May 17, 1955 C. A. BORCHER 2,708,409

DELAYED FIRING DEVICE FOR A DEMOLITION CORD

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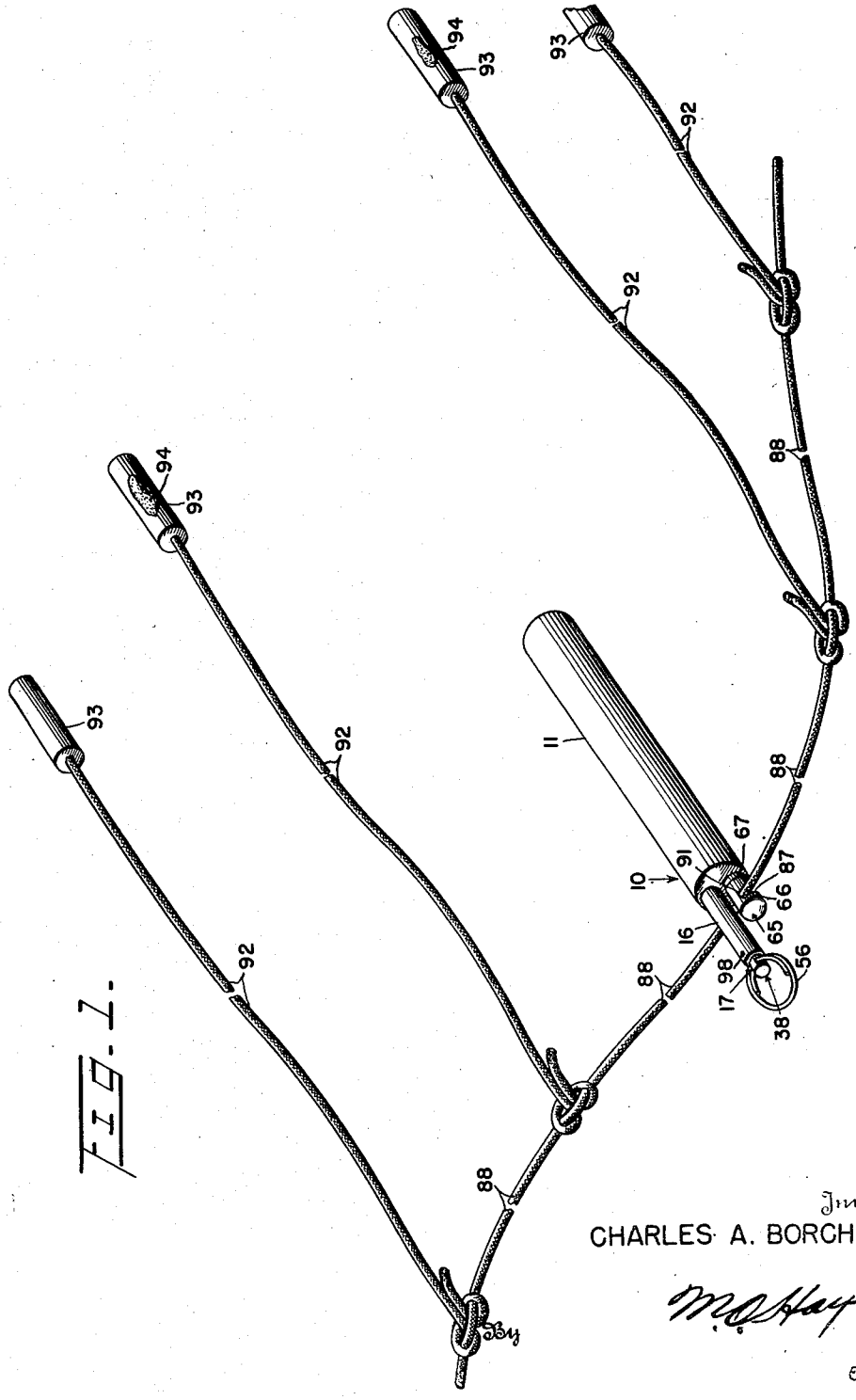


FIG. 1.

Inventor
CHARLES A. BORCHER

Attorney

May 17, 1955 C. A. BORCHER 2,708,409

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FIG. 2.

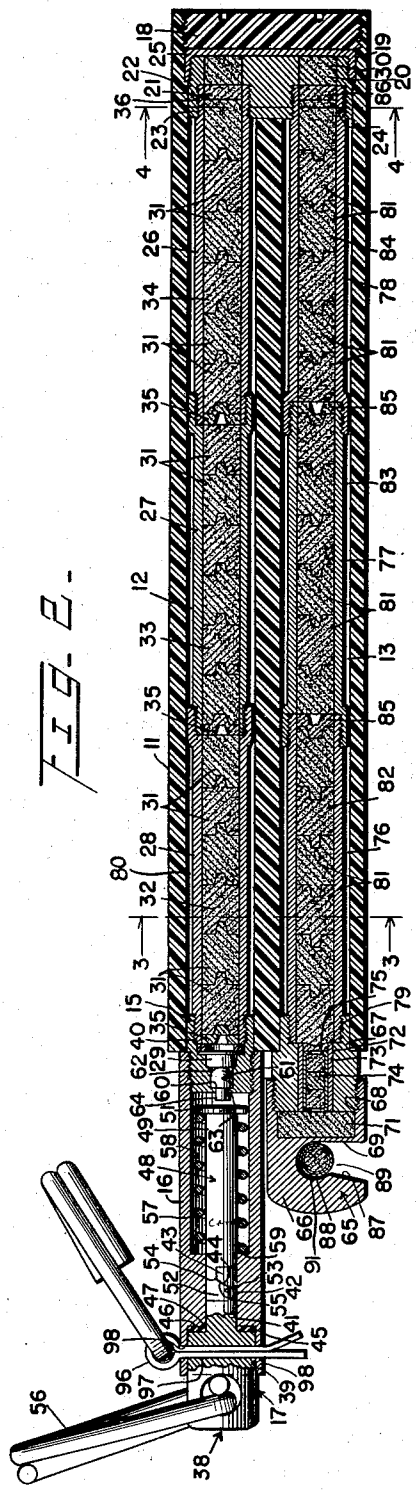


FIG. 4.

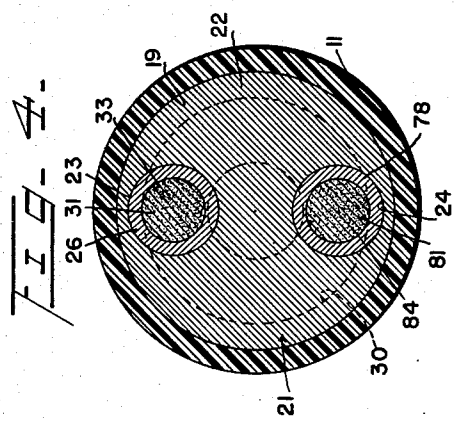
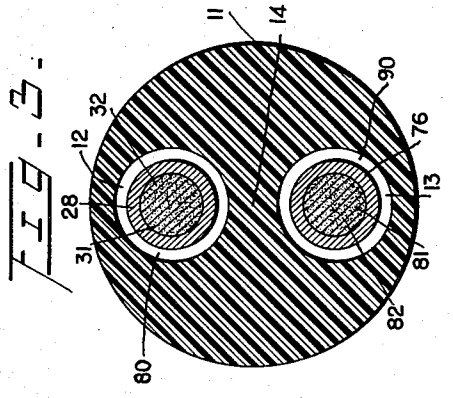


FIG. 3.



Inventor

CHARLES A. BORCHER

By M. O. Hayes

Attorney

May 17, 1955 C. A. BORCHER 2,708,409

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FIG. 5.

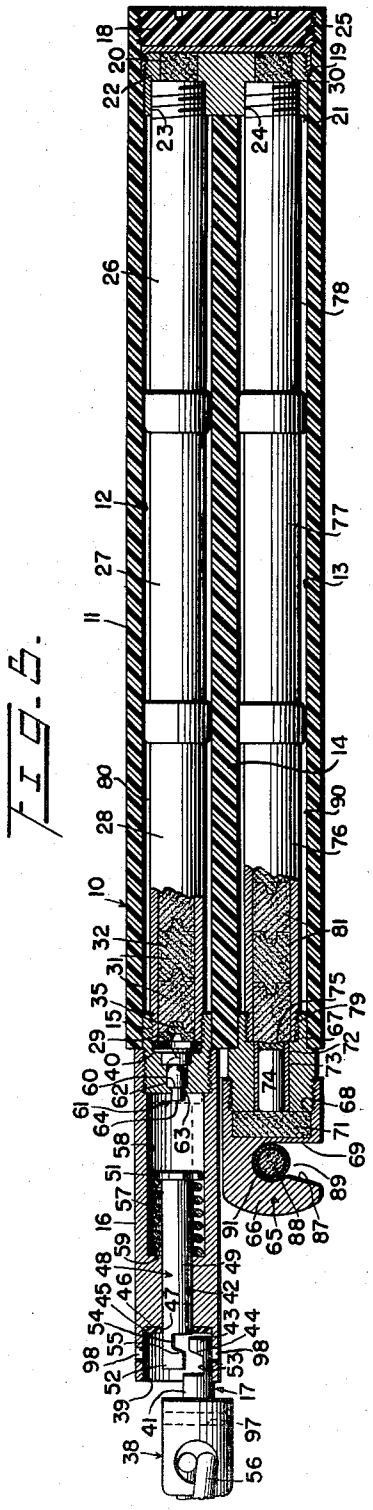


FIG. 8.

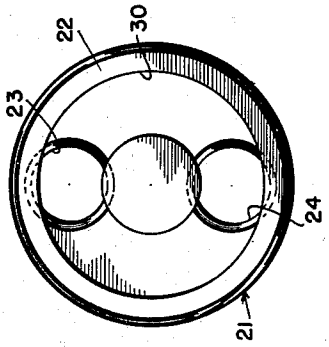


FIG. 7.

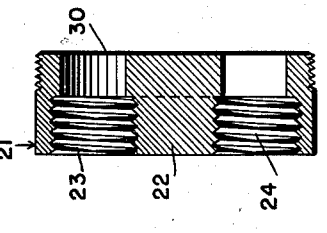
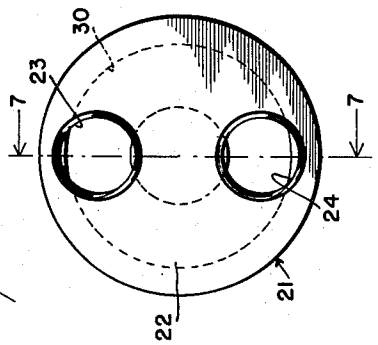


FIG. 6.



Inventor

CHARLES A. BORCHER

By M. O. Hayes

Attorney

United States Patent Office

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DELAYED FIRING DEVICE FOR A DEMOLITION CORD

Charles A. Borcher, Silver Spring, Md.

Application May 8, 1947, Serial No. 746,845

9 Claims. (Cl. 102—27)

(Granted under Title 35, U. S. Code (1952), sec. 266)

This invention relates to a long delay demolition firing device adapted for use either on land or water and more particularly to a device for firing a main demolition cord and a plurality of additional demolition cords secured thereto.

The present invention provides a new and improved long delay demolition firing device constructed in such a manner as to be easily transported underwater by a demolition crew member trained in the art of swimming underwater thereby to prevent detection by the enemy as the device is planted within enemy waters and in which means are provided for quickly attaching a main explosive cord thereto and having a plurality of additional explosive cords secured to the main cord, the explosive cords being adapted to be fired in predetermined time delayed relation with respect to the initial firing of the long delay elements therein thereby to destroy enemy underwater barriers and the like.

More particularly the present invention relates to a long delay demolition firing device adapted to cause wholesale destruction of enemy shore or underwater obstacles such, for example, as barbwire entanglements and underwater barriers and the like. The device of the present invention is adapted to fire a length of explosive cord and a plurality of explosive charges operatively connected thereto, the explosive force therefrom being adapted to destroy underwater barriers thereby to permit landing operations to be executed efficiently and quickly, as time is most essential when such landing operations are in progress. The device is adapted to be quickly attached to and fire a length of explosive cord and concurrently therewith a plurality of additional explosive cords and explosive charges, thereby to clear a beach or inlet of defense barriers and permit landing boats and troops with their equipment to make a safe landing thereon. The device in connection with the aforesaid detonating cords may also be employed for destroying secret and confidential military equipment used by our armed forces in the event that sudden seizure thereof appears probable. The device of the present invention, therefore, is advantageously employed for detonating a length of "Primacord" including a plurality of spaced additional "Primacords" secured thereto when a predetermined period of time such, for example, as 3 minutes has elapsed after the device has been set in operation thereby to demolish water or land barriers.

One of the objects of the present invention is the provision of a long delay demolition firing device in which means are employed for firing a length of "Primacord" having connected thereto a plurality of explosive charges in predetermined time delayed relation with respect to the initial operation of the firing device.

Another object of the invention is the provision of a new and improved demolition firing device in which a plurality of demolition charges are adapted to be quickly and detachably secured thereto and fired thereby.

Another object of the invention is the provision of a new and improved firing device in which means are

employed for firing a time delay element to cause combustion thereto to travel at a predetermined rate therealong in a predetermined direction, and in which means effective when the travel has been completed for igniting another delay element and cause combustion thereof to travel therealong at a predetermined rate in a reverse direction.

Still another object is the provision of a new and improved demolition firing device employing an annular igniter diametrically connected to a pair of delay elements and adapted to be fired by one of the elements thereby to initiate firing of the other delay element.

A still further object is to provide a new and improved long delay demolition firing device which is economical to manufacture, reliable in operation and which possesses the qualities of durability and safety during handling and transportation.

Still further objects, novel features and advantages of the invention will become apparent from the following description taken in connection with the accompanying drawings, wherein:

Fig. 1 is a view of the demolition firing device and the manner in which the elongated demolition charge is detachably secured thereto;

Fig. 2 is an enlarged longitudinal sectional view of the demolition firing device of Fig. 1 showing the parts thereof in a safe or unarmed position;

Fig. 3 is a cross sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a cross sectional view taken on the line 4—4 of Fig. 2;

Fig. 5 is a view partially in section and partially in elevation and showing the demolition firing device in the armed position in full lines and also showing the firing position thereof in dashed lines;

Fig. 6 is a detail front elevational view of the igniter holder employed with the present invention.

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 6; and

Fig. 8 is a rear elevational of the igniter holder of Fig. 6.

Referring now to the drawings for a more complete understanding of the invention, the demolition firing device disclosed thereon is generally indicated by the reference character 10 and comprising an elongated casing 11 composed of any material suitable for the purpose such, for example, as laminated phenolic with a fiber base, the casing being provided with two longitudinal bores 12 and 13 extending therethrough and separated by centrally disposed wall or web 14.

Secured in one end of the bore 12 as by a press fit or in any other suitable manner is a holder 15 having threaded engagement with a sleeve 16 adapted to slideably receive a firing mechanism generally indicated by the numeral 17. The other end of the casing is closed by a plug or disc 18 composed of laminated phenolic with a fiber base and having threaded engagement with an internally threaded recess 19 formed therein and in communication with the bores 12 and 13.

Arranged within the unthreaded portion of the recess 19 is a retaining member generally indicated by the reference character 21 and comprising a body 22 having bores 23 and 24 formed therein, the aforesaid bores being in communication with an annular recess 30 also formed in the member 21. The recess having arranged therein an igniter charge 20, the charge being maintained therein by an end cap 25 having threaded engagement with the retaining member 21, Figs. 2 and 5 and arranged in abutting relation with one surface of the disc 18.

One end of a tube 26 is threaded into the bore 23, the tube extending into the bore 12 a predetermined amount and being threaded at the other end thereof for threaded

engagement with a tube 27. The tube 27 is arranged within the bore 12 and disposed intermediately therein with respect to tube 26 and a tube 28, one end of tube 28 having threaded engagement with tube 27, the other end being threaded a predetermined distance into a recess 40 formed in the member 15, Figs. 2 and 5 and into abutting engagement with a percussion cap or primer 29 arranged in a reduced portion of the recess 40.

A plurality of pellets 31 are consolidated within each tube 26, 27 and 28 thereby to provide a delay train 32, 33 and 34 therein, the pellets being arranged in abutting relation with respect to each other and composed of any free and comparatively slow burning powder suitable for the purpose such, for example, as the type known to those skilled in the art as "F.13" powder. One end pellet in each of the delay trains is capped with an igniter charge 35 thereby to provide means for igniting each train in succession, the other end pellet of train 34 being capped by an igniter charge 36 arranged in abutting relation with respect to a portion of the igniter charge 20 disposed within the recess 30 formed in plug 18. By the aforesaid arrangement of the tubes and delay trains therein a continuous combustible delay train is provided from the percussion cap 29 to the igniter charge 20 in plug 18.

The firing mechanism 17 comprises a plug 38 slideably arranged within a well 39 disposed in one end of the sleeve 16 and extending a predetermined distance therebeyond Figs. 2 and 5. Integrally formed on the plug 38 is a shank 41 extending into a reduced bore 42 arranged in the sleeve 16 and in communication with the well 39, the shank having a lug 43 formed thereon on which is disposed a cam surface 44, the purpose of which will be more fully described hereinafter.

A sealing gasket 45 composed of any material suitable for the purpose such, for example, as rubber or the like is arranged within the well 39 and disposed between one end portion of the plug 38 and a shoulder 46 on the sleeve thus providing a moisture proof seal therebetween thereby preventing deterioration of the pyrotechnic materials contained within the demolition firing device. The gasket 45 is provided with a centrally disposed opening 47 through which the shank 39 extends.

A plunger 48 is slideably arranged within the bore 42 and releasably connected to the shank 41 and comprising a body 49 having a fluted striker 51 formed on one end thereof, the other end being provided with a lug 52 adapted to seat in a recess or cutaway portion 53 formed in the shank 41. As shown on Figs. 2 and 5 the plunger 48 is provided with a recess or cutaway portion 54 adapted to provide a seat for the lug 43 on the shank 41. Lug 52 has formed thereon a cam surface 55 adapted to coact with the complementary cam surface on the lug 43 thereby to release the plunger from interlocking engagement with the shank 41 when the shank has been moved outwardly a predetermined amount. It will be understood, however, that when the plunger 48 has been moved outwardly to the position shown on Fig. 5 in response to a sudden pull on the ring 56 secured to the plug 38, by the operator, the shank thereon is disengaged from the plunger. When this occurs the plunger is free to move inwardly to a firing position in response to the pressure applied thereto by a spring 57 arranged within an enlarged bore 58 in tube 16 and surrounding the plunger, the respective ends of the spring being in abutting engagement with the striker 51 on the plunger and a shoulder 59 formed on the tube 16 at the juncture of the wall defining the bores 42 and 58.

It will be apparent from the foregoing description, that the cam surface 44 on lug 43 is adapted to coact with the cam surface 55 on lug 52 in such a manner as to permit release of the plunger 48 from the shank 41 when the plunger has been moved to an armed position Fig. 5. The release of the plunger is effected in response to the pressure applied thereto by spring 57, in conjunction with the cam action between cams 44 and 55 as the plunger is moved outwardly sufficiently to bring the lugs 43 and 52 beyond the shoulder 46 and into the well 39. When this occurs the lugs 43 and 52 will become disengaged and release of the plunger with respect to the shank is effected.

As the plunger is released it is moved to a firing position in response to the pressure exerted thereon by the spring 57 shown in dashed outline Fig. 5, the striker 51 thereon being driven into engagement with a firing pin 61 with sufficient force to drive the pin into firing engagement with the percussion cap 29 thereby to initiate firing of the time delay train. The firing pin 61 is slideably arranged in a bore 62 disposed within the holder 15 and maintained therein by complementary shoulders 60 and 63 respectively formed on the firing pin and member 15. A reduced end portion 64 of the firing pin extending a slight distance beyond the outer surface of the member 15 in such a manner as to permit the striker 51 on the plunger to engage portion 64 thereon and move the pin a predetermined amount as the plunger is moved to the firing position by the spring.

An exploder generally indicated by the reference character 65 is secured in one end of the bore 13 in any suitable manner preferably by a press fit with the wall defining the bore. The exploder comprising a head 66 and a nipple 67, the nipple having threaded engagement with an internally threaded portion of the head 66. As shown on Figs. 2 and 5 the nipple is threaded into the head a predetermined amount thereby to provide a chamber 68 within the head, the chamber being disposed between one end portion of the nipple 67 and a relatively thin wall 69 on the head. Arranged within the chamber 68 and in abutting engagement with the nipple 67 and the wall 69 is an explosive charge 71 such, for example, as a tetryl pellet. The nipple 67 has formed therein a centrally disposed bore 72 extending therethrough in which is arranged a sleeve 73 composed of any material suitable for the purpose such, for example, as steel or the like. Disposed within the sleeve 73 is a detonator 74 having one end thereof in abutting engagement with the tetryl pellet 71, the other end thereof being in abutting engagement with an igniter charge 75 arranged in the sleeve 73 and adapted to fire the detonator 74 in predetermined time delayed relation with respect to the actuating of the firing mechanism.

Arranged within the bore 13 is a time delay element similar to the delay element arranged within bore 12 and comprising tubes 76, 77 and 78 secured together in the same manner as the aforesaid tubes 26, 27 and 28. The end tube 76 having threaded engagement with an enlarged bore 79 provided in the nipple 67 and in communication with the bore 72, the other end tube 78 being threaded into bore 24 and in communication with the recess 30. A plurality of pellets 81 are arranged within each tube 76, 77 and 78 thereby to provide a delay train 82, 83 and 84 therein, the pellets being composed of a slow burning powder such, for example, as the type heretofore shown and described. One end pellet in each delay train is capped with an annular igniter charge 85 thereby to provide means for igniting each train in succession, the other end pellet in train 78 being capped by an igniter charge 86 arranged in abutting relation with respect to the igniter charge 20 disposed within the recess 30 formed in the member 21, the igniter charge 85 on delay train 82 having abutting engagement with the igniter charge 75 arranged within sleeve 73. By the aforesaid arrangement of the tubes and delay trains therein, a continuous combustible train in effect is provided from the igniter charge 20 to the tetryl pellet 71. It will be understood, however, that by the aforesaid arrangement of the delay trains within the bores 12 and 13 a continuous delay is provided from the percussion cap 29 to the tetryl pellet 71, the burning time thereof being substantially 3 minutes.

As best shown on Figs. 2 and 5 the pair of delay trains

are diametrically connected to the annular igniter element 20, the igniter being fired by one of the trains and adapted to fire the other train. It will be understood, however, that when the first delay element is fired, combustion thereof will travel at a predetermined rate along the casing in a predetermined direction, and when this travel has been completed, ignition of the element 20 will occur thus igniting the other delay element thereby to cause combustion thereof to travel along the casing at a predetermined rate in a reverse direction to the direction of travel of the first delay element, the delay time controlled by the aforesaid delay elements being substantially 3 minutes. By the aforesaid arrangement of the delay trains and igniter element a firing connection between the trains comprising two arcuate firing paths is provided from one delay element to the other.

As best shown on Figs. 2 and 5 the head 66 of the exploder 65 has arranged therein a slot 87 adapted to receive and support a "Primacord" or explosive cord 88, the "Primacord" being of any desired length and detachably supported within the slot adjacent the pellet 71. The walls defining the restricted portion 89 of the slot are substantially parallel with respect to each other and terminate in a substantially circular portion 91. By aforesaid arrangement the "Primacord" is compressed or distorted as the cord is inserted into the restricted portion 89 of the slot 87. Thus when the "Primacord" has been forced through the restricted portion of the slot and enters the circular portion 91 thereof it seats therein. When this occurs the "Primacord" will assume its original form Figs. 2 and 3 thus preventing the cord from being readily withdrawn therefrom and also disposing the cord in the most advantageous position with respect to the pellet 71 such that the full force of the explosion as the pellet 71 is fired will be concentrated on the explosive cord thereby to cause detonating thereof.

If desired additional explosive cords 92 may be secured to the main explosive cord 88 as shown on Fig. 1, the cords being secured thereto in spaced relation with respect to each other and having respectively arranged on the free ends thereof a container 93 in which is disposed a quantity of explosive material 94, it being understood, however, that as the "Primacord" 88 is fired by explosive pellet 71, the spaced "Primacords" 92 and explosive charges 94 are fired concurrently therewith, the force of the explosion therefrom being sufficient to destroy the defense barriers and the like.

It will be apparent after a careful study of the drawings especially in Figs. 2, 3 and 5 that the bores 12 and 13 are slightly larger than the delay train assemblies respectively arranged therein, thus providing an air space 80 and 99 around each delay train assembly thereby to effect slow and even burning of each delay train.

While the invention has been described as employing a container secured to the end of each "Primacord" having a quantity of explosive material therein, it will be understood, however, that any suitable explosive may be used such, for example, as plastic explosive, the plastic explosive being molded on the free ends of each "Primacord" 92.

As shown on Fig. 2 the device is maintained in a safe condition by a pin 96, extending through a bore 97 arranged in the plug 38 and complementary openings 98 in the sleeve 16 and thus sliding movement of the plug is prevented until the pin is withdrawn from the aforesaid bore and openings.

Let it be assumed, by way of example, that the demolition charges 88 and 92 are desired to be fired, the safety pin 96 is withdrawn from the plug 38 and sleeve 16. When this has been done the ring 56 secured to the plug 38 will be grasped by the operator and a direct outward pull applied thereto by the operator whereupon sliding movement is imparted to the plug 38 and plunger 48, the spring 57 is additionally contracted between the striker 51 and shoulder 59. After the plug has been moved a predetermined amount by the operator, the lug 43 on shank 41 will become disengaged from lug 52 on plunger 48 in response to the pressure exerted on the plunger by the spring 57 and the action between the cam surfaces on lugs 43 and 52 thereby releasing the plunger from interlocking engagement with the shank.

When the plunger has been released continued action of the spring 57 will urge the plunger to a firing position as shown in dashed outline, Fig. 5 with the striker thereon in operative engagement with the reduced portion 64 on the firing pin 61, the force exerted on the firing pin by the spring 57 being sufficient to fire the percussion cap 29 thus igniting the igniter charge 35 in tube 26 which in turn ignites the powder train 32 therein, thereby initiating burning of delay trains 33 and 34 successively. When the delay train 34 has burned completely, ignition of the igniter charge 36 will occur thus igniting the igniter 20 disposed within recess 30. Igniter 20 ignites the delay 84 within tube 78 which is adapted to cause ignition and burning of delay trains 83 and 82 in succession thus igniting igniter 75 arranged in sleeve 73. When this occurs the detonator 74 is fired by igniter 75. As the detonator is fired the force of the explosion therefrom is sufficient to cause the tetryl pellet 71 to be fired, and concurrently therewith, and initiated thereby, the "Primacord" 88 is fired which in turn fires the spaced "Primacords" 92 and explosive charges 94 arranged thereon, the force of the explosion being sufficient to destroy underwater or field barriers as the case may be.

It will be understood, that the demolition firing device is constructed in such a manner as to have a delay period of 3 minutes before the demolition charges 88, 92 and 94 are fired thereby, the device being preferably employed for firing a plurality of demolition charges placed under water by a crew of skilled swimmers thereby to destroy underwater barriers sufficiently to permit landing boats and the like to be beached quickly and safely with negligible damage thereto.

While the device has been described in particularity with reference to a plurality of demolition charges adapted to be fired thereby in time delayed relation with respect thereto to destroy underwater barriers, it will be understood that, if desired, the device may be employed in connection with destroying secret equipment, field equipments and field barriers.

The many advantages of the demolition firing device constructed in accordance with the present invention will be readiiy apparent to those skilled in the art from a consideration of the foregoing description and drawings, and although a preferred embodiment of the device is illustrated and described, it is to be understood that changes in the details of construction and in the combination and arrangement of parts may be resorted to which fall within the scope of the invention as claimed.

The invention disclosed and claimed herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A demolition firing device comprising an elongated casing, a pair of time delay elements arranged within said casing in parallel spaced relation with respect to each other, means on said casing for maintaining said delay elements in said spaced relation, releasable firing means slideably arranged within the casing and adapted to be moved a predetermined amount to an armed position, means releasably secured to said firing means for actuating the firing means to said armed position, a pair of complementary inclined cam surfaces arranged on the firing means and the actuating means respectively for releasing said firing means as the firing means is moved to said armed position, resilient means operatively engaging said firing means

for urging the firing means for said armed position to a firing position as the firing means is released thereby to fire one of said pair of delay elements, an annular igniter fired by one of said delay elements for firing the other delay element, a head secured to the casing adjacent one end of said other delay element, said head having a slot formed therein terminating in a substantially circular portion for receiving and quickly connecting an elongated demolition charge of circular cross-sectional configuration thereto, and means including an explosive charge arranged in said head in alignment with said other delay element and fired thereby for firing said demolition charge in predetermined time delayed relation with respect to the firing of said one of the delay elements.

2. A demolition firing device comprising a casing, a percussion cap arranged within said casing, a time delay train in alignment with said percussion cap and adapted to be fired thereby, releasable firing means arranged within said casing and adapted to be moved slideably to an armed position, means releasably connected to said firing means for actuating the firing means to said armed position and adapted to release the firing means when moved to the armed position, a resilient member surrounding said firing means for urging the firing means from said armed position to a firing position as the firing means is released thereby to fire said cap, means on said actuating means for releasing said firing means, a second delay train arranged within said casing parallel to the first named train and spaced therefrom, an annular igniter fired by said first named delay train for firing said second delay train, a head secured to the casing adjacent one end of said second delay train, said head having a slot formed therein terminating in a substantially circular portion for receiving and quickly connecting an elongated demolition charge of circular cross-sectional configuration thereto, a detonator fired by said second delay train, and an explosive charge arranged within said head in alignment with said detonator and in substantial abutting engagement with said demolition charge and fired by said detonator for firing said demolition charge a predetermined period of time after said percussion cap is fired.

3. A demolition firing device comprising a casing, a time delay train arranged within said casing and adapted to burn for a predetermined period of time when ignited, means including a percussion cap for igniting said time delay train, releasable firing means arranged within said casing and adapted to be moved slideably to an armed position, means releasably connected to said firing means for actuating the firing means to said armed position and adapted to release the firing means when moved to said armed position, a spring operatively engaging said firing means and said casing for urging the firing means from said armed position to a firing position as the firing means is released thereby to fire said percussion cap, means on said actuating means for releasing said firing means, a second delay train arranged within said casing parallel to the first named train and spaced therefrom, an igniter housing disposed within said casing and having an annular recess therein in communication with said first and second delay trains, an annular igniter mixture closely fitted within said recess for establishing a firing connection between said delay trains and comprising two arcuate firing paths in parallel connected relation, a detonator fired by said second delay train, a head secured to the casing in alignment with said second delay train, said head having a slot formed therein comprising a restricted portion terminating in a substantially circular portion for receiving and quickly connecting an elongated demolition charge of circular cross-sectional configuration thereto, and an explosive charge arranged within said head in engagement with said detonator and in substantial abutting engagement with said demolition charge and fired by said detonator for firing said demolition charge in response to the shock received from said head.

4. A demolition firing device comprising a casing, a head secured to said casing and having a slot formed therein terminating in a substantially circular portion for receiving and quickly connecting an elongated demolition charge of circular cross-sectional configuration thereto, a pair of spaced time delay elements arranged within said casing, means for firing one of said time delay elements, an annular igniter fired by said one time delay element for firing the other time delay element, a detonator within said casing and fired by said other delay element, and an explosive charge arranged within said head in substantial abutting engagement with said demolition charge and fired by said detonator for firing said demolition charge in predetermined time delayed relation with respect to the firing of said one delay element.

5. A demolition firing device comprising a casing having a pair of bores arranged in parallel spaced relationship therein, a head secured to said casing and having a slot formed therein terminating in a substantially circular portion for receiving and quickly connecting an elongated flexible demolition charge of circular cross-sectional configuration thereto, a pair of time delay elements respectively arranged within said bores, means including a plunger for firing one of the delay elements, an annular igniter within said casing and fired by said one delay element for firing the other delay element, and means including an explosive charge arranged within said head in substantial abutting engagement with said demolition charge and fired by said other delay element for detonating said demolition charge in predetermined time delayed relation with respect to the firing of said one delay element.

6. A demolition firing device comprising a casing, a head secured to said casing and having a slot formed therein terminating in a substantially circular portion for receiving and quickly connecting an explosive cord of circular cross-sectional configuration thereto, a pair of slow burning time delay elements arranged in parallel spaced relation within said casing, a wall on said casing for continuously maintaining said elements in said spaced relation, means including a percussion cap for firing one of said delay elements, an annular igniter charge diametrically connected to said elements and fired by said one element for firing the other delay element, a detonator fired by said other delay element, and an explosive charge arranged within said head in substantial abutting engagement with said explosive cord and fired by said detonator for firing said explosive cord.

7. A demolition firing device comprising an elongated casing, a pair of bores arranged in spaced parallel relationship throughout the length of the casing, a pair of slow burning time delay elements respectively disposed within said bores, means for firing one of said elements to cause combustion thereof to travel at a predetermined rate along the casing in a predetermined direction, an annular igniter charge disposed intermediate said pair of elements in abutting relation therewith and effective when said travel has been completed for igniting the other one of said elements thereby to cause combustion thereof to travel along said casing at a predetermined rate in a reverse direction to the direction of travel of the combustion of said one element, a head secured to the casing adjacent one end of said other delay element and having a slot formed therein terminating in a substantially circular portion for receiving and quickly securing an elongated flexible demolition charge of circular cross-sectional configuration thereto, and detonating means fired by said other element when the travel of the combustion thereof has

been completed for firing said elongated demolition charge.

8. A demolition firing device comprising a casing, a head secured to said casing and having a slot formed therein and terminating in a substantially circular portion for receiving and quickly connecting an elongated flexible demolition charge of circular cross-sectional configuration thereto, a pair of time delay elements arranged within said casing in mutually parallel spaced relation, means for firing one of the delay elements, an annular igniter arranged within the casing in abutting engagement with one end of each delay element and fired by said one delay element for firing the other delay element, a detonator arranged within said head in abutting engagement with said other delay element and fired thereby, an explosive charge arranged within said head in firing engagement with said detonator and in substantial abutting engagement with said demolition charge and fired by said detonator for detonating said demolition charge in response to the shock received thereby from said head as said explosive charge is fired.

9. A demolition firing device comprising a casing, a time delay train arranged within said casing and adapted to be fired by a percussion cap disposed within the casing as the cap is fired, means for firing said cap, a second time delay train arranged within the casing parallel to the first named train and spaced therefrom, an igniter housing secured to said casing and having an annular recess therein in communication with said first and second delay trains, an annular igniter closely

fitted within said recess for establishing a pair of firing connections between said delay trains and comprising two arcuate firing paths in parallel connected relation therebetween, a detonator arranged in abutting engagement with said second delay train and fired thereby, a head secured to the casing in alignment with said detonator and the second delay train, said head having a slot formed therein comprising a restricted portion terminating in a substantially circular portion for receiving and quickly connecting an elongated flexible demolition charge of circular cross-sectional configuration thereto, and an explosive charge arranged within said head in engagement with said detonator and in substantial abutting engagement with said demolition charge and fired by said detonator for firing said demolition charge in response to the shock received from said head as the explosive charge is fired.

References Cited in the file of this patent

UNITED STATES PATENTS

44,630	Hughes	Oct. 11, 1864
997,800	Fuller	July 11, 1911
1,298,418	Stokes	Mar. 25, 1919
1,968,565	Mallet	July 31, 1934
1,988,467	Wiley	Jan. 22, 1935
2,382,879	Imber	Aug. 14, 1945

FOREIGN PATENTS

347,180	Germany	Jan. 16, 1922