engineers resting their ordinary hours. While at the home port, it was repaired as per sketch, and proved a very good job.

Two new combustion chamber stays were added owing to the thickness of the patch. The patch was riveted around

the longitudinal stay, as it showed signs of corrosion around the stay, with the nut well screwed on made a very good job of it.



BOILER END PLATE.

These remarks may be of some help to the Junior Section.

W. S. T.

The following members were elected at the meeting of Council held on Thursday, March 3rd, 1910 :—

As Members.

Robert Haxton, Deptford, S.E.
O. K. Shahbasian, Constantinople.
Frederick W. Smith, Singapore.
Luigi Stalio, Venice.

As a Graduate.

Oliver Bertram, Ilford.