PREFACE.

BRISTOL CHANNEL CENTRE,
35 STACEY ROAD, CARDIFF.
February 15th, 1899.

THERE was a large attendance this evening at the rooms of the South Wales Institute of Engineers, Park Place, Cardiff, of members of the Bristol Channel Centre of the Institute of Marine Engineers, in view of the renewed debate on Mr. Edward Nicholl's paper dealing with auxiliary machinery on board cargo boats. Mr. T. W. Wailes (Vice-President Bristol Channel Centre) was in the Chair.

Preceding the adjourned discussion, the meeting made nominations for the Bristol Channel Centre annual election of office-bearers and committee.

The CHAIRMAN said a deputation representing the Committee had waited upon Sir John Gunn and asked him to consent to be nominated for the presidency of the Centre. In the course of a very pleasant interview, Sir John stated his readiness to comply with the request. It was impossible to find a better man for the position, and he had great pleasure in moving that they nominate Sir John Gunn to the position of President of the Centre for the forthcoming year. Mr. M. W. AISBITT seconded the proposition, which found support from Messrs. D. GIBSON, J. F. WALLIKER, T. A. REED, A. S. JACKSON and J. CHELLEW, and was unanimously carried.

On the motion of Mr. T. A. REED, seconded by Mr. AISBITT, it was resolved to increase the committee from six to eight members, in addition to office-bearers, making fifteen in all. Nominations for the election were then continued as follows: Messrs. Gibson, Wailes, Aisbitt, T. A. Reed, A. E. Smithson, Geo. Sloggett, J. Boddy, J. Chellew, J. Fleming, W. Scott, J. F. Walliker, R. Williamson, Geo. Rutherford, W. Simpson, E. Nicholl, D. Lowden (Barry), H. G. Symonds, Evan Jones, Geo. Walliker (Barry), and N. Appelbee.

The meeting then entered upon the further consideration of Mr. E. Nicholl's paper on the above-named subject.

GEO. SLOGGETT,
Hon. Local Secretary.

CONTINUED DISCUSSION

AT

PARK PLACE, CARDIFF,

ON

WEDNESDAY, FEBRUARY 15th, 1899.

CHAIRMAN:

MR. T. W. WAILES (VICE-PRESIDENT).

PRIOR to the discussion being resumed Mr. E. Nicholl answered criticisms which were passed upon his paper at the last meeting. He said: I am very pleased at the amount of interest the paper has aroused, and I will take the President's (Professor A. C. Elliott) kindly criticism first, and especially seeing that his experiments with the "Worthington" pump were quite in keeping with the results I have given in the paper. I would like to point out, however, that the consumption of steam given by me is in every case in pounds per I.H.P., whereas the President states that in his case the consumption was 278 pounds per pump horse-power, which I take would be equivalent to brake horse-power in a winch. Although I do not expect or suppose that the mechanical efficiency would be anything like as low in the pump as with a winch, I have no doubt his figures would more nearly approximate mine if taken on the same basis. Another point I should like to draw your attention to, viz., the mechanical efficiency of the electric winch is taken at 35 per cent. by our

President, the same as given by me for the steam winch. But I have already stated this is very low, and I don't think we should have much difficulty in getting a motor winch to give double that efficiency.

Mr. Reed tells us that he designed winches, condensing arrangements, etc., with lagged steam-pipes *nineteen years ago*. I do not doubt that for a moment, but I regret that after telling us that he had got out this arrangement, after a degree of efficiency was shown, he went no further. In the first remark he verified my statement, after making a sweeping assertion that he disagreed with all my experiments and figures. I have already stated in my paper that the careful covering, etc., of pipes *is done* in first-class ships, but I am dealing with what we find in cargo steamers. There, I have said, lagging pipes are the exception and not the rule. Again, Mr. Reed says he cannot understand why I only got 10 lb. at the winch when running. Surely he must be aware that the effective pressure on the piston depends upon the load upon the winch. Of course, we all know that if I were to load the winch until it would barely move around, then we should get nearer the boiler pressure; but I think I have already shown that my winch was loaded as near as possible to what it would be when discharging a coal cargo, and those I maintain are the conditions we have to consider. Now comes the interesting part with reference to the 28 horse-power given by Mr. Reed. There is an old saying that you can prove anything by figures—Mr. Reed is under that impression—but we want facts and to know what exists. We hold these meetings with a view to improvements, and we must argue the advantages and disadvantages accordingly.

I find that by the manipulation of a few simple figures, and a mean pressure of 70 lb. per square inch, with the winch running 140 revolutions, we might get this horse-power:

$$\frac{6^2 \times \cdot 7854 \times \overset{\text{stroke}}{10} \times 2 \times 140 \times P \times 2}{12 \times 33000} = 28 \text{ H.P.}$$

Therefore P mean pressure

$$\frac{28 \times 12 \times 33000}{6^2 \times \cdot 7854 \times 10 \times 2 \times 140 \times 2} = 70 \text{ lb.}$$

How impossible it is to get a mean pressure of 70 lb. on a winch you all know, and surely Mr. Reed will admit that he is a long way off in such a deduction. I would also refer to the amount of consideration winches get, which Mr. Reed took exception to, and I maintain that my statement about the ill-usage is absolutely correct. I would ask him if he ever discharged cargoes of iron ore at Baltimore, Philadelphia, or coal at Port Said with Arabs driving winches, and many other places where their treatment has made the ship's engineers, who took an interest in their work, feel heart-sick after bestowing very much attention to them on the passage; they are abused, and in every cargo steamer it is a standing trouble between deck officers and engineers, *re* their oiling and treatment. I could say much more, but what I would say is well known to every engineer with ordinary sea experience.

Mr. Reed also touched on compound winches. I must admit at once that I never saw a compound winch. Some were made, I believe, by Messrs. Palmer about fifteen or twenty years ago, but they could not have been a very marked success, or I think we should have heard more about them. I merely mention this, as we expect Mr. Reed to verify his statement, and show us how to get the enormous power he stated he could get out of a winch 6 in. by 10 in., with an ordinary donkey boiler.

Then he tells me the steam pipes are too small. I have no doubt he will be surprised to know that there are winches of this size running, and doing their work well, with a flange fitted next to the winch with only a $\frac{3}{4}$ in. or 1 in. hole, which admitted steam to the cylinders. This is an old plan with many engineers to prevent the forward and after winches taking the steam too quickly from the Nos. 2 and 3, and with this

arrangement the winch worked well at a good even pressure, and far more satisfactorily than before.

From information in my possession from a very large firm of winch makers, they say a winch 6 in. by 10 in. is designed to lift a weight of about three tons (rather less than more), and 7 in. by 12 in. about four tons. There is a big difference between this and 28 horse-power, the horse-power I am working on being 33,000 pounds. The matter of where my gauge was fixed getting 10 lb. is made much of. My gauge was fixed in that position for convenience, and to keep out of the way of the men working at loading and discharging. The experiment and the deductions I am prepared in every particular to substantiate; and before anyone attempts to make a severe criticism he should take the same means to prove the winch efficiency as I did.

Mr. Simpson seems to think there is not much loss due to condensation in the steam pipes; I fail to see how he can come to that conclusion after perusing my figures and hearing the remarks of Dr. Elliott. I can further tell him I have had samples taken of the steam from the winch pipes, and when working under precisely the same conditions, and not a trace of salt was shown by the silver test; so that in some of the tests I am convinced there was no priming, consequently the water present must have been due to condensation. Then with regard to the objection to lagged pipes, I really do not think that burst steam pipes are so common as to nullify the advantages gained by covering them. I really cannot call to mind ever having a burst pipe; and often when they do burst it is due to carelessness in not keeping the pipes drained after the work is finished.

I quite agree with Mr. Field that winches are not so well looked after as they should be, and I hope this paper if it serves no other purpose will cause instructions to be given to pay them a little more attention;

but, exposed and driven as they are, the difficulty of keeping valves, etc., tight is very great.

I cannot agree with Mr. Aisbitt when he says, or rather implies, that a certain loss is necessary to rapid working of cargo. I think we can have quite as rapid working with more economy by lagging our steam pipes, and a very great deal more by electrically driven winches. I do not for a moment contend that we should sacrifice mechanical efficiency for steam economy, and I do not think we would. I think Mr. Aisbitt over estimates the loss of steam due to leaky piston rods, and after all, although the rods may be and certainly are rusty after a voyage, a few minutes' running soon brings the surface up on the rod; but by substituting phosphor bronze rods there would be a big saving in packing, and I should certainly favour them.

I have to thank Mr. Sydney Walker for the light he has thrown on the alternating current motor; and I may state that, when I stated that £50 was set off for upkeep of electric motors, I considered I was giving the maximum, and I have no doubt what he says is correct, that the upkeep would be very considerably less.

Although I see no mention of the able criticism of Mr. Evan Jones, his remarks were well to the point, and showed that his experience in winch designing was on a par with the results generally admitted. He dealt more particularly with a winch 7 in. by 12 in. doing 10 horse-power, but it must be remembered I dealt in all my tests with smaller winches, viz., 6 in. by 10 in. Assuming his remarks to be correct, and he is near the mark, then my winches 6 in. by 10 in. and 120 ft. from the donkey boiler with unlagged pipes bring the results of my tests fairly accurate, and 28 horse-power entirely out of reason.

I thank you for your criticism and the way you have received the paper, and now hope for some further useful criticism.

Mr. M. W. AISBITT said the author of the paper did not advise them to discard winches but to improve them. As to the different methods of driving winches, he remembered a longitudinal shaft being tried in 1872 on board the *Wooltana*, at Messrs. Palmer's. The shaft ran along the deck, with spur wheel at each winch. This was not found to answer at all, the shaft alway getting out of gear. This might have been got over by a universal joint, but on the whole it was found not to pay. No doubt some of the best results had been obtained from hydraulics, but, as the author had stated, the system was not desirable when vessels were in northern latitudes on account of the frost. Electrically driven winches would be the winch of the future when certain drawbacks had been got over. Such, however, could not be entrusted to the scaramouches of foreign ports who now worked the winches. As to Mr. Nicholl's figures, he had examined them mathematically and found them correct. Whether the data were right or not was a matter for discussion.

Mr. DAVID GIBSON said the results of the several tests of the winches, shown in the paper, were most interesting and, he must say, surprising, especially the small amount of the horse-power indicated, which he took to be the maximum obtained. He had not the opportunity of hearing the discussion at the last meeting, but from what he had heard the principal point raised was in the nature of a conundrum, viz., what was the I.H.P. of a winch; was it 2·8 or 28? There appeared to be a dispute as to where the decimal point should be. With reference to the I.H.P. obtained by the author, he did not wish for a moment to say that his findings were incorrect as he found them, but he really could not accept them as representing the maximum I.H.P. of a 6 by 10 winch, with 78 lb. boiler pressure. He should like to ask Mr. Nicholl if the stop valves were open, if the steam gauges

were correct, if the steam pipe area was contracted in any way, and if there was an uninterrupted flow of steam from the boiler to the winch. With reference to taking the consumption of steam by the indicator cards he did not think that much reliance could be placed on this method. The method of measuring the feed by the height of the water in the gauge glass might also be misleading if care were not taken to take measurements always at the same boiler pressure. As to the most economical method of discharging a ship's cargo, and the transmission of power, there was a good deal to be said. The steam winch was an expensive machine. The author had mentioned the hydraulic, electric, and the mechanical (shaft) methods. Whichever system was adopted, there was no doubt that that system, with a central power station in the engine room, would be the most efficient. Friction winches had been made and fitted, but they had not been at all a success. To discharge cargoes by electricity was doubtless very desirable, but, as had been pointed out, there were practical difficulties in the way of its adoption. The varying methods of discharging cargoes at different ports was a subject which might very well be discussed by the Institute. At Baltimore, for example, as the author had observed, the winch was worked out at the maximum number of revolutions to do work which was performed at Bristol at one-twentieth part of the speed. The author was quite right when he said that a slow speed with a heavy load was the most economical way of working the winch. The drop of steam at the pipe when the winch was running at full speed to 10 lb. seemed very remarkable. Then the revolutions of the author's winch were nothing like those usually made under average circumstances—140 revolutions. This could be doubled, and then not be considered an excessive speed in working a steam winch. The fitting of an injector to the donkey boiler was a means in the direction of economically discharging cargo. He had for many years fitted the injector to donkey boilers

with very good results. His own experience, and that of others gave the saving as between 15 and 20 per cent.

Mr. J. F. WALLIKER said he was much interested in the discussion, but he was afraid that shipowners and superintendents were apt to regard the efficiency and economy of the steam winch with something very like indifference. Only that day one of the latter had told him that he could discharge a 5,000-ton steamer in London by the winches in 72 hours at an expenditure of 18 tons of coal, which at a cost of say 6s. per ton was a small proportion of the total expenses, and whether they saved 20 or 50 per cent. on that mattered very little. He gave the statement for what it was worth, but it was certainly a phase worth considering. Regarding exhaust tanks he would like to note that these, if not properly designed, were apt to choke the winches by back pressure and thus prove a fruitful source of annoyance and trouble instead of assistance. Doubtless the best system was the adoption of the surface condenser, and this, he understood, had always given satisfaction where fitted. Members did not seem in much agreement as to the winch of the future—the use of electricity seemed to be the favourite—they would doubtless have to have power largely in excess of their ordinary requirements, and this would mean increased first cost not only in their motors but in their generating powers. This phase of the question would be best dealt with by those members who belonged to the electrical profession. He understood that motors were made for use in mines, etc., perfectly protected from dust and water, and this was much in their favour for ships' purposes. In conclusion he would add that he wished to see something adopted that would tend to decrease the work at sea of the engineers in the ordinary tramp steamer.

Mr. NEVILLE APPELBEE (Cardiff Electrical Engineer) said: Mr. Nicholls asked for discussion, and his wish seems to be in a fair way to being gratified. Most of us can endorse Mr. Nicholl's opinion that the auxiliary plant is responsible for the consumption of a great deal of

steam, and I read his paper with a good deal of interest, especially as regards his roughly sketched out electric winch installation. Before I came to the meeting I had wished Mr. Nicholls had been more explicit in the data he gave. Thus in the first and second tests he talks about the mean pressures on the pistons. Now which cylinder did this refer to (I thought) as the winch was apparently a compound? I understood at the meeting, however, that it had an ordinary pair of high-pressure cylinders. Then in test No. 3 he found the winch friction was 4·1 horse-power, and considers this must be 50 per cent. of the maximum the winch was capable of developing. This seems to me to be very small. Certainly in electric light practice two 6-in. by 10-in. cylinders would be expected to develop far more. This maximum power question is of great importance when the horse-power of the electric winches comes to be considered. I have no doubt that a great economy could be obtained by the use of electrically driven winches, and whether the economy is worth the outlay is a matter for the consideration of the ship-owner. For handling cargo the motors would probably be kept running the whole time, and the lifting tackle put in and out of gear as required. For this work I daresay that 8 horse-power electric motors would be large enough. They would, however, have to be most securely housed so that the weather did not destroy the motor. Winches have, however, to perform other work than lifting cargo, and I do not think an 8 horse-power motor would be of much use in pulling a ship off the ground. To keep current turned on to a motor which cannot move on account of the load against it, such as often happens with a steam winch, would certainly destroy it. I am not surprised to hear the enormous steam consumption of the pump the President tested. In electric light stations the feed pumps are invariably independent machines, and are now usually arranged to be driven by electric motors or by a steam engine with a heavy flywheel so as to get some expansion of the steam.

Mr. MASON (read by Mr. SCOTT): Permit me to congratulate Mr. Nicholl on his interesting paper. As quickness in loading and discharging vessels nowadays is naturally considered, the subject is of the first importance. Winches are a continual source of trouble and annoyance to all who have any dealings with them. Only engineers who have had experience with them at sea can appreciate the difficulties continually arising. Agents and stevedores are always ready to blame the engineer in charge when the least stoppage takes place, sufficient steam being an unknown quantity. I have never yet met a stevedore who would admit his arrangements could be at fault—it was always the fault of the steam. On one occasion in Hull I remember five gangs out of fifteen being knocked off work by the stevedore and complaints made to the agents of being stopped owing to the donkey boiler being too small to keep the winches going, although the latter had been condemned for months and not in use, and the main boilers used instead. Of course, as soon as this was pointed out I had no further trouble, and the fifteen gangs were kept going, though they had to be brought from another ship. As regards covering the steam pipes there is no doubt this effects a great saving where it can be done, but I have tried felt and canvas, asbestos meal, asbestos rope, cement, and also cork, all of which were quickly destroyed, and I have yet to see a covering that will stand the rough usage these pipes are subjected to when fitted on deck. I can corroborate the author as to the enormous loss that takes place in steam and coal through the present method of using winches. For instance, I had a vessel last year which discharged a cargo of 4,800 tons, the discharging time being fifty working hours ; the average height of lift was 22 ft. The vessel has three 7-in. by 12-in., one 6-in. by 10-in. and two 5-in. by 10-in. winches, the donkey boiler being 10 ft. diameter by 9 ft. long, multitubular, with two furnaces

and 800 square ft. heating surface—90 lb. working pressure. The actual coal used by measurement was fifteen tons as near as possible, two tons of this being used for getting up steam, damping fires, etc., leaving thirteen tons of coal to do the work.

Now the work done amounted to

$$\frac{\text{tons} \times \text{lb.} \times \text{ft.}}{60 \text{ min.} \times 50 \text{ hrs.}} = \frac{4800 \times 2240 \times 22}{60 \times 50} = 78{,}848 \text{ ft. lb. per minute,}$$

or 2·3 effective horse-power. To obtain this 582 lb. of coal per hour is used or 253 lb. per effective horse-power. If we allow 4 lb. per indicated horse-power per hour for high-pressure non-condensing engines, (a liberal allowance), this gives 145·5 I.H.P. to do 2·3 actual horse-power work, which is almost incredible, and at an evaporation of 3 lb. of water per lb. of coal, equal to 104·4 tons.

I may add that the winches were in first-rate order and nearly new, as well as being fitted with governors. This has been my practice for some years, as I find winches so fitted cost much less in upkeep, and the size of the boiler is practically doubled. Again, I had another vessel which discharged 3,800 tons of coal at Port Said, the winches to all intents and purposes never stopping, the time taken being 52 hours, the lift 20 ft., and $11\frac{1}{2}$ tons of coal were used.

Work to be done :

$$\frac{3800 \times 20 \times 2240}{52 \times 60} = 54{,}564 \text{ ft. lb. per minute} =$$

165 effective horse-power per minute; coal used

$$\frac{11{\cdot}5 \times 2240}{52} = 495 \text{ lb. per hour} = \text{horse-power (at}$$

4 lb. coal per I.H.P.) 124 horse-power nearly; or to put it another way, one effective horse-power per minute cost 300 lb. of coal per hour. In the first example I have given the exhaust went overboard, but in the latter the exhaust steam discharged into a tank under the donkey boiler.

Regarding the alternative suggested by Mr. Nicholl for winches, some years ago I designed a system something similar; it was unfortunately not carried out, the owners going in for steam cranes instead. It was as follows: A compound engine of 30 horse-power was placed alongside the donkey boiler, having a governor actuating the expansion valves; on the flywheel two endless ropes were arranged, one for forward and one for aft, and these worked the winches, arranged as usual and placed at the hatches. The winches were so designed that the drums for whipping were always running, but the barrels of the winches were worked by worms which in their turn were worked by friction clutches and brakes, the windlass being worked in a similar manner. This arrangement has advantages over the shafts in better leads, and the ropes could be unshipped when not in use. And I think we must look to some similar arrangement to the above in the near future, as it would practically place the driving, or I should say the wasting, of the steam out of the hands of the unskilled men now usually put on to drive the ordinary winch.

Mr. W. SCOTT: I may now make a few comments myself in reference to a few tests I have had made in our works with a 7-in. by 12-in. winch, ordinary type, the length of steam pipe from the boiler to the winch being 60 ft., the whole of the steam piping being uncovered and placed inside the works, with the exception of about 6 ft. where it joined the winch, the temperature in the open air outside the works being 58° Fahrenheit, and inside the works away from the boiler 64°, the winch being in good working order, and for the purpose of this trial new piston rings were fitted, the results of the tests being as follows:

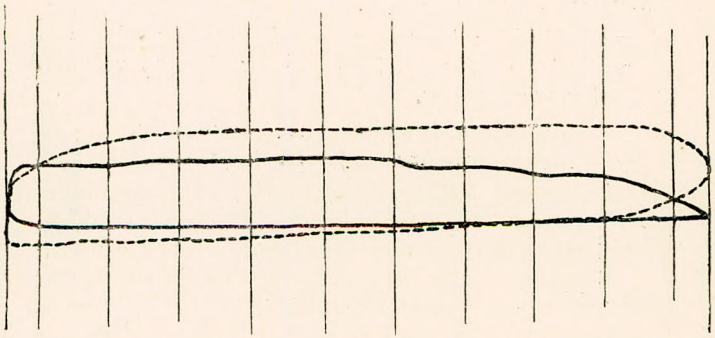
No. 1 *Test.*—Boiler pressure 62 lb. per square inch.

Mean initial pressure in the cylinder by the indicator cards 8,375 lb. (this proves that the pressure of 10 lb. as shown by the gauge placed by Mr. Nicholl

near the winch at such a distance from the boiler is about correct).

Mean pressure by the cards for both strokes 4·65 lb. Revolution per minute 120. Which gives us an I.H.P. of 2,602.

Maximum Pressure	...	8·375 lb.
Mean Pressure	...	4·65 lb.

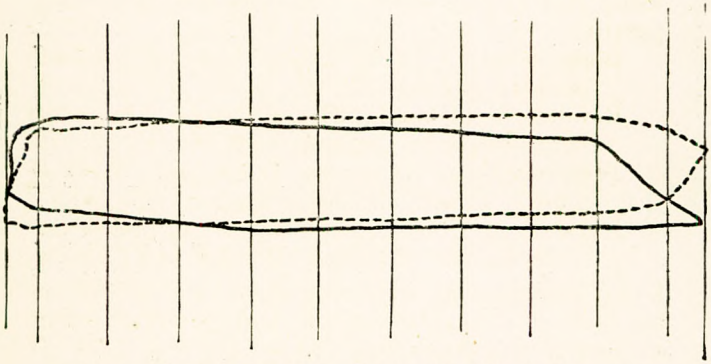


At the time those cards were taken a weight of 14 cwt. was lifted at the rate of 20 ft. per minute, which is equal to 31,360 ft. lb., or ·95 of a horse-power. This of course gives us the actual work performed, therefore the horse-power as developed in the cylinders minus the work actually performed must in this case be the loss due to friction, etc., which is equal to 1,652 horse-power, this loss representing about 63 per cent. of the total horse-power. Of course we must not forget in this case, as in the generality of cases, winches exhaust into the atmosphere, and during this test a large quantity of water due to condensation was present.

No. 2 Test.—This was with the same winch and under similar conditions, but after working for a considerable time, which showed less condensation, we got an initial pressure in the cylinder of 8,625 and a mean pressure of 5·74 lb., which gives us 3,212 horse-power with the same revolutions and boiler pressure.

This winch having been fitted with a governor so as to regulate the revolutions by the quantity of steam used, the only reason I can give for the increase of the I.H.P. without a corresponding increase of work is that the steam being drier through less condensation showed a better card. Gentlemen, since those results are so near those obtained by Mr. Nicholl, I do not think it necessary to occupy your valuable time with any further deductions which would in all probability approximate his; therefore there is nothing left for me to say but to thank Mr. Nicholl for his very valuable and interesting paper.

Maximum Pressure	...	8·625 lb.
Mean Pressure	...	5·74 lb.



Mr. A. S. JACKSON (Member) said: I took the opportunity a short time ago to make a few tests of the efficiency of the ordinary ship winch, in order to satisfy myself as to the I.H.P. The winch was an ordinary 7 in. × 12 in. of Clarke Chapman's type, and had not been overhauled or repaired in any way for the purpose of these experiments. My idea was to ascertain the horse-power indicated whilst lifting a weight of 25 cwt., which is equivalent to the usual work of a winch whilst discharging iron ore, but unfortunately, owing to other machinery running at the time, I was unable to get more than 52 lb. of steam at the donkey boiler.

On making the first attempt the winch, with 52 lb. of steam at the boiler, would not lift the above weight, so after fitting a double and single block, and thus making a double purchase, the following were the results :

Boiler pressure 50 lb. Mean pressure for both ends of cylinder 8·1 lb.

Revolutions of winch 112 per minute. Indicated horse-power by the cards 4·23.

Temperature of atmosphere 62 degrees. Weather fine.

Distance of winch from boiler 60 ft. pipes uncovered. Result 25 cwt. lifted 8 ft. in 15 seconds.

I made one more test and got the following results, using the same winch, same weight, and same purchase :

Boiler pressure 52 lb. Mean pressure for both ends of cylinder 6·79 lb.

Revolutions of winch 126 per minute. Indicated horse-power by the cards 3·99.

Temperature of atmosphere 62 degrees. Weather fine.

Distance of winch from boiler 60 ft., pipes uncovered. Result 25 cwt. lifted 7 ft. in 10 seconds.

I may remark that the above winch was an old one but in as good condition as the ordinary run of steam winches on tramp steamers.

Mr. EVAN JONES (Member) said the discussion seemed to have turned entirely upon the question of I.H.P. This was a great pity, because if they all started indicating to-morrow they would never arrive at the same results. With a view to verify Mr. Nicholl's figures, or otherwise, he himself had tested an 8-in. × 12-in. winch, with the permission of the Chairman, and got the most out of it. He loaded it up so that it could only go at 200 revolutions with 60 lb. pressure at the boiler. The distance from boiler to winch was 60 ft., and the drop in pressure from one to the other was 5 lb. The gauge was placed on the

pipe close to the winch, and a steady pressure was maintained on the gauge of 20 lb. when the winch was running. The I.H.P. of the winch was 13·336, and the brake horse-power 10·26. The initial pressure on the cards was 17½ lb. at one end, and 17 lb. at the other, which practically coincided with the pressure registered at the gauge. The steam pipe was 2½, and the winch was new. That was the maximum he got out of it with 60 lb. boiler pressure. There was a tremendous back pressure, and there was no length of exhaust pipe whatever. The exhaust was out of the cylinder, otherwise the back pressure would be considerably more. With regard to the 6 × 10 winch described by the author, he tried one of these winches with a boiler pressure of 65 lb. of steam, and the maximum was 6·7 brake horse-power, or effective power, with the boiler close alongside the winch. It lifted a weight of 7,448 lb. 16½ ft. in thirty-three seconds, or at the rate of 30 ft. per minute. Under these conditions the I.H.P. would be about eight.

Mr. SCOTT said these figures were about equivalent to those which he had given. The exhaust in his case went right under the roof, 30 ft. up.

Mr. EVAN JONES (continuing) said in the case of the 8 × 12, the pipe was outside exposed to the rain, and there was a drop, as he had said, of 5 lb., and the boiler was 60 ft. away. When the winch was not running the pressure at the gauge was 55 lb., but when running the gauge showed a steady pressure of only 20 lb. On the general question of the use of winches, he thought that with the improved facilities which were now being afforded for rapid loading and discharging at the great ports of the world, the winch on board ship would be done away with so far as the large cargo vessels were concerned. Of course, it was different with the ordinary tramp ship dealt with in the paper, which required to have her own appliances on board, and he thought the principal point was what would be the quickest method of loading and

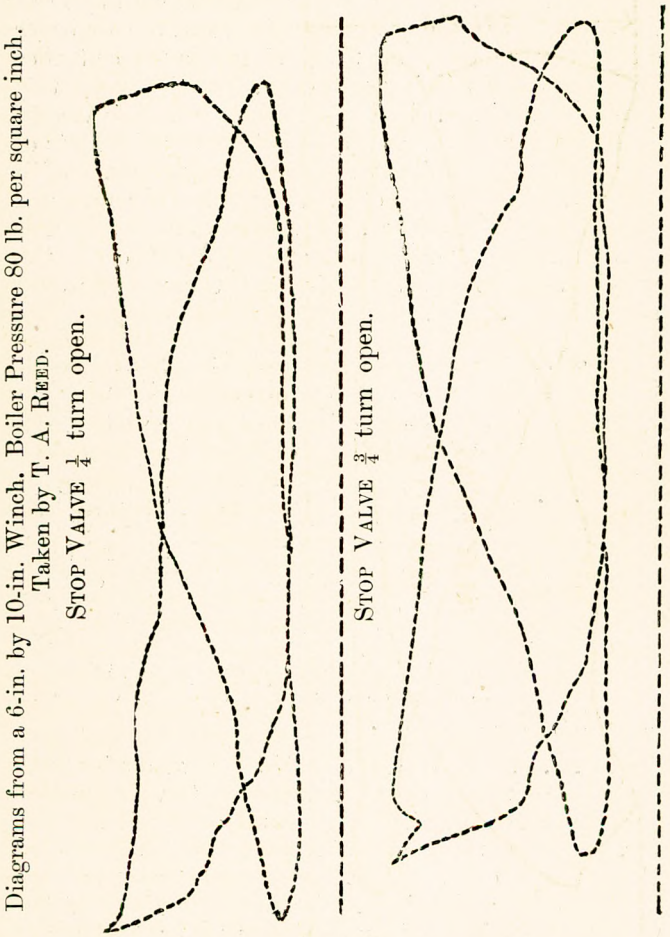
discharging such a ship. If appliances could be placed on board—say, to reduce during a year the time required to load and discharge a ship by from twenty to thirty days, the gain to the shipowner would be far more than the saving of a ton or two of coal per day in doing the work. By bringing this paper forward Mr. Nicholl did a very great service in directing the minds and stimulating the thoughts of engineers towards improving such appliances. With regard to the question of I.H.P., the steam winch was not a high-speed engine, but was put on board to lift a weight. If 28 horse-power was got out of it, the wheels would never stand it, and the winch would smash itself to bits.

Mr. J. BODDY (Member) advocated the central power in the engine room, with power diverted to the winches. It was time to do away with the method of carrying steam along the decks to them.

Mr. J. CHELLEW (Member) had yet to learn that there was anything to supersede the winch driven by steam, seeing the conditions under which it had to be worked, viz., discharging coal cargoes which envelop the winch in clouds of dust and dirt, cheap foreign labour, etc. He did not approve of electrically driven winches, or from a main shaft, with four or more counter shafts, owing to the noise and the excessive vibrating of deck beams.

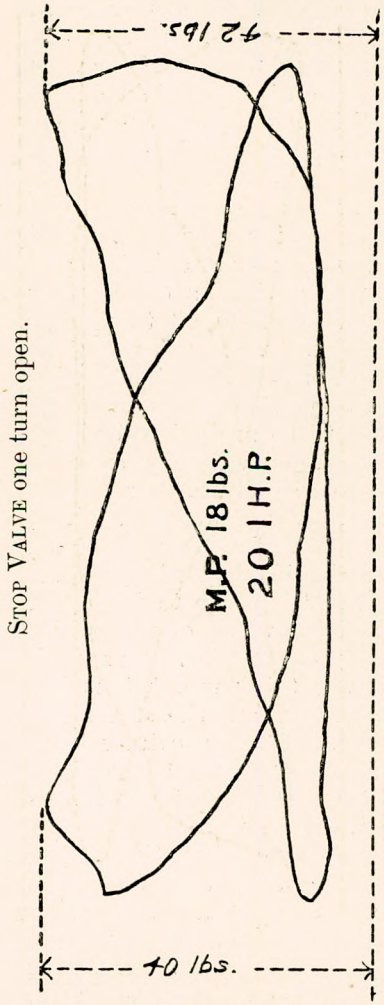
Mr. T. A. REED (Member) said there was a misunderstanding on the part of Mr. Nicholl as to what he (the speaker) had stated with reference to compound winches. Mr. Nicholl, at the last meeting, said he took steam after it had passed one cylinder, and he (Mr. Reed) asked if it was a compound winch. Nor had he denied that the winch was subject to ill usage. He never said he got 28 I.H.P.; what he did say was that he estimated the maximum at more nearly 28 I.H.P. than 4 as recorded by the author. With regard to the power of the winch, the winch had so many duties to perform that it re-

quired to be a powerful machine as well as a high-speed engine. He had counted from 350 to 450 revolutions.



As to Mr. Evan Jones's winch, being new it must have been rather stiff, and wanted a little lubrication. With regard to Mr. Scott's cards, without the stop

valve was full open they were not getting the maximum horse-power of the winch. Continuing, Mr. Reed said :



I commenced bluntly to initiate the discussion on this paper at our last meeting, by special request, before I was prepared to discuss the subject, perhaps too bluntly, and Mr. Nicholl will, I hope, allow me to take this opportunity of saying that my observations on that occasion were not in the slightest degree intended to be disagreeable to him, but merely an ordinary criticism of the statements he had put before the meeting. Having the honour of being a member of your committee, I am bound to feel appreciative of Mr. Nicholl's efforts to help forward the Centre by the good example he has set us of reading a paper. We both waxed a little warm over the matter, and I have no doubt that when Mr. Nicholl left the meeting he was impressed with the necessity of getting further data together to convince me of the evil course I was pursuing, while I also hoped to show him mine was the correct view of the case.

It appeared to me that there were some extraordinary drops in pressure, etc., between the donkey boiler and the winch when running, also when not running. Previous to the meeting I took some hurried experiments, so as to have something to work on for the evening's discussion, and the results then obtained have been verified since. On listening to the paper I felt that the author had been, perhaps unintentionally, too sweeping in his opening paragraph, as to the winch and its boiler receiving little, if any, consideration at the hands of marine engineers. That statement I considered it necessary to object to; in fact, the subject has always received a considerable amount of careful consideration from all thoughtful engineers, but, as you all know, one of the great drawbacks to rapid progress, or the perfecting of anything, is the great finance question, for the average shipowner naturally wishes to be assured beforehand that a new method will pay, and waits for someone else to spend money in experimenting. Hence, one waiting for the other to move makes progress slow. I stated that I disagreed with Mr. Nicholl's results, and I think that statement was justifiable, for if there are one or two items wrong it is fairly safe to infer that there is every likelihood of the whole of that which is based upon these being wrong also. Now it is apparent to everyone who will think it out, that if a boiler is generating steam freely, and the steam pipe leading to the engine not of some extraordinary length, which is not so in case of deck steam pipes, the steam pressure at the engine when standing, provided the valves are tight, will be the same pressure as that at its boiler, and that any condensation taking place in the pipes will be made up by the evaporation going on in the boiler, and the pressure will remain the same even if the pipes have become filled with water, that is if the pipes are on a level with the boiler, otherwise there would be a difference due to the head of water. Now Mr. Nicholl gives the condensation in the pipes at 40 per cent., and states that

with 78 lb. at the boiler there was only 60 lb. at the winch when it was standing, and bases his calculations on this. I then suggested, and still see no other explanation for this, that the winch valves were passing a lot of steam. Now, as before stated, I found no difference of pressure between the winch and boiler when the winch was standing.

Next, I stated that I estimated (for I had not had time to take the indicated power of a winch) that a double 6-in. × 10-in. winch should, in my opinion, more nearly indicate 28 horse-power as a maximum than four as given in the paper. Now, the author treated my assertion as absurd. Owing to my absence in Scotland and the North of England, and the absence of a steamer under my superintendence, I have not had an opportunity of carrying out further experiments beyond those taken the day after the meeting, the results of which I give for what they are worth; also as being more what one would expect from a winch. Mr. Nicholl stated the only true way to arrive at the power of an engine was by the indicator card; hence, I confine myself entirely to indicated horse-power, and trust that brake horse-power and effective horse-power will not be confounded with it.

I submit three cards taken from a winch eleven years old, which had not been in any way prepared or overhauled for the occasion, not even the valves adjusted. No. 1 card is with the stop valve one-quarter turn open, No. 2 stop valve three-quarter turn open, No. 3 barely one turn open. The boiler pressure was 80 lb., and the pressure 72 lb. at the winch in each case; the pipe was about 100 ft. long. What I wish you to notice is, that with the stop valve barely one turn open I got 20 I.H.P. Had I been able to load the winch more, of course I would have got a great deal more pressure on the piston, and a correspondingly higher power. When preparing for the higher power, the indicator gear carried away, as it was only temporarily

clamped on, and, having no more time, that finished my experiments, as the vessel was ready to go out of the dock; but I think you will agree with me that I have shown sufficient power with stop valve only one turn open to infer that had the stop valve been full open 28 horse-power would easily have been obtained, and I can only say I am sorry my experiment had its abrupt termination.

It is easier to criticise than to write a paper. The one before us has raised considerable discussion, and that is what we want. It has, moreover, set a large number of engineers experimenting with the much-abused winch. I have long been of the opinion that the electric motor is the motor of the future, but whether it is quite ready for the deck of a steamship is another matter, but I believe it will be some day.

In conclusion, I should again like to express my thanks personally to Mr. Nicholl for bringing this subject before the Institute. If beneficial change or advancements are to be brought about in marine engineering as in other things, the discussion and interchange of views on them must have a result tending to that end.

Mr. SYDNEY F. WALKER suggested that comparatively small electric motors should be employed for the regular winch work, and also one or two larger motors for heavier strains. Mr. Appelbee had raised the point of the motor being on deck. If it could be put under the deck it would be better. If it were essential the motor should be on deck it could be effectually enclosed and protected, switches and everything else connected with it.

Mr. EDWARD NICHOLL submitted that the debate showed he had proved his case up to the hilt. Time debarred him going further into details that night, but the longitudinal shaft mentioned by Mr. Aisbitt was now building in the north of England, under the supervision of Mr. Bonnymann, where a similar arrangement was being fitted. As to Mr. Gibson's point, the stop valve was full open on the winch he tested. With reference to electrical motors, he believed that

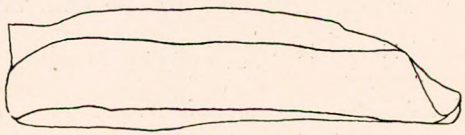
with a notched reversing lever the current could be regulated to suit either a slow or a fast pull on the winch. The tests given by Messrs. Scott, Jackson, Mason, and Jones served to bear out his own figures. With regard to Mr. Reed, it was perhaps a good job for him that he was not able to make more tests. As to 399 revolutions, how did Mr. Reed count them?

In order to make clear the methods used to obtain my deductions, the following notes will serve. The indicated horse-power I obtained as follows:

$$\frac{6^2 \times \cdot 7854 \times 10'' \times 2 \times 160 \times 4 \cdot 37 \times 2}{12 \times 33000} = 1 \cdot 99,$$

Say, 2 horse-power.

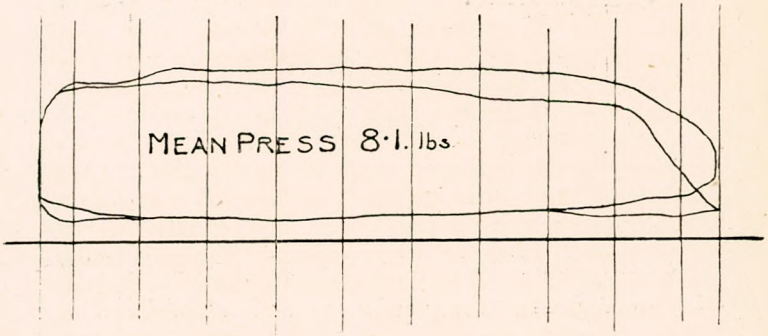
TEST Nº 1.



For the Steam Consumption.—I measure the pressure from the atmospheric line at $\frac{9}{10}$ from the commencement of the stroke for each end of the cylinder, thus:

No. 1.

I.H.P. = 4·23. 112 REVS.



which in this case is 4·69 lb. and 4·05 lb. per sq. in.

Now I look up a book of tables giving the volume of 1 lb. of steam at those pressures, which is

$$\begin{array}{rl} 4{\cdot}69 = & 20{\cdot}2 \text{ cubic ft. per lb.} \\ 4{\cdot}05 = & 21{\cdot}0 \quad ,, \quad ,, \\ \hline 2 \mid & 41{\cdot}2 \\ \hline & 20{\cdot}6 \text{ steam.} \end{array}$$

The reason why I take $\frac{9}{10}$ is, that it is the point just before the exhaust opens. Now, $\frac{9}{10}$ is 9″ since the stroke is 10″, and to this I add 1″ for clearance, which, of course, includes the volume of the steam ports. This I find is about right for this size of cylinder.

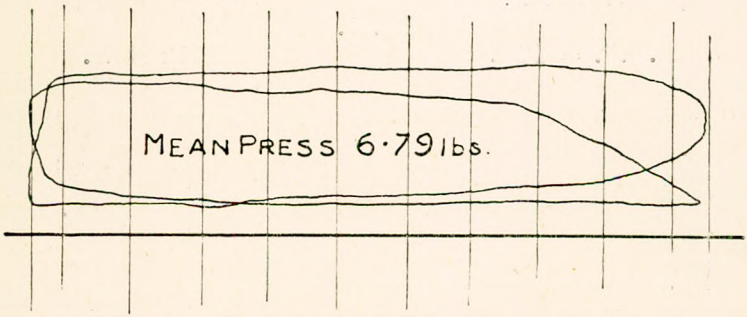
Now, the volume of steam used per revolution will be $\frac{6^2 \times {\cdot}7854 \times 10'' \times 2 \times 2}{1728} = \frac{1130{\cdot}8}{1728}$ cubic ft. for each winch per revolution, and for one hour we have

$$\frac{1130{\cdot}8 \times \overset{\text{Rev.}}{160} \times \overset{\text{Min.}}{60}}{1728} = 6282 \text{ cubic ft.}$$

Now this divided by the cubic ft. per lb. of steam, we have the lb. of steam accounted for by the diagrams. Therefore $\frac{6282}{20{\cdot}6} = 304$ lb. of steam per horse per

No. 2.

I.H.P. = 3·99. 126 REVS.



winch. Now the winch developed 2 horse-power. Therefore $\frac{304}{2} = 152$ lb. per horse per hour, which I have given as 150 lb.

Steam taken from Boiler.—Divide the water used per hour by the I.H.P. That was 250 lb. per horse per hour.

Percentage of Water in Steam Pipes.

$$\left(\frac{250-150}{250}\right) 100 = 40 \text{ per cent.}$$

The Brake Horse-power is measured as follows: The difference between the pull on the spring balance and the weight gives the actual drag on the winch barrel, which of course acts as friction. Now, if this drag in pounds be multiplied by the feet per minute through which the drag or friction acts, we have foot pounds per minute, which was the actual work the winch was doing, and this divided by 3,300 gives the brake horse-power as follows:

Winch wheels 14 teeth and 74, and 140 revolutions

$$\frac{14 \times 140}{74} = \text{revolutions of barrel.}$$

Now the actual drag was $260 \text{ lb.} - 58 \text{ lb.} = 202$ lb.

Now, $\dfrac{14 \times 160 \times 16'' \times 3{\cdot}1416 \times 202 \text{ lb.}}{74 \times 12 \times 33000} = {\cdot}775$ brake horse-power.

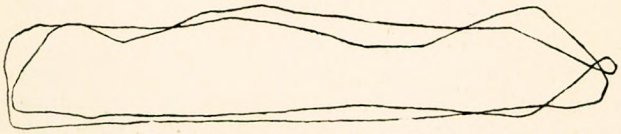
TEST Nº 2.

Now the horse-power absorbed by friction is simply the difference between the brake horse-power and the indicated, which is $2{\cdot}0 - {\cdot}775 = 1{\cdot}225$.

No. 3 *Test,* 4 *Horse-power.*—This was because the winch was not doing any work, only turning itself

around, consequently the whole horse-power represents friction.

TEST Nº 3.



The friction of the brake-rope represents useful work in my case, as if the winch had been raising cargo.

A cordial vote of thanks was passed to Mr. Nicholl for his paper, on the motion of the CHAIRMAN, seconded by Mr. DAVID GIBSON.

Mr. J. F. WALLIKER proposed a vote of thanks to the Chairman, and this having been seconded by Mr. AISBITT, and duly carried, the proceedings terminated.

PREFACE.

58 ROMFORD ROAD,

STRATFORD,

February 27th, 1899.

A meeting of the Institute of Marine Engineers was held here this evening, presided over by Mr. A. BOYLE (Member), when a Paper on "Auxiliary Machinery (Cargo)," by Mr. EDWARD NICHOLL (Member), was read, and in part discussed.

The Paper was previously read at Cardiff to the Members of the Bristol Channel Centre.

The discussion was adjourned till next meeting.

JAMES ADAMSON,
Hon. Secretary.