A floating power operated vessel designed to collect by suction from the surface of a body of water, as it moves thereover, floating pollutant matter. Adjacent the prow of the vessel is a suction pump compartment and inlet pipes below the water level connected to a suction pump in the compartment. Adjacent the stern of the vessel is a clean water collecting compartment having a discharge pipe adjacent the top thereof and above the water level for discharging the same downwardly onto the surface of the body of water. Between the forward pump compartment and the rear clear water collecting compartment there is provided a series of transversely disposed and longitudinally spaced partitions forming communicating chambers designed to separate by degrees the mass of pollutant matter from the water.

At least one suction swing pipe is pivotally jointed at the prow of the vessel. Formed in the prow is a recess in which the swing pipe is received when raised to its inoperative position. A winch and derrick on the top deck of the vessel is cable connected to the upper free end of the swing pipe. A scoop structure which may be one of a variety of forms and sizes is attached to the upper free end of the swing pipe. The scoop structures are each provided with a forwardly extending blade arranged to lie flat substantially at the surface level of the body of water. Optionally the free end of the swing pipe may be provided with a dredging nozzle and the swing pipe lowered such that the vessel may be converted into a hydraulic suction dredge.
3,651,943

1 POLLUTION SUCTION WATER SWEEPER
This invention relates to an improvement over patent granted to me on invention Suction Dredging Apparatus, patented May 19, 1970, U.S. Pat. No. 3,512,280.

This invention relates to a vessel equipped with a hydraulic suction pollutant collecting matter structure or suction water sweater which is also adapted to operate as a hydraulic suction dredge.

Bodies of water such as harbors, lakes, rivers and even the oceans are today presenting the problem of increasing pollution arising from oil slicks, debris and other collected matter floating on the surface thereof which renders such fouled bodies of water a menace to mankind and the environmental ecology as well as to navigation and the use of such bodies of water for recreation and commerce. Also, the floating pollutant matter is frequently washed ashore or lies at the shore line spoiling beaches, damming and/or killing wild life and generally creating a health menace as well as preventing the use by the public of such areas.

Accordingly, the primary object of this invention is to provide a floating vessel with a suction water sweeping apparatus including a swinging boom which is a suction swing pipe having a swivel joint connection to an inlet pipe of a suction pump, both the suction pump and the swivel joint being at the bottom deck level of the vessel below the water line; the upper free end of the swing pipe carrying a scoop structure having a direct connection to the swing pipe with the scoop structure disposed at the water level to gather thereinto floating pollutant matter and water which under suction is moved therefrom down through the swing pipe and into the hull of the vessel.

A further object of this invention is to form the scoop structure embodying the blade and channel body portion either rectilinear or arcuate, of rigid or flexible material, in one unitary piece or in connected sections with the connecting collar disposed centrally of the channel body portion.

A still further object of this invention is to form the scoop blade and the channel body portion of the scoop structure as an integral unit.

Yet another object of this invention is to pivotally mount the scoop blade at the forward edge of the channel body portion of the scoop structure and to provide float supports for the scoop blade adjacent in the forward free edge.

Another object of this invention relates to forming the scoop structure of separate sections connected together by flexible expansion joints.

Still another object of this invention is to form at the prow of the vessel a forwardly opening recess for receiving the swing pipe when raised to its inoperative position.

A yet further object of this invention is to provide a derrick and winch apparatus on the upper deck of the vessel, cable connected to the swing pipe to raise or lower the same.

Yet another object of this invention is to provide within the hull of the vessel a forward compartment adjacent the prow of the vessel for the suction pump equipment having a rearwardly extending rearwardly located piping of the suction pipe with its swivel connection to the inlet pipe being at the bottom of the prow recess.

A further object of this invention is to utilize a dual swing pipe arrangement swivel connected to a pair of inlet pipes, each of the latter connected to a separate suction pump and the free end of each swing pipe each connected by a collar to the channel body portion of the scoop structure.

Another object of this invention is to provide within the hull of the vessel a series of interconnected pollutant matter separating chambers defined by partition units raised from the bottom deck and each having a forwardly directed and inclined baffle member, the the water with some of the pollutant matter flowing rearwardly successively from one chamber to the other and the separated pollutant matter floating on top of the water above the upper edges of the partitions, the rearmost chamber having a rear bulkhead opening along its lower edge end into a rear clear and/or clean water collecting compartment adjacent the stern of the vessel, the separated pollutant matter accumulating on the surface of the water between the rear bulkhead of the suction pump compartment and the rear bulkhead of the rearmost chamber.

A further object of this invention is to provide at the top of the stern of the vessel a discharge pipe serving to discharge from the top of the clear water collecting compartment, the clear water back onto the surface of the body of water on which the vessel floats.

A still further object of this invention is to adapt the swing pipe for dredging purposes along the bottom of the body of water, the swing pipe carrying a dredging head or nozzle and having mounted thereon adjacent the dredging head or nozzle, a water sealed cabin for an operator therein to control by suitable electric controls and communication the movement of the swing pipe and/or the vessel, the cabin being further equipped with the necessary oxygen supply lines and other accommendations for the supply of the operator.

Further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that changes may be made in the specific construction illustrated and described within the scope of the appended claims.

In the drawings:
FIG. 1 is a side elevational view of a vessel equipped with one form of suction water sweeper.
FIG. 2 is a partial longitudinal cross-sectional view of the forward part of the vessel showing the swing pipe of the suction water sweeper in its inoperative raised position and some of its associated operating mechanism.
FIG. 3 is a plain view of the scoop or head of the suction water sweeper.
FIG. 4 is a cross-sectional view of the scoop taken on line 3–3, FIG. 3, showing details of construction.
FIG. 5 is a cross-sectional view similar to that of FIG. 4 of a modified form of scoop.
FIG. 6 is a detail cross-sectional view taken on line 6–6, FIG. 2, showing the forward recess in the prow of the vessel and the swivel mounting of the single swing pipe to the suction inlet pipe.
FIG. 7 is a lower elevational view of the prow of the vessel showing the forward recess in the prow and the placement of the swing pipe therein.
FIG. 8 is a fragmentary plain view partly in section of a dual suction swing pipe arrangement, the swivel mounting of each to a separate inlet pipe and the dual recesses in the prow of the vessel each receiving a swing pipe therein.
FIG. 9 is a plain view of a scoop or head of arcuate shape utilized with the dual suction swing pipe arrangement of FIG. 8.
FIG. 10 is a cross-sectional view taken on line 10–10, FIG. 9 of the arcuate scoop.
FIG. 11 is a detail fragmentary plain view of an arcuate scoop formed in sections showing a flexible expansion joint connecting adjacent sections.
FIG. 12 is a cross-sectional view taken on line 12–12, FIG. 11.
FIG. 13 is an elevational view of the vessel showing in slotted lines the baffle forming chambers and compartment arrangement for separating the collected pollutant matter from the water and the discharge of clear water.
FIG. 14 shows the swing pipe of FIG. 1 provided with a dredging head, and an operator cabin mounted on the swing pipe adjacent the dredging head.
FIG. 15 is a cross-sectional view similar to that of FIG. 10 of a modified form of arcuate scoop.
Referring to the drawings in detail, 10 denotes a dredging vessel of any desired type and size having a hull 12, a prow 14 and a stern 16. Included in the hull 12 is a bottom deck 17 and a top deck 18. Arranged at the forward end of hull 12 is a compartment 20 having a rear bulkhead 21 that is water sealed with respect to the top and bottom decks and the side
walls of the vessel. If desired compartment 20 may be divided by a wall 21a to form a separate compartment 22, that may serve to contain not only connecting sections of the inlet pipes 25, but also sundry equipment, supplies, etc. Provided in compartment 20 are one or more suction pumps 24 having an intake pipe 25 and an outlet pipe 26.

The prow 14 of the vessel is provided for its entire extent with a forwardly opening recess 28 for a purpose to be hereinafter described. The lower end of the recess being widened as at 29, see FIGS. 6 and 7. The rear wall 30 of the wide lower end 29 of recess 28 is vertical and is provided with a pair of laterally spaced openings 32, 33, preferably equally spaced from the longitudinal medial vertical center plane of the vessel, see FIG. 6. Pipe elbows 35, 36 which are identical in shape and size, having rear flanges 37 and integral nipples 38, are positioned in lower prow recess 29, the nipples 38 extending into openings 32, 33 with the flanges 37 abutting wall 30 and welded thereto as at 39 in water sealed relation. A collar 40 is securely fitted on each nipple 38 and is in turn welded in water sealed relation to the rear side of wall 30 as at 42. Each inlet pipe 25 has an end flange 43 which is secured to collar 40 by bolts 44. Suitable pipe flanges or gasket means (not shown) is provided between flange 42 and collar 42 to insure a water tight seal.

The pipe elbows 35, 36 are provided with outer flanges 46 arranged to lie in parallel opposed relation, the elbows and flanges 46 being internally machined to form co-axial cylindrical bores, see FIG. 7. A suction swing pipe 50 of elongated length corresponding substantially to that of prow 14, see FIG. 2, is formed at its lower end with a T-formation 51 provided with terminal flanges 52 and integral trunnion sleeves 54. The trunnion sleeves 54 extend into bearing bores 47 of elbows 35, 36 with the flanges 52 abutting the facing of elbow flanges 46, such that the swing pipe 50 is swivel mounted to the intake pipe elbows 26, 36 for swinging movement about a transverse axis in the directions shown by arrows A, B, see FIG. 2. As seen in FIGS. 2 and 6, the swing pipe 50 and is lower swivel connections to the intake pipes 25 are wholly contained within the prow recesses 28, 29 when the swing pipe 50 is in its raised inoperative position; the swing pipe 50 moving downwardly out of the prow recess 28 when lowered to an operating position.

Adjacent the upper free end of the swing pipe 50 is a collar 56 securely clamped thereto and provided with an eye 57. Mounted on the top deck 18 adjacent the prow 14 is a power operated derrick 60 having a pivoted forwardly directed pivoted boom 61 and a power operated winch 62 for raising or lowering the boom 61 by means of cable 63. An additional power operated winch 66 through cable 67 which passes through pulley block 68 on the derrick boom 61 and secured to eye 57 of collar 56 operates to raise or lower the swing pipe 50. It is to be noted that due to the normal rearward inclination of the prow 14 and recess 28, that the swing pipe 50 in its raised inoperative position is similarly inclined, and that paying out of cable 67 will under gravity action a lowering of the swing pipe 50 (the swivel axis thereof lying will behind the connection of cable 67 to eye 57 of collar 56).

The derrick and dual power operated winch for raising and lowering of the derrick's boom and for raising and lowering the swing pipe is similar to that shown in my above applied for Dredging Apparatus, Ser. No. 675,102, filed Oct. 13, 1967, allowed Dec. 4, 1969, patented May 19,1970, M. S. Pat. No. 3,512,280, Group 337, Class 037/057.

The dual inlet pipe arrangement shown in FIG. 8 is similar to the dual inlet dredge pipe construction shown and described in my above referred to co-pending application. In this form of construction the prow of the vessel is widened and constitutes the forward wall 70 of the inlet pipe compartment 22 which is provided with a projecting medial bar or rib 71. The forward wall 70 is formed to provide two laterally spaced suction swing pipe receiving recesses 73, 74 equally spaced from the longitudinal medial vertical center plane of the vessel each somewhat similar to the recess 28, 29 of FIG. 2. The two swing pipe recesses are identical and each defined by opposed vertical side walls 76, 77 and a rear wall 78, which walls constitute an integral part of the hull structure. Suitably mounted in each of the recesses such that the lower end thereof is a support bearing 80 each rotatively supporting one end of a swivel pipe 81. A swing pipe 83 (similar to swing pipe 50) has formed at its lower end a T-formation 84 and is secured by its end flanges 85 and bolts (not shown) to the abutting flanges 86 at adjacent outer ends of swivel pipes 81. Thus raising or lowering of the swing pipes 83 will cause turning of the swivel pipes 81 in their support bearings 80. The support bearings 80 include a suitable packing structure (not shown) such as is well known in marine construction to prevent entry of water through the bearings into compartment 22. Each suction swing pipe 83 delivers through swivel pipes 81 to a pair of inlet pipes 88. Elbows 89 are secured to each inlet pipe 88, and each elbow at its free end is provided with a bearing flange 90 and bored dimensioned to receive in bearing relation the free end of an associated swivel pipe 81, in the manner described above with reference to the bearing support of trunnion sleeves 54 in elbows 35, 36, see FIG. 6. The bearing elbows 89 and inlet pipes 88 are finally position in any desired manner (not shown) to the bottom deck 17 of the hull.

The bearing flanges 90 include a suitable packing construction (not shown) to provide a water tight seal. Both swing pipes 83 are connected at their free ends by a suction scoop structure (to be hereinafter described) and move in unison as a single swinging scoop. A yoke arrangement (not shown) such as is described in my aforesaid co-pending application is provided to which the cable 67 of winch 66 is secured for raising or lowering the dual swing pipes, 83.

FIGS. 3 and 4 illustrate one form of suction scoop 94 for use with the single suction wing pipe 50, the suction scoop 94 may be formed rigid of a non corrosive metal or it may be formed of a flexible non-metallic material such as plastic impregnated bonded fabric layers, synthetic reinforced rubber, etc., impervious to the effects of salt water and able to withstand heavy usage. In the form shown in FIGS. 3 and 4 the suction scoop 94 is seen to consist of an elongated rear channel portion 95 arcuate in transverse-cross section with an upper free edge 96 and a lower forwardly positioned edge 97, both edges being parallel and spaced apart a sufficient distance to provide a large elongated forwardly facing opening 98, permitting the ready entry into the channel portion 95 of a variety of pollutant matter. The upper edge 96 preferably lies rearwardly of the lower edge 97, and extending upwardly from the upper edge 96 is an integral plate 99 strengthened against rearward movement by transversely spaced integral brace members 100. Extending forwardly of lower edge 97 of channel portion 95 and integral therewith is a flat scoop blade 102 of any desired width. In the form of scoop structure 94 illustrated the same is shown to be made of a flexible self sustaining material. In order to insure an added degree of rigidity for the blade 102, the same may be reinforced by metal rods 103 embedded therein which rods may also be somewhat resilient. Each open end of the channel portion is provided with an inwardly directed radial flange 104 to which is secured by rivets 105, and end closure plate 106. Centrally of the channel portion 95 is an opening 98 there is provided a rear circular opening 110. Extending rearwardly from the end of opening 110 at a downwardly inclined axis and forming a recessed part, integral with or otherwise, on a corrugated neck 111 of short length provided at its rear edge with a radial outer flange 112. Swing pipe 50 is provided at its upper free edge with a corresponding flange 113. Bolts 114 (only one being shown) secure flanges 112, 113 together, there being between the same suitable gasket means (not shown). Corrugated neck 111 serves to provide a shock absorbing connection between the suction scoop 94 and the swing pipe 50 as well as providing for angular movement relative to the swing pipes 83. In use, the suction scoop 94 is free to give under impact and/or overloads or pressure preventing breakage of the scoop connection and/or damage to the swing pipe 50.
In the operation of the suction water sweeper, the swing pipe 50 is lowered to the point where scoop blade 102 lies at or slightly below the water level. The vessel 10 may be moving slowly forward. Pollutant matter floating on the surface of the water, such as an oil slick, miscellaneous debris, garbage, dead fish, birds, etc., is moved rearwardly with water on the blade 102 through front opening 98 into the channel portion 94 by suction set up by the suction pumps in operation as well as by the forward movement of the vessel as the scoop blade moves into the pollutant matter beneath the same, see FIGS. 1 and 4. Any pollutant matter that striked the deflector plate 99 falls downwardly either into the channel portion or back onto the scoop blade 102. The mixture of pollutant matter and water in channel portion 94 is by suction drawn through rear opening 110 into the neck 111 and downwardly through swing pipe 50 for discharge from the suction pump outlet pipe 26. The terminal portion of the outlet pipe 26 extends through an opening 116 in rear bulk head 21 into a chamber to be hereinafter described. Flanged collars 117, 118 rigidly secured by bolts 119 the terminal end of outlet pipe 26 to the bulk head 21 in water sealed relation. Preferably the outlet pipe extends through the lower end of bulk head 21 though in some cases it may be desired to have the same 26a extend through the upper end of the bulk head 21 (as shown by the dotted lines, FIG. 2) for discharge of collected pollutant matter such as crude oil and water.

Except for the space required for the operating machinery of the vessel, fuel and storage within the hull 12 (not shown), and the space it is sealed off in water tight relation from the remainder of the interior space forwardly enclosed by open (see FIG. 13) spaced forwardly of the stern 16 of the vessel is a bulk head 121 having its lower edge spaced from the bottom deck 17 to form an opening 122, the sides and top edge of bulk head 121 being secured in water tight relation to the sides and top edge of the hull to form a clean or/and clean water collecting compartment 123.

Dividing the entire interior hull space into separating chambers between front bulk head 21 and rear bulk head 121 are upstanding transverse partition walls 126, 127 and 128 each substantially of the same height with their lower edges spaced from the bottom deck 17, to respectively provide openings 122, 130 and 131. The partition walls are each at least half the height of the bulk heads to provide an uninterrupted collecting space 132 for the pollutant matter which floats on the surface of the water therein. Each partition wall at its lower edge is provided with a forwardly downwardly inclined baffle deflector plate 134. A similar downwardly inclined baffle deflector plate 135 is provided at the lower edge of rear bulk head 121. The partition walls along with the front and rear bulk heads 21 and 121 provide a series of pollutant matter separating chambers C,D,E and F. Thus the discharge into the first chamber C from outlet pipe 26 of pollutant matter and water, there will be an initial separation between the pollutant matter and the water with the former rising to the top to collect on the surface of the water, the first baffle deflector 134 holding back in chamber C the larger debris and allowing only smaller debris to flow with the water through opening 122, in a like manner each of the succeeding chambers D,E and F will hold back and separate the pollutant matter from the water so that water flowing through opening 122 at the rear bulk head 121 will be substantially entirely free of all pollutant matter and collected in collecting compartment 123 as clear and/or clean water. An outlet water discharge 130 from the top edge of the vessel at the upper part of the compartment 123 of inverted U-shape will discharge the collected clear and/or clean water from the compartment 123 downwardly onto the surface of the body of water on which the vessel is operating.

Should the pollutant matter be an oil slick (generally formed by crude oil) it is desirable that the discharge end of suction pump outlet pipe 26 be located at the upper end of front bulk head 21 as at 26a, see FIG. 13, to discharge the oil and water into compartment C. There will be successive separation of the oil and water in chambers D, E and F with the oil accumulating on the surface of the water.

When the depth of the accumulated pollutant matter in space 132 reaches the upper edges of the partition walls 126, 127, 128 the suction operation is stopped and the vessel proceeds to a location for receiving the accumulated or collected pollutant matter. The amount of pollutant matter collected in the vessel is considerable and increases with the size of the vessel.

To further insure the collection of clear and/or clean water in compartment 123 it may be desirable to provide a screen (not shown) across the bottom opening 122 of rear bulk head 121.

The crew of the vessel may be housed in cabins 140, 141 located on the top deck 18.

A modified form of suction scoop structure is shown in FIG. 5. In this construction, the scoop 150 includes a rear channel portion 151, corrugated neck 152 with flange connections 153, 154, upstanding deflector plate 155, and circular end closure plates 156, all similar to that of the channel portion of scoop 94 of FIGS. 3 and 4, and formed of a like flexible material. At the forward edge 157 of the channel portion 151 there is provided a hinge connection 158 for a rigid metal scoop blade 160 to provide for up or down position of movement of the scoop blade with relation to the channel portion 151. This movement is desirable in view of variations in the position of the swing pipe 50, the degree and nature of the pollutant matter and the surface movements of the body of water. Such longitudinal side edge of the scoop blade 160 there is provided an upstanding side wall 161 that tapers towards the front edge of the scoop blade 160 with the rear portion 162 of the side walls extruded rearwardly beyond the front edge 157 of the channel portion in overlapping relation interiorly of the end closure plates. On the underside of the scoop blade 160 and adjacent to the forward edge thereof there is provided at least a pair of depending brackets 163 each disposed adjacent a side wall 161. Viscous to each bracket 163 as at 164 is fastened to any of said size and configuration such as to maintain the front of the scoop blade 160 at the water level due to variations in the position of swing pipe 50 when in its operative position, see FIG. 1. The pivotal action of the scoop blade 160 will also accommodate the same under shock and sudden loads of pollutant matter received therefrom, thus avoiding stress and strain on the scoop blade if it were fixed to the channel portion as in FIGS. 3 and 4 and thus liable to break the same, as well as stress and strain on the scoop proper, corrugated neck, swing pipe and manipulating cable.

FIG. 9 illustrates an accurate formation of scoop suction structure for use with the dual swing pipe construction of FIG. 8. As with the suction scoop structure 94, FIGS. 3 and 4, the suction scoop 170 of FIG. 9 may be made of a non-corrosive metal or of a like flexible non-metallic self sustaining construction, and of any desired arcuate shape, in plan, much as part circular or part elliptical. In the constructional form shown the suction scoop 170 is formed as an integral unit of a flexible self sustaining nonmetallic material shaped in transverse cross-section, see FIG. 10 to provide a rear channel portion 171 arcuate or part circular in shape with an upper free edge 172 and a lower forwardly positioned edge 173 to provide a large arcuate forwardly opening 174, permitting the ready entry into the channel portion 171 of a variety of pollutant matter. The upper edge 172 which is rearwardly of the lower edge 173 is provided with an upstanding integral deflector plate 178 strengthened against rearward movement by spaced integral brace members 176. Extending forwardly of lower edge 173 of channel portion 171 and integral therewith is a flat scoop blade 177 of any desired width. Provided at the juncture of scoop blade 177 with lower edge 173 and embossed therein is a flexible and/or resilient metal rod 178. A similar rod 179 is located rearwardly of the deflector plate 175 at the corner thereof formed with the outer wall surface of the channel portion 171, the rod 179 passing through end brace members 180 and the intermediate brace members 176, the rod 179 having at one end a head 181, and being threaded at its opposite end to receive a nut 182. The rod 179 is formed of a non-corrosive metal and along with the em-
bedded reinforcing rod 178 serves to maintain the arcuate configuration of the suction scoop 170. If desired (and not shown) there may be embedded in the wall of the channel portion 171 transverse reinforcing rods. Also the open ends of the channel portion 171 may be provided with end closure plates similar to closure plates 106, see FIG. 4.

Provided centrally of the channel portion 171 of the suction scoop 170 and extending rearward therefrom are a pair of like channel necks 183 formed integral with the channel portion 171, the necks 183 opening into the channel portion in the same manner as the neck 111, FIG. 3, opens into the channel portion 95. Each neck 183 is provided at its rear end with a flange 184 to be secured to a corresponding flange 185 provided at the free end of each swing pipe 83 by bolts 186 (only one of which is shown). Suitable gasket means (not shown) are placed between the flanges to provide a water tight connection. The suction scoop 170 and its neck connections 183 is symmetrical with relation to a median plane between the two swing pipes 83.

The arcuate design of suction scoop 170 will provide for entrapment of the pollutant matter between the terminal ends of the scoop so as to be more readily drawn by suction over scoop blade 177 and into the channel portion 171 to pass into necks 183 and swing pipes 83. The arcuate suction scoop is more effective in large scale pollutant matter removal projects.

Due to the large size of the arcuate suction scoop it may be desirable, whether made of a non-corrosive metal or flexible material, the fabricating of the same in separate sections to be connected together. On such construction is shown in FIG. 11 and 12, wherein the suction scoop 190 shown fragmentized consists of an arcuate center section 191 and two like flanking arcuate end sections 192 (only one of which is shown), the center section 191 and end sections 192 forming an arcuate scoop similar to that shown in FIG. 9, with the component parts of each section, i.e., scoop blade 193, channel portion 194, deflector plate 195 and bracing members 196 similar respectively to scoop blade 177, channel 171, deflector plate 175 and bracing members 176 of the arcuate scoop 170.

Center section 191 is formed at each end with an integral transverse flange 197 that extends outwardly from the outer wall surface of the channel portion 191 beyond the top edge of deflector plate 195 and beneath the scoop blade 198. The inner end of each end section 192 is formed with a similar corresponding integral transverse flange 199. To connect the arcuate end sections 192 to the center arcuate section 191 there is utilized a flexible expansion joint 200 formed of spaced metal flanges 201, 202 to which is bonded or otherwise secured a heavy duty flexible connector 204 of a thickness substantially greater than the thickness of the wall of the channel portion 194, with radial arm portions 204a see FIG. 12. The flanges 201, 202 of the expansion joint 200 are secured to the flanges 199 and 197, respectively, by bolts 205. The forwardly presented surface of the flexible connector 204 is shaped to be flush with the upper surface of the scoop blades of the sections, the inside surface of the channel portion of the sections and the forward surface of the deflector blades of the sections as seen in FIG. 12. The flexible expansion joints 200 connecting the arcuate end sections to the center arcuate section will serve as shock absorbers and will permit deflecting movement of the end sections 192 incident to shocks of impact, etc., arising when the suction scoop 190 is in operation in masses of pollutant matter, or when striking large or movable objects.

In order to maintain the dual swing pipes 83 in the same plane and in parallel relation they may be interconnected adjacent their end flanges 185 by suitable cross-bars or braces (not shown). Also yieldable struts and/or guy wires (not shown) may be utilized, connected to selected parts of the arcuate suction scoop 174, 190 and to parts secured on the swing pipes 83 or to the cross-bars or braces connecting the same and so as to give additional support for the scoop as well as to relieve the flange connection of the necks 183 to the swing pipes 83 of excessive stress or strain that may either damage the same or the swing pipes 83.

As stated hereinabove the vessel with its swing pipes single or dual may serve as an hydraulic dredge by replacing the suction scoops with a dredging head of any desired type and lowering the swing pipes to bring the dredging heads into operative position. FIG. 14 shows such an arrangement wherein a single swing pipe 210a is provided with a suction dredging head 212. The swing pipe 210 has mounted thereon an operator's cabin 214 that may be detachably secured thereto. The cabin 214 has an arcuate base 215 shaped to seat on the cylindrical surface of the swing pipe with the flanges 216 thereof engaging an abutment ledge 217 so as to maintain the cabin perpendicular to the longitudinal axis of the swing pipe, and U-Bolts 218 extending through flanges 216 serve to secure the cabin 214 to the swing pipe. The cabin 214 is provided with an entry door 219 viewing windows 220, exterior search light 221, and is securely water-tight. The cabin 214 is supplied with oxygen and electric current as at 222, 223 and is in telephone communication with the operators on deck and/or offices on the vessel's bridge. The cabin 214 includes controls for operating the swing pipe and the dredge head so that the operator in the cabin may both view and control the dredging operation.

The single swing pipe 210 may be made up of telescopic sections (not shown) that are power operated in any suitable manner (not shown) so that the swing pipe 210 may be either extended or retracted by the operator in the cabin. The operator's cabin 214 may also be utilized in the same manner with a dual swing pipe arrangement.

FIG. 15 shows modified form of arcuate scoop construction wherein the same is formed of a flexible self-sustaining material and may be made in one piece or in sections as desired. The scoop structure 230 is seen to consist of a rear channel body portion 231 formed of an upper section 234 and a lower section 235. The upper section 234 has a lower rear edge 236 formed with a rearwardly or outwardly directed flange 237 and an upper beaded forward edge 238 provided with an embedded reinforcing rod or cable 240. The lower section 235 has an upper rear edge 241 formed with a corresponding flange 242 and a lower forward edge 244 having an embedded reinforcing rod or cable 246 and a forwardly extending integral scoop blade 247. The upper and lower sections 234, 235 are securely connected together by bolts 250 extruding through the clanges 237, 242.

The upper forward edge 238 and the lower forward edge 244 are vertically spaced apart to provide the opening 252 into the channel body portion. Bridging the opening 252 for its entire arcuate extent is a row of separate flexible depending flap members 254 that are positioned closely adjacent each other. The upper ends of the flap members 254 are secured in any desired manner to be inside of the upper section 234 adjacent its forward edge 238. The flap members 254 extend below the top surface of the scoop blade 247 and normally contact the inside surface of the lower section 235 adjacent its forward edge 244. Each flap member 254 is formed with a plurality of perforations 255 in the zone of the opening 252.

The flap members 254 function to permit the passage of debris that will pass through opening 252 when suctioning into the scoop structure liquid pollutant matter such as from an oil slick. At the same time the flap members will serve to trap within the channel such debris to be drawn into the swing pipes along with water and the pollutant matter. The flap members will prevent clogging of the opening 252 and at the same time will enhance the suction effect in drawing the collected pollutant matter water and debris in the channel body into the swing pipes.

While certain novel features of my invention have been shown and described and are pointed out in the appended claims, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its operation can be made by those skilled in the art without departing from the spirit of the invention.
I claim:
1. A combined vessel and suction apparatus comprising:
a. a floating vessel having a bottom deck, a top deck, prow and stern,
b. a suction pump means within a first compartment adjacent the prow of the vessel,
c. inlet pipe means connected to the suction pump means and extending forwardly through the prow of the vessel,
d. a swing pipe means swivelly connected at its lower end to the inlet pipe means and of a length at least substantially equal to the height of the prow of the vessel,
e. a suction scoop means mounted on the free forward end of the swing pipe means,
f. cable operated means on the vessel top deck connected to the forward end of the swing pipe means for manipulating the same from a raised upstanding inoperative position to a lowered forwardly extending operative position,
whereby,
said swing pipe means may be lowered to a position where the suction scoop means thereon is brought to the surface of the body of water such as to move under suction pollutant matter floating on said water surface along with a quantity of water through said scoop means into said inlet pipe means for discharge from said suction pump means into the interior of the vessel,
including:
g. a forwardly opening recess in the prow of the vessel extending for the full height thereof,
h. said recess at its lower end, both transversely and longitudinally, being widened to accommodate the swivel connection of the swing pipe means to the inlet pipe means,
i. said recess above its lower widened portion receiving therein said swing pipe means when raised to its inoperative position,
j. said recess being of a depth such that said swing pipe means along with its swivel connection will lie entirely rearwardly of the forward edge surface of the prow of the vessel,
wherein said suction scoop means comprises:
k. a rear elongated channel body portion having a forwardly directed opening defined by parallel upper and lower edges,
l. an upstanding deflector plate at the upper edge of the channel body portion,
m. a scoop blade substantially normal to the deflector plate at the lower edge of the channel body portion and extending forwardly thereof,
n. the lower part of said channel body portion lying below said scoop blade,
o. said channel body portion, deflector plate and scoop blade extending transversely of said swing pipe means,
p. a tubular neck structure centrally of said channel body portion extruding rearwardly therefrom,
q. means detachably connecting said tubular neck structure to the free forward end of said swing pipe means,
whereby, the combined pollutant matter and water is drawn by suction over the scoop blade into the channel body portion an through the tubular neck into said swing pipe means,
r. said tubular neck structure at its forward end being joined to the rear wall of the channel body portion and forming therewith an opening thereof of a size such as to extend above and below the plane of said scoop blade,
s. the axis of said tubular neck structure being downwardly inclined with relation to said scoop blade when the latter is in its operative position on the surface of the body of water,
wherein said means for detachably connecting the tubular neck structure comprises:
t. a radial flange at the rear end of said tubular neck structure,
u. a corresponding radial flange at the free forward end of the swing pipe means,
v. fastener means for detachably securing said flanges together,
wherein:
w. said scoop structure is rectilinear from end to end thereof,
x. a closure plate secured to each end of the channel body portion,
y. a plurality of brace members extending rearwardly of said deflector plate and connected thereto and to said channel body portion.
z. hinge means secured to the channel body portion at the lower edge thereof,
aa. said scoop blade at its rear edge being connected to said hinge means such as to have swinging up or down movement relative to said channel body portion,
bb. a side wall at each side edge of said scoop blade extending upwardly from the upper surface thereof,
cc. a rear portion of each said side wall extending rearwardly beyond the rear edge of the scoop blade in overlapping sliding relation to the inside surface of an adjacent end closure plate,
dd. float means beneath the forward edge portion of the scoop blade, and
ee. means pivotally connecting the float means to the scoop blade,
whereby,
in the operative lowered position of the swing pipe means and the scoop structure, the float means will maintain the moveable scoop blade substantially level with the surface of body of water irrespective of variations in the operative lowered position of the swing pipe means or to variations arising from movement of the vessel.