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"HARBOUR TUGS – Some Comments on Design & Handling"

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HARBOUR TUGS - SOME COMMENTS ON DESIGN AND HANDLING

It has been the Author's very fortunate experience to have been Master of some 34 shiphandling tugs, and to have been engaged in practically all sections of towage.

This experience covers that of deckhand on small petrol engine-driven half cabin launches engaged in the towing of logs, and punts of timber, to that of the larger lighter-cum-tugs used extensively on Sydney Harbour in the pre-war years, to that of Master of ship-handling tugs engaged in the normal daily routine of assisting ships to berth and sail, as well as carrying out ocean rescue and coastal towage.

In every facet of towing, the tug must be a highly manoeuvrable vessel, with a large displacement for her size and to have adequate power so that she can carry out the work for which she was designed.

Tugs in Australian ports that had the foregoing qualification of manoeuvrability were usually not of the shiphandling variety, but those usually owned by owner-skippers who ran their businesses and carried out the work as well. Large rudder angles, very little rake of keel, usually being brought about through necessity in order to be able to keep the boiler low, so that the skipper, who steered from near amidships, could see over it ! These little wooden-hulled steam tugs were extremely handy and could carry out any towage assignment within the scope of their power. It is pleasing to know that quite a few have been "dieselized" and are still in operation on Sydney Harbour although their designers, builders and original owners have long since retired.

Tugs like the "Champion" and "Theresa Ward" for instance, were products of the late nineties and 1900 respectively. They were built in the days when (apart from moving "dead" ships when they would make fast alongside the tow), all work was done on a towline. Both of these tugs had a rake of keel of approximately 6 feet, which may have provided the Naval Architects with the answers they were looking for, but provided the Tug Masters with absolute frustration, especially when working the steelworks channel in Newcastle with the "Champion", and having a strong ebb tide flowing south, and a fresh southerly breeze blowing north!! The ability of that tug to stem the tide because of her deep heel, and lay with her stern into the wind because of her light forefoot and forward top hamper, was something to see.

However, one soon learned, that in cases of the nature quoted above, the "Champion", because of her long length, narrow beam abd very fine run aft, could be taken down river stern first, and in fact, a great proportion of her time was spent going from job to job stern first because it eliminated the need to swing her !

The "Saint" class tugs of World War I vintage were for their size, particularly fine vessels from a handling point of view. They were 143 overall, with a beam of 29 feet, and a loaded displacement of 890 tons with load drafts of 13' F'wd and 15' Aft. Although not carrying a greater rudder angle than 32°, these tugs handled well both ahead and astern, and were very good when working a "stopper".

The word "Stopper" needs some explanation, as it is a word common only to New South Wales ports ! In Brisbane, Melbourne, Adelaide and Fremantle it is called a "Bullrope" whilst in the United Kingdom the name varies between "gog" and "gob rope", which originates from a "gog" or "gob" ring rivetted to the aft deck.

A "stopper" is always used by the stern tug, or in cases where the towed vessel is mocing astern then the tug ahead, if ahead, uses one too.

The "Saint" class tugs of course, were primarily designed as H.M.S. Tugs for rescue work, and from a commercial operators point of view, were most unhandy on deck. High engine room skylights and consequently high tow beams were the order of the day, and upper deck "tumblehome" was poor, so that the utmost caution had to be exercised when coming alongside a modern ship with a lot of "flare" forward and "run" aft.

When the "Saint" class tugs and their predecessors started to show their age, tug owners in this country had to go ahead with some kind of replacement programme, and, a few steam tugs were built, embodying generally, all the faults possible so far as cramped working space on deck for the deckhands, caused by over-sized engine room skylights, both in width and height, and the upper structure provided very little "tumblehome". In order to complete the picture, these tugs were fitted with Kort Nozzles, which, in a lot of instances impaired the manoeuvrability considerably in order to obtain tractive effort, which couldn't be used in most cases, because the tugs would tow on a ship's line, the strength of which would be doubtful.

However, during the late 1950's, a vigorous replacement programme was commenced, not only in this country, but in most countries of the world. The attached sheets will indicate the activity relating to completions and orders of tugs in the United Kingdom for the year 1957.

From the foregoing, it will be noted that the diesel engined shiphandling tug had come into its own, and consequently, vast improvements were made in the deck arrangements. Some owners, because of location and peculiarities of the area of operation, especially in the United Kingdom, made few changes in appearances to that of Steam Tugs.

The Tug Owners that utilised the benefits of the change to diesel power was that of the Tees Towing Company, whose tugs are stationed at Middlesborough, which is on the Tees River. These tugs have good deck space, the after deck being completely clear, with the exception of a rope grating aft, a "gob" ring on the centre line and bollards at each quarter. All berthing and unberthing of ships is performed on a tow line, the gear being supplied by the ship, so that a capstan is not required. This Tug Company also pioneered, in the tug "Acklam Cross", Diesel-electric propulsion in 1932, and to the best of my knowledge is the only owner of shiphandling tugs fitted with Voith-Schneider propulsion in the United Kingdom, the tugs being the "Hutton Cross" and "Banbury Cross".

The handling of tugs engaged in general duties as well as shiphandling tugs is the same the world over, the only difference being the peculiarities of the different ports themselves, that require an abundant store of local knowledge in order to achieve the utmost out of the vessel.

I have found that handling a tug in a river where there can be a strong flow and ebb, can be a problem, especially if the tug has to be swung. If the tug is too deep on the heel, even a tug with a right-hand propeller, and swinging to starboard, using the engines ahead and astern, the transverse thrust will not be of much assistance in throwing the stern into the tidal flow, whereas a tug with very little difference in draft fore-and-aft will have no difficulty in turning as her lateral underwater area will be fairly equal and the rudder power can be fully utilised.

The same problem arises when "hanging" on a line, awaiting instructions to commence towing, or, when berthing a vessel where it is desirous of remaining in the best position in order to assist the ship. The deep-heeled tug will want to stem the tide if any,

and if the location is not subject to tidal influence, but is subject to wind, then the deep-heeled tug with a light forefoot will blow away faster, and consequently, in order to keep in position a greater propeller speed is required, which can be embarrassing to the ship.

It is also of the utmost importance that a tug should be able to be handled when going astern with some sort of confidence, and without continually sheering through having the wind on the bow, and having to drop an anchor to keep her head steady. It is to be clearly understood that in all the foregoing comments, the tugs mentioned have been single screw.

From the capabilities of handiness, which of course includes the positioning of the two-hook, we must deal with vision, and tumblehome.

It has been the practice in a number of modern tugs for the wheelhouse to be positioned as far forward as possible, with the result that the tug master can never see the stem, if steering from abaft the wheel, consequently in those vessels the Master stands for'ard of the wheel and generally to starboard of amidships.

This forward positioning of the wheelhouse of course, restricts the overall view of the after deck, unless of course, the wheelhouse is raised, and then it becomes a hindrance when the tug is "lashed" alongside a ship, under the shoulder or aft. Because of this fault, I have seen the for'ard tug lashed up as far aft as the bridge on a modern ship, in order to avoid damage to the wheelhouse through the ship's flare, and it is more difficult to push or drag 150 feet of vessel bodily through the water, than at or near the extreme ends.

In order to achieve good visibility most shiphandling tugs in service in the U.K., have a flying bridge on the wheelhouse top, which is used in all weathers whilst towing, but I don't agree that it is necessary to go to this extreme when a wheelhouse can be designed to give all the vision necessary.

I favour the positioning of the wheelhouse somewhere close to 1/3rd of the tug's length abaft the stem. By positioning the wheelhouse in this position, it is possible to see the tug's stem when standing abaft the wheel, and it is also feasible to see the tow hook, and most of the after deck, especially so if the wheelhouse is raised a height of some three feet above the boat deck.

This positioning of the wheelhouse, allows for a better tumblehome, in that the upper structure is abaft, or close to the shoulder, and consequently close to the maximum beam of the tug. If the mast is abaft the wheelhouse structure, it also has the benefit of being protected by the maximum beam of the tug, and eliminates, (as does a stepped back wheelhouse) anxiety when "pushing-up" a vessel with a large "flare" or "run", and it can easily be seen the advantages that this arrangement provides when lashing-up alongside modern vessels, where every bit of tumblehome counts.

With a stepped back wheelhouse, the fore part of the boat deck provides an ideal stowage space for lead-line reels, explosive box, breeches buoy gear, as well as space for ventilators leading to the natural ventilation trunks to the accommodation, the ventilator cowls being below the level of the wheelhouse windows and therefore not blocking any vision.

The working deck layout on modern diesel tugs has been vastly improved, and it is possible to walk from forward to aft with a heaving line, or the end of a ship's line, without having to pass them around obstructions. This is extremely important because speed in handling gear of this nature is sometimes very necessary.

Good deckspace is a must, as deckhands need room to allow them to throw heaving lines, most of which are upward throws. Some little space is needed around bollards, and posts, especially as the deckhands have to use 7" and 8" manila ropes, which in wet weather swells and stiffens.

Some tugs in Australian ports carry their own towing gear, so are therefore fitted with capstans in order that they can retrieve it, and, because in most cases the tugs are capable of coastal and deep sea towing, they also have a hatch on the aft deck leading to a hold, or rope store.

These deck obstructions demand that some protection be given to the towing gear, and the preservation of manoeuvrability, and therefore tow-beams are placed over them. These beams ensure that the tow line when working from the hook does not foul the hatch coamings or the capstan control or capstan barrel. It is not necessary to connect the tow beams from bulwark rail to bulwark rail, as this only provides for further deck obstructions to the deckhands, and restricting the working space.

By referring to manoeuvrability in the preceding paragraph the inference was that if the towing gear should foul the Capstan, it could well be that, (provided the towing gear didn't carry away, or the capstan barrel didn't lift off or bend the shaft) the tug would be swung, as the towing point would be moved from the hook to the aft end of the tug which would be extremely embarrassing, without thinking of the dangers that may flow from such a happening.

The next important items in having a tug that will be manoeuvrable, with good vision and good tumblehome and clear working decks, is the positioning of the towing or strong posts and any bollards that are decided upon.

I strongly favour the positioning on the centre line forward, and as far forward as a reasonable breasthook will allow, a Cruciform type bollard, with the wings leading aft at approximately the same angle as the bulwark rail. The bollards are referred to as "H" bitts by tug men. This type of bollard allows two lines to lead under the horizontal section, with the added advantage of also being able to lay-up the two lines on the wings. In other words, this bollard has the same advantage as a "Gob ring" or Panama lead for making fast to high ships, with the addition of being able to make fast on the spot, instead of leading the lines away to other bollards. This saves unnecessary drift and consequent rendering of the lines, which can be a nuisance, especially if the slack has to be continually taken up.

I prefer two strong posts at each shoulder, the aftermost post just at the start of the round of the shoulder, with the second post between the aft post and the for'd "H" Bitts. By preferring a second strong post, to a cruciform bollard connected to the deck in approximately the same position, there is a saving in deck space, and a line can be lead either for'd or aft, whereas the Cruciform bollard on the deck, is well below bulwark height, and consequently all lines must pass through a hawse pipe, which can be the cause of severe chafe by causing a sharp nip. To my way of thinking the only thing achieved by the fitting of cruciform bollards at the shoulder, is to be sure of taking up valuable working deck space, as well as having something to fall over !

The positioning of the for'd shoulder strong posts can have quite some effect on the handling qualities when a tug is towing an oil lighter, flat top barge etc., when it is generally essential that the tugs head should be bowsed well in, so that the lighter towed, is slightly across the tug's bow, so that the two, if looked down upon, would appear to be wedge shaped. A spring made fast to the post on the shoulder well for'd will have a tendency to naturally cant the tugs head in towards the towed object, and if the towing spring, head line and aft breast lines are handled properly, the tow can proceed with the tug's helm being amidships.

The 'midships' strong post port and starboard is just what it is, and is generally only used when the tug is the "alongside" tug when towing a "dead" ship, with one or more other tugs, or when making fast alongside the berth, depending upon the port, location of the berth and distribution of the mooring bollards on the berth.

The bollards on the after deck, comprise a cruciform bollard on the centre line positioned as near to above the stern post as possible, as this bollard is used consistently with a "stopper" "bull-rope" or "gog-rope".

At each quarter a plain set of mooring bollards, free of any kevils or horns, so that a released tow-line will not foul on them, with consequent dangers. A lot of modern harbour-cum shiphandling-cum-sea tugs are not fitted with bollards at each quarter, but I have found them extremely useful on ocean tows, and would not dispense with them under any circumstance.

The number of hawse pipes fitted are 3 on either side, one set in the bulwarks, between the for'd Cruciform and for'd post, one abaft the aft shoulder post, and one abaft the quarter bollards aft.

The positioning of the cruciform bollard for'ard, and the spread of the vertical sections provide a good lead to the warping barrel of the windlass. It is generally hopeless to position a hawse pipe in the bulwarks for'd with a good line of lead to the warping barrel of the windlass, because in practise the bow is festooned with fender chains, and to pass a line through the hawse pipe is tantamount to reeving a rope yarn over a nail, as the pinnacle of achievement will be a chafed line !

The handling of towing gear at the aft end of the tug is usually by a Capstan, but some tugs have winches.

The advantage of a Capstan, far outweighs that of a hauling winch, because it takes up much less space and height, and a line can be lead to it from any direction, whether over the bulwarks or through the quarter hawse pipes.

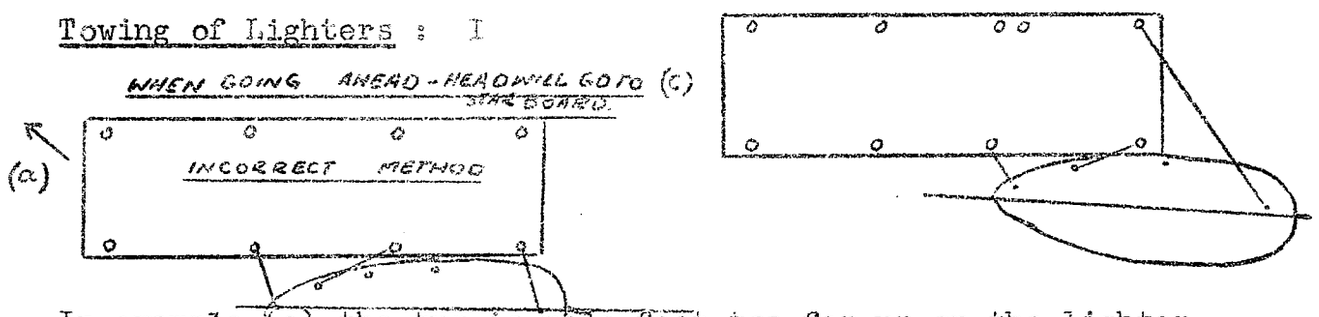
A winch on the other hand usually stands fairly high, but the main disadvantage is the fact that you can only heave a line either from a forward or aft direction, and then a suitable molgogger or a snatch block has to be used to maintain the direct line of pull. Any variation from a good lead and you get "riding" turns on the "Winch-end" which can be embarrassing at the least and dangerous. A winch also, with it's greater athwartship spread necessarily has to be protected by a higher and longer athwartship tow-beam which again reduces the working space, and when towing at sea, (or for that matter a low craft in the harbour) the high tow beam provides a position where a "nip" or chafe point is ready made, requiring special chafing gear to combat the problem.

A standard feature of our new tugs is the inclusion of a hawser lead, set in the bulwarks on the centre line aft. The lead consists of 2 vertical and 1 horizontal rollers, and is designed to take shackles and thimbles up to 12 inches in width.

When wishing to retrieve a hawser, the section of bulwark rail is lifted out and the wire falls into the lead. This eliminates lifting and fitting a molgogger into the bulwark rail, then lifting the wire up and into it, only a matter of 6 to 9 inches, but a wire can be extremely heavy if there is even only 15 fathoms of water. We have found it most necessary to heave our wires in over a revolving sheave or roller, rather than over the bulwark rail, as it increases the life of the wire, keeps it free of turns, which of course makes it easier to handle.

I will endeavour, with the aid of sketches, to illustrate the various jobs that a shiphandling tug is required to do, when attending ships together with some of the attendant traps that are consistent with ships working within a few feet of each other at speeds up to 6 knots in confined waters, as well as indicating how a tug should be made fast when towing lighters.

Towing of Lighters : I

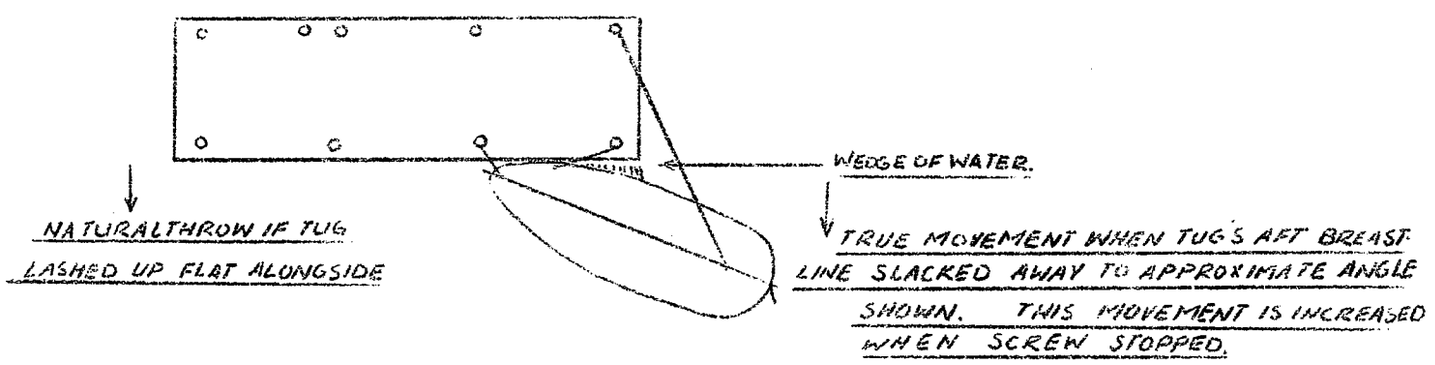


In example (a) the tug is made fast too far up on the lighter, and is too flat alongside, so that as soon as an ahead movement is given, the tendency, until some headway is gained, is to sheer away to starboard, and consequently, in order to steer at all, a considerable amount of port helm has to be carried. The effect when going astern is to swing to port very quickly, without gaining much sternway.

In example (c) the tug has the lighter lashed up on her shoulder, with her head bowsed well in, headline leading forward, as well as the aft breastline leading forward, and fore or towing spring leading aft.

This method allows good manoeuvrability and steering and when having to take the headway off the tow, the transverse thrust of the tug is counteracted by the "going astern on the port side of the tow only" and usually the tow will lose all way without canting much to port.

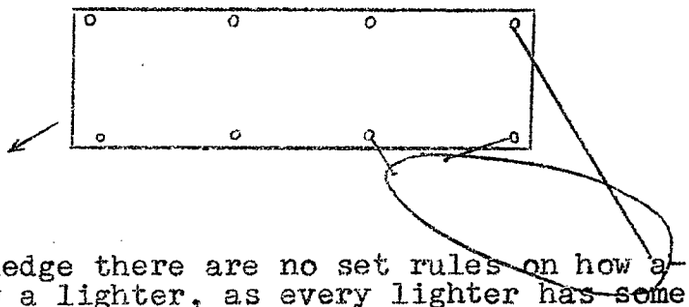
In order to 'back' a tow of this nature straight and then swinging against the natural "throw", which is head to port, it is necessary to slack up the aft breastline, thereby allowing a wedge of water between tug and tow. Upon stopping the tug's propeller, the momentum of the tow will carry the tug's head to starboard. All manoeuvres of course are subject to conditions of wind.



If possible it is advisable when towing lighters alongside to tow the "deep-end" first, as the leading deeper draft of the tow offers some directional stability with the deep-end of the tug, and is consequently much easier to steer, and manoeuvre.

As illustrated in sketch (a) how incorrect it is to lash-up flat alongside, when all the weight is on the headline, it is just as bad to lash-up too far aft with the tug's head bowsed in because then the tow wants to run across the bow of the tug, and a considerable amount of starboard helm has to be carried, and the main weight is on the aft breastline. This is shown in sketch (b)

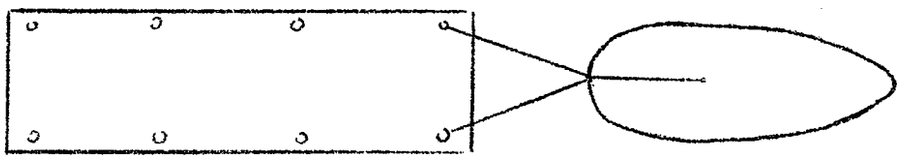
(b)



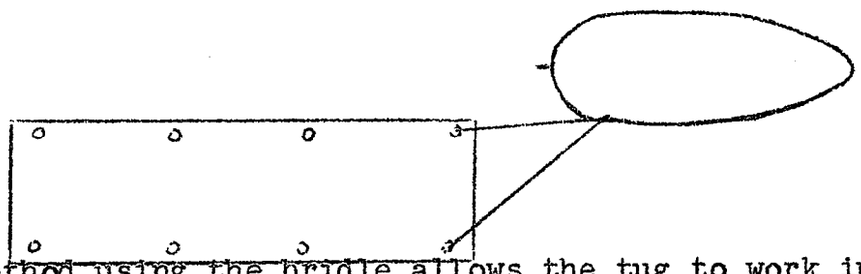
To my knowledge there are no set rules on how a tug should be lashed-up to tow a lighter, as every lighter has some characteristics that doesn't compare with another, and only experience after many tows, and the general appearance of the tow will allow the decision to be made on the method of lashing up.

At times, smaller tugs are called upon to tow lighters with a high deck load, which restricts the Tug Master's view to such an extent that he has to tow ahead. There are two methods used, one using a tow line and bridle, the other by using two lines.

METHOD SHOWING TUG TOWING ON A BRIDLE.



METHOD SHOWING TUG ON TWO LINES.



The method using the bridle allows the tug to work in a more confined space, and towing from the towing bollard or tow hook amidships allows complete freedom of steering.

The method using two lines, through the quarter pipe or lead over the bulwarks to the quarter bollards, also allows considerable freedom of steering, provided when you make the lines fast, you arrange that either one can be slacked away, and by so doing a balance can be attained. This method of course, also allows the tug's propeller wash to clear the tow.

The position alters somewhat when ship-handling tugs are attending moving ships, and a lot of care has to be exercised to avoid getting into serious trouble.

The operation of putting a towline aboard a moving ship, or taking a line from a moving ship, is much harder than it may appear, and the remarks previously passed about good vision being necessary will be appreciated.

In Figure II it can be seen the action a tug experiences when running up to take or pass a headline. It is correct that the tug should run alongside the ship, rather than endeavour to turn ahead of the ship.

When abreast of the ship's shoulder, the "outward run" will tend to force the tug's head away, (a) and when past the point of balance (b), this action will act on the tug's port quarter, and if a Master's reflexes are slow, the stage is set for the tug to run across the vessel's stem. In order to avoid happenings of this nature the Tuf Master, after ascertaining that all is clear ahead makes the run-up, by facing aft watching the distance between the tug's bulwark rail and the ship's side, and because at least 2/3rds or more of the tug is abaft the tug's wheelhouse any change of direction is quickly seen and easily rectified. It is also necessary to face aft to keep an eye on the passing or boarding of the towline.

In Figure III when passing or boarding a line from a vessel's quarter, consideration must be given to the "inward run" experienced, especially so if you are taking a line from the starboard quarter, and the ship applies starboard helm. From a beam distance of 20ft. the "inward run" is very noticeable and therefore the correct way is to pass at a slight angle across the ship's stern, in other words, you look at the beam of the ship, the "run" aft, and steer accordingly until the tug's head is clear, then once again you face aft and keep an eye on things. This is one instance that it is a great asset to be able to see the tug's stem when picking up a line. If you can't, you have a length of ship ahead of you and an imaginary tug's head that changes with any movement of the tug master within the wheelhouse.

The aft tug after connecting the towline, usually connects a "stopper" bullrope or "gog rope" to the towline in order that the tug can manoeuvre astern of the tow, depending of course on the berth location.

The word "stopper" has been previously explained, and the stopper is a very necessary part of a tug's towing gear, and by considered practical use of a stopper and application of rudder angle, a tug can steer a ship with precision, provided that when referring to a stern tug, the ship has headway, and, when used on a head tug, the ship has sternway.

Figure IV indicates the use of a "stopper".

(a) Assume the vessel in the figure is to berth starboard-side-to, with a wind blowing on her port side. Because of the location it is necessary to come into the berth at an angle, which means the tug on the starboard quarter has to assist in the swing. The tug at (a) is towing the stern to starboard, but must get onto the ship's port quarter in order to save the vessel from the wind blowing the vessel onto the berth.

(b) The tug master applies starboard helm, the "Stopper" is hove-in using the capstan. This will assist the tug to swing and run across the vessel's stern when the tug's propeller is stopped from the ahead position.

When in position (b) bearing in mind that the ship is moving away from the tug, the weight of the line made fast at the aft end of the tug, commences to swing her, and if it is desired to hurry up the process, a kick astern will accentuate the run across the ship's stern showing positions (c) and then (d). At position (c) the helm is to port to assist the swing of the stern in that direction, and at position (d) the helm is to starboard and with a kick ahead the stern is swung further, until the line of the towline crosses the centre line, when the "stopper" can be eased off as necessary.

This manoeuvre (changing position from one quarter to the other) can be comfortably carried out on a heavy ship, (having very little headway) by steaming around on the line, and not using a "stopper" at all.

In Figure V (a) (b) (c), with the "Stopper" paid out to what Tug Master's call "halfway", the stern tug can comfortably steer a "dead" tow, provided of course there is not too much headway on.

Should a tug be "dragging" on a stopper in a tideway, or in a position where the ship has a fair amount of head or sternway on it is most unwise to work the stopper at half way. If you try, the result usually is the carrying away of the "stopper" which will leave the tug in a precarious position of (in tugboat words) being caught "broad-off", or as the English and Scots say "girted" ! This can lead to possible capsizing should the main hawser fail to part, or the tow hook for any reason cannot be tripped.

(In order to prevent the tow hook jamming against the aft side of the deck house, we equip our tugs with "stop" rails or "horns" port and starboard in the way of the hook. The tow line is thus kept clear of the house, and the hook is therefore always clear to release should a tug get caught "broad-off".)

Under the above circumstances of having to go round, the towline is bowsed-down by the "stopper" as neatly as possible so that when the full weight comes onto the gear, the towline will not be far off the centre line in relation to the point where the "stopper" is laid up and made fast.

There are many tugs on the Tyne, Humber and Thames Rivers, which have a hawse pipe, set into the bulwarks on the centre line aft, the positioning of which assures the ultimate leverage that can be brought to bear by the "stopper", and it is easy to see that when "going round on a line" there must be the least amount of effort required at the extreme end to swing the tug.

In some ports in Australia, ship-handling tugs are not always used on the end of a towline, the general trend being to "lash-up", a term meaning to make fast alongside. The "lash-up" methods are widely used in the United States of America, and have many advantages, the main one being that if necessary, when pushing, full engine power can be used, which is something that can rarely be done when towing on gear supplied by the tow. If you do get gear from a ship that you can tow on at full speed, it is so heavy that the tug's crew have difficulty boarding the gear and placing the eye onto the hook !!

To illustrate Figure VI shows Sydney berths Nos. 9 to 14 Pyrmont, with vessels berthed at each berth, except No. 11 which is a cross berth and only used by lighters.

A vessel has to sail from No. 10 berth, which is an inner berth. Figure VI (1) and (2) shows how the aft tug, on a short towline - short by necessity, as the distance between the vessels at Nos. 9 and 13/14 in some cases is only about 100 to 120ft., so that the clearance on each side of a vessel using the inner berths can be as little as 10 feet. Consequently a vessel's stern cannot be allowed to wander, and, by using a short tow line, a tug travels a relatively shorter distance to get from one quarter to the other, than she would on a long line, and can therefore shift the line of pull faster in order to keep a vessel straight.

The aft tug (1) "lifts" the stern off, whilst the "head" tug "dangles" on the starboard head line, and a headline from the vessel is still fast, so that the vessel cannot move astern and collide with the vessel at No. 9.

When the stern is well clear the aft tug moves astern of the vessel, the headline of the vessel to the wharf is let go, and so some stern way is provided, with the head tug keeping abreast, until the stern of the vessel is well clear of the bow of the Ship at No. 9. Then, under the pilot's instructions the head tug

puts weight on the starboard headline (2), to swing the ship's head whilst the aft tug (2) moves onto the starboard quarter to "hold" the stern, in order to straighten the tow for the passage between the vessels moored at 9 and 13/14 berths. The arrows indicate the directions of forces used and movement.

It is obvious that the tug on the starboard headline cannot stay with safety in the position as shown in (3), so the best position for her, is to be tucked under the ship's port bow, made fast by a back spring lead from the for'd cruciform of the tug around the vessel's stem to the starboard lead. The head tug can go ahead on this spring, and thus completely control the vessel's steering, when being towed astern. By applying starboard helm, it is obvious that the tug can tow the vessel's head to port, and by applying port helm the tug can push the vessel's head to starboard, in other words, the vessel now has a bow rudder as long as the tug, and steering can be accelerated with the tug increasing propeller revolutions.

The Sketch Figure VI pos. (4) shows why a stepped back wheelhouse and mast is just as important as orthodox tumblehome, and the profile and head-on view of one of our modern tugs illustrates the above.

Figure VI pos. (5) illustrates how, when the vessel is clear of the berths, the relative positions of each tug, and their rudder angles when swinging a vessel with stern way on, head to starboard.

Certain berths in most any port dictates that the best possible service from a tug can be gained from "lashing" the tugs alongside the ship, one tug for'd, the other tug aft. For obvious reasons, twin-screw tugs are the most adaptable for this type of work, as more positive control can be exercised in position keeping.

At the present time there are only two twin-screwed tugs in Australia, the "Sirius Cove" at Sydney and the small "Tuart" in Bunbury. However, it has been proved over the years, if consideration by shiphandlers is given to the "Speed of approach" of their vessels to a desired berth, that a single-screw tug, "lashed-up" in the best position that the tug master can find, will provide an efficient and safe service.

It is rather distressing for a tug master, when ordered alongside for'd or aft, when attending some modern passenger vessels, to find that there is either nowhere to connect a line forward and aft, or the only leads aft are directly over, or in the way of the propellers !

The common method of "lashing-up" is to use two lines only forward; a breast from the forward cruciform and a fore spring leading aft to the shoulder post. Both lines should lead through the same hawsepipe. The forward breastline should lead slightly astern, which of course, enables the tug if ordered to "push-in", to go ahead, and without giving the ship headway, quickly reach the position of being at right-angles to the tow. If ordered to "go astern" to allow the tow to take the berth kindly, the spring is fast and in readiness for the kick astern.

Figure VII illustrates the methods used.
Position (a) ship has headway, so in order to avoid carrying away the forward breastline, it is necessary to leave the tug s rudder hard over to port - you will recall the action on the tug's bow in Figure II pos. (a). The action of the tug on the steering of the ship when in this position if the tug's screw is stopped, is to drag the ship's head to starboard, so it is always prudent to turn the screw over in the ahead position, at such revs as would coincide with the assumed speed, in order to reduce if not eliminate the drag.

When approaching the berth, the tug in this position, whilst the ship has headway, can only provide the ship with another propeller, in other words, if the tug goes astern, the ship's head will go to starboard. Should the vessel be well off the berth and requires a "push-in", the tug goes ahead, helm hard-over to port, and the position is as shown in position (b). To arrive at this position, the forward breastline would have to be eased off a little. The tug is now in a position to either push the bow in, or by going astern pull the bow to starboard. The position of the forward breastline, (as well as the spring being bar tight) will hold the tug's head in position, and will resist any transverse thrust. The tug will not remain at right angles should the ship gather headway again, and care has to be exercised with the spring should the ship gather stern-way, otherwise it will part under the strain.

Position (c) shows another method, using two lines, each leading through the cruciform bollard, one ahead one astern.

Position (d) and (e) illustrate the tug at right angles (d) pushing-in, and (e) the spread of the lines when the tug goes astern. The main draw back with this method is that when the tug goes astern for more than a minute or so, she cannot resist the transverse thrust of the propeller and will end up back alongside the ship giving the ship stern way.

The same characteristics applies in regards to pos. (a) (b) (c) (d) (e) if the tug is lashed-up under the port shoulder of a ship, with the exception that method (c) with subsequent position (d) is alright if the tug has to push in, but position (e) becomes untenable as the transverse propeller thrust will cant the tug under the flare of the ship's bow, and in order to avoid damage to the mast, wheelhouse etc. the springs have to be slipped and tug backed away clear !

A tug that has to lash-up at the aft end of a vessel meets with different problems than the head tug. A head tug, if the superstructure has good tumblehome, can lash-up invariably in the same position whether a ship is light or loaded, but an after tug has to consider the run of the ship as well as the propeller, and propeller wash.

There are two methods, and these are shown in Figure VIII Position (a) shows the tug lashed-up where the ship has some "flat" in the side, using the forward breastline and spring in the same manner as the for'd tug. The rudder also is hard aport, not only to ease the weight on the breastline but to ensure that should the ship swing to port or the breastline part, only an extra kick ahead will ease the position.

Position (b) is similar to that of Figure VII (b) : Even if the tow should go astern, the propeller wash will not effect the tug much, as the wash, at the distance shown runs fairly aft to forward, and only acts on the bow of the tug. Sternway of course may reach a stage where the spring will have to be eased.

Position (c) with a loaded, long and deep draft vessel may be the only position where the aft "lash-up" tug can get with safety, as well as being in the best position to render assistance.

In this case one forward spring is lead from the forward cruciform aft and made fast on the vessel's port quarter through the lead. The tug then goes ahead on this spring, whilst the other for'd spring is "sweated-up" and made fast. She is now in a position where the bow is well secured, and can't be washed in either direction by the propeller wash. The helm carried during this operation, may only be slightly to port. Should the tow require a "push-in" (berthing port-side-to) it is easy to get around, provided of course there is not too much headway, and in order to avoid going fore and aft under the 'run' a spring can be

put out from the port shoulder to the starboard leads of the ship, and if considered necessary another one off the tug's starboard shoulder, these lines will keep the tug in position even if the stern is amongst strong propeller eddies. I have never yet however, put out the extra springs as the position of the berth has never warranted the extra security to be taken.

The same applies to lashing-up on the port quarter of a vessel, and the utmost care in that case has to be exercised when lashed-up similarly to Figure VIII pos. (a). Should a vessel be going astern on her engines, but having headway through the water, it can be extremely difficult to lift the tug's stern away from the ship's port quarter, because the natural "bow" of the ship's stern is to port, and the transverse flow of water to the ship's propeller is sometimes impossible to overcome, until of course, the screw is stopped.

However, with modern tugs, and especially those with rudder angles of 45°, the above problem very seldom becomes a problem, because the tugs have not only the rudder power, but also a lot of engine power, coupled with a much shorter lever from the position forward where they are made fast. In other words, a tug of 132ft. overall, a beam of 25 feet and developing about 800 BHP., with a maximum rudder angle of 32°, can't be expected to compete with one 104'6" OA Beam of 26'6", developing 1260 BHP with a rudder angle of 45°.

It may well be asked why there aren't more twin screw-twin rudder type tugs, and the author has thought a lot about the proposition too.

As i see it, a twin-screw shiphandling tug is without doubt the most manoeuvrable of the orthodox type tugs, but apart from having a definite advantage in manoeuvrability in being able to get from say the port bow to the starboard quarter in one half or two thirds of the time it takes a well balanced designed single screw tug, that would be about the only advantage, especially as the desire to dash from the port bow to the starboard quarter may only be warranted once every five years, which makes it an expensive refinement.

In locations like the Manchester Ship Canal, it is not a refinement, but a necessity for the stern tug to be a twin screwed tug, as the tug acts as a rudder.

It is also necessary, (and I was fortunate in traversing the Manchester Ship Canal from Manchester all the way to the Eastham Locks) that the stern tugs employed on the canal, are capable of towing and manoeuvring a ship stern first into a lay-by clear of the Canal, if another ship is proceeding in the opposite direction. A single screw tug made fast head to stern couldn't carry out this operation, as she would eventually cant one way or the other, and end up head to stern under the bows counter, if of course the lines couldn't be slipped.

However, to get back to the question of why there aren't more twin-screw tugs in this country, I feel that for shiphandling in our ports, that this type of tug is not really necessary, anymore so than Tug Owners think that twin screw tugs would be a better porposition on the Thames. The PLA twin screw tugs that work in the docks of course are a different proposition. From the Tug Master's point of view, the advantage is only free running manoeuvrability, whilst the disadvantages for general harbour work is (a) Vulnerability of fouling a screw with a line over the side; (b) anxiety when attending twin-screw ships and you are the aft "lash-up"; (c) anxiety when handling the tug in the vicinity of buoys.

The disadvantages from an Owners and Superintendent's point of view, are that there are two of everything to look after; main engines, gear boxes, shafts, tail shafts and stern tubes, as well as two spade type rudders in some of the more modern tugs, which all leads to a more expensive vessel, with a consequent heavier maintenance charge over the years.

Regretfully, I cannot pass any comment on the Voith-Schneider type propulsion for tugs, as I have only seen photographs of these vessels.

There are many more varied manoeuvres that shiphandling tugs are called upon to perform than a short paper of this nature could possibly describe. Every tow, whether an Oil Barge, a P&O Liner, General Cargo Vessel or a Tanker, presents its own particular problems, as well as the change of location, run of tide, weather, and most important, the personality of the Pilot or Shipmaster whose thoughts and actions permeate the vessel from the bridge right through to where the tow line is made fast.

In closing may I enumerate the things that a tug should have - Good Manoeuvrability, good vision fore and aft, good Tumblehome, open working space both forward and aft, easy, fairly fast steering gear 3½ to 6 turns hard over to hard over in from 9 to 12 secs., positive Bridge Control of the main engines, and of course, every Tug Master's wish; the heaviest tug possible!

TABLE "A" HOME ORDERS

Area	Builders	Dimensions			Machinery		Performance	
		L.C.A.	M.B.	M.D.	Type	H.P.	EST Speed	EST Pull
Thames	R.Dunston				Dsl.	1280		
	Lobnitz				Dsl.	1500	11½Kts.	20T
	Pollocks				Dsl.	800		
					Dsl.			
Dover	Seawork	96'6"	24'4"	11'6"	Dsl.	2x500 HP	12½	14T+
Southampton	Thornycroft	112'1"	27'	13'	Dsl.	1340	11½	17T+
Bristol Channel	- -	93'	24'	11'	Dsl.	700 HP	10	10.75T
	R. Dunston				Dsl.	1300	12	20 T
	(Holland)				Dsl.	500		
West Hartlepool	Seawork	1016"	25'6"	11'9"	Dsl.	1070	11	14/15T

TABLE "A" HOME ORDERS

Area	Builders	Dimensions			Machinery		Performance	
		L.O.A.	M.B.	M.D.	Type	H.P.	F.R. Speed	Bollard Pull
Mersey	(Yarwood's				Dsl.	1270		
	(C. Hill Sons				"	1270		
	Cammell Laird		26'	12'6"	"	1170	11½Knts.	14/15T
	Seawork	106'6"	27'	14'	"	1680	11½ "	20T +
	Seawork	106'6"	27'	14'	"	1680 300		
	Yarwood's	104'3"	26'6"	13'	Stm.	1050	12½ "	13T
	Scotts Bowling		26'6"	12'6"	Dsl.	1350		
	?				Dsl.			
Belfast	C. Hill Sons				Dsl.			
	Seawork	97'	24'9"		Dsl.	1000	11Knts.	13T
	? ?							
Clyde	A.J. Inglis	103'			Dsl.	1140		
	Seawork	113'	26'9"	13'	Dsl.	880	12¼Knts.	11T +
Forth	H. Y. Robb				Dsl.	880		
	Yarwood's				Dsl.	450		
					Dsl.	1000	11Knts.	13/14T
Tyne	R. Dunston	93'10"	21'3"	11'	Dsl.	750		
							12Knts.	17/18T
Tees	Scotts Bowling				Dsl.	750		
	Phillip's	82'	23'6"	8'6"	Dsl.	750		
Humber	Cook Welton Cammell				Dsl.	1270		
	Seawork	63'	18'	7'6"	Dsl.	320	9½Knts.	5 T
					Dsl.	300		

TABLE "B" TUGS 1957 Sheet 1.

Market	Builders	Dimensions			Machinery		Performance	
		L.O.A.	B.M.	D.M.	Type	H.P.	F.R. Speed	Bollard Pull
Oil Co's	Lobnitz	105'	28'	14'	Dsl. Elect.	1000	11Kts.	12 T
	Clelands		31'	14'6"	Dsl.	32200		20 T
	Scotts Bowling				Dsl.	1500		
	Bolsons	49'6"	13'2"	5'6¾"	Dsl.	133		
		75'6"	18'0"	8'10"	Dsl.	500	10.25	6.5/1T
	Fairmile	73'			Dsl.	350		
Sudan	Fairmile	74'10"	18'6"	9'3"	Dsl.	313	9K	4.5T
Poland	C.Hill Sons	215'	39'	19'	Dsl.	3050		
New Zealand	Fleming &Ferguson	118'	34'	15'	Stm.	1700	12¼K	
Australia	Seawork		26'6"	12'6"	Dsl.	1000		
	A. Hall Co.	130'	32'	14'9"	Dsl.	1500	12.3K	24T
	Seawork							
S. Africa	Ferguson Bros.				Stm.	3000		
Irag	Scotts Bowling	135'			Stm.	1500		
W.Africa	Yarrows				Dsl.	1120		
Ceylon	(Awarded)	60'	15'	8'	Dsl.	240	9Knts.	33 T

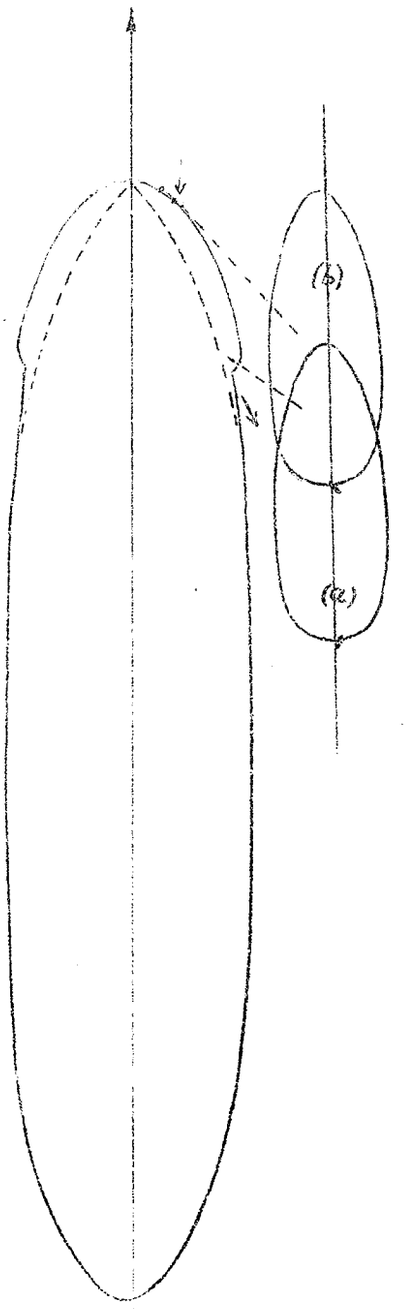
TABLE 1. COMPLETIONS - 1957

Date	Builders	Vessel	Dimensions			Machinery		Performance	
			L.O.A.	M.B.	M.D.	Type	H.P.	Speed	Bollard Pull
June/57	Yarwood	"North End"	104'3"	26'6"	13'	Stm	1050 ihp	12Knts.	13Tons
Jan./57	Seawork	"Sovereign"	97'0"	24'4"		Dsl	1290 bhp	10.5	17Tons+
Apr./57	G.Brown	"Garnock"		21'	9'3"	Dsl	324 bhp	9.5	4Tons
May/57	A.J.Inglis	"Flying Drake"	98'0"	25'	12'	Dsl	1075 bhp	12.1	12.75Tons
Aug./57	J. Lament	"Wrestler"		28'	12'9"	Dsl	1065 bhp	12.5	12.5Tons
Sep./57	" "	"Campaigner"		28'	12'9"	Dsl	1065 bhp	12.5	12.5Tons
July/57	Scotts Bowling	"Fiery Cross"		26'6"		Dsl	1200 bhp	11.25	18 Tons
Jan./57	R.Dunston	"Wyke"	75'0"	18'6"	8'9"	Dsl	432 bhp	9.6	5.6Tons
May/57	Phillips	"Sun XX"	107'3"	25'6"	12'8"	Dsl	1210 bhp	11.5	15.25Tons
June/57	Seawork	"Arthur"	72'3"	18'3"	9'6"	Dsl	460 bhp	9.5	7.25Tons
July/57	Seawork	"Varco"	72'3"	18'3"	9'6"	Dsl	460 bhp	9.5	7.25Tons
Dec./57	Seawork	"Diligent"	97'0"	24'4"	12'6"	Dsl	1008 bhp	12.5	16.2 Tons
Nov./57	Seawork	"John Henry"	62'0"	18'	7'6"	Dsl	302 bhp	9.5	5.2 Tons
June/57	Seawork	"Dart 10"	63'3"	16'4"	7'6"	Dsl	320 bhp	10.5	5 Tons
Dec./57	Phillips	"Banbury Cross"							

TABLE 1 A. COMPLETIONS - 1957

Mar./57	Yarwood	"Sir John Hall"	75'6"	19'	10"	Dsl	530 shp	10Knts	9.8Tons
May /57	"	"Sir Tom"	75'6"	19'	10"	Dsl	530 shp	10	9.8Tons
Jan./57	Seawork	"Abquaig 7"	72'3"	18'3"	9'6"	Dsl	500 bhp	10	7.2Tons
Jan./57	Seawork	"Abquaig 8"	72'3"	18'3"	9'6"	Dsl	500 bhp	10	7.2Tons
Aug./57	Fairmile	"El Tigeel"	74'10"	18'6"	9'3"	Dsl	313 bhp	9.5	4 Tons
Nov./57	Scotts	"Hashim"		33'	14'6"	Stm	1500 ihp	13	16 Tons
	A. Hall	"Tusker"	130'	32'	14'9"	Dsl	1600 shp	12.3	24Tons
		"El Kebir"							

FIG II.

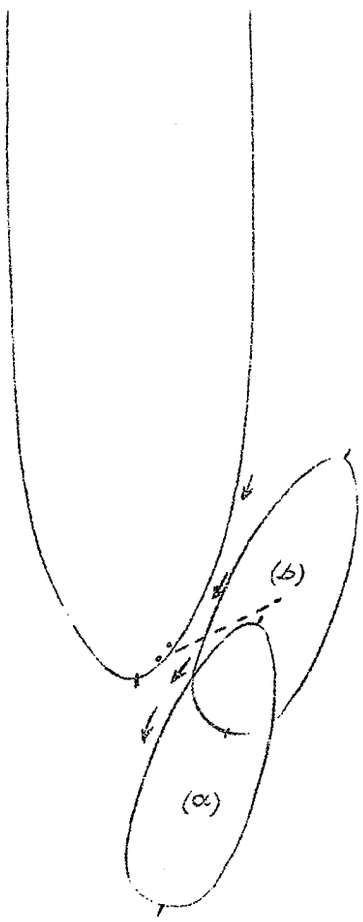


(a) PASS LEAVING LINE.

(b) POSITION TO COMMENCE TAKING HEADLINE.

RUDDER ANGLES USED WHEN PASSING OR BOARDING A HEAD LINE.

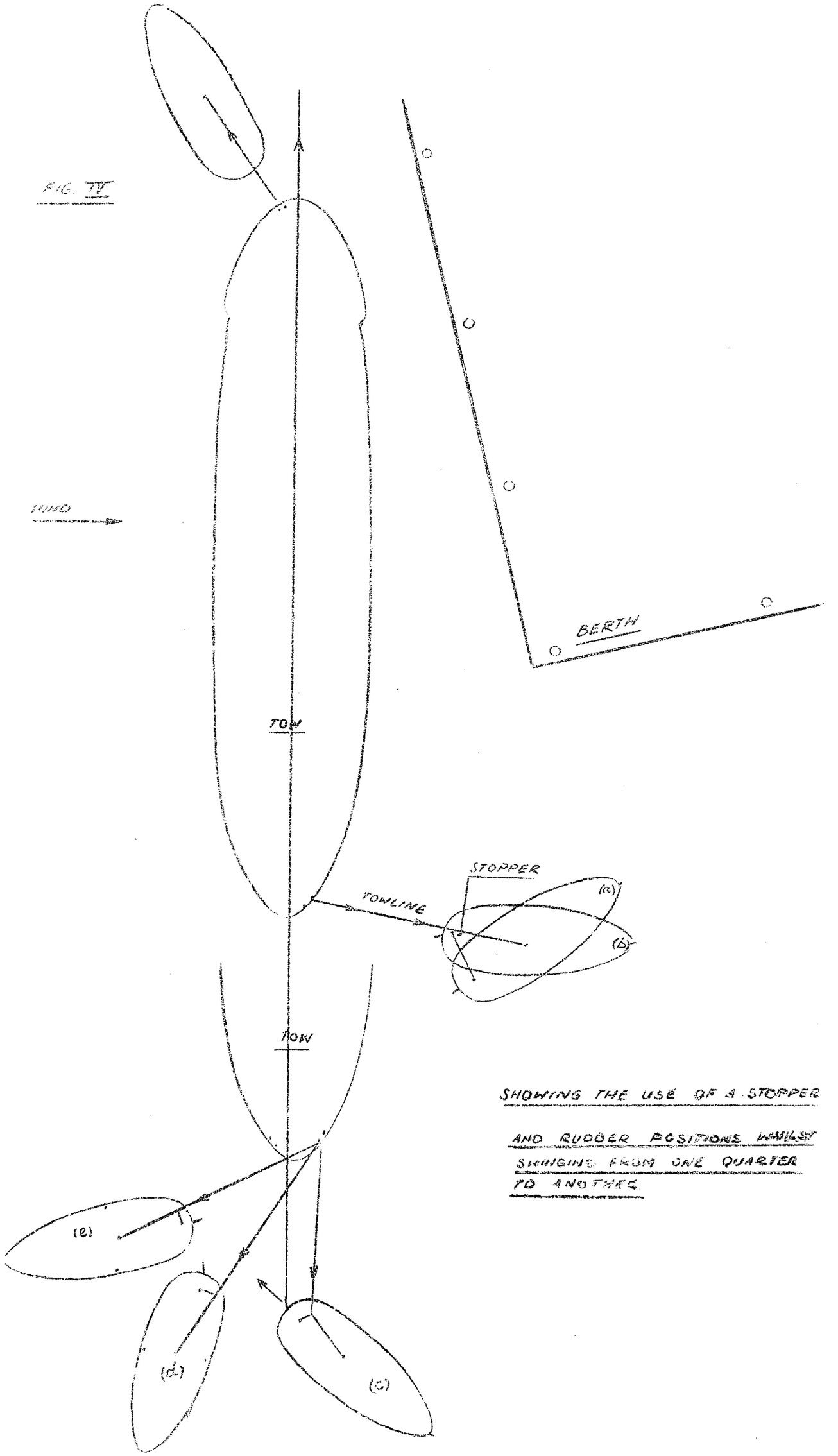
FIG III.



(a) PASS HEAVING LINE AND COMMENCE TO TAKE LINE ON BOARD.

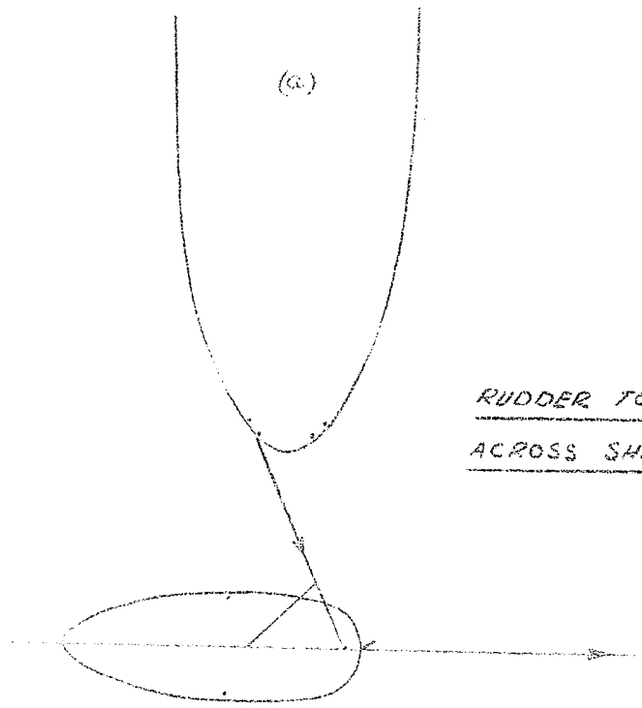
(b) WITH LINE ON HOOK HANDS CAN RUN LINE ALONG BULWARK RAIL TO TUGS PT. QUARTER.

FIG. 7F

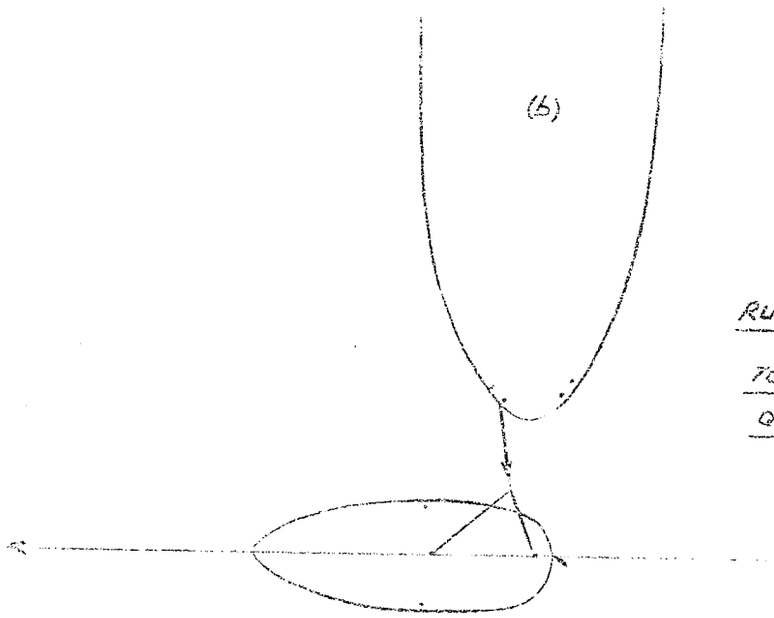


SHOWING THE USE OF A STOPPER AND RUDDER POSITIONS WHILST SWINGING FROM ONE QUARTER TO ANOTHER

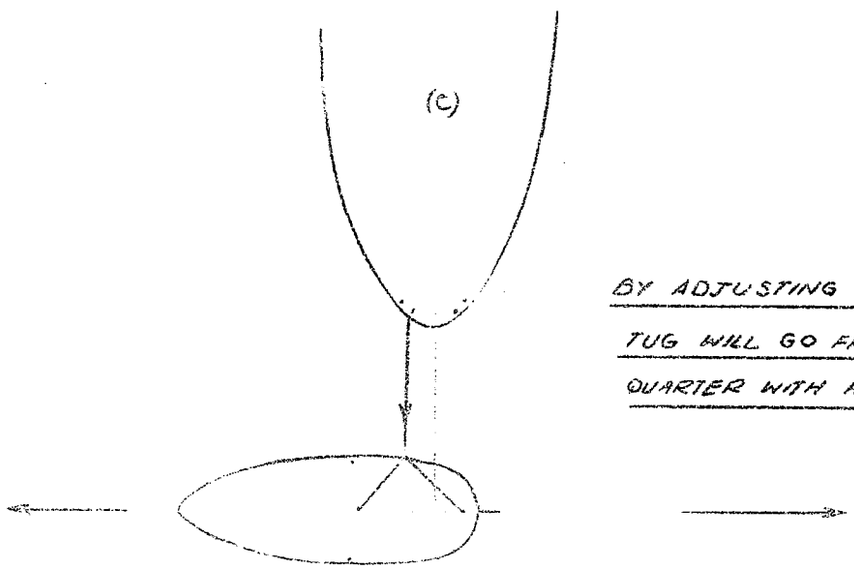
FIG I (a) (b) (c)



RUDDER TO STARB'D TUG WILL RUN ACROSS SHIP'S STERN AS SHOWN.



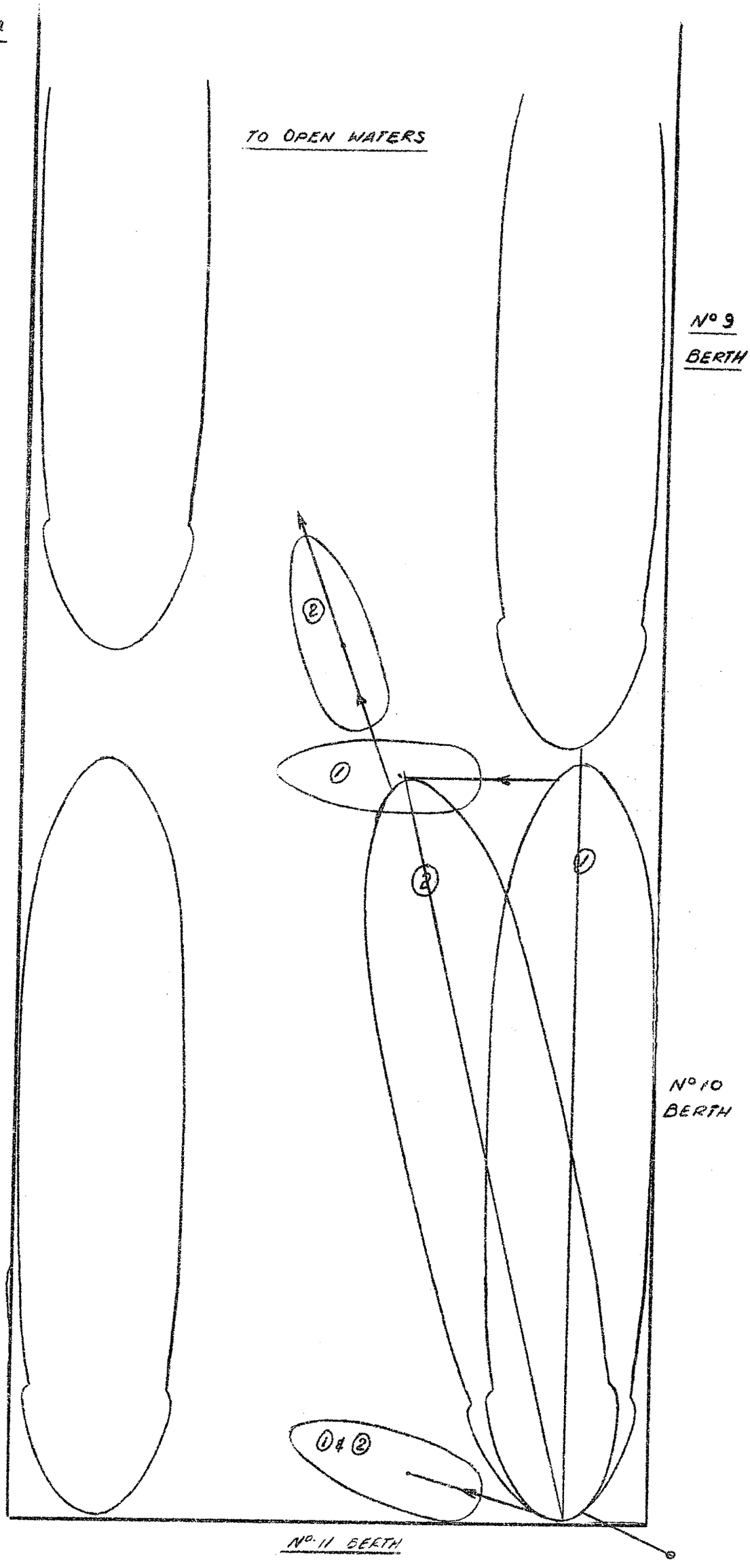
RUDDER TO PORT TUG WILL RUN TO SHIP'S OTHER QUARTER QUICKLY.



BY ADJUSTING PROPELLER REVS TUG WILL GO FROM QUARTER TO QUARTER WITH HELM AMIDSHIPS.

FIG VI

POSNS. ① & ②



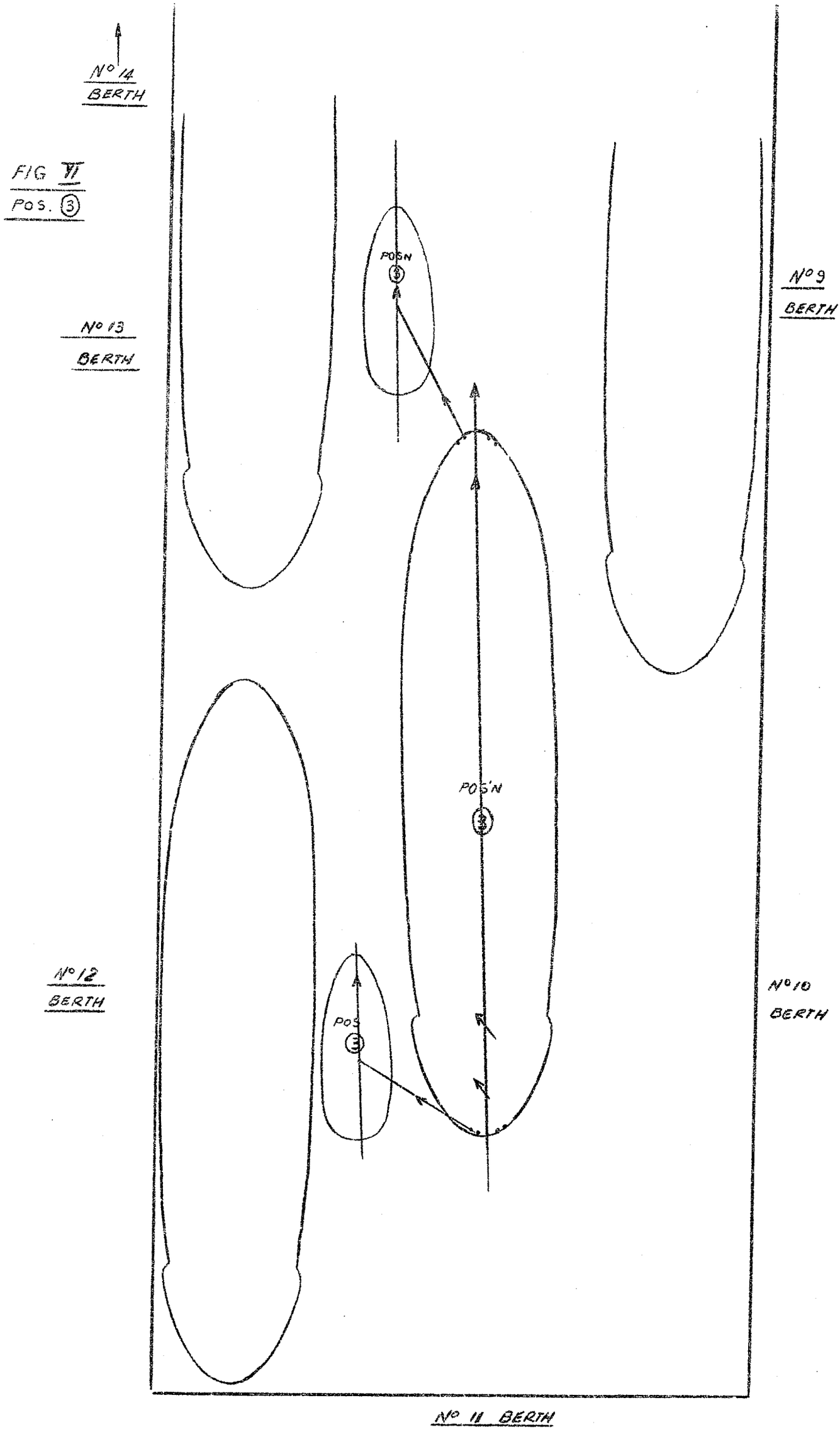

N° 14
BERTH
FIG VI
POS. (3)
POS'N
(3)
N° 9
BERTH
N° 13
BERTH
POS'N
(3)
N° 12
BERTH
POS
(3)
N° 10
BERTH
N° 11 BERTH

FIG VI
POS ④

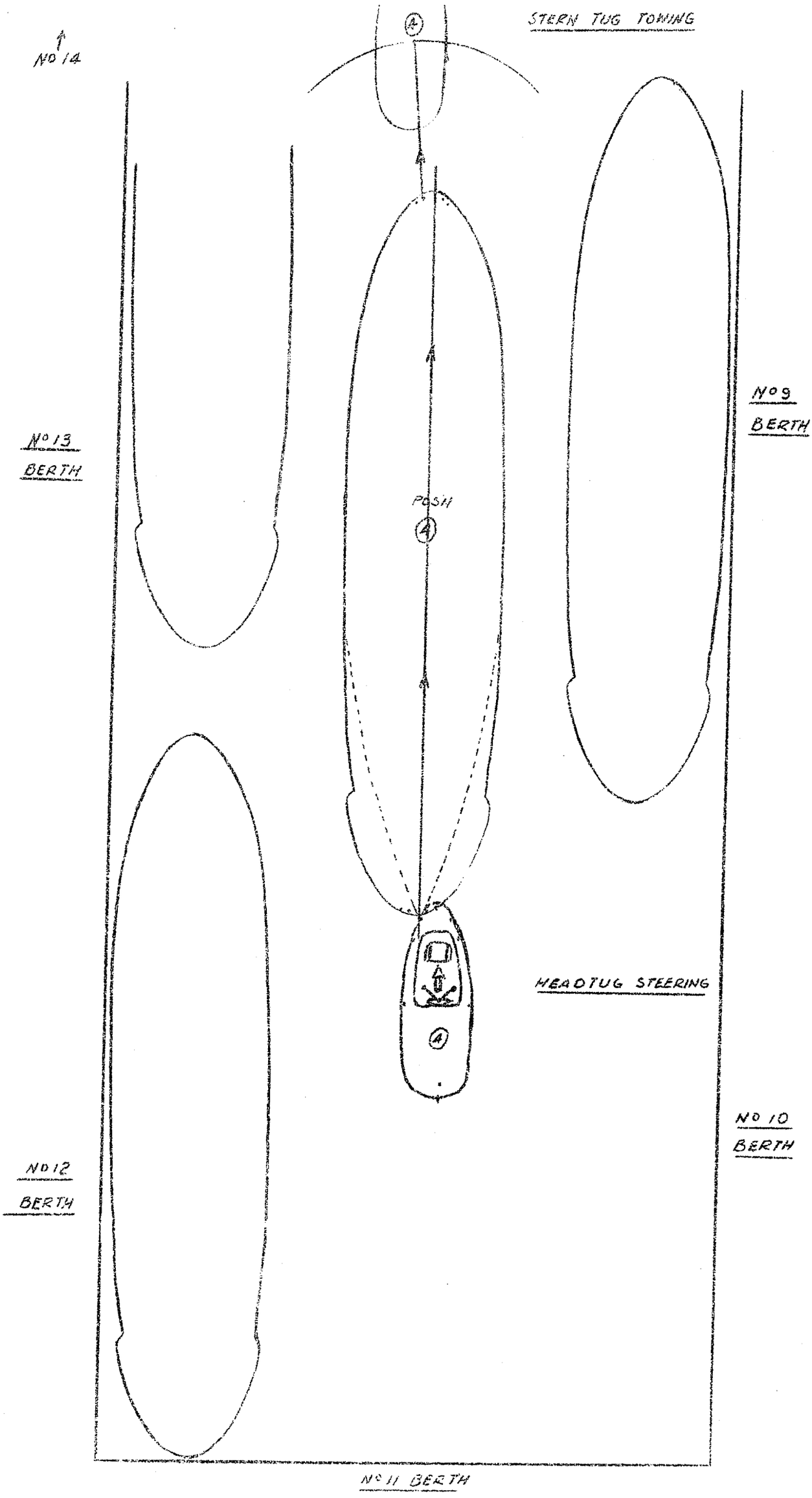
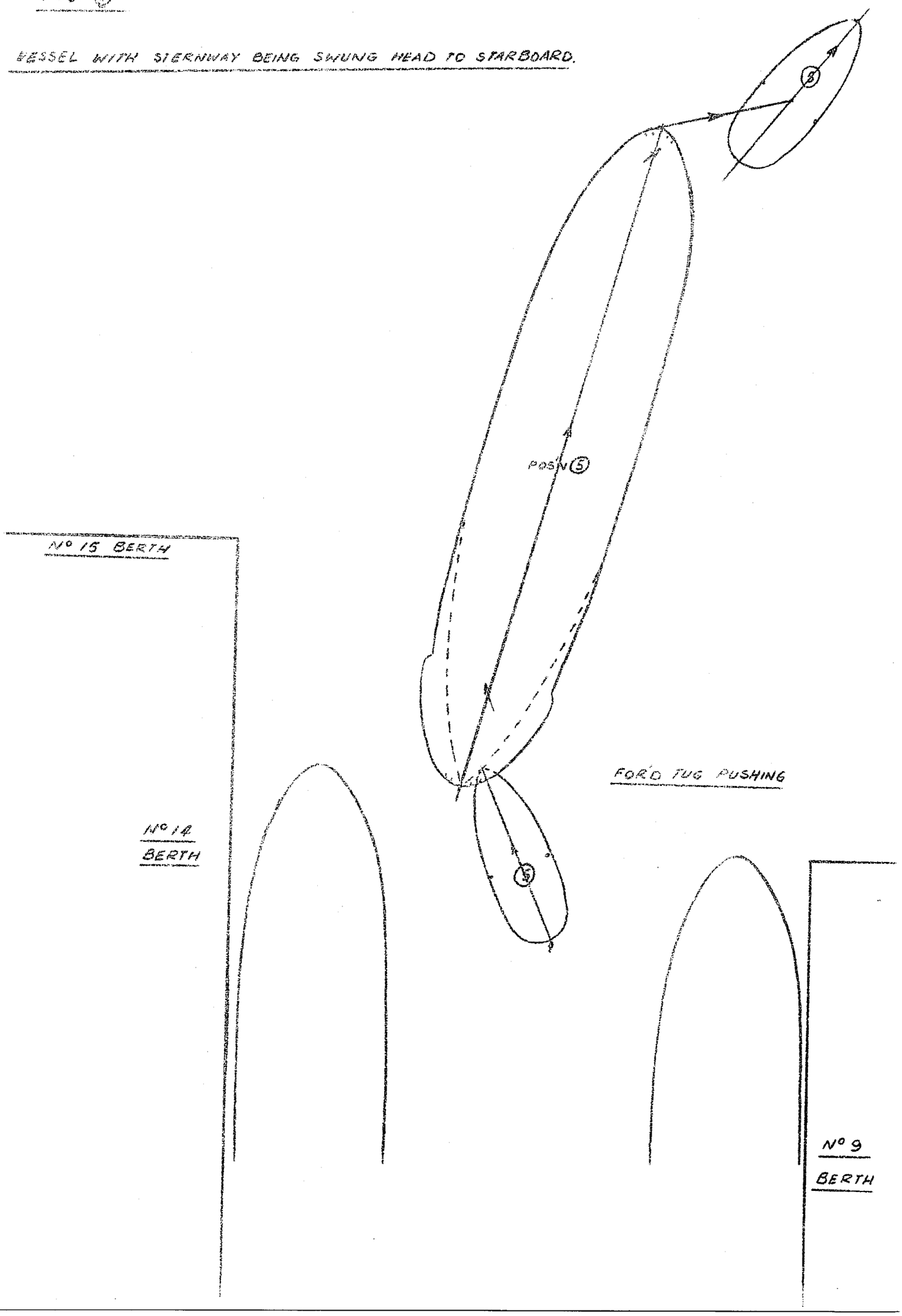

NO 14
STERN TUG TOWING
NO 13
BERTH
POSH
NO 9
BERTH
HEADTUG STEERING
NO 12
BERTH
NO 10
BERTH
NO 11 BERTH

FIG VI

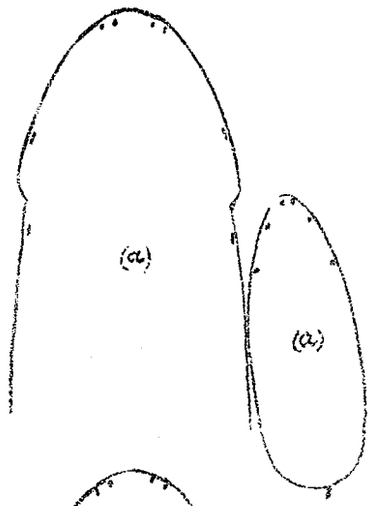
POS. ⑤

VESSEL WITH STERNWAY BEING SWUNG HEAD TO STARBOARD.

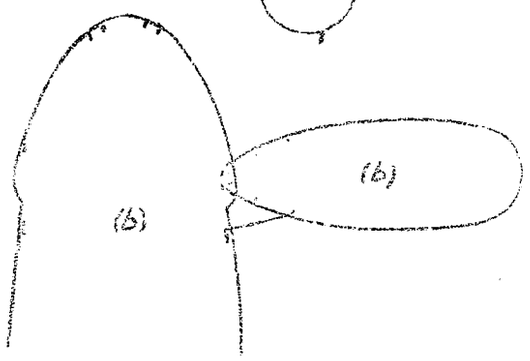


TUG "LASHED-UP UNDER "THE SHOULDER"

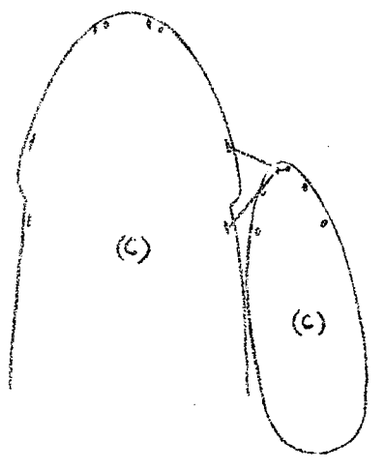
FIG VII



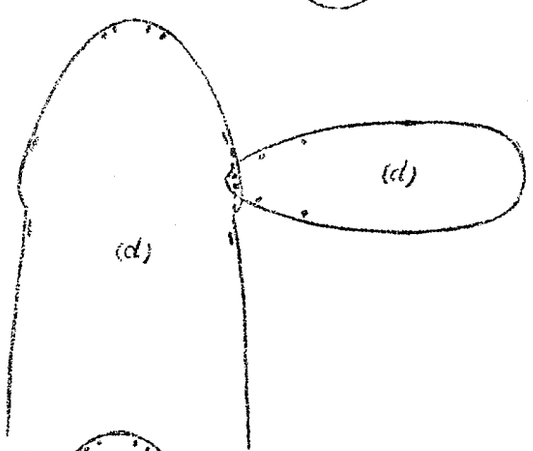
VESSEL WITH HEADWAY.



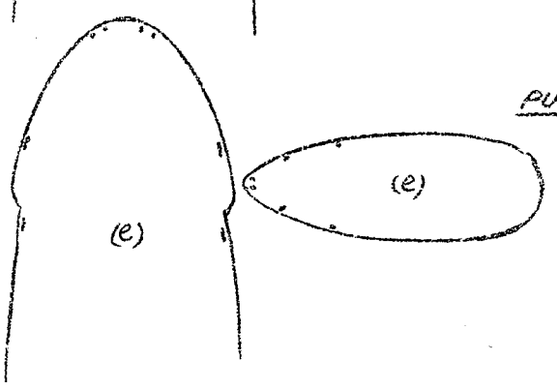
PUSHING IN / PULLING OFF
VESSEL STOPPED.



VESSEL WITH HEADWAY.



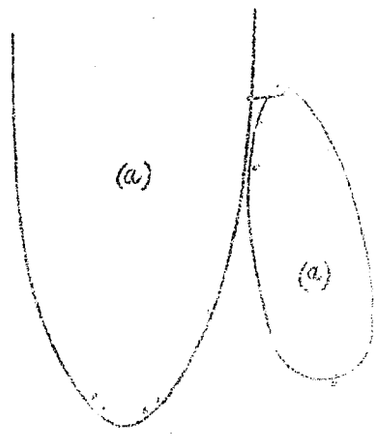
PUSHING IN VESSEL
STOPPED

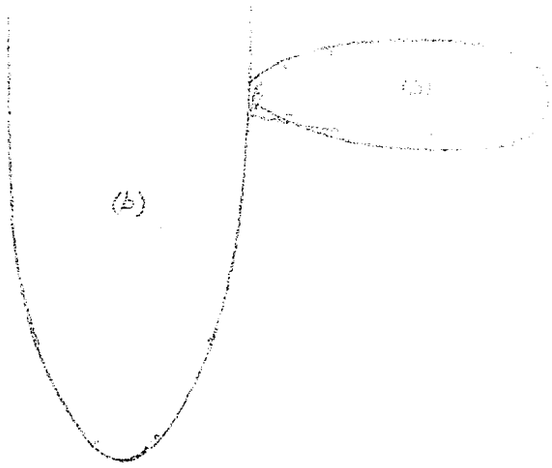


PULLING OFF
VESSEL STOPPED.

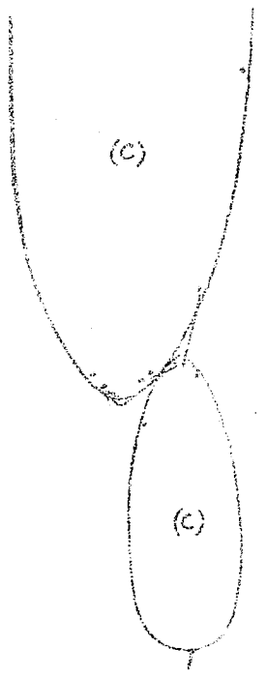
FIG VIII

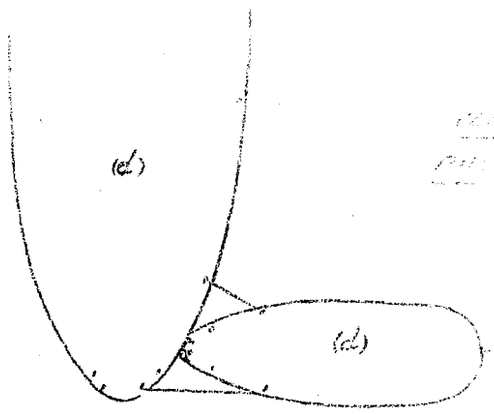
TUG "LASHED-UP" AFT





VESSEL STOPPED
TURNS IN TOWLINE
OFF





THE ROYAL INSTITUTION OF NAVAL ARCHITECTS
AUSTRALIAN BRANCH.

"HARBOUR TUGS - SOME COMMENTS ON DESIGN AND HANDLING" by CAPTAIN N. ABBOTT

DISCUSSION AT MEETING - 19TH AUGUST, 1964.

MR.E. TRIVETT (Garden Island) — Mr. President, gentlemen. It has been my good fortune to have known Mr. Abbott for many years and being instrumental in his joining the Institution in the first place. He has had, apart from local experience, quite a lot of experience in handling tugs overseas, as he brought out one of the Adelaide tugs from England and in the course of that voyage was successful in salvaging a rather large tanker, which was in difficulties in the Bay of Biscay in a bad storm. At that time, apart from picking up this tow, he also managed to take photographs of it which I was very pleased to see on his return home. The only thing was that some of the photographs just showed a great wall of water above the tug. He just had to time it when he got on top of a wave, because he could not even see the ship that he was towing. I feel that since he has been in Adelaide and been working closely with Mr. Lawson the tugs have definitely benefitted from his practical experience, and I have much pleasure in reading his paper.

MR. J. FOLLAN (Navy, Canberra) — Mr. President, gentlemen. I am happy to support our reader of the paper and to thank Captain Abbott for his very learned paper on this particular problem. I feel that this is something that we Naval Architects do not know very much about, particularly the handling of ships - we may be asked to design a ship but when it comes to handling, this is a particular trade of its own. It is indeed a pleasure to support this paper and I do hope that discussion this evening will be very deep and learned. I congratulate Captain Abbott on a very fine paper.

MR. E. ELLIS (State Dockyard) — Gentlemen. I think it is quite fitting that Captain Walker, who has very kindly offered to meet the bombardment of questions that I am quite sure will be forthcoming, is himself a tug Master. He is in fact the Master of the Flagship of the Waratah Tug Company, the motor tug "Willara" - I now throw the meeting open for discussion. It is from such discussion that we benefit greatly.

MR. J. KEEN (Niven & Doherty) — Captain Walker, may I start with a question? Capt. Abbott has mentioned tumblehome, but he has not indicated what his opinion is on the width of wheelhouses on tugs. Is it your experience that it should be as near as full width as the tumblehome allows or should it be as narrow as it can be made? Is there any practical experience on wheelhouses on tugs?

CAPT. WALKER: — No, you dont want wheelhouses particularly wide. You only want sufficient room to work in comparative ease the telegraph and wheel. The wheelhouse on "Willara" and "Manly Cove", their type, is quite wide enough, it would be about 8 feet. The width of the wheelhouse does not matter as long as it is not to the extremes of the boatdeck. That eliminates the old fashioned wings on a wheelhouse. The Theresa Ward and Saint class tugs all had wings to the wheelhouse to give the Master better vision to the after end of the tug, but the modern tug now eliminates all that and the wheelhouse does not need to be very wide at all.

MR. KEEN: — In that connection, would the modern trend of putting double telegraphs on either side of the wheelhouse and even double steering controls or electric steering controls be sensible, or would it be just as good to make it central and do away with and simplify economise on the double control?

CAPT. WALKER: No, the double telegraph is a great asset to tugs. If you are lashed to the port side of a ship you operate from that particular side all the time, the same goes for the starboard side.

MR. EKEN: Would you advocate them on the outside of the wheelhouse then?

CAPT. WALKER: No, on the inside only, the pilots can see the outside telegraph. We have experience with our own tugs, where we have the outside telegraph and we find that we have to hide it occasionally.

MR. EKEN: What do you think of the power assistance for enginercom control from the bridge? Is that really useful or is it just a question that probably the controls were a bit difficult in leads and needed the power assistance?

CAPT. WALKER: Is that the power telegraph? The only tug with a power telegraph is the "Willara". It is electrically operated, and, being electricity, it has its faults. I believe there is one being made at the moment by Westinghouse that is operated by air but I have not seen it, nor know anything about it, but think it would be an improvement. It does have a great advantage for the time lag, which you must wait for between the ahead to astern of the gearbox, 5, 7 or even as much as 9 seconds, to go from ahead to astern movement, which the power telegraph provides automatically, provided you can rely on it. We have had power failures on our boat but apart from that it is very satisfactory.

MR. EKEN: So it is not a question of the heaviness of the gear, but just purely better to secure the time lag?

CAPT. WALKER: No, heaviness has nothing to do with it at all. It is just to provide the correct time lag, because you have a tendency when you are in a tight corner to go from ahead to astern very quickly, instead of pausing at the stop sign for the appropriate time of 5 or 7 seconds. On the "Willara" with a power telegraph, you can go through from full ahead to full astern and she will pick it up automatically at the right lapse of time, when the propeller has had time to slow down.

MR. EKEN: She will take her own time automatically?

CAPT. WALKER: Yes, the weight of the gear does not make any difference.

MR. CLARKE, (General Manager Aust. Shipbuilding Board). I would like to thank you for the invitation for myself and other people from the Board, who are not members of the Institution, to be present here tonight. We have spent the afternoon, as you well know, in thinking about tugs for an owner and this has been most interesting to us and to the potential owners I am sure, I have two questions, one relates to the comment on page 2, para. 2 about the impairing of manoeuvrability by Kort Nozzles, and I would also like to hear a comment on the manoeuvrability of a Kort Rudder, if that is the correct term as opposed to the fixed Kort Nozzle. My second question is - how important to the working of the tug is easy access fore and aft right up to the stem and down to the stern for deckhands?

CAPT. WALKER: The first question on the Kort Nozzle - we have three tugs in our fleet with the Kort Nozzle, two of which have the old type plate rudder and the third one has the balanced rudder. The old type plate rudder I found was quite satisfactory with the nozzle, very good, but with the balanced rudder, it is not good at all. It is very difficult to manoeuvre this particular tug, she has a tendency, when you are manoeuvring in a particularly tight area, to go sideways before you can get sufficient headway or sternway. The tug will go sideways with you which is quite inconvenient when working in a tight corner. The other two tugs with the plate type rudder steer quite well going astern, provided you go slow. They manoeuvre very well and do not get the side slip which we experience in the balanced rudder job.

The second question, as to easy access for deckhands. They do need to get from the stern to the stem quickly. In the old class

tugs of the "Saint" class, we used to have the boatdeck with stanchions down from the boatdeck onto the bulwark rails and you could not bring a heaving line from forward to aft - you had to climb around on the other side of the tug or go around the sponson. You must have quick access from forward to aft. Although in Sydney now there are not many heaving lines used, most of our quarter lines are picked up by the tug, putting the tugs head against a ships stern. You lower the line down to the tugs foredeck and the crew run the eye down to the hook and then with sufficient slack the tug just peels off onto the quarter. It eliminates the heaving line aspect but, then again, you must have clear access to do that. Otherwise, there is the old system of bringing the tug, you amidship your tug in line with the quarter of the ship to get access and the quarter line straight onto the hook.

Mr. NICOL (Sydney Tech. College). Captain, you mention the balanced rudder and the blade type - were these vessels sister ships, same lines?

CAPT. WALKER No all three are different. You may know the three, the "Worang" "Wonga" and the third one with the balanced rudder is the "Woona". The "Worang" was built as the ordinary type ship and the nozzles were put on later. The "Wonga" was built with the nozzle and both tugs are exceptionally good with the nozzle. The "Woona" is no good at all.

MR. NICOL I was thinking that the lines of the ships may have some effect and not so much the rudder itself.

CAPT. WALKER: I do not think so. So you mean Fenwicks tugs have had a few put on? The "Leveret" had one and the "Hero" had one. Those two tugs proved quite successful with the nozzles, not only for improved pull but also for handling astern. There was only one which had a steering problem and that was the "Woona". The "St. Kitts" had a nozzle and she could steer very well astern.

MR. E. ELLIS (State Dockyard) Could you give an approximate range of suitable stability or suitable G.M's. for harbour tugs and ocean going tugs, i.e., in their worst conditions?

CAPT. WALKER: I am afraid I could not.

MR. EKEN: I have found research from Norway which gives model tests as well as a practical formula how the stability range of a tug should be taught and what the initial metacentric height should be, dependent on the size of the tug and the freeboard that the tug has. We have started in our designs to introduce that formula as a requirement of the specification. If you are interested I will send a copy.

MR. ELLIS Thank you Mr. Eken.

MR. CLARKE: What dimensions does that formula relate to?

MR. EKEN: The formula connects the beam, the freeboard, the height of the tow hook above the waterline and the draft of the vessel, as an approximate formula for the determination of the minimum metacentric height for the tug. Also the speed of the tow comes into it as that is the main danger, for when the tow comes sideways the speed of the towing ship might pull the ship over has a big effect on the water pressure on the ships side.

? (State Dockyard) The last thing that Capt. Abbott says in his paper is that he prefers the heaviest tug possible. Now, over the last few years, it is quite noticeable that the average size of tugs in Australian Ports is going down, when you compare the "Saint" class tugs with the latest ones. We talk about 90 to 100 ft. long although the power is going up a bit. I have often wondered whether the smaller, though higher powered, tug, is as useful in say handling tankers in exposed spots like Botany Bay, rather than the bigger lesser powered tugs.

CAPT. WALKER: There is a lot of contention about this - power weight. Some say that the old "Saint" class tug with less power but heavier weight could outpull the present modern tug. On a direct pull they could not, it would be impossible. With a tug boat when you are doing a tanker or any heavy ship you use your weight a lot. You go on a quarter line or a bowline, you get the tug on an angle where you use the tugs weight to assist you, you use full power. With the old "Saint" class tugs, you have a lot of weight and you would use less power to do it. With the present day tugs, you would use, probably half as much power again to get the same effect. Capt. Abbott is more for the level keel type of tug. I personally am for the hydroconic type of tug where you have the deep keel. You do find - I am quoting now the "Farm Cove" in Newcastle, I have experience in the "Farm Cove" - where the tide effect and wind is a different matter to the even keel tug, the hydroconic I find is much easier to manoeuvre. Also, I find that the hydroconic hull is far superior in pulling than the even keel type.

MR. C. BODEN Following on your remarks, what effect will be absence of a deep forefoot have?

CAPT. WALKER: It enables the tug to swing quicker in stopper work, you dont have so much plane of the ship in water to hold you.

MR. BODEN: Is it an advantage to have less forefoot or more forefoot?

CAPT. WALKER: I think it is an advantage to have less forefoot.

MR. BODEN: You can move the centre of lateral resistance further aft? What about its effect on the position of the tow?

CAPT. WALKER: It does not make much difference really, not with the diessel power type tug where you have instant power more or less. On the steam tugs, yes, where you have slow revolutions - it would have an effect then.

MR. D. HENWICK: We are building tugs with greater power now, getting up to pulls of 20 tons and upwards. What amount of power are we actually using? How often would you use, say, a 15 ton pull on a tug boat in Sydney?

CA T. WALKER: I would say one in every 300 ships. You cant use the power we have in tugs for the simple reason we dont have the lines to hold the tugs. The only time we can use full power is when we use our own tugs lines, which is not called upon very much, or if we are lashed up alongside a ship. On a ships line, we very rarely use full power.

MR. HENWICK: So that pulls of over 20 tons seem too high?

CAPT. WALKER: I think so, in Sydney, yes, or in N.S.W. actually. The 18 ton pulls seem to be adequate. The more bollard pull you have on a tug, you use it sometimes, when you are lashed up, but more than half the time it is not necessary.

CAPT. HELL (Navy) One of the recent developments in ship handling has been the introduction of bow propellers into ships. Would you consider that there might be an advantage in designing a tug with its own small bow propeller which would give it considerably improved manoeuvrability and may in certain circumstances eliminate the necessity for both the spring and a breast forward, for example, because you would have the ability to apply a side thrust as well as one fore and aft. Second point to the question, are there any particular precautions, not covered in the paper, which are necessary when tugs are handling ships that themselves have bow propellers?

CAPT. WALKER: If the tugs have bow propellers, I think you would eliminate a lot of the tug Masters, usefullness. Experience would not count then. (Laughter). You just get anybody then and take a ship away at any time - we discount that one. With ships handling with

bow propellers, the only ones actually ever done are the "Oriana" the "Canberra" and the latest one now the "Japara", the Australian National Line ship. We found them very effective, very easy. The "Japara" when going into a particular berth does not have a tug forward at all, she only has one tug aft, and I suppose half the time she could do without a tug at all. The "Canberra" and "Oriana" of course have not sufficient power to manoeuvre that ship in confined spaces off the Sydney Cove, they need the tug boats there. Fortunately!

MR. MITCHELL (Cockatoo Docks): Could you please comment on why in some parts of Britain the tugs still take the vessels into docks, i.e. big docks, whereas here it is generally accepted that the docks do most of their docking and do that rather by shore means.

CAPT. WALKER: Actually I think the only way you mean is by the floating docks, the tug to go straight through with the tow.

MR. MITCHELL: In the Gladstone Dock, Liverpool, the tug always takes the ship into the dock then pulls her over to one side and the tug goes out under its own steam. It might be the docking authorities there that allow that. Generally in other parts they insist on the tug letting go prior to the bow entering the dock. Could you comment on that?

CAPT. WALKER: There is only one dock capable of handling a tug and ship, i.e. Captain Cook Dock, Garden Island. Your dock, Cockatoo, (Sunderland Dock) you could not get in there with the average ship, even with a small ship you could not get in. Plus the fact that I think the Sunderland Dock is stepped down, isn't she? Coming out of that dock, you would probably foul a propeller on the dockside. One of our tugs got fouled on Fitzroy Dock on the steps down, the old fashioned type - but I have taken a ship into Capt. Cook Dock on the bowline, straight through, and come out again - that was the "Mt. Kiera" I think it was. It is still our practice, even when we put the aircraft carrier into the dock to go in with it.

MR. MITCHELL: The question I was really asking is "which is your preference"?

CAPT. WALKER: Well, I prefer to go straight through with it, it is much easier. You have to put the ship in, onto the dockhead. The Sutherland Dock is quite good really because you can get away from it quite easily, but in Captain Cook you are surrounded by a small dock on your port side and land on your starboard side and you have very little room to manoeuvre, particularly when you have an aircraft carrier behind you with the flight deck with so much overhang - you have very little room to come out before the ship enters the dock. I would prefer to go through the dock if I could. I have witnessed this scene in Vancouver, they have a floating dock there, the tug goes straight through it. In Newcastle, it would be a very excellent thing too. It would be very good if you could do that but she always has that catwalk across the end of it - I think it it permanently fixed or welded.

E. ELLIS: I dont think there would be many dock masters that would agree with your preference.

CAPT. WALKER: When Morts Dock was opened, we used to go in there to get the ships out. They would never allow the tug to go in close to the dockhead because we used to affect the wood on the sills - there were always screams and yells from the dockmasters there. But Sutherland Dock is a very good dock actually. Fitzroy is a bit of a bug bear, getting ships into the Fitzroy Dock. There is very little room and there is insufficient water on the port side. There is often quite a current too.

R. BIE (Shipping & Trans.) There is a conflict of opinions in regard to the stability of tugs. The American Society Naval Architects regard the bollard pull as being suddenly applied, it is dynamic, whereas the American Coastguard regard it as being gradually applied - static. The dynamic approach standard the results of a G.M. twice as great as the gradual application. As a practical man do you think that the dynamic factor should be made mandatory, giving very high G.M. such as some cases reaffirmed 4½ feet, or do you think that it might be more reasonable for the sea keeping qualities, when they go to sea, the ship could compromise between a sudden application and gradual application for the total pull?

CAPT. WALKER: The gradual application is far superior so far as we are concerned in the harbour or outside tows. This sudden application approach does not make sense to us.

MR. BIE: Thank you very much, we will have to ignore the recommendations of the learned body corresponding to this in America.

CAPT. WALKER: That was only my opinion though.

MR. EWEN: I would like to add to that, that it could not be the G.M. that would be raised to double the height, it would be the extent of the work exerted by the force and the area enclosed by curves of dynamic forces must be compared and the .G.M. could even be the same, so long as we have enough reserve stability build up for the curve, so I dont think that it should effect the G.M. in any case.

MR. BIE: The Americans take into consideration the distance between the bollard and the centre of effort of the rudder. That is their upsetting. If the rudder effort is regarded as dynamic you do get twice the G.M. that you do from a static.

MR. EWEN: That is probably the result of a very raw application of a straight formula, which approximates the amount of work done which should not be applied for tugs because of the shape of a tug, as these do not belong to the type of ships, for which the formula has been written.

MR. CLARKE: You commented, Captain, on the significance of pre-running speed especially in Ports like Sydney and Botany Bay and in that connection would you comment on the growing practice of two speed and three speed gearboxes for tugs.

CAPT. WALKER: We have the two speed gearboxes, I have not had the three speed. I think that is coming in the "Iron Cove". We only have the two speed at the moment in Sydney.

MR. CLARKE: I think the Adelaide Steamship Construction are now building one with the three speed, aren't they?

CAPT. WALKER: Yes, there are two I think, the "Taipan", she has just been launched, and the "Iron Cove", she will be here very soon with 3 speed gearbox. We have a free run gear in some of our tugs. Waratah have one and Fenwick's have two. We have a towing gear which reduces your revolutions.- it is an engineering problem, I do not know what it is - but I do find it is very good to hang on a line with it in towing gear.

MR. CLARKE: Would you say something about the kind of free running speed which is desirable?

CAPT. WALKER: You mean revolutions?

MR. CLARKE: No, ships speed.

CAPT. WALKER: We have to abide by the regulations on speed in the harbour. Certain sections of the harbour are different speeds. We usually run around at about 6 or 7 knots, depending on how much time we have, we usually allow about 2½ hours from Sydney to Botany Bay

from wharf to wharf, which is ample time. We can do it from Heads to Heads in 50 minutes if required. I would say normally about 7 knots in Sydney Harbour is quite ample.

E. BODEN: What would it be outside?

APT. WALKER: 9 - 10 knots, normally we allow from heads to heads at Botany Bay, which is about 12 miles - usually about an hour and a quarter, but if necessary we can do it in 50 minutes, weather permitting of course.

. ELLIS: Captain, does this mean that in most cases it is very rarely the practice to use full power?

APT. WALKER: Oh no. I often get a "blitz" because of the wash I cause around Garden Island, Goat Island, Cockatoo - we dont mean to do these things, we dont just give the tug a burst, it is usually to chase a job. We know a ship is coming up and we want that particular one, we have our opposition Company's hanging around and we do at times go full speed.

R. EKEN: Would it be right Captain to say that particularly Monday morning and Friday afternoon the jobs of entering or leaving Port are so close together that you have to hurry around at max. possible speed, and even then the tugmasters select the vessels with fast working pilots whilst letting some other slow ones take their time to come up.

APT. WALKER: Undoubtedly, but our opposition has to do the same.

R. BODEN: Does it not appear from what has been said tonight, that there is a lot of excess power being installed in tugs?

APT. WALKER: We would use that power - that excess power - in one in every 300 ships. You could probably get away with it with less power, but it would take you longer that is all. We have increased the bollard pull on tugs by 25%. I do think we are getting a little bit high probably for the companies' economic side of it.

R. BODEN: That is the capital Cost? It makes them harder to build?

APT. WALKER: Yes, if you have higher bollard pull you have higher fuel consumption. I think the all-round tug for Sydney Harbour is 18 tons bollard pull. The "Willara" is 22½, the "Manly Cove" and "Farm Cove" are about the same, but you very rarely use that power. They got away with it for years beforehand when tugs only had 14 tons max. bollard pull.

R. EKEN: May I add that I recently wrote to Captain Abbott asking him if he would comment also on the desirability of having these high bollard pulls and he reluctantly answered me that it was a matter of Company policy and he would not be allowed to say what he thought. I did mention to him that I knew on the Continent a lot of the big ships are handled with more tugs rather than with bigger tugs. I got the impression that he would be inclined to have the more tugs with smaller power.

MR. BODEN: It would appear that the prestige value of more bollard pull has something to do with it.

CAPT. WALKER: Prestige costs money.

MR. BODEN: I am wondering whether in fact from a Naval Architects point of view we are chasing a myth - that is tugs having very high bollard pulls which are only used once in 300 times.

CAPT. WALKER: It would not pay. That particular time when I used a tug with a bollard pull of 23 tons, like the "Tusker" has, possibly they knew they did not have that particular tug and they used two tugs as far as the Company is concerned.

MR. EKEN: The line handling with available lines is practically impossible.

CAPT. WALKER: The lines you take with a tug of 28 tons bollard pull, you need a very good line to hold it. It is all right on a direct pull but when you start swinging you are a pendulum on the end of a ship. You swing from one quarter to the other quarter. That is the danger when you get the actual weight of the tug as well as the power that breaks your lines.

MR. ELLIS: This raises the point, Captain, that in an emergency to push instead of pull might be better. You could be quite thankful that you had that extra power, I suppose.

CAPT. WALKER: Oh yes, I could manoeuvre the M.T. "Kurraba", she has a pull of about 9½-10 ton on a ship and I would use the maximum power to move that ship. The "Willara" has a maximum pull of 22½ tons and I would use that maximum power and get the ship finished 5 minutes earlier. You do use it, it is there, but half the time it is not necessary. It is handy. Even manoeuvring at times you use full power, only for quickness, that is all. You would get there just the same probably 5 minutes later with less frustration probably, than you would do with using full power. We do have a tendency to use too much power because we have it there.

MR. ELLIS: I know there have been times when I have hoped that tugs would have a little more power. When you are moving a dead ship into dock and you get a blow and the ship gets dangerously close to the dock walls.

CAPT. WALKER: The tugs have the power. You have big tugs in Newcastle, the "Warila" and the "Farm Cove" are two good tugs. You have all the power in the world but you cant use it. Although you may think a ship is going very slowly, it is better to go slow and safely than quickly. You cant control a ship when you have too much speed on it, too much movement one way or the other. It must be a slow movement. You are moving a mass of 14, 16, 20,000 tons, The slower you are going into a dock the better. You have control of a vessel when you move slowly but not when you go fast.

CAPT. BELL: To follow on Mr. Ellis' point, if you do use a very high bollard pull under these conditions a great risk is the parting of gear when you completely lose control. It is better, perhaps, to have a gentle nudge rather than lose control completely and have a nasty nudge.

CAPT. WALKER: We have had occasions in Sydney when we were pulling heavy wheat ships from the wheat wharf around Peacock Point to Darling Harbour - it is quite a right angle turn, then another right angle turn around into Walsh Bay - and we have had occasion of bow lines and so forth when we are only on half speed, probably doing only 100 shaft revs. when she could be doing 180. The ship is going towards the wharf, you know she is taking a shear, but if you give it extra revs. the line will break, so rather just keep as you are and set the line and just help as you go along rather than try and give a sudden jerk. Sometimes it does not pay off, but sometimes the line could not take any more.

MR. [illegible]: Does that mean that since the ships provide the lines, you now have no control over the strength of the lines?

CAPT. WALKER There is a formula that relates to the breaking strain oc lines, but that is only for new lines. With the old lines, we have to use our own judgement as to what strain it will hold. Most tug Masters have a good idea of the strain of the line they get hold of. Occasionally you fail, but that is all you can go by. If we use the tugs lines, the special "harbour line" for the purpose, we can really give service by using the full power.

MR. ALSOP (P.W.D.) I notice that nothing has been said about radio telephonic communication between the Pilot or ShipMaster and the Tug Master. To w hat extent is this form of communication used?

CAPT. WALKER: We have the V.H.F. system in our tugs, the commercial tugs of N.S.W. on which we have our domestic channels and radio harbour control. All vessels entering or leaving Sydney under tugs, all traffic goes

through harbour control and they give us the various channels to work with. We have four or five channels in Sydney and Newcastle for the Captain to work his ship, and then we are in direct communication with that vessel through our V.H.F. on board the tug. It is very good, it has been used now for 6 or 7 years and it has helped us immensely.

R. ALSOP: Does the pilot or the ship master con the ship through the use of radio telephone?

APT. WALKER: From ship to tug they use it extensively. You get the odd one who wont. He gets the channel to work with but they give us the orders what to do by using the old hand whistle, but the majority of them use the V.H.F. to its fullest extent actually. We find it very good compared to the old hand whistle. You do not have to peer out and strain to hear a whistle. You have echoes etc. which can confuse the number of blasts given on the whistle.

R. CLARKE: Is it not true that a washing machine factory uses the same frequency as the tug service?

APT. WALKER: They have tried to get rid of them but have been unsuccessful.

R. LAST (Lloyd's Register) I get the impression from reading the paper quickly for the first time tonight that the twin screw tug has many advantages from the point of view of manoeuvrability. The thing that seems to be against it is the maintenance angle and the number of extra parts. Would you be able to comment on the use of a swivelling Kort Nozzle which is common in Sweden as being almost equivalent to twin screw? The Kort Nozzle presumably that you have been speaking of tonight is the fixed type with the rudder behind it. I have seen a number of designs with a swivelling Kort Nozzle.

APT. WALKER: That is a Kort Rudder. I have never actually seen one. The only ones I have seen are those in the Navy Pinnaces with the K rt Rudders. But I believe there is some tug in the Manchester Ship Canal that has the Kort Rudder which is quite a large tug and has a large bollard pull. It can pull up in its own length from full speed and can turn in its own length from full speed. That is the Kort Rudder. As to the twin screw vessel, I have had a go at a twin screw tug in Sydney, the "Sirius Cove". She handles extremely well but (- end of tape prevented recording -

R. EKEN: Could it be said that for places where only a single tug is available, the twin screw tug has the advantage of quick shifting capacity from bow to stern or vice versa as may be required?

APT. WALKER: Yes, but that does not apply to Sydney Harbour.

MR. LAST: The handling of lighters, etc. seems to be a bit crude. I was wondering if you have any comments on the use of a pushing type of tug for the same purpose. It would seem to me to be much more direct and less likely to hazards in that the tug is right behind the lighter instead of alongside.

APT. WALKER: Our particular tugs could not do it because we are too high. We have the hydroconic hull which has a high bow on them and would be too high for the average barge or punt and we would be on our stem and be metal to metal actually.

R. LAST: I was thinking rather of the special design of a pushing tug for the use of handling say, oil barges in the harbour.

APT. WALKER: I dont think the work would warrant it. There is not enough work for it. There are only three oil barges in the harbour of interest to commercial tugs - three as far as ships bunkering is concerned and the present method that we use of lash up is quite satisfactory.

B. COLES (PORTS & HARBOURS VICTORIA): Could you comment on the efficiencies of the various towing hooks that are available?

APT. WALKER: The one we have at the moment on the tug is the old fashioned type, just the ordinary trip hook, then we have in three of our tugs the German design, the Knieff hook, a tow hook primarily designed to prevent the tug from being towed over. The hook is not suspended from the centre of the tug as with the conventional type, it is suspended from an angle iron that extends practically out to the bulwark and it does reduce the manoeuvrability of the tug on the line, that particular type of hook. The tug will not come around on a line as quickly as they will if pivotted in the centre. They have a new type of hook, I believe, patented by the Adelaide Ship Construction Yard but I dont know much about it at all - it is supposed to be very good. The Iron Cove has one.

B. FENWICK: There is one point there that Captain Abbott did not comment on and that is the height of a hook. Would you care to make any comment on the height of a hook so far as deckhands work is concerned?

APT. WALKER: The height of the hook has a big bearing so far as the deckhand is concerned. We have one on the "Woona", I would say the height of the hook would be 5'6" from the deck. You have to climb up on top of the tank top to get the line on top of the hook. While we have the other extreme in the "Manly Cove", Farm Cove", "Sirius Cove" where you can walk right up to the hook and put the line on, it is actually only waist high. Waist high is a good height. Our other boat, the Warratah boats, you also have to climb on top of the daily service tank to put the line on the hook, which is a disadvantage.

L. ELLIS: Captain, this question of towing hooks is one of great interest in connection with tugs and I think it would add to the value of this paper if you could get us some definite information on the hooks. It could be passed on to people per medium of the discussion of the paper. I think it would be of great interest to most people here.

APT. WALKER: This new hook I believe that has been designed is supposed to revolutionise all towage risks, it cannot be faulted, I believe.

B. HEIN: I have seen this hook on the M.T. "Naldham" in Brisbane. It is a hook which is shaped from a disc, and as a result by drilling some holes from the opposite side of the cut out for the hook shape, the hook is completely balanced and will stay put in any position. It will freely spin around. It is balanced. The result is that if the tow hook is slipped, meaning that if the hook gives away, it is very easy to put it back into place, where, with the old hook with the enormous mass of material that is in it, it takes terrific leverage to put it back into place. That is the main advantage of it. The slip gear of this hook is put inside the carrier in such a way that it is well protected and as a result it is pretty reliable to work all the time. When the skipper decides to slip the hook, even from the wheelhouse, he just pulls the lever with a little light rope and the hook is away.

APT. WALKER: We have a similar type on three of our tugs. We have the German type, it is a cumbersome thing, but it is very efficient. That can be released from the wheelhouse, but that has been disconnected due to the fact that it is dangerous to the crew if they anywhere near the hook when it is being released. That hook on that class, the German design, is very efficient, it cannot fail to trip, it cannot injure anyone, as you dont have to be anywhere near the hook to release it you can release it from either side or from the boatdeck or as I said from the wheelhouse, but it is an enormous contraption.

B. HEIN: That is mainly due to the fact that they are trying to give the hook a leverage to keep the ship upright when the component of the pulling force goes lower in through the deck than the attachment of the hook, thus giving an additional stability safeguard.

L. ALSOP: Another thing that I would like to see incorporated in this paper is the possibility of using a Plenger rudder, i.e. the waterproof motor driving a small propeller situated in the centre of a rudder. Do you know if any tug companies have ever given this matter any consideration?

CAPT. WALKER: I dont think so, actually I do not think that it would be very - I do not know very much about it - but dont forget that these tugs have lines around your stern, close to your stern, under your stern, you are working with lines around your propeller all the time, not near your propeller, I am not saying that, but you have enough to worry about your propeller alone without having any other attachment to your rudder, if it has moving parts, I mean. I have never seen it.

MR. KHEN: The Pleuger Rudder is mainly applied to small cargo vessels or coasters.

MR. ANDERSON (Navy) So far as towing hooks are concerned, quite a lot of tugs have spring loaded devices. I would like your opinion as to whether spring loading is essential or whether it should be a straight out hook. Another question, while we are speaking about Kort Nozzles, one disadvantage in my mind that has not been mentioned tonight is that during trials on a tug with a Kort Nozzle, I found that you have to anticipate your reverse speed from the forward to astern or stationary motion. For instance, if you are moving ahead and you want to come to a stationary position, to change the flow of water you would actually have to cut the propellers before the motion is stopped otherwise you would start to go astern. I am wondering if you ever came across this at all with Kort Nozzles. This was noticed for the first time when a ship was taken on trials - coming alongside was a case of backwards and forwards until you were able to synchronise the speed of the ship with the changing propeller revs. This may only be because it was a new ship.

CAPT. WALKER: The nozzle ships I have handled I have found extremely quick so far as ahead to astern movements, and they stop the headway very quickly. If you are coming into a wharf and you are coming in at reduced speed down to the lowest speed and you are in full astern you get practically instant stop on the nozzle jobs I have worked with. As for the spring laden hook, I think they are excellent. I have never actually worked them but I would like to see them they are very good indeed, particularly for using wire onto our hooks - our crews wont take wire - the whole object of the spring laden hook was to take wire or wire rope, the combination Europe rope, so that they take it over to the spring, which is not in the wire, but our crews wont take it, we just have to use Manilla.

MR. ELLIS: Gentlemen, I think Captain Walker has done a particularly good job under difficult circumstances. It is a very difficult thing to step in and answer questions on a paper that has been prepared by someone else. I think it may have added to the value of the discussion as there are a number of points in which Captain Walker has disagreed with the author of the paper and I think this is a very good thing. Captain Walker, on behalf of all present, I would like to thank you for stepping in and fulfilling this difficult task.

THE FOLLOWING COMMENTS WERE RECEIVED FROM CAPTAIN ABBOTT AFTER HE HAD READ THE FOREGOING DISCUSSIONS -

"..... I will substantiate generally the remarks of Captain Walker, to whom I am indebted for reading the paper.

I will endeavour to supply supplementary answers to those already given by Captain Walker.

(1) Tumblehome - On our tugs, the wheelhouses are more or less standard size, approximately 10 ft. fore and aft and 7 ft. wide, with 2 ft. wide bridge wings outside the doors, the tumblehome of the bridge wings being approximately 7 ft. inside the sponson; additional tumblehome is gained with fender thickness.

(2) I agree wholeheartedly with Captain Walker's comments relating to Outside telegraphs, (page 2) and this particular answer is tied to Captain Walker's answer 5th paragraph on page 8, which relates to ship's towing gear, or in simple terms using a ship's mooring line to tow on.

It will be appreciated that if a tug is towing on a ship's mooring line of doubtful strength, that experience alone will dictate what power can be used, and it is rather distressing for a Tug Master to experience a harbour tow taking a sheer, and again practical experience coupled with wisdom dictates that propeller revs should not be increased otherwise the tug will part the line, and it is far better to hold onto a doubtful line than carry it away, thereby leaving the ship to sheer as she will.

Turning back to page 2, it will now be realised why the Tug Master has to resort to "hiding" the outside telegraph occasionally. Some Shipmasters and pilots do not realise what they have on the end of a towline - nor the true condition of a ship's line, and it is embarrassing to say the least, to have orders to "give her all you can", and then to be blamed for carrying away the line!

Page 2 - Power assisted bridge engine room controls have been installed to protect the clutches in the gearbox. You can go from full ahead revs to full astern revs in 8 seconds, the centre 4 seconds, covering the shaft breaking, emptying of ahead clutches, some engine run-down speed, before engaging the astern clutches. In manual control the telegraphs are easily handled, but the inbuilt automatic protection is eliminated, and it takes an extremely cool Tug Master to count 4 in the stop position before putting the handle astern, when a tug is in a tight corner!

Captain Walker's comments on Kort Nozzles, stems from mutual experience as we have served as Master on the same tugs, and consequently, no further comments are necessary on my behalf. The comments on clear deck space concur with mine also.

Page 2 - Referring to GM: We stipulate conditions of:-

(a) Light Ship Condition
(b) Half capacity in fuel oil tanks and domestic water tanks, with ballast tanks full.
(c) Half capacity in all tanks.
(d) Full load condition.

with a GM of not less than 18 inches in light condition, and fully loaded condition for harbour or sea duty of not less than 24 inches.

Page 3 - last Paragraph : heaviest tug possible.

This comment related purely to having the heaviest possible tug for a given size, and whilst I agree that in the past the "Saint" class tugs displaced 890 tons they were 143ft. OA with 1200 IHP, providing approximately 12 ton Static pull. Captain Walker correctly states the use of power weight. We now have general purpose or standard type tugs of approximately 400 tons displacement, 104'6" OA with between 1080 and 1600 BHP to give a static pull of 18 to 23½ tons. It is therefore possible, to transfer

effective efforts from say, one bow to the other with a modern tug in a quarter of the time that a "Saint" class tug would take, and unless your towing gear is first class the "Saint" could easily carry it away because of her amplification of weight as she swings on the end of the line. (See also Page 8).

Page 4. - The pros and cons concerning deep forefoots and rake of keel has been debated at length with Captain Walker and three other Sydney Tug Masters, and I am pleased to advise that the deep forefoot has been voted to win the day through (a) easier manoeuvrability in a tide way (b) resistance to blowing away and pivoting of the deep heel, (c) astern manoeuvrability where the deeper forefoot provides some measure of directional stability (d) with a sluice keel and correct placing of the cruciform bollard aft, the deep forefoot tug swings as quickly on a stopper.

Captain Walker's comments (page 4) relating to amount of pull used is correct when using ship's lines. In South Australian ports 6 out of 7 tugs use their own gear in practically every instance. However, generally 15 tons pull and sometimes much less is used and this depends on prevailing conditions, location and the pilot or Shipmaster, but the 2 tugs do use full power when berthing Supertankers of 97,000 DWT Loaded.

This particular question is tied to Mr. Eken's comments on page 7, paragraph 12 - In Continental ports with a large volume of shipping and barge traffic it is a practise to use 4 or 5 small tugs on handling one ship. In other words, there is ample work apart from shiphandling to occupy this number of tugs.

The recently granted subsidy arrangements which are applicable to vessels over 200 Tons Gross, will in future, have some considerable bearing on the size of tugs, the minimum of which I would assume to be in the vicinity of 105' overall, to meet requirements of GRT.

In our country, the volume of shipping is smaller and barge towage is almost non-existent, and it would be uneconomical to provide 4 smaller type tugs of 600 BHP and 10 ton pull each when two standard type tugs of 1080 to 1600 BHP and 18 to 23½ tons pull, can do all and every tow. For instance, the smaller type (4 off) would employ 16 men, whereas 2 standard tugs employ 10 men, not forgetting that the initial outlay, maintenance etc. would be higher with 4 smaller tugs.

Page 4 - Paragraph 12 - I was privileged to spend a day on board a tug named the "Maximus" working on the Tyne. This tug had a Kort Rudder and a bow propeller working in an athwartship tunnel. Unfortunately, the Kort Rudder's maximum angle was 20°, consequently, the bow propeller was a necessity, and I formed the opinion that she couldn't do anything in the way of towing or manoeuvring that the tug "Wonga" couldn't do.

Page 5 - Paragraph 4 - I have the feeling that in the discussion concerning docks that Captain Walker was thinking about Dry and Floating docks, whereas Mr. Mitchell was discussing the Gladstone dock which is a wet dock, used by ships in the cargo handling field at branches No. 1 and No. 2. There is also a graving dock at the N.W. corner of the Gladstone Dock. It is necessary for the head tug to go into the lock of the Gladstone Dock to enable the ship's head to be held up, especially if the tide is flowing. I have had the pleasure of proceeding through the Gladstone Dock lock and into Hornby Dock as well, with both tugs locking in with the tow.

I have only steamed into the Captain Cook Dock to shift a Sloop, and all the Dry Dock Masters that I have come in contact with, are very jealous of their particular dock sills and keel blocks, and make certain that a tug master is working near hallowed ground. Fortunately, I have never been in any trouble ahead of a ship approaching a dry dock, and have always managed to either stem the dock head, passing the towline ashore, then backing out clear. However, it would be handy if you could steam straight through the Floating Dock at Newcastle, (N.S.W.) especially with a strong S.W. or S. wind blowing.

Page 10 - Paragraph 3 - The heights of the hooks on the "Tenacious" "Tarpan" and "Tapir" are approximately 3'6" high, just a little above waist height, so that it is easy for the deckhands to place the eye of a line on. The hooks on "Tarpan", "Tapir" and "Maldham" are of Adelaide Ship Construction Manufacture, and are known as the ASCOL hook. The profile drawing of the "Tarpan" which was attached to the paper indicates the style, and she was the first tug in this country fitted with this most efficient and safe hook.

Page 10 - last Paragraph and Page 11 - To the best of my knowledge there are no tugs fitted with a Pleuger rudder, and I am quite satisfied with our present tug design and equipment. As Captain Walker pointed out, the dangers associated with working lines are ever present, more especially with tugs that use their own wires which are hove on board through a centre roller lead, and it could well be that a Pleuger rudder may be vulnerable to damage.

Regarding spring loaded hooks, I have been fortunate in observing the hook on the tug "Aysgarth" based at Liverpool. For shiphandling work on short towing gear, short by necessity working out of Canada Dock, ebb tide, strong westerly wind, and quite rough steep sea, with the tug pitching rather heavily, I formed the opinion that without some spring the line may have parted a number of times, because of the pitching. The Hook's spring gear compressed about six to eight inches, thus relieving the shock load. Because of this feature, it is safe, and it is feasible to use a wire directly off the hook. For general purposes, and by that I mean to take Ocean Towage into consideration, a spring loaded hook creates additional chafing problems because of the fore and aft movement in the wire caused by the hook's springs flexing, and consequently, extra continuous care must be exercised with the tug's chafing gear, over the tow rails.

I have carefully considered fitting spring loaded hooks on our tugs, but find that they are not necessary because (a) they are by necessity rather bulky and (b) we consider our towing springs of synthetic fibre between hook and wire is better as it gives up to 18 inches of flexibility under shock loads, which a spring loaded hook wont give (c) our towing arrangements, and port practices concerning crew members, who will not place a harbour wire on the hook, spring loaded or not.

I concur with Captain Walker's comments on Kort Nozzles, in that I have never experienced any difficulty in so far as engine movements are concerned and ahead or astern movements are positive. If making way through the water, then bringing the screw to stop, headway is lost very quickly, because of the dragging screw within the nozzle.

I sincerely trust the foregoing will go in some small way towards clearing up the answers to the main questions asked, and I should be pleased if you would include these comments as additions to the "Discussions".

In closing, please convey my sincere thanks to the President and Members of the Australian Branch Council of the R.I.N.A. for accepting my paper.

N.W. ABBOTT.
Manager and Superintendent
Ritch & Smith Limited,
Port Adelaide.