DISCUSSION

58 ROMFORD ROAD, STRATFORD,

ON

MONDAY, FEBRUARY 27th, 1899.

CHAIRMAN:

MR. A. BOYLE (MEMBER).

MR. J. G. HAWTHORN (Member of Council): I remember, in my own experience, being on a steamer where a good deal of trouble was experienced with the ship's winches. At first the trouble was attributed to the donkey boiler not being sufficient for its work. We had two winches forward to serve the forehatch, two under the bridge and two aft. The donkey boiler to work these winches was 10 ft. 6 in. high by 7 ft. 6 in. in diameter, and we carried in that boiler 60 lb. of steam. But in discharging cargo, when the winches at the two after hatches were in use, we could not get the forward winches to work. I was one of the junior engineers in the ship, and the chief engineer suggested to me that after cargo work was stopped for the day we should see if we could not work those winches, as he expressed it, expansively. That night, therefore, we disconnected the steam connections to the different winches, and fitted in blank flanges with holes the sizes of which varied, the largest opening being to the forward winches, and the smallest opening to the winches nearest the donkey boiler. Next morning, when the stevedore's men came on board, every one of the winches worked admirably. When we saw the result we naturally considered why, before the alteration, the after winches should run away with all the steam, and concluded that a great deal of steam had been lost in doing useless work in the winches. As chief engineer of a steamer it has been my duty to keep down the coal bill as much as possible, and I know something of the methods of stevedores' men

which explains a great deal of the waste that takes place. We want a technical sympathy between the people who discharge the ship and those who have to look after the plant. The way in which the winches are sent off at full speed is very objectionable, and the man who is left to look after it seldom knows where the water is in the donkey boiler. The wonder is that more accidents do not occur. The kind of water used for the donkey boiler is too often not considered. I remember one occasion at Nice when the donkey-man said that he could not get the salinometer into the pot. We were working out the lower part of the cargo, which was coal, and we were discharging in the middle of the harbour. Owing to certain works that were going on ashore, there was quite a stream of chalky water setting in the direction of the vessel, and we were pumping that into the donkey boiler. The most remarkable thing, however, was that when we opened the boiler most of the scale which had been there was gone, but the boiler contained a large quantity of chalky sludge. I think that to a certain extent Mr. Nicholl is very correct in some of his remarks as to the want of attention from which donkey boilers and deck machinery suffer at the hands of those who ought to be better informed.

Mr. JAMES ADAMSON (Hon. Secretary): There are one or two thoughts that struck me when I was reading the paper. I thought Mr. Nicholl was rather in error in supposing that no special attention had hitherto been paid to improve cargo appliances on steamships, and that winch steam pipes are seldom or never covered with non-conducting material.

Mr. HAWTHORN: The author refers to the ordinary cargo steamer where the winch pipes are very seldom covered.

Mr. JAMES ADAMSON: That is unquestionably a mistake. Again, we have urged here for years that auxiliary condensers should be provided in the engine

room in order to utilise the exhaust steam from all auxiliary machinery for the boiler feed in place of the barbarous exhaust tank. Another cause of waste is that steam is never shut off, whether the winch is lifting or lowering, and is used whether it is required or not. This is against economy. In view of the discussion upon this paper I wrote to one of our members, Mr. A. B. Brown, of Edinburgh, who has sent me the following communication on the subject:

Mr. A. B. BROWN (Member): I received your letter enclosing proof of a paper by Mr. Edward Nicholl on steam winches, which I have read with considerable interest.

I made in 1890 some very elaborate experiments with a good steam winch having 6-in. cyl. × 11-in. stroke. The consumption of steam in both cases was ascertained by weighing the water from the surface condenser, and the weights given in the accompanying table include also the condensation of an unprotected line of steam pipe 200 ft. long.

There is no doubt whatever that the practice of fitting auxiliary steam gear outside the engine room of any steamer is a barbarous one, and sooner or later when shipowners wake up to their own interests it will be abandoned. There is no question whatever in my opinion what will eventually take the place of steam. That will be hydraulic machinery, which in every respect shows a large balance of advantages over electric gear. To begin with, a very economical compound or triple-expansion pumping engine can be located in the engine-room, and this also applies in the case of electrical distribution of power. From this point, however, the hydraulic and electrical systems differ greatly. In the hydraulic system the water pressure being high (viz., 1,000 lb. per sq. in.) all the lifting appliances take the form of direct-acting hydraulic rams moving at a speed of one-sixth part that of the cargo being lifted. This, to begin

with, is an enormous advantage, and conduces to great durability of the working parts.

In like manner the working of capstans and windlasses can be effected by hydraulic engines of large power occupying small space and working at a slow speed.

The steering gear in the hydraulic system is of the very simplest description, and throughout the entire system, with the exception of a worm and wormwheel in the windlass, there is not a cog-wheel, brake, or clutch.

Taking the electric system and beginning at the compound or triple-expansion steam engine, a large slow-running dynamo must be provided, the expense of which to begin with is much greater than the pumps connected with the hydraulic engine. From this dynamo the current is carried to the various machines on deck, and now the principal defect of the electrical system is encountered. The electric motors, to fulfil the conditions of efficiency and economy, must run at a high speed not less than 1,000 revolutions per minute. With such a high-speed motor the complication of gearing necessary to reduce its armature speed to that of the lifting rope discharging cargo (which works at about 2 ft. to 3 ft. per second) is much greater than that of the ordinary steam winch, if toothed gearing is used. It has been proposed, however, by electricians to effect this by a worm and wormwheel. The fatal objection to this arrangement is the low efficiency of such an arrangement in consequence of the enormous friction in the worm which acts on the teeth of the wormwheel.

With an accurately-machined wormwheel, and a perfectly-formed curved worm, the best result that can be got under conditions of copious lubrication is 30 per cent. efficiency—70 per cent. being lost in friction. On the other hand, with well made machine-cut spur gearing, and a quiet-running dynamo, the

efficiency would be 50 per cent., the other 50 per cent. being taken up by the friction of the gearing and the various bearings of the shaft. It may be stated that this allowance for friction is too great, and I know that higher results can be got in testing an electric motor when new and in fine order and the train of gearing in similar condition with all the lubrication carefully attended to ; but it will be found under ordinary sea-going conditions that not more than 50 per cent. can be relied on. This being so with the electric winch, the same holds good in the application of electric motors to other purposes on board ship. There is one point, however, about electrical distribution which shows to a great advantage over the hydraulic, and that is that the system is not affected by very low temperature, which would freeze up the hydraulic system unless the fluid is sufficiently charged with glycerine to prevent this happening. On the other hand, the immunity of the hydraulic machinery from derangement with heavy seas breaking over it stands out in marked contrast to the fatal consequences of salt or other water getting at any parts of the electrical machinery. Electricians will say that there is no difficulty whatever in hermetically sealing all the electrical parts, and that is quite true ; but as access has to be provided for lubricating the bearings and adjusting the brushes of the electric motors the water-tightness depends on the care taken to secure the doors provided for such access, and this is exactly what seems to be an impossibility on the deck of any steamer. As a matter of fact, in my experience of the last twenty years, it is out of the question to expect the deck hands of a ship to effect the simple operation of cleaning the hydraulic rams of the various lifts and oiling them to protect them against rust. So impossible has this become that my practice for the last fifteen years has been to electro-deposit a substantial covering of copper on all these working parts so that they require no attention whatever. It would no doubt be said by electricians that the deck hands of a steamer must be taught to treat electric machinery

with special care, but this seems to be quite out of the question to expect, as the captain and chief engineer with their officers nowadays have their hands already too full in the modern steamer to have any further burdens laid upon them, and so the auxiliary machinery on deck which requires the least or if possible no attention whatever is the machinery for them, apart from its economic efficiency or first cost. To sum up on this point, the three systems—steam winches, hydraulic lifts and electric winches—might be put as follows: *Steam Winches* have the advantage of being extremely cheap in the matter of initial cost, but in their cost of upkeep and consumption of steam, not to mention the discomfort on account of the noise they make, they are simply intolerable, and if a separate account were kept of the foregoing items few shipowners would have anything to do with them. *Hydraulic Gear* is expensive in initial cost, being almost four times that of steam winches with the copper pipes. This, however, is very soon saved in the almost total absence of repairs and in the great economy of steam, not to mention the comfort of the silent working of the machinery—a true indication of durability. The efficiency of this system is extremely high, due to the total absence of gearing, shafting, etc. *The Electric System* has very much the disadvantage of the hydraulic system in initial cost; indeed, if I am correctly informed, it is higher than the hydraulic system under similar circumstances. Its efficiency is also lower than the hydraulic system in consequence of the large amount of gearing involved, and the skilled attention necessary to keep it in good order has up to the present deterred many shipowners from adopting it. The North German Lloyd, who are the most enterprising company in the world in the way of adopting new methods of an experimental nature, in 1896 fitted three of their ships—ss. *Preussen*, *Sachsen* and *Bayerm*—with a complete hydraulic system, and these ships are still running and doing good work, although there have been a good many mishaps on account of

the hydraulic mains freezing up, due no doubt to a want of sufficient attention in charging up the system with non-freezing fluid at the proper time. This, the only defect they have experienced, led them to make a departure in two of their recent ships, which they fitted throughout with electric gear. This completely obviated any trouble in very low temperatures, but a sufficient number of other disadvantages disclosed themselves to induce the company to return again to hydraulics, the last ship ordered by them in Germany being now fitted with hydraulics by my firm. In the recent ships we have fitted for the Royal Mail Company this freezing difficulty is completely got over by having two separate tanks, one of which is charged up with the necessary strength of glycerine and water and the other with soap and water. These are connected to the pumping engines by necessary valves, and now it is no trouble whatever for the engineer in charge when coming into a port where there is a chance of very cold weather to turn on the glycerine tank and shut off the water tank, and on leaving port again he reverses the operation. This arrangement effects a very great saving in glycerine, which is somewhat expensive and has the property of leaking through stuffing boxes where pure water would not pass.

Mr. G. HALLIDAY (Member): I have lately gone into the question of auxiliary machinery on board ship, more especially into the motive power for auxiliary machinery on board battleships. The latest experience in these matters is that obtained on board the ships of war of the United States in the war with Spain. The experience gained has been collated, and reports have been issued by the officers. These reports all embodied the idea that most was gained by the use of electric motors. The turrets for the guns were moved by electric motors with entire satisfaction. The officers are also in favour of applying electric motors to all gun-working machinery. There is no danger from burst pipes; it is noiseless, and the space

occupied often less, while an armour-clad motor would resist the effects of splinters efficiently. I have a very strong prejudice in favour of electricity as the motive power for auxiliary machinery.

Mr. MAWSON: With regard to the communication from Mr. Brown that has just been read I may state that I came home from Hong-Kong as passenger on the *Sachsen*, and I made the acquaintance of the chief engineer. I saw this plant at work at Colombo, Aden and Genoa, and I made a point of seeing it got ready for work and started. It struck me at the time that it was a very practical sort of machinery, and they simply had no trouble whatever with it. The water went from the pipes to the lift, and there was no mishap, great or small, that I saw throughout the voyage. Both the *Paris* and the *New York* were fitted with Brown's gear and I have not heard that they have had any trouble whatever with it. I have had no experience with electric motors, but almost anything, I should think, is better than the ordinary steam winch of to-day. Certainly the present winches do use the steam. In some of the latest ships built by Harland and Wolff, of Belfast, they have a separate condenser for the auxiliary machinery, and there is no donkey boiler in those steamers.

Mr. W. MCLAREN (Member): I am very much in favour of electrically-driven winches. The only difficulty that I see is in the starting power of the motors. That is where the great difficulty is at the present time. With regard to hydraulic gear I must certainly speak very highly of it, and there is no difficulty in getting men to work it. But Brown's gear is expensive. The first cost is heavy. If the initial cost were to be reduced this gear would no doubt have a better chance in the market, and would, I think, become very popular.

The discussion on the paper was then adjourned until Monday, March 13th, 1899.

On the motion of Mr. McLAREN, seconded by Mr. HALLIDAY, a hearty vote of thanks to the author of the paper was unanimously agreed to, and a similar compliment to the Chairman for presiding concluded the meeting.

DISCUSSION CONTINUED

ON

MONDAY, MARCH 13th, 1899.

CHAIRMAN:

MR. A. BOYLE (MEMBER).

THE CHAIRMAN: We have to-night to resume the discussion upon the paper read on a former occasion on "Auxiliary Machinery on Board Ship." Looking over the paper I might say that it appears to me to divide itself under four heads: Firstly, the advantages and disadvantages of all the various forms of steam winches, especially as regards the enormous consumption of steam and water; secondly, the alternative plan of hydraulic gear, in regard to which a most interesting letter from Mr. Brown was read at our last meeting; thirdly, we had the very attractive proposal of having electric motors on board ship, which the author appears to favour; and fourthly, we have the plan of a shaft running continuously fore-and-aft, which by means of friction or other gear can be made to transmit power to the winch barrels. I am sure there are some present who can give us information or the results of their experience in regard to some or all of these methods. The Hon. Secretary has received a communication on the subject; after it is read we shall then be very glad to hear the views of any gentlemen present, for the paper deals with a matter

upon which a good deal may be said and as to which a variety of opinions may be held.

The HON. SECRETARY: The following is a further communication from Mr. A. B. Brown (Vice-President), on the subject of hydraulics:

"I enclose the results of the experiments on the steam winch *versus* steam derrick, which were omitted to be sent to you. There is just one error in the letter, viz., that the cost of the hydraulic gear is not four times that of steam winches and copper pipes, but about three times that of the cheapest winches and twice that of first-class winches. The mistake arose through my taking into account the steering gear, capstan, and windlass.

The following comparative tests for consumption of steam have been made with the ordinary ship's steam winch (cylinders 6 in. × 11 in. stroke) and combined steam and hydraulic derrick, both working at the end of a line of steam pipes 200 ft. long, having exhaust carried back to surface condenser, and raising one ton through 27 ft. twice in one minute. The results show a saving of 25 per cent. in favour of the derrick.

		WINCH. lb.	DERRICK. lb.
1st trial of 30 lifts ...	Condensed Water	329	263
2nd " " ...	"	315	250
3rd " " ...	"	337	219
	Total ...	981	732
Mean consumption per lift		10·9 lb.	8·13 lb."

Mr. BASIL JOY: I am very glad that the discussion on this paper was deferred from our last meeting until to-night, because in the interval I have taken the opportunity of communicating with Messrs. Clarke, Chapman & Co., who are probably the largest makers of steam winches in the world, and I have been able to obtain certain information from them on the subject. I had wished and I had intended to take

some indicator cards of my own, but owing to the pressure of other matters I have not been able to do so. First of all I think it rather a pity that the author should have called his paper "Auxiliary Machinery on Board Ship," because it rather puts one on the wrong tack. It should have been "Winches and Donkey Boilers." I think we shall all be very grateful to Mr. Nicholl for having brought this subject before us, because, so far as I am aware, it is one that has not previously been dealt with; but I do not think he has laid before us any actual facts, as regards experiments for instance, that are of any very great value. On page 43, after referring to certain tests which, he says, show a very extraordinary state of things, he admits it may be asked "why no greater weight was tried on these winches," and he replies to this by saying "experiments could not well be tried when the ships were loading or discharging cargoes; again, the time at my disposal was limited." One would almost have preferred that he should have kept the matter back until he had had an opportunity of going into the matter thoroughly. For example, one of the tests recorded in the paper was made with what is usually known as a 7-ton winch, but having regard to the very light load employed for the tests the results are practically valueless. An engine of this character cannot be working at its best economy with such a very light load. Then as to the consumption, I am afraid that I have not been able to get any very reliable data to lay before the Institute, but Messrs. Clarke, Chapman & Co. tell me that if shipowners will only tell them they want economical winches, there will be no difficulty in putting them in the ships. As a rule they want cheap winches (first cost), and they get them. Probably the best thing that can be done under the circumstances is to do as Messrs. Clarke, Chapman & Co. are doing, and that is, put a good governor on the stop valve which can be set to a given number of revolutions, so that no matter what happens you cannot get more than that number

of revolutions. With regard to electric winches we tried them some time ago, and on the question of cost they are much more expensive than steam winches; but the great objection we found was that when the salt water got to them it spoilt them or put them out of order, and we could not keep it out. There is also a difficulty in using them for warping purposes, as it is impossible to know what strain you have got on the barrel. With regard to the plan of having a continuous shaft running fore-and-aft along the deck, I believe the system was tried on two ships, but so far as I know they were the only ships on which it was tried. The experiment was never repeated. Probably it was because if, say, only two winches were required, the whole length of shafting had to be kept revolving. The shaft, therefore, was not using its full power, and this could not conduce to economical working.

Mr. A. H. MATHER (Member): The author starts his paper by saying that this is a subject which has received very little consideration hitherto. It may be that in the past it has received very little consideration, but everything points to the fact that it is now receiving more attention than it has ever had before. If we look at what has been done in the Navy during the last year or so, we find that the question of auxiliary machinery is coming very much to the front. The experiments which have been conducted by the author of the paper seem to have been very well carried out in themselves, but the results are not given in a very clear form. No doubt the author is thoroughly conversant with the results, but reading them in the paper does not give the clear impression that one would like to have, and some of the things we read are rather misleading.

With regard to Test No. 3, the author says: "In this case a very considerable quantity of the water present in the steam was due to priming. I regret not having

made a test of the steam dryness, as this could have been readily done." That is a point upon which I should have been very glad of some further information. I confess I am not aware of any ready method of getting at the dryness of steam. We are given no details as to how the dryness may be arrived at. I do not agree with the author that there is very little hope of improving the present type of steam winch on board ship, and I think that the question of expense has a great deal to do with the class of auxiliary machinery usually fitted. Comparisons have been made between steam winches and other systems of deck machinery, including electrical motors, and in this connection Mr. Joy has touched on the question of first cost. With electrical plant you have to go to a much greater first cost than with steam winches; but if the same amount of money is spent on steam winches and the gear is treated with the same care as you bestow upon electrical plant, I believe you will get much better results with steam winches. I do not hold that the present steam winch is incapable of much improvement. The form of steam winch usually installed on board ship at present is capable of great improvement; cheapness and not economy is the paramount question.

Mr. J. R. RUTHVEN (Member of Council): The ideas I have on this subject are very similar to those just expressed. This paper furnishes shipowners with a grand object lesson on the question of cost and expense. It is not always an economical course to buy cheap goods, and in this matter I think it has been very well proved all round that cheapness is a very expensive luxury. I think with the last speaker that if engineering knowledge was devoted to steam winches, and money and care spent on them, as on other machinery, they would give much better results. All stevedores should now understand the working of steam winches, and it is only fair to these men to try and improve the existing winches as far as possible, and make them more economical. I do not think it would prove

economical in the long run to start educating the stevedores all over the world in the working of an entirely new class of winches. Taking steam winches altogether, I think that if they were improved up to, say, 30 or 40 lb. of water per I.H.P. per hour—and I see no difficulty in doing that—it would answer every purpose. We know the good points and the bad points of steam winches, and we know the good points of some electrical machines, but we do not yet know their bad points. There can be no question in my mind that if the experience and thought and knowledge of engineers were devoted to the improvement of steam winches we would get very much better results than at present. The point about testing the dryness of steam is a most interesting question, and I should very much like to know how Mr. Nicholl proposes to do it, even if it is but a simple method. I remember reading about some experiments that were conducted by the Navy Department in America for testing the dryness of steam, and it was not a simple affair at all. Indeed, it struck me at the time that it was a very elaborate arrangement, and if Mr. Nicholl would point out to us an easier method we should all be very much obliged to him.

Mr. W. McLaren (Member) advocated the use of electrical motors for working auxiliary machinery on board ship, and said there need be no difficulty whatever in housing them and protecting them from injury when not in use.

Mr. C. Noble (Member of Council): I think I must agree with those who hold that electrical motors will be the coming power on board ship for loading and unloading. The other day I saw an electric motor on board a ship that was used for driving a ventilating fan, and I found that the motor was enclosed in a water-tight case. It seems to me that motors for driving electric winches might be protected by being enclosed in water-tight cases in the

same way. I do not believe that the suggested shaft running fore-and-aft alongside the hatchway coamings would show any economy. I once saw a somewhat similar arrangement employed for operating a quadrant attached to the rudder head in connection with steam steering gear. A shaft leading to this quadrant was driven from the engine-room, but it absorbed so much power that the plan was not continued. After two years' trial they had to take the engine out of the engine-room and put it on to the quadrant. For winches I do not believe that this method would answer at all. I do not know whether it is the shipowners who are to blame, but there can be no doubt that the class of winch often put on board ship is very poor indeed—the bearing parts are very small. Another trouble is that the winch pipes are never covered properly, and there is great waste in consequence.

Mr. A. J. NOBLE (Associate Member): It is with great diffidence that I rise to speak with so many experienced men present, but as I have had some experience with hydraulic, steam, and electrically driven machinery, I am convinced that electric motors are the most economical. They have been applied with success on tramways, where the difficulties to be overcome, in regard to wet, dust, and vibration, are greater than would have to be overcome through the action of salt water. I have not had time to obtain any figures on the subject, having received the paper only yesterday evening, but I shall probably be able to obtain some by the next meeting. Electrically driven auxiliaries have several advantages which ought to commend them to shipowners. They can be made water-tight, and are simple in working. They are not apt to get out of order when once put in and looked after by experienced men. They are quicker in working and can be stopped as suddenly as hydraulic machinery; they can also be immediately reversed if necessary with no harm to the machine. Their

greatest advantage, however, is economy in coal consumption, because there is only a loss of ten per cent. in the transmission of power. It is not necessary to confine ourselves in the use of electricity to winches, for it can be applied with success to the circulating pumps, steering gear, capstan and ash hoists, and save a large amount of space. The only instance of the use of motors on board ship which has come directly under my notice was on the ss. *Faraday*, where motors are used for the ash hoists and fans. They came fully up to the requirements, but in the case of the ash hoists were not the most economical, on account of the grooved wheel friction gearing, where a considerable percentage of power was lost. Messrs. Siemens Bros. have at present large orders from the Admiralty for electric winches; the machines for supplying the power being of 6 poles, about 200 ampères at 80 volts, and fitted with carbon bushes. Motor driven pumps are also a considerable item in their business, and by the next meeting I hope to have details of their capacity for work. In the works all the machinery, cranes and portable drills are driven by electricity, and although running night and day stops for repairs are unknown. The loss due to auxiliaries on board ship is considerable, and with careful tests would prove to us that the loss is far larger than is calculated by the average engineer. On one occasion when passing through the Suez Canal we filled up our boilers at Port Said, and before we were half way through it was an inch from the bottom of the glass, due to the waste of water in using the canal light. That case alone proves that there is a very large loss, and it requires rectifying in these days of keen competition.

Mr. KEAY (Member), after criticising some of the data furnished in the paper, which he thought far from clear in many particulars, said: I quite agree with Mr. Joy that the figures are not very useful because the winches were not worked at anything like their

full power, and winches working at the low pressure here indicated must have been working at a very poor economy indeed. In the Navy this question of auxiliary machinery is of much more importance than in the merchant service. Some warships have as many as eighty auxiliary engines, many of which are only worked at their full power for short periods. In ordinary cruising war vessels use about 60 per cent. of their full power, and yet even at that power the coal used for the auxiliary machinery often exceeds the coal used for the main engines. Within the last year or two electrically driven pumps have been used on board ship with very satisfactory results. There is certainly a very wide field for the application of electric motors to auxiliary machinery on shipboard, and I feel confident that within the next few years we shall see great developments in this direction. I know the superintending engineer of a large line running out of London who is already using electric motors for his pumps.

Mr. WATSON (Graduate) asked whether there was not a considerable loss when hydraulic gear was used to lift a light load.

Mr. JAS. GIRVIN (Member): I have not seen this paper until I came into the room this evening, but with regard to the remarks that have been made about deck machinery, for utility and advantage on board ship, I consider that hydraulic gear is superior to any winches that I have ever seen. I have had a good many years' experience with hydraulic gear, and have had very little trouble with it. For the work it has to do it is better than any system of winches I have seen. The last speaker, Mr. Watson, has suggested that there is a great waste when a hydraulic crane is used for lifting a light load, but there is really no difficulty in the matter. The water is throttled as it enters the ram, quite independent of the accumulator. The pressure or power is regulated by the admission of the water into the lifting ram. The pressure is

constant in the accumulator but not in the lifting ram, and the water allowed into the lifting ram is regulated by the power required for the lift. I was in the first ship that was fitted with hydraulic gear, and there were some slight difficulties at first, but after they had been rectified there was no trouble whatever. With regard to the economy of the system, I have known other ships fitted with the same size of boiler for working steam winches, and they were only able to work some of the winches with the steam furnished by that boiler. They were obliged to work the whole set of the winches with steam supplemented from the main boilers. With a similar boiler in the ship fitted with hydraulic gear, there was no difficulty in providing plenty of steam for working all the hoists at the same time. I believe, too, in the matter of economy, that the results are very much in favour of hydraulic gear.

The CHAIRMAN: And the relative cost of upkeep?

Mr. GIRVIN: The cost of upkeep—in the case of good and simple hydraulic gear—is I believe, less than the ordinary expense of keeping steam winches in order.

Mr. WATSON: What I really want to know is, is the cost of lifting a light load the same as that of a heavy load?

Mr. KEAY: The point raised by Mr. Watson is an interesting one, but it is clearly true that with hydraulic gear it costs as much to lift a light load as to lift a heavy load, and for that reason hydraulic gear is sometimes provided with two supplies of water—one under high pressure and one under low pressure—and the low pressure is used unless the high pressure is required. In that way—by applying the two pressures as required—a real economy is effected.

Mr. HALLIDAY: Is there any experimental evidence of the saving by the smaller pressure being used?

Mr. KEAY: I do not know that I can bring forward any experimental evidence.

Mr. HALLIDAY: I do not say that it is not true, but I do not see it.

The CHAIRMAN: It is a great pity that the author did not give us the successive steps by which he arrived at his results. Altogether I do not think the paper is quite so satisfactory as it might be. However, we have had a very useful and interesting discussion so far, and I do not think it can be said that the subject has been exhausted.

Mr. RUTHVEN proposed that the discussion on the paper be adjourned until another evening.

Mr. C. NOBLE seconded the motion, which was put and carried.

DISCUSSION CONTINUED

ON

MONDAY, APRIL 24th, 1899.

CHAIRMAN:

MR. A. BOYLE (CHAIRMAN OF COUNCIL).

THE CHAIRMAN: A good deal has been said both here and at Cardiff upon many interesting points raised by this paper, and some exception has been taken to the results—in a sense the amazing results—given by the author as deduced from his experiments. I do not know, however, that it is necessary to labour that point, because we all know that widely different results could be obtained from different steam winches on different ships, and even from the same winches on the same ship worked under different conditions.

Perhaps it would have been as well if Mr. Nicholl had shown more fully the steps by which he arrived at his results. It is easy to say how much water has passed from a boiler, but it is not so easy to say how much of that water left the boiler in the form of steam, and how much as water. Trials of this character, to be satisfactory, should extend over a sufficiently long period to enable you to note the amount of coal consumed and other points which would give something more trustworthy to work upon. But, as I have said, it is not necessary to labour that point, and there are many other points in the paper which seem to call for remarks.

Mr. A. J. NOBLE (Associate) writes as follows: I am sorry that I am unable to attend the adjourned discussion owing to pressure of business. I have taken a keen interest in the subject of electric motors, owing to its importance to the marine engineer, and through the kindness of Messrs. Crompton & Co. I have been able to obtain a few figures relating to the cost of motors, which could be fitted to gearing already in use on board ship. Motors for winches of 8-brake H.P. can be supplied for £89 per winch; for ashhoists of 2-brake H.P. at £31; for steering gear; for steering gear and windlass of 12-brake H.P. £111 each; for centrifugal pumps of 8-brake H.P. £89 each. These prices include starting switches, resistances, wiring and connections.

The cost of generating plant with an output of 50 to 51 kilowatts would be £260, and leave an ample margin for light installation. This will not include the cost of engine and boiler, which should be about 74 H.P.; but allowing 2½ lb. per I.H.P. the consumption is 37 cwt., or, allowing for loss by radiation in steam pipes, would be about 2 tons per 24 hours, and would run the six winches, centrifugal pump, general service pump and lights at the same time.

Of course it is understood that the smaller the motors the greater is the percentage of loss in the

transmission of power. The subjoined are the results of a test of a 7/7 (7 in. diameter of armature and 7 in. magnets) ironclad motor of 2-brake H.P. at 100 volts and 750 revolutions per minute, coupled direct to a 4-in. centrifugal pump:

Speed.	Volts.	B.H.P.	Efficiency.	
717 rev.	99	1·97	60%	Brake test.

1*st Test.*—Mean head of water 12 ft., lifting 3 ft. and forcing 9 ft.:

Volts. 115; amp. 22·5; galls. per min. 256.

2*nd Test.*—Mean head 10 ft., lifting 3 ft., and forcing 7 ft.:

Volts. 112; amp. 22·25; galls. per min. 298.
„ 117 „ 22·5 „ „ 320.

3*rd Test.*—Mean head 12 ft., lifting 3 ft., and forcing 9 ft.:

Volts. 115; amp. 22·25; galls. per min. 309.

4*th Test.*—Mean head 13 ft., lifting 10 ft., and forcing 3 ft.:

Volts. 117; amp. 22·5; galls. per min. 287·5.
„ 117 „ 24 „ „ 320.
„ 118 „ 22·5 „ „ 310.

Mr. G. HALLIDAY (Member): I was not here when this paper was read, but with reference to the allusions by the author to the use of electric motors on board ship, it would be very interesting and instructive if we could ascertain, even roughly, the cost of working by electric motors as compared with other methods. It appears to me that electricity ought to be very economical, considering that electric motors and dynamos have such a very high efficiency. If I remember correctly, the combined efficiency of electric dynamos and motors is said to come out at about 91 per cent., while some of the steam winches referred to in the paper were said to give an efficiency of only 10 or 15 per cent. It appears from these figures that electric winches come a long way before the others;

but in using electricity there is also the cost of the attachments to be considered. With regard to hydraulic winches I cannot say much, but according to some of the statements that have been placed before us the efficiency of hydraulic gear is very high indeed. The difficulty in discussing this paper is that we have not sufficient data before us, showing the relative efficiency of the different systems referred to—steam, hydraulic, and electrical. The paper does not give us anything reliable to go upon, and I think we might ask the author if, in the course of his reply, he cannot place before us in tabulated form the efficiency of the different arrangements that have come under his notice. We want to get the average efficiency of the steam winch, the average efficiency of the hydraulic winch, and the average efficiency of the electric winch ; and I think we may look for some further information on these points from the author of the paper.

The CHAIRMAN : The efficiency of a steam winch varies very much, and, in addition to that, the considerations of first cost and cost of upkeep come in. The percentage of efficiency in working alone would only give you one side of the question, so to speak.

Mr. HALLIDAY : That very point was raised in a discussion on this subject at the Institution of Naval Architects. Lieutenant Herton, of the United States navy, took part in the discussion, and the question of the use of electric motors for working the gun turrets and other machinery was brought before the meeting. He was asked how these electrical appliances worked, and why the naval architects in the United States had resolved to do away with electricity on warships for these purposes. The answer was that the wires were all over the ship and that if anything went wrong during an action you would have to send men all over the place to find out the fault, so that the action might be all over and the battle settled before the place and cause of the breakdown had been ascertained. On the other hand, if anything goes wrong with steam

pipes there is generally some indication, by steam blowing off in the wrong place for instance, which enables you to tell at once where the failure is. At the same time Sir William White gave his opinion virtually in favour of the electrical arrangements.

Mr. BASIL JOY (Associate Member) : The great objections to electrical winches on board ship are that you cannot use them for warping and they are so liable to be damaged by salt water. One further point I may mention in regard to hydraulic winches is that they are not only economical but noiseless, and especially on board passenger ships calling at different ports, when loading or unloading is often carried on at night time, a noiseless cargo gear is a great advantage. I believe that the original introduction of hydraulic gear for this purpose was due to the difficulty in discharging a cargo of horses. The steam winches made such a great noise that they could not get the horses ashore.

Mr. W. LAWRIE (Member) : I think that this paper will have served a good purpose if it has only directed our attention to the different points referred to, but I am afraid that I cannot agree with the author when he says that "every suggested improvement would seem to have been tried or approved on board ship, with the exception of winches and the poor much-abused donkey boiler." The steam winch of to-day is a very different machine from that generally used when I first went to sea, and there can be no doubt that in the class of steam winch used there has been a distinct improvement. It may be said : "Yes, you have improved the design of the winch and made the working parts more secure and more accessible, but still the machine itself is simply the winch of the old days." I think the author himself gives a very good reason why we have not moved in this direction in a hurry. Towards the end of the paper he says : "The winches themselves are most abused machines. After being practically under water for days, sometimes weeks, withou

being oiled or receiving the slightest attention, steam is put on and the rusty rods commence tearing packing and all else to pieces." How would electric winches work under such conditions? I will not go to the extent of endorsing all the statements of the author, but that steam winches on board ship are very much neglected machines there can be no question. Then again the deck of a steamer is not an ideal place for an elaborate or delicate machine, and judging from my own experience of the use of electricity for lighting on board ship I am afraid that electric machinery would prove more troublesome than you dream of. If you consider the various duties that a steam winch is called upon to perform, I think you will find it very hard to get another machine that will do the same work. It is not only used to load and unload vessels, but is also a very important auxiliary in docking and undocking, and is just as useful for moving a ship about in harbour. I was in a ship once when the officers grumbled and made it a grievance that the winches could not be made to haul the vessel over six inches of mud. It must be remembered also that steam winches are now worked by unskilled labour, and if you introduce fine machines you must provide a higher class of labour for driving them. It would not be very hard to design a steam winch that would do the work of the present steam winches, and yet not be such a coal-eating machine. But in providing a very fine machine, first of all the first cost is increased, and the next thing is that you must have skilled labour to look after it. If you tell a shipowner that you propose providing a new steam winch which will save a ton of coal but that you will have to call upon him for another 22s. 6d. per week for labour, he will probably reply that he does not want the new winch. Then again the efficiency of a steam winch may be greatly affected by the manner in which it is worked. A steam winch in my opinion ought never to be reversed. It ought to go ahead all the time, and if that course were followed and the

machine taken care of the steam winch would be found a much more economical machine than it is now. I do not wish you to understand that I am arguing against improvement. I am only reminding you of the conditions under which steam winches have to do their work on board ship; and if we can get electric winches to do that work equally well, and at the same or a less cost, then I have no doubt that electric winches will become universal. The author gives us some very elaborate figures as to the cost of using electric machines, and this information, it is well to bear in mind, comes from a port where they cannot afford to cover the winch steam pipes. Hydraulic gear gives plenty of trouble, and the slightest leak at the valve may upset the whole. With steam winches there may be a very considerable leakage, but so long as the man in charge can see his way about the machine will somehow go round.

Mr. F. COOPER (Member): I should think that the objections to electric winches on the ground of cost would come under the same category as the objections to the electric light. Until people commenced to use the electric light the cost was high, but the more it is used the more the cost is brought down. And so, I suppose, it will be with electric winches. I believe that at Brighton, owing to the number of people using the electric light, they can now get the light in their houses at about half the cost at which it can be obtained in any part of London. Until you have given electrical engineers an opportunity of showing what electrical engines can do on board ship it is hardly fair to criticise them.

Mr. W. LAWRIE: Do the electrical engineers say that they can put an electric motor for winch work on a ship's deck that will stand the weather? This question was put to an electrical engineer, and his reply was that he would not like to say so. If these motors want as much care and attention as are required by the motors in the cars in South London, I

am afraid they would not be likely to get it on board ship.

Mr. BASIL JOY: The objection to a continuous shaft for driving the winches on a ship's deck is that you must have an engine of sufficient power to work the whole of the six or eight winches connected to the shaft. But if you want to work, say, only two winches, you still have to work this great engine which is not working at anything like its full power, and therefore is not working economically.

Mr. JAMES ADAMSON (Hon. Secretary): There are one or two points that ought to be stated as the result of our consideration of this paper. In the first place there is the question of the coal consumption for auxiliary machinery, which is always a moot point on board ship. Engineers are frequently accused of increasing the quantity of coal said to be consumed for the auxiliary machinery in order to reduce their consumption per indicated horse-power. No doubt this is not done in the best regulated vessels, but it appears to be done considerably within the sphere of Mr. Nicholl's observations. It would be an excellent thing if we could have some basis for ascertaining the actual consumption for the auxiliary engines on board ship, as at present there is an enormous variation, according to the elasticity of the views of the chief engineers, and it is very hard to determine how much coal is used. It has been remarked that the title of this paper—"Auxiliary Machinery on Board Ship"—is a misnomer, inasmuch as it only deals with steam winches and donkey boilers, and I think there is plenty of room for another paper on auxiliary machinery. The question of compound winches has not been touched upon in this discussion. I believe that several compound winches have been tried, and it would be very interesting if we could get the names of the steamers on which they were fitted, and the results. I think we ought to emphasise the necessity for covering all winch steam pipes with some non-

conducting material. I was astonished to learn that there were so many steamers going to sea with bare steam pipes, so much so that it seems to be the rule with cargo steamers. What is the best composition to use for covering winch steam pipes, and what is the economy by so covering them, are questions not only of interest but of importance. The fitting of the auxiliary condenser is another point we ought to emphasise. The barbarous exhaust tank ought certainly to have been done away in modern steamers by this time. It is a source of trouble, and there is very little gained by its use. An auxiliary condenser ought to be fitted in every engine room. I consider hydraulic gear infinitely preferable to steam winches for a passenger ship, for the reasons already mentioned by Mr. Joy. Of course the great trouble is in winter, to provide against frost, and no doubt those connected with, or responsible for, the working of hydraulic machines in the winter months do not sleep all their hours at night. The hydraulic machines originally fitted gave very little trouble, and were most successful. The gear was, perhaps, more simple than it is now, and probably for that reason it worked well. With reference to electricity, Mr. McLaren has already laid us under obligation to him in regard to his paper on steam pipes, and it seems to me from what has been said in this discussion that he is going to place us under yet another obligation by giving us a paper on electric motors for cargo gear. I do not know that Mr. Brown, in his communication read at a previous meeting, gave us the efficiency quite in the way desired by Mr. Halliday, but he told us that the first cost of hydraulic gear was three times the cost of cheap steam winches and twice that of good steam winches, and that in working the hydraulic gear showed a gain of 25 per cent. over steam winches in economy. I think we are all at one with Mr. Nicholl as to the insufficient attention given to deck machinery as a rule, and it is a great pity, for the sake of economy, that the services of a properly qualified

winchman, which used to be the rule, have in most steamers been dispensed with, for his wages were, I think, more than recouped by the saving which his services effected, as no doubt the remarks made in the course of the discussion on this subject are justified.

The CHAIRMAN: If no other gentleman desires to offer any remarks I think we may now close this discussion, and I believe it is customary for the Chairman at this stage to sum up the discussion, but as a matter of fact I have very little to add to what has already been said. In the first place there is our old friend the steam winch, which, we are all agreed, is very wasteful, noisy and troublesome. It takes a great amount of oil, and on account of its age we cannot expect much improvement in its general behaviour, but I believe that one of the great causes of this trouble and waste is the insufficiency of the boiler for the work it has to do. If the boiler was sufficiently large for the work required a great deal of this trouble and waste would disappear. Hydraulic gear has been most favourably spoken of by those who have had experience with it, as being both economical and in every way serviceable. The fact is that why so little attention has been paid to the economy of cargo machinery is that, when even by keeping everything in first-class order economy is obtained, it is not so readily brought to the notice of the shipowner as economy with the main engines. Electric motors, in spite of the disadvantages that have been spoken of, will possibly prove successful in the future when properly tried, but there is one great drawback attending the fitting of a higher type of machine for working cargo, and that is the quality of the driver. As a rule, the higher the type of the machine the more the efficiency of that machine is likely to suffer from the incompetence and ignorance, and perhaps the absolute indifference, of the driver. I am sure the author deserves our best thanks for having brought this paper before us, and it will, I believe, have the

effect of causing more attention to be paid to cargo gear on board ship than has generally been the case in the past.

Mr. BASIL JOY thought the subject of auxiliary machinery on board ship far too large for treatment in one paper, and he suggested a series of papers for next session dealing with different branches of the subject.

The CHAIRMAN: I think that a very admirable suggestion, and it will no doubt be considered.

A vote of thanks to the Chairman concluded the meeting.