Imas '69 Plenary Session paper—
Main Propulsion Machinery

SOME CONSIDERATIONS BY A SHIPOWNER ON THE SELECTION OF MAIN PROPULSION MACHINERY FOR CARGO SHIPS

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The selection of main propulsion machinery has become a more complicated matter than in the past on account of modern trends in the transportation of goods. The various cost factors of ship operation are given and the influence of manning, maintenance, reliability, automation and sailing schedule on the main propulsion installation are discussed. In separate sections Diesel engine—single and multi-installation—and turbine installations, are compared in relation to horsepower output. Statistics of ships under construction with main propulsion machinery above 20 000 bhp are presented.

INTRODUCTION

Recent developments in the transport of goods, the economic benefits derived from the increased size of ships, and the introduction of modern techniques of operation and control, i.e. the governing of machinery, have all had an influence on the selection of main propulsion machinery.

The generally accepted principle is still that the most economical installation should be selected. Although this sounds very simple it proves to be a rather complicated problem; not only because of the many different factors influencing the economy of a ship and its machinery, but also because of the interrelation of these factors and their effect upon each other.

One must realize that a modern ship should be designed as an integrated unit and not as a combination of separate components: hull, main engine, auxiliaries, etc. Shipowners have appreciated this situation and a new approach is gradually being adopted.

More and more shipping companies have created, or are creating, their own research departments; and in some countries the smaller companies are pooling their technical talent to form a single research group.

The aforementioned developments in modern methods of sea transport, as for instance the containership, barge container, roll-on roll-off ship, and combinations of these three, require tremendous investment and volume of cargo. As a result, companies already large have formed into combines, which ordered the new tonnage for these advanced transportation methods.

The advantage of bringing together the research and technical groups of these companies will be evident.

In the following paragraphs some of the factors which have to be considered in the selection of main machinery will be discussed. The author realizes that many other factors are not dealt with but to keep the paper within the prescribed scope a selection had to be made and only the following subjects will be discussed:

General Economics
Manning Scales
Reliability and Safety
Maintenance
Automation
Sailing Schedule

In the closing section an opinion will be given on the main propulsion machinery now in general use for ship propulsion. Nuclear propulsion, therefore, will not be included.

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GENERAL ECONOMICS

In Fig. 1 a comparison is given of the transport cost for a certain volume of cargo between conventional cargo liners built in 1958, modern unit load cargo liners built in 1968, and a container—barge carrier—roll-on roll-off combination. Further, the increase in cost of the conventional cargo liner from 1958 to 1968 is given.

Although it is not intended to deal with all costs factors o transport, it is considered necessary to include in Fig. 1 such costs as stevedoring, claims, commission and port dues in order to show the reasons for the development of modern methods of transport.

From Fig. 1 the conclusion can be drawn that the modern cargo liner is reaching its economic optimum and that further improvements must come from modern methods of transport and increase in scale.

In this section only the operational costs, i.e. excluding costs connected with the cargo, will be considered. From a comparison of costs involved in the running of a conventional cargo liner in 1958 and 1968, the following facts emerge.

Depreciation and Interest

Depreciation and interest show an increase of about 35 per cent. From Fig. 1 it can be seen that the much faster unit-load ship of 1968 cannot improve on this figure notwithstanding the smaller number of units required. As the main cause, the time spent in port must be considered; and perhaps the large, fast container ship and barge container may provide a solution.

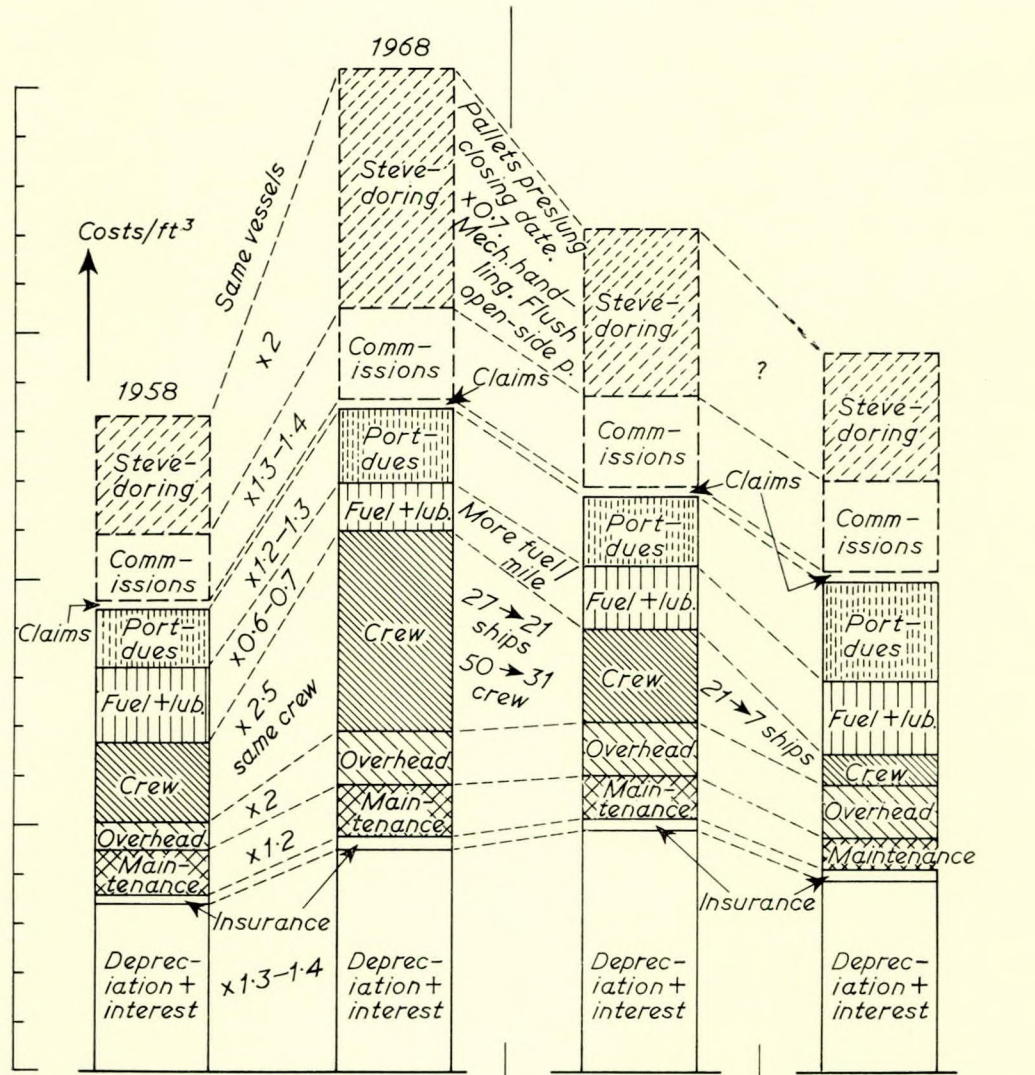
Insurance is closely related to capital and will rise accordingly.

Maintenance

The increased cost of maintenance proves to be 15–20 per cent. The reasons for this small increase are higher efficiency, rationalization, and better planning of maintenance by shipboard personnel, which could balance part of the increased cost of repair work ashore. See the section on maintenance which follows.

Overheads

Overheads show an increase of some 100 per cent. This is partly due to higher wages, but also to the increase in office



	Normal cargo liner, 27 ships	Unit-load liner, 21 ships	Barge-container, 7 ships
Service speed:	18½ kn 10 000 shp Diesel	20½ kn 16 000 shp Diesel	21½ kn 32 000 shp turbine
Bale capacity:	610 000 cu. ft. 11% lost space	700 000 cu. ft. 22% lost space	1 400 000 cu. ft. 24% lost space
Cargo volume:	545 000 cu. ft.	545 000 cu. ft.	1 065 000 cu. ft.
Cargo/r'd trip:	1 090 000 cu. ft.	1090 000 cu. ft.	2130 000 cu. ft.
Round trip: At sea	49 days	At sea 44 days	At sea 42days
Sailing in port	5 days	Sail'g in port 5 days	Sail'g in port 5days
In port	56 days	In port 37 days	In port 9 days
	110 days	86 days	56 days
Round trips/ship per year:	3·3x	4·3x	6·5x
Total round trips/ year:	90 sailings	90 sailings	46 sailings
Total cargo transported/year:	98 mill. cu.ft.	98 mill. cu.ft.	98 mill. cu.ft.

FIG. 1—*Comparison of transport costs per cubic foot for a cargo/liner service*

personnel. Modern transportation methods, rationalization on board, and research, require a larger shore staff.

Total Crew Cost

Total crew cost brings the largest increase. If the same crew as in 1958 was still employed in 1968, the increase would be 150 per cent. In the next section of the paper this matter will be treated in more detail.

Fuel and Lubricating Oil

The trend of fuel and lubricating oil costs is most interesting. In contrast to all other cost factors, fuel oil cost shows a definite decrease in the price per ton. The horsepowers required for modern methods of transport increase the total fuel and lubricating oil cost, but its relative effect is decreasing. This means that a slightly reduced efficiency of the main propulsion system due to simplicity in operation and maintenance will have less effect than in the past.

The choice of main propulsion machinery will influence these cost factors, which will be commented on in later sections of the paper.

The influence of differences in weight, space requirements, fuel oil bunker capacities, initial cost, etc., are deliberately omitted, because the importance of these items is so very dependent on the specific service required from the ship.

MANNING SCALES: CREW COST

From Fig. 1 it can be seen that if no crew changes had taken place since 1958, the crew cost in 1968 would have been about 150 per cent higher.

With the unit-load ship of 1968 a substantial reduction could be obtained; but on account of the much smaller number of vessels required the container-barge-carrier offers most benefits.

These new forms of transport, including the mammoth tanker and mammoth bulk carrier, are only now coming into operation and are still limited to certain trade routes and fields of application.

The vast majority of ships in the merchant fleet consist of the more conventional types of cargo vessel. It is therefore clear that shipowners have given much attention to the problems connected with the provision of the most economical crew required to operate a ship efficiently. The result of these studies can also be applied to the aforementioned mammoth ships.

In Fig. 2 particulars of the actual total crew and its cost is given for the cargo liner m.v. *Seine Lloyd*, 12 000 dwt, 10 500 bhp, from 1961 to 1968. In the same figure the cost trend for a constant crew is shown.

The reduction in crew numbers that took place in the years between commissioning the ship in 1961 and the year 1968 was a result of rationalization in various departments as well as mechanization and automation in the engine room. Notwithstanding the appreciable reduction in crew numbers, from 46 to 33, achieved mainly by cutting down the number of less well qualified personnel and junior officers, there is still a total increase in cost of 30 per cent and no sign that this trend will change.

It is therefore understandable that shipowners must carefully analyse the workload for the safe and efficient running of their ships at sea as well as in harbour.

At the present time the best way to man ships is a subject arousing much discussion and many controversies. It is the author's opinion that the ship of the future must be manned by a single type of officer, trained for his special duties from the start. The advantage of having one kind of officer only, compared with the existing navigation and engineer officers, is evident. The number of officers required on board a sophisticated cargo liner would then be only 60–70 per cent of the number employed at the moment. France is leading in providing this type of officer training but it may be expected that other nations will shortly follow her lead.

The crew for this ship of the future must also be completely integrated, except perhaps those whose services are concerned with catering, and they would most probably require a better training than is currently provided.

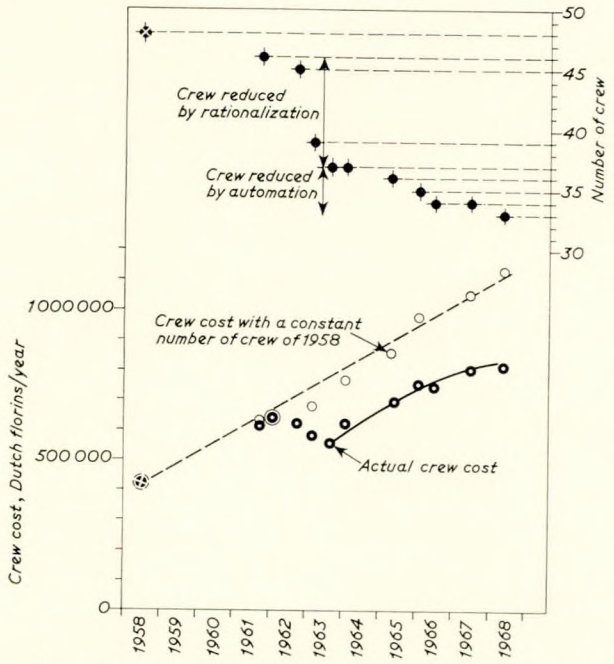


FIG. 2—*Actual crew cost of the mv Seine Lloyd (12 000 dwt; 76 000 cu. ft; 10 500 bhp)*

The ship of the future requires a machinery installation designed for:

a) An engine room periodically unmanned;
b) Operation of the main propulsion installation from the bridge;
c) Fully mechanized deck and cargo gear.

The types of main propulsion unit may influence manning scales. In some countries, Holland for instance, government regulations require a larger minimum engine room complement for a steam turbine installation compared with a Diesel engine installation.

First there is the boiler installation, which may require a fireman, but also there is the theory that with a steam turbine installation a one man watch cannot cope efficiently with the many situations which might develop into emergencies. However, these regulations date from a time when periodically unmanned engine rooms had not yet been thought of.

In recent years much progress has been made in the field of automation and in providing safeguards for steam turbine installations; and although the good results achieved with Diesel engine installations have not yet been reached, these are bound to come.

On the other hand, crew numbers should be decided upon, not only according to the minimum safety limit, but also to the workload at sea and in port. On this basis the total crew number required for both main propulsion systems will probably be the same.

A point that has not been raised is the availability of engineer officers with the required knowledge and skill for dealing with either or both types of prime mover. Also, in an individual company, the existing arrangements respecting their engineer officers, due to their training and experience, may play an important role.

RELIABILITY AND SAFETY

Reliability of ship machinery has always been a primary requirement but now that unattended engine rooms are being discussed it becomes even more important. Since Admiral Rickover's Address to the National Metal Congress of the United States,* the study of reliability engineering as applied to

* RICKOVER, H. G. 1962. Abstract entitled "This concerns us too!" of Admiral Rickover's Address to the National Metal Congress of the United States. "The Marine Engineer and Naval Architect", July 1963, pp 333/336.

TABLE I—STOPPAGES AT SEA DURING THE YEAR 1967

DIESEL SHIPS

	Type of ship	Year of building	Operating h in 1967	Failure rate (number of stoppages)	Total time ship stopped	FAILURE COMPONENTS OF MAIN DIESEL ENGINE												Electric system	Steering equipment	Stern tube bearing
						Fuel injection valve	H.P. fuel injection pump	Fuel valve cooling	Exhaust valve	Starting air valve	Piston and cylinder liner	Cylinder cover	Cylinder cooling	Indicator valve	Scavenging airbelt fires	Exhaust gas blower	Lubricating oil system			
					h min	h min	h min	h min	h min	h min	h min	h min	h min	h min	h min	h min	h min	h min	h min	h min
Maas Lloyd	Cargo liner	1956	2887	11	21 . 46	1x=00·54	4x=07·18		4x=12·06	1x=01·00			1x=00·28							
Merwe Lloyd	C.L.	1957	3676	9	33 . 33	1x=01·19	2x=05·48		4x=12·54			1x=12·10			1x=01·22					
Mersey Lloyd	C.L.	1959	4692	8	25 . 18	1x=00·49			1x=01·51		2x=16·10				1x=01·54	2x=04·29		1x=00·05		
Main Lloyd	C.L.	1962	3958	2	01 . 01	2x=01·01														
Schouwen	Bulk Car.	1963	5231	22	17 . 34	18x=10·58	3x=06·31											1x=00·05		
Goeree	B.C.	1963	4263	9	04 . 00	7x=03·11	1x=00·24		1x=00·25											
Wonosobo	C.L.	1955	5009	1	00 . 15	1x=00·15														
Marne Lloyd	C.L.	1957	4341	6	04 . 32	4x=03·42	2x=00·50													
Musi Lloyd	C.L.	1957	4374	4	18 . 58		1x=00·28					1x=10·00				1x=07·00		1x=01·30		
Mississippi Lloyd	C.L.	1958	4227	2	07 . 34	1x=00·28										1x=07·06				
Madison Lloyd	C.L.	1960	4909	3	05 . 45	1x=00·30		1x=00·10											1x=05·05	
Seine Lloyd	C.L.	1961	3673	3	17 . 30		1x=00·50							1x=00·06		1x=16·34				
Walcheren	B.C.	1966	5559	19	28 . 36	3x=00·52	11x=23·48			1x=00·13						3x=03·05		1x=00·38		
Wonosari	C.L.	1952	3908	7	03 . 59	4x=02·19	2x=01·25													1x=00·15
Wonogiri	C.L.	1953	3627	15	23 . 36	8x=03·30	4x=05·57				2x=13·27						1x=00·42			
Wonorato	C.L.	1954	3712	7	05 . 45	4x=01·23	2x=02·52								1x=01·30					
Schelde Lloyd	C.L.	1958	4170	8	20 . 16	6x=02·07					1x=18·00								1x=00·09	
Schie Lloyd	C.L.	1960	3640	18	07 . 25	14x=05·33	4x=01·52													
Average, ship/year				8/9	13 . 41															

TURBINE SHIPS

	Type of ship	Year of building	Operating h in 1967	Failure rate (number of stoppages)	Total time ship stopped	Failure components of main propulsion plant				Electric system	Steering equipment
						Gearing	Condenser	Feedwater system	Boiler		
					h min	h min	h min	h min	h min	h min	h min
Overijsel	Cargo liner	1946	3519	—	— . —						
Limburg	C.L.	1946	4493	—	— . —						
Utrecht	C.L.	1946	4416	—	— . —						
Zeeland	C.L.	1946	3595	1	09 . 42		1x=09·42				
Ampenan	C.L.	1951	4286	1	01 . 00						1x=01·00
Bengalen	C.L.	1956	4486	1	01 . 38	1x=01·38					
Ameland	Tanker	1956	5241	4	07 . 04		1x=06·00	1x=00·24		2x=00·40	
Vlieland	Tanker	1959	6060	1	12 . 30		2x=12·30				
Doelwijk	Tanker	1963	7286	—	— . —						
Average, ship/year				1	03 . 30						

the merchant marine, has been stimulated in many countries. This is very important since it will certainly lead to the production of more reliable machinery.

Table I gives particulars of stoppages at sea in 27 ships during 1967 and shows that there is still much room for improvement. It is interesting to note that the steam turbine installation apparently has a better record in this respect than the Diesel engine installation. As this analysis covers a one-year period only, it was decided to find out whether this tendency was persistent and an analysis was made of records covering a period of ten years. The result showed that:

For motorships, the average time lost in stoppages at sea was 10–15 hours per year;

For steam turbine ships, the average time lost in stoppages at sea was 1–2 hours per year.

Those who were studying the new science of reliability engineering came to a similar conclusion. In regard to the ships investigated, these stoppages were relatively less important than port delays, of which the inconvenience greatly exceeded that caused by stoppages at sea. But for future ships the situation may be quite different.

The unattended engine room will require very reliable main and auxiliary machinery and very reliable regulating, controlling and alarm equipment.

It is not possible to go into detail in this paper, but it seems proper to invite manufacturers to scrutinize their designs, realizing that the failure of one small item may cause the failure of a system and may eventually endanger the safety of a ship. The time may not be far distant when "reliability" factors will be included in specifications for main and auxiliary machinery.

Regarding safety, it seems advisable to warn those who let themselves be governed by economic gains alone. In studying turbine installations especially, one notices a tendency to promote layouts and designs with very attractive fuel rates, but one wonders whether all the problems and risks connected with this economy have been carefully calculated.

MAINTENANCE

In Fig. 1 it is shown that maintenance is also one of the important cost factors in ship operation. The maintenance accounted for in Fig. 1 only records payments the shipowner has made to repair firms and for spare parts, etc., but does not include the work done by the ship's personnel on repair and maintenance.

As with so many facets of ship operation, routine inspections and maintenance work on board ship are often undertaken for no other reason than that one's predecessor has done it also. On account of ever increasing repair costs ashore as well as crew costs, maintenance has become the subject of much study. In the past ten years some very interesting papers have been published, dealing with the analysis of maintenance, stressing the importance of planning and lengthening the inspection periods by careful research.

In Fig. 3 maintenance costs are given for the engine room installations of a series of four 14-year-old motorships and for a series of six motorships of about 10 years old. These curves contain some useful information. For both series of ships it can be seen that the increase in maintenance cost is very low, less than 10 per cent, in the age group 5–15 years. These increases were able to be kept as low mainly as a result of rationalization and maintenance research. The other interesting feature is that the figures show a lower slope for the more recently built ships, notwithstanding the higher propulsion power. This means that the better materials used throughout engine room installations are paying off.

As an example of maintenance research and rationalization, Table II shows the operating hours between piston overhauls for various main Diesel engines used in the fleet of the Royal Rotterdam Lloyd. In the years around 1958 these operating hours varied between 3000 and 4000 hours. Although this achievement can be interpreted as a compliment to the manufacturers of Diesel engines, there are still quite a number of important parts of the Diesel engine that require maintenance at much shorter intervals, such as fuel injectors, exhaust valves, H.P. fuel oil pumps. In this respect the Diesel engine with its many moving parts is definitely at a disadvantage compared with the steam turbine.

To compare the maintenance costs of the Diesel engine installation with those of the steam turbine installation, the graph in Fig. 4 may be helpful. In this figure the maintenance costs of four steamships with 8500-bhp steam turbines and four motorships with 8400-bhp Diesel engines are given over a period of nearly twenty years. All eight ships were built during the years 1946–1949.

It is most interesting to note that in the past twenty years the aggregate cost of maintenance for the two groups of ships is nearly the same; this leads to the tentative conclusion that maintenance costs for these two propulsion systems are equal in

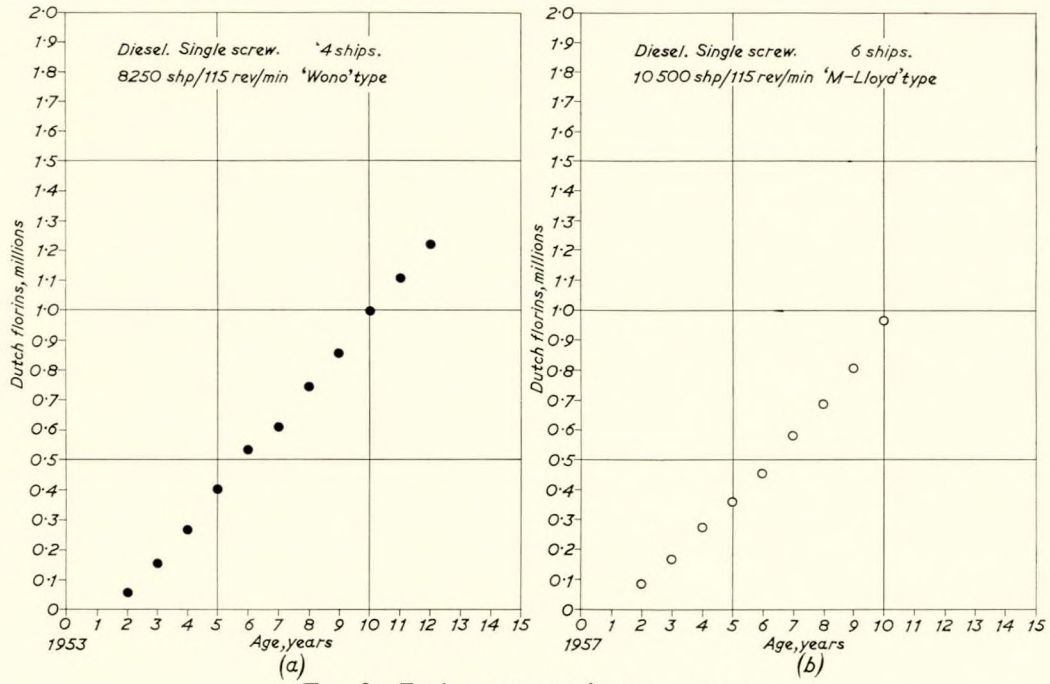


FIG. 3—*Engine room maintenance costs*

TABLE II—PISTON OVERHAUL AND LINER WEAR

Manufacturer and type	Periodic piston overhaul time	Maximum tolerated cylinder liner wear	Average cylinder liner wear	Acceptable limit of burning-in of the piston crown	Maximum width of piston grooves after repair	Remarks
	h	mm	mm/1000 h	mm	mm	
Sulzer S.D. 72	6/7000	6/7	0·07*	12/15	20	*Second series liners
Sulzer R.S.D. 76	7/8000	5/6	0·07	12/15	21	
Sulzer R.S.A.D. 76	7/8000	6/7*	0·07	12/15	21	*Some cracked liners after 40 000 h
Sulzer R.D. 76	7/8000	6/7	0·14	12/15	21	
Sulzer R.D. 90	7/8000	?	0·11	10/12	22	
Stork H.O.T.L.O. 75/150	8/9000	3/3½*	0·06	10/12	12 and 19	*On account of blowby
Stork H.O.T.L.O. 75/160	8/9000	3/3½*	0·06	10/12	12 and 19	*On account of blowby
Stork H.O.T.L.O. 90/170	?	?	?	12/15	14 and 19	
M.A.N. K.Z. 78/140A	6/7000	4½/5½*	0·10	12/15	16 and 20	*On account of blowby
M.A.N. K.Z. 78/140C	6/7000	4½/5½*	0·10	12/15	16	*On account of blowby

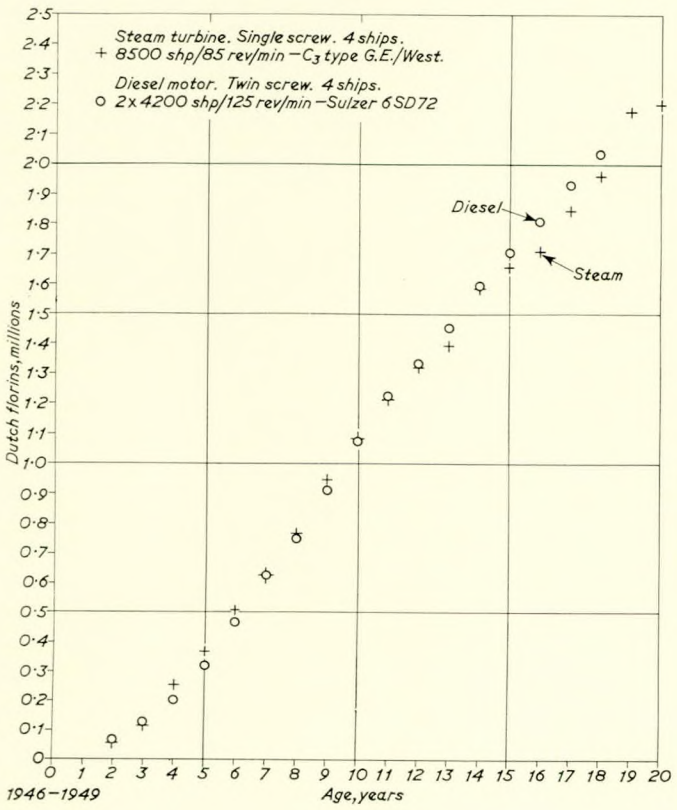


FIG. 4—*Engine room maintenance costs over a period of twenty years*

the power range up to 10 000 bhp. Although the author is not in a position to show a similar comparison for the higher power ranges, for instance 20 000 bhp or even higher, it is his opinion that the result would be the same.

A point that will count more and more in the future will be the kind of maintenance that the main propulsion installation will require. In particular, the amount of dirty work and degrading cleaning jobs should be reduced. For the cleaning of scavenge air spaces, pistons and exhaust spaces, special methods will have to be developed, as for instance mechanical cleaning, chemical cleaning and waterwashing. Some of these methods will have to be incorporated in the design of the Diesel engine.

Regarding the steam turbine installation, it is the cleaning of the gas path in the boiler which sometimes proves to be an almost impossible and in any case highly unpleasant job.

Another way to ease maintenance, which is getting more attention lately, is to ensure the accessibility of all components that need regular inspection and overhaul. In this respect the designers of propulsion machinery are urged to incorporate in their design for the unmanned engine room all the control and alarm instruments, with the necessary wiring, and not to add these afterwards.

And last but not least, an important factor in reducing maintenance cost is the need to avoid overrating the performance of the main propulsion unit. Shipowners who do not estimate the manufacturers' ratings very intelligently, soon find themselves involved in serious maintenance problems.

AUTOMATION

Study and analysis of the work of engine room personnel have led to the conviction that many, if not all, watchkeeping duties could be performed by control engineering and alarm equipment. Extensive experience already gained in shore practice has proved that in many cases regulating and controlling instruments can perform certain duties better than the hand operation of a watchkeeper.

Much has been written and said about the complex of

mechanization and regulation, control and alarm equipment usually called "automation". Experience has shown that its use on board ship is highly appreciated by engineer officers. Now they are even stimulating its extended use. When automation was first introduced, there was considerable diversity of opinion as to the extent to which it should be used, which is quite a normal reaction to new developments. Now the various attitudes are settling down; shipowners and their staffs realize that one should not install more equipment than is really necessary.

In Holland, very satisfactory co-operation between Government and shipowners has resulted in a list of minimum requirements for one-man and unmanned watches for Diesel engined ships as well as for steam turbine ships. Further, a "check list" for the regular controlling of the required equipment has been produced. Also, the various Classification Societies have now laid down their rules for automated ships. However, in spite of all these rules, the shipowner must himself select the particular make of equipment. Experience gained in shore-based industry often proves insufficient for shipboard use. There really seems to exist a need for a good instrument evaluation institution. Shipowners can ask the various research institutions to assist, which is actually done, but it seems to be difficult to simulate ship conditions satisfactorily in a laboratory.

The author was pleased to learn that Lloyd's Register of Shipping is setting test specifications to meet the need for approved control engineering equipment. On the other hand, the best testing ground is found in the ship itself, but experience gained in this way is normally confined to the company concerned. International meetings such as this one organized by the Institute of Marine Engineers are extremely helpful in creating the necessary international exchange of experience and discussion as to future developments.

The amount of "automation" that is needed for the two main propulsion types, i.e. Diesel engine and steam turbine, differs considerably. In particular, the correct regulation and control of steam generating plant under all conditions are especially difficult problems. With the modern steam turbine plant, where in order to get the most attractive fuel ratings very complex and vulnerable systems are created with reheat and main auxiliaries on bleed steam, automation becomes a major design problem that affects safety, reliability, maintenance and manning. The Diesel engine installation has proved to be an easier problem to solve and quite a number of Diesel engined ships are now operated with engine rooms equipped to allow for their being periodically unmanned.

SAILING SCHEDULE

The development of modern methods of transport has also revolutionized sailing schedules. For the new containership, barge carrier and roll-on roll-off ship, high service speeds and minimum time in port are essential. This means that main engine availability must be of the highest order and stoppages at sea negligible. The effect of delays is not only very expensive, but it may upset the complete organization and have far reaching consequences. It is therefore a necessity to know in the predesign stage exactly the time in port that will be available for maintenance work, because it may have a decisive influence on the selection of the main propulsion unit.

A similar situation exists in regard to the very large tanker. In this trade it is mostly forbidden to work on the main engine during loading or discharging. And if one realizes that lost time for these ships means loss of income of about £300 per hour, the importance of main propulsion availability is clear.

From experience, the author would suggest that main propulsion availability of the steam turbine ship is greater than for the motor ship. Moreover, the propulsion power requirements of these ships will be above 25 000 bhp. For the Diesel engine this means a larger number of cylinders, which makes increased maintenance inevitable.

Diesel Engines: Direct Drive and Multi-engine Installation

After the second world war, the research of Mr. John Lamb gave the final impetus to the use of heavy fuel in the low speed Diesel engine. A couple of years later supercharging of the Diesel engine with exhaust gas turbines came into practical use.

These developments made the low speed Diesel engine a formidable opponent of the steam turbine. With the exception of the U.S.A. the Diesel engine conquered the marine field to a very large extent. The reasons are obvious. The total cost for fuel and lubricating oil are at least 15 per cent lower for the Diesel engine installation; and the other cost factors such as maintenance, crew and investments are equal or lower. Moreover, the Diesel engine installation is quite simple to automate for periodically unmanned engine room operation.

Statistics show that of all ships built after 1965 in the power range 4000–20 000 bhp, 99 per cent were Diesel engined ships. This tendency would certainly continue to the highest required powers if this were possible and if no other considerations were involved. First, there is the limitation of the power output. Although the power output of the large-bore Diesel engine has risen to somewhere between 3000–4000 bhp per cylinder, it is prudent to use only 75–80 per cent of this power. Secondly, the sailing schedule and/or availability requirements are so stringent that it is doubtful if the direct drive Diesel engine can perform these exacting duties without penalties in lost time. Then there is the problem of the maximum horsepower that can be absorbed by a propeller with limited dimensions, as for the container-barge type vessel, or the influence of propeller efficiency in regard to revolutions if dimensions are not restricted. In these cases propulsion machinery with gearing will give a much wider choice than the large bore Diesel engine.

A solution for some of these problems may be found in choosing a twin-screw installation with its higher first cost, increased complexity and maintenance burden, etc.

So far only the low speed direct drive Diesel engine has been considered, but now the multi-engine medium speed Diesel installation requires attention. In the last ten-year period an interesting development in this field has been noticeable. The advantage of the multi-engine installation as regards lower first cost, weight and space requirements are well known and will certainly ensure the future of these installations. On the other hand, whether the medium speed Diesel engine will replace the low speed is doubtful. Although some very promising results have been obtained, there is insufficient proof that the medium speed Diesel engine can consume heavy fuel as reliably as the low speed Diesel. Further, it must be realized that for the same output one needs approximately six times as many cylinders as for the low speed Diesel engine. Apart from the greater number of failure possibilities, this means a heavy burden on maintenance and consequently on personnel. In the author's opinion, such a development would not contribute to the improvement of shipboard conditions.

In the years before the second world war, at which time also larger powers were required, multi-engine installations were developed. The author is familiar with one of the more outstanding examples, which is installed in a passenger vessel. This installation is a masterpiece of engineering with an unprecedented record of flexibility and of the availability of the main propulsion unit. The maintenance burden became a heavy one indeed when the ship's schedule had to be changed and the original arrangement by which a week was available for maintenance work at each of the terminal ports, was reduced to a week or less at only one of them. Only by careful route planning, using as few engines as possible while still keeping to schedule, was it possible to keep to the timetable.

It may be that the author is a little prejudiced, but it is his strong belief that the multi-medium speed Diesel engine installation for the propulsion of the advanced container ship or large tanker can only be considered if sufficient spare units are installed and sufficient maintenance personnel can be employed, or if the sailing schedule is very easy.

Steam Turbine Installation

In the previous section it has been explained why the steam turbine lost its hold as prime mover for the dry cargo vessel. The only fields of application where the steam turbine can maintain itself are the following:

a) Where horsepower requirements are outside the

possibilities of the direct-drive Diesel engine;

b) Where main engine availability is a primary requirement.

In the meantime manufacturers of steam plants have developed the steam turbine installation enormously and are now offering installations with fuel consumption below 180 g/bhp. Improvements have been made in practically all components of the installation, boiler, turbine and gearing. To provide the lowest fuel consumption figures, designers introduced multi-stage feedwater heating, one boiler, reheat cycles, bleed steam for various auxiliaries, etc. On account of maintenance, manning problems and safety, it is doubtful whether one should ask for this maximum efficiency. But even with less sophisticated heat cycles and lower boiler efficiencies, the improvement of the steam turbine installation is remarkable. This development came together with the realization of the mammoth tankers and the very fast container ship. Ships like these require extremely large propulsion horsepowers and machinery availability of the highest order; so here the steam turbine has the advantage, also as regards its great flexibility in the choice of propeller revolutions.

Maintenance of the steam turbine installation differs considerably from that of the Diesel engine, requiring much less routine inspection. The critical part is usually the steam raising plant. The modern membrane wall type boiler has practically eliminated exposed refractory material. It would be necessary to incorporate in the design special cleaning facilities for the gas path. The smaller number of routine inspections would probably be balanced by the greater difficulty of rendering the complete steam plant automatic under all conditions, especially when manoeuvring. It might therefore be worth while to consider remanning the engine room at these times.

In the turbine propulsion system, the gas turbine can also be incorporated. Recent developments of this kind of prime mover, using aviation experience and equipment, have been very interesting, especially in the higher power ranges. However, until now, fuel rates and in particular the special fuel requirements, have prevented the use of this type of propulsion and will limit its use.

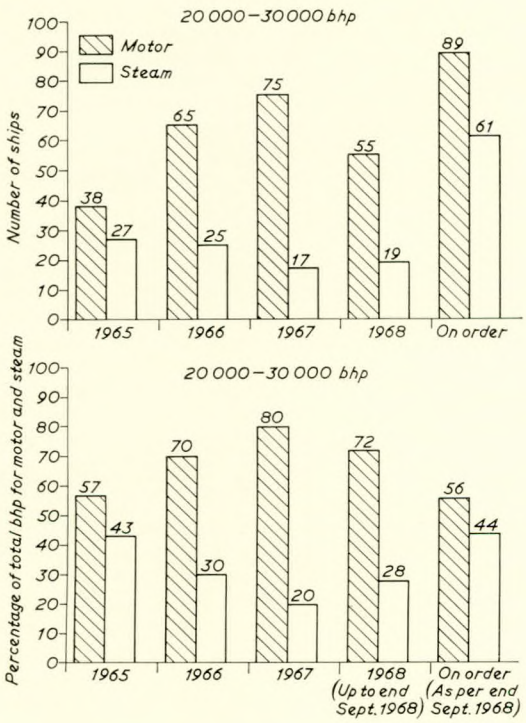


FIG. 5—*Comparison between motor and steam ships with propulsion power above 20 000 bhp, delivered between 1965 and 1969*

SUPPORTING STATISTICS

In order to support the opinions expressed in the foregoing sections, some statistical information has been compiled

As already stated, in the horsepower range up to 20,000 bhp, 99 per cent of all ships built after 1965 were equipped with Diesel engines for main propulsion. More interesting however, is what happened in the 20 000–30 000-bhp range. In Fig. 5, a comparison is made of the number of steamships and motorships delivered between 1965–1969 and the percentages of the total horsepowers delivered during this period are compared.

In Fig. 6, steamships and motorships now on order, with

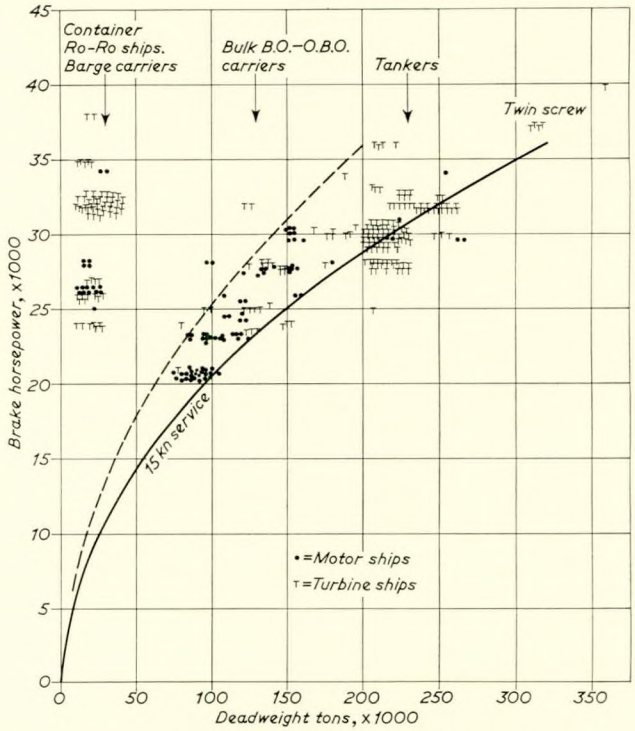


FIG. 6—*Ships on order at the end of November 1968 with propulsion power above 20 000 bhp*

horsepowers of 20 000 bhp and above, are plotted on the base of their deadweight tonnage. On noting the types of these ships, some very interesting facts emerge, which may provide proof for opinions expressed earlier in the paper. In Fig. 6 these types are indicated; and it can be seen that there is a definite preference for steam turbine installations for the container-barge carrier and the tanker. Probably the machinery availability has counted heavily in favour of this type. Of the motorships, it seems that the largest group are the bulk and ore carriers. This type of ship spends more days in port in which maintenance on the main propulsion unit is possible. For the very high powers, 32 000 bhp and above, the steam turbine is the dominant choice.

CONCLUSIONS

The views of modern management on ship operation have led to the creation of research organizations within shipping companies, and these assist in the selection of new types of ship and their main propulsion units.

Main propulsion units should not be selected on their fuel consumption only; reliability, ease of automation, availability, maintenance and manning may each or all have a decisive influence.

For dry cargo ships, which usually have sufficient time in port, the direct-drive low speed Diesel engine is economically superior to the steam turbine in the power ranges to 20 000 bhp.

In the power ranges above 20 000, a general prediction cannot be made as the above-mentioned factors have to be studied carefully; but the development of the steam turbine installation

will lead to a preference for this prime mover in the higher power requirements of 30 000 bhp and above.

ACKNOWLEDGEMENTS

The author wishes to express his gratitude to the Board of Directors of the Royal Rotterdam Lloyd for their permission to use Company information and to thank all those who assisted in compiling the various data.

REFERENCES

There are too many papers and publications dealing with the subject to allow of a list of references. The author would prefer to refer only to *The Transactions of the Institute of Marine Engineers*.

Statistics were obtained from Lloyd's Register of Shipping, *The Motor Ship* and *Fairplay*.

Branch Annual Reports

ATLANTIC

The membership at the end of the year totalled 128.

During the year five general meetings were held in addition to the Annual General Meeting. The average attendance at lectures was 54 and a number of interesting papers were presented.

A Dinner was held on November 15th and the Annual Golf Tournament for the Howard Rogers Cup took place on June 21st at Oakfield Golf and Country Club near Halifax, N.S. The trophy winner was Mr. J. Green.

In August a most enjoyable picnic was held on MacNabs Island in Halifax Harbour for members and their families.

The Branch has lost the services of Mr. J. Hornsby, Mr. D. McIntyre, Mr. F. Hicks and Mr. G. C. Johnson owing to retirement or transfer.

J. Hornsby (*Chairman*)
G. C. Johnson (*Honorary Secretary*)

BOMBAY

The total number of members in the Branch now stands at 352, an increase of 101 over the previous year.

Three technical meetings were held during the year, during which a list of papers was presented, and included two joint meetings at the Conference Hall of Scindia Steam Navigation Co., Ltd., and one in the Rainbow Room, Grand Hotel, Ballard Estate, Bombay.

Mr. M. J. Pearce, Assistant Secretary, Institute of Marine Engineers, while in Bombay met the members of the Branch at the Rainbow Room, Grand Hotel, Ballard Estate. The meeting was attended by 110 members including a member each from Calcutta and Vizag. Mr. Pearce informed the members of the position of the Institute vis-à-vis the Council of Engineering Institutions. He discussed the extent to which present and future members would be entitled to define themselves as "Chartered Engineers". He further gave details about IMAS '69 and the facilities available for block booking. He also informed the meeting that a well equipped library is maintained at Memorial Hall and members may consult by correspondence.

In February a visit to Tarapur Atomic Power Station was arranged by Mr. B. S. Sood, Chief Mechanical Engineer, Bombay Port Trust, and Vice-President of the Bombay Branch when nearly 50 members enjoyed a most pleasant and interesting trip.

It was reported that the President of India awarded the PADMA BHUSAN to Mr. M. A. Master in appreciation of his distinguished service in the cause of shipping. A function was held at the Walchand Hirachand Hall, Indian Merchants' Chamber, to congratulate Mr. Master on the conferment of this award.

The Annual Social Dinner was held at the Sarin House Mazagon Dock Ltd., Bombay. About 150 members, guests and ladies were present. The atmosphere was one of cordiality and enjoyment. After an excellent dinner, there was dancing and later an Indian classical dance was performed by Miss Shashikala W. Katre, daughter of Mr. W. K. Katre, which was enjoyed by all.

In concluding the meeting the Committee wished to express their thanks to the various members of the Institute who devoted their valuable time to help the Branch in all matters and in particular to Messrs. Ericson and Richards, Bombay, for the use of their office premises, and Messrs. Scindia Steam Navigation Co. Ltd. who made available their Conference Hall for the Branch's technical meetings.

S. C. Sundaram (*Chairman*)
T. S. Rajan (*Honorary Secretary*)

NORTH EAST COAST

The total membership of the Branch stands at 1161 members of all grades.

Six technical meetings were held during the year. Attendance at these meetings has been satisfactory.

The Annual Dinner and Dance was held at the Gosforth Park Hotel, Newcastle-upon-Tyne. This was a very successful evening and greatly enjoyed by all present.

Three golf meetings took place during the year, the Spring meeting at Foxton Hall Golf Club, the Autumn meeting at Ponteland Golf Club and a match at Seaton Carew, Hartlepool. The Branch's Section were winners for the first time since 1964.

The Committee wish to express their appreciation of the services of the retiring Chairman of the Golf Section, Mr. A. J. S. Bennett, M.B.E., and to welcome the new Chairman Mr. J. Loveridge. They also wish to express appreciation of the services of the Golf Section Secretary, Mr. J. D. Hugill who will continue to serve in this capacity and Mr. D. Costar will serve as Treasurer.

During the year Mr. C. Wappett retired as Social Secretary of the Branch and appreciation has been recorded for the wonderful work he has done for a number of years. Mr. A. E. Dean has been elected to succeed him.

Thanks were extended to Mr. A. J. S. Bennett, M.B.E., for the work he has done in arranging Junior Lectures at the South Shields Marine and Technical College, and to Mr. W. A. Jones for devoting time to meeting and entertaining Lecturers prior to the Branch's meetings and also the University of Newcastle for the use of the Lecture Theatre and Committee Room.

The Branch wish to thank the retiring Chairman, Mr. J. F. Butler, M.A., for the excellent work he has done during the last two years.

J. F. Butler (*Chairman*)
T. Matthews (*Honorary Secretary*)

OTTAWA

At the end of 1968 the Ottawa Branch membership stood at 83, an increase of 9 over the previous year.

Five technical meetings were held during the year. Attendance at these meetings has been satisfactory, being of the order of 35. On several occasions the Branch had the pleasure to welcome guests whose professional speciality was related to the papers presented at the meetings.

The Annual Cocktail Party was held on 9th May and was considered an outstanding success.

On 27th May the Branch had the pleasure of entertaining Captain W. S. C. Jenks, O.B.E., R.N. (Chairman of Council) and Mr. J. Stuart Robinson, M.A. (Director and Secretary of the Institute) and their wives. Members enjoyed the company of the distinguished guests and congenial informality set the tone for this most enjoyable party which was held in the wardroom of the Carleton Club by kind permission of the Commanding Officer. During the year the Branch continued to use the facilities of the Bytown Officers' Mess for all of its business and social affairs.

The Branch wish to express their regret over the death of two members, Mr. B. S. B. Boyce and Mr. G. V. E. Steel.

F. Harley (*Chairman*)
J. R. E. Clark (*Honorary Secretary*)

ST. LAWRENCE

The past year proved quite a successful one and the Executive Council was particularly active. The Branch, through the untiring efforts of its Vice-President, formed close association in the C.E.I.I.C. and in so doing will no doubt do much to further the activity and prestige of the Institute.

Financially the year was generally successful although it is becoming increasingly difficult to maintain the present level of activity and desired excellency under the existing financial arrangements. It is only due to the extreme diligence of the Treasurer that the Branch is able to continue in solvency.

Six technical meetings were held during the year.

One of the highlights of the year was the visit of Captain W. S. C. Jenks, O.B.E., R.N. (Chairman of Council) and Mrs. Jenks, Mr. J. Stuart Robinson, M.A. (Director and Secretary of the Institute) and Mrs. Robinson. The reception in their honour was very successful and well attended.

The Annual Dinner Dance was most successful. This is now well established as an annual social event and is a tribute to the enthusiasm of the Social Committee which makes it possible.

Mr. R. Morrison has retired as Honorary Secretary and will continue to serve on the Committee; Mr. L. Kenny has been appointed as his successor.

Mr. Findlay has been chosen by the Executive Council to represent the Branch at IMAS LONDON 1969, and it is felt by the Council that this selection is a particularly good one.

Mr. K. C. Hamilton has accepted the Chairmanship for 1969, with effect from 27th January.

T. R. Bradley (*Chairman*)
L. Kenny (*Honorary Secretary*)

SYDNEY

The total number of members residing in New South Wales and the Australian Capital Territory, the area covered by the Sydney Branch, now stands at 416, e.g. an increase of 16 over the previous year.

Five technical meetings were held, during which a number of extremely interesting papers were read and included a joint meeting with the Royal Institution of Naval Architects.

The Annual Students' Meeting was held in June, when 39 students attended and a paper entitled "Lloyd's Register of Shipping" was presented by Mr. H. Gerrard, C.Eng., M.I.Mar.E., Principal Surveyor for Australia, Lloyd's Register of Shipping.

In September, Mr. A. N. Grieves, C.Eng., M.I.Mar.E., was nominated and unanimously elected to represent the Sydney Branch at the IMAS Conference in London.

In November, Committee members had the opportunity of discussing matters affecting the Institute, and in particular its future development in the southern hemisphere, with Captain W. S. C. Jenks, O.B.E., R.N. (Chairman of Council), Mr. B. Hildrew, M.Sc. (Vice-Chairman of Council) Mr. J. Stuart Robinson, M.A. (Director and Secretary of the Institute) and Mr. M. J. Pearce (Assistant Secretary Administration) during their visit from London. This visit and opportunity for discussion were much appreciated.

In December an inspection of the refrigerated cargo ship *Port Caroline* was arranged with permission of Joint Cargo Services Ltd. and was well attended by members who were afterwards entertained on board.

The Annual Dinner was held on 7th November when members and their wives had the pleasure of meeting Captain W. S. C. Jenks, O.B.E., R.N., Mr. B. Hildrew, M.Sc., Mr. J. Stuart Robinson, M.A., Mr. J. Pearce, Professor Mitchell, Sir Leslie Rowan, Mr. Tuft, Mr. Aldis, Admiral F. Purves and Mr. J. Thomason. The toast "The Institute" was proposed by Professor Mitchell and Captain Jenks replied. Mr. C. Bie proposed the toast "Our Guests" and Mr. Hildrew replied on behalf of the guests. Approximately 140 attended this successful function at the Wentworth Hotel.

In September a most enjoyable Buffet Dinner and Dance was held aboard m.v. *Australasia* attended by about 90 members, wives and guests.

Other social events included a luncheon for the London officers at the Royal Sydney Yacht Squadron and a Barbeque dinner, also with London officers and interstate visitors, at "Kenilworth" hostel for Marine Engineering Cadets. On their return from New Zealand Mr. J. Stuart Robinson and Mr. Pearce were farewelled at an informal luncheon at the Rugby Union Club.

C. Bie (*Chairman*)
W. F. Ellis (*Honorary Secretary*)

Branch Annual General Meetings

Home

NORTHERN IRELAND

The Annual General Meeting was held at Belfast College of Technology, Millfield Building, on 18th February 1969. Mr. D. H. Alexander took the chair. Apologies for absence were received from Messrs. C. C. Pounder and R. L. Atkinson.

The Chairman, in his opening remarks, reviewed 1968, the first year of operation as an official Branch. The Financial Statement and the Annual Report were read by the Honorary Secretary and both were formally approved.

Sections of the Rules relating to the Branch formation were read from the Institute's Royal Charter and By-Laws for the benefit of members in attendance. This was followed by an announcement of the nominations for additional Committee members, as per nomination papers recently circulated. The Chairman explained that, since only four nominations were received, and the Committee being anxious to increase its numbers, these four nominations were being elected "en masse" and no ballot was, therefore, being held.

The Committee for 1969 is as follows:

Local Vice-President and Chairman:	D. H. Alexander, O.B.E., F.C.G.I., M.Sc.,Wh.Sc.
Vice-Chairman:	C. C. Pounder (Past President)
Committee:	R. L. Atkinson
	J. B. Baillie
	A. Beck, B.Sc.
	A. W. Brew
	E. E. Hopkins
	J. Skeats
Honorary Secretary:	S. K. Reid
Honorary Treasurer:	J. Sloan

The time and venue of Lecture presentations were discussed, members deciding that the venue remain unchanged, but time for future meetings be changed to 6.30 p.m. with tea served from 5.30 p.m. Four meetings should be the target. The Honorary Secretary should investigate the possibility of circularizing corporate members with copies of the Provisional Papers Programme 1969/70; and investigate also the possibility of delivering to members with the notification post-cards, an advance copy of the lecture notes.

It was decided that the new members of the Committee, currently attached to Harland and Wolff's, would open proceedings regarding the possibility of compounding the Branch Annual Golf Outing with that of Harland and Wolff and arranging a tour of the new building dock for members of the Branch.

The Chairman introduced Mr. David B. Glover, the Branch Nominee for the Lloyds Register of Shipping Competitive Award.

A vote of thanks to the Chairman and Committee was formally proposed by Mr. Dickinson and there being no further business, the Chairman declared the Meeting closed.

NORTH MIDLANDS

The Annual General Meeting was held on 12th February 1969, at the Sheffield Industries Exhibition Centre, Carver Street, Sheffield 1. Mr. G. Prentice, Chairman of the Branch, was in the chair, 20 members attending. The Annual Report and Financial Statement were presented and approved.

Mr. G. Prentice, retiring Chairman, introduced the new Chairman, Mr. M. G. Cokayne, and thanked the Honorary Secretary and Honorary Treasurer and the members of the Committee for the help received during his term of office.

Thanks to the retiring Chairman were proposed by Mr. H. V. Campbell and carried by acclamation.

The new Chairman mentioned that due to Mr. F. H. Soppitt leaving the Branch there was a vacancy for a branch representative on Guild of Benevolence and Mr. M. J. W. Batey agreed to accept this post.

The constitution of the Committee for 1969/70 is as follows:

Chairman	G. Cokayne
Committee:	H. V. Campbell
	P. E. Guymer
	A. M. Jarvis, B.Sc.
	A. J. Lazenby
	G. Prentice
	J. C. Proudfoot
	P. A. Sparrow
Honorary Secretary:	G. Wilkinson
Honorary Treasurer:	Y. Arakie

Following the Annual General Meeting a lecture on the history and development of methods for cold repairs of castings and other industrial equipment, was given by Mr. Mortimer of Metalock Ltd., Yorkshire. The lecture was followed by the presentation of a colour film "The Flying M" demonstrating the actual repairs carried out on a power press, together with a number of unique repair techniques.

The questions which followed were answered by Mr. Mortimer, who produced a photographic "casebook of repairs" for members' inspection.

Thanks were extended by Mr. Cokayne to Mr. Mortimer for the presentation of an extremely interesting talk. This was followed by a round of applause and the meeting closed to enjoy a cocktail party.

SCOTTISH

The Annual General Meeting was held on Wednesday, 12th February 1969, at the University of Strathclyde, Glasgow, at 6.15 p.m.

Mr. A. Campbell, B.Sc., Chairman of the Branch, presided at the meeting. After the Annual Report and Statement of Accounts had been presented and approved, the Chairman thanked the Committee for the support they had given him during the past year. Mr. Campbell also expressed his thanks to Mr. L. D. Trenchard for his work as Honorary Secretary, to Mr. J. D. B. Mundie as Honorary Assistant Secretary and to Mr. R. Marshall as Honorary Treasurer.

Messrs. L. D. Trenchard, J. D. B. Mundie and R. Marshall were duly elected as Honorary Secretary, Honorary Assistant Secretary and Honorary Treasurer respectively.

The Chairman thanked Mr. H. C. Kemp and Mr. J. J. W. Bryne for their services as Auditors and they were duly re-elected.

Mr. J. M. Cochrane was re-elected as one of the scrutineers. It was with deep regret that the Chairman announced the death of Mr. David Currie who was one of the scrutineers. Mr. T. H. Smeaton was elected as second scrutineer.

The newly constituted Committee is, therefore:

Honorary Vice-President: R. Beattie

Vice-President:	E. C. Cowper
Vice-President:	W. McLaughlin
Corresponding Member, Aberdeen:	J. H. King
Corresponding Member, Dundee:	J. M. Anderson
Corresponding Member, Greenock:	J. A. Conn
Corresponding Member, Leith, and Chairman:	J. Rorke, B.Sc., Ph.D.
Vice-Chairman:	J. R. Herd
Committee:	A. Campbell, B.Sc. (co-opted)
	J. Bowes, B.Sc.
	J. J. W. Bryne
	A. Campbell, B.Sc. (co-opted)
	C. A. Creber
	R. J. Donaldson
	E. Evans
	W. B. Leitch
	B. R. McGonigal
	K. Maddocks
	G. R. Strachan, M.A.
	F. Y. Whitham
Honorary Secretary:	L. D. Trenchard
Honorary Assistant Secretary:	J. D. B. Mundie
Honorary Treasurer:	R. Marshall

There being no further business the meeting was adjourned.

SOUTH WALES

The Annual General Meeting was held at the South Wales Institute of Engineers, Cardiff, on Monday, 10th February 1969. The Meeting was opened by the Chairman at 6.00 p.m., who welcomed the 24 members present. Apologies were received from Messrs. F. R. Dale, B.Sc., A. J. Cant, D. J. Williams and J. K. Phelps.

The Minutes of the last Annual General Meeting were read by the Secretary and unanimously accepted.

The Chairman, Mr. F. R. Hartley, then read his Annual Report and conveyed his thanks to the Committee for their support during the previous year. The Report was unanimously approved, it having been proposed by Mr. David Skae and seconded by Mr. T. W. Major that the statement be accepted.

Mr. M. F. Heslop and Mr. A. D. C. Owen volunteered to act as scrutineers in the ballot for the four vacancies on the Executive Committee. Seven nominations had been received and the ballot showed for Messrs. R. Crosby, J. W. Jardine, T. W. Major and D. J. Williams.

The Committee for the year is as follows:

Honorary Vice-President:	David Skae
Chairman:	*To be elected*
Committee:	R. S. Andrew
	H. F. Close, B.Sc.
	H. J. Elworthy
	S. J. French
	N. C. James
	A. H. John
	J. K. Phelps
	R. H. Scott
	A. B. Smith
	G. S. Taylor
	D. J. Williams
	R. Crosby
	T. W. Major
	J. W. Jardine
Honorary Secretary:	G. W. Fox
Honorary Treasurer:	J. W. McMaster

The Chairman thanked the scrutineers for their services. Mr. David Skae proposed a vote of thanks to the retiring Chairman Mr. F. R. Hartley and expressed the Branch's gratitude for the conscientious manner he had shown and the work he had done during his term of office. The Meeting supported Mr. Skae's vote of thanks with warm and extended applause.

The Meeting closed at 6.45 p.m.

Following the Annual General Meeting, the Metalock organization were pleased to show their interesting colour film, "The Flying M", after which Mr. Powell and Mr. Steets showed a ready willingness in answering many queries on their process and service. Mr. Hartley in proposing a vote of thanks to Mr. Powell and Mr. Steets, thanked them for a most interesting hour. The vote of thanks was warmly supported by all present. The meeting was closed at 7.50 p.m.

WEST MIDLANDS

The Annual General Meeting of the Branch was held at the Engineering and Building Centre, Broad Street, Birmingham, on Wednesday, 19th February 1969, at 6 p.m. Captain J. M. C. Dunlop took the chair, and the meeting was attended by nine members. The minutes of the last Annual General Meeting were read and signed. The Statement of Accounts was submitted and was approved by the members present.

The Chairman thanked the Committee for the support given during the year and the help received by the retiring members, Mr. A. Fowler and Mr. G. H. Cornish, B.Eng.

In the absence of further nominations, Mr. K. H. Harrison was re-elected as Honorary Treasurer and Mr. A. Myatt was returned as Honorary Secretary. On behalf of the members, the Chairman thanked the retiring Secretary for the years of good service which he had given to the Branch and the Institute.

Nominations had been received for the two vacancies on the Committee, and as there were no further nominations, Mr. H. J. Martin and Mr. G. Connor were elected.

The newly constituted Committee for 1969/70 is as follows:

Vice-President:	H. E. Upton, O.B.E.
Chairman:	*To be elected*
Vice-Chairman:	*To be elected*
Committee:	Captain J. M. C. Dunlop, R.N.
	J. H. Gilbertson
	R. R. Gilchrist, M.A.
	R. M. Hills
	Lt. Cdr. G. C. Holland, D.S.M., R.N.
	W. H. Lindsey
	H. J. Martin
	G. G. Connor
Honorary Secretary:	A. Myatt
Honorary Treasurer:	K. H. Harrison

Reference was made to the rather low attendance at the Lectures during the year, and it was confirmed that the Committee would give urgent attention to this matter in an effort to improve.

Mr. G. H. Cornish, B.Eng., proposed a vote of thanks to Captain J. M. C. Dunlop, R.N., for taking the Chair due to the absence of the Chairman.

There being no further business, the meeting was adjourned.

WEST OF ENGLAND

The Annual General Meeting of the Branch was held on 3rd March 1969, in the Engineering Lecture Theatre, Bristol University.

The Minutes of the previous Annual General Meeting were read and adopted.

Mr. R. Yarr, C.Eng., M.I.Mar.E., was elected Chairman of the Branch. This motion was carried out unanimously on the proposal by Mr. J. V. Fry, seconded by Mr. A. H. Whitlow.

The newly formed Committee is, therefore, as follows:

Local Vice-President:	F. C. Tottle, M.B.E.
Chairman:	R. Yarr, C.Eng., M.I.Mar.E.
Vice-Chairman:	J. E. Gander

Committee:	D. C. Burgess
	J. V. Fry
	Capt. A. A. C. Gentry, R.N.
	G. T. Hughes
	T. A. Mogg
	A. G. A. Muirhead
	W. H. Sampson
	R. C. Thomas
	J. P. Vickery
	A. H. Whitlow
Honorary Secretary:	R. Ellis
Honorary Treasurer:	D. J. Macintosh

Mr. W. H. Sampson was elected to represent the Branch on the local C.E.I. Committee.

Mr. C. W. J. Stow, who has retired from the Committee will continue serving the Guild of Benevolence.

The Annual Report and Financial Statement were presented and approved.

A vote of thanks to the Chairman was proposed by Mr. R. Knapp for the valuable work he had done during the year. Thanks were also extended to the Local Vice-President by Captain A. A. C. Gentry, R.N.

There being no other business the Annual General Meeting ended at 8.00 p.m.

Canadian Division

ATLANTIC

The Annual General Meeting was held on 17th January 1969, at the R.C.N. Dockyard Management Association Building, Halifax, N.S. The meeting opened at 8.00 p.m. with 26 members present.

The Annual Report and Financial Statement were read and approved unanimously.

The Chairman, Mr. G. Hornsby, called for two scrutineers to count the votes in the ballot and Mr. R. Smythe and Mr. A. Cain were proposed and appointed. Due to be replaced by reasons of transfers and retirements were the Honorary Secretary, Mr. G. C. Johnson, and Committee Members Messrs. J. Hornsby, F. Hicks and D. McIntyre.

There being no nomination for the office of Honorary Treasurer, Mr. H. R. Macpherson was duly re-elected.

The retiring Honorary Secretary, Mr. G. C. Johnson, then read the Information Bulletin concerning the IMAS 1969 Conference and following this, introduced Mr. T. M. Pallas, B.Eng., Secretary for Canadian Affairs, who addressed the meeting with reference to the Conference and future outlook of the Institute.

The meeting then proceeded with the election of the new committee.

The constitution of the Committee for 1969 is as follows:

Local Vice-President:	Cdr. V. F. O'Connor, C.D., B.Sc., R.C.N.
Chairman:	Lt. Cdr. H. C. Ashcroft, R.C.N.
Committee:	M. R. Evans
	D. C. Flamank
	T. R. Forsythe
	J. Mitton
	K. Nicol
Honorary Secretary:	B. D. Lawson
Honorary Treasurer:	H. R. Macpherson

The Chairman then called on the Local Vice-President to present each of the retiring Committee Members with a small brass model dory, as an appreciation of their service to the Branch.

The retiring Honorary Secretary, Mr. G. C. Johnson, was also presented with a pewter beer tankard, in recognition of his invaluable service to the Branch since January 1963.

The meeting adjourned at 10.45 p.m. after a vote of thanks was given for the use of the D.M.A. facilities.

EASTERN U.S.A.

The Branch met to elect their Committee members in April 1969. A further meeting was held on the 7th May to elect the Chairman.

The Committee is, therefore, constituted as follows:

Chairman:	R. T. Young
Committee:	J. S. Low
	N. McAskall
	P. V. Meulengracht
	F. Milsom
	C. K. Stevenson
Honorary Secretary:	V. W. Bugg
Honorary Treasurer:	R. Imlah

GREAT LAKES

The Annual General Meeting was opened at 8.30 p.m. with Mr. R. C. H. Reed as Chairman. The meeting was held at George Brown College, 21 Nassau Street, Toronto, Ontario. Twenty-nine members attended.

The meeting was preceded by a dinner served by the training staff at George Brown College.

It was moved by Mr. G. White and seconded by Mr. L. D. McBean that the Minutes of the meeting of 21st November be adopted as written. The motion was carried.

It was decided that a social evening be held in early March at the Holiday Inn at Oakville, if the space were available.

The Chairman appointed Mr. L. D. MacArthur and Mr. T. C. D. Mordecai to audit the Treasurer's Report. The Honorary Treasurer, Mr. E. Bustard presented his report and was moved by Mr. G. Fowlie, seconded by Mr. A. K. Basu that the Report be adopted. The motion was carried.

Mr. A. Parkinson and Mr. M. Painter were appointed as election Scrutineers and the results of the ballot were announced with the two new Committee members being Mr. W. Dixon and Mr. G. White.

The Committee is, therefore, as follows:

Local Vice-President:	G. P. Fowlie
Chairman:	D. G. Champion
Vice-Chairman:	J. E. Jackson
Committee:	W. Dixon
	D. McDonald
	G. White
	A. Williams
Honorary Secretary:	G. W. R. Corbin
Honorary Treasurer:	E. E. Bustard

Mr. D. G. Champion was nominated to succeed Mr. R. C. H. Reed whose term of office had expired as Chairman.

A discussion took place regarding more publicity for the Great Lakes Branch. Mr. R. Beverage consented to take over this part of the activities.

Mr. G. White consented to serve on the Scholarship Committee.

A lively discussion was held regarding support of the C.E.I., and what discussions should take place at the IMAS Conference in London.

Finally it was moved by Mr. G. White, seconded by Mr. L. D. McBean that the meeting be adjourned.

NEWFOUNDLAND

The Annual General Meeting was held at the Shriner's Club, St. John's, Newfoundland, on 23rd January 1969. The meeting started at 9.00 p.m.

The Minutes of the last Committee meeting were read and adopted.

A letter from Mrs. M. Maude Salt and a cheque to cover the H. Stuart Salt Award for 1969 was read and passed to the Treasurer.

A copy of a letter from Mr. T. M. Pallas, Chairman—Prize and Awards Committee to the Director and Secretary of the Institute in London was read and filed, together with a letter from Mrs. B. Baker, Administrative Officer, London.

A letter from Mr. T. M. Pallas dealing with matters to be brought up at the Conference was read and discussed. It was moved by Mr. G. Garland, seconded by Mr. I. Causer and carried that a letter be forwarded to inform him that the Branch agreed with the sentiments expressed.

It was moved by Mr. J. Noel, seconded by Mr. A. Whiteway and carried that Mr. L. A. Johnson, O.B.E., be nominated the Branch's delegate to attend the IMAS Conference in London.

A letter from Mr. T. M. Pallas, was read and filed. The Secretary was asked to inform Mr. Pallas of the transfer of Mr. L. G. Garland, from the St. John's Office of Canadian Steamship Inspection to Marystown, Placentia Bay, Newfoundland as Senior Canadian Steamship Inspector, with effect from 10th February 1969.

The Annual Report and Financial Statement were read and approved.

The Chairman appointed Mr. J. W. Noel and Mr. H. Carey as auditors of the Honorary Treasurer's Report.

The election of officers and Committee members for 1969 was then conducted and resulted as follows:

Local Vice-President (St. John's):	R. A. Harvey
Chairman:	L. A. Johnson, O.B.E.
Vice-Chairman:	G. F. Hayward
Committee:	H. C. Carey
	E. S. Hoskins
	J. R. Kazak
	G. P. McCarthy
	J. W. Noel
	H. Pond
	A. J. Whiteway
Honorary Secretary:	K. Harrison
Honorary Treasurer:	H. G. Evans

It was agreed that Mr. J. R. Kazak be responsible for educational activities and lectures from Engineering Instructors at Memorial University of Newfoundland.

There being no further business the meeting adjourned at 11.00 p.m.

OTTAWA

The Annual General Meeting was held on Tuesday, 14th January 1969, in HMCS *Bytown* Officers' Mess, 78 Lisgar Street, Ottawa, Ontario. Twenty members attended.

After a buffet supper, the meeting started at 6.25 p.m. The Branch Chairman, Captain F. Harley was in the chair. The Minutes of the Fourth Annual General Meeting, the Annual Report and the Financial Statement were read and approved. Mr. R. V. Smith, the Chairman of the Papers Committee, who is retiring at the end of 1969, outlined the provisional technical programme for the early part of next year, which he would pass on to his successor.

It was agreed that a social evening be held during the winter. Details will be settled by the Committee. Enquiries made by Lt. Cdr. D. J. Brown, R.C.N., had ascertained that the Civil Service Recreational Association Centre appeared to offer the best proposition for this purpose.

Election of officers was next considered. It was pointed out that there was an error in the Notice of Meeting in that nominations from the floor were not permitted by the by-laws. The Honorary Secretary had agreed to serve for a further term and the only nominee for Honorary Treasurer was Lt. Cdr. E. V. Dear, C.D., R.C.N. (Retd.). Four Committee members, Mr. C. F. Collins, Mr. R. V. Smith, Mr. J. H. Birtwhistle, and Cdr. H. G. Gillis, R.N., were retiring, as required by the by-laws. Mr. J. R. Reid and Lt. P. H. D. MacArthur, R.C.N., were appointed election Scrutineers.

Following the elections, the 1969 Committee stands as follows:

Local Vice-President (Ottawa):	Capt. R. W. Edwards, C.D., R.C.N.
Chairman:	Capt. F. Harley, R.C.N.
Vice-Chairman:	*To be elected*
Committee:	A. M. Alexander
	Cdr. K. L. Farquharson, C.D., R.C.N.
	Dr. A. Feingold
	R. G. A. Lawrence
	Cdr. K. W. Moore, M.Sc., R.C.N.
Honorary Secretary:	J. R. E. Clarke, B.A.Sc.
Honorary Treasurer:	Lt. Cdr. E. V. Dear, C.D., R.C.N.

The Chairman thanked the retiring Committee Members for their services over the past three years.

The Chairman then stressed that Branch activitites must be co-ordinated with the Canadian Division. This applied particularly in the case of the proposed brief to be included in the report of the Canadian Division to the pre-IMAS Meeting, a copy of which was enclosed with the Notice of Meeting.

Mr. Pallas, the Secretary for Canadian Affairs, outlined the IMAS Convention and in particular the business meeting, to be attended by a delegate from each Branch. He wondered about the future of the Institute, noting that the C.E.I. would set the standards for all Engineering Institutions in the U.K. and could possibly be compared to the Professional Engineers' Societies in Canada.

Captain F. Harley, R.C.N., noted a different approach to Institute membership in the U.K., where practical rather than academic training was stressed, as was the case with Lloyd's Register and the Board of Trade. The U.K. system produced highly trained technologists whose status approached, if it did not equal that of academics in Canada.

Commander Ford hinted at the difference in professional engineers' qualifications in the various Canadian provinces.

Captain Hopkins mentioned professionalism as such. He considered that marine engineers should govern themselves as professionals, as do doctors, lawyers, etc. He supported the report which accompanied the Notice of Meeting, noting that it encompassed the whole marine environment.

Mr. Stead, the Vice-President for Canada, claimed some points that had been raised in the discussion. Also, in support of the view that the range of professions attracted to the Institute should be broadened, he drew a parallel with oceanography which was a field embracing a number of disciplines. In IMCO it was now considered, for example, that its terms of reference covered not only conventional shipping, but also all "equipment operating in the marine environment". He felt that the Institute should likewise broaden its programme to attract members of associated professions.

In concluding the meeting the Chairman stated the Institute would retain its identity and its relationships with the licensing Bodies in the U.K. and Canada.

The meeting closed at 8.15 p.m.

ST. LAWRENCE

The Annual General Meeting was convened by the Chairman Mr. T. R. Bradley at 6.40 p.m. at the Board of Trade Club, 1080 Beaver Hall Hill, Montreal.

The Minutes were read by the Honorary Secretary, Mr. R. A. Morrison, and adopted on a motion by Mr. K. C. Hamilton, seconded by Lt. Cdr. C. J. J. McLauchlan, B.Sc., R.C.N.

The Chairman gave a brief résumé of the activities for 1968 noting that the year had been very active and highlighted by a visit by Captain W. S. C. Jenks, O.B.E., R.N., (Chairman of Council), J. Stuart Robinson, M.A., (Director and Secretary of the Institute).

Mr. T. R. Bradley expressed pleasure at the flow of technical papers which had been presented during the year.

Attendance at the Annual Dinner Dance had broken all records and was most encouraging.

The Chairman remarked that the financial year had been generally satisfactory.

Mr. Don L. Finlay had been nominated to represent the Branch at the IMAS '69 Conference in London and Mr. Bradley felt that this choice was a particularly good one.

It was agreed that an extraordinary meeting be held at the close of the technical discussion on the future of the Institute and Branch policy in terms of the Council meeting to take place in June.

Mr. H. A. Sledge reported that the Branch was still solvent and that the financial report was available for inclusion with the Chairman's Report to the Council.

He noted that the time was not considered appropriate for a scholarship fund. However, prizes were being awarded to the highest DOT examination candidate.

Mr. H. T. Phillips and Mr. J. Lindsay were appointed Scrutineers to check the Financial Statement.

Lt. Cdr. C. J. J. McLauchlan B.Sc., R.C.N., reported on the technical papers which had been presented during the year. It was suggested that at least five technical papers per year should be presented. On the whole, attendance at the technical meetings had been good.

Lt. Cdr. McLauchlan thanked the Committee and those responsible for organizing the technical meetings.

He drew attention to the future joint S.N.A.M.E. meeting on Self Unloaders in the Great Lakes, which was being hosted on March 12th by the Branch.

Mr. W. A. Mason reported that the Annual General Meeting had been arranged as requested at the Board of Trade Club. Consensus of opinion among members was that this was a popular spot

He reported that the joint S.N.A.M.E. meeting for March 12th would be held in the International Salon on the 4th floor, of the Board of Trade Club.

In closing his report he thanked Mr. T. Ross who, as a member of the Board of Trade Club, had allowed his name to be used for arranging the site for meetings. Thanks were also extended to Mr. A. Sodhi for his joint help in meeting arrangements.

On a motion by Mr. K. C. Hamilton seconded by Mr. H. A. Sledge the above reports were accepted and adopted.

The Chairman reported that the following members were retiring from the Committee; Lt. Cdr. C. J. J. McLauchlan, B.Sc., R.C.N., Mr. W. P. Graham. He also noted that Mr. R. A. Morrison, B.Eng., was retiring from the position of Honorary Secretary.

Mr. T. R. Bradley stated that for reasons of business pressure he could not devote the time necessary to the Chairmanship and had decided to retire. He stated that he had asked Mr. K. C. Hamilton to take over as Chairman.

The Committee is, therefore, constituted as follows:

Local Vice-President (Montreal):	D. L. Findlay
Corresponding Member (Quebec):	E. G. White
Chairman:	K. C. Hamilton
Committee:	J. R. J. Boddington
	K. Bulman
	R. T. Hesketh
	R. Lyle
	W. A. McCloy
	W. Mason
	R. A. Morrison, B.Eng.
	Lt. Cdr. R. R. Richards, R.C.N.
	K. Wilson
Honorary Secretary:	L. Kenny
Honorary Treasurer:	H. A. Sledge

These appointments were accepted unanimously on a motion by Lt. Cdr. C. J. J. McLauchlan B.Sc., R.C.N., which was seconded by Mr. H. A. Sledge.

There being no other business to discuss, the meeting adjourned at 7.30 p.m.

VANCOUVER

The Annual General Meeting and Dinner was held on Thursday, 30th January, 1969, at the Sands Motor Hotel, Vancouver, British Columbia.

Mr. D. I. McGuinness, B.Sc., was in the chair.

Mr. D. U. Alexander was elected to serve on the Committee, Mr. R. W. Brown and Mr. N. Sisgworth were re-elected to the office of Honorary Secretary and Honorary Treasurer respectively.

The Committee for 1969 is as follows:

Local Vice-President	R. G. Boomer
Chairman:	D. I. McGuinness, B.Sc.
Committee:	D. U. Alexander
	P. Dale
	L. T. Midford
	A. L. Plint
	A. C. Ritchie
	J. Watson
Honorary Secretary:	R. W. Brown
Honorary Treasurer:	N. Sigsworth

Mr. D. I. McGuinness introduced Mr. J. D. Gillis, Public Relation Assistant of the White Pass and Yukon Route, who gave an introductory talk and then presented a film entitled "Frontier Buster". Mr. Gillis stated that as far as he knew the White Pass and Yukon were the first in the world to start shipping with containers. The discussion period was enjoyed by all, everyone gaining knowledge of the North Country.

There being no other business, the meeting was adjourned.

VANCOUVER ISLAND

The Annual General Meeting was held in the Dockyard Officers' Club, H.M.C. Dockyard, Esquimalt, B.C., on Thursday, 13th February, 1969.

The meeting under the chairmanship of Cdr. K. E. Lewis, C.D., R.C.N., Local Vice-President, opened at 8.00 p.m. The Chairman welcomed the members present and introduced Lt. Cdr. W. R. Hayes, C.D., R.C.N., a prospective member. Cdr. K. E. Lewis explained that due to the adverse weather conditions it had been necessary to postpone the Annual General Meeting to this date.

The minutes of the 1968 Annual General Meeting were presented, and adopted as written. There was no business arising from the Minutes.

Reports of officers were presented as follows:

Cdr. K. E. Lewis, C.D., R.C.N., Branch Local Vice-President commented on his appointment as Local Vice-President and asked the members for their support during the ensuing year. The report was adopted.

Mr. E. W. Phillips, Branch Chairman of the Committee, reported that seven Committee Meetings had been held during the year covering business transaction of the Branch. He thanked the Committee members for their support during the year and looked forward to a successful season. Mr Phillips moved adoption of the report seconded by Lt. Cdr. L. G. Copley, R.C.N., (Ret'd).

In the absence of the Honorary Treasurer, the Honorary Secretary presented the Financial Report, and the Annual Report covering all business matters for the year. The Honorary Secretary moved adoption of the Report duly seconded by Mr. W. White. Due to the absence of Cdr. J. S. Osborn, R.C.N., (Ret'd), Chairman of the Awards and Prizes Committee, the report was read by the Honorary Secretary. This comprehensive report covered a series of specific recommendations and in the absence of Cdr. Osborn, was passed to the Committee for perusal and necessary action.

It was agreed that the Annual Dinner be held again on 17th April, 1969, and arrangements be made with the CFB Mess, Esquimalt, B.C.

The Honorary Secretary moved that letters of appreciation and thanks be forwarded to the Master Attendant, H.M.C. Dockyard for arranging clearance at the Dockyard Main Gate and parking facilities, and to the President of the Dockyard Officers' Club for the use of the Club facilities for meetings, with a further request for continuance during the ensuing season. The motion was seconded by Mr. W. Phillips and was adopted.

The International Marine and Shipbuilding Conference was discussed and Cdr. Lewis was elected as representative member for the Branch and it was agreed that the delegate appointed be briefed as to the requirements relative to this important Conference.

There being no further new business election of officers and Committee members was raised.

In accordance with the Branch practice the Honorary Secretary read Article 6 of the by-laws covering resignations and eligibility for re-election for Honorary Secretary and Honorary Treasurer. The Honorary Secretary and Treasurer tendered their resignations.

On the final resignation of the Honorary Secretary, no nominations were received for this position. After much discussion Mr. J. McPherson agreed to remain in office until a suitable replacement was available.

Mr. G. W. Holme, Honorary Treasurer and Mr. A. M. Galbraith, Recording Secretary were elected by acclamation.

Cdr. Osborn and Lt. Cdr. Copley were warmly thanked for their effort and the good work they had done over the last three years.

The Committee for 1969/70 is, therefore, constituted as follows:

Local Vice-President (Vancouver Island):	Cdr. K. E. Lewis, C.D., R.C.N.
Chairman:	E. W. Phillips
Committee:	R. Baird
	H. B. Brett
	D. Campbell
	Lt. Cdr. M. M. Locke, C.D., R.C.N.
	Lt. Cdr. D. D. Mill, R.C.N., (Ret'd).
Honorary Secretary:	J. McPherson
Honorary Treasurer:	G. W. Holme
Recording Secretary:	A. M. Galbraith

The Annual General Meeting adjourned at 9.45 p.m. for a cheese and wine party, attended by all present.

Indian Division

CALCUTTA

The Annual General Meeting was held at the D.M.E.T. College Hall, on 20th March 1969. The meeting took place with Mr. T. K. T. Srisailam in the chair, and with a total of 54 members in attendance. The Statement of Income and Expenditure was read and approved.

Scrutineers were appointed for the election of the new Committee members.

The Chairman reported that, during the year, the Committee had met on five occasions. He also reviewed the activities of the Branch in 1968.

The total number of members registered with the Branch now stands at 165.

The Institute's India Division prizes for the best technical papers read by Students of the Marine Engineering College, Calcutta, were awarded to Cadet K. K. Dutta and to Cadet A. Prasad.

The Committee for 1969 is, therefore, as follows:

Local Vice-President:	B. Hill
Chairman:	T. K. T. Srisailam
Committee:	D. C. Agnihotri
	J. N. Chakravarty
	K. S. Chetty
	A. K. Ghoshal
	K. Kishor
	D. Madhok
	R. S. Sachdev
	G. Tye
Honorary Secretary:	J. E. D'Souza
Honorary Treasurer:	K. D. Pradham

There being no further business the meeting was adjourned.

COCHIN

The Annual General Meeting was held on 2nd March 1969, in the Blue Room, Naval Mess. Minutes of last year and Audited Accounts were read and adopted.

The results of the ballot were given. The Committee for 1969 is constituted as follows:

Corresponding Member:	P. L. D'Abreo
Chairman:	Cdr. T. V. S. Rajan, I.N.
Committee:	Lt. Cdr. C. N. V. Chalan, I.N.
	V. L. Krishnamurthy
	A. Mathew
	Lt. A. Singh, I.N.
Honorary Secretary:	K. S. Mani
Honorary Treasurer:	V. V. James

The Chairman reviewed the activities of the Branch during the year.

The Annual General Meeting was followed by a Cocktail party and Dinner which was attended by all the members and their ladies.

MADRAS

The Annual General Meeting was held at 6.00 p.m. on 8th April 1969 at the Sea-Farer's Club, Radio Road. Mr. K. Parthasarathy was in the chair. Seventeen members attended.

The Annual Report and Financial Statement was read and approved on a motion by Mr. P. C. Kumar, seconded by Mr. Kasturirangan.

Two Committee members were retiring, Mr. S. Kasturirangan and Mr. J. Matthew. Mr. P. C. Kumar was elected to fill one of the vacancies.

The Committee for 1969/70 is, therefore, as follows:

Local Vice-President	K. Parthasarathy
Chairman:	A. T. Joseph
Committee:	M. N. Arunchalam
	A. Dutta
	P. C. Kumar
	L. Iyer
	I. M. Rao
Honorary Secretary:	V. K. Desai
Honorary Treasurer:	T. S. Govindarajulu

The Chairman spoke of the "Symposium in Ship Maintenance" to be held in April/May. He also briefed the members about the preferred activities over the next year and the technical papers to be presented.

It was decided that the Annual Dinner be held in July.

There being no further business the meeting was adjourned.

Overseas

AUCKLAND

The Annual General Meeting was held on Tuesday, 25th February 1969 in the Lounge of the Marine Engineers Building at 28–30 Anzac Avenue, Buckland at 7.15 p.m. and was attended by eighteen members. The Annual Report and Financial Statement were presented and approved.

There being only two nominations for the two vacancies on the Committee these members were duly elected to office.

The Committee for 1969 is as follows:

Local Vice-President and Chairman:	H. Whittaker
Committee:	J. M. Bray
	W. S. T. Dowse
	N. J. B. McDougall
	C. J. Olliver
	B. Pacey
	Eng. Cdr. G. W. Shotter, O.B.E., R.N.Z.N.

Honorary Secretary:	C. S. Harnett
Honorary Treasurer:	Lt. Cdr. G. Bandy, R.N.Z.N.

The meeting was concluded with the screening of a film entitled "The Engineers", which was released by courtesy of Mr. G. J. Webster, Director, Lister Blackstone, N.Z. Ltd. The Meeting closed at 10.30 p.m. with a vote of appreciation to Mr. Webster.

CALIFORNIA

The Annual General Meeting was held on February 25th 1969, at Westinghouse Electric Corporation, Marine Division in Sunnyvale.

Dr. Davis took the chair and called the meeting to order at 6.35 p.m.

The meeting was opened with a review of the activities during the first year of the new Branch and some of the initial problems in its foundation.

This was followed by the Treasurer's presentation of the Financial Statement, which was accepted by the members present.

Dr. Davis then retired the officials and Committee. Mr. Stasek proposed the 1968 Committee be re-elected en bloc. This was seconded by Mr. Sumner and carried by the members.

The results of the ballot were given and Capt. H. Rumble, Mr. F. A. J. Findley and Mr. C. Grey were elected.

The Committee for 1969 is as follows:

Chairman:	Dr. A. W. Davis
Vice-Chairman:	J. A. Stasek
Committee:	F. A. J. Findley
	J. S. Greenhill
	E. Marlborough
	J. J. O'Loughlin
	Dr. A. J. Paszyc
	Capt. H. P. Rumble, U.S.N., (Ret.)
	F. J. Thomas, B.Sc.
Honorary Secretary:	H. Comerford
Honorary Treasurer:	A. Forshaw

Dr. Davis thanked those present on behalf of the Committee and opened the meeting for discussion of any other business.

Various sources for papers were discussed, and it was proposed that Mr. C. Grey be requested to assist the Secretary in these matters. Mr. Grey accepted this task.

Mr. Stasek reported on the progress with regard to student participation and his contacts with the California Maritime College.

There being no further business, the Chairman closed the meeting at 7.30 p.m.

CAPE TOWN

The Annual General Meeting was held at the S.A. Merchant Navy Academy, Granger Bay, on 10th February 1969.

The Committee for 1969 is as follows:

Local Vice-President:	A. L. Brown
Chairman:	P. F. H. Brebner
Committee:	N. C. Humphries
	Commodore (E) J. R. Nortier, M.B.E., S.A.N.
	M. Truter
	D. F. Utley
	R. J. Wilson
Honorary Secretary:	D. McG. Clark
Honorary Treasurer:	W. K. Thomas
Honorary Auditor:	C. S. Russell

The principal meetings of the year included the Annual General Meeting and election of Committee members for the ensuing year.

A visit to R.N.A.S. *Otway* at Simonstown Dockyard, was authorized and organized by the Royal Australian Navy and the South African Navy. The Branch wishes to express its sincere thanks to both Services and to the Officers concerned.

In September a technical meeting was held. This was a Joint Meeting with the S.A. Institute of Civil Engineers.

In October a meeting was held in Johannesburg under the chairmanship of Mr. A. J. Scott, Corresponding Member, Johannesburg. It was attended by Mr. J. Stuart Robinson, M.A., (Director and Secretary of the Institute) who was en route to Australia.

Discussion centred mainly on the Professional Engineers Bill. The ramifications of this Bill and its impact on members of the Institute of Marine Engineers in South Africa, were discussed in breadth and depth. As a consequence, a Steering Committee consisting of the three Area Representatives was elected—subject to formal approval by the Durban and Cape Town Committees—to co-ordinate views of the local members, and represent their opinions as required to the appropriate officers sponsoring the Bill and administering the proposed Council.

Another technical meeting was held in November.

The Annual Dinner was held in the President Hotel, a total of 117 members and guests being present. Mr. C. S. Russell was in the chair, and the main speakers were: His Worship the Mayor, Mr. Marsh, Managing Director, Safmarine, Mr. Malan, former Manager Director, Safmarine. This was a most enjoyable evening in delightful surroundings.

DURBAN

The Annual General Meeting was held early this year under the Chairmanship of Commodore D. W. Robertson, B.Sc., S.A.N., who presented his report for the year 1967–68. He reviewed the activities of the year which ranged from technical meetings, a number of well attended quarterly luncheons, a film evening and a very successful Annual Dinner. He reminded the members that a valuable library, donated by Mr. Cruickshank, was now available to members.

The Chairman reported that the Professional Engineers Bill had become law, but that it would take approximately six months before it became operative. It was also reported that the total number of members of all grades in the Branch now stands at 52.

The results of the ballot were then given and the Committee for 1969 is, therefore, as follows:

Local Vice-President:	H. T. V. Horner
Chairman:	P. F. Balfour
Committee:	L. T. Brown
	R. Halliday
	G. C. Loveleace
	R. M. Murray
	T. H. Noel
	L. A. Turrell
Honorary Secretary:	R. C. Baker
Honorary Treasurer:	J. Holdsworth

There being no further matters to discuss, the meeting was adjourned.

JOINT MALTA BRANCH, I.MAR.E. AND R.I.N.A.

At the Annual General Meeting, which was held early this year, the following members were elected to the Committee:

The Committee for 1969 is, therefore, as follows:

Chairman:	C. E. Morley
Committee:	E. Debono
	J. C. Ellul
	M. S. Esdon
	J. W. Hipwell
	A. Raimondo
	L. P. Smith
Honorary Secretary:	J. J. P. Abela
Honorary Treasurer:	L. Mizzi

It was agreed that Mr. C. E. Morley would be representing the Branch at the Domestic Conference to be held in London.

PAKISTAN

The Annual General Meeting was held on 17th October 1968. The following members were elected to the West Pakistan and East Pakistan Committees:

West Pakistan

Committee:	H. Abbas
	Capt. Z. A. D. Abid, P.N.
	A. S. Benjamin
	J. Mansoor
	Cdr. M. A. K. Niazi, B.Sc., P.N.
	A. Rahim
	M. A. M. Siddiqi
Honorary Secretary and Treasurer:	Cdr. T. A. Thanwey, P.N.

East Pakistan

Local Vice-President:	I. Ahmed
Committee:	W. Alavi
Honorary Secretary:	M. A. Ansari

QUEENSLAND

The Annual General Meeting was held in the Ward Room, H.M.A.S. *Moreton*, New Farm, Brisbane on 5th February 1969.

In accordance with the Rules, three members retired from the Committee, and four members were nominated for the vacant positions; the ballot was conducted and the results were declared at the meeting.

The Committee for 1969 is therefore, constituted as follows:

Chairman:	A. J. Watkins
Vice-Chairman:	A. L. Redford, M.B.E.
Committee:	N. A. Bailey
	E. E. W. Cross
	Lt. Cdr. B. A. N. Kemp, R.N.
	L. B. McDonald
	D. F. Porter
	R. W. Thacker
Honorary Secretary:	J. Chapman
Honorary Treasurer:	L. P. Roessler

Mr. L. B. McDonald declined re-election as Chairman and offered to continue to serve as Committee member.

An additional ballot was held to elect a Branch representative to the domestic conference to be held prior to IMAS 69. The member elected was Mr. J. Chapman, and Mr. A. J. Watkins was nominated reserve in case the former would be unable to attend.

SINGAPORE

The Annual General Meeting was held in the Shell Theatrette at 5.30 p.m. on Wednesday, 9th April, 1969. After light refreshments had been served the meeting was opened under the chairmanship of Mr. G. R. Watt at 5.30 p.m. in the presence of 23 corporate members and 8 student members.

The Minutes of the previous Annual General Meeting, having been circulated, were adopted on a motion by Mr. M. K. Das Gupta seconded by Mr. E. R. Yates.

The audited Statement of Accounts had been circulated amongst the members. It was proposed by Mr. A. F. Tonnies and seconded by Lt. G. C. Rae, R.N.R., that they be accepted. This proposal was unanimously carried.

The Chairman then proposed that as all members present had received a copy of the Branch 1968 Annual Report it also be taken as read. This was approved and proposed by Mr. K. R. Vesuna and seconded by Mr. N. J. Mistry, to which all present unanimously agreed.

The Local Vice-President, Mr. J. M. Mair, reviewed the procedure adopted in the election of last year's Branch Committee. All corporate members received forms of nomination for the new Committee together with a current membership list, 32 nomination forms were returned, nominating 13 members for election.

The Committee for 1969/1970 is, therefore, as follows:

Local Vice-President:	J. M. Mair
Committee:	D. R. Austin
	P. R. Gresser
	A. C. H. Heng
	J. M. Mair
	G. C. Rae
	A. F. Tonnies
	K. R. Vesuna
	E. R. Yates
Honorary Secretary:	J. Thomas
Honorary Treasurer:	M. K. Das Gupta

There being no further business, the meeting was adjourned.

SYDNEY

The Annual General Meeting was held at Science House, Gloucester Street, Sydney, on Wednesday, the 26th February 1969, at 6.00 p.m. with Mr. C. Bie as Chairman. Fourteen members attended.

The Minutes were presented and adopted on the motion by Mr. P. G. Elliott, seconded by Mr. W. B. C. Elder.

The Chairman raised the subject of a close liaison existing between the Victoria and Sydney Branches, on the question of the proposed Nautical Science Course at the Royal Melbourne Technical College and drew the members' attention to the election of Messrs. Prandolini, Alder and Yule as Educational Sub-Committee.

The Chairman outlined prospects of the future resulting from the talks held with the party from London Headquarters.

A vote of thanks was expressed to Mr. W. F. Ellis, Mr. J. W. Lamb and Mr. K. M. Murray, for their good services during the year and also to Joint Cargo Service Pty Ltd., Cockatoo Docks and Engineers Co. Pty Ltd., and Associated Steamships Pty Ltd., for their support.

Thanks were also extended to Mr. A. B. Smith for his acceptance of the position of Honorary Treasurer.

It was reported that Captain R. G. Parker, O.B.E., R.A.N., had been appointed Vice-President for Australia.

The Committee for 1969 is, therefore, as follows:

Vice-President for Australia:	Captain R. G, Parker, O.B.E., R.A.N.
Chairman:	H. Gerrard
Vice-Chairman:	J. W. Lamb
Committee:	G. S. Cole
	F. W. Davies
	Cdr. P. G. Elliott, R.A.N.
	K. R. Longes
	J. A. McGillivray
Honorary Secretary:	K. M. C. Murray
Honorary Treasurer:	A. B. Smith

The Annual Report and Statement of Accounts were presented by Mr. K. M. C. Murray, Honorary Secretary and were adopted on the motion by Cdr. P. G. Elliott, R.A.N. and seconded by Mr. E. S. Clark.

A welcome was extended to Mr. H. Gerrard as the new Chairman, who was then asked by Mr. C. Bie to occupy the chair.

Mr. H. Gerrard expressed his thanks to all members for their support and stated that little did he think when he became a founder member of the Branch, that he would one day occupy this high position. He then asked the members to carry a vote of thanks to the retiring Chairman, Mr. C. Bie.

A very interesting paper was read and was followed by a lively discussion, in which Mr. E. S. Clark, Mr. C. Bie, Mr. Edwards and Mr. L. J. Prandolini took part. The Chairman called upon Mr. G. S. Cole to move a vote of thanks to the speaker, which was supported by the members in the usual fashion.

Cdr. P. G. Elliott, R.A.N., moved that a letter of appreciation be forwarded by the Secretary to the former Honorary Secretary, Mr. W. F. Ellis; this was unanimously supported by all the members and the Honorary Secretary was directed to attend to the matter.

The meeting closed at 7.45 p.m.

VICTORIA

The Annual General Meeting was held on 17th January, 1969. Mr. J. Dixon and Mr. A. J. Edwards were elected to the offices of Minutes Secretary and Auditor.

The Committee for 1969 is as follows:

Local Vice-President and Chairman:	J. B. Thomson
Committee:	R. Armstrong
	P. Bossen
	D. A. Gillies
	G. P. Hodge
	K. R. G. Lauder
	D. N. Moore
	C. Ogden
	K. Paxton
	R. L. Saunders
Honorary Secretary:	I. K. Mott
Honorary Treasurer:	Lt. Cdr. J. H. Coles, R.A.N.V.R.

There being no further business, the meeting was adjourned.

WESTERN AUSTRALIA

The Annual General Meeting was held on Wednesday, 12th February, 1969.

The retiring Chairman thanked the Committee for a very full and enjoyable year and recalled that on both occasions on which he held office he had the pleasure of welcoming the Chairman of Council.

The Committee for 1969 is constituted as follows:

Local Vice-President, Perth:	E. E. Freeth, B.Eng.
Chairman:	F. H. S. Scriven
Vice-Chairman:	E. J. McManis
Committee:	A. McAllister
	Cdr. G. A. Kerr, R.D., R.N.R.
	E. Morris
	R. W. Robinson
Honorary Secretary:	C. B. Jagger
Honorary Treasurer:	J. J. McCarthy

The Treasurer's Report was well received, congratulations being extended to Mr. Smith on the equitable balance for the social functions held.

The formation of a Division in Australia was keenly discussed after a brief résumé of the New South Wales combined meeting by Mr. Freeth.

The submission to the Commonwealth Committee of Inquiry into Awards for Colleges of Advanced Education was brought before the meeting and the view of the Committee that conformity should come through C.E.I. was endorsed.

There being no further business, the meeting was adjourned.

Representative's Report

United Kingdom Automation Council.

Representative: H. E. Upton.

During the year it has been considered desirable and convenient to express once more the objects of the U.K.A.C. in its constitution. They are:

a) to stimulate interest in, to spread knowledge of, and to foster the development and applications of automatic control and computation;
b) to afford a common meeting ground for the adhering organizations whereby such of their activities as fall within the purview of the Automation Council can, if they so desire, be co-ordinated and extended;
c) to encourage and, if desired, to co-ordinate the presentation at International Conferences of British papers whose subjects fall within the purview of the Automation Council;
d) to maintain as may be desirable, liaison with other countries which support such International Conferences.

The year under review has not been an easy one for the Executive Committee and a major re-appraisal of the Council's role and structure has taken place and action will be given to effect the concensus of opinion which was expressed at a discussion during December, 1968.

Panels.

The Executive Committee during the year met on nine occasions to consider the work of the various Panels, the structure of which is as follows:

Applications Panel;
Education and Training Panel;
Joint Planning Panel.

The re-constitution of the Research and Development Panel has been held in abeyance.

Applications Panel.

The Panel has the following terms of reference:

to consider the possibilities and difficulties of increasing the application of known aspects of automation and to make recommendations.

It became clear during the year that if the programme of work envisaged by the Panel and endorsed by the Executive Committee were to be carried out, the full-time support of a qualified officer would be required. An approach to the Ministry of Technology for an annual grant was made, for this and other purposes. After consideration, the Ministry expressed themselves as being unable to assent to a general grant, but ready to help in the financing of specific projects, if these had their approval.

Discussions have proceeded with the officers of the Ministry and a modest grant has been offered to support the production, in collaboration with the British Scientific Instrument Research Association (S.I.R.A.), of the experimental issue of what may be the first of a series of publications, in standard form and layout, similar in concept to Data Sheets, which will contain in simple and understandable terms as much relevant information as possible about the automation of particular industrial processes.

It is proposed that these publications be called "Automation Matters".

Education and Training Panel.

The Panel's terms of reference are:

i) to review the present and future need for education and training at all levels from craftsmen to professional level in the development and application of automation and computation;
ii) to review the extent to which the aims, scope and content of existing and proposed schemes of education and training meet these needs;
iii) to have power to invite the submission of evidence from interested persons or organizations;
iv) to make recommendations to the Executive Committee of U.K.A.C. including proposals for their implementation.

The Working Party for which the Panel acts as a Steering Committee has continued its work, thus performing a useful service pending the publication of the findings of the Committee on Technician Courses and Examinations, the Chairman of which is Dr. H. L. Haslegrave.

Foreign Relations.

The fourth triennial Congress of the International Federation of Automatic Control (I.F.A.C.) was held in Warsaw from 16th–21st June 1969.

Thirty-four papers by British authors, chosen by the British Programme Committee under the Chairmanship of Professor P. K. M'Pherson, were sent forward for consideration to the I.F.A.C. Congress, 1969, Programme Committee. Professor J. H. Westcott serves on this Committee and has visited Warsaw to attend its meeting.

The Chairman has sent his congratulations to the British Computer Society and to the Organizing Committee for their successful planning and conduct of the Fourth International Federation for Information Processing (I.F.I.P.) Congress which was held in Edinburgh from 5th – 10th August 1968.

Meetings in the United Kingdom.

A large number of meetings on subjects within the U.K.A.C.'s purview have been held both in London or elsewhere in the U.K. during the year and details of these have appeared in the U.K.A.C. News. Others, held specifically under the aegis of the U.K.A.C., which were sponsored either separately or jointly by individual member societies.

Annual Lecture.

The Executive Committee have been fortunate in obtaining the acceptance by Mr. Stafford Bree of their invitation to deliver the Eighth U.K.A.C. Annual Lecture. Mr. Beer took for his subject "Prerogatives of System in Management Control" and delivered the Lecture after the Annual General Meeting on 16th January, 1969.

Marine Engineering and Shipbuilding Abstracts

No. 8, August 1969

Coastal Bitumen Tanker

Sölvesborgs Varv of Southern Sweden have delivered their largest ship, the motor tanker *Engelsberg* to the Nynäs Petroleum Co., a member of the important Johnson Group. This ship is a highly-specialized tanker to carry bitumen products and has a number of novel features in her tank arrangement, machinery and fire-fighting equipment.

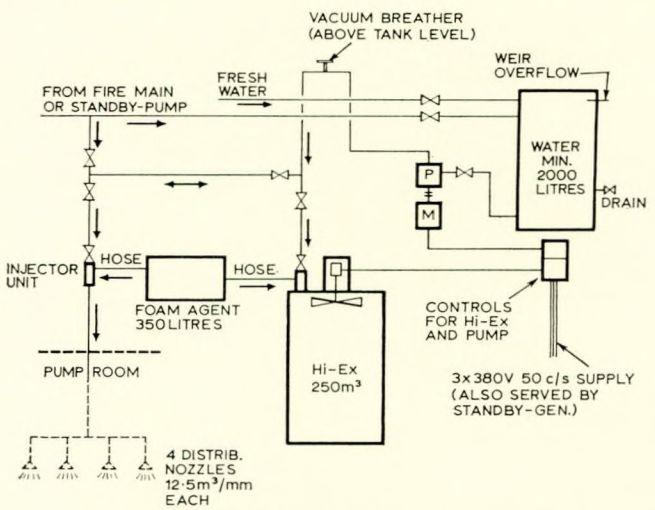
Engelsberg has been built to Lloyd's Register class with the designation 100 A1 Bitumen and oil-carrier, strengthened for navigation in ice. She complies with the latest Swedish and International regulations and the requirements of Det norske Veritas, class F. The principal dimensions are as follows:

Length, o.a.	349 ft 5 in
Length, b.p.	318 ft 3 in
Moulded breadth	51 ft 2 in
Depth to upper deck	29 ft 6 in
Cargo tank capacity	3620 m^3
Clean ballast, inc. peaks ...	900 m^3
Bunkers	280 m^3
Service speed	14 knots
Gross measurement	3709·08 tons
Net measurement	1957·59 tons
Deadweight	3820 tons
Draught	18 ft 3 in

The four main cargo tanks are quite independent of the hull of the ship, in order to allow for free thermal expansion and contraction. Each tank comprises a shell which is smooth internally and stiffened by external intercostal longitudinals, deep transverse webs and bottom girders.

The tanks are insulated with 100 mm thick mineral wool slabs.

The space surrounding the bitumen tanks is potentially dangerous due to leakage of gas or liquid and is therefore monitored by a gas detector system and equipped for total flooding with light foam within two minutes. The foam, with an expansion factor of 1000, is generated by two Meteor-Hi-Ex 200 SAF units. A similar unit serves the engine room. Fire extinguishing in the pump room is by medium expansion foam (factor × 200) from four injectors; while two portable foam monitors projecting a jet with a reach of 6 to 10 m are provided for fire fighting on the tank deck. The foam generating equipment, which employs a synthetic foam agent, was supplied by Svenska Skumsläcknings AB, Solna, Sweden.



Diagrammatic sketch of high expansion foam fire-fighting system.

Not least among the advantages of foam extinguishing, especially by light foam, is that very little water is employed to fill a space entirely and hence the stability of the ship is not thereby endangered, while secondary damage by wetting is minimized. Moreover, the danger to persons occupying the space is reduced. It is perfectly possible to breathe in a foam-filled area providing one does not remain stationary for lengthy periods. Unlike CO_2, the foam is instantly visible when released.

The main propelling machinery of *Engelsberg* comprises four Hedemora-Pielstick Vee-6 Diesel engines, type V6A/15, each developing 690 bhp at 1500 rev/min. These are arranged two forward and two aft of an ASEA four-input single-

output reduction gear type UM4-25/22. The after pair of engines is arranged higher and slightly closer to the centre-line than the forward pair.

The transmission between each engine and its gear pinion is by a Holset rubber vibration damper coupling and a Fawick-Airflex 14VC 1000 friction clutch. The output drive shaft runs from the after end of the ASEA gear, below and between the after engines, to terminate in a four-bladed KaMeWa c.p. propeller. The overall transmission ratio is 1500/200.

Each of the forward engines is directly coupled at its forward end to a 500 kVA, 390 V 50 c/s ASEA three-phase synchronous generator, type GAD-87, and, by an extension of the generator tailshaft, to a Bornemann V7T cargo oil pump. The cargo pumps, which are of screw type, absorb about 250 hp each and are engaged and disengaged by Vulkan-Planox EZ86-PL143 elastic/friction couplings.—*Marine Engineer and Naval Architect, May 1969, Vol. 92, pp. 194–199.*

Gas Turbine Generator Sets for Mammoth Tankers

Hagbart Waage Rederi are to have gas turbine auxiliaries in the three 220 000 dwt tankers they have on order, two with the Akers Group and one with Götaverken. They are Turbosafe marine gas turbine stand-by/emergency generating set systems produced by Kongsberg Vapenfabrikk.

The Turbosafe system provides a combined souce of stand-by and emergency power, with the Kongsberg 1200 kW gas turbine generating set located outside the engine room in a fireproof enclosure on the poop-deck. In this way, normal power requirements can be met even in an emergency situation, thus improving the general safety of the ship without increasing the cost. In case of blackout, the starting sequence will automatically be initiated and the main switch actuated when the correct frequency and voltage is obtained. During docking, normal electricity supply can be maintained to the entire ship, as the gas turbine is independent of cooling water supply.

By installing this generating set outside the engine room one obtains an emergency set that will not only cover the required emergency lighting, but also all domestic, auxiliary power and navigational requirements. Added safety is assured by isolating all outside power requirements (steering engine, navigational aids, deck machinery, accommodation and lighting) from the engine room through a separate switchboard. Thus the power supply is not vulnerable to damage to the engine room electrical system.

The generating set consists of a KG2-3H gas turbine connected to a 1200 kW brushless three-phase 60 cycle alternator on a common bedplate. It is equipped with automatic start/stop and monitoring systems, which can be augmented to incorporate automatic synchronizing equipment. The complete generating set weighs less than 7·5 tons (16 500 lb) and with an overall length of only 4·2 m (14 ft) it may be installed as one unit. The air-oil cooling capability, in combination with low weight and virtual freedom from vibration, permit easy installation in any desired location, without reinforcement of the ship's structure. The turbine can accept load within one minute of initiation of the start sequence.

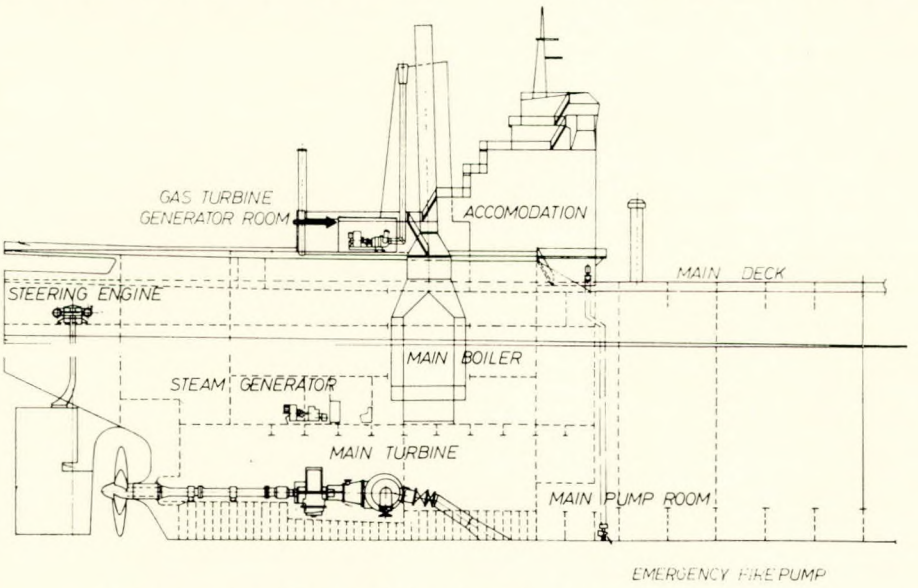
The basic KG2 gas turbine engine consists of a compressor section, a diffuser, a combustor and a turbine section. Air enters the engine through an intake screen, and flows to the compressor through a contoured inlet casing. The compressor, consisting of an inducer and a radial impeller, discharges into the vaned diffuser. From the diffuser, the air enters the pressure vessel, from which it is delivered to the single-can combustion chamber. Fuel is injected through six nozzles into the combustion chamber.—*Tanker and Bulk Carrier, May 1969, Vol. 16, pp. 30–31.*

Spain's First Special Liquid-chemical Carrier

The first special liquid-chemical carrier built in Spain is now in service. The 1900 dwt *Fosfórico* was built for Naviera Química, S.A., Bilbao, by Tomás Ruiz de Velasco, S.A., Erandio, near Bilbao. Her principal dimensions are: Length, o.a., 77·31 m; length, b.p., 70 m; breadth, 12·2 m; height, 5·5 m; and draught, 4·798 m. She is propelled by a N.S.W.-Werkspoor-Naval type TMSBS-396 supercharged Diesel engine built in Spain, developing 1550 bhp at 288 rev/min which gave an average speed of 13·25 knots on trials, under rather adverse weather conditions.

Fosfórico was built to Lloyd's Register of Shipping class ✠ 100 A1, Oil or Chemical Carrier, and is fitted with stainless-steel cargo tanks, pipelines and pumps throughout. Her owners decided in favour of stainless steel, as this material —although expensive—gives the greatest versatility to the ship, as corrosive chemicals, solvents, oils (both mineral and vegetable), wine and a vast range of chemical products can be carried. *Fosfórico's* first cargo was sulphuric acid, which proved a good test for her installations.

Her eight cargo tanks may be heated under certain



Elevation showing typical location of generator set on deck.

conditions with an adequate system of temperature control, and the pumps are also controlled from a central panel in the bridge. The tanks may be cleaned with hot or cold fresh water by means of Butterworth equipment and may be dried by forced hot air. Fire precautions include independent installations for steam and nitrogen, which may be used according to the cargoes carried. For the production of steam, two Clayton automatic steam generators are provided. These can be in full production in less than three minutes and may function independently or in parallel.

The bridge has extremely good visibility and contains a complete range of navigational and other equipment, including telecontrol of the main engine, pumps and temperature recorders. The accommodation is to the usual high standard and is completely air-conditioned throughout.—*Fairplay International Shipping Journal, March 13th 1969, Vol. 230, p. 28.*

Kockum-built L.P.G. Carrier

A number of shipyards have developed the specialized techniques required for the construction of the refrigerated liquefied petroleum gases ship and among these is Kockums Mekaniska Verkstads AB. of Malmö, Sweden, which has recently delivered the 26 500 m³ *Phillips Arkansas* to Philtankers Inc., Monrovia, an operating subsidiary of the U.S. Phillips Petroleum Co.

Built under the special survey of American Bureau of Shipping to the requirements of their highest class ✠ A1 (E) —Liquefied Gas Carrier, Ice strengthening class C, ✠ AMS, ✠ RMC—and outfitted in accordance with regulations of U.S. Coast Guard and Svenska Sjöfartsstyrelsen, *Phillips Arkansas* has the following principal particulars:

Length, o.a.	606 ft 1 in
Length, b.p.	565 ft 11 in
Beam, mld.	83 ft 8 in
Depth, mld.	52 ft 10 in
Draught, scantling	31 ft 9 in
Corresponding	21 380 dwt
Draught (propane)	26 ft 7 in
Corresponding	14 877 dwt
Cargo capacity	26 591 m³
Ballast capacity	9176 m³
Bunkers: heavy oil	1349 tons
Bunkers: Diesel oil	409 tons
Pump capacity: cargo	6 × 300 m³/h
Pump capacity: ballast	2 × 275 m³/h
Gross tonnage, intern	18 013 tons
Net tonnage, intern	10 784 tons

The ship has a deep double bottom with sloped ballast wing tanks and triangular top wing tanks (as in a modern bulk carrier) extending to the pump room in the forward deep tank, a cofferdam between the engine room to the pump room and a bulbous bow with an 800 hp electrically-driven KaMeWa-type bow thruster. A two-storey deck house over No. 3 cargo tank, connected to the poop super-structure by a closed passageway, houses the control room for cargo handling and a triplex reliquefaction plant for boil-off cargo gas.

Cargo tanks are of prismatic shape with athwartships sloping top, approximately fitting the inner form of the cargo hold. Void spaces, sufficient for external tank inspection and the vital inert gas atmosphere normally surrounding the tanks, have been provided all over. Each tank has a bottom recess, a centreline dome, a longitudinal wash bulkhead and a transversal wash web frame. They are strengthened with welded side stiffeners and extra stiffeners at the bottom supports. Tank insulation is by means of two overlapping layers of prefabricated glasswool slabs, each 10 cm thick, applied to the outside of the tanks on plastic pins.

Material used in the tank plating is fully-killed special silicon-aluminium fine-grain treated low-carbon manganese steel with impact properties of 4·15 kgm (minimum) at −52°C. The steel was developed and produced by Domnarvet Steel Works in collaboration with Kockums. A special electrode, OK 73·52, containing 1·6 per cent nickel, was also developed by ESAB and Kockums' laboratories.

Cargo gas discharge is by six 300 m³/h electrically driven submerged centrifugal deep-well pumps of the J. C. Carter type, two in each tank. The motor is close-coupled to the pump and mounted in a fabricated casing extending from the dome top to the tank bottom recess. The pump and motor assembly is supported at the lower end of the casing by a conical seat. There is also a spring-loaded foot-valve that is operated by the weight of the pump unit. When in position, the pump unit keeps the valve open, admitting cargo liquid to the casing. By means of a four-sectional flanged pipe attached to the pump and a special lifting device, the pump unit can be brought up on deck for overhaul even with a full cargo tank. Pressurized inerting of the pump casing and lifting-pipe is, of course, vital during the pump lifting operation.—*Shipbuilding and Shipping Record, February 28th 1969, Vol. 113, pp. 285–289.*

Work Analysis in Partly-automated Ship-operation

The work study here described was carried out, by activity sampling methods, in the East German motor-ship *Fläming*, a 7500 dwt general-cargo vessel. It was done during a voyage on the East Africa route, and embraced ship operation at sea, near port, and in seven ports of call.

With the exception of the automatic pilot, all the automated systems in the ship are in the engine room department which is extensively automated. The main engine has bridge control, and there is a centralized control room.

The purpose of the study was to obtain information on operation and organization in this type of ship, including the work distribution within the three departments (engine room, deck and hotel services) and, where applicable, the effect of mechanization and automation on work distribution. The results, which are discussed, are given in tables showing the percentage of each watchkeeper's or steward's working time spent on each of his several duties, and, for each duty, the percentage time worked by each watchkeeper or steward sharing that duty.

Comparisons were made with the results of a similar study in a ship with no automation. The results of the comparison for the engine room departments of the two ships are shown in histograms.—*Suhrbier, H. J. and Schwarz, H., Schiffbautechnik, September 1968, Vol. 18, pp. 520–522; Journal of Abstracts of The British Ship Research Association, February 1969, Vol. 24, Abstract No. 27 142.*

Specialized Dutch-built Ship for Roll-on/Roll-off Cargo Service

In the short-sea trades, one of the most significant trends in recent years has been the move to trailer-borne cargoes. An interesting small vessel of this class is *Duke of Holland*, a 758 gross ton vessel designed and built by A. Vuyk en Zonen, Capelle a/d Ijssel, Holland, and delivered to the Norfolk Lijn N.V., Scheveningen.

Principal particulars are:

Length, o.a.	75·00 m
Length, b.p.	66·80 m
Breadth, moulded	13·60 m
Depth to shelterdeck	8·90 m
Depth to main deck	4·25 m
Draught	4·20 m
Deadweight (approximately) ...	1050 tons
Gross register	758·78 tons
Net register	413·72 tons
Service speed	15½ knots

The ship is provided with an unusually wide stern door

ramp—7 m wide—and trailers are manoeuvred into and out of the main deck garage space using Stephen Shipchargers, two of which are maintained at each terminal. Up to 24 trailers can be carried, these being of the 10 m size and each with a maximum combined load of 36 tons and of this total, six trailers can be stowed on the upper deck.

At sea, the ship will be operated entirely from the bridge, the engine room being unmanned. A Lips c.p. propeller is driven at 275 rev/min via a Lohman and Stolterfoht gear-box powered by an MWM engine of the T6RHS 345 A type, rated at 2400 bhp at 500 rev/min.

The main engine is run at constant speed and the ship's speed is controlled solely by variations in propeller pitch. This is a system which is proving to be increasingly specified for various types of vessel.

In *Duke of Holland*, as in other installations of this kind, full advantage has been taken of the constant speed of the main engine to drive a Still 118 kVA a.c. generator which supplies the ship's mains at sea and, when required, in port. There is also a separate MWM engine of the RHS 618 A-type which is rated at 250 bhp at 1500 rev/min and drives a 200 kVA Still machine which independently powers a 190 hp Schottel bow thrust unit. If required, the auxiliary set can be used to supply the ship's mains but when the main engine is shut down this will normally be the duty of a small air-cooled MWM-engined harbour generator.—*The Motor Ship, February 1969, Vol. 49, pp. 541–543.*

Ferry with Four Gas Turbines for 30 Knots

A high-speed, 160-ft, gas turbine driven passenger vessel is now under construction at the Martinolich Shipbuilding Co., Tacoma, Washington. Destined for service between the mainland and Catalina Island off the California coast, the 500-passenger ship is being built to plans and specifications prepared by Philip F. Spauling and Associates, Naval Architects and Marine Engineers of Seattle.

The 30 knot, all aluminium liner, powered by four 1250 hp G.E. gas turbine engines, will make the cross-channel trip in one hour. The operators claim she will be the fastest vessel to ever serve the public in transportation to Catalina Island.—*Marine Engineering/Log, March 1969, Vol. 74, p. 80.*

Swedish Multi-engined Ferries

The Swedish Ferry operators Stena AB have ordered three of a new type of roll-on roll-off ship, two from Trosvik Mekaniske Verksteder in Brevik, Norway, and one from Kristiansand Mek Verksted. The design is a joint effort by the owners and Trosvik who in recent years have built *Viking IV* and two similar trailer ferries. To ensure maximum utilization of space on board and rapid loading of the trailers it is necessary for the propulsion machinery to be very low and compact.

After due consideration the owners and the yards decided that a twin-screw Normo four-engine plant would be suitable. Each shaft is driven by one LSM 8 and one LSM 9 engine, arranged as shown in the sketch and provided with auxiliary equipment for burning class B fuel. The total continuous output of 4600 bhp will give a speed of about 17 knots. Each pair of engines will drive a c.p. propeller through twin pinion reduction gears and, in addition, each LSM 8 engine will drive a 400 kVA alternator through a shaft extension aft of the gear-box. A three-cylinder RSGB-3 Bergen Diesel engine coupled to a 300 kVA generator will provide power in port. The ships are to be classed by Det Norske Veritas, be ice-stiffened to category B and equipped to class EO (unmanned engine room).—*Marine Engineer and Naval Architect, May 1969, Vol. 92, p. 234.*

Japan's First Catamaran Fireboat

A catamaran fireboat, the first built in Japan, was delivered by Nippon Kokan Kabushiki Kaisha to the Maritime Safety Agency on 4th March. Named *Hiryu*, the vessel is now in service with the Yokohama headquarters of the agency and greatly improves its fire fighting capacity in the busy Tokyo Bay area.

The catamaran design is said to offer several advantages compared with conventional fireboats. The vessel's twin hulls give an unusually wide breadth of 34·1 ft compared with her length of 90·2 ft (27·5 m). This extra breadth affords a wide, stable platform for the 49·2 ft high fire-fighting tower and ensures improved navigational stability. The shallow draught of 6·9 ft permits operation in areas not possible with conventional fireboats of similar displacement. The vessel features exceptional manoeuvrability, as she has engines and screws in each of the twin hulls. She is thus capable of making a complete circle almost on the spot with one screw propelling ahead and the other in reverse.

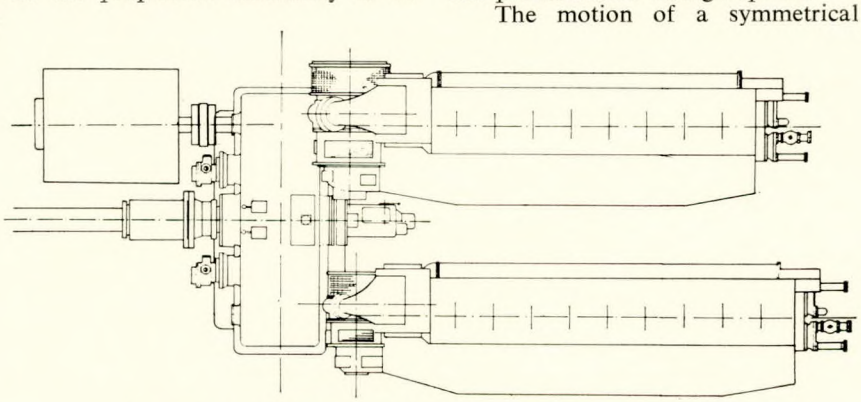
The boat's fire-fighting tower is equipped with a total of seven hoses and nozzles, two for water, two for chemical foam, two capable of handling water or chemical foam and one that can be used alternately for either water or foam.

A 1100 bhp main engine is installed in each of the twin hulls. These are Mercedes Benz MB 820 Db Ikegai Diesels each driving a three-bladed controllable-pitch propeller through a reduction-gear system.—*Fairplay International Shipping Journal, April 3rd 1969, Vol. 231, p. 29.*

Catamaran Wave Resistance

The evaluation of resistance (frictional, residual and additional) is extremely important in the design of catamarans. In this paper a study is made of additional resistance, which is due to interaction between the hulls and includes frictional, form and wave components, of which the last predominates at high speeds.

The motion of a symmetrical Michell ship moving



Arrangement for one shaft of the Stena trailer ferries

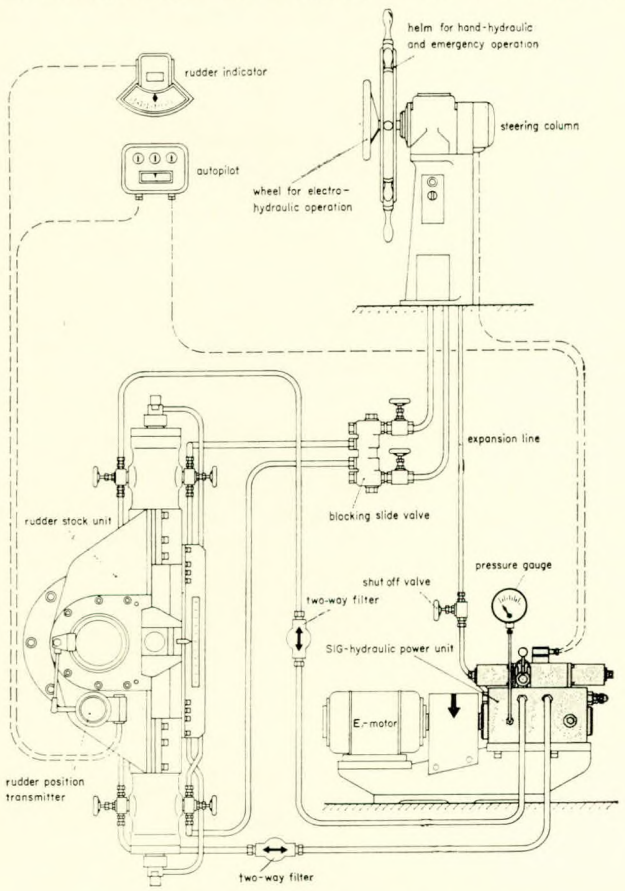
parallel to a rigid wall is analysed. In the hydrodynamics of an ideal liquid, this is equivalent to the combined movement of two hulls over an unlimited surface. Wave-resistance formulae are derived and extended to the case of a slender hull (large length/breadth and length/draught ratios). Numerical calculations were made for a particular fine hull form (length b.p. 125 m, breadth 6·58 m, draught 3·5 m, i.e. 410 ft, 21 ft, 10·5 ft). The theoretical results are compared graphically with model-test results and show good agreement. The results show that the additional wave resistance due to interaction can either decrease or increase the wave resistance of a catamaran in comparison with the doubled wave resistance of a single fine hull. For such a vessel there is, at any given Froude number, a single value of hull separation giving the maximum negative additional wave resistance.

Resistance is calculated for hulls with U- and S-shaped sections. The theoretical results are compared with the results of East German model tests and show good agreement. The hull with S-shaped sections can be expected to give the better negative value of additional wave resistance. The principal particulars of the models used are tabulated.

Comparison of the theoretical and test results show that the formulae presented allow the calculation of the wave resistance of a single fine hull, and of a catamaran having such hulls.—*Dubrovskij, V. A., Sudostrenie, 1968, No. 7, pp. 12–15; Journal of Abstracts of The British Ship Research Association, February 1969, Vol. 24, Abstract No. 27 045.*

Drive and Control Unit for Steering Gears

A series of compact variable-delivery pumping units has been developed by a Swiss company for the drive and control of marine steering gears. The units are designed for constant speed drive by an electric motor or any suitable unidirectional engine and the output may be controlled electrically, hydraulically, or by a combined electro-hydraulic signal. Consequently the units may be incorporated in any current type of setting gear, either as main control units for smaller ships, or as additional power drives for larger vessels. Two basic units are available, both incorporating screw pumps and a flow control, operated hydraulically or by solenoids.



Drive and control unit for steering gears

In the simplest of the two types, the constant-speed screw pump discharges to a piston control valve, which is positioned either by energizing a solenoid or hydraulically, depending upon the type of signal provided by the steering telemotor system. When the control valve is in its mid position, i.e. when the signal is neutral, both inlet/outlet pipes from the unit are blanked off. To ensure a flow of oil through the pump in this condition, ports are exposed by the control valve which causes a relief valve to open. A low-pressure flow of oil then takes place from the discharge of the pump to an oil sump through the relief valve, thus minimizing power consumption and temperature rise. When the control valve is moved from its mid position the pressure relief valve closes and the pump discharges high pressure oil through the control valve to the particular outlet selected. Although the relief valve is closed in this condition it will act as a safety valve at excessive pressures. This type of unit is designed to give oil flows of up to 50 l/min at pressures up to 160 kg/cm^2.—*The Motor Ship, June 1969, Vol. 50, p. 136.*

Turbine Powered Vessel for Natural Environment Research Council

An order has been placed by the Natural Environment Research Council (N.E.R.C.) with James Lamont and Co. Ltd., Port Glasgow, for a new research vessel to join their expanding fleet; delivery is due in 1971.

The design of this vessel is the result of an exhaustive feasibility and design study carried out by the Glasgow consultants Y-ARD Ltd., who have been retained by N.E.R.C. to advise on all matters relating to the vessel. The vessel will be mainly operated by the N.E.R.C. and used partly by the Scottish Marine Biological Association Laboratory (S.M.B.A.) located at Dunstaffnage, near Oban, and partly by university and other research groups. The vessel has been designed to undertake biological and general oceanographic research.

Since high noise levels transmitted into the water can seriously affect biological sampling and there is an increasing use of and dependence on underwater acoustics, both for detection and telemetry, the entire vessel is designed to produce a minimum of noise and vibration transmission to the surrounding sea and shipboard laboratories at all ship speeds.

The vessel will be of all-steel construction built to Lloyd's Class ✠ 100 A1 LMC, Ice Class III and to Board of Trade Class VII requirements. The design will be generally of the transom stern trawler type, but without a stern ramp. The hull form will be such that there is a minimum of air entrapped under the hull whilst under way to maintain good acoustic contact with the water in the region of the sonar transducers.

Principal particulars are:

	metres	ft in
Length, o.a.	50·29	165 0
Length, b.p.	43·74	143 6
Beam	10·97	36 0
Height, to upper deck	5·03	16 6
Draught, mean	4·04	13 3
Power	1050 s.h.p.	
Service speed, approximately ...	10·5 knots	

To achieve the high thrust necessary for towing the

large fishing nets and assist in accurate manoeuvring, a steerable Kort nozzle will be fitted round the fixed pitch propeller. To further assist manoeuvring at low speeds a steerable lateral thrust unit of the water jet type capable of exerting a thrust of 2 tons will be fitted in the forward part of the vessel. This will give the vessel the required high degree of control necessary when holding wires vertical in the water even in adverse states of winds and currents and when operating at very low speeds of the order of 0–5 knots. Another design feature which helps in this respect is the distribution of the wing areas aft which in addition to housing laboratories and providing a well sheltered trawl deck, always ensures that the vessel will head into the wind.

Passive stabilization tanks will be fitted to give the vessel the maximum resistance to roll. Sufficient reserve of stability will be allowed for the extension of facilities for special gear, etc., as required by scientists during certain scientific cruises.

All forms of propulsion were considered in the light of basic requirements in addition to the operating profile which trawling and station-keeping routines impose on the main and auxiliary machinery. The main propulsion machinery system which evolved is a single-cylinder unidirectional steam turbine coupled to a reverse reduction epicyclic gear-box and thence to a fixed pitch propeller.

Two packaged fire tube boilers will supply steam at approximately 250 lb/in^2 and 620°F to the turbine. The boilers have automatic flame control with a turn-down ratio of 4:1 and will follow closely the steam demand of the turbine without manual adjustment. Each boiler package includes the forced draught fan, fuel heater, boiler level controls and feed water pumps. The main turbine develops approximately 1050 hp and is an adaptation of a standard and well-proven marine auxiliary turbine. The turbine drives a fixed pitch propeller at 2000 rev/min through an epicyclic reverse reduction gear.—*Shipbuilding and Shipping Record, March 21st 1969, Vol. 113, pp. 398–401.*

Prediction of Stopping Times and Distances for Ships with Various Types of Propulsion Installation

In this study, the author derives a method for predicting the stopping times and distances for ships having various types of propulsion installations (Diesel, Diesel-electric, turbo-electric, etc.). A number of design variables are taken into account, including ship length, displacement, power, speed, propeller characteristics, thrust-deduction fraction, and wake fraction.

From trials results and design data, a specific thrust-power is determined for ships with various types of propulsion. Using the stopping time t as measured in the trials, this is then expressed as a specific deceleration power $V_A^2/2t$, where V_A is the initial speed. An initial speed of 10 knots is used as a reference for comparing the different types of propulsion installation, with the corresponding values of $V_A^2/2t$ plotted against specific thrust-power.

To predict a ship's stopping time, the specific thrust-power is first calculated, and $V_A^2/2t$ for the type of propulsion concerned is then read off a graph. This reading for 10 knots is then converted for the required initial speed with the aid of further curves.

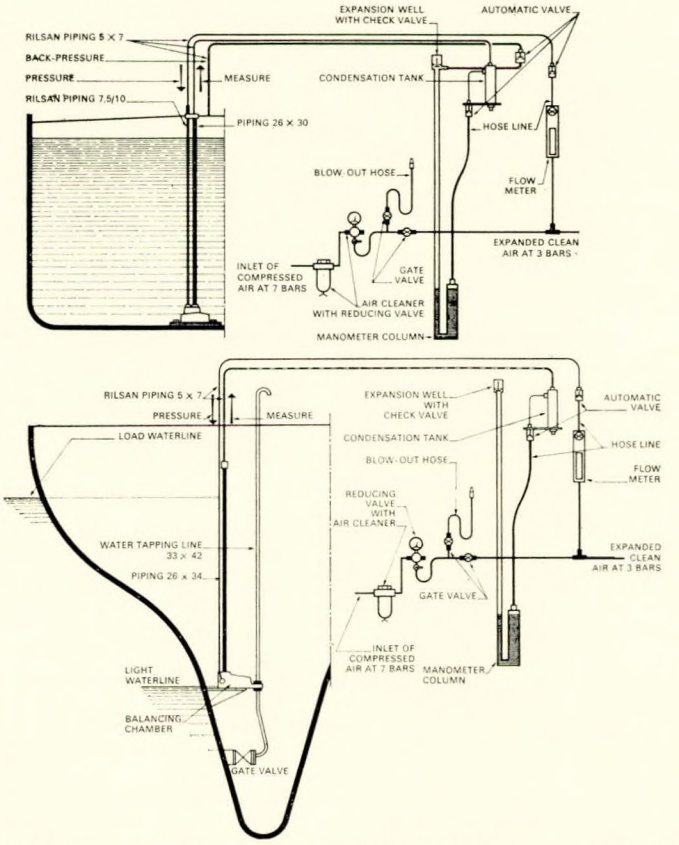
When the stopping time has thus been found, and the free-stopping differential quotient has been calculated (see Abstract No. 25 394, June 1967), a coefficient is determined which enables the ratio of mean speed to initial speed to be established from a graph or graphs. The stopping distance can then be easily calculated.

A high proportion of the ships considered in the study have electric propulsion-power transmission.—*Groebe, H., Schiffbauforschung, 1968, Vol. 7, No. 1/2, pp. 54–66; Journal of Abstracts of The British Ship Research Association, February 1969, Vol. 24, Abstract No. 27 065.*

French Tank Level and Draught Indicators

The remote tank level indicator operates on the principle of level detection through the hydrostatic pressure exerted by liquid of a known density on a pneumatic probe at the bottom of the tank. A mercury manometer for each tank gives a continuous reading of liquid level.

Accuracy is claimed to be ± four cm, ± five mm for end-of-fill indicator and this feature is said to have been responsible for a growing number of orders. Among notable recent installations is that in the French Shell tanker *Magdala* of 212 000 dwt.



Diagrammatic arrangements of inter-technique tank level indication system (above) and ship's draught remote indicator (below)

Intertechnique ship's draught remote indicator, like other equipment of this kind, is particularly useful on board tankers where rapid cargo discharge/loading results in very considerable changes in draught within a short period.

The principle of the system is that a vent pipe is in connexion with the sea: water height in the vent pipe is directly related to the pressure and is measured in the vent pipe by a pneumatic probe. The accuracy of this item of Intertechnique equipment is said to be ± one cm, regardless of height.—*Shipbuilding and Shipping Record, April 25th 1969, Vol. 113, p. 587.*

Underwater Oil Production System

A complete underwater production system providing for the drilling, production, storage and offloading of offshore petroleum resources in deep waters at substantially less cost than possible by conventional methods was introduced recently by Ocean Systems, Inc.

Known as UPS (Underwater Production System), it is a novel approach to the critical economic problem of offshore

oil recovery in waters deeper than 300 ft, which has become a major concern to the oil industry. At 300-ft depths, according to Ocean Systems, the UPS system is competitive with conventional, platform surface recovery methods, or subsea completion techniques and offers progressively greater cost savings as the water depths increase. For example, at 600-ft depths, a complete drilled-in and producing UPS system can be installed for less than the cost of a bare surface platform with conductors.

The heart of the new system is a large, double-walled, positively buoyant underwater capsule containing all the required petroleum production equipment in a shirt-sleeve atmosphere. The diameter of the capsule, as well as the specific production equipment will be determined by the required job. For example, spheres 80 ft in diameter have been designed for production and on-board storage of 35 000 bbl of crude, and 40-ft spheres engineered for producing shallow sand reservoirs and offloading by pipeline. The capsule is installed 150 ft below the water surface and is restrained from movement by conductor legs.—*Marine Engineering/Log, February 1969, Vol. 74, p. 74.*

Cargo Motor Liner for Dutch Owners

The cargo motor liner *Gooiland*, latest addition to the fleet of the Koninklijke Hollandsche Lloyd, Amsterdam, has been specially designed for the service maintained by her owners between the ports of Amsterdam, Bremen and Hamburg, and various ports on the Brazilian east coast.

Gooiland has been built by Machinenfabriek en Scheepswerf van P. Smit Jr. N.V., Rotterdam, and was launched on 14th November, 1968. Construction has been to the highest class of the American Bureau of Shipping, while the ship fulfils the requirements of the Dutch Shipping Inspectorate and Port Labour Inspection Service. She has three cargo holds forward and two aft of the engine room, while four deep tanks are provided in No. 4 lower hold for the carriage of liquid cargoes. All the cargo holds are mechanically ventilated and protected by a CO_2 fire-fighting installation and automatic smoke detecting device.

The hatchways of Nos 1–4 hold are covered by MacGregor Single-Pull hatchcovers measuring, respectively 10·960 × 6·5 m (No. 1) and 15·75 × 7·80 m (No. 2, 3 and 4). Hydraulically operated non-watertight folding flush hatchcovers, provided with Werklust hydraulic cylinders, are used for No. 3 hatchway in the upper and lower tween decks. The dimensions of these covers are 15·75 × 7·80 m. Elsewhere flush pontoon hatchcovers are used, as well for the use of fork trucks in the holds. Cargo is handled by one 5-ton electric deck crane, eight 3 (6)-ton and four 3/6/20-ton derricks. Deck machinery, such as the windlass, mooring and warping winches, cargo and topping winches are electrically driven. The Hastie steering engine is of the electro-hydraulic type.

Principal particulars are:

Length, o.a.	147·50 m
Length, b.p.	133·80 m
Breadth, moulded	18·50 m
Depth to upper deck	10·60 m
Summer draught	7·50 m
Deadweight capacity (metric) ...	9200 tons

The main propulsion machinery of the vessel consists of a direct reversing single-acting two-stroke Schelde-Sulzer Diesel engine type 5RD68. The engine, which is controllable from the bridge, has an output of 5500 shp at 135 rev/min. The engine drives a Cunial four-bladed bronze Lips propeller with a diameter of 4800 mm, and gives the vessel a speed of 15½ knots. The engine is supercharged by means of two turbo blowers and arranged for the use of heavy fuel oil.

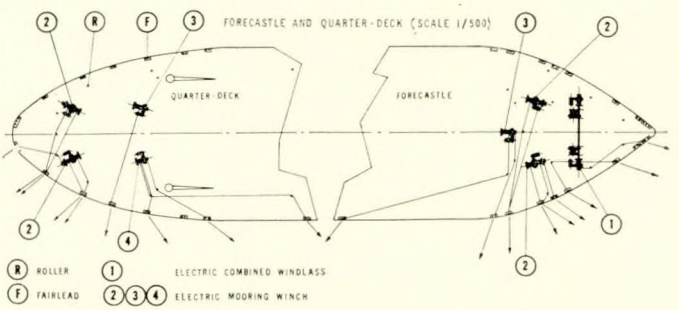
The electronic measuring and alarm system installed on board the vessel is of the Fokker type ES-MAS-6804. It has been designed for operation with unmanned engine room and is of the digital type with 17 temperature and four pressure measuring points. These points are scanned at the rate of 100/sec. Push buttons on the Mimic Diagram enable the operator to select those points of which he wants to know the temperature or pressure. The value measured can be read directly in the correct physical quantity (deg C or ATA) on two display units, in three figures. These display units are installed in the engine room console. This arrangement ensures that no large numbers of relatively vulnerable meters are necessary. It also practically excludes the chance of reading errors. In the case of unattended engine rooms there is little sense in having meters as there is nobody to use them.

What is necessary and extremely important is correct and reliable alarming at these measuring points. The limit value at which this alarming is to begin can be preset and carried out with so-called cipher-wheels or thumbwheel switches, to make a faultless setting quickly. The limit value setting units are also fitted in the appropriate line of the Mimic diagram on the engine room control console. Alarming can take place with reference to the upper limit, the lower limit or a combination of the two.

Alarming is at digital level, that is, after the conversion from analogue to digital value.—*Holland Shipbuilding, April 1969, Vol. 18, pp. 36–38.*

All-electric Deck Machinery for French Tankers

The French tanker company, Sté. des Transports Maritime Pétroliers, has now taken delivery of the third in a series of La Ciotat-built 75 000 dwt ships which are notable in that they have no steam-raising plant on board. Instead, the whole of the mooring equipment is electrically operated using equipment designed and supplied by Brissoneau and Lotz, of Nantes.



Layout of mooring arrangement

There are nine automatic electrically operated 20-ton mooring winches at constant voltage, two combined with drums for 88 mm HR chain and four fitted with twin barrels.

The following performances were achieved on the moor-
setting 5: high-speed take-in of moorings: 35 min; 1 hour

At the drum—First wind-on layer:
manual operation or warping:
setting 4: 20 tons at 15 m/min or (50 ft/m) at ½ normal capacity;
setting 4: hold 25 tons duration limited to 3 min;
setting 5: high-speed take-in of moorings: 35 min; 1 hour normal working;
automatic operation—working at constant load—automatic hold and walking back:
setting 1: 6·5 tons
setting 2: 13 tons
setting 3: 20 tons
strain effort on brake: 35 tons

The general use of 68 mm-diameter polyfilene hawsers has been the subject of successful experiments by the S.T.M.P. on previous ships and the crew have found that the behaviour of these hawsers was undoubtedly superior to and less costly than in the case of conventional steel hawsers.

Two 10-ton winches for handling hoses are located in the hazardous area, roughly amidships. They could not for this reason be of the conventional electrically operated type —otherwise special arrangements would have had to be made to protect the electrical components or special motors of the "flame-proof" or "explosion-proof" adopted. For these reasons the owners and the shipyard selected the hydraulic system developed by Brissoneau and Lotz.

Each winch is independently equipped with its own hydraulic circuit, consisting of:

a) a winch driving motor of the fixed displacement piston type—of cast iron—developing 25 m/kg at 1400 rev/min under normal working conditions with a differential pressure of 13 atm at the intake;
b) a shoe-type brake—fitted between the motor and the winch reducing-gear, and connected to the ship's general compressed air system;
c) an electro-hydraulic generator installed in the engine room, a gas-free zone presenting no hazards. It consists of a variable flow pump driven by a 45 kW encased electric motor;
d) a remote control mechanism comprising a servo-motor controlling the variation in the hydraulic pump flow, integral with the pump and similarly immersed in the reservoir.

The effective length of piping between pump and winch or between operator and pump is approximately 90 m.—*Shipbuilding and Shipping Record, 7th March 1969, Vol. 113, pp. 329–331.*

Automating Navigation

Any voyage consists basically of three components—arrival or departure, traverse of coastal waters, and ocean passage. Each presents its own individual demands on automated ship handling, and it might be that, until such time as the art becomes well advanced, automation should be confined to the control of a ship only during her ocean passage, where there is literally searoom, while handling should be left to human agency in close waters on approach and departure lanes where the risk of collision or grounding is greater.

On ocean passages the principal information factors to be taken into account are obviously weather, present and ahead, and position. On the open sea the other vessels, wreckage, or the occasional iceberg which might present collision hazards are relatively infrequent although anti-collision radar should ideally be kept going, and its information fed into the computer, even in the clearest of weather. Wind and weather conditions in the immediate vicinity of the vessel could be assessed by normal existing instrumentation and fed into the computer which would then command the ship's speed, autopilot adjustment, and if necessary, stabilizer settings to achieve maximum safe speed under the conditions obtaining.

Warning of worsening conditions ahead on the preferred track of the vessel could be obtained from the scanning of facsimile charts or from weather routeing advice received from the shore, and the necessary optimum avoiding action would then be calculated and ordered by the computer.

Dead reckoning, if not yet quite defunct, is at least becoming moribund with the spread and perfection of position-finding systems and the recent introduction of doppler sonar devices which keep a continual check on the ship's progress in relation to the only constant element around her, the seabed. The Decca and Loran systems, geographically limited to specific areas of coverage, are now supplemented—and may in time be supplanted—by Omega and the navigation satellite system, both developed originally for the United States Navy and both capable of providing high-accuracy position-fixing with world-wide coverage, although four more Omega transmitting stations have yet to be completed to provide global use of this system. And there is, of course, always the radio direction-finder although this is less useful at long distances from the shore.

Electronics can, therefore, already produce all the on-voyage information necessary for the ocean passage. Position can be determined at any time of the day or night, in any visibility, and with a high degree of accuracy. Course made good can be set against desired course, and correction applied as necessary via the autopilot. Bad weather ahead can be avoided. Anti-collision watch can be kept and safety action, if it should become necessary, taken automatically.

Technically, it is also possible to divert in order to go to the rescue of another vessel in distress by combined use of the automatic alarm receiver and the automatic direction-finder, the read-out from which, in cases of distress, would take precedence over normal voyage instructions. Read-out is here an operative word—all incoming information would have to be presented in digital form for digestion by the computer.—*Leuchars, J., Shipping, April 1969, Vol. 58, pp. 13–14.*

First Lash Ship Launched

The world's first 43 000 dwt LASH (Lighter aboard ship) vessel, *Acadia Forest* was launched from the Uraga Heavy Industries shipyard at Yokosuka. Owned by A. S. Molash Shipping Co. of Norway, the vessel will operate on a long-term charter to Central Gulf Steamship Corporation of the United States and will sail between the Mexican Gulf ports and Europe, carrying mainly the products of the International Paper Company.

Principal particulars are:

Gross	39 000 tons
Deadweight	43 000 tons
Length, o.a.	859 ft 7 in
Length, b.p.	767 ft 8 in
Breadth, moulded	106 ft 7 in
Depth, moulded	60 ft 0 in
Draught, moulded	36 ft 11 in
Trials speed	20·4 knots

Basically, the LASH system consists of a large number of lighters and the vessel which is equipped with a 500 ton gantry crane for lifting the lighters on board. In some respects the system is similar to containerization, the lighters, being loaded and discharged independently of the LASH ships, are virtually floating containers. Unlike the container-ships, however, this ship has its own crane enabling the lighters to be lifted on or off the ship without using the port facilities, thus there is no delay in waiting for a berth. Once the lighter-handling operations of the carrying ship have been completed, the latter can then sail for the next port on its schedule leaving the off-loaded lighters to be taken by tug to their destination on the inland waterway system. As a result of this the time spent in port by the ship is reduced to a minimum.—*Shipbuilding International, May 1969, Vol. 12, pp. 28–29.*

Problems of Dynamic Boosting of Diesel Engines

The paper describes an investigation into the induction ramming of a single-cylinder Diesel engine. There is a basic description of the process followed by a summary of a mathematical solution and some test results. The varied parameters include suction-pipe length, engine speed, and cam form, and for each condition the air mass flow is measured by a commercial not-wire anemometer.—*Cser, G. and Janosdeak, E., Acta Technica, 1967, Vol. 58, Nos. 3/4, pp. 203–245.*

Determination of the Resistance to the Passage of an Icebreaker in Open Water and in Various Ice Conditions

Empirically-based methods are presented for the approximate determination, at the design stage, of the resistance to an icebreaker's passage in open water and in commonly-encountered ice conditions. The open-water resistance formulae are based on model tests of a considerable number of icebreakers whose particulars are tabulated.—*Katsman, F. M., Kashtelyan, V. I. and Ryblin, A. Y., Sudostroenie, No. 11, November 1968, pp. 6–8; Journal of Abstracts of the British Ship Research Association, February 1969, Vol. 24, Abstract No. 27 048.*

On taking the Rough with the Smooth

This paper attempts a simple quantification of the increase in ship resistance due to increased surface roughness. This enables a vessel's service performance statistics to be better understood and handled, particularly in reference to decision taking re-sandblasting. The general behaviour of resistance increase, due to fouling and roughness, increase simultaneously, involving a wake increase direct attention to the use of the latter to quantify the former.—*Telfer, E. V., presented at The Institution of Engineers and Shipbuilders in Scotland, March 4th 1969; Paper No. 1338.*

Development of Solid Lubricant Compacts for use in Ball Bearing Separators

Hot-pressed solid lubricant compacts were developed for use as ball bearing separator materials where bearing lubrication is supplied by a transfer film from the bearing separator to the bales and nall raceway. The approach taken in the compact materials development is described and fabrication techniques are briefly discussed. The importance of bearing separator design and the effect of compact processing parameters on bearing life are presented.—*Hubbell, R. D., McConnell, B. D. and Van Wyk, J. W., Lubrication Engineering, January 1969, Vol. 25, pp. 31–39.*

The First O.C.L. Container Ships

This paper describes the first large container ships designed for the UK Australia trade and touches on the background of the development of the container ship concept. The reasons for the decisions on the main features are given and the principal problems of powering, strength and container handling and stowage are explained.—*Meek, M., presented at a meeting of The Royal Institution of Naval Architects, 25th March 1969.*

Laboratory Evaluation of Worm Gear Lubricants

This paper compares the laboratory bench test performance of seven commercially available petroleum lubricants currently used in worm gear service. It represents an attempt to learn more about the relative characteristics of the different lubricant types, by use of accelerated wear and oxidation tests which have been modified to simulate more closely, worm gear conditions.—*Domonoske, D. D., Lubrication Engineering, December 1969, Vol. 24, pp. 572–585.*

The Development of the Connexion between a Ship's Propeller and its Shaft

An analysis of fractures in the shaft and the boss of various possible keyless connexions (for example, with a special nut according to the SKF or Pilgrim system, with oil forced between the boss and shaft under high pressure) is given. Detailed description of the plastic method developed by Lips N. V. and CIBA using an elastic intermediate layer (Araldite) absorbing the movement between shaft and boss which prevents the two faces from sliding over each other is also analysed by the author.—*Beckhoven, J. van, Polytechnisch Tijdschrift, 1969, Vol. 24, No. 5, pp. 201–206.*

The Corrosion Behaviour of Cunifer-10 Alloys in Seawater Piping Systems on Board Ship

After a general and short survey concerning the selection of materials for sea water piping systems on board ship with respect to the specific environmental conditions and the various corrosion aspects, the first results of a thorough study of the corrosion behaviour of Cunifer-10 alloy are presented. The influence of the heat treatment on the corrosion behaviour of the alloy and the influence of the operating conditions on the protective layer are discussed.—*Goetzee, W. J. J. and Kievits, F. J., International Shipbuilding Progress, February 1969, Vol. 16, pp. 59–68.*

Design Data for High Speed Displacement Hulls of Round Bilge Form

This report contains the results of resistance tests on a systematic series of fast round-bilged displacement type model hulls, and forms part of a programme of research into this type of vessel being undertaken by Ship Division of the National Physical Laboratory. Examples of vessels covered by the data given in this report are patrol vessels, launches, work and river boats and vessels approaching destroyer form such as corvettes and frigates.—*Marchwood, W. J. and Bailey, D., National Physical Laboratory, Ship Division, February 1969, Ship Report No. 99.*

Classification and Definition of High Temperature Welding Cracks in Alloys

There has been confusion in the understanding and classification of high temperature forms of welding cracks in ferrous and non-ferrous alloys. Terms such as "hot cracking", "hot tearing" and "hot fissuring" have been used indiscriminately. This paper presents a classification of the observed forms of high temperature welding cracks, excluding reheat or stress relieving cracking, on the basis of their microstructural characteristics.—*Hemsworth, B., Boniszewski, T. and Eaton, N. F., Metal Construction and British Welding Jnl, February 1969, Vol. 1, No. 2s, pp. 5–16.*

Some Comments on the Performance in Calm Water of a Single-hull Trawler Form and Corresponding Catamaran Ships made up from Symmetrical and Asymmetrical Hulls

An investigation of the calm water performance of catamaran ships has been proceeding at Ship Division NPL for some time; the present study extends the earlier work, and considers the power requirements of catamaran ships for application as trawlers. Symmetrical and asymmetrical hulls derived from the lines of a good single hull form are included in the investigation together with some simple calm water performance comparisons between the catamaran ships and the parent trawler form.—*Everest, J. T., National Physical Laboratory, Ship Division, February 1969, Ship Report No. 129.*

Development of Mathematical Models for describing Ship Structural Response in Waves

Available mathematical models that describe ship-wave interactions are evaluated in order to develop a technique for predicting ship structural response characteristics. Major consideration is given to the bending moment and slamming responses for an arbitrary ship form in any state of sea, at any relative heading and forward speed.—*Kaplan, Paul, Ship Structure Committee, Progress Report SSC-193, January 1969.*

Patent Specifications

Vertical Bulkhead or Shifting Board Suspension

This invention relates to a suspension device for flexible partial bulkheads, particularly detachable longitudinal bulkheads or shifting boards for loose material carried in ships.

Fig. 1 shows a longitudinal view of a longitudinal partial bulkhead for loose material. Fig. 2 shows a cross section through two longitudinal partial bulkheads, and Fig. 3 shows a cross section of the suspension system.

Fig.1.

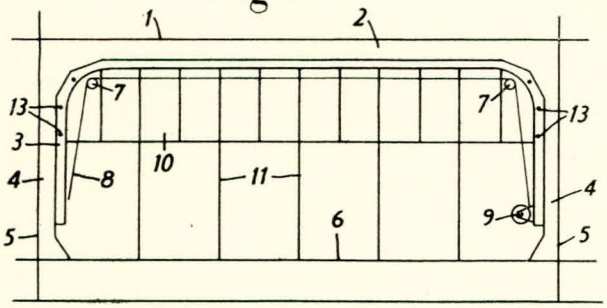


Fig.2.

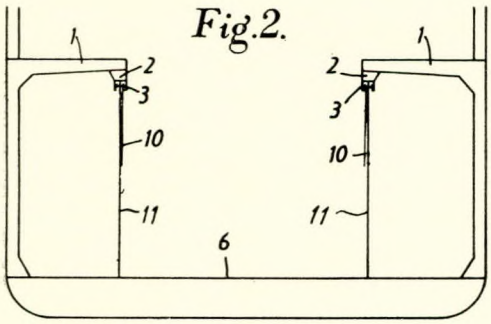
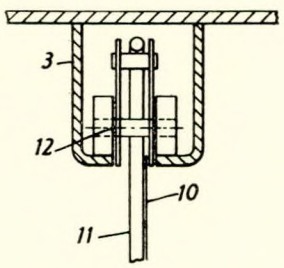


Fig.3.



On the lower side of longitudinal girders 2, underneath the deck of a ship, a guide track 3 is provided, the track curving at the ends of the hold and proceeding down in the bulkhead struts 4 of the hold bulkheads 5 in the direction of internal floor 6. In the zone of the curved part, guide pulleys 7 are provided over each of which a traction cable 8 passes to a traction device 9, such as a winch. The flexible board 10 which is attached to vertical cable supports 11 is installed by being introduced into that part of guide track 3 extending along hold bulkhead 5, and is drawn into guide track 5 by traction cable 8 and clamped down between hold bulkheads 5. The curved ends of the flexible longitudinal bulkhead 10, as well as its lower corners are secured against displacement in the curved and in the vertical guide track 3, by means of retention devices 13, such as cotter pins.— *British Patent No. 1 148 620 issued to VEB Warnowwerft Warnemunde. Complete specification published April 16th 1969.*

Unloading Granular or Lumpy Cargo

This invention relates to a method and apparatus for landing granular or lumpy goods from a cargo boat moored alongside a wharf. Referring to Figs 1 and 2, a cargo boat 1 has float tanks 2 disposed on both sides, and a port 3 with two shutter doors at the bottom of hold 5. Each of the shutter doors 4 is pivoted to the centre girder 7 of the boat by means of hinge 6 at one end of the door. The port 3 is opened and closed by operating the shutter doors 4 by means of shift chains 8.

FIG. 1

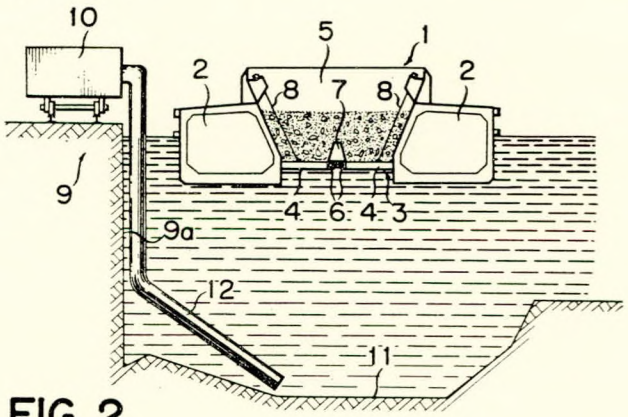
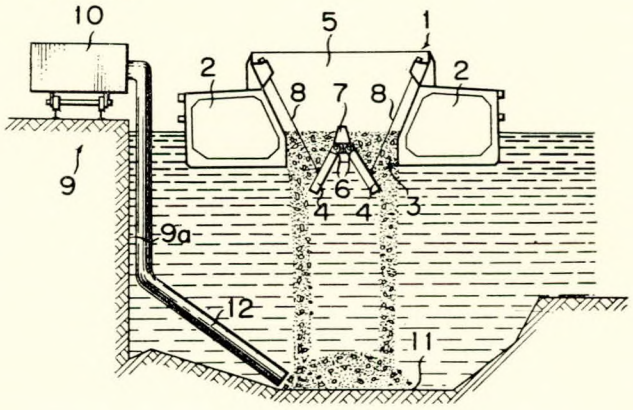


FIG. 2



At a loading port, granular or lumpy cargo such as ore or coal is loaded into the hold 5. The bulk material may be transported to the boat suspended in water flowing through a pipe-line, and then is introduced with the water carrier into the cargo hold. The water carrier is separated from the cargo due to the different gravities between them, and drained out.

At an unloading port, a combination of wharfage 9 and a suction device 10 is provided for landing the granular or lumpy cargo. The wharfage 9 has a pit 11 in its bed

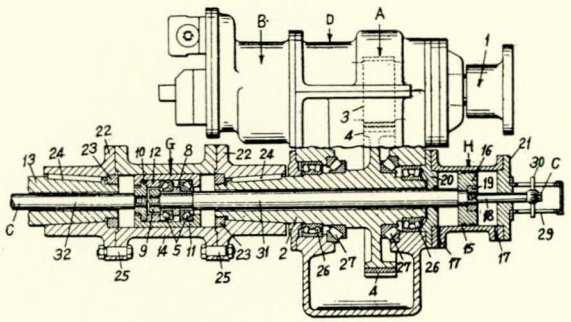
adjacent the wharf side 9a. The suction device 10 has a suction pump (not shown) and a conduit 12 communicating with the pump. One end of the conduit opens in the pit 11.

To discharge the cargo the boat is first guided to a point above the pit and moored adjacent the wharf side 9a. The shutter doors 4 are opened to pour the cargo from the hold 5 on to the floor of pit 11. The cargo in the pit is finally sucked up through the conduit 12 to the wharf 9 by the operation of the suction pump.—*British Patent No. 1 147 500 issued to Nippon Kokan Kabushiki Kaisha. Complete specification published April 2nd 1969.*

Propeller Drive with Pitch Control

This invention relates to marine propeller drives, with provision for pitch control, and has for an object to provide an arrangement permitting a construction which is less liable to hydraulic liquid leakage than conventional arrangements.

Fig.2.



The drive shown in Fig. 2 comprises a drive input shaft 1, directly coupled to an engine shaft, and a propeller shaft 13 connected with the shaft 1 through clutch B by a reduction gear A, consisting of pinion 3 and gear wheel 4. The gear wheel 4 is rigidly fitted on a hollow gear output shaft 2 which is supported by gear casing D through two pairs of bearings 26 and 27.

Flanges 22 are fixed to the aft end of shaft 2 and the fore end of propeller shaft 13 through flange bolts 25, flanges 22 and keys 24. A pitch control shaft assembly C is concentrically installed through the hollow output shaft 2. The pitch control shaft assembly C consists of a fore part 31 and of an aft part 32, which are connected together by a coupling G at their aft and fore ends respectively.

The coupling G consists of a pair of thrust bearings 5, a bush 8, a nut 9, a spacer 12, a collared nut 10 fixed to the fore end of the aft part 32 of the control shaft assembly, and a connecting cylindrical housing 11. Housing 11 is axially split into two longitudinal halves and is slidably supported by the cylindrical surface of coupling sleeve 14. The housing is provided at each end with a collar, the fore collar supporting the outer race of the fore thrust bearing 5 aftwardly, whilst the aft collar directly supports forwardly, the collar of nut 10, and indirectly supports the outer race of the aft thrust bearing 5 through the latter collar and spacer 12.

From the description of coupling G it is clear that the device connects the fore and aft parts of the control shaft assembly only in the axial direction and not in a rotary direction so that the control shaft assembly C can shift, as a whole, axially fore and aft, and aft part 32 rotates with propeller shaft 13, while fore part 31 does not rotate in the gear output shaft 2. The fore part 31 is secured to piston 16 in cylinder 15 of an oil pressure piston and cylinder unit H.

The pitch of the propeller may be changed by introducing oil pressure by a regulator from an oil circuit into cylinder 15 through passage 17 on one side of the piston so as to urge the latter, with fore part 31 of the control shaft axially in either a fore or an aft direction. At the same time, aft part 32 of the control shaft will also be axially shifted but due to coupling G, the aft part 32 revolves with the propeller shaft 13. The pitch will thus be changed and controlled.—*British Patent No. 1 151 279 issued to Kamome Propeller Kabushiki Kaisha. Complete specification published 7th May 1969.*

Corrigendum

In the May 1969 issue, page 173, under the title "Shipping Company's Experience with S.E.M.T. Pielstick Engines", the fuel and lubricating oil consumptions given in the final paragraph should have been shown as 155 grams/bhp-h and 0·8 grams/bhp-h respectively and not as published.