April 9, 1946. R. D. BOURNE 2,398,131

METHOD FOR BUILDING SHIPS

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FIG. 1.

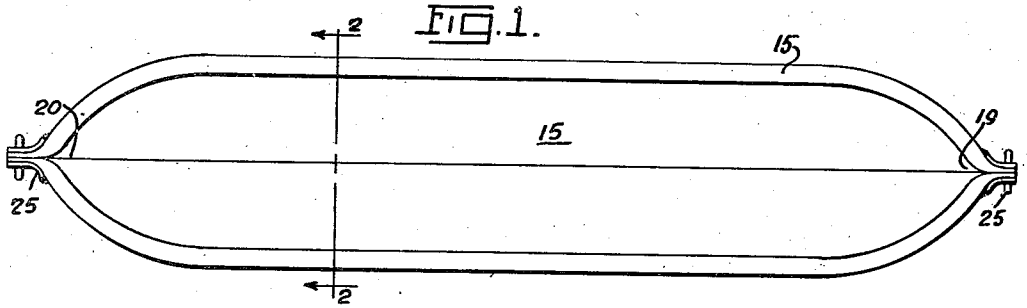


FIG. 2.

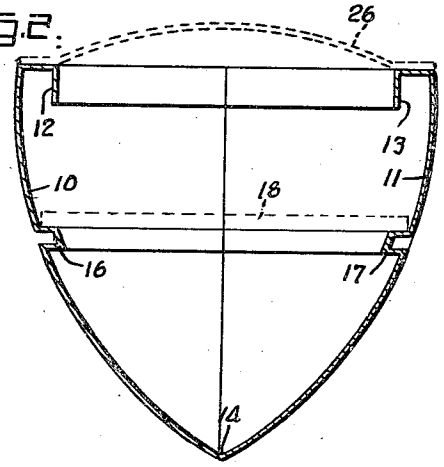


FIG. 4.

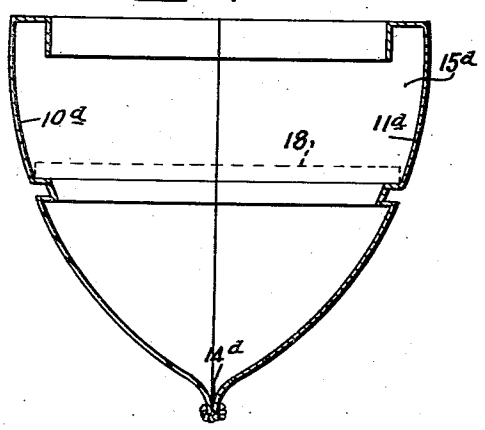
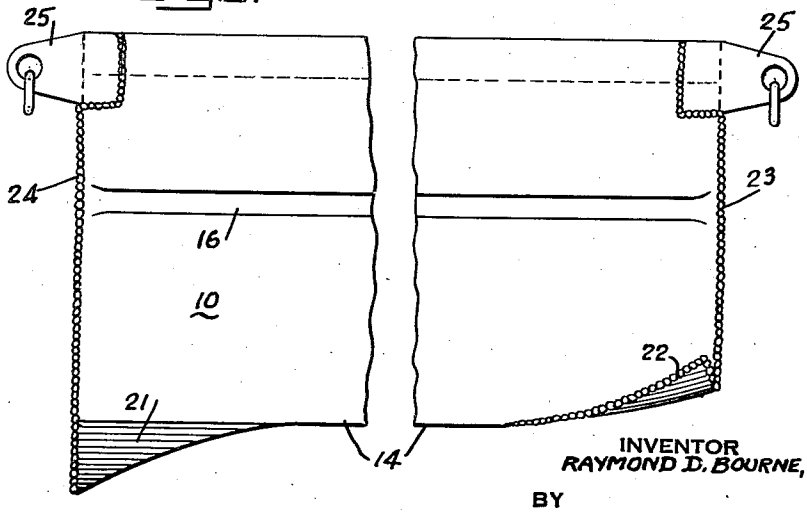


FIG. 3.



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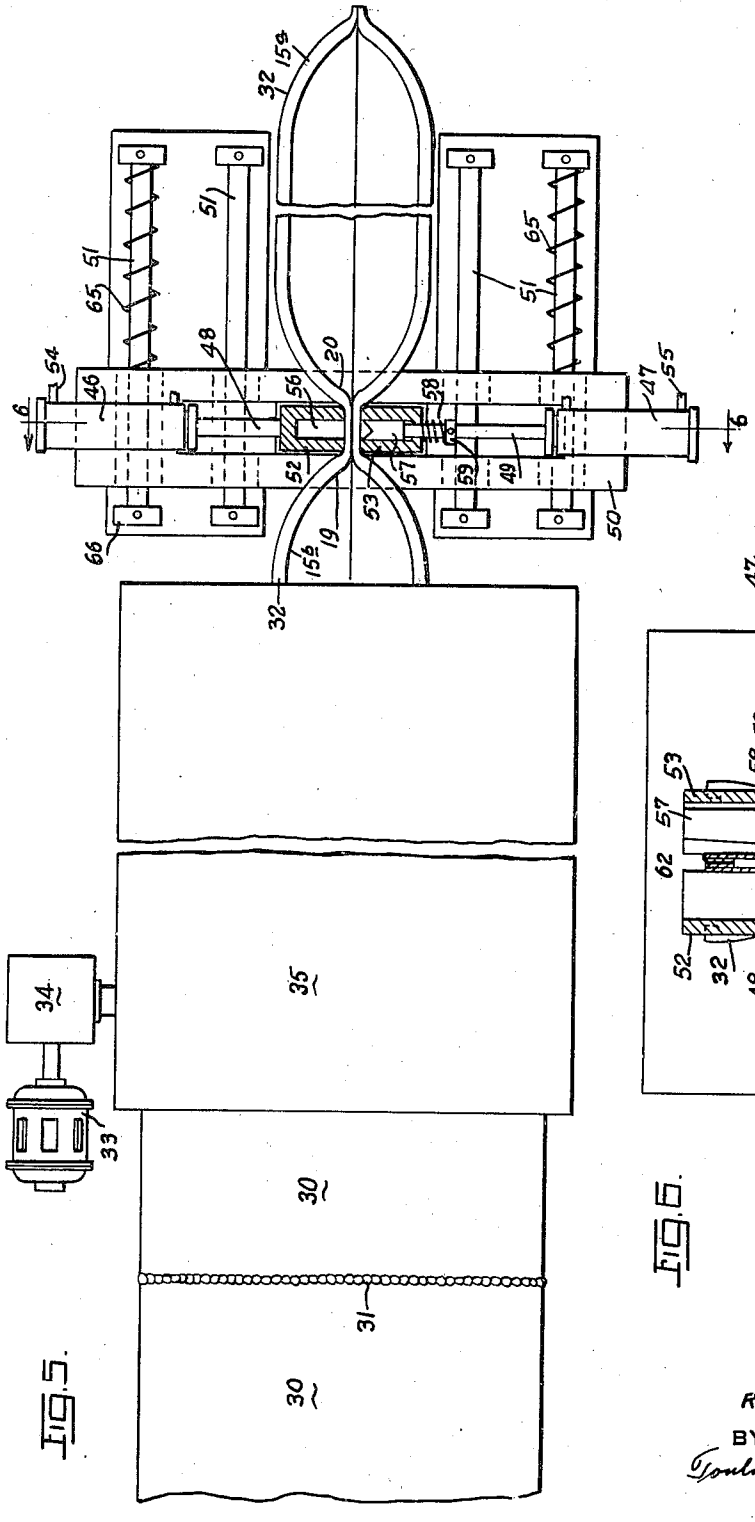


FIG. 5.

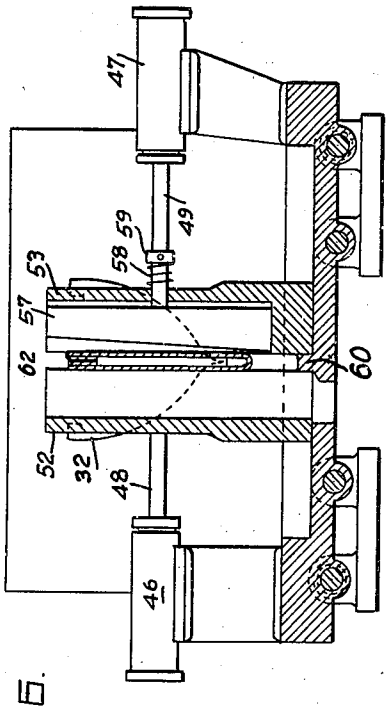


FIG. 6.

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METHOD FOR BUILDING SHIPS

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Fig. 7.

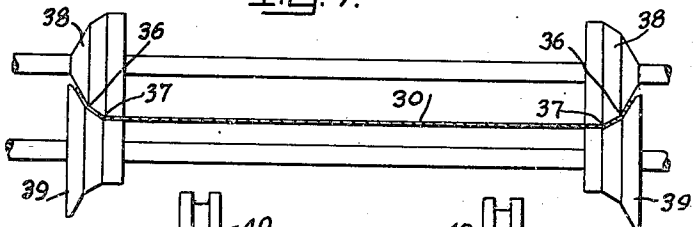


Fig. 8.

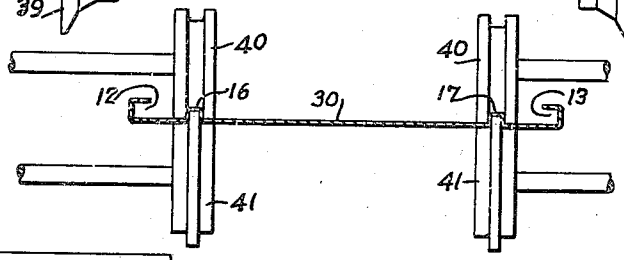


Fig. 9.

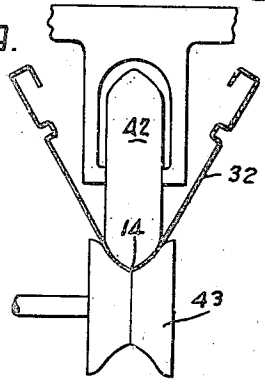
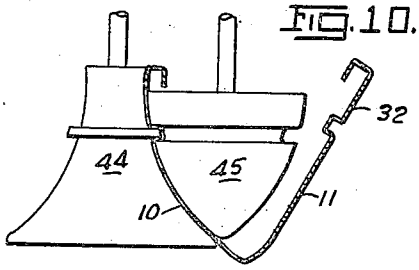


Fig. 10.



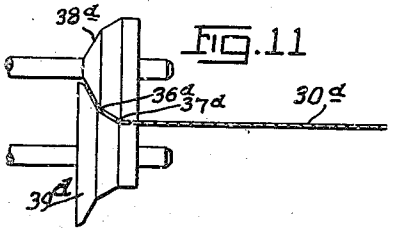
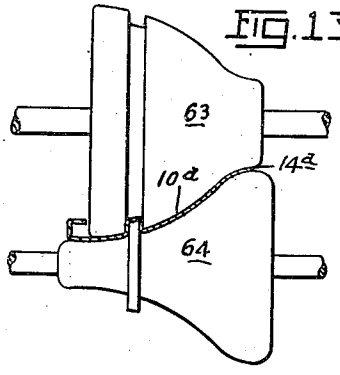


Fig. 11

Fig. 13



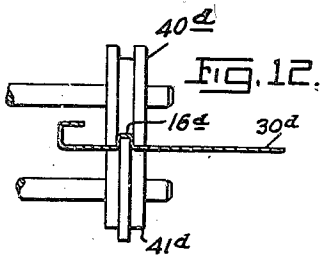


Fig. 12.

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UNITED STATES PATENT OFFICE

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METHOD FOR BUILDING SHIPS

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Application November 5, 1942, Serial No. 464,599

6 Claims. (Cl. 114—79)

This invention relates to a method of manufacturing boats and small cargo vessels.

An object of the invention is to provide a method of manufacturing boats, barges and the like by a continuous forming operation.

Another object of the invention is to provide a method of producing boats, barges and other vessels from a continuous metal sheet by forming the sheet into a desired cross-sectional contour and pinching the formed sheet together at regular intervals to thereby produce individual vessels from the continuously formed sheet.

Another object of the invention is to provide a method for producing vessels for cargo or passenger service by forming metal sheets in a continuous rolling operation to produce a desired cross-sectional contour of the vessel, and subsequently pinching the formed metal sheet together at regular intervals to form the bow of one vessel and the stern of another and severing the vessels in the area at which the formed sheet is pinched together to thereby produce individual vessels in a continuous forming operation.

Another object of the invention is to provide a process for producing cargo or passenger vessels that is a continuous process which consists of producing the vessels by forming sheets of metal of a length suitable for the vessel that is to be produced and tacking the sheets together so that a continuous metal sheet can be passed between forming rolls to produce a continuous cross-section of the desired contour for a vessel, and pinching the formed sheets together at the line of division between the individual sheets, and severing the sheets at this line of division so that the stern of one vessel and the bow of another vessel are formed simultaneously, and just before the sheets are severed.

Another object of the invention is to provide a method for producing cargo or passenger vessels wherein the two sides of the vessels are produced by a continuous forming operation, and are subsequently brought together and secured in their proper relationship by welding along the keel line of the vessel.

Further objects and advantages will become apparent from the drawings and the following description.

In the drawings:

Fig. 1 is a plan elevational view of a vessel formed by the process of this invention.

Fig. 2 is a transverse cross-sectional view of the vessel shown in Fig. 1 and is taken along line 2—2 of Fig. 1.

Fig. 3 is a side elevational view of the vessel shown in Fig. 1 showing the manner in which the bow and stern of a boat are formed.

Fig. 4 is a transverse cross-sectional view of a vessel similar to that shown in Fig. 1 wherein the sides of the vessel are formed from separate metal sheets and are welded along the keel line.

Fig. 5 is a plan view of a rolling and forming mill for producing the vessels in accordance with the teaching of this invention.

Fig. 6 is a vertical cross-sectional view taken along line 6—6 of Fig. 5 showing the manner in which the formed metal sheets are pinched together and severed.

Fig. 7 is a diagrammatic illustration of the rolls provided in the forming mill for producing the first operation upon the metal sheet as it enters the forming mill to produce the vessels.

Fig. 8 is a diagrammatic illustration of a second group of forming rolls for producing a subsequent operation in the series of operations performed upon the metal sheet as it passes through the forming mill.

Fig. 9 is a diagrammatic illustration of the forming rolls for producing the keel of the vessel.

Fig. 10 is a diagrammatic illustration of the rolls for producing the curved side walls of the vessel.

Figures 11, 12 and 13 are diagrammatic illustrations of the rolls used in producing one side of a vessel when the vessel is to be constructed from two sheets of metal and assembled by securing the sheets together along the keel line.

The process disclosed in this invention is adapted to produce passenger or cargo vessels by a continuous operation. Sheets of metal are fed into a rolling and forming mill wherein the sheets are bent and formed into the desired contour for providing the side walls of a vessel. When the formed sheets leave the forming mill they are pinched together at periodic intervals so that the stern of one vessel and the bow of another are formed simultaneously. Subsequently the vessels are severed in the area at which the formed sheets have been pressed or pinched together. The line of severance between the vessels, which now forms the bow or stern of a vessel, can be welded to provide a suitable hull.

A vessel constructed in accordance with the teachings of this invention is shown in Figures 1, 2 and 3. The vessel consists of side walls 10 and 11 that have channel sections 12 and 13 formed in the upper edges of the side walls 10 and 11. The channel sections 12 and 13 provide a reinforcement, or stiffening of the side walls

10 and 11 along the gunwales of the vessel. The vessel 15 as shown in Figures 1, 2 and 3 is constructed from a single sheet of metal. The side walls 10 and 11 are therefore formed upwardly from the keel 14. A reinforcing channel section 16 is provided in the wall 10, and a similar reinforcing channel 17 is provided in the wall 11. A partition 18, shown in dotted lines in Fig. 2, can be supported upon the channel sections 16 and 17 provided in the side walls 10 and 11. If the vessel 15 is of relatively small size the partition 18 may be used as a seat for passengers, or in larger sized vessels the partition 18 may be used as a platform to support cargo in the upper portion of the vessel 15 that may be different from the cargo placed within the lower portion of the vessel. If desired a liquid cargo could be placed within the lower portion of the vessel 15 while a dry or bulky cargo could be supported upon the partition 18 and thereby separate the two types of cargo.

The vessel 15 is formed from a continuous sheet of metal so that the cross-sectional contour shown in Fig. 2 will exist throughout the length of the vessel 15. When the formed sheet of metal, such as that shown in Fig. 2, is discharged from a forming mill, to be hereinafter described, suitable apparatus is provided for pinching, or pressing the sides 10 and 11 of the vessel together so that the bow 19 and the stern 20 will be formed.

When the side walls 10 and 11 are brought into engagement with one another, by apparatus to be hereinafter described, the excess metal in the sheet produced by closing the side walls 10 and 11 into engagement with one another will extend downwardly from the keel 14 as shown in Fig. 3, the excess metal being indicated by the downwardly extending portion 21 to form a stabilizer at the stern of the vessel. The metal at the bow of the boat is slit longitudinally in alignment with the keel 14 so that the metal can be folded over and welded to the side of the boat as indicated by the folded portion 22.

As previously mentioned, when the formed sheet has been pressed or pinched together to form a bow or stern of a vessel and severed, the line of severance is welded to seal the same, indicated by the weld portion 23 on the bow and the weld portion 24 on the stern of the vessel. Tow rings 25 are secured to the bow and stern of the vessel so that they can be connected together by suitable tow lines when towing a plurality of the vessels.

The vessel disclosed in Figures 1 to 3 is constructed from a single sheet of metal, and is preferably constructed from sheets that are of a length suitable for forming a single vessel so that the lines of severance between the vessels will be at the line of juncture between adjacent metal sheets. If desired, however, the metal sheets can be of a length longer than a single vessel and the sheets severed at whatever periodic intervals are desired to form the desired length of vessel. In the latter instance the joint between adjacent metal sheets would be suitably welded to seal the joint.

When the vessels 15 are to be used as barges for carrying cargo a cover 26, shown in dotted lines in Fig. 2, is provided for closing the top portion of the vessel and is suitably secured to the gunwales of the vessel.

In order to form the vessel as shown in Fig. 1 to 3 inclusive, metal sheets 30 are butt welded together by the weld joint 31. The weld joint 31 may be a continuous weld across the sheets 30, or a tack weld, depending upon whether or not the sheets 30 are of a length equal to the length of a vessel to be formed, or the weld 31 will appear between the bow and the stern of a vessel. The metal sheets 30 are therefore adapted to be fed into a rolling and forming mill 35 that is provided with a series of rollers adapted to form the hull 32 of the vessel. The rollers within the rolling and forming mill 35 are driven by a suitable electric motor 33, or other source of power, that drives the rolls through a speed reducing mechanism 34.

The operations that are performed upon the metal sheets 30 as they pass through the rolling and forming mill 35 are shown in Figures 7 to 10 inclusive. The operations disclosed in Figures 7 to 10 are not all of the operations performed upon the metal sheets but are significant operations that have been illustrated to show the major forming operations of the hull 32. It is therefore to be understood that several other forming operations can be performed between each of the steps disclosed in Figures 7 to 10.

When the metal sheets 30 enter the forming or rolling mill 35 one of the first operations upon the sheets 30 is to break the edges of the sheet 30 parallel to the sheet edges as indicated at 36 and 37. To break the metal along the parallel lines 36 and 37, the metal sheet 30 is fed between the rollers 38 and 39, similar rollers being provided for breaking each edge of the sheet 30. These break lines 36 and 37 are the initial forming operations for producing the channel sections 12 and 13 shown in Fig. 8. It is, of course, understood that there are a number of rollers that work upon the edges of the metal sheet to roll the same into the channel sections 12 and 13 between the operation disclosed in Fig. 7 and the operation disclosed in Fig. 8. However, the intermediate forming operations are merely a continuance of the sequence of folding the edges of the sheet 30 at the break lines 36 and 37 so that the intermediate rolls that produce this rolling operation have not been specifically illustrated.

After the channel sections 12 and 13 have been formed, the sheet then passes between a pair of rollers 40 and 41 that forms the channel sections 16 and 17. This operation may, of course, be performed by a series of rollers, and preferably should be performed in this manner because the metal used between the channel 16 and 17 in the forming operation reduces the dimension between certain points in the channel sections 16 and 17 tending to stretch the metal sheet between the channel sections 16 and 17. Also, these channel sections could be formed one at a time to reduce the tendency of stretching the sheet between the channel sections 16 and 17.

After the channel sections 16 and 17 have been formed the sheet 30 then passes through a pair of rollers 42 and 43 that are adapted to shape the metal sheet along the mid line to form the bottom of the vessel and the keel 14. Here again, the operation between the step disclosed in Fig. 8 and the step disclosed in Fig. 9 ean be performed by a series of rollers to gradually bring the sheet 30 into the position shown in Fig. 9 with the keel 14 fully formed. Preferably, the operation would be performed in this manner because the metal sheet would require gradual bending upwardly along its mid line from the horizontal position.

After the keel 14 has been formed, the metal sheet is then in condition for forming the side

walls 10 and 11 of the vessel 15. The sheet is then carried between forming rollers 44 and 45, as shown in Fig. 10 to form the side wall 10 of the vessel 15. After the side wall 10 has been formed, the side wall 11 is carried between similar rollers to form this side of the hull 32 to conform with the side 10.

After the forming operation on the side wall 11 of the hull 32 the sheet leaves the forming and rolling mill 35 with a cross-section like that disclosed in Fig. 2. The cross-section illustrated in the drawings is only one of many cross-sections that can be formed in a forming and rolling mill, and it is merely illustrative of one type of vessel that can be produced by the continuous process disclosed in this invention. By altering the shape of the rollers within the forming mill 35, and the sequence of operations that are performed upon the metal sheet, cross-sections of various configuration can be produced.

When the hull 32 leaves the forming and rolling mill 35 with a completely formed cross-section, the hull 32 is passed between an apparatus that is constructed and arranged to pinch the hull 32 at periodic intervals to thereby cause the side walls to engage one another and form the stern of one vessel and the bow of another. The apparatus is also adapted to shear the sheet in the area in which the side walls are compressed together, thereby severing one vessel from another.

The apparatus for pinching the side walls of the hull 32 together consists of a pair of hydraulic motors 46 and 47 that are connected to a suitable source of pressure fluid for reciprocating the motors, and thus reciprocating the rams 48 and 49 toward one another. The motors 46 and 47 are, of course, provided with suitable fluid inlets and outlets, and suitable control mechanism for directing the flow of fluid to and from opposite ends of the motors 46 and 47 to regulate the operation of the motors. The hydraulic motors 46 and 47 are supported upon a carriage 50 that is slidably supported upon guide rods 51 that permit the carriage 50 to move with the movement of the hull 32 as it is discharged from the forming and rolling mill 35. The carriage 50 can be driven by a suitable mechanism adapted to operate the carriage in synchronism with the movement of the hull 32, or the movement of the hull 32 can itself drive the carriage 50 along the guide rods 51. The springs 65 provided around the guide rods 51 urge the carriage 50 against the stops 66 when the clamping members supported by the carriage are not in engagement with the hull 32 that is advancing from the forming and rolling mill 35. Whenever the clamping members, carried by the carriage, engage the hull 32 it will be carried forward against the springs 65 so that the clamping operation upon the hull 32, and a subsequent severing operation, can be produced without stopping the movement of the sheet 30 through the forming and rolling mill 35.

The rams 48 and 49 of the hydraulic motors 46 and 47 support the clamping members 52 and 53 respectively. These clamping members 52 and 53 engage the side walls of the hull 32, and when fluid is supplied to the conduits 54 and 55 of the hydraulic motors 46 and 47 respectively, the clamping members 52 and 53 advance simultaneously toward the center line of the hull 32.

As shown in Fig. 5 the hull 32 has been advanced between the clamping members 52 and 53 until a predetermined length of hull has passed therebetween, this length of hull being indicated on the right hand side of the clamping members 52 and 53. When the predetermined length of hull has passed the clamping members 52 and 53, hydraulic fluid will be supplied through the conduits 54 and 55 of the motors 46 and 47 to advance the clamping members 52 and 53 into the hull 32 and thereby pinch the side walls of the hull together. This operation produces the stern 20 of one vessel and the bow 19 of another vessel.

The clamping member 52 is provided with a recess 56 that is adapted to receive a shearing blade 57 that is advanced from the clamping member 53, the shearing blade 57 being carried within the clamping member 53. A spring 58 positioned between the clamping member 53 and a collar 59 prevents the shearing blade 57 from advancing into engagement with the hull 32 until the members 52 and 53 have pinched the side walls of the hull 32 together. The members 52 and 53 engage a stop 60 when they have pinched the side walls of the hull 32 together. Subsequent increase in pressure upon the hydraulic motors 46 and 47 causes the shearing blade 57 to advance into the recess 56 in the clamping member 52 and thereby shear the stern 20 of the vessel 15*a* from the bow 19 of the vessel 15*b*. The shearing blade 57 is preferably constructed with the shearing edge 62 disposed upon a slight angle to increase the effectiveness of the shearing blade.

After the vessel 15*a* has been sheared from the continuous sheet passing through the forming and rolling mill 35, the bow and stern ends are welded as shown in Fig. 3 and indicated by the weld lines 23 and 24.

As previously mentioned, the pinching of the hull 32 by means of the clamping members 52 and 53 produces excess metal along the keel of the vessel at the bow and stern. This excess metal at the stern 20 may be pinched together to form a stabilizing fin 21 to aid in guiding the vessel when it is being towed. The excess metal at the bow 19 projects downwardly exactly like the stern portion 21, Figure 3. In all cases, the metal at the fold is integral and continuous. The metal at the fold of the bow portion is then slit for the necessary distance by any well-known metal-cutting device, or the separation may be effected by passing a grinding wheel externally along the fold thus grinding through the metal and forming a slit. Next, the triangular shaped sections formed by the slit are each folded outwardly and upwardly along a line substantially coincident with the line of the keel until each lies flat against its adjacent side of the vessel. Subsequently, the contacting folds are welded to form a watertight joint and the edges of each triangular portion are welded continuously or in spots to the adjacent sides of the vessel to form a smooth rigid lower bow section.

Alternatively after the step of slitting as aforesaid, the two triangular portions may be pried apart to separate the edges formed by the slit. One triangular section may then be folded inwardly and upwardly between the separated portions and substantially along the line of the keel. The two separated portions are then bent back into contact and the other triangular section is folded upwardly and over the first section. The edges are then sealed in any desired manner to form a smooth, rigid, watertight joint. The portions are then folded over one another and welded to the side walls, one of the portions being welded to the inside wall of the bow while the

other is welded to the outside wall of the bow as indicated by the portion **22** shown on Fig. 3. This folding operation can be performed between any suitable dies, or if the sheet metal is not of an extremely heavy gauge, the flap portions could be bent by a workman with the use of a heavy hammer.

The continuous forming and rolling process disclosed provides a method for rapidly producing cargo or passenger vessels that are suitable for service that does not require an elaborate construction of a vessel. The vessels are particularly suited as tow barges that can be pulled behind a towing vessel, such as a freighter, to increase the quantity of cargo that can be moved by a single freighter, most freighters, and other boats, having excess power that can be utilized by towing a number of the vessels or barges disclosed herein.

In Fig. 4 there is shown a vessel **15***d* that is constructed from two sheets of metal, each sheet forming a side wall of the vessel **15***d*. In this modification the side wall **10***d*, and the side wall **11***d* are formed independently, and are subsequently brought together at an assembly station so that they can be welded together along the keel line **14***d* and at the bow and stern of the vessel. When the vessel **15***d* is constructed from two sheets of metal, which are joined along the keel line, a vessel can be constructed that is considerably larger than the vessel disclosed in Fig. 2. While the two vessels shown in Figures 2 and 4 are illustrated as being of the same size, it can readily be understood that if the vessel of Fig. 2 is made from one sheet of metal that the same sheet of metal when formed into a single side of a vessel such as that shown in Fig. 4 that the vessel **15***d* can be considerably larger than the vessel **15**.

In forming the sheets for the vessel **15***d*, the metal sheets **30***d* are passed between forming rolls **38***d* and **39***d* to break the edge of the sheet along the lines **36***d* and **37***d*, as shown in Fig. 11. The sheet is then passed between forming rolls **40***d* and **41***d* to form the channel section **16***d*, as disclosed in Fig. 12. The operations performed in Figures 11 and 12 are the same operations as performed in Figures 7 and 8 as heretofore described, except that the operation is performed along only one edge of the metal sheet **30***d*.

The formed sheet **30***d*, after leaving the rolls shown in Fig. 12, is then passed between forming rolls **63** and **64** that shape the sheet **30***d* into the desired contour for providing a side wall **10***d* of the vessel **15***d*, and also forming the keel portion **14***d*. A single set of rolls can produce both sides of the vessel **15***d*, the sheets being positioned end for end to thereby provide left and right hand sections of the vessel **15***d*.

The wall sections **10***d* and **11***d* are then brought into adjacent relationship and the bottom edges of the sheets are welded along the keel line **14***d*.

The vessels shown in Fig. 4 can be constructed from individual sheets of the desired length to produce a vessel of a specified length, the ends of the sheets in this case being formed either before or after welding the sheets together along the keel line. If desired, the formed side wall sheets **10***d* and **11***d* can be passed between forming members as disclosed in Fig. 5 for simultaneously producing the bow of one vessel and the stern of another after the sheets have been welded along the keel line.

While the method of manufacturing vessels as disclosed herein constitutes a preferred method yet it is to be understood that the various steps in the process can be altered without departing from the spirit of the invention, also the apparatus for performing the various steps of the process can be altered, all of which can be accomplished without departing from the spirit of the invention. It is therefore understood that all such modifications as fall within the scope of the appended claims are intended to be included herein.

Having thus fully described my invention what I claim as new and desire to secure by Letters Patent is:

1. The method for producing water going vessels in a continuous process which consists of, passing a continuous length of metal web between a series of forming rolls to bend the web along lines parallel with an edge of the web to thereby form the same into a continuous formed sheet having the cross-sectional contour of a hull of a vessel, forming the same hull cross-sectional contour throughout the length of the web, applying pressure upon opposite sides of the formed hull to collapse the hull until the sides engage thereby forming the stern of one vessel and the bow of another, severing the stern of one vessel from the bow of another in the collapsed area, and sealing the bow and stern of the vessel along the lines of severance.

2. The method for producing water going vessels in a continuous process from a metal web which consists of, passing a metal web through a series of forming rolls to bend the web along lines parallel to an edge thereof, bending the web along the longitudinal median line thereof to form a substantially U-shaped metal member having the same cross-sectional contour throughout the length of the web as it leaves the forming rolls, engaging the sides of the U-shaped metal form by clamping members that collapse the U-shaped form toward the median line of the form, advancing the clamping members with advancement of the U-shaped metal form as it leaves the forming rolls during the clamping operation, severing the U-shaped forms from one another through the clamped portion thereof, releasing the clamping members from the U-shaped form, and sealing the ends of the U-shaped members along the lines of severance.

3. The method for producing water going vessels in a continuous process from a metal web which consists of, passing a metal web through a series of forming rolls to bend the web along lines parallel to an edge thereof, bending the web along the longitudinal median line thereof to form a substantially U-shaped metal member having the same cross-sectional contour throughout the length of the web as it leaves the forming rolls, engaging the sides of the U-shaped metal form by clamping members that collapse the U-shaped form toward the median line of the form, advancing the clamping members with advancement of the U-shaped metal form as it leaves the forming rolls during the clamping operation, severing the U-shaped forms from one another through the clamped portion thereof, releasing the clamping members from the U-shaped form, and returning the clamping members to their initial position for subsequent engagement of the U-shaped metal form upon subsequent actuation of the clamping members to thereby sever a determined length of formed web from the continuous web.

4. The method for forming water going vessels in a continuous process which consists of, passing a metal web through a series of forming

rolls to bend the same along lines parallel to an edge of the web and gradually produce a substantially U-shaped cross-section in the web that is the same throughout the entire length of the formed web, clamping the side walls of the formed U-shaped web together at periodic intervals, severing the web through the clamped areas, and sealing the severed ends of the individual severed portions of the web, whereby individual vessels are produced from a continuous length of formed metal web.

5. The method for forming water going vessels in a continuous process which consists of, securing a plurality of metal sheets together in an end to end fashion to form a metal web having sheet section lengths equal to the length of a vessel to be produced, passing the assembled metal web between a series of forming rolls to bend the same along lines parallel to an edge of the web to gradually form the web into a substantially U-shaped contour having the cross-section of the hull of a vessel, clamping the side walls of the U-shaped web together at the points of juncture between the sheets that compose the web, severing the web at the points of juncture to thereby produce individual vessels, and sealing the vessels along the severed edges.

6. The method for forming water going vessels in a continuous process which consists of, passing a metal web through a series of forming rolls to bend the same along lines parallel to an edge of the web and gradually produce a substantially U-shaped cross-section in the web that is the same throughout the entire length of the formed web, clamping the side walls of the formed U-shaped web together at periodic intervals to thereby simultaneously form the stern of one vessel and the bow of another, the excess metal produced in the bow and stern portions of the vessels by the clamping of the U-shaped web extending downwardly from the bottom of the U-shaped member, slitting the excess metal at the bow of the vessel longitudinally along the median line of the U-shaped member, folding the flaps produced by the slitting operation upon one another to form the bottom edge of the bow of the vessel, clamping the excess metal at the stern of the vessel together along the median line of the U-shaped web to form a stabilizing fin, severing the web through the clamped areas, and sealing the severed ends of the individual severed portions of the web, whereby individual vessels are produced from a continuous length of formed metal web.

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