Nov. 5, 1940. J. J. DIRSCHEL 2,220,085

LEAK STOPPER

Filed March 10, 1939 2 Sheets-Sheet 1

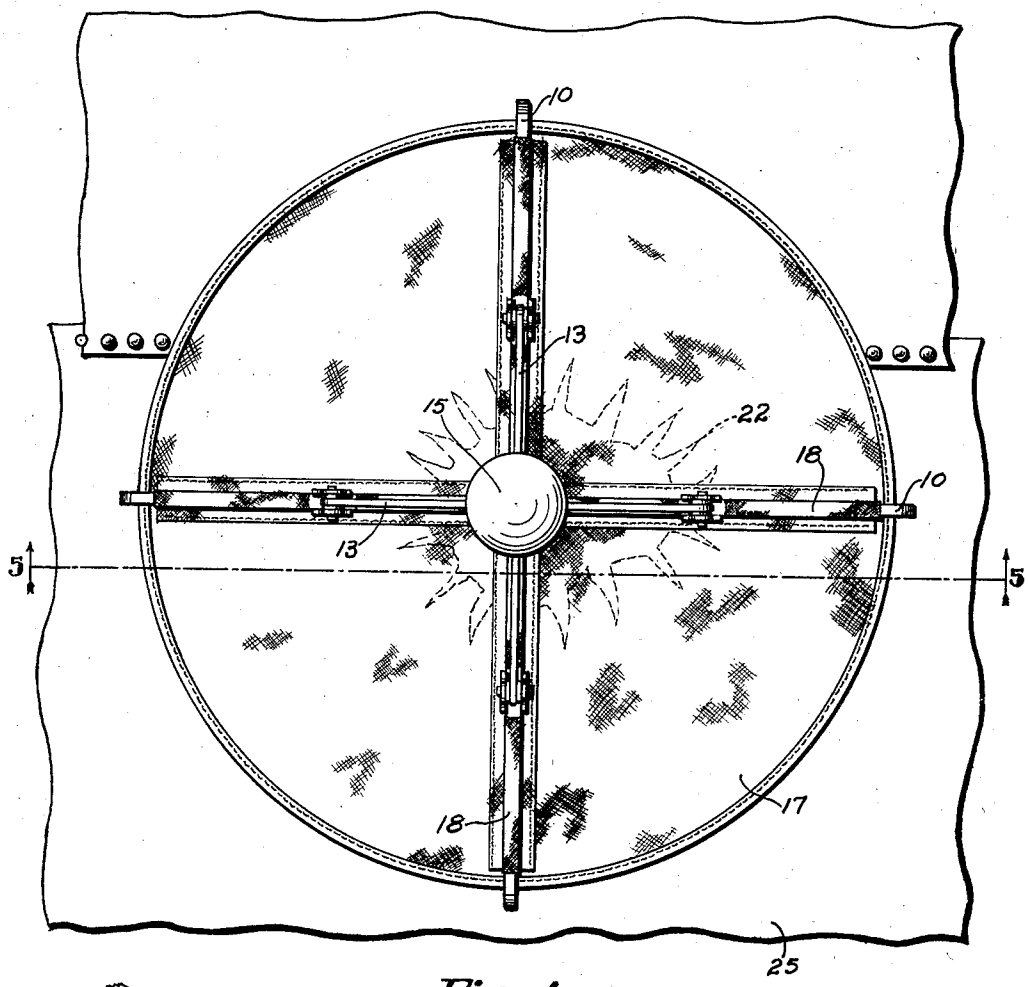


Fig 1

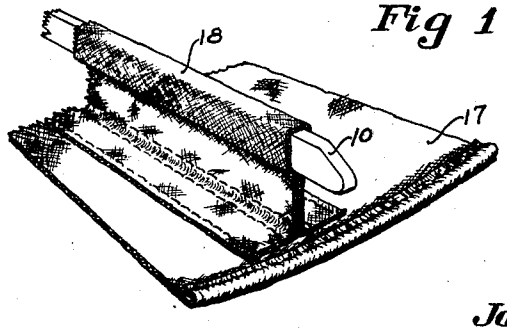


Fig 2

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LEAK STOPPER

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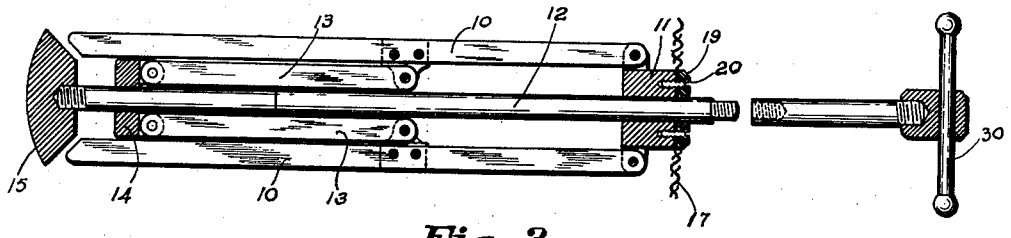


Fig 3

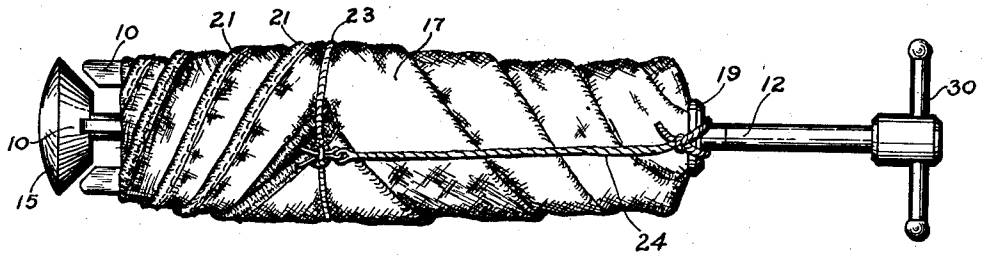


Fig 4

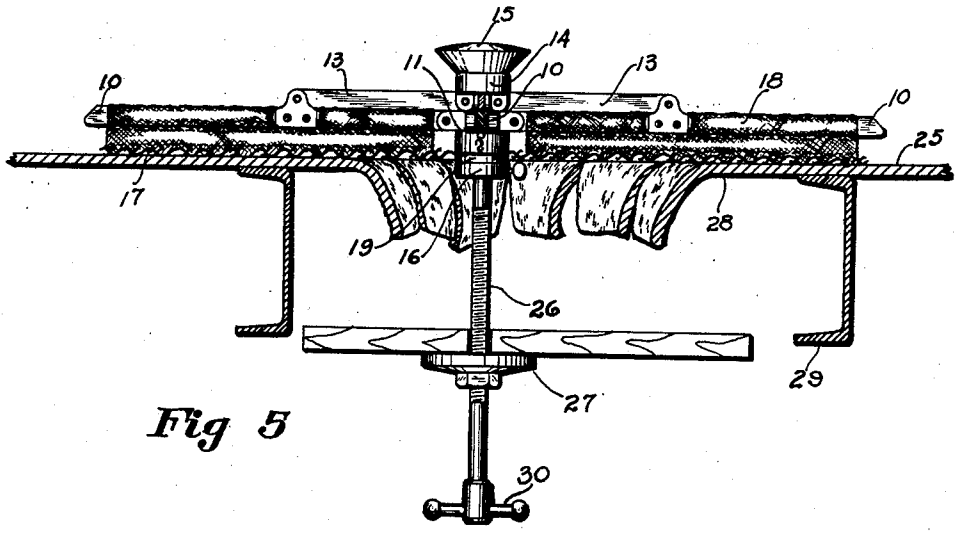


Fig 5

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Patented Nov. 5, 1940

2,220,085

UNITED STATES PATENT OFFICE

2,220,085

LEAK STOPPER

John J. Dirschel, Buffalo, N. Y.

Application March 10, 1939, Serial No. 260,998

5 Claims. (Cl. 114—227)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalty thereon in accordance with the provisions of the act of April 30, 1928 (ch. 460, 45 Stat. L. 467).

The invention pertains to the means and method of stopping and repairing leaks in the hulls of vessels, and more particularly to leak stoppers for temporarily repelling the influx of water into water-buoyed vehicles through damaged portions of the hull thereof, caused by punctures, ruptures, sheering to plates, damages to ports, etc.

The most prevalent devices employed at present fail in successful operation and performance unless the puncture or rupture is comparatively small and of reasonably smooth edges. Most of such devices require the use of guiding chains, lines or ropes, as well as men in diving suits or helmets in order to apply the same to the exterior of a hull. Many men are required and lives are endangered. Much time is lost which allows a great quantity of water to flow into the hold, thereby endangering and damaging the vessel, its equipment and the cargo as well as causing direct injury, or through panic, to its crew and passengers. The application of devices of the character in present use, if not carried out with precision, is subject to considerable fouling, resulting in additional loss of valuable time.

The object of my invention is to improve and simplify known and used devices of the character, and more particularly to provide a stopper which may be applied to the exterior of the hull of such a vessel from the interior while the vehicle is afloat.

Another object of the invention being to provide a device whereby the water inflow, caused by damage to the hull of a vessel, may be checked and stopped in the shortest time practicable.

Other objects of the invention being to provide a simple, practical, portable and relatively economical emergency device whereby leaks in hulls caused by accidental damage, including gun fire and other warfare functions, may be quickly and satisfactorily stopped until such time as the damage may be temporarily repaired and yet provide a stopper of such durability as will prevent disabling the vessel until such time as it can be listed, a cofferdam built and used, or the vessel dry-docked for accomplishing permanent repairs in the event that temporary repairs cannot be made at the time and location of the injury.

Still another object of the invention is the provision of a stopper which, when installed, will provide a relatively smooth surface with a minimum projection beyond the contour of the hull in order to minimize resistance to the travel of the vessel and also to minimize lateral forces of water upon the stopper tending to displace the same.

Another object being the provision of a tight seal and means for reinforcing the stopwater material over the damaged portion sufficiently to retain the same in position, irrespective of the displacement forces of the water thereon.

It is to be understood that the above general statement of the objects of my invention is intended to broadly explain the same without limiting it in any manner. Other objects will become apparent from a consideration of the following description of my invention and the accompanying drawings.

In the accompanying illustrative drawings of practical and workable embodiments having the characteristics of my invention and by which the same may be practiced, there is shown in—

Fig. 1, a plan view of an applied leak stopper as viewed from the exterior, or water side, of the hull;

Fig. 2, an enlarged section, in perspective, illustrating a manner of applying the stop water material to a rib of a stopper;

Fig. 3, a sectionalized view of the structural members of a stopper in closed position;

Fig. 4, an elevational view of a stopper in closed position; and

Fig. 5, a sectionalized view taken at line 5—5 of Fig. 1.

My improved leak stopper somewhat resembles that of an umbrella, the structural details of similarity and difference being pointed out hereinafter, which, for the sake of general comparison, may be considered as applied to the rupture of a hull by grapsing the tip and pushing the handle foremost through the rupture from the interior of the hull and allowing the umbrella to open with the covering in contact with the exterior of the hull surrounding the rupture and with the ribs and struts, or braces, outermost.

Broadly, my invention comprises a collar, a shaft slidable within the collar, plurality of ribs pivoted to said collar, a fitting on said shaft, struts pivotally connecting said fitting with intermediate points on said ribs, whereby said ribs may be moved from a folded position substantially parallel to said shaft to an open position substantially at right angles to said shaft as said collar and fittings approach each other, a foldable sheet of stopwater material on the outside of said

ribs when in folded position, means on said shaft for releasably locking the collar and fitting with respect to each other and means cooperating with said shaft to clamp said material between the ribs and a surface.

More specifically, my invention comprises a plurality of ribs, each hingedly connected at one end thereof to a base fitting stationed but free upon a shaft, a plurality of foldable struts for limiting the movement of said ribs to positions substantially at right angles to said shaft, said struts each being hingedly connected at one end thereof to a second base fitting also mounted upon said shaft, and each connected at the other end thereof to said ribs at points removed from the hinge connection of said ribs to said first base fitting, said ribs and struts being adapted to fold into parallelism with said shaft reversely of each other, a sheet of stopwater material secured to the outer side of said ribs and to said first base fitting to form a substantially flat surface when said ribs are distended, releasable means for compactly holding the loose folds of said sheet of material when said ribs are folded into parallelism with said shaft, means for releasably locking said ribs and struts in distended position, and means on said shaft adapted to be brought into contact with the interior of the hull to cooperate with said locked members to clamp said sheet of stopwater material between the ribs and the exterior of the hull.

By reference to the drawings it will be seen, from the embodiments there shown to illustrate my invention, that the device comprises a plurality of ribs **10**, which are each hingedly connected at one end thereof to a base fitting **11** provided with an opening by means of which the fitting is mounted upon a shaft **12**. This fitting is stationed on the shaft, yet free to allow the shaft to be pulled therethrough, at a point approximately the length of the ribs from said head of the shaft. Hingedly secured to each of the ribs **10** at a point intermediate their ends are struts, arms, or braces **13**, which are hingedly secured at their other ends to a second base fitting **14** also mounted upon the shaft **12**. This second base fitting **14** may be slidingly mounted upon the shaft similar to that of the first fitting **11**, or may be secured to, or form a part of, the forward end of the shaft, as described more fully hereinafter. The struts **13** are of such length and connected to the ribs at such positions as to permit the ribs to be pivoted about their hinge connections from a position substantially in parallelism with the shaft **12** (see Fig. 3) through an arc of approximately 90° into a position substantially at right angles to the shaft (see Fig. 5).

The struts are preferably, but not necessarily, so positioned and connected to the ribs as to lie along the backs of the inner end portions of the ribs when in opened or distended position to serve as strong backs or reinforcements (see Figs. 1 and 5) and to lie along the backs of the outer end portion of the ribs when in closed or folded position (see Fig. 3). This may be seen by reference to Figs. 1, 5 and 3, from which it will also be seen that the ribs and struts fold in opposite directions toward each other into parallelism with each other and the shaft, whereby to form a compact device for storage as well as for easy passage of the device through a rupture. During the opening and folding operations of this embodiment the strut fitting **14** is moved to and from the rib fitting **11** in a manner similar to a conventional umbrella. The fittings **11** and **14** uniformly control the opening and closing of the ribs and struts and when in opened and applied position the combined elements distribute the stresses which might otherwise have to be sustained by a single rib due to the irregularity of the rupture. The uniform assumption of stresses also tends to relieve the weaker portions of the hull surrounding the rupture from undue strain.

If it is preferred to have the strut fitting **14** slidable upon the shaft **12**, the shaft of course need not be moved through the rib fitting **11** to open and close the device; whereas, if the strut fitting **14** is fixed to or forms a part of the shaft **12**, it is of course necessary to move the shaft through the rib fitting **11** during the operation. In the former event, however, when the device is opened and the strut fitting **14** is in abutment with the rib fitting **11**, the shaft is then pulled through the rib and strut fittings until the head **15** provided on the forward end of the shaft is brought down against the strut fitting **14**. The shaft is then locked against retraction to prevent a closing of the elements.

The head **15** may be wedge shaped and serve as means for forcing the ribs to open by pulling the shaft through the fitting **11**. The shaft **12** may consist of a series of sections screw-threaded into each other whereby a major portion of the withdrawn shaft may be removed, when the device is opened, and a keyed ring **16** (Fig. 5) or other suitable means applied to the shaft in abutment with the rib fitting **11** to serve as the aforementioned means for locking the device in open position.

In combination with the elements described, I provide a sheet, disc or layer of stopwater material **17** having a radius substantially that of the length of the ribs **10**. This sheet of material is applied to the outer side of the ribs, that is, the side of the ribs opposite that which lies adjacent the shaft when in closed position, and is secured thereto by some suitable means, such as sleeves **18** surrounding the ribs and secured to the back of the sheet of material **17**. As shown in Fig. 5, the sleeves should be provided with openings or separations to afford the free operation of the hinge connections between the struts and the ribs. These sleeves should be relatively tight fitting or of sufficiently heavy material as to prevent intussusception or invagination whereby the sheet of material is maintained in distended positions and substantially flat and in conformity with the surface of the hull, whereby creeping and misplacement of the disc of material is minimized.

The stopwater material is also provided with a centrally located aperture (not shown) through which the shaft **12** may pass and may be secured to the rib fitting **11** by suitable means **19**, such as a nut and washer or a washer shaped element secured to fitting **11** by means of screws **20**.

When the device is closed triangular folds **21** in the stopwater material are formed between the ribs, the large or skirt end being at the inserting or forward end of the device. These folds, as shown in Fig. 4, may be successively wrapped tightly about the closed unit, or otherwise compacted, and so held together with the folded structural elements by suitable means whereby the device may be readily stored and whereby it may be conveniently inserted into a small rupture, such as indicated in dotted lines in Fig. 1 by character reference **22**. Suitable means for holding the folded device compactly is shown in Fig. 4 as comprising a line **23** having an eyelet at each end held together with a toggle pin to which

is tied a rip cord 24 extending to the handle end of the shaft where it will be readily accessible for releasing the device when it is pushed through a rupture.

The sizes of the fittings and shaft are governed by the strength requirements and sizes of the ribs and struts which in turn are governed by the size or span of the rupture to which the device is to be applied. For this reason a plurality of the devices varying in span size and correspondingly varying in strength should be carried to meet varying emergencies. If need be, two or more of the devices may be applied in overlapping or side-by-side manner.

In the application of the device for the purposes stated, it is pushed head foremost while in a closed position through the rupture until the base fitting 11 is at least into the mouth of the rupture, and while held in that position the rip cord is pulled. The release will be instantaneous as well as the seating in place and water stoppage. The water pressure into the mouth of the folds 21 is ordinarily deemed sufficient to force the sheet open and flatly against the exterior of the hull 25 of the vessel, the sheet pulling the ribs and struts open while they in turn direct an even and uniform spread of the sheet. Should the device not respond to the water pressure instantaneously, the rib fitting 11 may be held firmly in position and by an inward pull on the shaft the strut fitting 14 will be forced toward and into contact with the fitting 11, thereby forcing the struts to open and the ribs as well as the sheet carried thereby. The shaft, if not already withdrawn, may then be pulled inward until the head 15 is hard against the fitting 14 and the latter hard against the fitting 11. The withdrawn sections of the shaft inboard of the rib fitting may then be removed and the keyed ring 16 slipped onto shaft, if not already there, into abutment with the rib fitting and there secured to hold the device open. The stopwater material when opened will ordinarily be held against the hull by water pressure, at least temporarily until a threaded section 26 and inside padded shoring, plate, crossbar or other suitable means, may be applied to the shaft, drawn rigid, by means of a nut and washer 27 in contact with the interior of the hull 28 or its framework 29, whereby the sheet is clamped against the exterior of the hull by the ribs. Additional shores can be worked as needed and the entire device secured in a manner capable of withstanding pressures and resistances due to water forces as well as to motions of the vessel. The action can be compared to that of a bolt in firmly drawing two separate parts together.

The end section of the shaft may be provided with a transverse rod to form a hand grasp 30 for the operator. This rod is preferably slidable in order that the device may be held from one side of the inflowing water.

In this construction, arrangement and application, it will be seen that the stopwater material is brought directly into contact with the surface of the hull, and since the ribs are on the back of this stopwater material, there are no arched portions in the material, which are ordinarily formed when the ribs lie beneath the material in contact with the hull, through which water may seep or flow into the rupture. It will also be seen that the struts form strongbacks for the ribs and, likewise, the ribs strongbacks for the stopwater material, and form exceedingly strong reinforcements and clamping means for securing the stopwater material in direct contact with the hull of the vessel. It will also be seen that when the device is applied, locked and clamped to the damaged portion of the hull, as will be seen in Fig. 5, the projections beyond the contour of the hull are considered negligible as compared to devices of the character in the prior known art. Its compactness for storage is one of exceptional desirability, and its construction is of such a simple nature as to afford convenient and ready installation.

Having described my invention, what I claim is:

1. A leak stopper for punctures or ruptures through hulls of water buoyed vehicles comprising a plurality of ribs, a shaft and a base fitting slidingly mounted thereon, each of said ribs being hingedly connected at one end thereof to said base fitting, a second base fitting mounted on said shaft, a plurality of foldable struts for limiting the movement of said ribs to positions substantially at right angles to said shaft and for serving as strongbacks for said ribs, said struts each being hingedly connected at one end thereof to said second base fitting and each connected at the other end thereof to said ribs at points removed from the hinge connection of said ribs to said first base fitting, said ribs and struts being adapted to fold into parallelism with said shaft reversely of each other, a sheet of stopwater material secured to the outer side of said ribs and forming a substantially flat surface when said ribs are distended, releasable means for compactly holding the loose folds of said sheet of material when said ribs are folded into parallelism with said shaft, means for releasably locking said fittings in abutment with each other to thereby hold said ribs and struts in distended position, and adjustable means on said shaft adapted to be brought into contact with the interior of a hull to cooperate with said locked members to clamp said sheet of stopwater material between said ribs and the exterior of the hull.

2. In a leak stopper the combination of a collar, a shaft slidable within the collar, a plurality of ribs pivoted to said collar, a fitting on said shaft, struts pivotally connecting said fitting with intermediate points on said ribs whereby said ribs may be moved from a folded position substantially parallel to said shaft to an open position substantially at right angles to said shaft as said collar and fitting approach each other, a foldable sheet of stopwater material on the outside of said ribs when in folded position, and means on said shaft for releasably locking the collar and fitting with respect to each other.

3. In a leak stopper the combination of a collar, a shaft slidable within the collar, a plurality of ribs pivoted to said collar, a fitting on said shaft, struts pivotally connecting said fitting with intermediate points on said ribs whereby said ribs may be moved from a folded position substantially parallel to said shaft to an open position substantially at right angles to said shaft as said collar and fitting approach each other, a foldable sheet of stopwater material on the outside of said ribs when in folded position, means on said shaft for releasably locking the collar and fitting with respect to each other, and means cooperating with said shaft to clamp said material between the ribs and a surface.

4. In a leak stopper the combination of a shaft, a slidable fitting on the shaft, a plurality of ribs pivoted to said slidable fitting, a second fitting on said shaft, struts pivotally connecting said second fitting with intermediate points on

said ribs whereby said ribs may be folded substantially parallel to said shaft and extended to positions substantially at right angles thereto, a flexible sheet of stopwater material on the outside of said ribs when in folded position, releasable means for holding said ribs and material compactly folded along the sides of said shaft, and means for locking said fittings in proximity to each other whereby the ribs may be held in distended position.

5. A leak stopper comprising the combination of a plurality of radially extending ribs pivoted to a common unit at their rear ends as distinguished from their foremost ends when the stopper is in closed position, a plurality of radially extending struts pivoted to another common unit at their foremost ends when the stopper is in closed position, means pivotally connecting said struts to said ribs, means for maintaining said units in axial alignment, releasable means for maintaining said ribs and struts at predetermined angles with respect to each other, a sheet of foldable stopwater material carried by said ribs on the backs thereof as distinguished from their foremost faces when the stopper is in opened position, and means for clamping said material between said ribs and a surface to which the device is applied.

JOHN J. DIRSCHEL.