Aug. 23, 1960 C. C. VOGT 2,949,853

DRILL MINE

Filed March 28, 1951 5 Sheets-Sheet 1

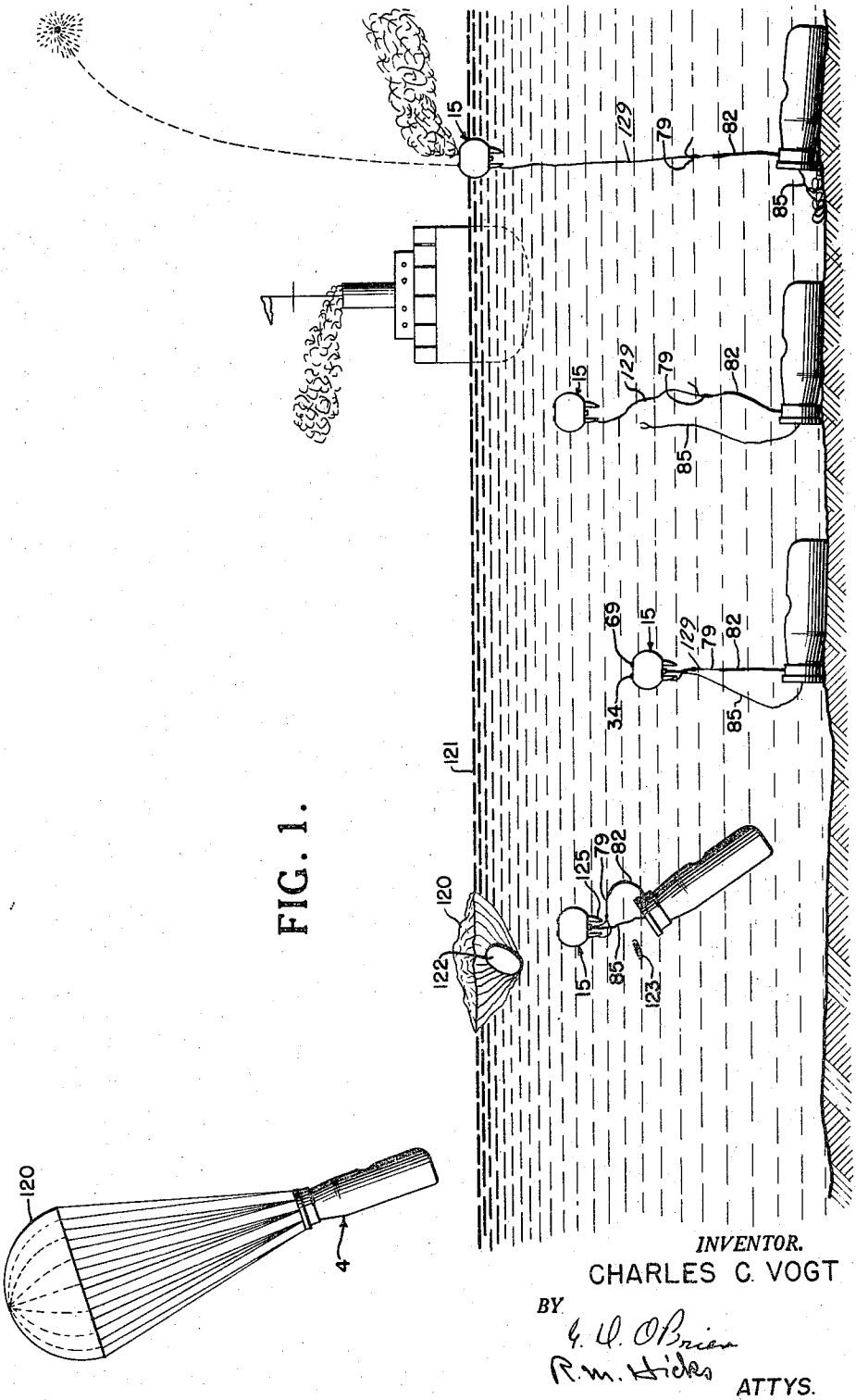


FIG. 1.

INVENTOR.
CHARLES C. VOGT

BY
G. W. O'Brien
R. M. Hicks
ATTYS.

Aug. 23, 1960 C. C. VOGT 2,949,853

DRILL MINE

Filed March 28, 1951 5 Sheets-Sheet 2

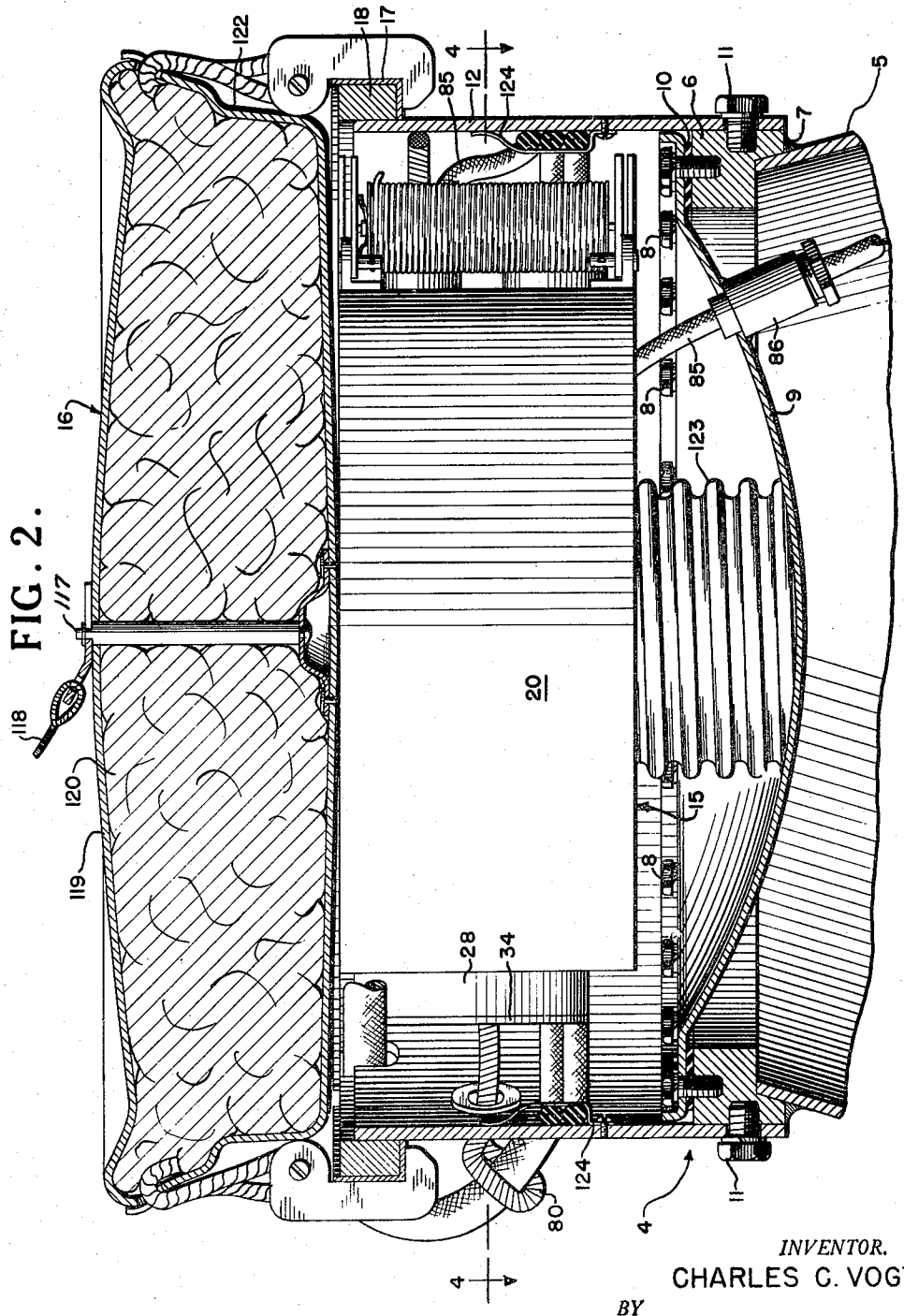


FIG. 2.

INVENTOR.
CHARLES C. VOGT
BY
G. W. O'Brien
R. M. Hicks ATTYS.

Aug. 23, 1960 C. C. VOGT 2,949,853

DRILL MINE

Filed March 28, 1951 5 Sheets-Sheet 3

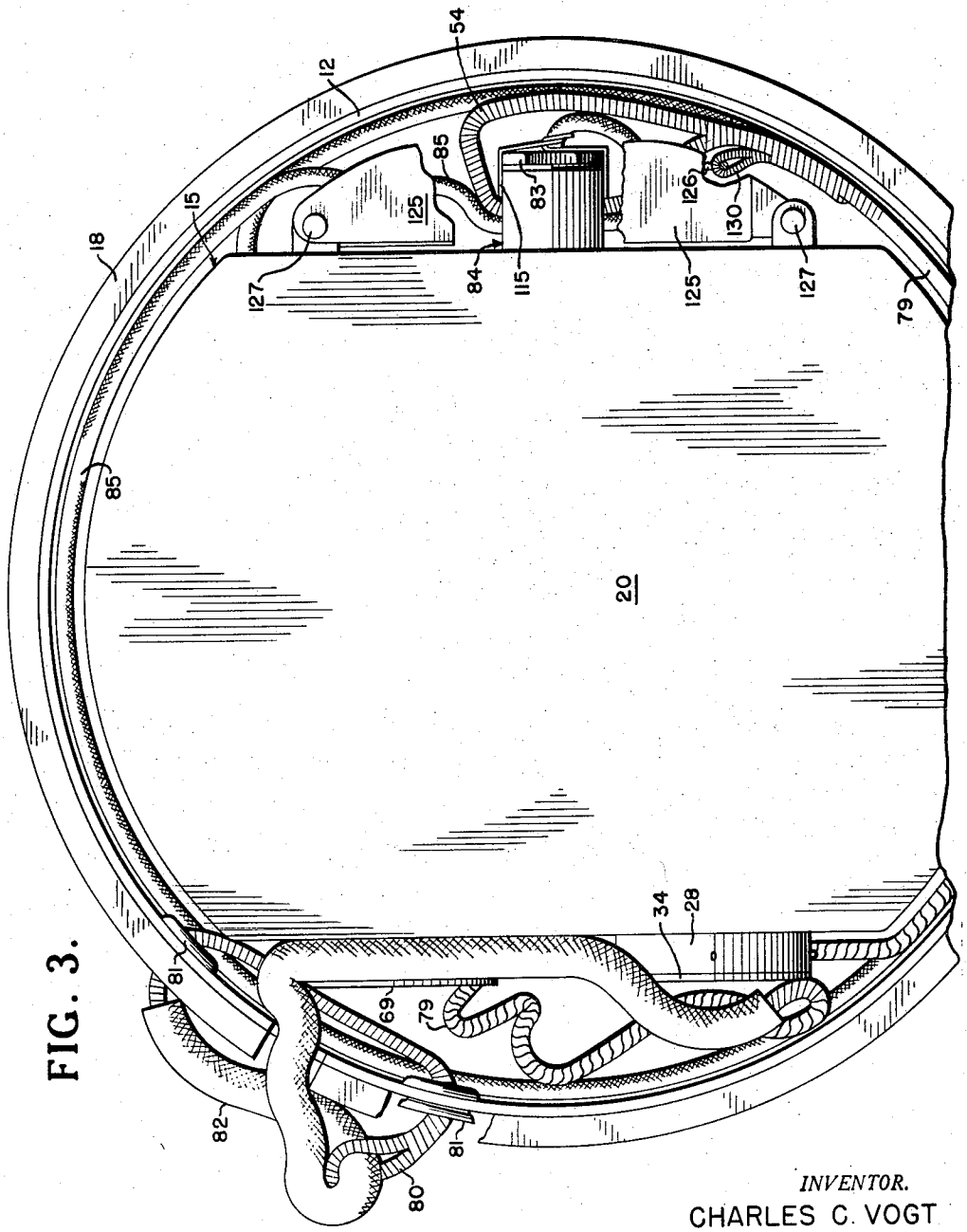


FIG. 3.

INVENTOR.
CHARLES C. VOGT
BY G. D. O'Brien
R. M. Hicks ATTYS.

Aug. 23, 1960 C. C. VOGT 2,949,853

DRILL MINE

Filed March 28, 1951 5 Sheets-Sheet 4

FIG. 6.

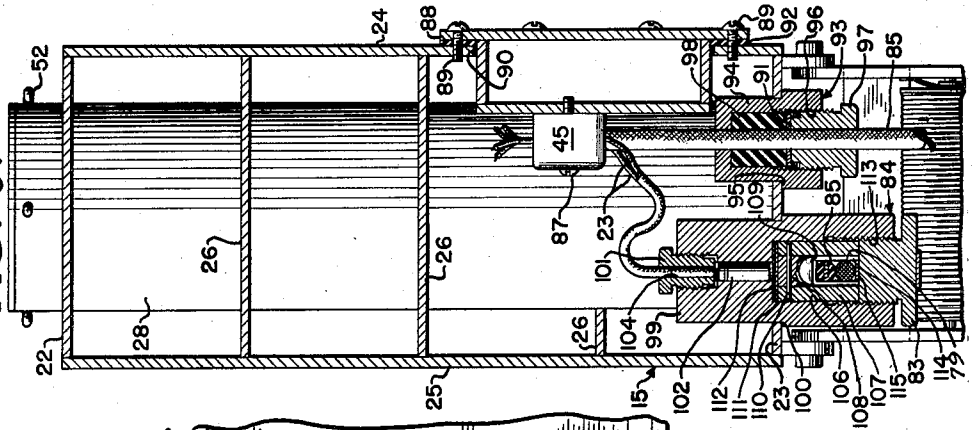


FIG. 5.

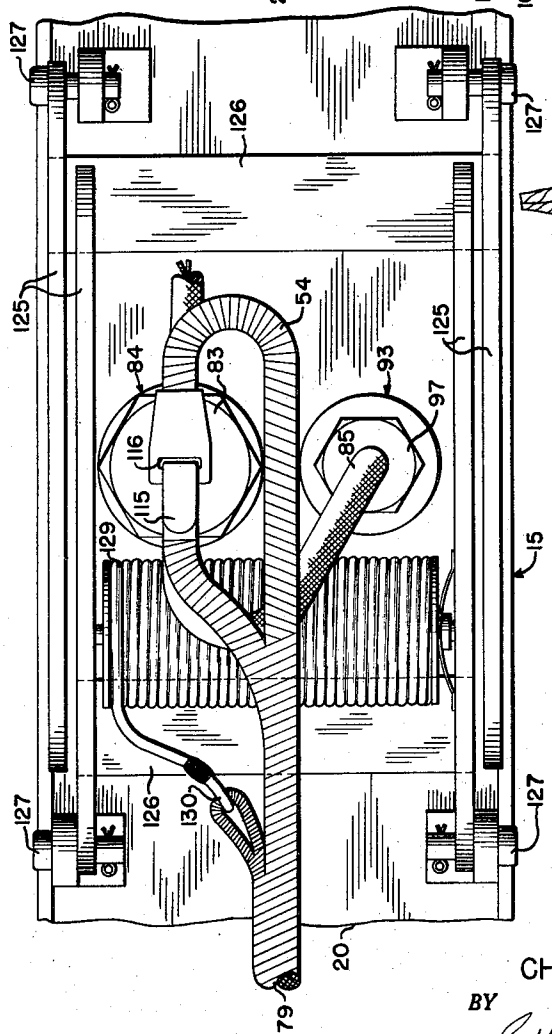
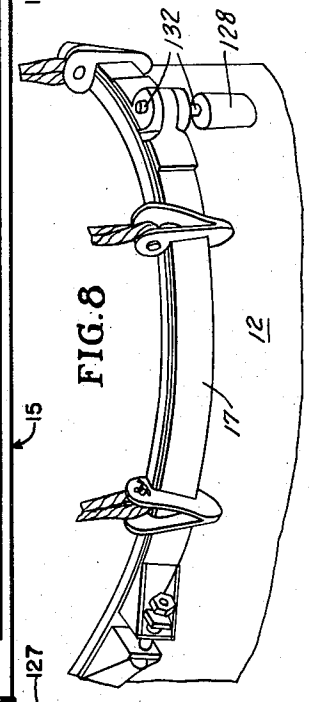


FIG. 8



INVENTOR.
CHARLES C. VOGT
BY
G. W. O'Brien
R. M. Hicks ATTYS

Aug. 23, 1960 C. C. VOGT 2,949,853

DRILL MINE

Filed March 28, 1951 5 Sheets-Sheet 5

FIG. 4.

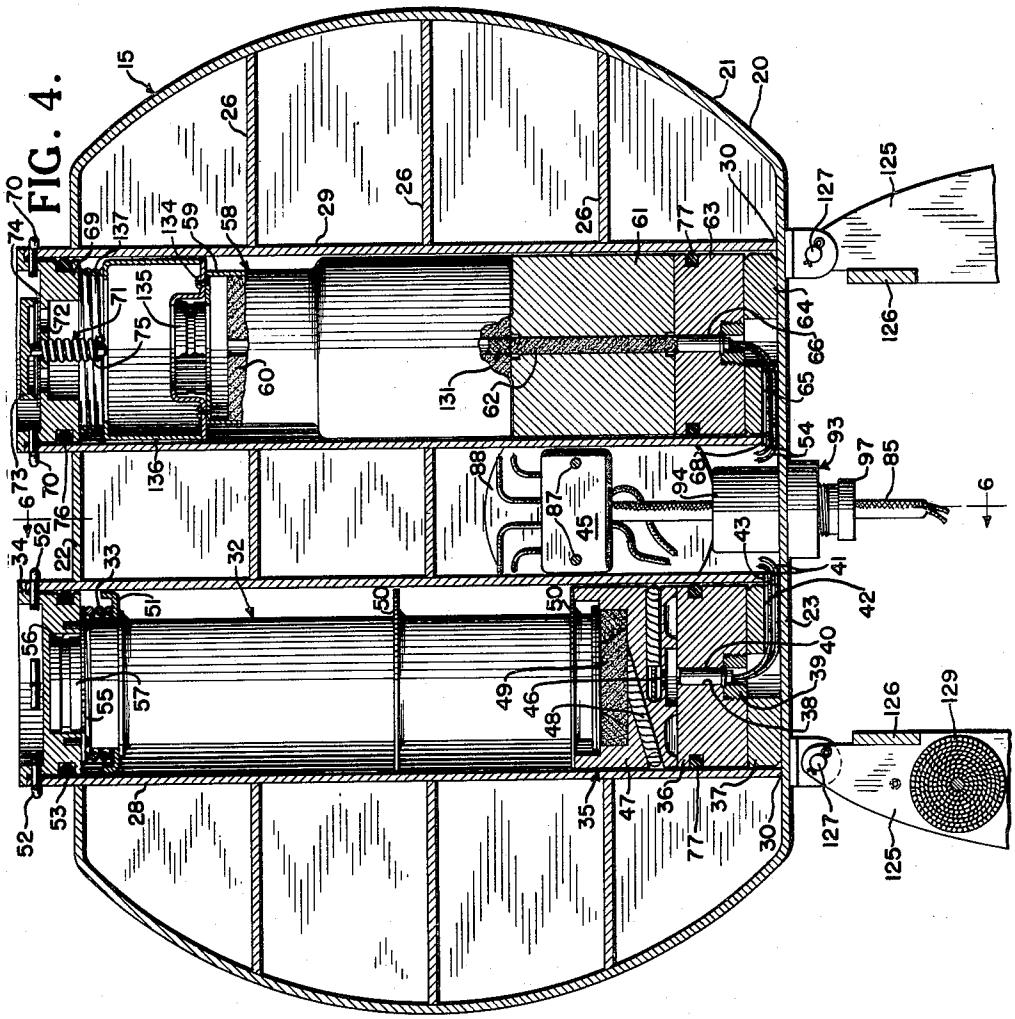
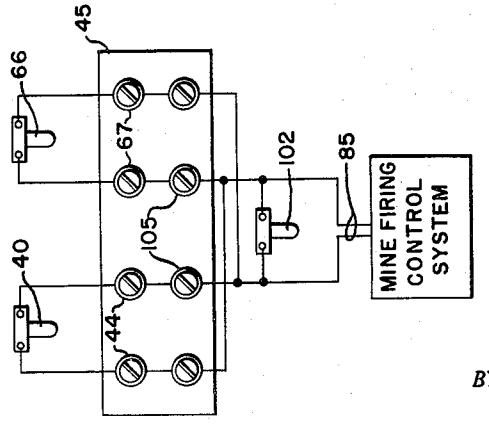


FIG. 7.



INVENTOR.
CHARLES C. VOGT
BY
R. D. O'Brien
R. M. Hicks ATTYS.

United States Patent Office

2,949,853

Patented Aug. 23, 1960

2,949,853

DRILL MINE

Charles C. Vogt, 6808 Denton Road, Bethesda, Md.

Filed Mar. 28, 1951, Ser. No. 218,060

13 Claims. (Cl. 102—10)

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

This invention relates generally to test apparatus and more particularly to a drill mine with which tests may be conducted simulating all conditions of transporting and planting a service mine and with particularity to the firing of the mine as it lies upon the bed of a body of water after the planting thereof without effecting the explosion of the mine, as would be the general case, or without requiring recovery of the mine or its underwater examination in order to determine the response of the mine to the firing conditions imposed thereupon.

Heretofore, considerable difficulty has been encountered in the field testing of certain forms of underwater ordnance and particularly mines of the airborne type. Such mines are generally adapted for being transported by plane to the place of launching whereupon as a mine is released from a plane in flight a parachute attached to the after portion of the mine is adapted to open for lowering the mine at a predetermined rate to the surface of the water. Upon impact of the mine with the water an inertia responsive mechanism, generally included as an element of the parachute pack assembly, releases the parachute from the mine which thereupon sinks to the bed of the body of water to await, as would be the general case, the approach of an enemy vessel.

With the constant development of new and improved mines of the underwater type the problem of field testing such mines becomes more acute for the reason that prior to the acceptance of any form of new or improved mine control, or firing mechanism, or the like, which materially changes a mine's design, it becomes necessary to subject a drill or test mine, wherein such changes or improvements have been incorporated, to all the conditions required of a mine in service, thereby to expose and eradicate therein such weaknesses in structure as may subsequently render a service mine erratic or inoperative.

Heretofore the testing of such mines has been conducted by first requiring that the mine be transported by plane to the place of launching whereupon after the mine is released to come to rest upon the bed of the body of water, tests are commenced thereupon as by passing over the mine surface craft of various sizes and shapes in order to determine under what conditions the mine may be influenced to fire. Further tests generally include subjecting the mine to various sweeping operations to determine if the mine may be prematurely detonated, or if, by reason of countermine shock or the shock of the mine striking the surface of the water or the bed of the body of water, following the launching thereof, the mine may be rendered inoperative or defective.

Such test operations have, heretofore, required months of effort on the part of test crews and technical personnel as well as involving numerous pieces of naval apparatus at great expense to the Government. The time and expense required for such tests has been largely due to the requirement heretofore that a diver seek out the mine as it lies upon the bed of the body of water to determine if, in effect, the mine had been detonated, there being generally provided within the mine means such as a lamp

illuminable upon a signal normally effective to fire the mine and discernible through a glass covered opening in the mine case whereby, upon an examination of the mine by the diver, the response to the mine to the particular test conducted thereupon could be determined.

In order that such mine testing operations may be simplified there is provided by the present invention a drill mine possessing all the physical and functional characteristics of a service mine with the exception that in lieu of the explosive charge normally present within a mine there has been substituted therefor an inert mass comparable in size and weight to the charge whereby the ballistic characteristics of the mine may be thusly maintained during its descent through the air after having been launched from a plane in flight. In lieu of the detonator, normally effective to explode the mine responsive to a signal produced thereto by the approach of an enemy vessel, there is provided an electrical squib or detonator so arranged as to operate a cutting device for disconnecting from the after portion of the mine a float assembly which upon ascending to the surface of the water is provided for discharging therefrom a visible signal for indicating that the mine had been fired by the particular test then being conducted thereupon. In addition to the foregoing, there is provided by the present device means for further facilitating the testing of such mines by maintaining a continuous connection between the float and mine as by a cable payable from the float as it ascends towards the surface of the water and by which the mine may be thereafter located upon the completion of a series of tests conducted thereupon and raised for an examination, or for the resetting of the firing mechanism thereof in case the mine has been fired.

It is the object of the present invention to provide a drill mine possessing the characteristics of a service mine and from which a signal float is discharged to the surface of the water in response to a signal produced in the mine comparable to that required to fire the latter by movement thereover of a surface vessel.

A further object is to provide a drill mine for generating a signal therein in response to an actuating source to release from the mine a float to the surface of the water and from which a visible signal is thereupon directed.

A still further object is to provide a new and improved drill mine capable of responding to a signal produced therein by an actuating source to free from the mine a float assembly having therein a star and a smoke signal releasable from the float upon the latter reaching the surface of the water to visibly indicate the actuation of the mine by said source.

A further object is to provide a buoyant signalling assembly partially releasable from an underwater mine as the latter is launched into a body of water and, in response to a signal normally effective to detonate the mine is further released sufficiently to ascend to the surface of the water and direct therefrom a signal visible during day or night operations for indicating the response of the mine to a firing condition.

A further object is to provide a float assembly releasable to the surface of the water from a mine resting on the bed of the body of water to produce a signal visible from a position remote from the float and indicative of the operation of the controls of the mine to firing position.

Further objects and many of the attendant advantages of this invention will be more readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanied drawings wherein:

Fig. 1 shows in diagrammatic form the test mine during the launching operation, the releasing of the parachute and discharging of the signal float assembly from within

the mine and release thereof to moored position, the releasing of the float responsive to the firing of the mine and the discharge from the float of the flare and smoke signal upon the rise of the float to the surface of the water;

Fig. 2 is a view in section of the after portion of the mine with the signal float assembly shown in elevated position within the mine and retained therein by the parachute pack assembly;

Fig. 3 is a plan view of the float assembly as arranged within the end of the mine with the parachute pack removed;

Fig. 4 is a view partly in section and partly in elevation of the signal float assembly as taken along the section line 4—4 of Fig. 2;

Fig. 5 is a fragmentary view in elevation of the signal float assembly before release from the mine and as viewed from the right in Fig. 2;

Fig. 6 is a sectional view of the float assembly taken along the sectional line 6—6 of Fig. 4;

Fig. 7 is a diagrammatic view of the electrical circuit of the signal float assembly and whereby the float is activated by an electric signal communicated thereto upon the firing of the mine; and

Fig. 8 is a view in perspective and partially broken away of an inertia actuated parachute release mechanism suitable for use with the device of the present invention.

Referring now generally to the drawings and more particularly to Fig. 2 thereof, the drill or test mine of the present invention and generally designated **4** is shown as including a casing **5** of which the after end portion thereof is equipped with an annular ring **6** preferably welded to the casing as at **7** and to which is secured as by bolts **8** a somewhat concavely formed end plate **9**. An annular washer or gasket **10** preferably formed from a resilient material such as rubber or the like serves as a suitable water proof connection between the casing and end plates **5** and **9** respectively as the latter is secured to the casing by the tightening of the bolts **8**.

Preferably secured as by bolts **11** about the outer periphery of the ring **6** is a cylindrical receptacle or shield member **12** wherein is received the signal float assembly of the test mine and generally designated **15**. A conventional parachute assembly generally designated **16** and substantially as shown and described in the copending application of G. B. Brown, Serial No. 705,120, filed October 23, 1946, for a Parachute Pack, now Patent 2,577,737, issued December 11, 1951, and secured as by a quick release sectionalized ring **17** to an extending ring or flange section **18** of the shield **12**, provides means whereby the float assembly is maintained in a nested position within the end of the mine until such time as the parachute release ring **17** is disengaged from the ring **18** upon impact of the mine with the water, as will hereinafter be more fully described.

The signal float assembly **15**, Fig. 4, is comprised of a float housing **20** including a substantially cylindrical section **21** whereupon may be provided a pair of flats **22** and **23** hereinafter referred to as the upper and lower surfaces of the float assembly respectively as determined by the floating position of the latter within a body of water. Closing the ends of the cylindrical section **21** is a pair of end plates **24** and **25**, Fig. 6, preferably secured as by welding to the edges of the section, respectively, thereby to provide a sealed assembly which is buoyant within a body of water. The housing **20** may be strengthened against hydrostatic pressure when submerged within a body of water by the arrangement therein, in the manner illustrated, of a plurality of horizontally disposed partitions **26** preferably welded along the ends thereof to the housing section **21** prior to the assembly and securement over the ends of the section of plates **24** and **25**.

Extending vertically through the housing **20**, as viewed in Fig. 4, is a pair of tubular guides **28** and **29**. The lower ends of these guides are so arranged as to rest upon the flat **23** to which they are preferably secured as by welding thereto at **30**. The said guide tubes **28** and **29** are preferably of such a length as to extend through the upper flat **22** but not beyond the radius of the cylindrical section **21** of the float housing **20** to possibly interfere with the receiving of the float assembly within the shield **12** during the arrangement of the float within the end of the mine, as illustrated in Fig. 3.

Preferably received as by telescoping within the tubular guide **28**, Fig. 4, is a conventional signal flare assembly generally designated **32** and adapted, as by the arrangement of a spring **33** therebetween and a closing cap **34** for the tube, to be yieldably compressed to the upper surface of a delay fuze assembly generally designated **35** and supported from the inner surface of the flat **23** as by a pair of spacer blocks **36** and **37**.

Provided within the block **36** is a centrally arranged bore **38** wherein is secured, as by a ring screw **39**, an electroresponsive detonator or squib **40** with the leads **41** therefrom extending outwardly through the screw and by way of a radial slot **42** provided therefor within the lower surface of the block **37** and a bore **43** formed in the lower section of the tubular guide **28** to connect, as at **44**, with a terminal block **45**, Fig. 7.

The squib **40**, when electrically energized by current applied thereto by way of the terminal block **45**, directs a jet of flame through a bore **46** formed in the lower section of the fuze chassis **47** to ignite the end of a delay element **48** lying across the bore **46** and wound about the fuze chassis to extend inwardly therein for connecting in ignitable relation with a charge **49** preferably preformed and arranged within the end of the chassis, as illustrated. After a predetermined delay of approximately 40 seconds, as determined by the composition of the fuze element **48**, the charge **49** is ignited for expelling from the end of the tube **28** the signal flare assembly **32** concurrently with igniting the fuze of the flare, not shown, to effect the burning of the flare as it ascends into the air to produce a signal visible from a long distance from the position of the float assembly upon the water.

To centrally position the flare assembly **32** within the guide tube **28** there is provided upon the flare a plurality of guide rings **50** preferably welded to the side of the flare and with the rings further providing means for guiding the flare vertically through the tube as the flare is discharged therefrom upon the ignition of the charge **49**. A removable guide ring **51**, and whereupon rests the lower end of the spring **33**, is carried outwardly from the tube with the flare, the ring **51** possibly separated from the flare during the ascent of the latter into the air.

Initially the closing cap for the tube **28** is secured therein as by a plurality of cotter keys **52**. These cotter keys are preferably formed from one of the softer metals such, for example, as brass or the like and shearable by outward movement of the flare against the cap following the ignition of the charge **49**. Provided about the cap **34** is an annular groove **31** wherein is arranged an O-ring gasket **53** formed preferably from rubber and compressible between the cap and inner surface of the tube **28** whereby is provided a high pressure seal about the cap until such time as the cap is separated from the tube by movement thereagainst of the flare **32**, as hereinbefore described.

Retained as by a perforated plate **55**, within a recess **56** formed therefor in the under surface of the cap **34** is a drying pellet **57** preferably of a material having a high affinity to moisture such, for example, as silica gel or the like and whereby any dampness present within the guide tube **28** following the assembly therein of the flare **23** will be absorbed by the pellet.

Received within the cylindrical guide **29** is a smoke flare assembly generally designated at **58** and comprised of an annular casing **59** wherein preferably is packed a quantity of smoke producing composition **60**.

The arrangement of the smoke flare within the tube

29 is such as to cause the base of the flare to rest upon a time delay block 61 wherein is centrally disposed a length of delay element 62. Beneath the block 61 there is disposed a pair of spacer blocks 63 and 64 within which is provided in the base of the latter a radial slot 65. In ignitable relation with the element 62 and centrally disposed within the block 63 is an electroresponsive squib 66 with the leads 54 from the squib extending outwardly therefrom, by way of the slot 65, to connect with the terminal block 45 as at 67, Fig. 7, after passing thereto through an opening 68 formed therefor in the lower end of the tube 29. The arrangement of the squib 66 is such, with respect to the delay element 62, as to ignite the element when the squib is energized by current applied thereto by way of the block 45. An igniting pellet 131 is so disposed with respect to the delay element 62 as to be ignited thereby and thusly to ignite the composition 60 after a predetermined time delay following the ignition of the element by the squib 66.

A cap 69 closing the end of the tube 29 may be secured therein as by an arrangement of cotter keys 70 in a similar manner to the arrangement of the cotter keys securing the cap 34 within the tube 28. Whereas in the case of the cap 69, instead of the cap becoming separated from the tube upon the ignition of the flare 58 the cap is provided with a relief valve assembly generally designated 71 and whereby gaseous pressure in the form of smoke, generated within the tube by the burning of the composition 60 of the flare, is discharged through the cap by way of the ports 72 by the lifting therefrom of the valve cap 73.

In order to provide a water tight seal between the valve cap 73 and the cap piece 69, prior to the ignition of the flare 58 there is provided between the said caps a resilient washer 74 of rubber or the like, and compressible to the cap piece 69 by the valve cap 73 as the latter is drawn to the washer by a valve spring 75.

There is provided within a cylindrical like extension 136 secured as by screws 134 to the upper end of the flare casing 59 a perforated drying pellet 135 similarly formed and from similar material to the pellet 57 whereby such moisture, as may be present within the tube 29 following the assembly therein of the flare 58, may be absorbed before becoming effective to alter the characteristics of the various ignitable components of the tube. A spring 137 interposed betwen the cap 69 and the upper end of the extension 136 yieldably maintained the base of the flare 58 in bearing contact upon the block 61.

There is arranged about the valve cap 34 an O-ring gasket 76 similar to the O-ring 53 and whereby moisture is prevented entering the tube 29 therebetween and the cap during such time as the float assembly is moored closely to the mine resting upon the bed of the body of water. There is further provided, as means for sealing the lower ends of the tubes 28 and 29 respectively, a pair of O-rings 77 arranged about the blocks 36 and 63 respectively and whereby gaseous pressure generated within the tubes during the operation of the float assembly, is thusly prevented from entering the float housing 20 by way of the openings 43 and 68.

Securing the float assembly to the shield 12 of the mine is a relatively short length of mooring cable 79, eight feet having been found satisfactory. Formed in one end of the cable is a loop 80 for securing in the manner illustrated the cable within openings provided therefor in the wall section of the shield. The mooring cable 79 is protected from being cut by the edges of these openings by the arrangement within the openings of suitable grommets 81. To further protect the cable 79, as the float assembly is expelled from the shield during the launching of the mine there is provided about the cable a tubular rubber sleeve 82 flexible with the cable and arranged therewith between the shield and the base of the signal float assembly, Fig. 3, as the latter is received within the shield during the assembly therein of the float. The opposite end of the mooring cable 79 is secured as by a threaded plug 83, Fig. 6, within the bifurcated end portion of a cutting assembly generally designated 84 fastened, as by welding, within the base of the float housing 20.

There is provided, as an electrical connection between the mine and float assembly 15, a two conductor cable 85 of a length substantially the same as the mooring cable 79. One end of this cable is arranged for extending, by way of a gland nut assembly 86, Fig. 2, into the mine for connecting with the mine firing control system, Fig. 7, and which may be of any type suitable for the purpose. Upon the operation of the firing control system of the mine, a voltage is produced which, in a service mine, would fire the mine. This voltage, in the instant device, is communicated by way of cable 85 to the float assembly 15 and thence to the terminal block 45 to electrically activate the squibs 40 and 66 and accordingly the respective flares 32 and 58, as hereinbefore described.

The terminal block 45, and whereupon is made the squib connections with the cable 85, is secured as by screws 87, Fig. 4, to a hand hole cover 88, Fig. 6, secured as by screws 89 within an opening 90 formed therefor in the end plate 24. A gasket 92 arranged between the cover and the plate 88 and 24 respectively, provides a suitable pressure seal therebetween as the cover is secured to the plate by the tightening of the screws 89. A suitable electrical arrangement for connecting the squib leads with the cable 85 is shown to advantage in Fig. 7. If it is so desired the squib leads may be connected in series with the cable. The gland nut assembly 93 is constructed in a similar manner to the assembly 86, and comprised of a body section 94 having thereon a positioning flange 95 whereby the body is secured as by welding the under surface of the housing 20. Threaded as at 96, within the lower end of the body 94 is a gland plug 97 adapted, when properly rotated within its threaded connection within the body, to compress about the cable a resilient washer 98 whereby is provided a pressure and water tight seal about the cable as it enters the float housing 20.

Before the passage of the electrical cable 85 into the float housing the cable is arranged through the cutting assembly 84 along with the loop 54 formed in the opposite end of the mooring cable from the mine whereby as the cutter is subsequently actuated to cutting position, as will hereinafter be more fully described, the float assembly is freed of the cables to start its ascent towards the surface of the water.

The cutting assembly 84 is comprised of a cylindrical like body section 99 whereupon is provided a positioning flange 100 whereby the body is positioned with respect to the under surface of the float housing 20 while being secured thereto as by welding. Secured as by a threaded plug 101 within the body is an electroresponsive detonator or squib 102 from which the leads 103 thereof pass, by way of a bore 104 in the plug to connect with the terminal block 45 as at 105, Fig. 7.

Intersecting the bore 104 is a somewhat larger bore 106 wherein is slidably received a bifurcated cylindrical guide section 107. Slidably received within this guide is a cutting block 108 and whereon is provided a sharp cutting edge 109. The arrangement of the block within the guide is such as to provide for the block being initially secured to the guide as by a shear pin 110 with the arrangement of the guide within the bore preventing shifting or separation of the pin from its securing position with the block so long as the guide remains in an assembled position within the body.

Separating the bores 104 and 106 is a pair of frangible partitions 111 and 112 of which the latter thereof is formed preferably of rubber whereby moisture is prevented from entering the float assembly by way of the

bore 104 as the washer 112 is compressed by the guide 107 to the base of the bore 106 as the plug 83 is drawn into the threads 113 and against the lower end of the guide.

There is provided in the guide and body sections 107 and 99, respectively, transverse slots 114 wherein are retained, as by the plug 83, the electrical and mooring cables 85 and 79, respectively.

To insure against loosening and possible separation of the plug 83 from its threaded connection with the body 99 there is arranged about the plug and through the slots 114 a thin metallic strip 115 which, because of an eyelet 116 formed therein, threads with itself over the top of the plug 83 for permitting removal of the plug only after this locking band has been properly loosened.

As the required voltage is applied to the squib 102 to cause the detonation thereof, the force exerted thereby is sufficient to penetrate the partitions 111 and 112 for driving the cutting block 108 through the shear pin 110 and downwardly across the electrical and mooring cables 85 and 79, respectively and against the end of the plug 83 which thereupon provides an anvil against which the cables are cut.

Let it be assumed, for the purpose of description of the operation of the mine, that, as the mine is released from a plane in flight to start its descent toward the surface of the water, Fig. 1, a release pin 117, Fig. 2, connected to the plane as by an arming wire 118 is drawn clear of its securing position with the parachute pack covering 119 whereby the parachute 120 is freed to lower the mine end first into the body of water 121.

As the mine strikes the water a conventional inertia responsive release mechanism, Fig. 8, comprising a mass 128 carried by a pin 132 slidably disposed within a clevis secured to the end portion of a pair of adjacent sections and forming a part of the parachute release ring 17 becomes operative to disengage the sections of the ring thereby to allow the parachute and retaining dish 122 therefor to move clear of the shield 12 for freeing the float assembly 15. The inertia responsive release mechanism may be of any type suitable for the purpose such for example, as the inertia responsive parachute release mechanism disclosed in an application by G. B. Brown for Parachute Pack and Release Means Therefor, filed February 21, 1944, now Patent 2,565,470, issued August 28, 1951. As this occurs, a spring 123 interposed between the float assembly and mine end plate 9 forcibly expels the float from the shield allowing the float to assume a position above the mine as moored thereto from the end of the mooring cable 79.

As the float assembly moves from the shield 12 the electrical cable 85 initially retained as by a plurality of spring clips 124 against the interior surface of the shield 12 is drawn free to connect electrically the float with the mine, as hereinbefore described.

As the float moves from the shield 12, suitable stabilizing fins 125, Fig. 5, secured in pairs respectively as by cross bars 126, pivot freely about studs 127 secured to the base of the float assembly, to assume a downward position, Fig. 4, thereby to provide, in addition to their stabilizing function, sufficient ballast to the float as to maintain the latter in an upright position within the water.

As tests are conducted upon the mine of the character hereinbefore described and which when becoming effective to actuate the firing mechanism or system of the mine to firing position, instead of the mine being detonated in the usual manner of service mines, an electrical signal is directed along the cable 85 to the terminal block 45 and thence to the respective squibs 40, 66 and 102 to effect their simultaneous detonation. Upon detonation of the squib 102 the cutter 84 is actuated to cut the float free of the electrical and mooring cables 85 and 79, respectively thereby to allow the float to commence its ascent toward the surface of the water. As the float rises, the time delay element 62 and the assembly 35 suffiicently delay the ignition of the charges 131 and 49 as to permit the float assembly to ascend to the surface of the water before the operation of the smoke and signal flares as hereinbefore described.

In order to provide means whereby the mine may be quickly located following the operation thereof there may be provided, as between the fins 125, a reel of wire or cable 129 and secured as at 130 to the cable 79, Figs. 1 and 5, and payable from the reel as the float ascends toward the surface of the water after having been cut free of the cable's end 54.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practised otherwise than as specifically described.

The invention described 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. An underwater ground mine of the character disclosed comprising, in combination, a casing adapted for launching within a body of water, a float assembly releasably secured to said casing and submerged therewith within a body of water, a fire control system arranged in said casing and responsive to the influence of a mine actuating source to produce an electrical signal, inertia responsive means including a spring disposed between said casing and float assembly for releasing the float from said casing as the mine enters the water, means responsive to a signal produced by said system for releasing said float assembly for ascent within the water, and signaling means carried by said float and responsive to said signal for producing a visible signal when said float reaches the surface of the water.

2. A test mine of the character disclosed for launching within a body of water comprising, in combination, a mine casing having therein a fire control system responsive to the influence of a mine actuating source for producing an electrical signal, a float assembly releasably secured to said mine casing and immersible therewith as the mine is launched within a body of water, means electrically connecting said float assembly to said fire control system, means responsive to a signal produced by said system for releasing said float assembly for ascent to the surface of the water, and signaling means carried by said float assembly and responsive to the operation of said system for producing a visible signal when the float assembly reaches the surface of the water.

3. A test mine of the character disclosed adapted for launching from a plane in flight including, in combination, a casing, a fire control system housed in said casing, a receptacle forming a part of said casing, a float assembly arranged in said receptacle and releasable therefrom upon the launching of said mine within a body of water, a length of mooring cable connecting said float assembly to said casing for maintaining said float assembly submerged with said casing beneath the surface of the water, means responsive to an electrical signal produced by said fire control system for releasing said float assembly from said mooring cable thereby allowing said float to rise to the surface of the water, and means carried by said float assembly and responsive to said electrical signal for producing a visual signal upon the rise of the float to the surface of the water.

4. An underwater ground mine of the character disclosed comprising, in combination, a casing adapted for launching within a body of water, a float assembly releasably secured to said casing and submerged therewith within a body of water, a fire control system arranged in said casing and responsive to the influence of a mine actuating source for producing an electrical signal, a length of mooring cable connecting said float assembly

to said casing, means responsive to said signal for releasing the float assembly from said casing thereby to allow said casing to rise to the surface of the water while connected to the casing by said cable, and signaling means carried by said float assembly and responsive to said signal to produce a visible signal upon ascent of the float assembly to the surface of the water.

5. A test mine of the character disclosed adapted for launching from a plane in flight including, in combination, a casing housing therein a fire control system, a receptacle forming a part of said casing, a float assembly arranged in said receptacle and releasable therefrom upon the launching of said mine within a body of water, a length of mooring cable connecting said float assembly to said casing for maintaining the float assembly submerged with said casing beneath the surface of the water, a locating cable connecting said float assembly to said mooring cable, means responsive to a signal produced by said fire control system for releasing the float assembly from said mooring cable thereby to allow the float assembly to rise to the surface of the water while connected to the mooring cable by said locating cable, and means responsive to said signal for producing a visual signal upon the rise of the float assembly to the surface of the water.

6. A test mine of the character disclosed adapted for launching from a plane in flight including, in combination, a casing, a fire control system arranged in said casing and responsive to the influence of a mine actuating source for producing an electrical signal, a receptacle forming a part of said casing, a float assembly arranged in said receptacle and releasable therefrom upon the launching of said mine within a body of water, a length of mooring cable connecting said float assembly to said casing for maintaining the float assembly submerged with said casing beneath the surface of the water, means responsive to said electrical signal for releasing the float assembly from said cable whereby the float assembly may rise to the surface of the water, signaling means carried by said float assembly and ignitable for producing a signal visible after the rise of the float assembly to the surface of the water, an ignitable delay element for igniting said signaling means, and electroresponsive means for igniting said delay element in response to said signal.

7. A test mine of the character disclosed adapted for launching from a plane in flight including, in combination, a casing, a fire control system arranged in said casing and responsive to the influence of a mine actuating source for producing an electrical signal, a receptacle forming a part of said casing, a float assembly arranged in said receptacle and releasable therefrom upon the launching of said mine within a body of water, a length of mooring cable connecting said float assembly to said casing for maintaining the float assembly submerged with said casing beneath the surface of the water, a locating cable connecting the float assembly to said mooring cable, means responsive to said electrical signal for releasing said float assembly from said cable whereby the float assembly may rise to the surface of the water while connected to the mooring cable by said locating cable, signaling means disposed within said float assembly and ignitable for producing a signal visible after the rise of the float assembly to the surface of the water, a delay element ignitable for ignition of said signaling means, and electroresponsive means for igniting said delay element in response to said signal.

8. A test mine of the character disclosed adapted for launching from a plane in flight to come to rest upon the bed of a body of water comprising, in combination, a casing, a fire control system arranged in said casing and responsive to the influence of a mine actuating source for producing an electrical signal, a parachute pack, a receptacle arranged on and forming a part of said casing and having said pack secured thereover, a float assembly arranged in said receptacle and secured therein by said parachute pack, means for partially releasing said parachute from said pack upon release of said mine from said plane in flight, means for completely releasing said parachute from said mine upon impact of the mine with the surface of the water whereby the float assembly is released from the receptacle, a length of mooring cable connecting said float assembly to said casing for maintaining the float assembly submerged with said casing beneath the surface of the water, electroresponsive means responsive to said electrical signal for releasing said float assembly from said cable whereby the float assembly may rise to the surface of the water, signaling means ignitable to produce a signal detectable after the rise of the float assembly to the surface of the water, and time delay ignition means for said signaling means ignitable responsive to said signal for delaying the ignition of said signaling means until the rise of the float to the surface of the water.

9. A test mine of the character disclosed adapted for launching from a plane in flight to come to rest upon the bed of a body of water comprising, in combination, a casing, a fire control system arranged in said casing and responsive to the influence of a mine actuating source for producing an electrical signal, a parachute pack, a receptacle arranged on and forming a part of said casing and having said pack secured thereover, a float assembly arranged in said receptacle and secured therein by said parachute pack, means for partially releasing said parachute from said pack upon release of said mine from said plane in flight, means for completely releasing said parachute from said mine upon impact of the mine with the surface of the water thereby to release said float assembly from the receptacle, a length of mooring cable connecting said float assembly to said casing for maintaining the float assembly submerged with said casing beneath the surface of the water, a locating cable connecting said float assembly to said mooring cable, means responsive to said signal for releasing said float assembly from said mooring cable thereby allowing said float assembly to rise to the surface of the water while maintaining the connection thereof to the mooring cable by said locating cable, and means responsive to said signal for producing detectable signal after the rise of the float assembly to the surface of the water.

10. An underwater ground mine of the character disclosed comprising, in combination, a casing adapted for launching within a body of water, a float assembly releasably secured to said casing and submerged therewith within a body of water, a fire control system arranged in said casing and responsive to the influence of a mine actuating source for producing an electrical signal, a length of mooring cable connecting said float assembly to said casing for maintaining the float assembly submerged with said casing beneath the surface of the water, means responsive to said electrical signal for releasing said float assembly from said cable whereby the float may rise to the surface of the water, signaling means ignitable to produce a signal detectable after the rise of the float assembly to the surface of the water, and ignition means for said signaling means including a delay element ignitable by said electrical signal for delaying the ignition of the signaling means until the rise of the float to the surface of the water.

11. A test mine of the character disclosed for launching within a body of water comprising, in combination, a mine casing having therein a fire control system responsive to the influence of a mine actuating source for producing an electrical signal, positively buoyant means secured to said mine casing and immersible therewith as the mine is launched with the water, means electrically connecting said buoyant means to said fire control system, means disposed between said mine casing and the buoyant means for releasing said buoyant means from said casing as the mine enters the water, and means carried by said buoyant means and operated by said sys-

tem for producing visible signals when the buoyant means has reached the surface of said water.

12. A test mine of the character disclosed adapted to be launched from a plane in flight, the combination of a casing, fire control means disposed within said casing, positively buoyant means releasably secured to said casing, means disposed between said casing and buoyant means for releasing said buoyant means from said casing as the mine enters a body of water, means connected to the buoyant means and to said casing for mooring and maintaining said buoyant means submerged beneath the surface of said water, means responsive to an electrical signal produced by said fire control means for releasing the buoyant means from said mooring means whereby said buoyant means rises to the surface of said water, and a plurality of devices on said buoyant means responsive to said electrical signal for producing a plurality of visual signals as the buoyant means reaches the surface of said water.

13. A test mine of the character disclosed adapted to be launched from an aircraft in flight, the combination

of a casing, a fire control system responsive to the influence of a mine actuating source for producing an electrical signal, a float assembly releasably connected to said casing and releasable therefrom as the mine is launched within a body of water, means including a helical spring for releasing said float from said casing as the mine enters said water, a short length of mooring cable connecting said float to said casing for maintaining the float submerged beneath the surface of the water, means responsive to said electrical signal for releasing the float from said cable whereby the float assembly rises to the surface of the water, a pair of ignitable signaling devices carried by said float assembly for producing a pair of visible signals as said devices are ignited, a pair of delay elements connected to said signaling devices respectively for igniting said devices after the float has reached the surface of the water, and a pair of electroresponsive detonators connected to said delay elements for igniting said delay elements in response to said electrical signal.

No references cited.