United States Patent [19]

Hanks

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[54] **APPARATUS FOR COLLECTING SPECIMENS**

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[52] **U.S. Cl.** **37/55,** 37/63, 43/6.5

[51] **Int. Cl.** **E02f 5/00**

[58] **Field of Search** 37/55, 63; 43/6.5

[56] **References Cited**

UNITED STATES PATENTS

3,438,142	4/1969	Krutein	37/58 X
3,624,932	12/1971	Doyle	37/55
1,447,553	3/1923	Hudson	43/6.5
3,462,858	8/1969	Francklyn	37/55
3,160,966	12/1964	Skakel	37/60

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[57] **ABSTRACT**

Biological and geological specimens are collected from the water, floor, or sub-floor of a waterway by the use of a surface craft carrying a water tank which is open to atmosphere and which is mounted for downward movement into partial submergence in the waterway, the water tank having an intake opening adjacent its bottom and an exhaust conduit which is in adjacent but spaced relationship with respect thereto. Both the intake opening and the exhaust conduit communicate with the water at a level which is lower than the normal level of the surface of the water therein when the water tank is in its lowered position. A flexible conduit extends downwardly from the intake opening of the water tank to a point which is at or adjacent the locale of the specimens to be collected. The intake port of a suction pump carried on the surface craft communicates with the exhaust conduit of the water tank. The foregoing arrangement permits the establishment of a head in the water tank which is of sufficient magnitude to enable water to continuously flow upwardly through the flexible conduit and into the water tank and out of the exhaust conduit of the latter. An upwardly inclined perforate endless belt conveyor is disposed with its lower end between and below the intake opening of the water tank and the adjacent end of the exhaust conduit therefor. The upper end of the upwardly inclined perforate endless belt conveyor projects upwardly beyond the upper end of the water tank; and a collection device on the surface craft collects specimen which are retained on the upper flight of said conveyor as it approaches or arrives at the upper limit of its travel.

1 Claim, 6 Drawing Figures

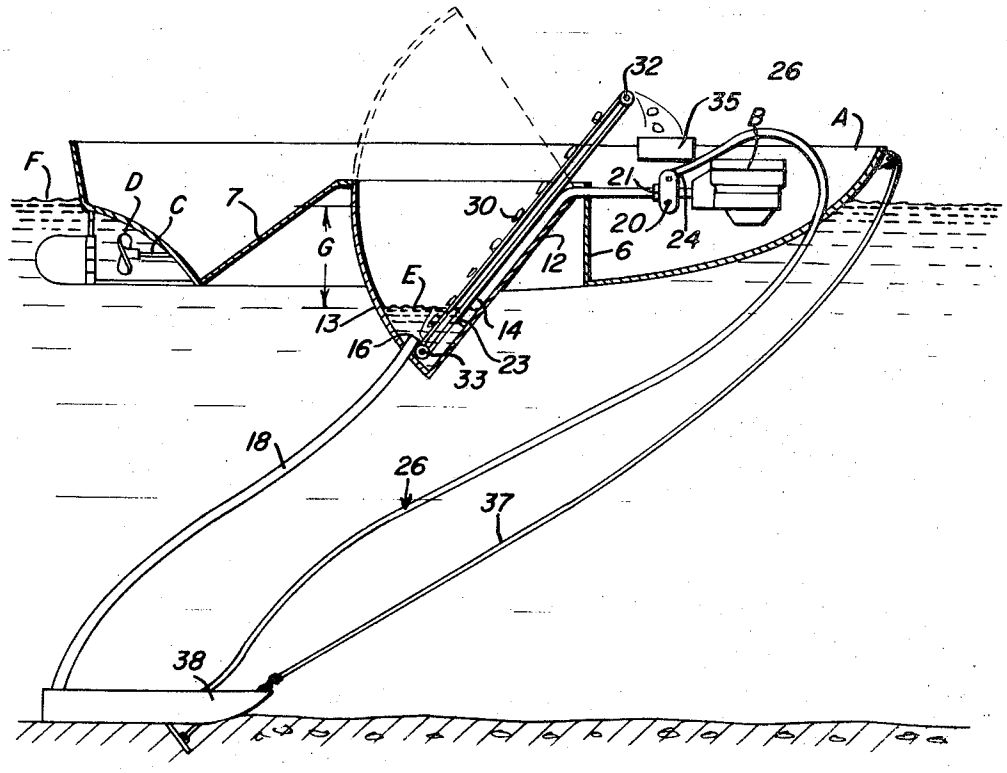


Fig. 1

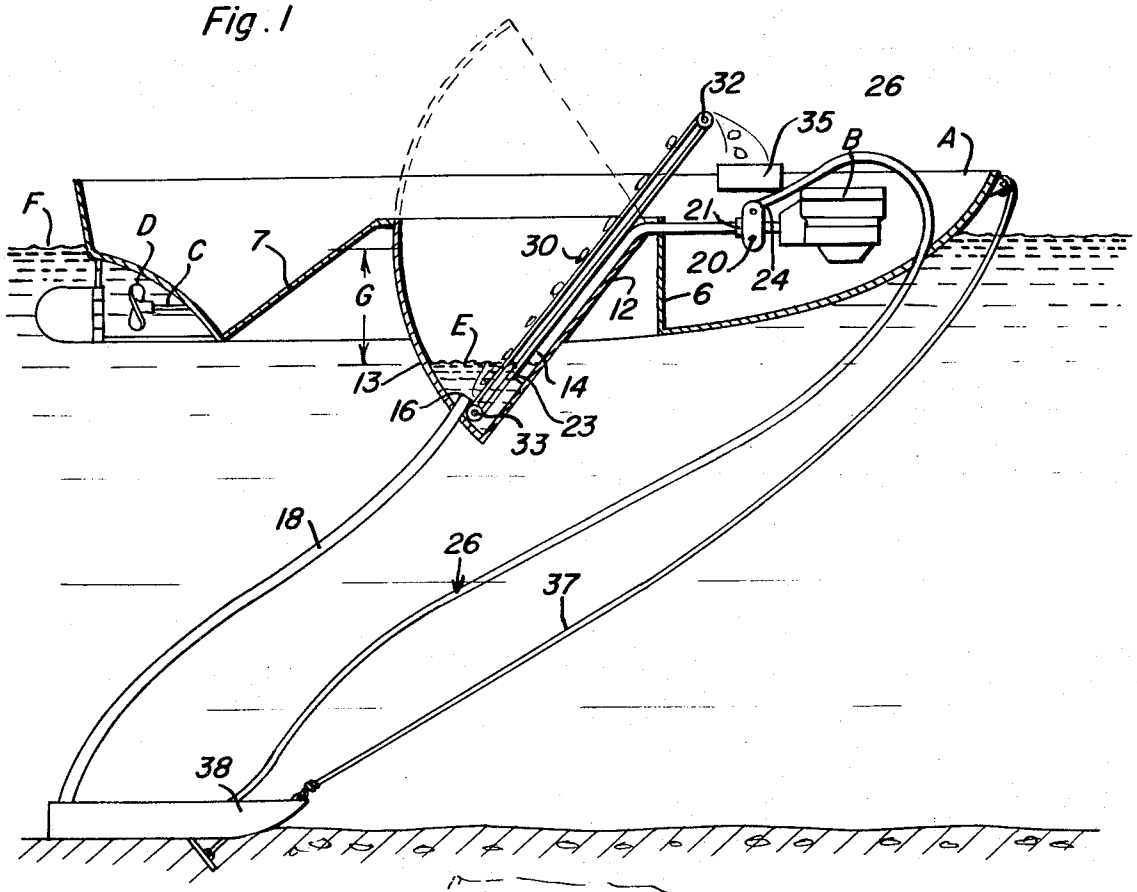
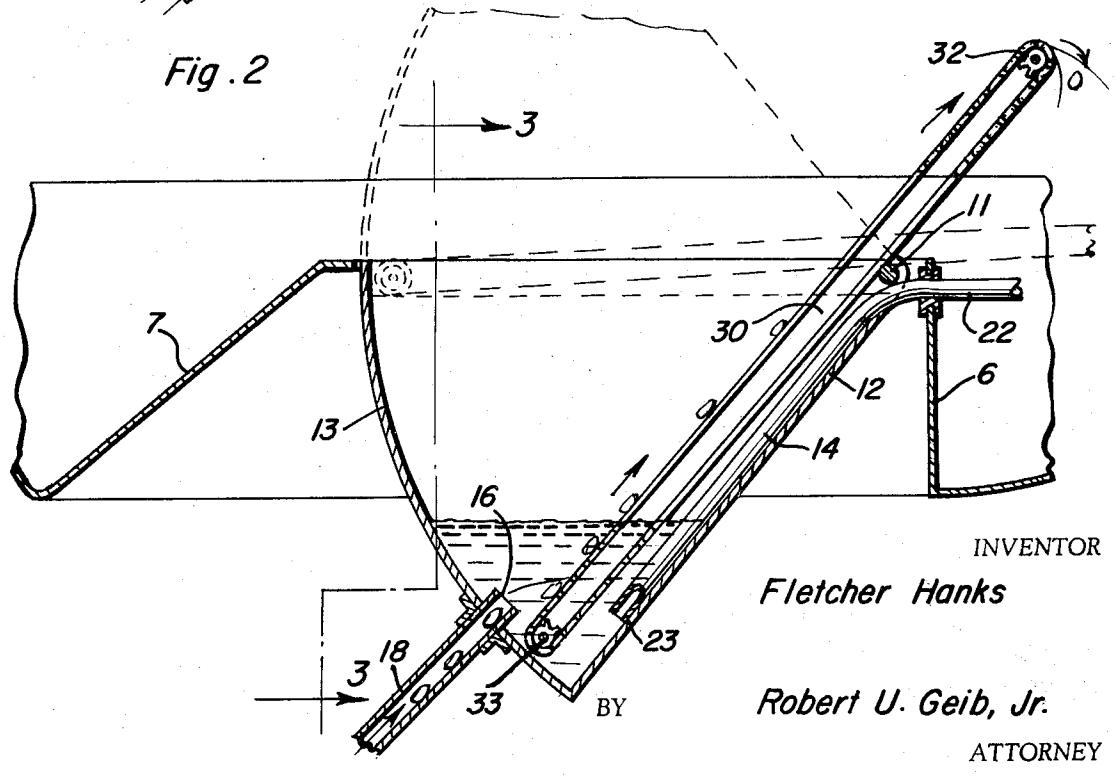


Fig. 2



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Fig . 3

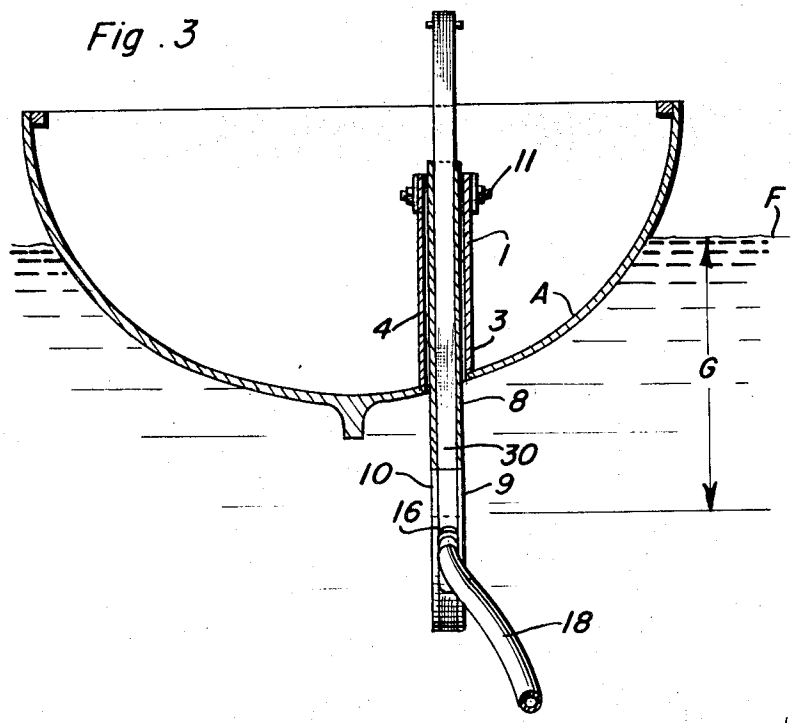


Fig . 4

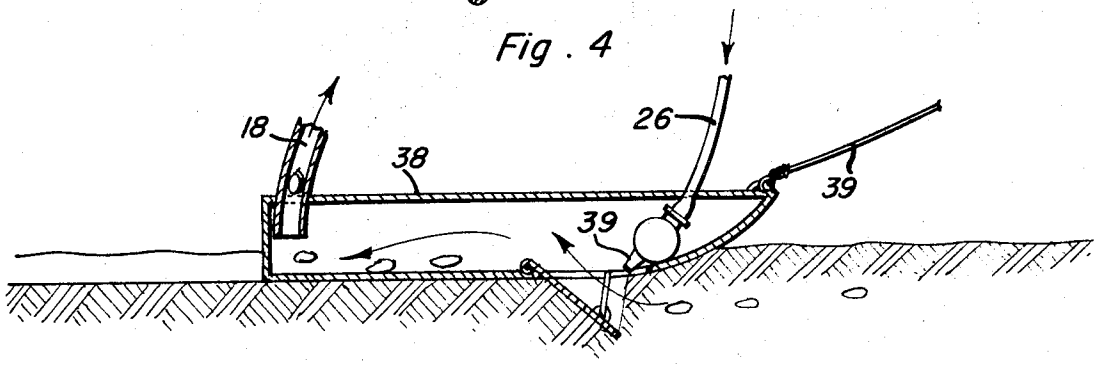
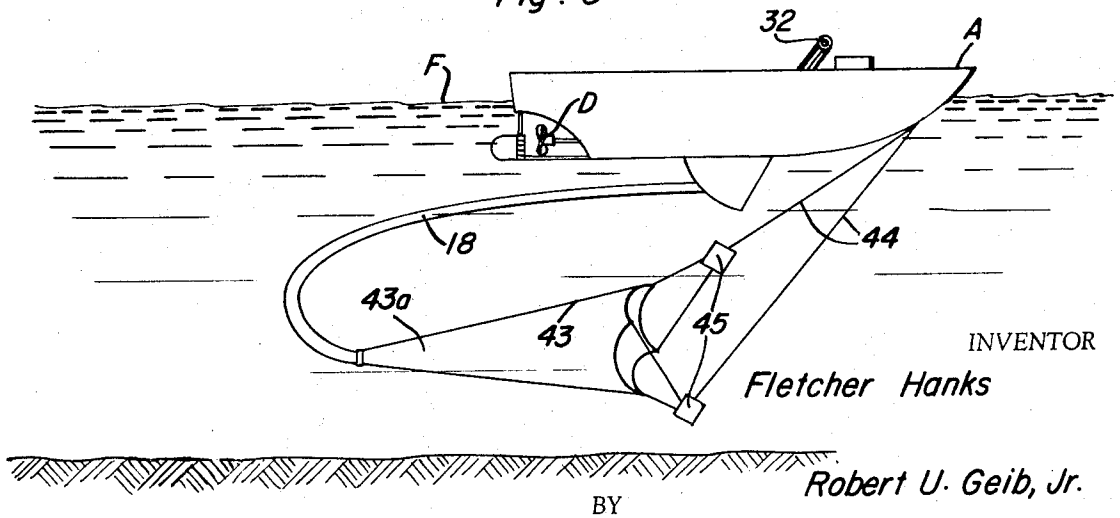


Fig . 5



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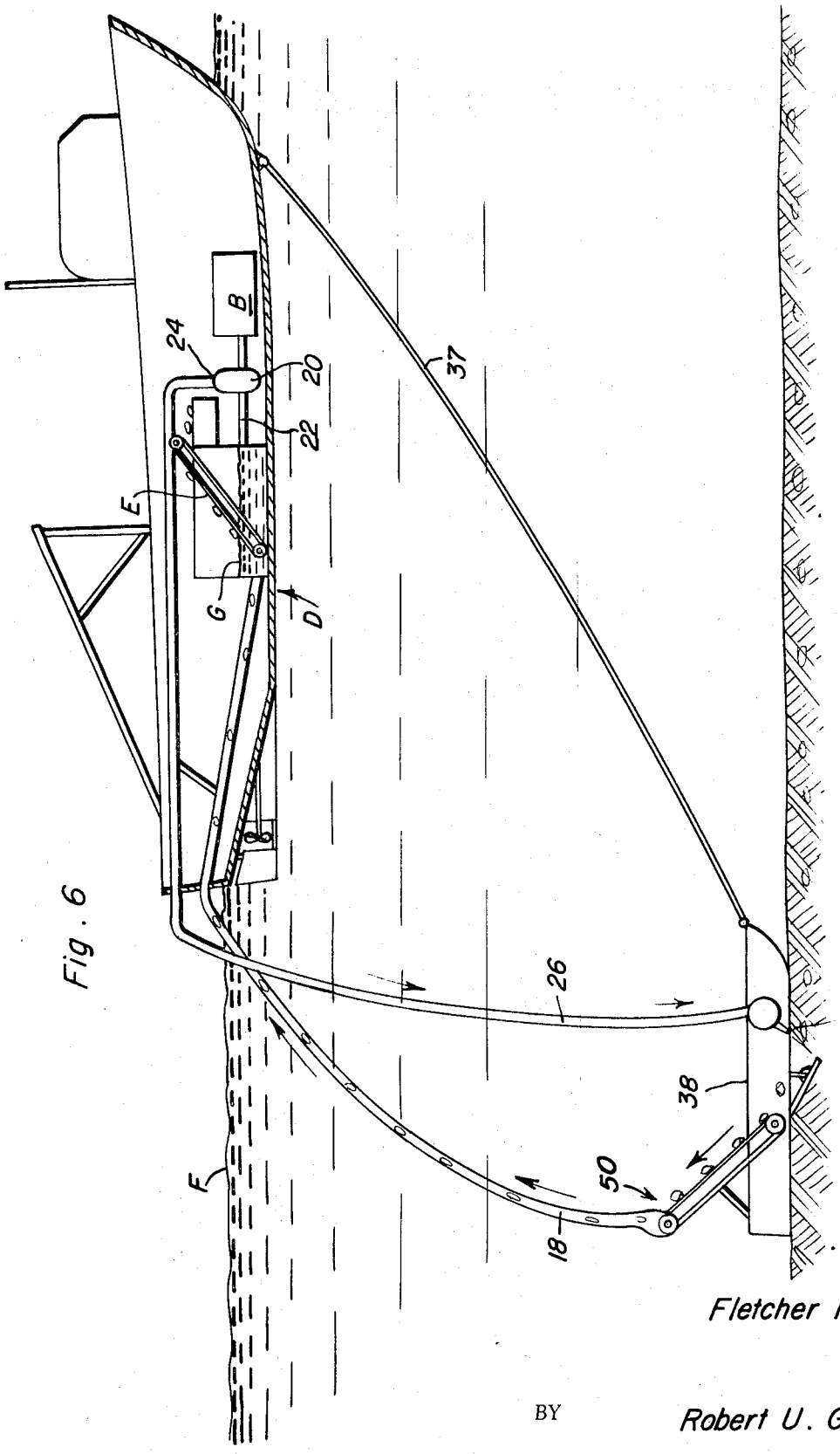


Fig. 6

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APPARATUS FOR COLLECTING SPECIMENS

It is, of course, well-known that in the water and on the floors, or in the sub-floors, of certain bodies of water, or waterways, significant quantities of biological and geological specimens exist; such as shellfish, lobsters, shrimp, fish, scallops, nodules of valuable ores and so forth.

However, the harvesting or collecting of such specimens and marine nutrients have presented numerous difficulties. Some of the methods employed are cumbersome and awkward, or the apparatus expensive and inefficient.

It is among the objects of the present invention to harvest or collect specimens of the type referred to and marine nutrients of various kinds in a manner which is highly efficient and which may be practiced with apparatus which is relatively simple and inexpensive to manufacture, install, operate, and maintain.

The foregoing and other objects and advantages will become more apparent after referring to the following description and annexed drawings in which like reference numerals designate like parts, and wherein:

FIG. 1 is a schematic elevational view of a form of apparatus which embodies the teachings of the present invention;

FIG. 2 is an elevational view, on an enlarged scale, of a portion of the apparatus of FIG. 1, e.g., the retrieval tank and well therefor which will be fully described hereinafter;

FIG. 3 is an elevational view of the stern of a boat carrying the novel apparatus;

FIG. 4 is an enlarged view of a dredge which may be utilized to collect biological and/or geological specimens from the water, the floor or sub-floor of a waterway preparatory to their being pulled by suction upwardly into the retrieval tank;

FIG. 5 is an enlarged view illustrating a net or trawl which may be utilized with the apparatus of the invention; and

FIG. 6 is a view which is similar to that of FIG. 5 but illustrating the employment of an endless conveyor between the trailing end of the dredge and the lower end of the suction pipe.

Referring more particularly to the drawings, the letter A generally designates a marine vessel in the form of a boat which is powered by the usual internal combustion engine B through propeller shaft C and propeller D.

Slightly offset with respect to the axis of the propeller shaft C, and in parallelism therewith, is a well 1 which is generally rectangular in plan and which embodies parallel side walls 3 and 4 and front and rear (or fore and aft) right-angularly extending end walls 6 and 7; much in the manner of the well for a centerboard which is used on various types of sailboats.

Disposed in the well 1 is the retrieval tank of the apparatus of the invention which is generally indicated at 8, the same comprising a pair of parallel side walls 9 and 10 which are substantially triangular when viewed in elevation, forwardly inclined, and which are pivotally connected at their apices to the side-walls 3 and 4 of the well 1 adjacent their forward, or front, ends as indicated at 11.

The edges of the bottom, or lower side edges, of the parallel side walls 9 and 10 of the retrieval tank 8 are closed by a closure strip or plate 12; and a generally similar strip or plate 13 closes the rearward or sternwise edges of the parallel side walls 9 and 10, or base of the forwardly inclined triangular formation, which, as shown are curvilinear.

The upper edges of the parallel side-walls 9 and 10, or other side of the forwardly inclined triangular formation, are unclosed, and remain open.

Disposed to extend practically co-terminously along the retrieval tank 8, and in close parallel adjacency with respect to the closure strip or plate 12, is a conduit 14 which has its lower end 23 extended enough to maintain the desired level of water in the tank and extends forwardly to a point which is at least slightly beyond the point of pivotal connection 11 of the retrieval tank with the forward ends of the side-walls 3 and 4 of the well 1.

Adjacent the lowermost end of the curvilinear strip or plate 13, at the rearward or most sternward end of the retrieval tank 8, is an intake port 16 to which there is attached the upper end of a flexible conduit 18. The lower end of this flexible conduit 18 extends downwardly in the waterway to the locale of the specimens to be collected.

Disposed in the hold of the boat A, and forwardly of the well 1 and (triangularly-shaped) retrieval tank 8 is a suction pump 20 having an intake port 21 which is connected by a conduit 22 to the forward end of the aforementioned conduit 14.

The suction pump 20 may be powered through a driving connection with the internal combustion engine B or by totally independent means, as desired.

The outlet or exhaust port 24 of the suction pump 20 is connected to a flexible conduit 26 which may function in one of several different ways as will be described hereinafter.

Disposed in the retrieval tank 8 is a perforate endless belt conveyor generally indicated at 30 which embodies a mesh fabric of stainless steel or other suitable material and which is trained around lower and upper rollers 32 and 33 which are journaled in, and supported by, the parallel side walls 9 and 10. As shown in FIGS. 1 and 2 the lower end of this perforate endless belt conveyor 30 extends downwardly into the retrieval tank 8 between the rearward, or sternward, end of the conduit 14 and the relatively adjacent intake port 16 of the retrieval tank.

The upper roller 32 of this perforate endless belt conveyor 30 is suitably driven either through a power connection with the internal combustion engine B or independent means (neither of which is shown).

The upper end of the perforate endless belt conveyor 30 projects upwardly beyond the water tank 2 and terminates above a collection device 35.

With the pivotally mounted water tank 8 in its lowermost position with respect to the well 1, and with the level of the water in the retrieval tank at about the level indicated at E, a head of water will be established as represented by the distance G which is between E and the level of the surface of the waterway (sea level) which is indicated at F.

Of course, the greater the distance G between the levels of the water in the retrieval tank and the surface of the waterway, the greater will be the head and it must be sufficient to at least overcome the friction in the flexible conduit 18. Therefore, it is important that the generally triangularly shaped retrieval tank 8 be lowered sufficiently to develop a head in the retrieval tank 8 that will overcome the friction in the flexible

conduit **18** and develop a velocity of the water through the flexible conduit **18** to prevent the desired material from falling out of solution because of the difference of the specific gravity of the desired material and the water.

The operation of the suction pump **20** maintains the level E of the water in the retrieval tank **8** at the desired low position.

It will be understood that with the low level of water in the triangular (as viewed in elevation) retrieval tank, and the relatively light weight of the perforate endless belt conveyor **30** and its connecting driving instrumentalities, results in considerable buoyancy; and accordingly means are provided for holding the retrieval tank at the desired low level.

A device for achieving the immediate foregoing may acceptably take the form of a curvilinear rack which is secured to the curvilinear rearward, or sternwise, strip or plate of the retrieval tank and which is driven through a gear by a hand-operated crank mechanism which is secured to the rear end wall of the well **1** in which the retrieval tank is disposed. It is believed that such elements are sufficiently well-known for raising and lowering purposes as not to require illustration in the drawings.

This hand-operated crank mechanism may be effectively used in both lowering and raising the retrieval tank **8.**

Alternatively, various other types of hand-operated means may be employed; or power means where necessary or desirable.

The well **1** is of sufficient length to permit the curvilinear rearward or sternward end of the retrieval tank **8** to be raised sufficiently above the level of the water in the well to permit the attachment of the flexible conduit **18** to the intake port **16.**

Since the well **1** is open at the bottom the level of water therein will naturally be the same as the level of the surface F of the waterway.

Also, the greater the distance between the level E of the water in the retrieval tank **8** and the level F of the waterway (sea level) the greater the velocity of the water coming up the flexible conduit **18** and through the intake port **16.**

If the head G, which causes the velocity is great enough, the water rising through the flexible conduit **18** and passing through the intake port **16** of the retrieval tank **8** will carry the sought-after biological and geological specimens which were below sea level, or on the bottom or sub-bottom of the waterway; such as shellfish, lobsters, shrimp, fish from a fish trawl, scallops, nodules of ore containing valuable metals, etc.

It is found that an object that is in a pipe carrying a liquid that is travelling six times the rate at which the object falls free, due to gravity, through that liquid, it will continue to travel through the pipe, although the pipe might be at any attitude, without falling out of solution. For example, a surf clam, with specific gravity of 1.5, that falls free at the rate of 1.25 feet per second in sea water, will not fall out of solution (collect on the bottom side of a horizontal pipe) providing the velocity of the liquid through the pipe is six times the free fall rate of the surf clam, i.e., $1.25 \times 6 = 7.5$ feet per second velocity of water through the pipe to keep the surf clams from falling out of solution and clogging-up the pipe.

In most cases it will, of course, be necessary to discard some of the material that moves up the flexible conduit **18** and enters the intake port **16** adjacent the bottom of the retrieval tank **2** when in its operative position. Also, there is usually a limitation as to the size of solids a suction pump can safely accept.

Accordingly, the positioning of the bottom of the perforate endless belt conveyor **30** adjacent the lowermost portion of the retrieval tank **8,** and between the intake port **16** and the adjacent lower end of the conduit **14** permits the upper flight of the conveyor belt **30** to move everything which is of larger diameter than the size of the openings or interstices of the mesh or fabric, and that would damage the pump impeller, to move upwardly therealong and be dropped from the upper end thereof into the collection device **35.**

Thus, the desired biological and/or geological specimens, along with the solids of undesirable size for the suction pump **20,** may be separated while at the collection device **35,** or moved therefrom by another endless belt conveyor (not shown) for separation at another location.

Some biological and geological specimens to be harvested by the method of the invention will be easily damaged if forced against the mesh of the fabric of the perforate endless belt conveyor **30;** and accordingly the fabric of the belt must provide enough area so that the velocity of the water through it is slow enough not to create damage.

Referring to the previously given example with respect to surf clams which free fall through sea water at 1.25 feet per second, it is found that they do not suffer damage when striking one another at that velocity.

The area of the perforate endless belt conveyor **30** which is below the level of the water in the retrieval tank **2** should be in excess of the cross-sectional area of the flexible conduit **18** and intake port **16** in the retrieval tank so that the surf clams do not break when hitting the belt. In a 12-inch flexible conduit at the velocity of the water moving therethrough with the surf clams etc. into and through the intake port **16** is 8.6 feet per second. The cross-sectional area of the flexible 12-inch conduit is 127.43 square inches.

Accordingly, the area of the surface of the mesh-type fabric of the perforate endless belt conveyor should be at least as great as x in the following equation, wherein x equals the area of belting under water that will reduce the rate of water through it to the free fall rate of the surf clam:

$8.6/1.25 = x/127.43$ or $x = 876.7$ square inches

The pressure line or flexible conduit **26** which communicates with the exhaust port **24** of the suction pump **20** may be used to agitate the bottom of the waterway and expose sub-surface specimens to the action of the flexible conduit or suction hose **18.** Also to clear out the latter whenever required by back flushing it.

In FIG. **4** of the drawings, the lower end of the flexible conduit **18** (suction hose) is shown as connected to the rearward, or sternward, end of a dredge **38** which is dragged along the surface of the bottom of the waterway by means of a cable **39** which is suitably connected to the boat A. The lower end of the flexible conduit **26** which is connected to the exahust port **24** of the suction pump **20** may be advantageously connected to a jet or to a series of jets **39** which are mounted adjacent the forward end of the dredge **38** or into the bottom

thereof for agitating the bottom of the waterway to expose biological or geological specimens.

The blade on the dredge **38** may be satisfactorily raised and lowered to whatever extent is desired by a conventional fluid cylinder and piston arrangement.

On the other hand, some applications of the invention do not require the use of the pressure line or flexible conduit **16** which connects with the exhaust port **24** of the suction pump **20.** When dragging with a net or trawl **43,** as shown in FIG. **5,** for lobsters, scallops, shrimp, fish, etc., water pressure on the bottom or subbottom of the waterway is not necessary. In such operations the specimens are collected by the net or trawl **43** as it passes over the bottom.

In the employment of conventional nets or trawls the shellfish are frequently damaged; and, accordingly, it is desirable to remove them from the net or trawl as soon as possible.

By having the lower end of the flexible conduit (or suction line **18**) of the invention attached to the cod end **43***a* of the net or trawl **43** (as shown in FIG. **5**) the shellfish, fish, etc. can be retrieved within seconds of the time they enter the net. Thus, the net or trawl **43** remains in an unloaded condition so that the speed through the water remains constant and more favorable for fishing.

The modification of FIG. **5** of the drawings comprises apparatus for retrieving fish from a mid-water trawl; that is, catches fish that are off the bottom and sometimes are actually on or very near the surface of the water. According to this embodiment the flexible conduit or suction hose **18** is connected at its upper end to the retrieval tank (as in the case of the earlier embodiments) but the lower end thereof is connected to the cod end of a net or trawl **43** which is connected at its leading or forward open end to supporting cables **44** which are attached to the marine vessel A adjacent the bow thereof. If desired, the supporting cables **44** may be provided with otter boards **45.**

Referring to FIG. **6,** an upwardly and rearwardly inclined endless belt conveyor **50,** which may be of entirely conventional design, is attached to the trailing end of the dredge **38** and delivers material on the upper flight of the endless belt conveyor to the lower end of the suction pipe **18.** This endless belt conveyor may be driven in any suitable manner, such as by means of a conventional hydraulic motor and the angularity thereof adjusted by a conventional fluid cylinder and piston arrangement.

While the retrieval tank **8** (which is substantially triangular when viewed in elevation and pivotally mounted for upward and downward movement somewhat similar to a centerboard as used in sailboats of various kinds) is particularly well adapted for its intended purpose, the present invention contemplates retrieval tanks of other shapes and suspension; for example, a retrieval tank which is rectangular in plan, elevation and cross-section, and mounted for level upward and downward movement in the well **1** as by means of cooperating nut-and-screw arrangements at the four corners thereof.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. Apparatus for collecting biological and geological specimens from a waterway comprising, in combination,

a surface craft including a hull having an opening in its underside

the hold in said hull having a well which communicates with the opening in the underside thereof

a water tank having a top which is open to atmosphere

the periphery of said water tank being smaller than, but generally conforming to, the periphery of the interior of said well

said water tank being disposed in said well and mounted for downward movement into partial submergence in the waterway and for upward movement therefrom

said water tank having an intake opening adjacent its bottom and an exhaust conduit which communicates with the interior of said water tank and which is in adjacent but spaced relationship with respect to said intake opening

both said intake opening and said exhaust conduit communicating with the water tank at a level which is lower than the normal lever of the surface of the water therein when said water tank is in its partially submerged position

a flexible conduit having one end communicating with the intake opening of said water tank

the other end of said flexible conduit extending downwardly into the waterway to a point which is at or adjacent the locale of the specimens to be collected

a suction pump carried by said surface craft and having intake and exhaust ports

a third conduit establishing communication between the intake port of said suction pump and the exhaust conduit of said water tank

the foregoing construction and arrangement being such that the surface of the body of water in the water tank will be maintained at a level which is below the surface of the waterway; and the application of the suction pump will create a head of sufficient magnitude to enable water to continuously flow upwardly through the flexible conduit and into the water tank

an upwardly inclined perforated endless belt conveyor disposed with its lower end between and below the level of the intake opening of said water tank and the adjacent end of said exhaust conduit

said upwardly inclined perforate endless belt conveyor projecting upwardly beyond the upper end of said water tank and the well in the hold of said hull when said water tank is in its lowermost position

and

a collection device on said surface craft for receiving specimens which are retained on the upper flight of said perforate endless belt conveyor as it approaches or arrives at its upper limit.

* * * * *