This invention relates to apparatus for effecting temporary sub-surface repairs in the hulls of vessels at sea. It is an object of the invention to provide apparatus whereby under-water hull fastening devices such as bolts or rivets may be replaced by operations conducted entirely within the hull or above the surface of the water.

Another object of the invention is to provide apparatus of the character described by means of which the type of repairs mentioned above may be very rapidly carried out.

A further object of the invention is to provide improved apparatus by means of which a guide line may be passed, from a position interiorly of and below the waterline of a ship's hull, through a constricted opening in said hull where a closure device may be attached to the line and drawn into the opening in the hull to close the latter.

A still further object of the invention is to provide, in apparatus of the nature referred to, improved means for carrying to the surface of a body of water, from a position below said surface, a normally non-buoyant member.

Still another object of the invention is to provide in apparatus of the character described and including a normally non-buoyant member inflatable to render it buoyant, means in the nature of a hand tool which may be attached to said non-buoyant member for substantially instantaneously rendering it buoyant.

The invention possesses other objects and features of advantage which, together with the foregoing, will be specifically brought out in the detailed description of the preferred form of my invention hereunto annexed. It is to be understood that the invention is not to be limited to the specific form thereof herein shown and described as various other embodiments thereof may be employed within the scope of the appended claims.

Referring to the drawings:

Figure 1 is a vertical sectional view of a vessel's hull showing therein the character of leak which the apparatus of my invention is adapted to repair.

Figure 2 is a longitudinal vertical sectional view of a form of line bobber and leek stopper.

Figure 3 is a longitudinal vertical sectional view of the bobber inflating tool.

Figure 4 is a fragmental top plan view of the structure of Figure 3; the plane in which the view is taken being indicated by the arrows 4—4 of the latter figure.

Figure 5 is a longitudinal vertical sectional view of the preferred form of the bobber of my invention.

Figure 6 is a view similar to Figure 5 showing the bobber in its inflated condition.

Figure 7 is an enlarged fragmental vertical sectional view, similar to portions of Figures 5 and 6, showing the method of exhausting the bobber air sac.

Figure 8 is a vertical sectional view taken in the plane indicated by the line 8—8 of Figure 5.

Figure 9 is a longitudinal vertical sectional view of a modified type of bobber.

Figure 10 is a view, partly in side elevation and partly in vertical section showing a fragmentary portion of a ship's hull with the repair bolt in position in the aperture to be closed.

Figure 11 is a view, similar to Figure 10, showing the bolt finally secured in place.

It sometimes occurs, during the voyage of a ship, that stresses set up by pounding seas or hogging and sagging of the hull may set up stresses sufficient to shear rivets from the shell plating at points thereof connected with frames, stringers, butt straps and the like. Usually, where one rivet is sheared, several surrounding rivets are similarly affected and if the resulting leakage of sea water into the hull is not promptly checked, serious damage to cargo, if the leak occurs in a hold, may result. The simplest method of repairing a leak occasioned by a broken rivet is to knock the severed sections of rivet from the hole and drive into the latter a wooden plug sufficiently tight to stop the flow of water. This repair however must be closely watched to insure that the plug does not become loose and dislodged from the hole. Furthermore, the wooden plug stopper will not work at all where the rivet has been knocked out in a butt strap for the reason that water will continue to seep or pour into the ship through the butt interstice and the lap between the butt strap and shell plate. In stopping this type of a leak and in positively plugging the leaks in frame holes and the like, it was previously the practice to send a diver over-side, if the weather conditions permitted, whose first duty was to laboriously locate the hole or holes to be plugged and thereafter insert into the holes repair bolts of a size and shape simulating the removed rivets but having a threaded shank which, when passed inboard through the hole, could receive a nut and washer for tightly clinching the bolt in the hole and which simultaneously drew together any separated units such as the shell plating and frames, the
plating and butt straps or similar parts. Not only did this procedure require considerable time to perform but at least two men were required, one being the diver and the other operating from within the ship to apply the nuts to the bolts and to clinch them up. In cases where the leaks happened to be in the bilge plates or at points deep below the waterline, the diver had a very difficult task and, sometimes, was unable to do the job at all.

I have provided means whereby repairs of the above-described type may be very expeditiously accomplished and wherein the work may, if needed be, require the services of only one man or two at the most. In Figures 5 and 6 I have shown the principal embodiment of my invention which comprises what may be aptly termed a bobber having a pair of cylindrical plugs 12 and 13 which are secured in the opposite ends of a tubular member 14, and bands 15 encircling the ends of the sac being crimped circumferentially so as to radially compress the sac about the plugs and thus provide a fluid-tight joint therebetween. The plug 13 is provided with a coaxial tubular extension 17 threaded into the outer end 16 which is a tubular valve housing 16 having a pair of diametrically opposed ports 19 opening through the side walls thereof and into the chamber 21. The plug member 13, in the tubular extension 17 thereof, is provisioned with a similar axial chamber 22 and ducts 23 drilled longitudinally through the plug member establishing communication between the chamber 22 and the sac cavity 24. A check valve, preferably of the flap type, is provided in the chamber 21 for the purpose of limiting flow of fluid, specifically air, uni-directionally through the ports 19 and thence into the sac cavity 24. In detail however, it comprises a cup-shaped rubber member 26 sized to snugly fit into the chamber bore 27 of the valve housing 16, the closed end 28 of the member being centrally apertured to receive a screw 29 threaded into housing and serving to retain the rubber valve in place. The skirt of the valve member is extended sufficiently so as to completely overlie and close the ports 19. It will be seen that if pressure exists in the chamber 21 which is greater then atmospheric the rubber valve will be subjected to an internal radial expansive force tending to bulge the portions of the valve skirt in registry with the ports 19 outwardly through the latter and thus tightly seal the ports and the chamber 21. Conversely, if air, at a pressure exceeding that which may exist in the chamber 21, is admitted to the ports 18 from the exterior of the housing 16, the valve skirt will be readily displaced inwardly thereby opening the ports and permitting the air to flow into the chamber 21 and thence into the sac 14.

Means is provided for limiting the pressure admitted to the sac, irrespective of how much excess pressure may be originally introduced through the ports 18, so as to primarily guard against accidental rupture of the sac. Extending axially into the plug 12 is a bore 31 having at the bottom thereof a coextensive counterbore 32 forming a chamber 33 which is in communication, through a plurality of drilled passages 34 with the cavity 24. The peripheral portion of the bottom of the bore 31 bordering the counterbore 32 form a valve seat adapted to engage the rubber washer 36 carried at one end of a plunger 37 arranged concentrically of the bore 31 and slidably guided in the bore 38 of a plug 39 adjustably engaged, by means of the screw threads 41 in the end of the plug 12. A coil spring 42, interposed between the disc valve 36 and the plug 39, serves to forcibly maintain the disc valve on its seat. Vents 43, drilled through the wall of the plug 12, serve to establish communication of the chamber 44, defined by the bore 31, with the atmosphere. Let us assume that a pressure of 25 pounds per square inch is all that can safely be introduced into the cavity 24 to expand the sac 14. The plug 39 is manipulated so as to compress the spring 42 and thus store in it sufficient force, in addition to the pressure of the atmosphere against the exposed area of the disk valve carrier, to just balance the pressure which will be imposed on the face of the disk valve in the chamber 33. If air at a pressure of 25 pounds per square inch is admitted through the charging ports 19 into the cavity 24 the sac 14 will expand radially, as shown in Figure 6, to the point where the stretched member and the force of the atmosphere on the exterior thereof exerts a counter-pressure sufficient to balance the internal pressure. Under these conditions the valve 36 will remain closed since no more pressure than the predetermined amount may be admitted into the cavity 24 from the source. However, in the event that air at a pressure in excess of 25 pounds per square inch is admitted through the closed ports 19, the sac will expand to a point wherein its internal pressure slightly exceeds 25 pounds whereupon the valve 36 will crack open and allow the excess pressure, for as long as it may persist, to escape from the cavity 24 through the passages 34 into the chamber 21 through the valve port and vents 43 to the atmosphere.

Conveniently portable means is provided for storing fluid under pressure and for injecting the bobber when desired. Referring to Figures 3 and 4, a plier-type hand tool is provided comprising a cylindrical body 46 having a chamber 47 therein which may be charged with a volume of compressed air from a pump or other source through a charging valve 48 carried by a plug 49 which is in threaded engagement with a boss 50 formed integrally with and extending axially from the body 46. The proportions of the body 46 and the thickness of its walls are such that the chamber 47 is capable of storing a sufficient volume of air at a comparatively high pressure to completely inflate the sac 14 several times before the pressure in the chamber 47 drops to the point where recharging is required. The opposite end of the body 46 is provided with an integral projection forming a fixed jaw 52 and a pivot lug 53, the latter being provided with a fixed pivot pin 54. A trigger 55 which lies alongside of and longitudinally parallel to the body 46, is provided, having a pair of spaced arms 57 traversing the pivot lug 53 and provided with elongated apertures 58 extending transversely of the axis of the body 46, in which the pivot pin 54 is movably engaged. The remote ends of the arms 57 are connected integrally with a jaw 59 which confronts and parallels the fixed jaw 52. Means are provided for registering the jaws 52 and 59 with the charging ports 19 of the bobber and means is further provided for releasing air from the chamber 21 for conducting the air into one of the aforesaid charging ports. Each of the jaws, in the confronting faces thereof, is provided with a shallow counterbore 61 for fixedly receiving a rubber washer 62, the washer in the movable jaw 59.
being centrally apertured to receive a circular pin 53, fixed in the jaw, and the washer in the facing 92, also having therein a central aperture 64 in axis with the pin 63. Projecting into an end of the chamber 47 is a boss 65 which is centrally bored to slidably receive a valve stem 67 extending exteriorily of the body 46 and positioned to be engaged by a portion 68 of the trigger 56 upon movement of the latter toward the body 46, by being concentric with the stem 67 opening into the chamber 47 and normally closed by a valve 71 formed integrally with and at the inner end of the stem 67. A coil spring 72 interposed between a plug 73, threadedly engaged with the chamber wall, and the end of the valve 71 serves to forcibly retain the latter in closed position. The aperture 64 in the washer of the fixed jaw 52 is registered with a short passage 74 intersecting a diagonal passage 76 which communicates with the counterbore 69 and a plug 77 seals off the end of the passage 76. With the valve 71 then with the passage 74, it will be noted, by reference to Figures 5 and 8, that portions 78 of the housing 18 immediately surrounding the charging ports 19 are flattened. This is done to provide seating surfaces for the rubber washers 91.

When it is desired to inflate the bobber, the charging tool, just described and illustrated in Figure 3, having been first charged with a volume of compressed air is brought into proximity with the housing 18. The pin 63 is then inserted in one of the ports 19 thus automatically substantially-alining the trigger 56 with the other port 19. Upon squeezing the trigger 56, against the pressure of the leaf spring 75, toward the body 46 the washer 62 will be forcibly compressed into air-tight contact with the flat portions 73 surrounding the charging ports. Continued pressure on the trigger 56 will cause engagement of the portion 68 thereof with the valve stem 67 so that the valve 71 is opened thus permitting air to flow into the counterbore 69, through the passages 75 and 74, into and through the ports 19 past the check valve 26, thence through the chambers 21 and 22, and the passages 23, into the sac cavity 24.

Means is provided for securing a line to the bobber, the purpose for which will be explained presently. In the extreme end of the housing 18 is provided a coxial drilled recess 81 provided with internal screw threads 82 for receiving the correspondingly threaded shank 83 of a plug 84 whose external diameter should not and does not exceed that of the housing. The tip of the plug 84 is axially drilled so as to snugly receive the end of a cord or wire rope 86, a knot or knob 87 being tied or braided on the cord or rope so as to securely fix the latter in the plug.

In Figure 1 I have shown a method of practical application of the bobber of my invention. The figure represents a cross-section of a water-borne vessel 88 in which the water leak 80 caused by a broken and dislodged shell rivet 91 is to be stopped. Positioning a helper 92 in a boat 93 on the outside of the ship and approximately vertically above the location of the leak, the other worker 94 equipped with a bobber and a charging tool, such as shown in Figure 3, descends into the ship and locates the leak. If necessary the latter worker removes any piece or pieces of the rivet that may be in the hole. He then pushes the defeated bobber through the hole in the position wherein the sac 14 precedes the housing 18. After securing himself that the sac 14 is entirely clear of the hole and lies entirely exteriorly of the shell, he then attaches the line 85 by screwing the plug 84 into the end of the housing 18. Then, by applying the charging tool to the ports 19 and pressing the trigger 56, he injects the sac to its expanded limit as shown in Figure 6. The entire bobber is thus rendered buoyant and, as soon as it is completely pushed through the hole, it will bob to the surface of the water in the vicinity of the waiting helper 92 carrying with it the line 85 which remains threaded through the hole. After the bobber is re-engaged by the helper 92 the latter detaches it from the line by screwing the plug 84 out of the end of the housing 18 and thereafter attaches the plug to a suitable repair bolt 95 such as shown in Figure 10 which comprises a duplication of the shell rivet with the exception that the shank 87 is extended and is provided with screw threads 98. The plug 84 is fitted into a threaded recess 99 which is a duplicate of the one in the end of the housing 18 described previously. After signalling the worker 94 that all is in readiness the helper 92 drops the repair bolt 95 outside whereby the worker 94 draws in the line until, eventually, the bolt is drawn into and through the hole as shown in Figure 10. Thereafter, a soft lead or copper sealing washer 101 is applied to the repair bolt shank followed by a rubber washer 102 and a nut 103, the latter being then cinched up so as to draw the conical head of the bolt tightly into the hole countersink and thus close the hole and, in the case of overlapped plates, to bring the plates tightly together and thus reduce or stop any steam leaks in the immediate vicinity of the repair.

The helper, after removing the bobber from the line may deflate it if it is to be immediately returned aboard ship to float additional lines to the surface. In Figure 5 it will be seen that the plunger 107 is provided adjacent its outer end, with a circumferential groove 104, and when the valve 105 is closed, to register substantially with an aperture 106 drilled transversely into the plug 120 and intersecting the plunger bore thereof. In Figure 7 it will be seen that when a somewhat pointed tool 108 is inserted into the aperture 106, to engage in the groove 104, and rocked side-wise as shown in the drawing, the plunger may be moved sufficiently to crack open the valve 105 and thus exhaust the air from the cavity 120 through the valve port and the vents 43 to the atmosphere.

In Figure 9, I have shown a bobber constructed in accordance with the principles of my invention but embodying only the barely 'essential parts necessary to perform the functions outlined above. However, under some circumstances this type of device may not perform satisfactorily. For instance, if a rivet hole is encountered which is small enough to offer considerable resistance to the passage of the defeated bobber through the design of Figure 9 would probably cause a wadding of the rubber sac in the hole with the result that complete passage of the bobber through the hole would be made impossible. In the structure of Figures 5 and 6 I have provided means for lending rigidity to the sac but which does not interfere with the normal functioning of the latter. Secured in any suitable manner, such as by threading, in an aperture 105 formed centrally of the plug 12 is a retaining ring 106 or rod 108 which extends axially of the sac 10, slidably through a central aperture 111 formed in the plug 13, and terminates in a collar 112 positioned to slide in the chamber 22.

Passages
2,446,189

2,446,189

113 drilled axially through the collar 112 provide additional airflow communication between the chambers 21 and 22. The proportions are such that when the sac is in its deflated condition, as shown in Figure 5, the collar 112 will impinge against the outer end of the housing 18 where the latter threads into the chamber 22. Thus any force which tends to compress the sac axially will be resisted by the tube 109 as will forces tending to flex the sac about its axis. However since the tube and collar are free to move toward the left as viewed and shown in Figure 6 the normal expansion of the sac when air pressure is admitted thereto will in no way be interfered with.

In Figure 2 I have shown a modified form of device, although operating on the general principles outlined above, is intended to serve as a leak stopper in certain instances where repair bolts cannot conveniently be used or wherein the outboard portion of a broken rivet cannot be removed or driven from the hole. The plug member 114 is secured in the end of the rubber sac 116, as already described, by means of a cramped metallic band 117 and a tube 118, anchored at one end in a central aperture 119 formed in the plug member, has a globular outer end 121 and is provided with apertures 122 through which communication may be had from the interior of the tube to the cavity 123 of the sac. A valve housing 124, similar to the housings 18, is provided being threaded onto a nipple 126 formed on the plug member 114 and is fitted with charging ports 127 and sealing surfaces 128 bordering the ports. In the chamber 129 of the valve housing is a check valve 131 identical with the valves previously described except that a screw 132 having an axial bore 133 therethrough is provided for securing the valve in place. The passage 134 through the mounting screw opens into a chamber 134, concentric with the housing, which is closed by a threaded plug 135 having a central aperture 137 and radially spaced ports 138. A valve stem 139, slidable in the aperture 137, has an integral valve disc 140 carried on a spring member 141 outside of the chamber 134 and a coil spring 142, concentric with the stem 139 and interposed between the plug 136 and a washer 143 which is mounted by a nut 144 on the stem, serves to hold the valve disc 141 with adjustable pressure in position closing the ports 138. The stem 139 is extended by a shank 145 beyond the valve disc 141 and is fitted with a head 147 which projects sufficiently beyond the outer end of the plug 136 to enable a person to grip the head 147 with his fingers and thus lift the valve disc 141 from its seat. A cap 148 provided with vents 149 is provided for engaging the projecting threaded end of the plug 136 and is for the purpose of protecting the valve mechanism against accidental disturbance or damage. The tube 118 in the sac 116 lends sufficient rigidity to the latter so that it may be worked in deflated condition into holes or cracks that are to be closed after which the sac is inflated in the manner above described. This device is useful both as a bobber and as a means for stopping hole leaks when a large group of the latter exist and it is desired to reduce the large volume of water flowing into the vessel while the more permanent repair effected by the bolts 96 may be carried on in successive of the holes.

Repairs of the nature described are usually carried out in comparatively deep water. However in some instances the vessel may be located or anchored in relatively shallow water and in order to prevent fouling of the repair bolt with marine growth, rock crevices or the like when the bolt is dropped through the rear side of the vessel skiff, I provide the bolt with an apertured lug 151 through which a doubled cord 152 may be threaded, the latter being used for controlling the descent of the bolt through the water so that the bolt may not approach any sub-surface object which might foul it. After the bolt has been finally set in place, the cord 152 may be detached by drawing on one of the strands until it is retracted from the lug aperture.

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

1. In apparatus for inserting, from the outboard side of a water-borne ship, a stopper in a hole existing in the hull of said ship and positioned considerably below the waterline thereof, and a line to be passed through said hole from the inboard to the outboard ends thereof and to be elevated toward the surface of the water to be there connected with the stopper which is then drawn into the hole by retrieval of the line through the hole in an inboard direction; means forengaging with and for transmitting the line toward the surface of the water comprising a sac radially-expandable to enclose a volume of air sufficient to render said sac and its associated parts buoyant so as to permit ascension thereof toward said surface of the water, a plug secured in said sac having therein a central conduit and charging ports opening into said conduit through which air under pressure may be admitted to said conduit to flow into and to inflate said sac, flexible valving means in said conduit and overlying said charging ports for limiting, unidirectionally, the flow of air through said ports into said conduit, a valve in communication with said sac and operative, upon establishment of a predetermined pressure in said sac, for exhausting from said sac air in excess of said predetermined pressure, and means for regulating said valve to govern the operative limit thereof.

2. In apparatus for inserting, from the outboard side of a water-borne ship, a stopper in a hole existing in the hull of said ship and positioned considerably below the waterline thereof, and a line to be passed through said hole from the inboard to the outboard ends thereof and to be elevated toward the surface of the water to be there connected with the stopper which is then drawn into the hole by retrieval of the line through the hole in an inboard direction; means forengaging with and for elevating said line toward the surface of the water comprising a sac radially-expandable to enclose a volume of air sufficient to render said sac and its associated parts buoyant so as to permit ascension thereof toward said surface of the water, a first plug secured in said sac having therein a conduit and ports opening into said conduit through which air under pressure may be admitted to said conduit to flow into and to inflate said sac, means in said conduit and overlying said charging ports for limiting, unidirectionally, the flow of air through said ports into said conduit, means for regulating said valve to govern the operative limit thereof, a second plug secured in said sac in axial registry with the first plug, said second plug having therein a discharge port in communication, respectively, with the interior of the said sac and with the atmosphere, a plunger in said plug carrying a valve disc and mounted co-axially of said discharge port and for movement
toward, and to close said port, and adjustment member threadedly engaged in said plug and movable toward and from said inport, a coil spring interposed between said valve and said adjustment member.

3. In apparatus for inserting, from the outboard side of a water-borne ship, a stopper in a hole existing in the hull of said ship and positioned considerably below the waterline thereof, and a line to be passed through said hole from the inboard to the outboard ends thereof and to be elevated toward the surface of the water to be there connected with the stopper which is then drawn into the hole by retrieval of the line through the hole in an inboard direction, means engageable with and for elevating said line toward the surface of the water comprising a sac radially-expansible to enclose a volume of air sufficient to render said sac and its associated parts buoyant so as to permit ascension thereof toward said surface of the water, a first plug secured in said sac having therein a conduit and ports opening into said conduit through which air under pressure may be admitted to said conduit to flow into and to inflate said sac, means in said conduit and overlying said charging ports for limiting, unidirectionally, the flow of air through said ports into said conduit, means for forcing air under pressure through said ports, a second plug secured in said sac in axial registry with the first plug, said second plug having therein a discharge port in communication, respectively, with the interior of the sac and with the atmosphere, a plug in said plug carrying a valve disk and mounted co-axially of said discharge port and for movement toward and to close said port, an adjustment member threadedly engaged in said sac and movable toward and from said inport, a coil spring interposed between said valve, and said adjustment member, and means for manually moving said plug and valve to lift the valve from said discharge port.

4. In apparatus for inserting, from the outboard side of a water-borne ship, a stopper in a hole existing in the hull of said ship, and positioned considerably below the waterline thereof, and a line to be passed through said hole from the inboard to the outboard ends thereof and to be elevated toward the surface of the water to be there connected with the stopper which is then drawn into the hole by retrieval of the line through the hole in an inboard direction; means engageable with and for elevating said line toward the surface of the water comprising a sac radially-expansible to enclose a volume of air sufficient to render said sac and its associated parts buoyant so as to permit ascension thereof toward said surface of the water, a first plug secured in said sac having therein a conduit and ports opening into said conduit through which air under pressure may be admitted to said conduit to flow into and to inflate said sac, means in said conduit and overlying said charging ports for limiting, unidirectionally, the flow of air through said ports into said conduit, means for forcing air under pressure through said ports, a second plug secured in said sac in axial registry with the first plug, said second plug having therein a discharge port in communication, respectively, with the interior of the sac and with the atmosphere, a plug in said plug carrying a valve disk and mounted co-axially of said discharge port and for movement toward and to close said port, an adjustment member threadedly engaged in said sac and movable toward and from said inport, a coil spring interposed between said valve, and said adjustment member, and means for manually moving said plug and valve to lift the valve from said discharge port.
In apparatus for inserting, from the outboard side of a water-borne ship, a stopper in a hole existing in the hull of said ship and positioned considerably below the waterline thereof, and a line to be passed through said hole from the inboard to the outboard ends thereof and to be elevated toward the surface of the water to be there connected with the stopper which is then drawn into the hole by retrieval of the line through the hole in an inboard direction; the combination of means engageable with and for elevating said line toward the surface of the water comprising a sac radially-expandible to enclose a volume of air sufficient to render said sac and its associated parts buoyant so as to permit ascension thereof toward said surface of the water, a first plug secured in said sac having therein a conduit and charging ports opening into said conduit through which air under pressure may be admitted to said conduit to flow into and to inflate said sac, said first plug in portions bordering said ports having flattened sealing seats, a second plug secured in said sac in axial registry with the first plug, said second plug having therein a discharge port in communication, respectively, with the interior of the sac and with the atmosphere, a spring-pressed valve closing said discharge port and disposed on the atmospheric side thereof, and a closed vessel containing air under an elevated pressure, said vessel having thereon a pair of movable jaws adapted to be brought into intimate engagement with the sealing seats of said first plug, one of said jaws having thereon a pin engageable with one of the charging ports so as to center the jaws being provided with resilient gaskets interposed between the jaws and the sealing seats so as to preclude air leakage from the charging ports, the other of said jaws having a discharge aperture therein and a conduit in communication with said discharge aperture and said vessel, a valve in said conduit for releasing air from the vessel to flow from the discharge aperture and said valve being operative upon movement of said jaws toward each other.

In apparatus of the class described, a bobber comprising an elastic sac, a plug connected to and closing the open end of said sac, a tubular stem secured in said plug and extending into said sac through which air may be admitted to said sac to inflate the latter, a valve housing connected with and extending from said plug, said valve housing having therein a pair of separated chambers and charging ports opening into a first of said chambers, said first chamber being in communication with said tubular stem and the second chamber being in communication with the atmosphere, a check valve associated with said charging ports for limiting flow of air through said ports unidirectionally into said first chamber, means associated with said check valve having therein a passage providing communication between the first and second chambers, means for forcing air under pressure through said charging ports and a spring-pressed valve in said second chamber for normally shutting off said second chamber from the atmosphere and for venting said second chamber to the atmosphere when the pressure therein exceeds a predetermined value.

CARL A. ODING.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>211,597</td>
<td>Ryd</td>
<td>Jan. 21, 1879</td>
</tr>
<tr>
<td>417,814</td>
<td>Winchett</td>
<td>Dec. 31, 1880</td>
</tr>
<tr>
<td>2,338,597</td>
<td>Pleak</td>
<td>Jan. 4, 1944</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>320</td>
<td>Great Britain</td>
<td>Jan. 6, 1896</td>
</tr>
<tr>
<td>196,413</td>
<td>Germany</td>
<td>Mar. 19, 1908</td>
</tr>
<tr>
<td>254,106</td>
<td>Italy</td>
<td>Nov. 15, 1926</td>
</tr>
</tbody>
</table>