The War's Effect On Merchant Shipbuilding—I.*

The Standard Ship and Momentous Problems of Production

By Homer L. Ferguson¹

In a military sense, this war is narrowed down to the question as to whether the German submarines can sink the English ships and those of the Allies at such a rate as to force peace upon Great Britain, ourselves and the other Allies before the Germans are sufficiently thrashed on land to recognize that fact. When the submarine campaign was started in February, the German Minister of the Navy promised his people that in August of this year England would be brought to her knees. The rate of sinking for a time increased until it became probably three or four times the rate of building.

There have been two schools of thought regarding the proper method of meeting the German submarine campaign. One school has held that only by the production of the maximum number of ships in the shortest space of time until the production of new vessels should more than equal the destruction of vessels in being, would the question be answered. The other school has held that there were vessels in plenty to feed England and to carry our troops to France and to feed them, and that the proper method to meet this menace was to build a large number of submarine chasers, destroyers and other vessels of war to go after the submarine itself. There is a very strong feeling that catching the submarine away from its base is something like catching bees out among the flowers instead of in the hive.

The exponent in an official way of the theory of building the maximum number of ships is, of course, the United States Shipping Board, with the Emergency Fleet Corporation as the largest individual owner and builder of merchant ships anywhere, either at this time or at any other time in the history of the world. All of the shipbuilders have had their new ships commandeered by the Shipping Board, and these ships are now being pushed to completion under the direction of the Shipping Board. In addition to the ships under construction at the time the Shipping Board took over all these vessels on August 3d last, the Shipping Board has placed contracts for 200 to 300 additional steel ships and for about 200 wooden and composite ships. The English have built ships at a very rapid rate during the past six months but prior to that time their capacity had fallen off woefully. The figures of British shipbuilders are that in normal years their capacity in tons was about two million. In 1915 they built only 700,000 tons. In 1916 only 550,000 tons. In the first six months of 1917 they built 500,000 and by the end of 1917 they will have built during this year almost two million tons, or practically their normal tonnage.

In comparison, it is interesting to look at our record, which is mostly in the future. The largest tonnage ever built by us in any year prior to the present year was in 1908, when we built 615,000 tons. In 1917, or at the end of the fiscal year of 1916-17, on July 1st, the total tonnage turned out in merchant ships in this country was close to 800,000 tons. Of course we expect that that will be bettered very much, and the production, except for labor difficulties, would have been very much greater than that; but it is a far cry from 800,000 or 1,000,000 tons of ships a year to a prospective 2,500,000 to 5,000,000 tons of ships a year, and especially when we consider that the best the first shipbuilding country of the world ever did in any one year was only 3,000,000 tons.

Now as to the methods of turning out such an enormous tonnage in a short time. The standardized ship was first thought of by Noah. It certainly would have been had he built a second ark. Every other shipbuilder has thought what a joyful thing it would be if he could only build two or three or four ships just alike. If the war does nothing else for shipbuilding, it will at least demonstrate that the individual tastes of individual owners need not be met in every instance. Ships are not built alike for the reason that ships are built by units and tens instead of by thousands. And what applies to the automobile industry or hat industry or any other industry where the units are small and the aggregate number is very large is not possible where you are building a thing that is worth a half million or a million or more. It is certainly not possible under ordinary circumstances with a very scattered ownership. But with a single ownership, like the Emergency Fleet Corporation, it becomes possible for the owner to specify that all

ships shall be alike, and thus we have standard ships!

There is an idea extant that if a ship is called "fabricated" or "standardized" it becomes rather easy to build. It does become easier to build, but it is not any easier to drive a rivet in a fabricated ship than in a common ship, and the 7,500-ton fabricated ship will have about 650,000 rivets and some riveters must do a considerable amount of work to drive those rivets in that ship the same as in any other ship. The most onerous work in building a ship is in the driving of the rivets; and, if any concern is going to build one ship a week, it must drive 650,000 rivets a week. When we consider that the best rivet drive is by the Union Iron Works, where they drive 250,000 rivets a week, and the next best by the three largest shipyards on this coast is about 200,000 rivets each per week, the problem of driving 650,000 rivets a week assumes a rather difficult aspect to the casual observer. Still, we all hope it will be done, but if it is done it means the importation of an enormous number of new workers into the industry.

The fabricated ship has the center of the stage at the present time. In England a standardized ship was adopted which is very much like a fabricated ship, and they are being turned out at a rapid rate. The first ships have already been completed and are on the sea now, if indeed they have not already arrived in this country. The fabricated ship, like the English standard ship, has the disadvantage of low speed, and at the same time it has the advantage of a large carrying capacity. The records of submarine sinkings, such as have been gathered, indicate that speed is probably the safest defense against the submarine. The number of very slow ships sunk is very great in proportion to the number attacked. Probably 90 per cent of the slow ships are sunk when attacked by a submarine. As the speed becomes greater the immunity of the ship from torpedo attack becomes greater—not only because she presents a more difficult target but also because the vessel may run away from the submarine in darkness or in daylight if she has a greater speed than the submarine has on the surface, and also because the vessel may be maneuvered much more quickly. One of the most gratifying things about submarine warfare is that the torpedoes are not making the speed as in the early days of the war. The speed of the torpedo has undoubtedly become much decreased. Just why we do not know, although it is probably due to the absence of tungsten and manganese and some other ingredients now so difficult to obtain in Germany. Vessels of 16 or 17 knots have actually dodged the torpedoes.

The vessel of 16 or 17 knots is also needed to carry soldiers. We are shipping all our soldiers to Europe in vessels of 14 knots or over because it is thought to be too hazardous to ship them in the slower vessels. We have at the present time in this country enough vessels in commission to ship soldiers to Europe at the rate of not more than one million a year. That includes all vessels of 14 knots or over. But by building a large ship as well as a speedy ship an additional factor of safety is obtained, which may be illustrated by stating that a torpedo will blow just as big a hole in a little ship as a big ship. When a small, short ship has a large hole in it a relatively larger proportion of its length is open to the sea. When a similar hole is blown into a long ship a very much smaller proportion of that vessel is open to the sea. So that it is perfectly possible to design, and practical, indeed to design, a ship of 500 or 600 feet long, so subdivided that it will take two and probably three torpedoes of the German variety and still stay afloat. The design, however, must be of such character that when the compartments are flooded the ship will still remain upright. The requirements of passengers who go to sea are such that the ordinary passenger ship shall have a very small metacentric height. But with a small metacentric height the rolling of the vessel is very easy, so that the passengers are not made ill with the motion of the ship as easily as they would be if there were a large metacentric height and the ship rolled quickly and with a jerk. The ordinary passenger ship is modeled with a small metacentric height, and three-fourths of them, when bilged or torpedoed, will probably turn over before sinking.

A great deal of talk was heard years ago, when the "Titanic" went down, about making ships safe. The "Titanic" was probably the safest ship that ever crossed the ocean, with the exception of the "Olympic." The "Empress of Ireland," the "Lusitania" and the whole host of passenger ships of which we have any record have turned over as they went down, and they probably righted after they went down. So that in designing a

ship that will be safe against submarine attack not only must the question of subdivision be taken care of so as to limit the length of the vessel that may be damaged by a torpedo, but also that the vessel when torpedoed will remain upright and be able to get into port. A number of vessels have been torpedoed and have been towed into port and repaired on the other side, even after the crews had deserted them. In fact there is a strong notion that the crews have been over-ready to desert the ships and have left when the ships were still afloat, which is proven by the fact that these ships have been towed in.

The larger type of ship which will probably be built before the war is over by a number of concerns in a position to undertake this work will be designed with a high speed for troop transport, with a close subdivision to make the ship safe, and with a large amount of stability so that the vessel will also be safe against turning over.

The war so far has developed, or called attention to, three distinct types of vessels: The standardized or fabricated ship like both the English and the United States have adopted, the large troop transport which has been described, and, in addition, the submarine chaser.

In addition to these three types of ships brought out by the war, there has been a very definite attempt to rejuvenate what some of us have considered a dead industry. I do not know whether there are many wooden ships building around Philadelphia or not, and I would not like to criticize the wooden ship builders; but I should like to see a few. We have a few of the older wooden ship builders left, but the building of a wooden vessel to my mind is so much more difficult than the building of a steel vessel and requires so much higher skill than does the building of a steel vessel that I wonder how they can ever expect to build them.

I do not believe that a 288-foot wooden ship built in a lumber yard, either south, west or north, and necessarily by men who are not expert ship carpenters, will ever relieve any great distress on the other side of the water, caused by lack of fuel or food. On the other hand, these vessels may be used in our own trade at home. My chief regret is that they are not made shorter, because when such ships are over 200 ft. long it is rather difficult to hold the ends up. If we get more vessels through building wooden ships, let us build them, but it is unfortunate that the type was settled before many professional wooden ship builders were on the job. The wooden ship builders of course have taken a good many men from the steel shipyards and have lessened production to just that extent; but, on the other hand, they will add a very considerable tonnage, now that practically all our large coastwise ships are either going abroad or are in the way of being commandeered for foreign service, so that the wooden ship will serve a useful purpose.

The standard ship probably offers the best opportunity for a large increase in our tonnage. The standard ship has been built on the Great Lakes for years. Shipbuilding there has become largely a manufacturing operation for the reason that the ships themselves simply form a part of the manufacturer's business of carrying iron ore from Lake Superior down through the Canal to the eastern points where it is shipped to the steel furnaces. The loading and unloading of the ore permitted the standardization of docks, hatches and so on, and the method of construction became standardized because the work which the ship did was standardized. Many ask why we do not build ships just like they do on the Lakes, and the answer is that we do not do the same work that they do. On the coast, with the coal trade, there has been some effort toward standardization. With the standardized ship the main benefit is not in the hull of the vessel, or in the fabrication of the vessel in the steel mill. The main benefit is that the machinery and the outfit, the winches, the pumps, the steering gear, the engines and boilers and all the thousand and one things that go into the ship are standardized and may be produced in large quantities at some point other than the yard of the builder. The standardization of the fittings of a vessel are more important to my mind than the standardization of the hull. The amount of money saved in the latter will be the money to build the templates, patterns, etc., amounting to not more than 12½ to 15 per cent of the labor cost of the hull. We are told, too, that all the riveting will be done at the steel mills. It probably will not and if 20 per cent is done it will be more than I think will be done unless the railroads will carry pieces of steel as large as this auditorium.

Shipyards have naturally tried to standardize within their own practice the fittings that go on the various ships

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they build, and a great step is being made in that direction by one of the largest corporations in the country. The Bethlehem Company own so many shipyards that they are in a position to standardize as between their various yards, with the result that there will be considerable saving in cost and in time in the production of all the things that go into a ship. But in building the standardized ship, or in building any other ship, the real problem is not the problem of equipment; it is not the problem of money even; it is not, except in part, the problem of location, but it is the problem of men. A very simple lesson in arithmetic will indicate that if 100,000 rivets are to be driven in one day and any one gang of riveters will drive 300, then it will take so many men and boys and helpers to get that drive. It is quite desirable to get back to our arithmetic again when we have built so many ambitious high hopes of what we expect to do. I can state for our company, the most fortunate thing we did when this war started was that we only promised to deliver ships in the quantity that we had been delivering before. In other words, we did not capitalize our noble purposes and high ambitions, and I am very happy to say that we therefore have only about four more vessels on our hands for which we received a fixed price.

Saying that we are going to do a thing does not do it, and hoping that we are does not do it, and promising to the newspapers that we are going to build all these ships does not do it. As a matter of fact, enthusiasm and high hopes, unless counterbalanced by good judgment and experience, do more harm than good, because a good many people are lured into a sense of security that we are going to win against this submarine menace, when, as a matter of fact, there is nothing to justify any such conclusion. For instance, on the Delaware and on the Chesapeake, which we, on the Chesapeake, are pleased to consider the two largest shipbuilding communities in the United States, there are at present about 33,000 men employed in the shipyards. There could be employed to advantage in these same yards at this time a total of 48,000 men, and within the next six months, or the next nine months at the latest, these same yards, barring the fabricated shipyards, could employ to advantage a total of 60,000 men. So the problem becomes arithmetical again. You have 32,000 men working. To get the maximum production out of the shipyards already in existence you will need to use 60,000 men. Where are the 28,000 extra trained shipbuilders to come from? Add to that the fabricated shipyards, which on the Delaware will probably require 20,000 men, and in the vicinity of New York an extra 10,000, and we have in this immediate district need for approximately 60,000 new mechanics in the shipbuilding business.

According to Admiral Capps, there will be needed in the whole United States in shipbuilding within the next six months an additional 150,000 men. Now, consider for a minute where these men must come from or how we are to get them. In the first place, most shipbuilding men or mechanics require both skill and experience. We can give them the experience fairly quickly, but we have not time to give them the skill. In other words, it is necessary that men be recruited from industries where they do work similar to the work of shipbuilding in order that they may become quickly adapted to the work of shipbuilding. I say other industries without specifying what particular industry. Of course, it would be natural to pick the non-essential industries if there are any such. But I would say that they should be taken from *any* other industry if necessary, because our problem in the war becomes the most difficult when the question of transportation is considered.

We are operating or preparing to operate 3,000 miles from our base and that is the crux of the whole question. A reasonable solution has been proposed for every physical problem presented by this great war except the problem of over-sea transportation. I do not know whether it is giving away information that would be of benefit to the enemy to say that that transportation is entirely inadequate, but if anyone does not think so all he has to do is to look at the congestion in our various ports. The problem of over-sea transportation absolutely has to be met before we can get into the war effectively, and the problem of sea transportation is probably the most difficult of all problems we have to face. Therefore, the men should be furnished for the solution of this problem, no matter what industry they are taken out of. We are making a fine, large army; we are making all kinds of quartermaster supplies and guns and other things, but none of them are of any use whatever unless carried to Europe. Our soldiers must be carried to Europe, and not only that, but the soldiers that are carried to Europe must be fed and must have ammunition. The excitement created by the war so far will be but a gentle zephyr compared to the excitement that would permeate the United States if, perchance, we get a million men in France from the United States and they go hungry. My own opinion as a plain American is that that is the

largest problem that looms up in the future. The distress that has been occasioned here by the sufferings of Frenchmen, Englishmen and Belgians and the different peoples of Europe will be very slight compared with what will be occasioned by some of our boys not having the proper blankets or foods or something else, all of which must be carried to them in ships. So that the problem of building these ships becomes a military problem of prime importance—the most important single problem that confronts us at the present time.

I have been quoted recently in an extract that I gave of this talk to the newspapers as favoring the conscription of laboring men. I do not say that I favor the conscription of laboring men, but I do say this—that sooner or later the United States will tell all men who are essential in any industry or any occupation in the prosecution of the war that *this* is their job and they are to stay by it until the war is over. It is perfectly ridiculous that our men who are already in Europe and those who are going there now should for a minute suffer on account of some difficulties that arise between employers and employees in the great shipyards of this country. Not only should the man who pounds iron and drives rivets be told that he shall be kept on his job, but also every employee in the company, from the president down to the office boy, is to do the same thing, and he is not to seek or obtain other employment, except for good reason given the Government authorities. It simply comes down to this: Whether we are playing a game of amusing ourselves, or whether we are in to win. If we are in the war to win, no one should be timid about telling the laboring man or the unions or anybody representing them just what part they have got to play along with the part that other people should also play. In fact, when the war started a few of us in conversation with the Secretary of the Navy told him that we thought the thing for him to do was to commandeer the shipyards together with all their employees; to put us all on the Government payroll if he wanted to do so, and give us as many stripes on our uniform as he thought proper, and if we did not do as he thought the United States wanted us to do to court-martial us and send us down to Atlanta or some other convenient penitentiary. And I think something of that sort should be done. Any man who has charge of shipbuilding or engineering in any capacity who is not perfectly willing that that should be done both to himself personally as well as to his men has a very one-sided view of this war which needs to be corrected. Of course, it is held by the National Council of Defense, and by a number of exalted bodies that the *status quo* as between employer and employee should remain the same during this war. Of course, it should remain the same, and we all know that it is not remaining the same, and we all know that the labor leaders as a rule are unable to control the men.

There is a solution of this labor problem effected with the transport workers on the other side; Liverpool, for instance. A number of the soldiers were sent back to Liverpool and went to work. You will remember a few years ago in France a great threatened strike on the railroads was settled by making soldiers out of all railroad employees. Our present stevedore troubles are in a fair way of being settled by giving the colored man a chance to be a stevedore instead of being a soldier in the trenches and so far as I have been able to observe in our neighborhood, several thousand of them are glad to take advantage of this glorious opportunity and are stevedoring for their country very quietly and very effectively, and I do not see why of all the men who have been passed into the National Army that we should not have in so essential an industry as shipbuilding those of them who are mechanics on conditions set by the Government and on pay to be approved by the Government, to work in these shipyards until the war is over, or until they should perchance prefer to go to the front instead of staying in the shipyards.

[TO BE CONCLUDED]

A Nomenclature of Smells

A CORRESPONDENT asks, "Is there no genius prepared to give us a nomenclature of smells?" and, referring to a paper on "Wound Treatment" in our columns, suggests that it ought to be possible to name a wound smell, and so to obviate the despatch of samples. An approach has been made many times, but with little success, to the establishment of a system of nomenclature comparable for smells with the classification which we have been able to set up in the cases of the senses of seeing and hearing. The fact is that, so far, smells have not been capable of the analysis which is possible with light and sound. In both these cases we have a gamut or a law of octaves, as also with the atomic weights in chemistry, and perhaps some day a similar analysis in regard to odours will be forthcoming. At present we are without a nomen-

clature, and everybody experiences the difficulty of describing a smell. We have to be content to say that a given smell resembles another smell which is more or less familiar. The fact is that the sense of smell has been the least cultivated of the senses, and it is just possible that if the subject had received the same attention as have the senses of hearing and sight the study of odors would have reached a higher scientific plane, though, it appears to us, the classification of smells must always suffer from the absence of the mathematical analysis capable in optics and acoustics. As it is, in our struggle to describe a smell we are confined to using such terms as peculiar, persistent, pleasing, disagreeable, sour, bad, musty, sickly, and so forth. Now these are all adjectives which give us little enlightenment. We appreciate at once what is the color of an object called red, and when we fall back on the reference to common objects, for the purpose of more exactly defining a color—thus a yellow color is frequently described as lemon or canary, a red color as brick or claret—our comparisons are made to objects whose hues are fixed by mathematical laws. In the case of sound and light we have a comparatively narrow scale. There are seven primaries as seen in the spectrum and in the range of notes from A to G. It is difficult at present to determine whether smells may be similarly brought into a system of scales or octaves. Such a system, however, has been suggested in the construction of perfumes. Many years ago Dr. Septimus Piesse, for example, set out a series of odors in parallel with a musical scale and showed how it was possible to make a bouquet correspond to a cord. Perfumers thus speak of a gamut of odors, placing the name of the odor in a position corresponding to its effect upon the olfactory sense in the order of the amplitude of vibration. The gamuts of odors thus constructed certainly suggests a law of octaves, for we find that, according to Dr. Piesse's ingenious arrangement, at the lower end of the scale the note B corresponds with clove, while the octave B above gives stocks and pinks and the higher octave B cinnamon. The keen sense of smell will recognize a similarity of odors here just as the musician recognizes the repetition of a note in octaves. The fact that some persons associate certain colors with smells, and that others speak of certain musical notes as suggesting corresponding colors, is interesting sentimentally but not scientifically.—*The Lancet*.

Structure of Hide and Leather Fibres

EACH hide fibre consists of a great number of fibril complexes, each complex containing an undetermined number of fibrils, between which gelatin is found in swollen hide. During swelling and falling, the fibrils and their complexes undergo alterations of position, etc., including twisting, the fibrils of fallen hide however being straight. The interfibrillar penetration of alkali during swelling is easily recognized with the ultra-microscopic. Chrome, aldehyde, and chamois leathers show a closer structure of fibres than vegetable-tanned leathers, and are naturally less easily acted upon by boiling with water. While the unswollen hide fibre is more or less optically empty, the leather fibre shows a distinct ultra-microscopic structure, which with vegetable-tanned leather gives information as to the subdivision and amount of tannin taken up, and which can be brought into relation with the physical properties of the leather. The fibrillary structure of gelatin is proved by the ultra-microscope to be a network.—Note in *Jour. Soc. Chem. Ind.* in an article by W. MÖLLER in *Z. angew. Chem.*

A Gun the Italians Lost

SEVERAL interesting photographs have appeared in the pages of the SUPPLEMENT illustrating the sensational engineering feats performed by the Italian army in the prosecution of its campaign on the Austrian border, and on the first page of this issue will be found another view showing a powerful field howitzer being hoisted by derricks and tackle to a snowy mountain top. Hundreds of guns, both big and small, were thus laboriously installed in almost inaccessible mountain fastnesses, but unfortunately, as was developed during the recent calamitous reverses, it was impossible to quickly withdraw the armament thus so advantageously placed. All of these wonderful strongholds among the mountain peaks had to be abandoned when the Italian line was flanked by the Germans, together with their equipment and munitions, and undoubtedly the loss of so many guns is one of the most serious aspects of the catastrophe, for Italy was none too well supplied with guns, and much time will be required to replace them. It was this shortage of guns also that can account for the difficulties encountered in making a quick and successful stand against the advance of the enemy, after the first retreat.