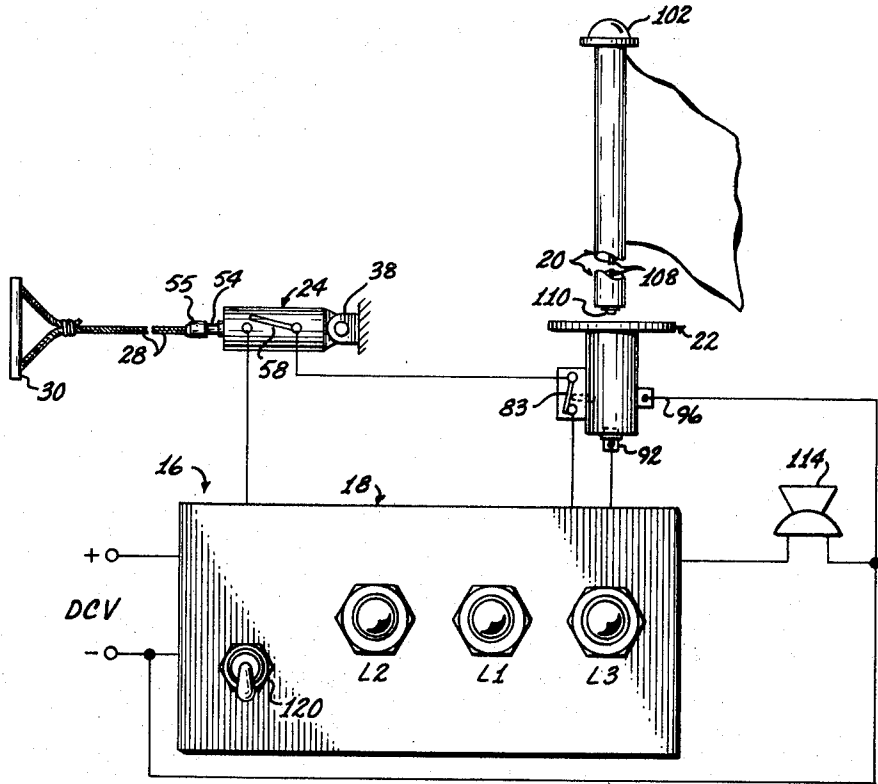


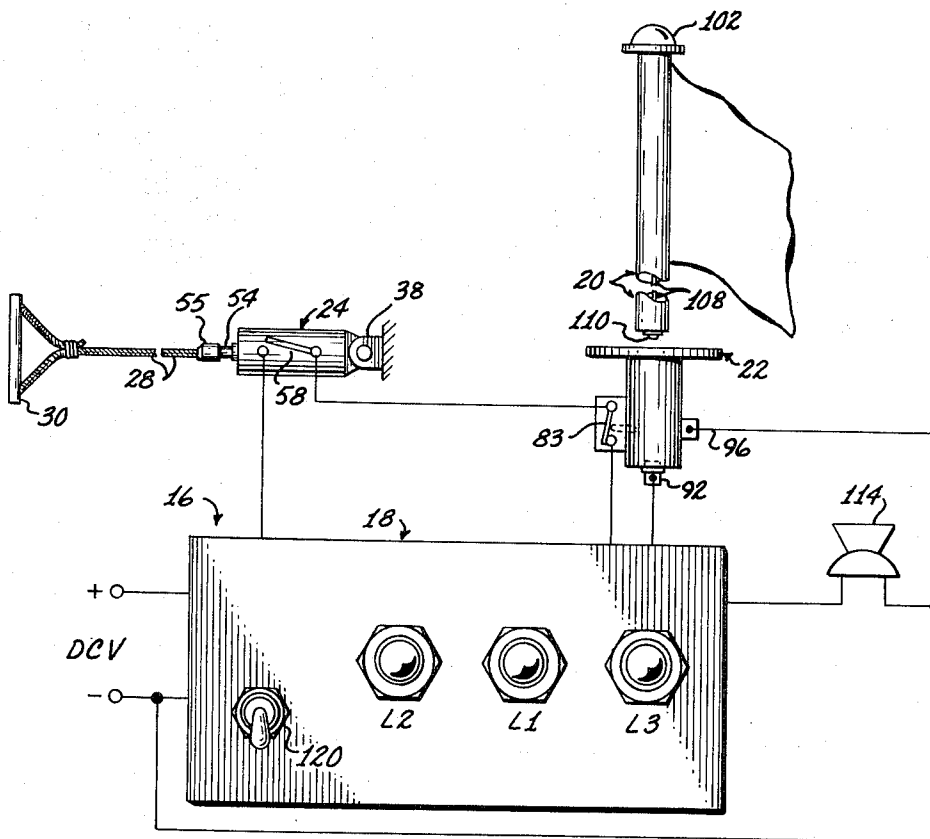
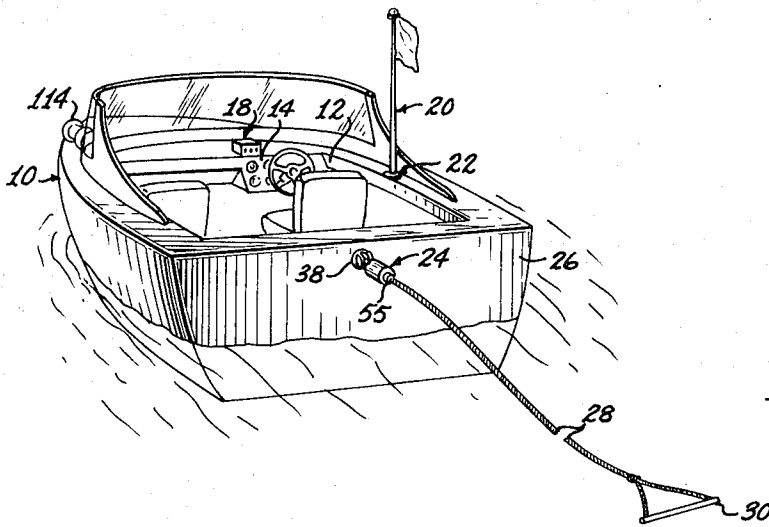
[54] SKIER ALARM SYSTEM
[76] Inventor: Donald C. Langford, 5838 W.
Fairmount Ave., Phoenix, Ariz.
85031
[22] Filed: Nov. 13, 1972
[21] Appl. No.: 306,324
[52] U.S. Cl. 340/279, 9/310 A, 200/61.18,
340/421
[51] Int. Cl. G08b 21/00
[58] Field of Search 340/279, 421; 9/310 A,
9/14; 200/34, 61.18, 52 R
[56] References Cited
UNITED STATES PATENTS
3,091,757 5/1963 Brock 340/421

3,109,075 10/1963 Ratcliff 200/61.18
Primary Examiner—John W. Caldwell
Assistant Examiner—Glen R. Swann, III
Attorney, Agent, or Firm—Herbert E. Haynes, Jr.

[57] ABSTRACT
An alarm system for use with ski boats is automatically operated when a water skier releases his grip on the tow line to produce an alarm indicative of "skier down". The system will continue to produce the alarm until a flag is raised as a warning to other boats whereupon the alarm will cease.

11 Claims, 7 Drawing Figures





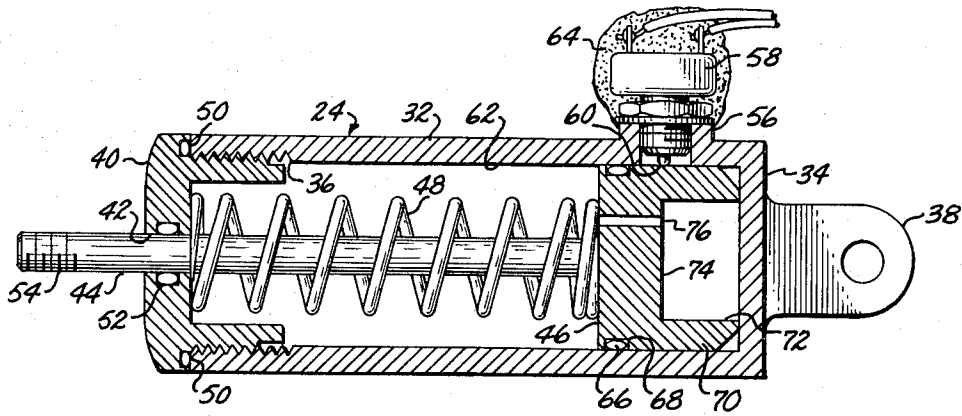


FIG. 3

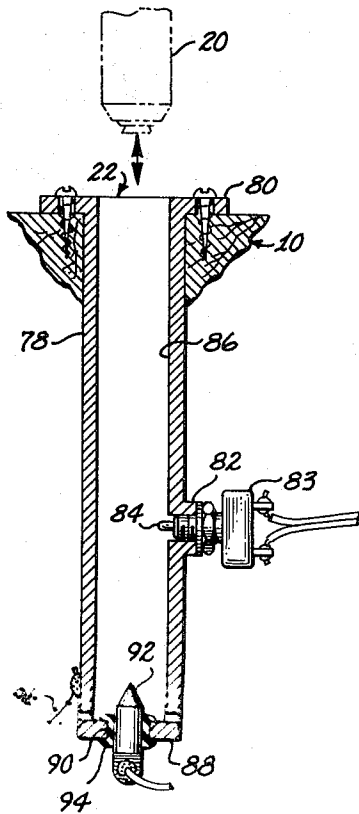


FIG. 4

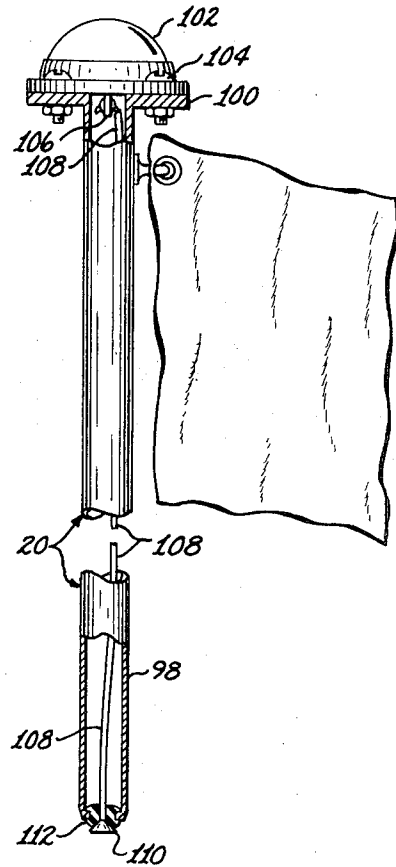
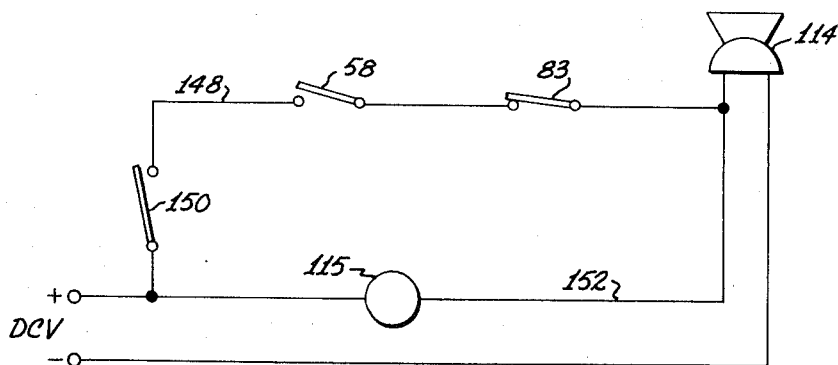
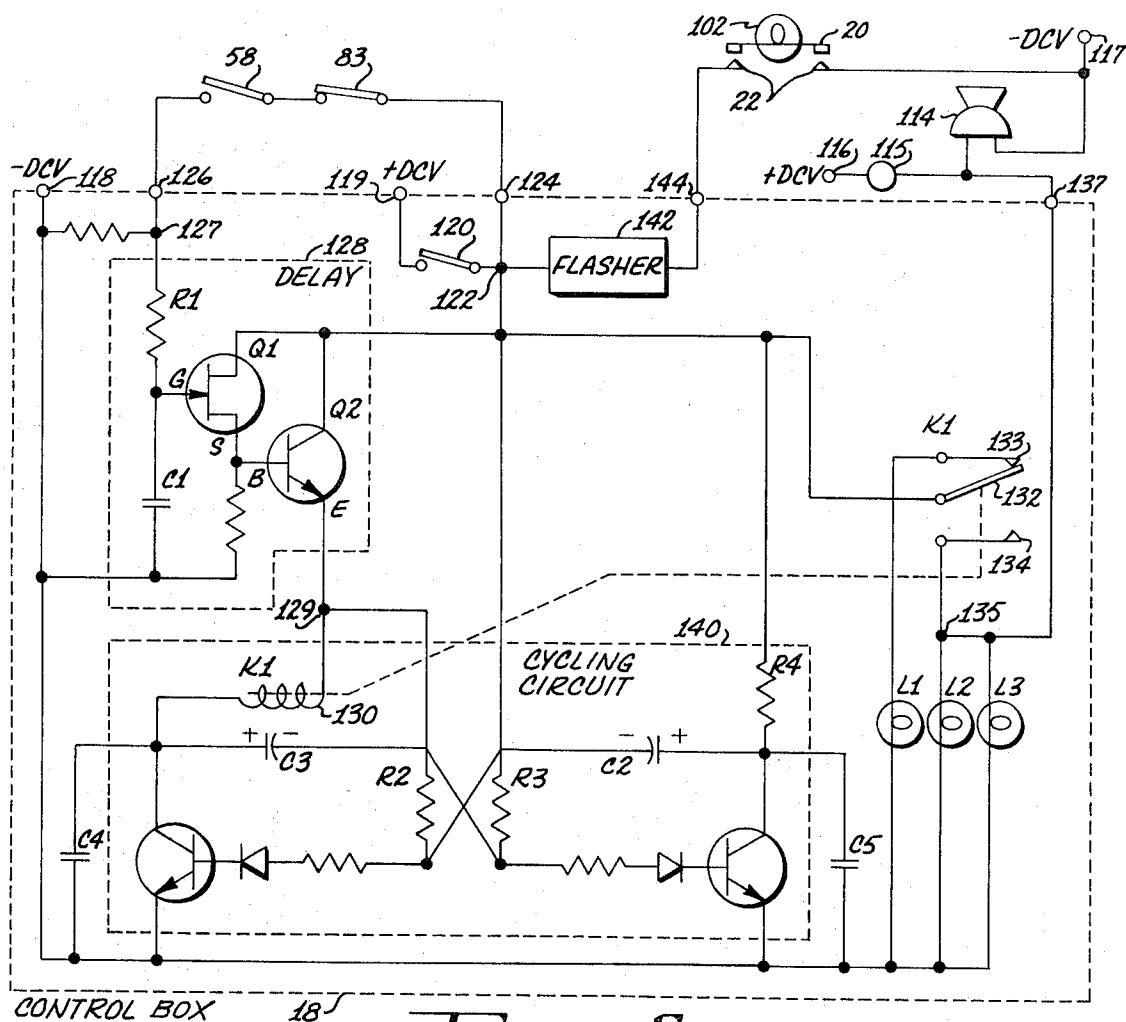


FIG. 5



SKIER ALARM SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the sport of water skiing, and more particularly to an automatic system which produces an alarm that notifies the boat operator when a skier goes down and requires raising of a warning flag before the alarm will terminate.

2. Description of the Prior Art

The sport of water skiing has become extremely popular and is carried out by the motor boat towing of a person on water skis. Generally a tow line affixed to the stern of the boat is grasped by the person on the skis so as to be towed across the surface of the water. This sport has gained widespread acceptance and it is widely recognized that various substantial dangers are involved therein. Aside from the natural physical danger of falling, the skier is subjected to further danger of injury by other boats cruising in the vicinity. While there is relatively small likelihood of collision between another boat and a skier being towed upon the surface of the water, there is a substantial danger of a "downed" skier being run over by another boat.

During the sport of water skiing it is inevitable that a majority of skiers will sooner or later be forced to release the tow line for one reason or another. While this is not normally hazardous in itself, it places the downed skier in the dangerous position of being relatively invisible to the operators of other boats in the area, particularly if these boats are being driven at the relatively high speeds needed for skiing. Due to the increasing popularity of this and other water sports, the lakes and other similar areas suitable for water skiing are becoming more congested, thus tragic accidents of the type described are becoming more numerous.

This problem has been recognized for a considerable period of time and several methods to alleviate the problem have been tried. One such attempt involved a warning device, such as a flag, being worn on the head of the skier which would be raised when the skier went down. This approach has several limitations such as; the limit upon the height to which such a flag can be raised, the skier must be in a vertical position to display the flag, and wearing of such devices are unpopular with many skiers.

As indicated by laws enacted in many states recently, the general solution to this problem appears to reside in two requirements. The first requirement is that an observer be present in the tow boat to watch the skier and warn the boat's operator when the skier has gone down. The second requirement is that a flag be raised on the tow boat immediately as a warning to other boats in the vicinity.

Enforcement of this latter requirement is difficult at best and some boat operators and observers are not raising the warning flag at all. The first thought that occurs to the occupants of the tow boat when the skier goes down is to slow the boat, turn it around and pick up the skier. Through observation it has been noted that in many instances when the flag is raised, it is done after the boat has returned to the skier, at which time most of the danger has passed.

The requirement of an observer being present in the tow boat has kept many skiers from enjoying the sport of water skiing. For example, a couple cannot ski unless

they have a third party with them, and many boats have difficulty attaining the necessary speed with the additional weight of an observer. Several attempts to devise an acceptable observer replacement system have been tried. Such prior art systems have enjoyed little or no commercial acceptance for various reasons such as complexity, expense, unreliability and the like.

One such prior art system includes a switch mounted in the handle of the tow rope which activates an alarm when the skier releases his grip. The alarm in this system includes a warning light on the dash board of the boat, a bell, or both. The tow rope is a high wear item and must be replaced at periodic intervals. Therefore, the user of such a prior art system must periodically replace a tow rope, the costs of which are necessarily higher than usual due to the switch, wiring, and means for making these items water tight. The chance for malfunction of this type of equipment is very high, as the wiring in the tow rope is easily frayed and short circuits result.

Another prior art system includes a tension switch interposed between the tow rope and the boat which completes an electric circuit to an appropriate alarm system when tension on the line decreases. This system is very erratic due to momentary slackening of the tow rope when a skier rides over the crest of a wave. When a tow rope is being dragged through the water, after the skier is down, the drag exerts a force on the rope which is often sufficient to turn off the alarm system. Thus, the operator of the boat is never sure as to exactly which of these conditions is setting off the alarm. Also, this prior art system does not include any provisions for compelling the operator to raise a warning flag.

Therefore, from the foregoing, it may be readily apparent that a need exists for an inexpensive, reliable, and improved alarm system for boats towing water skiers.

SUMMARY OF THE INVENTION

In accordance with the present invention an improved alarm system for use with a motor boat towing a water skier is disclosed.

The system comprises tension sensing means which operates a switch when the tension normally applied to the tow rope decreases indicating that the skier has released his grip on the tow rope. The switch activates an alarm which notifies the boat's operator that the skier has gone down. Also included in the system is a delay means that prevents momentary slackening of the tow rope from turning the alarm on when the skier is "up." This same delay means also prevents momentary excessive forces exerted on the tow rope when it is being dragged through the water from turning the alarm off when the skier is "down."

Once the alarm system of the present invention has been set into operation, it will continue to operate until a "skier down" warning flag is raised on the tow boat. The act of the operator's placing the warning flag into a special socket, or the automatic raising of the flag will interrupt power to the alarm system.

The electric circuit of the alarm system may include means by which the audio and/or visual alarm is operated in a flashing or intermittent mode.

Accordingly, it is an object of the present invention to provide a new and useful water skier alarm system.

Another object of the present invention is to provide a new and useful water skier alarm system which warns

the tow boat operator when a skier goes into the water.

Another object of the present invention is to provide a new and useful water skier alarm system which actuates an alarm when a skier goes into the water and requires that a warning flag be raised on the boat to terminate that alarm.

Still another object of the present invention is to provide a new and useful alarm system of the above described character which incorporates a turn-on and turn-off delay means.

The foregoing and other objects of the present invention, the various features thereof, as well as the invention itself, may be more fully understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a typical water skiing apparatus which includes the various features of the skier alarm system of the present invention.

FIG. 2 is a schematically illustrated block diagram of the alarm system of the present invention.

FIG. 3 is a sectional view of a load cell which forms part of the alarm system.

FIG. 4 is a sectional view of a special flag pole socket which illustrates the alarm interrupt portion of the present invention.

FIG. 5 is a fragmentary view of the flag pole partially broken away to illustrate the various features thereof.

FIG. 6 is an electrical diagram of the alarm system of the present invention.

FIG. 7 is another embodiment of the electrical diagram of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more particularly to the drawings, FIG. 1 illustrates a motor boat 10 of the type typically employed for water skiing. The boat 10 is provided with the usual operator's area 12 having a dash board 14 upon which the instruments necessary for operating the boat are displayed.

The water skier alarm system 16 as seen in FIGS. 1 and 2 includes a control box 18 which may be mounted on the dash board 14 or any other suitable location within the view and reach of the boat operator. The system 16 also includes a "skier down" warning flag 20 and flag socket 22 which are also preferably mounted adjacent to the operator's area 12 of the boat 10. A tension sensing means or load cell 24 is mounted to the transom 26 of the boat 10, and has a conventional tow rope 28 and handle 30 mounted thereto.

As seen best in FIG. 3 of the drawings, the load cell 24 comprises a cylindrical hollow housing 32 having a closed end 34 and an internally threaded open end 36. The outer surface of the closed end 34 is provided with mounting means 38 for connecting the cell 24 to the boat. The exact configuration of means 38 is immaterial as long as a pivot or swivel coupling is formed between the cell 24 and the transom 26.

The open end 36 of the housing 32 is closed by a threaded plug 40 which has a central opening 42 formed therein. A piston rod 44 extends through the opening 42 and carries a piston 46 on its inner end. A compression spring 48 is positioned within the housing 32 and has one of its ends in engagement with the plug 40 and its other end engages the piston 46, thus biasing

the piston toward the closed end 34 of the housing. The plug 40 is provided with a first O-ring type gasket 50 which seals the plug to the housing, and with a second similar type gasket 52 which seals the piston rod 44 and yet allows axial reciprocal movement thereof. Thus, the cell being described forms an airtight and watertight structure.

The extending end 54 of the piston rod 44 is provided with a suitable means for coupling the tow rope 28 thereto, such means may take the form of a coupler 55 (FIG. 2) which is threadably connected to the end 54 of the rod 44.

The housing 32 is provided with a boss 56 adjacent to the closed end 34 in which a suitable normally open tension switch 58 is mounted. The tension switch is positioned so that its operating plunger 60 extends into the bore 62 of the housing 32 for engagement with the piston 46. To prevent water or moisture from contacting the switch 58 and/or entering into the housing 32 through the boss 56, the entire area may be covered with a suitable electrically insulative waterproof potting compound 64.

As hereinbefore mentioned, the switch 58 is normally open so that when the piston 46 is in the at rest position as shown in FIG. 3, the switch will be held in the closed state by its plunger 60 contacting the piston 46. When a skier applies tension to the tow rope 28 the piston 46 will be moved, against the bias of the spring 48, toward the plug 40. This movement of the piston releases the plunger 60 of the switch 58 and thus allows the switch to assume its normally open state.

As will hereinafter be described in detail, two embodiments of the alarm system 16 of the present invention are disclosed herein. In the preferred one of these embodiments an electronic delay means is provided to prevent momentary changes in tow rope tension from affecting the alarm system, and in the second embodiment a mechanical delay accomplishes the same result.

The need for some form of delay may be more easily realized when it is considered that a skier will not always exert the same amount of tension on the tow rope, in fact, as often occurs, particularly in rough or choppy water, the tension will be completely released for short periods of time due to such things as the skier passing over the crest of a wave. Therefore, without a delay of some sort, the alarm will be momentarily turned on which will be very distracting. A number of such false alarms may cause the boat's operator to ignore the alarm. It may be easily recognized that such an ignore attitude on the part of the boat's operator could be costly when the safety of a downed water skier is considered.

A need for a delay means has been demonstrated for the condition of momentary slackening of the tow rope tension when a skier is "up." This type of delay may be called a "turn-on" delay as it functions to delay turning on of the alarm.

A need also exists for a "turn-off" delay to prevent excessive increases in tow rope tension from turning off a previously activated alarm. When a tow rope is released by a skier it will, of course, fall to the surface of the water and be towed along in the wake of the tow boat, and oftentimes the handle of the rope will bounce in the wake. It has been determined through experimentation that when the tow rope hits the water and is pulled through the choppy water behind the tow boat, momentary increases in tow rope tension of a magni-

tude above that which can be absorbed by the spring 48 will occur.

For a clearer understanding of the need for a turn-off delay the following example will be given. Assume that the force required to compress the spring 48 is 40 pounds, momentary increases in tow rope tension up to approximately 40 pounds will be absorbed by the spring and the tension switch 58 remain closed. However, when the increases in tow rope tension momentarily exceeds the amount which can be absorbed by the spring, the switch 58 would open and turn off the alarm were it not for the turn-off delay.

In the embodiment to be hereinafter described wherein the turn-on and turn-off delay is accomplished electronically, the load cell 24 is fabricated with its piston 46 being a loose fit within the bore 62 of the housing 32, thus, the load cell is a quick acting device.

When mechanical delay is desired the piston 46 is sealed within the bore 62 of the housing 32 such as by an O-ring 66 fitted within an annular groove 68. The piston 46 is formed with a skirt portion 70, a recess 72, and a piston head 74. The head 74 is provided with an orifice 76 formed therein which allows a predetermined fluid flow rate through the piston during reciprocal movements thereof thus providing a dash-pot type of action. It should be understood that the size of the orifice will determine the time delay, and that any fluid material may be employed such as air, oil and the like.

When the load cell 24 causes the tension switch 58 to close indicative of the skier having gone down, the alarm system 16 will be activated as will be described. The system 16 will continue to produce an audio and visual alarm until the flag 20 is raised to give warning to other boats in the vicinity.

To implement the alarm interrupt function occurring as a result of raising the warning flag, any of several devices could be employed. For example, an automatic mechanism (not shown) such as a solenoid operated linkage arrangement could be connected to a pivotably mounted flag pole, and upon completion of the pivot movement a suitable switch could be contacted to interrupt the power to the alarm.

However, for such reasons as simplicity, economy, and ease of installation, a manual system is preferred and that system will now be described in detail.

In the preferred manual alarm interrupt means, the flag socket 22 is mounted within reach of the boat's operator as previously described, and as seen in FIG. 4 includes a tubular body 78 with a suitable mounting flange 80. Intermediate the ends of the body 78 there is provided a boss 82 in which a normally closed alarm interrupt switch 83 is suitably mounted so that its operating plunger 84 protrudes into the bore 86 of the body. Therefore, when the flag 20 is inserted into the socket 22 the switch 83 will be operated thereby from its normally closed state to an open state. As seen schematically in FIG. 2, the alarm interrupt switch 83 is in series with the tension switch 58, thus the circuit which was closed by switch 58 will be opened by switch 83. This switch arrangement and the effect it has on the alarm system will be described in more detail later.

Once again referring to FIG. 4, wherein an optional feature of the present invention is illustrated, it will be noted that the lower or closed end 88 of the tubular body 78 has an aperture 90 formed therein in which an electric contact 92 in the form of an upstanding stud is mounted. The stud 92 is mounted in a gromet 94 so as

to be electrically insulated from the body 78. A ground wire 96 is suitably attached, such as by soldering, to the exterior of the body 78. When the alarm system 16 includes this optional feature the body 78 of the socket 22 is formed of electrically conductive material such as metal which would otherwise not be needed.

Included further in this optional feature is a flag 20 of special construction as shown in FIG. 5. The flag 20 includes a hollow tube 98 of metallic material having a flange 100 at its upper end upon which a light 102 is mounted such as by screws 104. The light 102 is provided with a depending terminal 106 to which a wire 108 is attached. The wire 108 extends downwardly through the tube 98 and terminates with an electric contact 110 retained in an insulative gromet 112 carried at the lower end of the tube.

It may now be easily seen that with the socket 22 provided with the electric stud 92 and the ground wire 96 and with the flag 20 constructed as described, the light 102 will be lit when the flag is inserted within the socket. The circuit which accomplishes this is from the stud 92, through the contact 110 to the terminal 106 through wire 108. The ground is provided from the light 102, through the tube 98 body 78 to the ground wire 96.

As hereinbefore mentioned, two embodiments of the present invention are disclosed. The mechanical and electromechanical components previously discussed will remain virtually the same except as noted with respect to the load cell 24. As will become easily apparent as this disclosure progresses, the differences between the two embodiments lies in the now to be described electrical circuitry.

FIG. 6 illustrates the first, and preferred embodiment, wherein the electrical components enclosed within the dash line box identified as control box 18 are physically located in that control box which is mounted adjacent to the operator's area as described. Those components located outside the box 18 of FIG. 6 include the tension switch 58 in series with the alarm interrupt switch 83, the flag pole mounted light 102, a boat horn 114, and horn button 115, the latter two elements being the boat's standard equipment.

A DC voltage is applied to the horn 114 through the button 115 via terminals 116 and 117 in the conventional manner. The same source of DC voltage, which may be the boat's battery (not shown) is connected to terminals 118 and 119 of the box 18.

The positive DC potential applied to terminal 119 is routed through an off-on switch 120 to a junction 122 from which it is directed to several locations as will be described. The first of these locations to which the positive DC potential is applied is a terminal 124 to which is coupled the series circuit previously mentioned as containing the alarm interrupt switch 83 and the tension switch 58. The DC potential is routed through these switches 58 and 83, when the previously described conditions dictate that these switches are in the closed state, and is directed back into the box 18 by means of terminal 126.

When the DC potential is applied to terminal 126 it is directed to an input terminal 127 of a delay circuit 128. The delay circuit 128 operates to provide the turn-on and turn-off delay previously described.

The delay circuit 128 includes an RC timing network formed of resistor R1 and capacitor C1, the electric values of which determine the amount of time of both

the turn-on and turn-off delay. It has been determined through experimentation that a delay of approximately 1½ seconds is ideal and the values of R1 and C1 which produce this amount of delay are 1.5 megohm and 1 micro-farad, respectively.

The DC potential is routed through the RC network of delay circuit 128 and is applied to the gate (G) of a field effect transistor Q1 the source (S) of which is coupled to the base (B) of a current gain transistor Q2. The emitter (E) of transistor Q2 is coupled through an output terminal 129 which in turn is connected to the coil 130 of relay K1. The relay K1 is actuated when the voltage applied thereto reaches approximately 8 volts, and will be de-energized when the voltage drops below this value.

When no DC potential is applied to the RC network of circuit 128, the S terminal of Q1 will be in the range of 2 volts which places the E terminal of Q2 in the range of 1.3 volts. Since 1.3 volts is insufficient to energize the relay K1 its center contact 132, which receives positive DC from junction 122, will be in engagement with contact 133 thereof, thus directing power through L1 which is the power-on light and may, for example, be green in color.

When DC voltage is applied to the RC network circuit 128 voltage on E of Q2 will rise to the 8 volt value in approximately 1½ seconds, the time constant of the RC network, and relay K1 will thus be actuated. It should be noted that as more time elapses the voltage on E of Q2 will raise to the full applied DC voltage which will normally be 12 VDC supplied by the boat's battery. The turn-off delay results from this 12 VDC value being present on E of Q2, i.e., it will take approximately 1½ seconds for the 12 VDC to decay to the voltage value which de-energizes K1.

With the relay K1 energized its center contact 132 will have moved into engagement with a contact 134 thus applying the DC potential to a junction 135. The junction 135 directs power to a pair of alarm lights L2 and L3 which may, for example, be red in color. Also, the DC potential at junction 135 is coupled through a terminal 137 to the horn 114 thus causing it to blow.

An additional feature which may be included in this preferred form of the control circuit is identified in the schematic of FIG. 6 as the cycling circuit 140. The cycling circuit 140 is a free running multivibrator the operation of which is well known in the art. The cycling circuit 140 is employed to alternately energize and de-energize the relay K1 which will cause flashing of the lights L1, L2, and L3 and will cause the horn 114 to blow in interrupted blasts. The flashing of the lights L1, L2, and L3 will be so that when L1 (green) is on, L2 and L3 (red) will be off, and then when L1 is off, L2 and L3 are on.

The values of R2 and C2 of the cycling circuit 140 determine the length of time that relay K1 will be de-energized, and the values of R3 and C3 determine the length of time that K1 will be energized. It will be noted that two capacitors C4 and C5 are connected to the cycling circuit 140 and that these capacitors are not normally employed with this type of circuit. Capacitors C4 and C5 are employed to filter electric noise which results from the horn 114 and other of the boat's electric appliances.

Also, it should be noted that the cycling circuit 140 include a collector resistor R4 and would normally also

include a similar resistor which for this application, has been replaced by the coil 130 of K1.

Returning now to the junction 122, it will be seen that DC potential is routed therefrom to a flasher unit 142 such as that commonly employed in the automotive field to flash such devices as turn signals and emergency lights. The output from the flasher 142 is coupled to a terminal 144 of the control box 18 and to the socket 22, and thus the light 102 mounted atop the flag 20 will flash.

Reference is now made to FIG. 7 wherein is shown the wiring diagram of the second embodiment, i.e., the one that incorporates the mechanical delay of load cell 24. The alarm circuitry 148 of this embodiment is formed of an on-off switch 150, the loadcell operated tension switch 58 and the alarm interrupt switch 83, which are connected in series with respect to each other. This alarm circuitry 148 is connected in parallel with the usual horn button 115 which is in the positive DC line 152, to the horn 114. Thus, the horn 114 may be blown in the usual manner by the button 115, or may be caused to blow by the previously described conditions which cause the alarm circuitry 148 to be closed.

It should be readily apparent that the embodiment illustrated in FIG. 7 is in its simplest form and could easily be modified to include some of the features that were included in the circuit of FIG. 6. For example, the flasher 142 and light 102 could be added, and the horn 114 could be operated off of this same flasher 142 so as to blow intermittently.

While the principles of the invention have now been made clear in an illustrated embodiment, there will be immediately obvious to those skilled in the art, many modifications of structure, arrangements, proportions, the elements, materials, and components used in the practice of the invention, and otherwise, which are particularly adapted for specific environments and operation requirements without departing from those principles.

For example, it would be obvious to one skilled in the art that a plurality of skiers could be towed behind a single tow boat and each skier could have a load cell coupled to his individual tow rope. It would be a simple matter to connect the tension switches of the plurality of load cells to the control circuitry so that the alarm would be triggered by any one of the skiers going down.

The appended claims are therefore intended to cover and embrace any such modifications within the limits only of the true spirit and scope of the invention.

What I claim is:

1. A system for producing an alarm which notifies the operator of a tow boat when a water skier being towed thereby has released his grip on the tow rope and continues to produce that alarm until a flag is raised on the tow boat, said system comprising:

- a. tension means mountable between the tow boat and the tow rope for sensing the tension applied to the tow rope by the water skier and for sensing when that tension is released;
- b. a tension switch connected to a power source and operated by said tension means for movement from a normally open state when the tension is on the tow rope to a closed state when that tension is released;
- c. a control circuit coupled to receive the power from said tension switch when that switch is closed;

- d. alarm means connected to said control circuit for producing an alarm when power is applied thereto by said control circuit; and
- e. alarm interrupt means including a raisable warning flag assembly mountable on the tow boat for terminating the alarm produced by said alarm means upon raising of the flag.
- 2. A system as claimed in claim 1 wherein said alarm interrupt means comprises:
 - a. a flag socket mountable on the tow boat and having an alarm interrupt switch which is closed when said flag socket is empty, said interrupt switch connected in series between said tension switch and said control circuit; and
 - b. a flag pole insertable within said flag socket for opening said interrupt switch.
- 3. A system as claimed in claim 1 wherein said control circuit includes means for delaying the turn-on and the turn-off of said alarm means for a predetermined length of time.
- 4. A system as claimed in claim 1 wherein said control circuit comprises:
 - a. a delay circuit having an input terminal and an output terminal, the input terminal coupled to receive the power from said tension switch; and
 - b. a relay coupled to the output terminal of said delay circuit.
- 5. A system as claimed in claim 1 wherein said control circuit comprises:
 - a. a delay circuit having an input terminal and an output terminal, the input terminal coupled to receive the power from said tension switch;
 - b. a relay coupled to the output terminal of said delay circuit; and
 - c. a cycling circuit coupled to said relay for alternately energizing and de-energizing said relay at a predetermined rate.
- 6. A system as claimed in claim 5 wherein said cycling circuit includes a free running multivibrator.
- 7. A system as claimed in claim 2 wherein said flag socket further includes an electric contact mounted in the bottom thereof within an electrically insulative gromet.
- 8. A system as claimed in claim 7 wherein said electric contact is coupled through a flasher to a power source.
- 9. A system as claimed in claim 2 wherein said flag

pole is provided with a light mounted on the top thereof which has a power lead depending therefrom through said flag pole and terminating in an electric contact in the bottom of said flag pole.

10. A system for activating an alarm which notifies the operator of a tow boat when a water skier being towed thereby releases his grip on the tow rope and holds that alarm activated until a warning flag is raised on the tow boat, said system comprising:

- a. tension means mountable between the tow boat and the tow rope for sensing tension applied to the tow rope by the water skier and for sensing when that tension is released;
- b. a tension switch connected to a power source and operated by said tension means for movement from a normally open state when tension is on the rope to a closed state when that tension is released;
- c. alarm means coupled to said tension switch for producing an alarm when said tension switch is closed;
- d. a flag socket mountable on the tow boat and having an alarm interrupt switch which is closed when said flag socket is empty, said interrupt switch connected in series between said tension switch and said alarm means; and
- e. a flag pole insertable within said flag socket for opening said interrupt switch.

11. A system as claimed in claim 10 wherein said tension means comprises:

- a. a hollow cylindrical housing closed on one end thereof and open on the other end;
- b. a plug having an axially positioned aperture formed therethrough, said plug sealingly mounted in the open end of said housing;
- c. a piston slidably reciprocal within said housing and in sealing engagement with the bore thereof, said piston having an orifice formed therethrough;
- d. a piston rod extending axially from said piston and sealingly slidably extending through the aperture of said plug;
- e. a compression spring within said housing for biasing said piston toward the closed end of said housing; and
- f. means on said housing for mounting said tension switch thereon in a position so that a plunger of said switch extends into the bore of said housing.

* * * * *

50

55

60

65