Aug. 26, 1952 J. H. PEARCE 2,608,171

CORRUGATED, AIR DISTRIBUTING UNDERBODY FOR WATER-BORNE VESSELS

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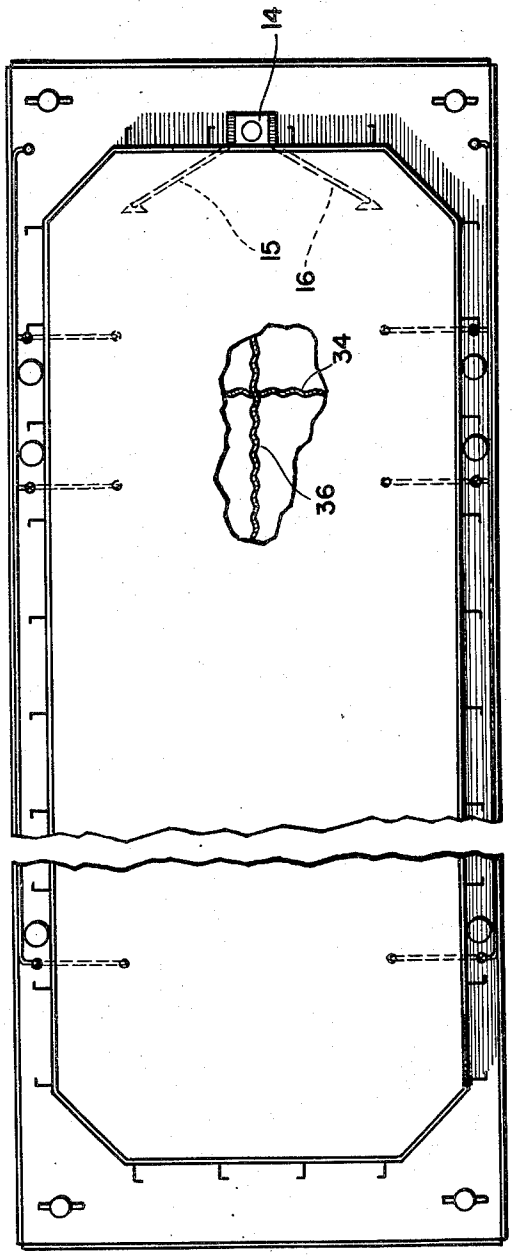

FIG. 1

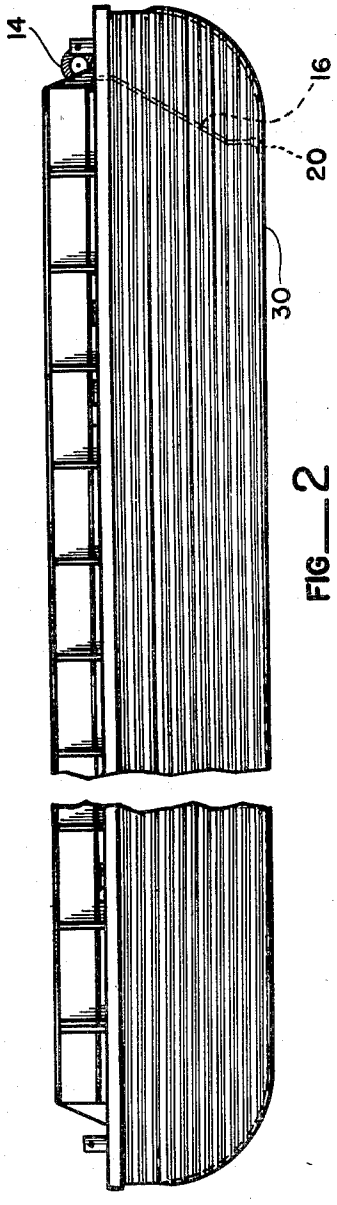

FIG. 2

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FIG. 3

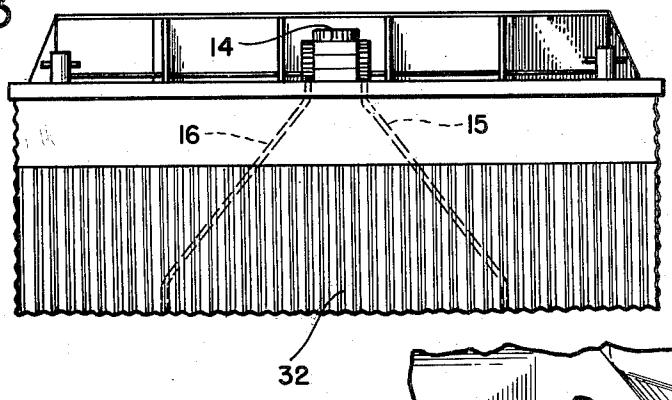


FIG. 4

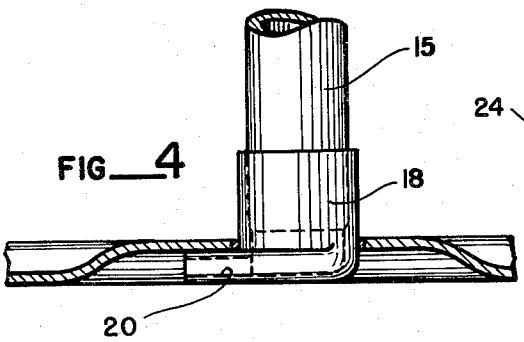
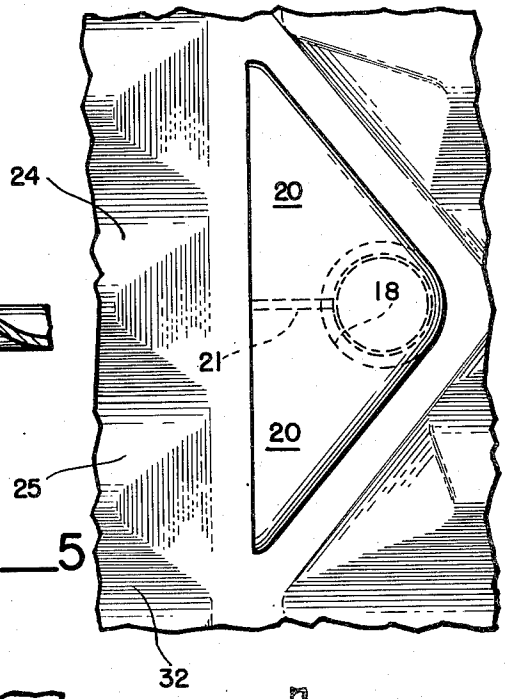


FIG. 5



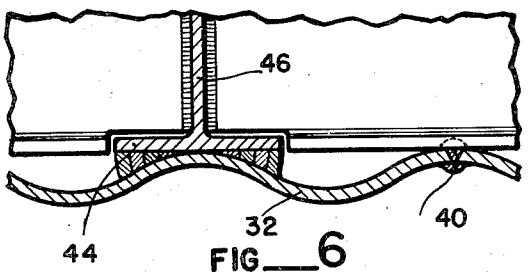


FIG. 6

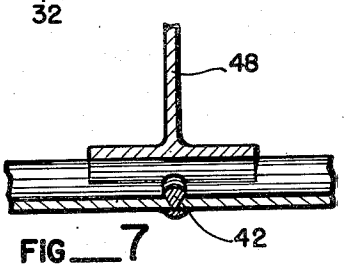


FIG. 7

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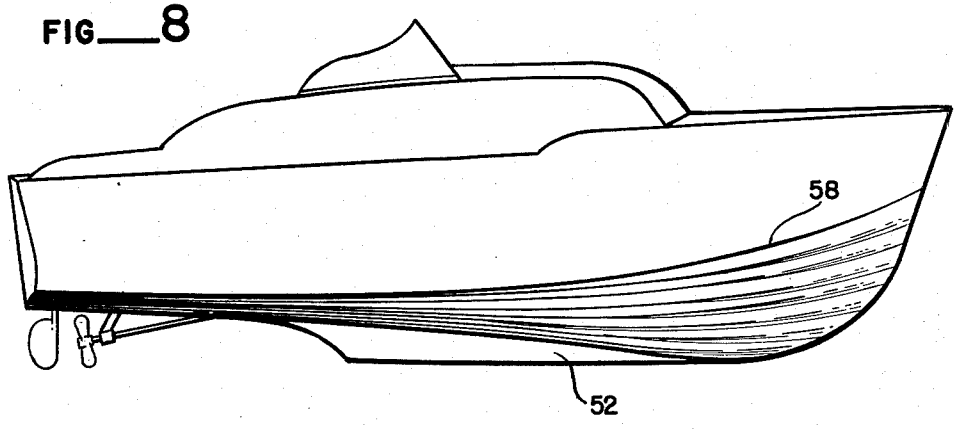
FIG. 8



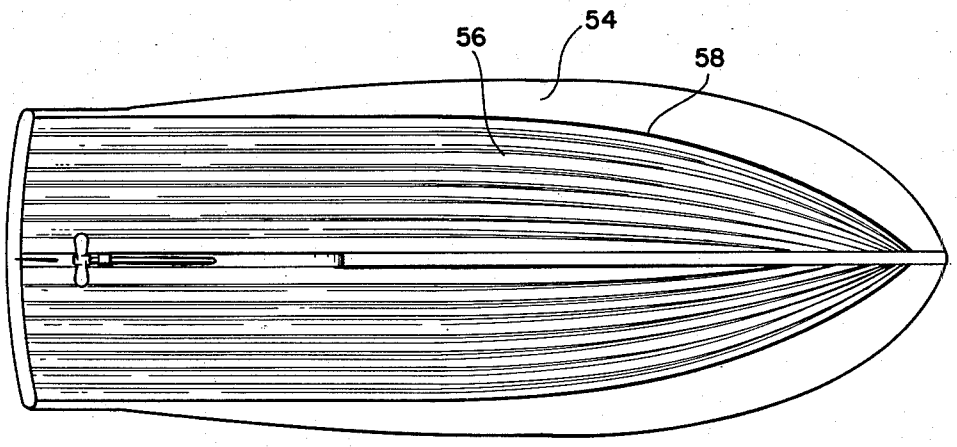
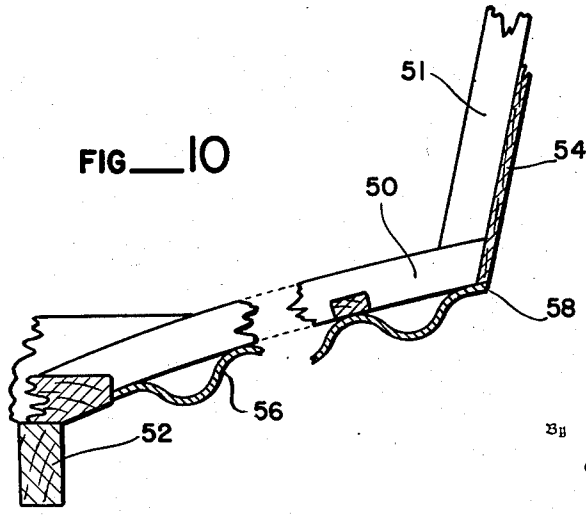


FIG. 9

FIG. 10



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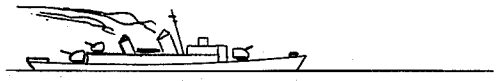

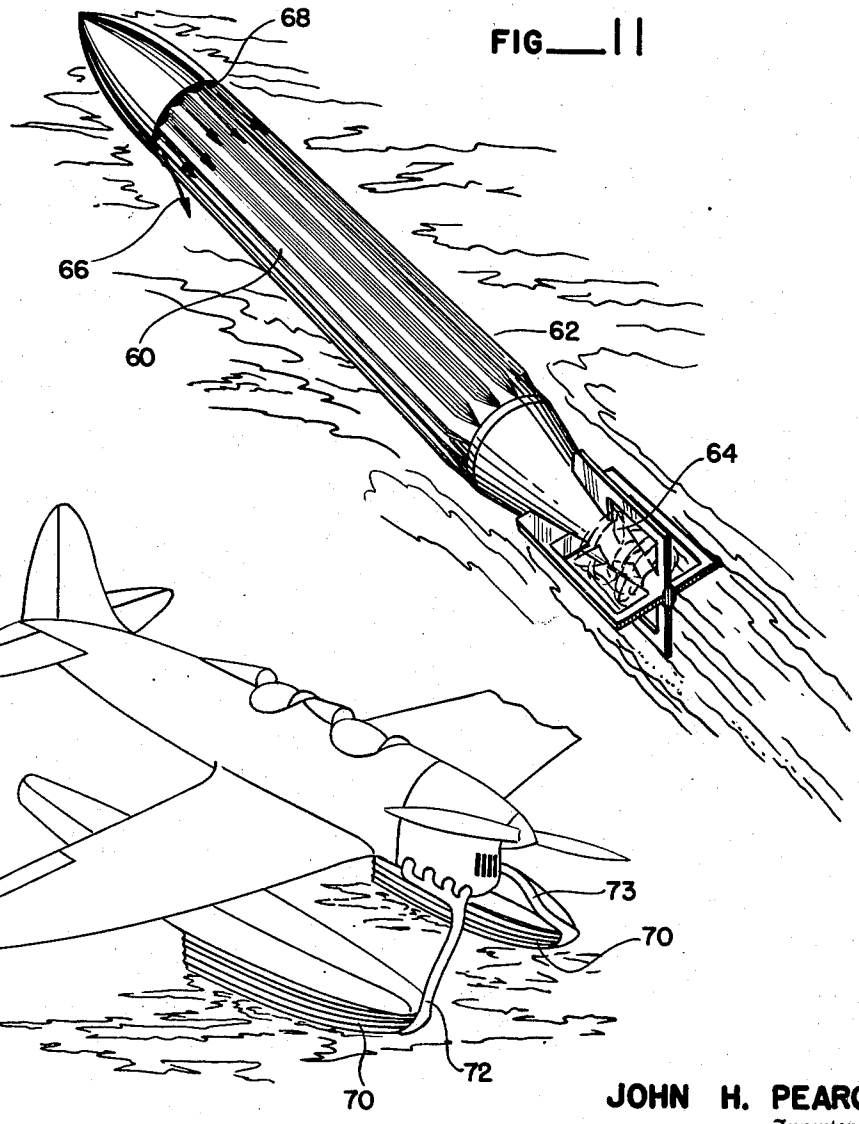

FIG. 11

FIG. 12

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Patented Aug. 26, 1952 2,608,171

UNITED STATES PATENT OFFICE

2,608,171

CORRUGATED, AIR DISTRIBUTING UNDERBODY FOR WATER-BORNE VESSELS

John H. Pearce, Seattle, Wash.

Application March 14, 1949, Serial No. 81,264

2 Claims. (Cl. 114—67)

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My invention relates to the construction of hulls for water borne vessels, in which the surface below the water line is plated with longitudinally corrugated shell plating, which permits of the introduction of air to act as a cushion to give certain buoyant characteristics and to reduce the friction encountered by the vessels passing through the water.

Investigations of the desirable lubricating properties of air under the hull of vessels have been conducted going back prior to 1906. Many patents have issued on various arrangements and a great deal of experimental work has been pursued by private interests and in behalf of the United States Navy. The majority of these tests have indicated that the introduction of air under a ship's hull gave little material advantage and the cost of intercepting sufficient air to theoretically achieve its intended purpose, proved to be far more costly than the gain derived. There have, however, been outstanding examples, where the air cushioning arrangement proved to be particularly satisfactory. The first practical employment of cushioning air has been in the hulls of racing hydroplanes, where air was normally introduced at the step, or steps, in those boats and the trials proved a very substantial gain in speed, which, of course, reflects decreased resistance, the motive power and hull design being equal. More recently hydroplanes have departed from the single or multiple step arrangements in favor of the three point suspension, where side pontoons and the transom area provide these three points. Under such conditions, no practical solution has been found for the introduction of air. All these various trials point to the final conclusion that in a hull particularly adaptable to the air lubrication plan, a very worthwhile gain is made and it is with this conclusion in mind that I have produced my new plan for plating the underbody portion of such types of water borne hulls.

Probably the greatest saving to industry and transportation as a whole is in improving the underwater characteristics of the common barge. Tremendous quantities of freight are so transported on our various rivers and waterways and a relatively small increase in efficiency will mean a great saving in propulsion fuel, greater speed in the delivery of the freight and the barges themselves can be more economically constructed using the teachings of my present invention.

Typical of other applications of the principles are the large number of pleasure and work craft employing the V bottom construction, most especially the type employing the newer monohedron form of hull. Very worthwhile savings can be made by employing the principles in the design of submarine torpedoes and an especially advantageous application is in the plating of floats for airplanes.

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Exhaust gases from internal combustion engines and the products of combustion from fuel burning steam plants are usually more satisfactory for lubrication purposes than is air and by directing these gases under the hull of a boat, the objectionable dirt which normally is discharged into the atmosphere, is made use of and is absorbed in the water. Such constructions will give the boats a more pleasing profile and free the passengers and the boats themselves from the annoyance which comes from these discharge gases.

The principal object of my present invention, therefore, is to provide a new form of plating for the underbody portion of water borne vessels, so they can be most readily adapted to effectively use the cushioning and lubricating effect of introducing air between the hull and the water supporting the same.

A further object of my invention is to provide a hull in which the supporting air will be trapped and caused to move lengthwise along the bottom of the ship as the ship passes over the water.

A further object of my invention is to provide longitudinal channels extending the underbody length of the ship, which while forming guides for cushioning air, also assist in the prevention of rolling the ship.

A further object of my invention is to greatly simplify the task of plating a ship by having plating corrugated longitudinally thereof, so that it can more easily resist distortion over longer clear spans between frames and structural members.

A further object of my invention is to reduce the weight required in the materials for satisfactorily plating a ship's bottom, due to the fact that when the plate is corrugated, it attains a marked degree of stiffness which makes it possible to use lighter plating for the same effective strength.

A further object of my invention is to provide a ship's bottom in which the unsupported plating will be stiffened, so that a vessel will be less seriously damaged, as in grounding and the like.

A further object of my invention is to facilitate the speed and maneuverability of vessels over other vessels of like size and design employing similar power.

Further objects, advantages and capabilities

will be apparent from the description and the disclosure in the drawings, or may be comprehended or are inherent in the device.

In the drawings:

Figure 1 is a top plan view of a freight-handling barge made after the teachings of this present invention. The view is broken at one point so that the essential features may be shown on an enlarged scale.

Figure 2 is a side elevation of the barge of Figure 1.

Figure 3 is a front end elevation of the barge of Figure 1.

Figure 4 is a fragmentary view, shown partly in vertical section, to illustrate one manner of introducing air into the bottom area of a barge.

Figure 5 is a bottom plan view of the equipment shown in Figure 4 and illustrating how from a single supplying tube, air can be fanned out so as to be introduced into several longitudinal corrugations.

Figure 6 is a transverse sectional view in fragmentary form and taken along a vertical plane, showing one satisfactory method of securing my shell plating to the framework of the ship.

Figure 7 is a typical longitudinal sectional view, although not along identical plane as Figure 6.

Figures 8 and 9 show respectively a vertical profile and a bottom plan view of a monohedron form of pleasure boat hull to which my invention is particularly adaptable.

Figure 10 is a typical vertical cross sectional view in fragmentary form through the hull of Figures 8 and 9.

Figure 11 is a perspective view showing a submarine torpedo, using this present invention.

Figure 12 is a perspective view showing this invention as applied to the floats of an airplane.

Referring more particularly to the disclosure in the drawings, in Figures 1 through 7 I have illustrated my invention as applied to scows and barges for use normally on inland waterways. These vessels, to be fabricated from metal, have their main stress members running lengthwise of the vessel, with yieldable cross members cut in between the longitudinal members at such intervals as are required for adequate support and placement of the outer plating. This form of construction tends to give a metal constructed craft the flexibility of wood vessels, fixed against longitudinal movement but capable of transverse movement. However, in my method all the underbody portion of the hull is plated with sheeting having longitudinal corrugations and so arranged that the various sheets are abutted together so that in effect a corrugation may start at the bow of the vessel and run without interruption to the stern. It is believed it will be obvious that by having the plating corrugated, the transverse support members can be spaced much further apart than when flat plating is used. This, however, is only one of the advantages of this method. A prime advantage of this structure is that air can be introduced at the bow of the vessel and the pressure of the water surrounding the hull is sufficient to hold the air in the corrugations, where it acts as a lubricant and reduces the skin friction between the water and the hull plating. This action reduces the power required to force the vessel through the water or increases the speed of the vessel with the same power. In the higher speed vessels the natural draft can be depended upon to cause air to enter the corrugations and then be carried throughout the length of the ship by the movement of the ship through the water. In slow moving vessels, especially freight carrying vessels, the speed is not normally sufficient to produce a suction under the hull and this requires that air under low pressure must be forced down at the bow and possibly at other points throughout the length of the ship, thus giving the required lubrication.

Referring to Figures 1, 2 and 3 it will be noted that I have provided an air pump, or more properly, blower, at **14**, and air under the pressure created by the blower is forced downwardly as through pipes **15** and **16**. Pipes **15** and **16** terminate in the fittings shown in Figures 4 and 5, wherein pipe **15** engages a fan-shaped fitting, having a coupling **18** and a flared-out portion **20**. Normally it is desirable to provide a baffle in this member, as at **21**. When so arranged, the air is projected out and will better engage in the corrugations **24**, **25** and the like. To suit the hull design any desired number of pipes **15** and **16** might be employed. However, experience has indicated that for barges of ordinary dimensions as commonly used, such as a 40-foot width and 120-foot length, the air introduced under the bottom at two points, will flow out and give quite adequate distribution over the entire bottom of the hull.

In order to take full advantage of the principle of having a yieldable plating structure, and one which will not set up accumulative stresses under welding, such as has been the cause of so many welded boat failures, I find it desirable to employ the corrugated plate throughout various other parts of the vessel.

I have found it, therefore, desirable to have the side plates of the barge, as **30**, formed of the same general plating as the bottom **32**; and as it is necessary to provide a plurality of compartments, I employ corrugated transverse walls, as **34**, and corrugated longitudinal walls **36**. These can be satisfactorily welded together without fear of subsequent failure.

Since all corrugations should be smooth and run along the whole length of the vessel, it is obvious that special attention must be given to the welding of the joints. The various plates are end and laterally abutted to adjoining plates and then the welding achieved after the showing of Figures 6 and 7, such welding calls for a new type of automatic welding, in which the electrodes must follow closely the contour of the corrugations. This form of welding is generally referred to as "top side" welding and as it can be readily examined for flaws by means of X-ray, it is a very dependable method of securing the margins of the plate and of securing the plates themselves to the structural members. This form of welding is known to those skilled in this field and the detailed technical differences not now in common practice, will remain the subject of an additional application. Therefore, it is not felt that any greater detail is required in this present application.

After the welds are completed, the excess metal deposited on the water side of the plates, should be ground smooth as with a portable grinder, so that a smooth, finished surface will be provided which will not in itself be a source of increased skin friction. At **40** and **42**, I have illustrated respectively longitudinal and transverse seams and in Figure 6 I have illustrated a load distributing pad **44**, which has been built up so as to transfer loading from plating **32** to the longi-

tudinal structural member 46. In Figure 7, attachment is made to the transverse frame 48.

In Figures 8 and 9 I have illustrated corrugated metal plating for the bottom of a pleasure boat. There are many work and utility boats, however, that also may be plated in the same manner. To be successfully applied, the plating should be used in the V bottom form generally referred to as a monohedron type or a surface formed by the development of a plurality of cones, so that a corrugated metal sheet, even though it has longitudinal stiffness, can conform to the designed bottom form. Boats of this order may be steel framed or as I have illustrated in Figure 10, my plan may be applied to a boat in which the framing, as 50 and 51, is of wood and where the keel, as 52, may also be of wood. In fact, this arrangement may be carried out by having the top sides planked in wood, as indicated at 54. If wood is used, of course, the individual plates of metal, as 56, would be welded together to form one continuous sheet and then this sheet, which would be comparable to a plywood boat bottom, is swung around the frames and either welded to metal framing or screw fastened to wood frames. Most of this type usually are powered to give above average speed and as the chine 58 swings up well at the bow, it provides a natural flow of air under the boat and can comparably be considered as an excellent application of my principle.

In employing the longitudinally ribbed or corrugated outer casing 60 of the submarine torpedo 62, we again have a very fine basis for a practical design, in that the propellers 64, are normally operated by air motors and the discharge of this air would be more than adequate if the discharge is made after the showing of the arrows 66, which can be arranged by fashioning the head 68 after the fashion of a fish's gill, to provide openings discharging into the corrugations.

In Figure 12, the corrugated plating is shown as applied to the pontoons of an airplane, at 70, and the exhaust from the engine is lead through tubes 72 and 73 to a point under the front of each pontoon. The initial exhaust is usually oil bearing and thus particularly effective. A very great suction occurs in the heavily loaded pontoon and the present invention is a great aid in taking off from the water and very substantially reduces the run required.

It is believed that it will be clearly apparent from the above description and the disclosure in the drawings that the invention comprehends a novel construction of a corrugated, air distributing underbody for water borne vessels.

Having thus disclosed the invention, I claim:

1. A gas distributing underbody for a barge having a flat bottom, consisting of: a hull frame forming said flat bottom having its main stress members disposed longitudinally thereof; curvedly corrugated plating for said hull having each corrugation running from end to end thereof, fixedly secured to said stress members, disposed with the corrugations substantially parallel to the longitudinal axis of said hull, there being a load distributing pad between each stress member and said plating, the lower face of each pad being shaped transversely to conform to the contour of the contiguous plating, said corrugations being shallow and closely spaced, said plating being secured together by having the edges of adjacent plates butt welded together; means for introducing gases under the bow of said hull and means for distributing said gases transversely under said flat bottom.

2. A gas distributing underbody for water borne vessels, comprising: corrugated plating for the hull of the vessel disposed with the corrugations substantially parallel to the longitudinal axis of said hull and each corrugation running from end to end thereof, said corrugations being shallow and closely spaced, said plating being secured together at its seams running transversely of said hull by having the edges of adjacent plates juxtaposed and butt welded; and a plurality of fan-shaped fittings positioned to introduce gases, from a source of gases, under the bow of said hull and distribute the gases transversely under said hull, each fitting distributing gases transversely over a plurality of corrugations.

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