Jan. 30, 1951 W. R. SMYTHE 2,539,643

APPARATUS FOR DECELERATING TORPEDOES

Filed May 8, 1946 4 Sheets-Sheet 1

FIG. 1

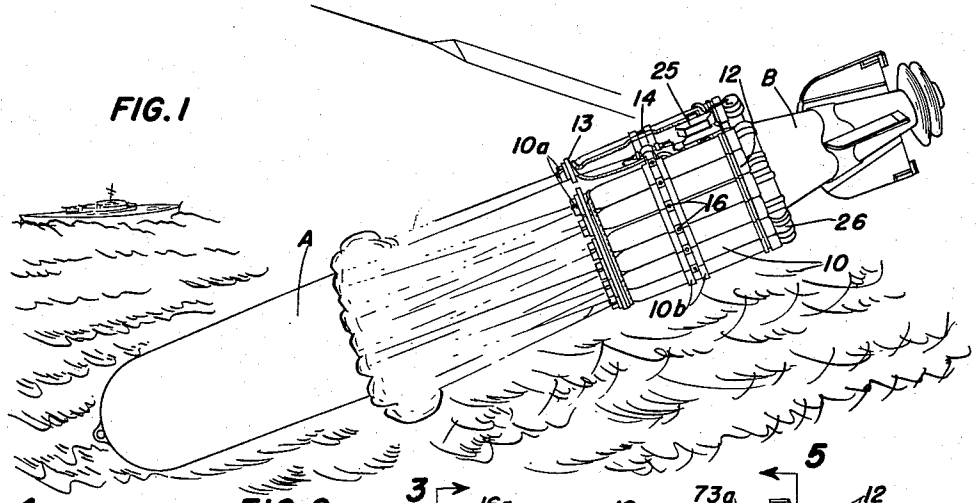
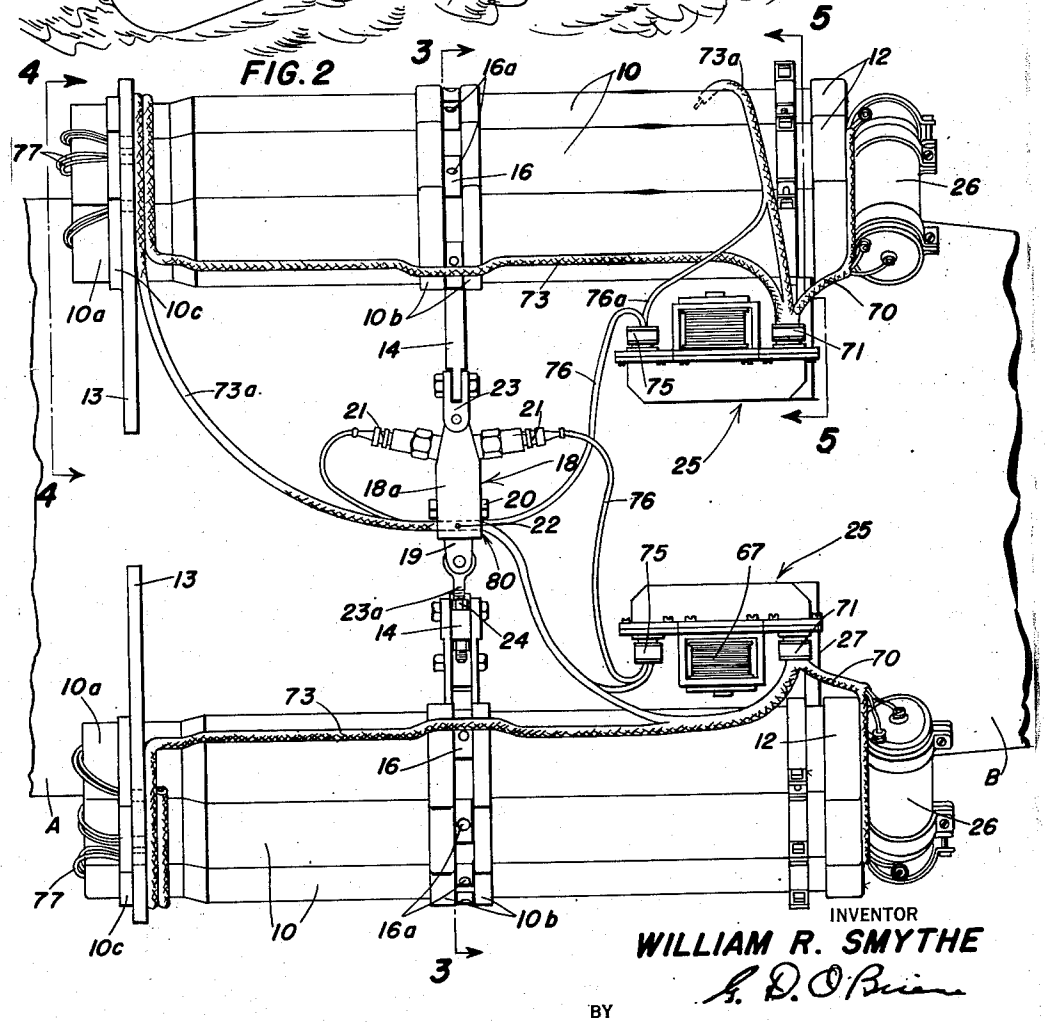


FIG. 2



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APPARATUS FOR DECELERATING TORPEDOES

Filed May 8, 1946 4 Sheets-Sheet 2

FIG. 3

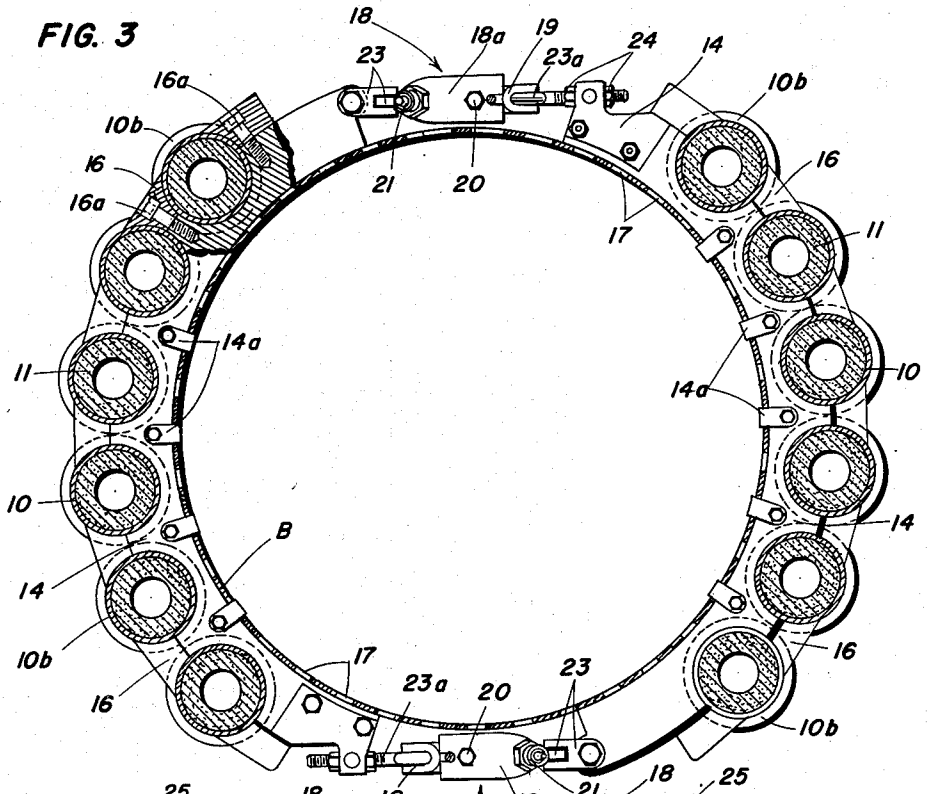

FIG. 4

FIG. 5

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APPARATUS FOR DECELERATING TORPEDOES

Filed May 8, 1946 4 Sheets-Sheet 3

FIG. 6

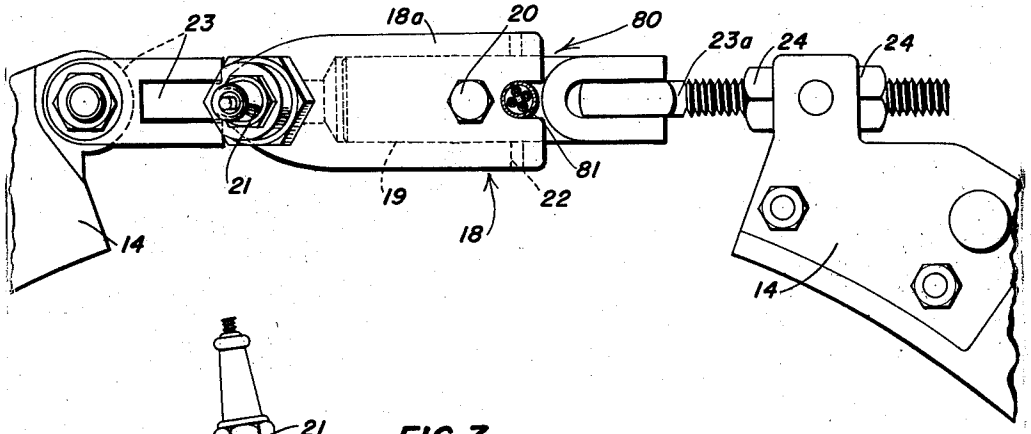


FIG. 7

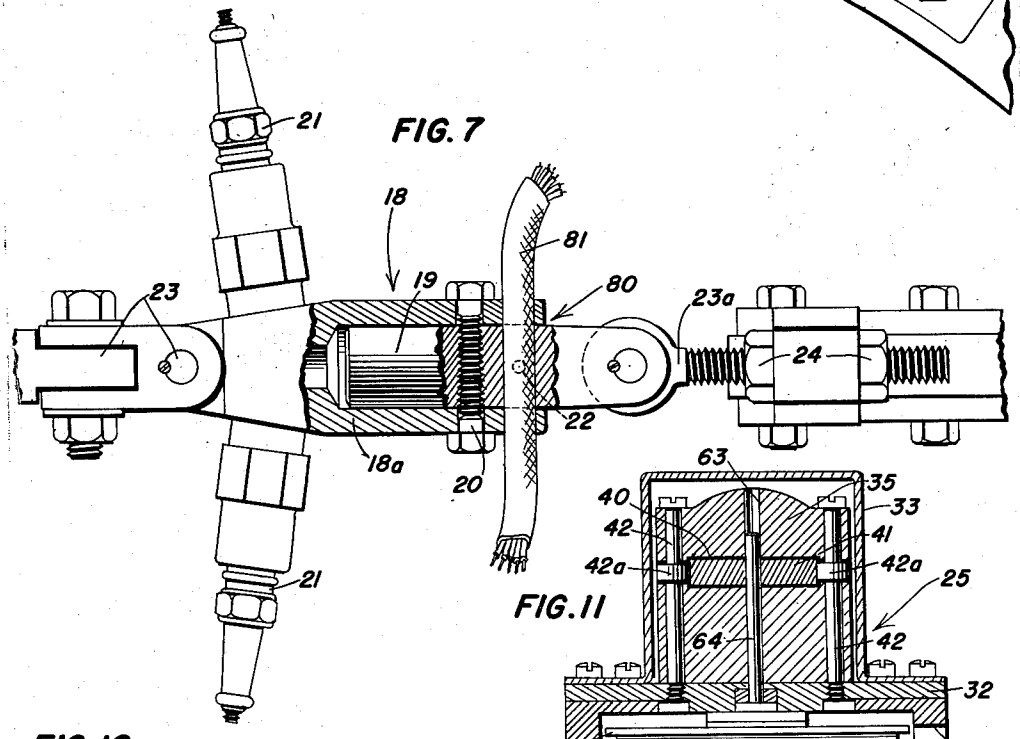
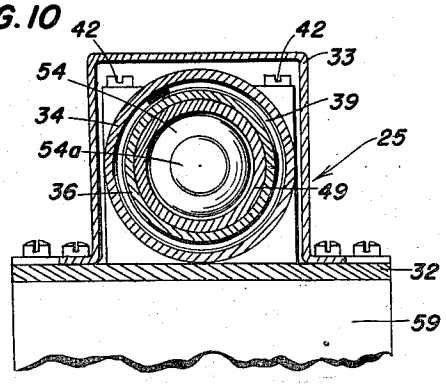


FIG. 11

FIG. 10



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APPARATUS FOR DECELERATING TORPEDOES

Filed May 8, 1946 4 Sheets-Sheet 4

FIG. 8

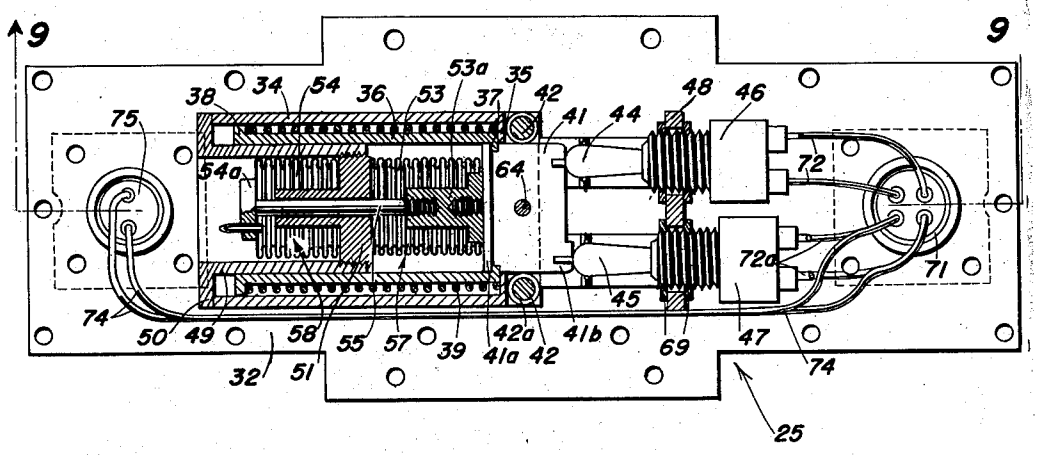
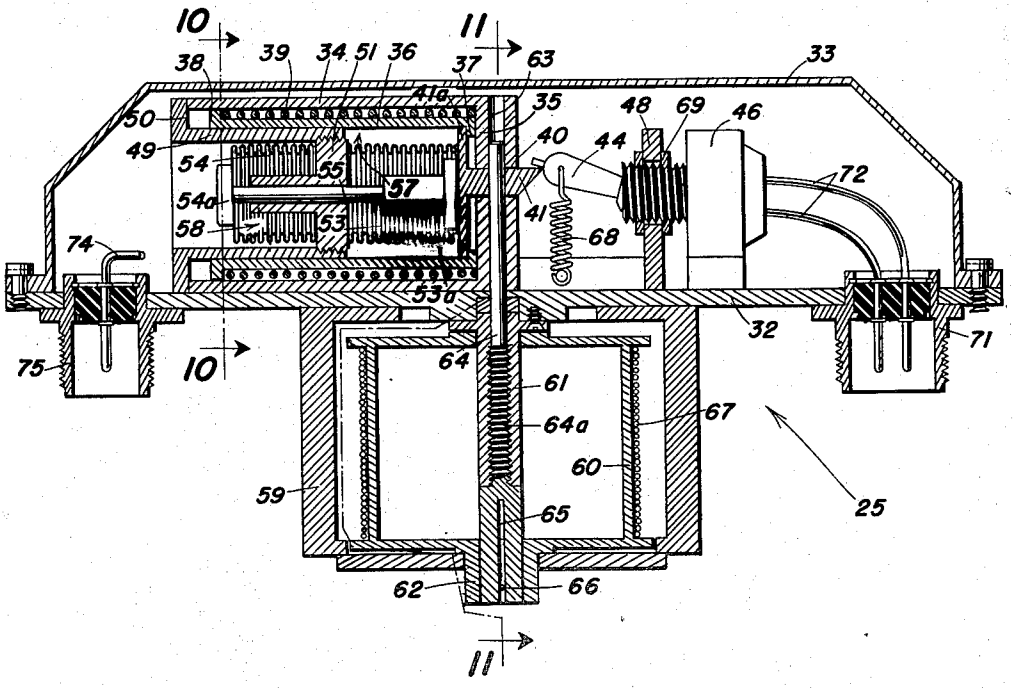


FIG. 9



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Patented Jan. 30, 1951 2,539,643

UNITED STATES PATENT OFFICE

2,539,643

APPARATUS FOR DECELERATING TORPEDOES

William R. Smythe, Sierra Madre, Calif., assignor to the United States of America as represented by the Secretary of the Navy

Application May 8, 1946, Serial No. 668,027

6 Claims. (Cl. 114—20)

1

This invention relates to apparatus for decelerating torpedoes, that is, to apparatus for reducing the forward velocity of a torpedo so that it may enter the water without damage when launched at high altitude or from a fast moving airplane.

One object of the present invention is to provide an apparatus for decelerating torpedoes, which employs rocket motors mounted around the torpedo body with their discharge jets directed forwardly parallel to the axis of the torpedo.

Another object of the invention resides in the provision of an apparatus of this character which is automatically thrown clear of the torpedo after effecting the desired deceleration and before the torpedo strikes the water.

Another object is to provide an apparatus of this character which may be readily installed on conventional torpedoes and in no manner interferes with the normal operation thereof.

A further object of the invention is to provide a torpedo deceleration apparatus in which the decelerating force is produced by rocket motors, and which includes a timer for initiating operation of the rocket motors after the torpedo is dropped and then initiating operation of mechanism for throwing the deceleration apparatus clear of the torpedo before the latter strikes the water.

An additional object is to provide a timer of the character described which is so arranged that the timing period between ignition of the rocket motors and operation of the mechanism for throwing the deceleration apparatus clear of the torpedo varies with change in temperature at virtually the same rate that the burning periods of the rocket motors vary; that is, to provide a timer which automatically shortens or lengthens its time interval in accordance with the changes in burning time of the rocket motors insofar as such changes are due to changes in temperature.

These and other objects of the invention may be better understood by reference to the accompanying drawings, in which:

Fig. 1 is a side view of a torpedo having one form of the new deceleration apparatus, showing the torpedo in flight during operation of the apparatus;

Fig. 2 is an enlarged side view of part of the torpedo, showing the deceleration apparatus thereon;

Figs. 3, 4 and 5 are sectional views on the lines 3—3, 4—4 and 5—5, respectively, in Fig. 2;

Figs. 6 and 7 are detail side and top views, respectively, of the discarding mechanism which initially joins the two deceleration units;

2

Fig. 8 is a side view, partly in section, of one of the timers for controlling operation of the rocket motors and the discarding mechanism, with the timer cover removed;

Fig. 9 is a sectional view on the line 9—9 in Fig. 8, but with the cover in place, and

Figs. 10 and 11 are sectional views on lines 10—10 and 11—11, respectively, in Fig. 9.

The deceleration apparatus, as illustrated, comprises a pair of deceleration units encircling a torpedo A near its rear end. Each deceleration unit employs a plurality of rocket motors 10 having propellant grains 11, each motor being disposed with its axis parallel to the torpedo axis and having its nozzle or discharge end 10a directed toward the front end of the torpedo. The rocket motors 10 may be conventional and may be internally similar to the rocket motor disclosed in a copending application of C. C. Lauritsen, Ser. No. 481,645, filed Apr. 2, 1943, for Rocket Device now Patent No. 2,469,350. The bomb case illustrated in said copending application is, of course, omitted and caps 12 substituted. The caps 12 are threaded or otherwise secured to the motor tubes 10 at their front ends, which are directed toward the rear end of the torpedo.

The tube of each rocket motor 10 is modified to fit closely in a nozzle end yoke 13, an intermediate yoke 14 and a spacer cleat 15. One nozzle end yoke 13 is provided for each deceleration unit, each yoke being in the form of an arcuate plate having holes which receive the nozzle ends 10a of the rocket motors comprising the unit. There is also one intermediate yoke 14 for each set of rocket motors, each intermediate yoke being in the form of an arcuate plate having semicircular, peripheral recesses which receive the rocket motors. Retaining wedges 16 are inserted between adjacent rocket motors 10 and secured to the outer edge of the intermediate yoke 14, as by means of screws 16a. As shown, each motor tube 10 has spaced shoulders 10b between which the intermediate yoke 14 and adjacent wedges 16 are received. Also, the nozzle end portion 10a of each motor tube has a shoulder 10c engaging the outer face of the yoke 13.

The after body B of the torpedo, at the point opposite the rear or capped ends 12 of the rocket motors, is not truly cylindrical in cross section. Consequently, the spacer cleats 15 are made adjustable radially, as shown in Fig. 5. The yokes 13 and 14 and the spacer cleats 15 are arranged

so that they hold the longitudinal axes of the rocket motors 10 parallel to the longitudinal axis of the torpedo. The intermediate yokes 14 transmit the thrust of the rocket motors to the torpedo from the shoulders 10b, suitable means being provided to secure the yokes 14 and the torpedo against relative longitudinal movement. For example, the intermediate yokes may have projections 14a (Fig. 3) which fit into the usual bolt recesses 17 provided in the after body B to receive the bolts for connecting the after body B to the main body A of the torpedo; or these connecting bolts (not shown) may hold suitable lugs engaging the yokes 14.

As shown, each deceleration unit employs six rocket motors 10, although any other desired number of motors may be used. The two units are joined by two identical discarding mechanism 18 shown assembled in Figs. 2, 6 and 7. Each discarding mechanism 18 comprises a socket member 18a and a mating piston member 19 which are initially held together by shear bolts 20. The socket member is adapted to contain a small charge of powder adapted to be ignited by electric squibs (not shown). Dual ignition plugs 21 extend laterally from the base end of each socket member 18a and are electrically connected to the squibs. Vent holes 22 (Fig. 6) are provided near the extremity of the socket member 18a so that the explosive pressures are substantially relieved before the piston member 19 is fully ejected from the socket member by explosion of the powder charge therein.

Each discarding mechanism 18 is joined by flexible links 23, 23a to the adjacent end portions of the intermediate yoke 14 of the two deceleration units. One of these links may include an adjustable and separable connection 24 so that the two deceleration units may be readily secured to or removed from the torpedo.

The deceleration units are each provided with a timer 25 which controls current supplied by batteries 26 supported across the capped ends 12 of the rocket motors. Each timer 25 is mounted on a suitable bracket 27 secured to one of the spacer cleats 15 of the corresponding deceleration unit. The timers 25 are identical in construction, so that a description of one of them will suffice.

The timer is contained in a housing comprising a flat base plate 32 and a cover 33 shaped to accommodate the timing mechanism therein. Within the housing and extending with its axis parallel to the base plate 32 is a cylindrical shell 34 having a partition 35 at one end and open at its other end. Within the shell is a latch carrier 36 in the form of a tube spaced from the shell 34. The latch carrier is provided with an internal flange 37 at its inner end which confronts the partition 35, and an external flange 38 at its other or outer end. A coil compression spring 39 surrounds the latch carrier 36 between the flange 38 and the partition 35 so as to urge the internal flange 37 away from the partition 35.

The partition 35 is provided with a slot 40 which extends across the partition 35 parallel to the base plate 32. The slot 40 receives a latch plate 41 which is provided with a disk member 41a fitting within the latch carrier 36 and bearing against the internal flange 37. The shell 34 may be secured to the base plate 32 by bolts 42 which pass through the side margins of the slot 40 and which may be provided with guide rollers 42a adapted to engage the sides of the latch plate 41 and facilitate friction-free movement thereof.

The latch plate 41 is adapted to restrain the toggle arms 44 and 45 of toggle switches 46 and 47, as will be described in more detail hereinafter. The toggle switches are supported by a bracket 48 spaced from the partition 35 and parallel thereto.

A tube 49 fits into the outer end of the latch carrier 36 and is secured by an external flange 50 to the corresponding end of the shell 34. The inner end of the tube 49 is located approximately midway between the extremities of the latch carrier 36 and is provided with a plug 51 threaded therein.

Bellows 53 and 54 of the "sylphon" type are secured to the faces of plug 51 and extend in opposite directions therefrom. The forward bellows 53 is secured to an end fitting 53a which in turn is secured to the disk 41a which supports the latch plate 41.

A stem 55 is secured to the end fitting 53a and extends through the plug 51 to another end fitting 54a secured to the extremity of the rear bellows 54. The bellows 53 and 54, together with their end fittings 53a and 54a and the plug 51, define respectively a forward chamber 57 and a rearward chamber 58. The chambers are filled with a damping liquid and the clearance between the stem 55 and plug 51 is such that the flow of the liquid between the two chambers 57 and 58 is restricted so that the latch 41 moves slowly under urge of the spring 39.

Toluene serves admirably as a damping liquid for use with the deceleration apparatus, for the reason that its viscosity decreases with temperature at nearly the same rate as the burning time of the rocket motors 10.

A reel cage 59 is secured to the bottom of base plate 32 and supports a reel drum 60. A hollow journal 61 is secured to the base plate 32 for supporting the inboard side of the reel drum 60, while the outboard side of the drum 60 has a boss 62 which is journaled in the cage 59.

The journal stem 61 is internally threaded and registers axially with a hole 63 extending through the partition 35. A latch pin 64 is slidable in the hole 63 and normally extends through a mating hole in the latch plate 41. The intermediate portion of the latch pin 64 is threaded, as shown at 64a, to mate with the threads in the journal stem 61, so that the latch pin is moved axially when it is rotated. The outer end portion of the latch pin 64 is slotted, as indicated at 65, and extends through a central opening in the boss 62. A cross pin 66 fits into the slots 65 and extends through the reel boss 62 so as to rotate the latch pin when the reel drum 60 is rotated.

A lanyard 67 is removably attached at one end to the reel drum 60 and is adapted to be wrapped about the drum several times so that when the free end of the lanyard is pulled, the drum is rotated sufficiently to withdraw the latch pin 64 from the latch 41, whereby the latch is moved clear of the toggle arms 44 and 45 by means of the spring 39 as restrained by the fluid in the chambers 57 and 58. The free end of lanyard 67 extends through a slot 59a (Fig. 11) in cage 59 and is suitably connected to the airplane, so that when the torpedo is released the lanyard is unwound from reel 60, thereby rotating the reel and withdrawing latch pin 64.

Springs 68 are attached to the toggle arms 44 and 45 and anchored to the base plate 32 so as to snap the switches from one position to another as soon as the latch plate 41 clears the toggle arms. The toggle switches 46 and 47 are

preferably mounted in the bracket 48 by means of adjustable connections 69, and the edge of the latch plate 41 may be stepped at 41a so that one toggle arm is released before the other. The interval between release of the toggle arms is, of course, dependent upon the viscosity of the damping fluid.

Two timers 25 are preferably used so that either one is capable of igniting the rocket motors 10, of both deceleration units and operating the two discarding mechanisms 18. Thus, timed operation of the rocket motors and discarding mechanisms is assured even under adverse operating conditions. This dual timer ignition system requires electrical conductors passing between the two deceleration units from each timer, as shown in Fig. 2. As there shown, the batteries 26 on each deceleration unit are connected by wiring 70, a plug and socket connection 71 on the adjacent timer, and wiring 72 and 72a to the normally closed switches 46 and 47, respectively. Extending from each plug and socket connector 71 are parallel connections 73 and 73a, the connection 73 leading to the usual electrical igniters of the parallel connected rockets 10 of the corresponding deceleration unit, and the other connection 73a leading to the igniters of the rockets of the other deceleration unit. The switch 47 in each timer 25 is connected by wiring 74, in parallel with wiring 72a, to a plug and socket connector 75 on the timer. Branch connections 76 and 76a extend from each connector 75, the connection 76 leading to one of the ignition plugs 21 on the corresponding side of the torpedo, and the other connection 76a leading to one of the ignition plugs 21 on the opposite side of the torpedo. The wiring 73, 73a is connected to the rocket igniters through conductors 77 extending through the nozzle ends 10a of the rocket motors.

From the foregoing, it will be seen that the toggle switch 46 of each timer is adapted to complete the circuits from the batteries 26 to all of the rocket motors 10, and the other switch 47 is adapted to complete the circuits to the electric igniter plugs 21 of the connecting means 18. The toggle switches are preferably arranged so that they short the electrical igniters in the rocket motors and the igniter plugs 21, when the toggle switches are in their initial positions shown in Figs. 8 and 9, to minimize the possibility of accidental ignition.

The lanyards 67, which are connected to the airplane, must unwind from their respective drums 60 upon release of the torpedo, before the rocket motor switches 46 are released. Thus, the rocket motors are not ignited until the torpedo is a safe distance from the airplane.

The propellant 11 contained in the rocket motors has a burning speed which varies with temperature. It is desirable that the rocket motors complete their burning period before the deceleration units are thrown clear of the torpedo. In order to insure this, the damping fluid chosen for filling the bellows 53, 54, namely toluene, varies in viscosity at nearly the same rate as the variation in burning speed. The interval between operations of the two toggle switches 46, 47 should exceed the burning period of the rocket motors by approximately 25 per cent. The burning period of one type of rocket motor varies from 0.2 second to 0.8 second; consequently the timer used in conjunction with this motor should vary from about 0.3 to 1.0 second within the same temperature range as that considered for the burning time of the rocket motor.

In order to facilitate complete separation of the conductors which join the two deceleration units, one of the discarding mechanisms 18 may be provided with a conduit shearing means 80, as shown in Figs. 2, 6 and 7. This comprises mating holes in one of the socket members 18a and its piston 19, through which extends a conduit 81, preferably of plastic material, carrying the necessary conductors.

Operation of the deceleration apparatus is as follows. The two deceleration units are secured around the torpedo A by the two sets of connections 18, 23 and 24, the connection between the after body and the forward body of the torpedo cooperating with the projections 14a on yokes 14 to secure the units against longitudinal movement on the torpedo. The nozzle ends 10a of the rocket motors are directed toward the forward end of the torpedo so that the thrust of the rocket motors is directed rearwardly in opposition of the forward travel of the torpedo. The wiring is then connected as described.

When the torpedo is launched, the lanyards 67 rotate the drums 60, so that the latch pins 64 are withdrawn from latch plates 41 after the torpedo has cleared the airplane a safe distance. The springs 39 then move the latch plates 41 outwardly against the restraining force of the liquid in bellows or dashpot 53, 54, whereby the switches 46 and 47 are operated in timed sequence. When the first switch 46 is operated, rocket motors 10 are ignited and their resulting action creates a substantial backward thrust to slow the forward velocity of the torpedo. Experimentation indicates that twelve rocket motors, of the type disclosed in said copending application Ser. No. 481,645, give a total thrust of fifteen tons lasting approximately a half a second, which is sufficient to reduce the speed of a one ton torpedo by 120 knots.

After the interval required for the operation of the rocket motors 10, approximately three-fourths to one second, the second switch 47 is operated to close the circuits to the squibs (not shown) connected with the ignition plugs 21, causing the powder charges within the discarding mechanisms 18 to separate the piston members 19 from their socket members 18a with sufficient force to throw the two deceleration units clear of the torpedo. In the operation of the discarding mechanisms 18, the shearing device 80 shears the cable 81 by action of the piston 19, thereby facilitating separation of the deceleration units from the torpedo.

I claim:

1. In combination with an aircraft-launched, water-borne torpedo, a torpedo decelerating apparatus comprising a pair of arcuately shaped supporting yokes, explosively actuated means initially connecting said yokes together at their extremities to form a band encompassing the torpedo body and adapted when actuated to separate said yokes, rocket motors carried by said yokes, and a timing device for igniting said rocket motors and thereafter actuating said connecting means, whereby said rocket motors and their yokes are thrown clear of said torpedo.

2. A torpedo decelerating apparatus comprising a pair of rocket supporting yokes adapted to be mounted on a torpedo, a pair of separable links connecting said yokes at their extremities to form a band around the torpedo, at least one of said links comprising a piston and a socket member defining a chamber for receiving an explosive which when ignited drives said piston and socket

member apart, and rocket motors carried by said yokes.

3. In combination with an aircraft-launched, water-borne torpedo, a torpedo decelerating apparatus comprising a pair of decelerating units each including an arcuate supporting device conforming to the torpedo body and a plurality of rocket motors carried by said device, separable connecting means joining said supporting devices to form a band around the torpedo body and hold said rocket motors with their discharge ends directed forwardly and generally parallel to the torpedo axis, each of said separable connecting means including piston and socket elements defining a chamber for an explosive charge adapted when ignited to thrust said elements apart, thereby to throw said supporting devices and their rocket motors clear of said torpedo body, and a shear device initially restraining said piston and socket elements.

4. In combination with an aircraft-launched, water-borne torpedo, a torpedo decelerating apparatus comprising a pair of decelerating units each including an arcuate supporting device conforming to the torpedo body and a plurality of rocket motors carried by said device, separable connecting means joining said supporting devices to form a band around the torpedo body and hold said rocket motors with their discharge ends directed forwardly and generally parallel to the axis of said torpedo, each of said separable connecting means including piston and socket elements defining a chamber for an explosive charge adapted when ignited to thrust said elements apart, thereby to throw said supporting devices and their rocket motors clear of said torpedo body, a shear device initially restraining said piston and socket elements, and a timing device for initiating operation of said rockets to effect deceleration of said torpedo body and thereafter operating said connecting means to effect separation of said supporting devices and their rocket motors from the torpedo body.

5. In a torpedo deceleration apparatus having a plurality of electrically fired rocket motors, a discarding mechanism for throwing the deceleration apparatus clear of the torpedo and adapted to be started electrically, and a source of electrical energy, a timer mechanism comprising a pair of switches for controlling the supply of energy from said source to said rocket motors and said discarding mechanism, respectively, latch means restraining said switches and movable to release said switches in sequence, a spring urging said latch means free of said switches, a dashpot for controlling the rate of movement of said latch under urge of said spring thereby to control the interval between release of said switches, a pin initially restraining said latch, a drum, means connecting said drum with said pin to withdraw said pin from said latch upon rotation of said drum, and a lanyard for rotating said drum.

6. A timer mechanism comprising a hollow cylinder closed at one end, a latch carrier mounted in the cylinder, a compression spring coiled around the carrier within the cylinder for urging the carrier toward the open end of the cylinder, a dashpot for restraining movement of the carrier by the spring, a latch on the carrier extending through the closed end of the cylinder, a pair of switches, biasing means for operating the switches, the latch normally holding the switches against operation by the biasing means and being movable by the spring to release the switches in sequence, a latch pin movable in the cylinder and normally locking the latch against movement, a drum connected to the pin and rotatable to withdraw the pin from the latch and thereby release the latch, and a lanyard wound around the drum for rotating the same.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,611,353	Lepinte	Dec. 21, 1926
2,269,900	Bickel	Jan. 13, 1942
2,329,736	Wise	Sept. 21, 1943
2,343,347	Turner	Mar. 7, 1944
2,356,301	Brase	Aug. 22, 1944
2,426,537	Van Dorn	Aug. 26, 1947