April 26, 1960 A. J. NELSON 2,933,837

ELEVATOR DISCHARGE HYDRAULIC DREDGE

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FIG. 1

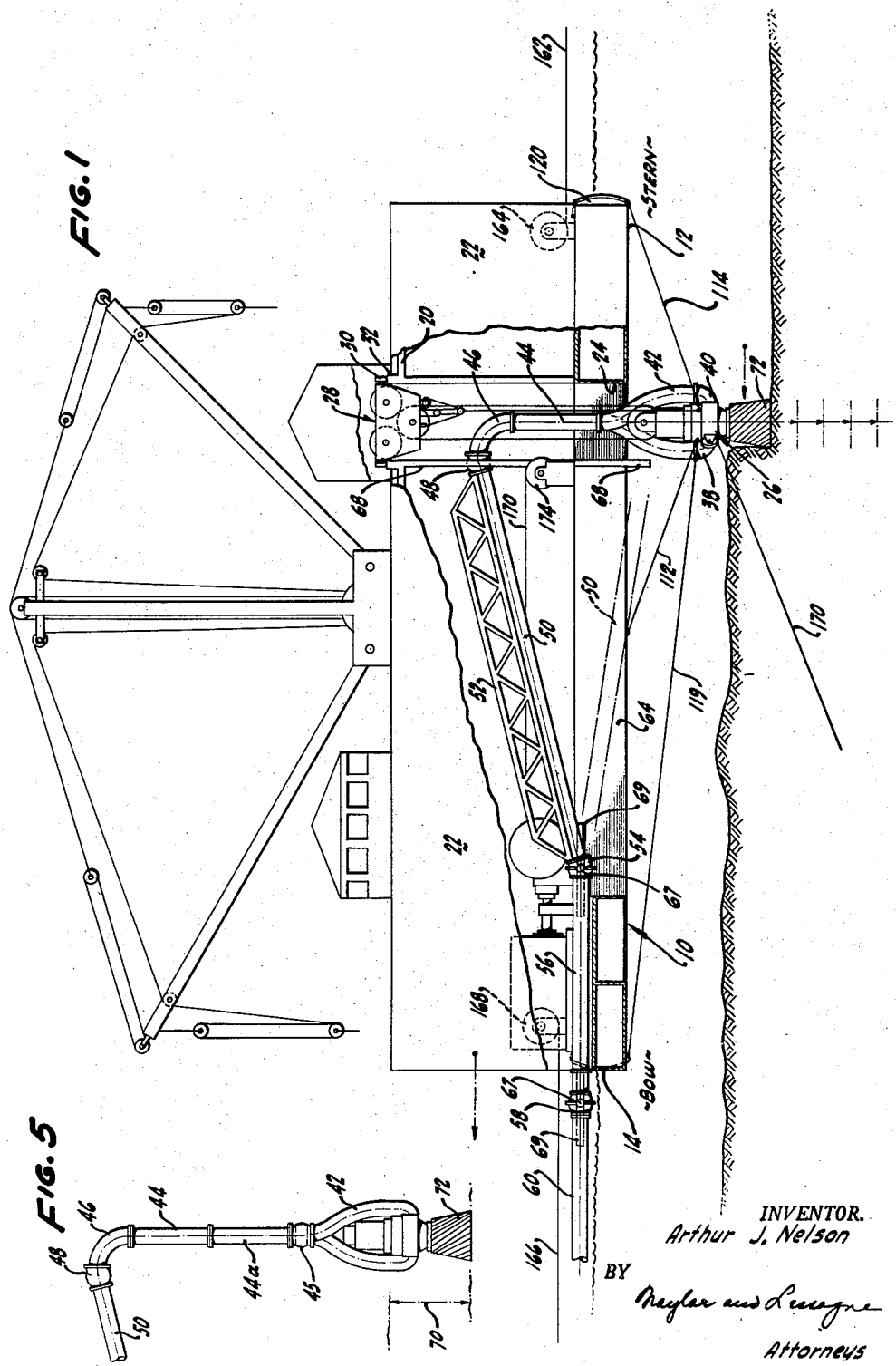

FIG. 5

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ELEVATOR DISCHARGE HYDRAULIC DREDGE

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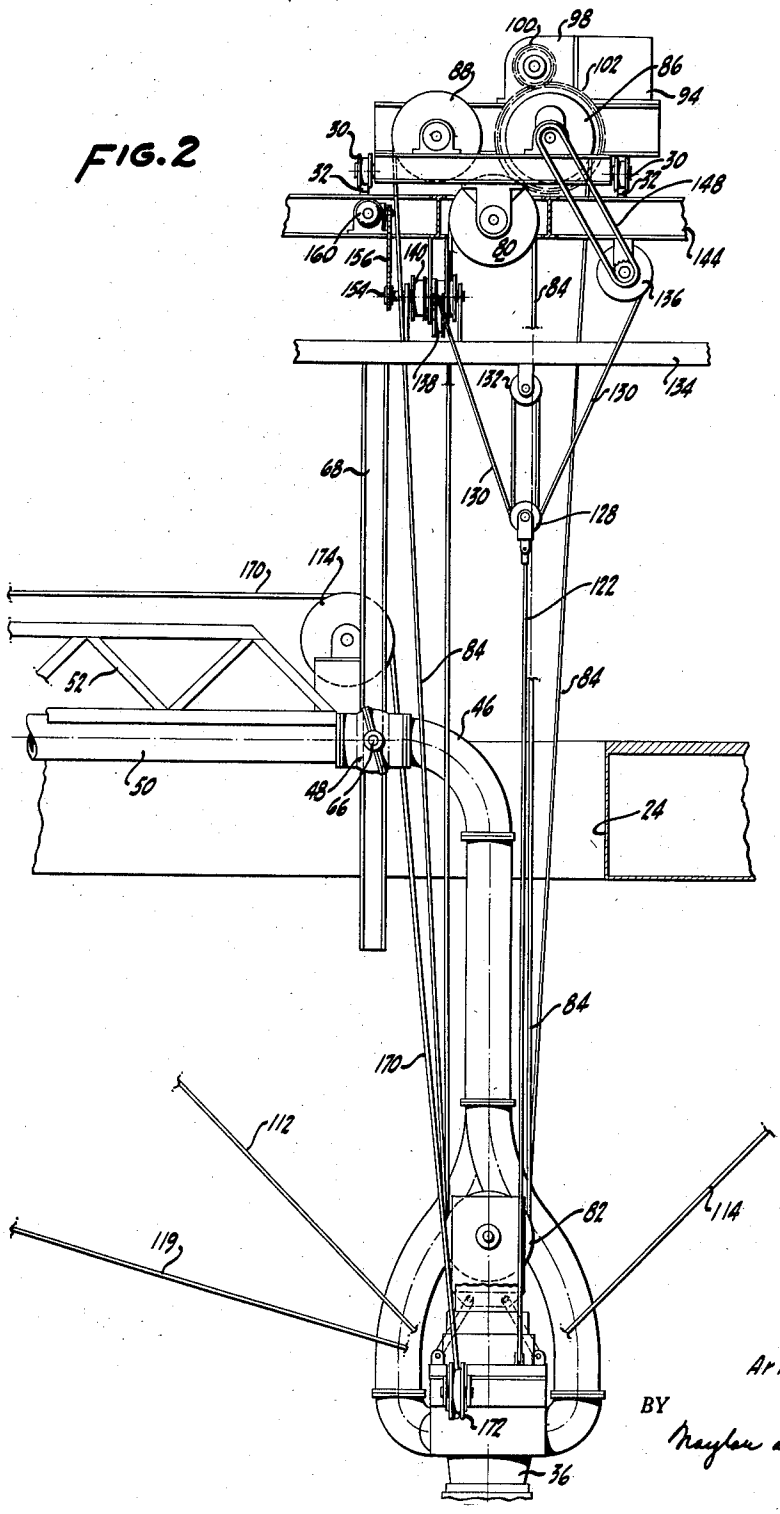
FIG. 2



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ELEVATOR DISCHARGE HYDRAULIC DREDGE

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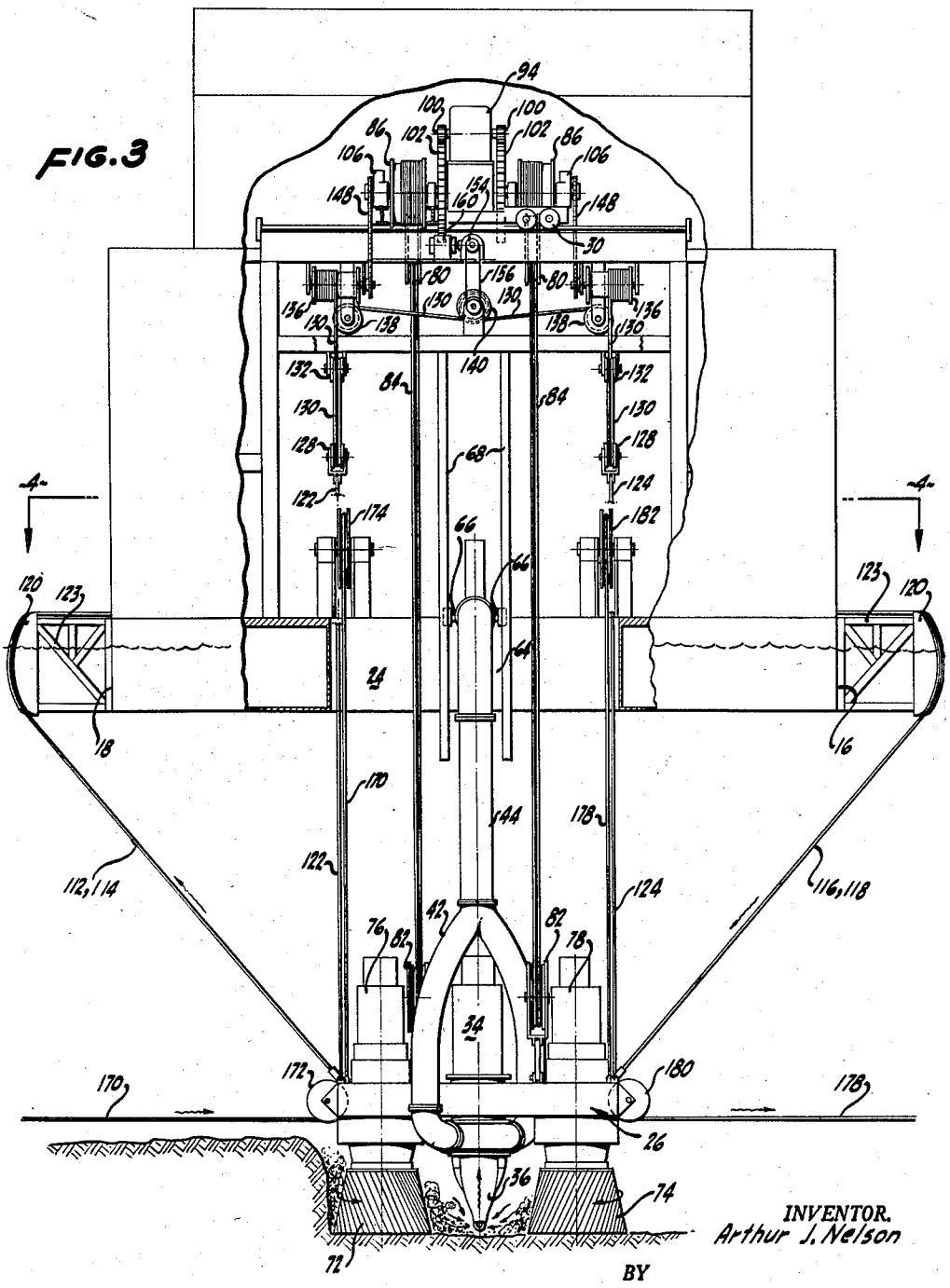
FIG. 3



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ELEVATOR DISCHARGE HYDRAULIC DREDGE

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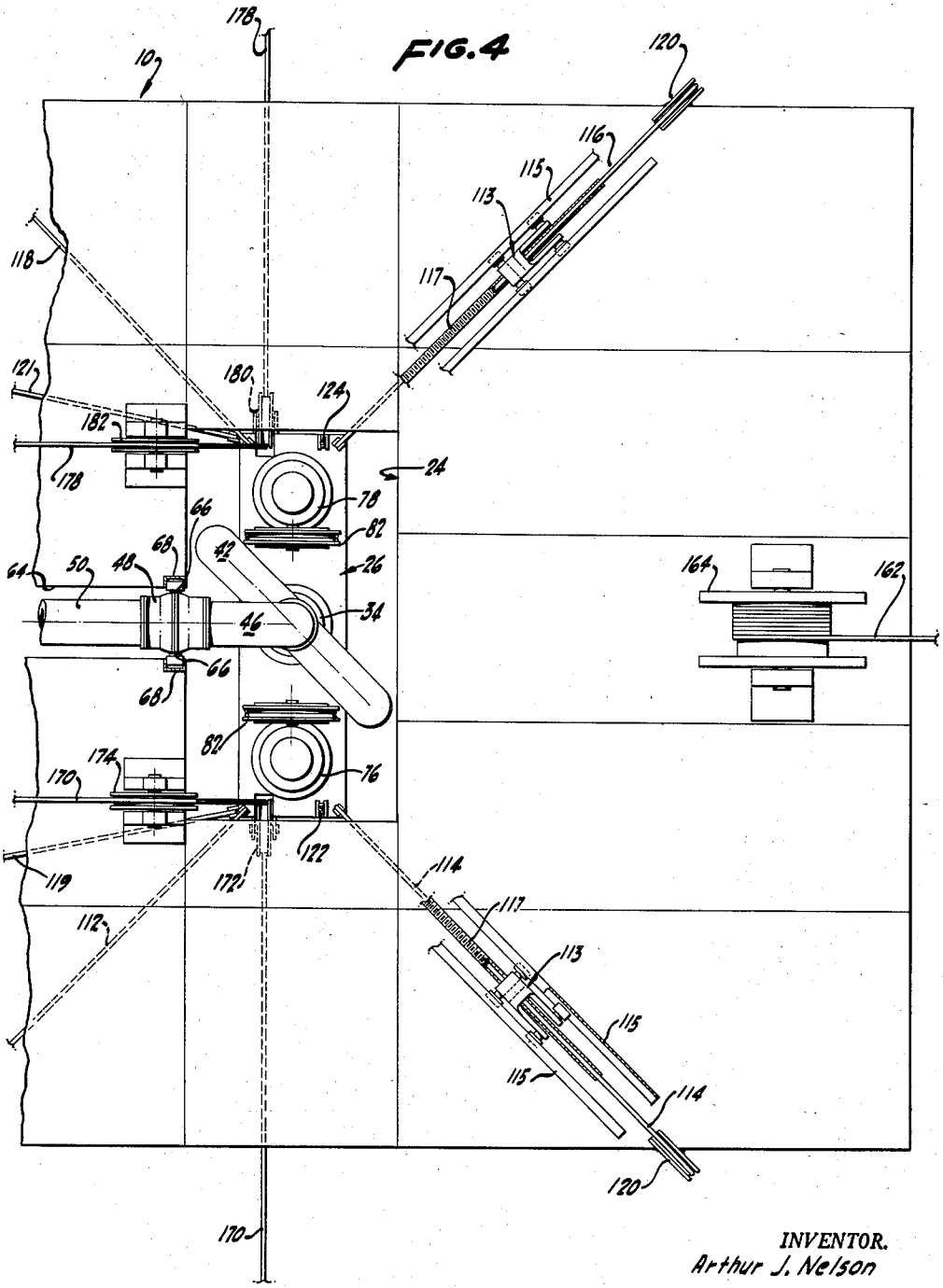
FIG. 4



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ELEVATOR DISCHARGE HYDRAULIC DREDGE

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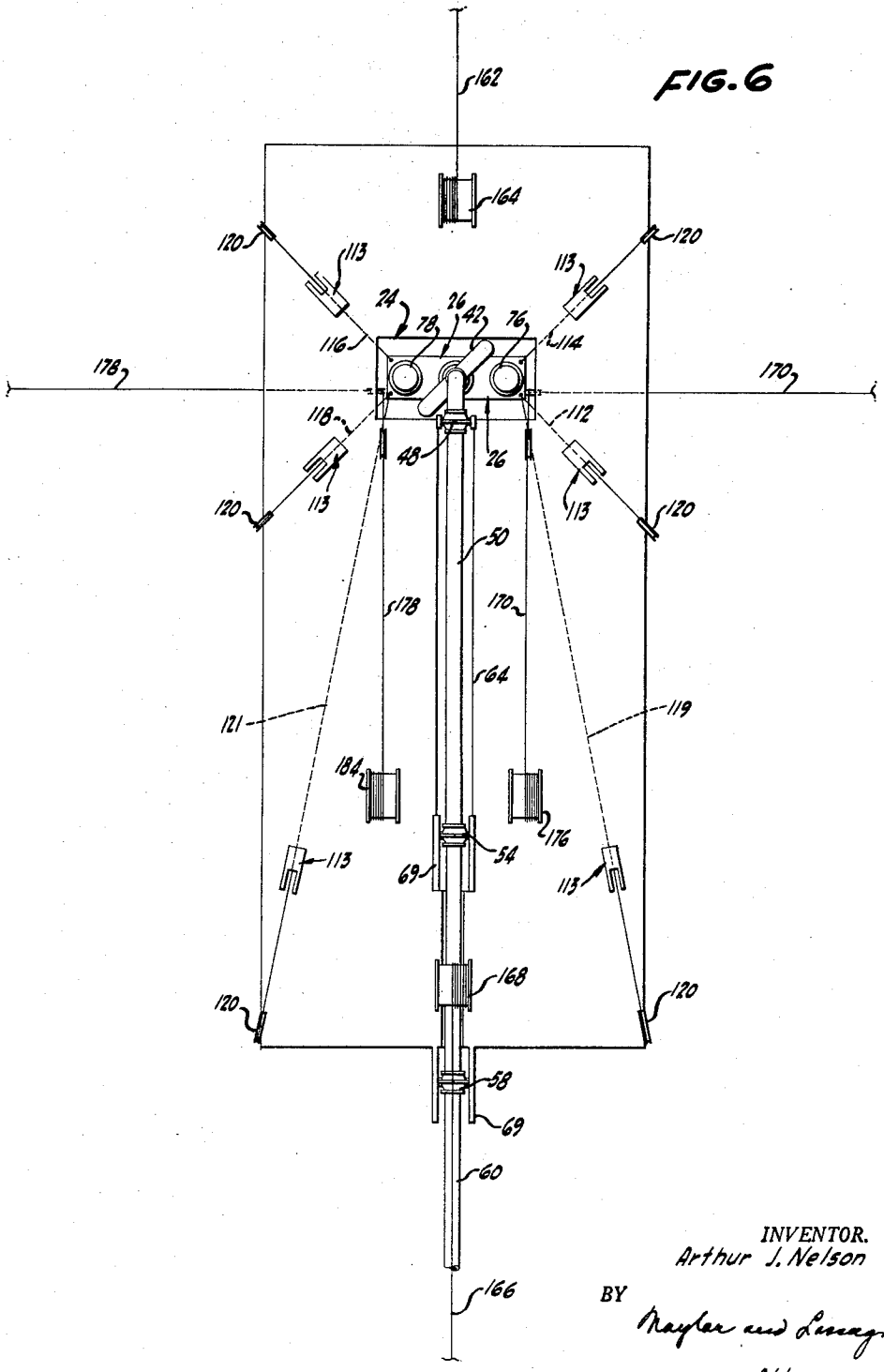
FIG. 6



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ELEVATOR DISCHARGE HYDRAULIC DREDGE

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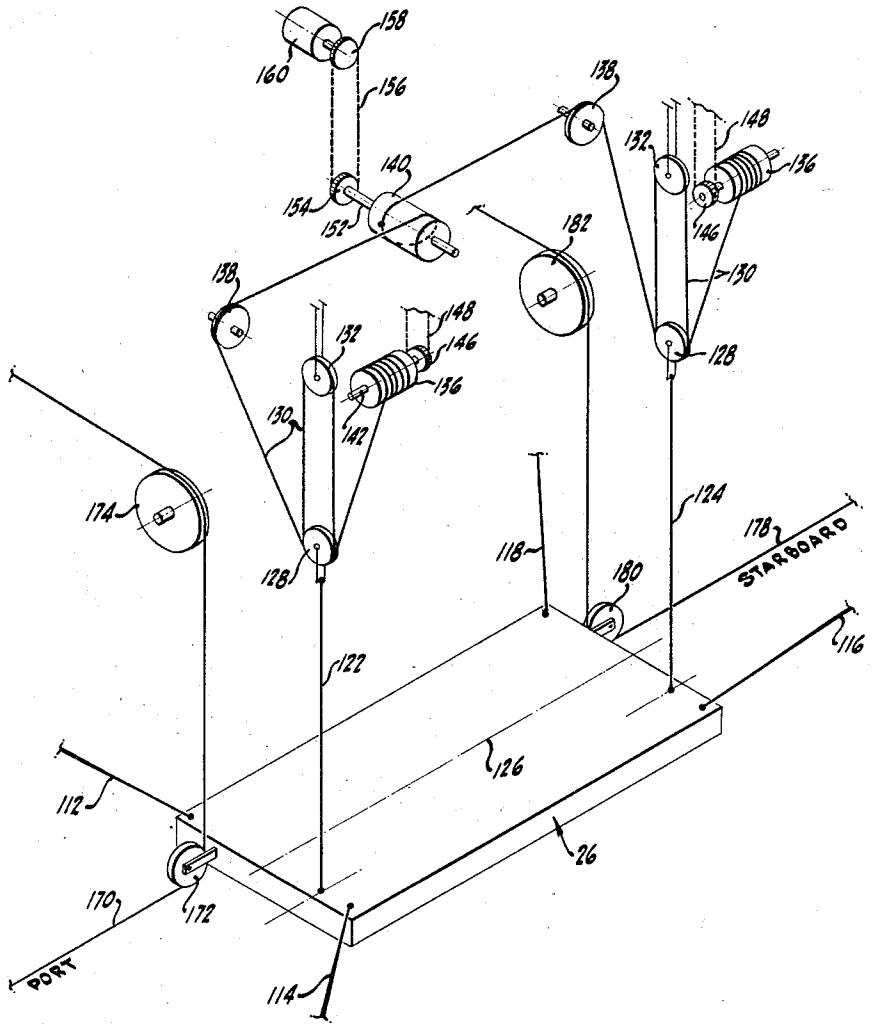
FIG. 7



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ELEVATOR DISCHARGE HYDRAULIC DREDGE

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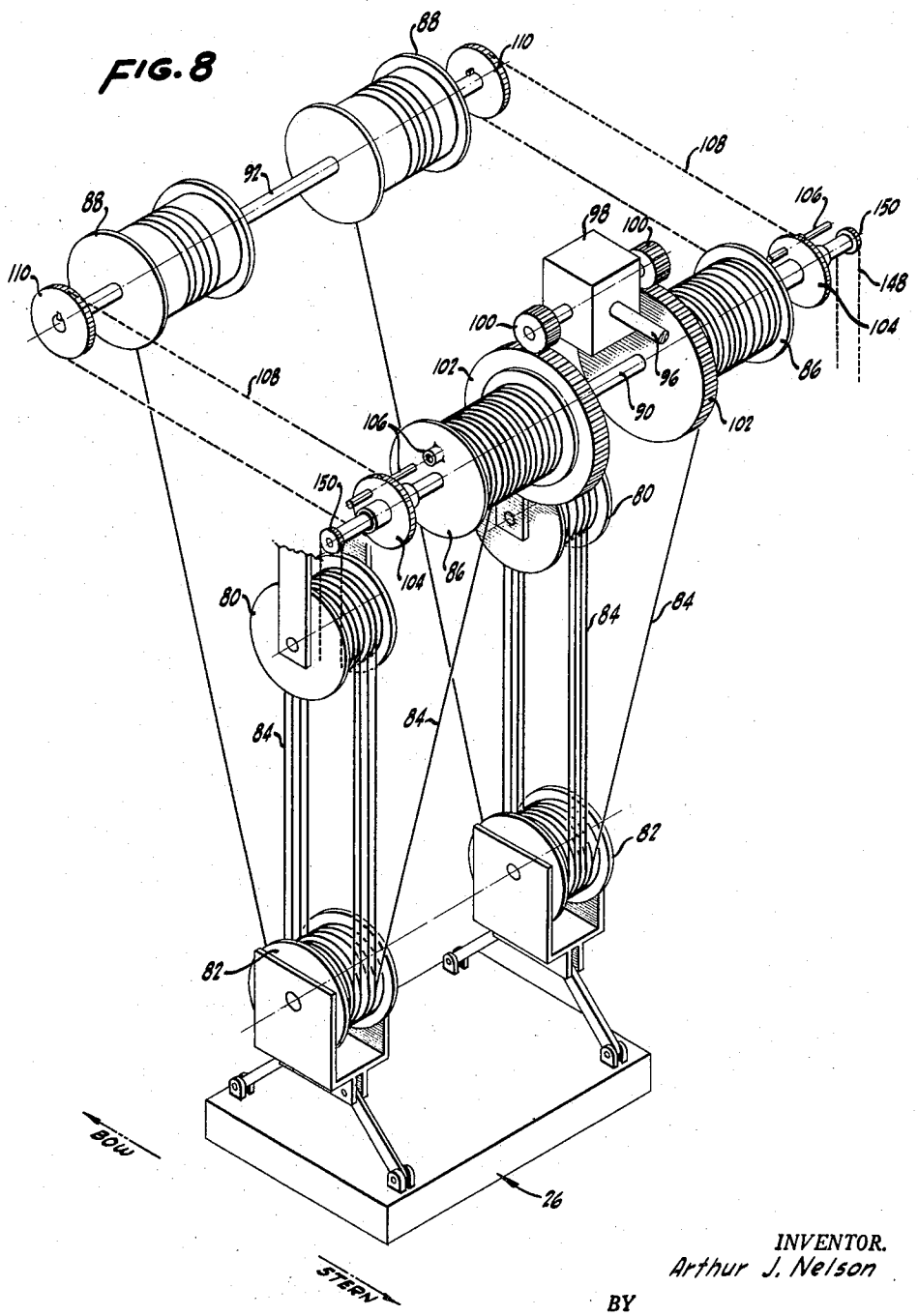
FIG. 8



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ELEVATOR DISCHARGE HYDRAULIC DREDGE

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FIG. 9

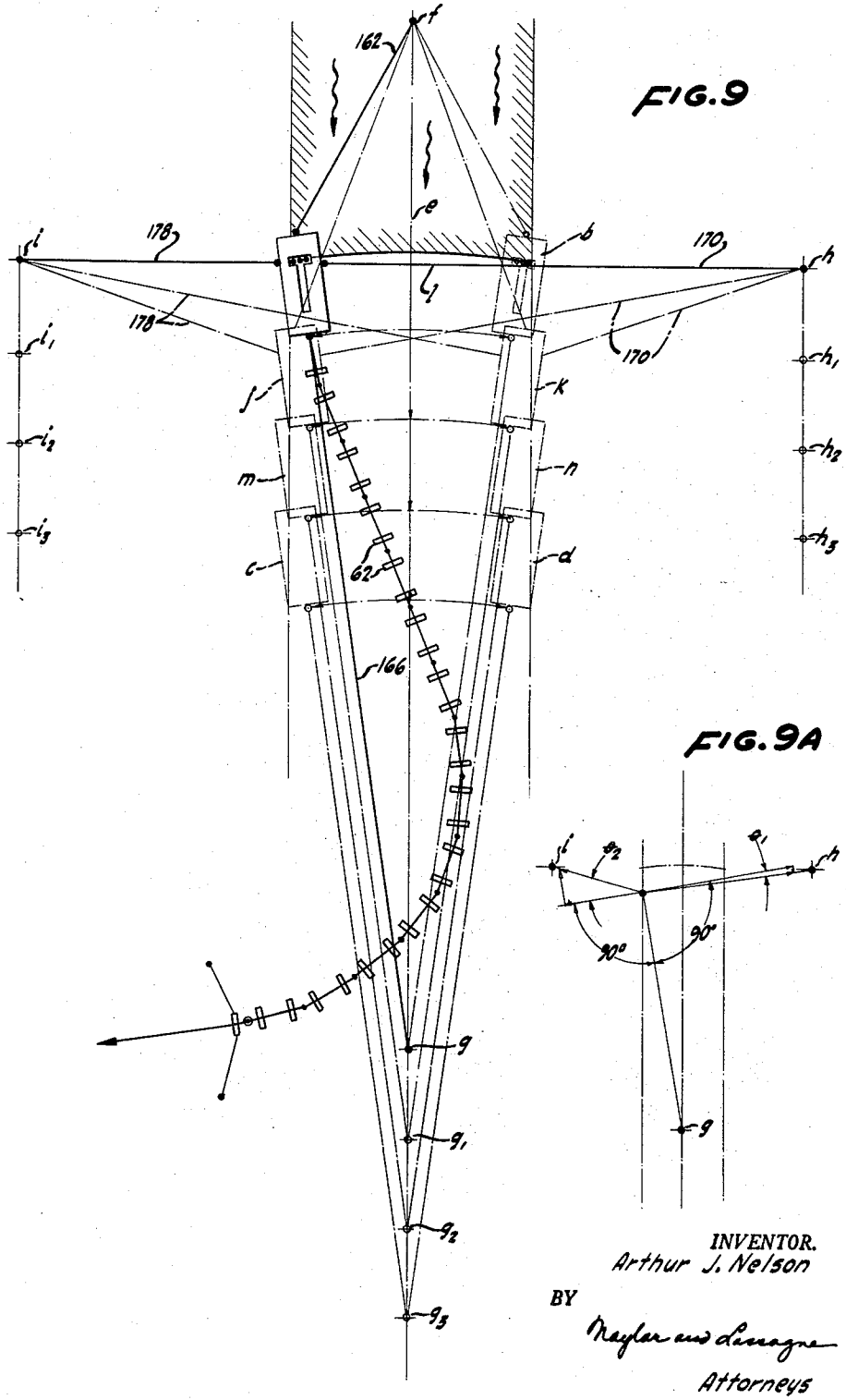

FIG. 9A

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United States Patent Office 2,933,837 Patented Apr. 26, 1960

2,933,837

ELEVATOR DISCHARGE HYDRAULIC DREDGE

Arthur J. Nelson, San Rafael, Calif.

Application July 6, 1953, Serial No. 366,124

21 Claims. (Cl. 37—65)

This invention relates to hydraulic dredges, and more particularly to improvements in hydraulic dredges of the elevator discharge type.

An object of the invention is to provide a novel and efficient type of hydraulic dredge for the loosening of compacted material disposed beneath water level, the raising of such material to an above-water level, and the conveying of such material to a remotely located discharge point, with said dredge comprising a floating hull, an elevator platform carried thereby and adapted to be vertically moved to be adjacently disposed to the water bed, and submersible pump and cutter means disposed on said platform.

Another object of the invention is to provide a hydraulic dredge with a floating hull having, in plan form, a T-shaped alleyway extending vertically therethrough, with the head of the T constituting a well for a dredging elevator which is adapted to be raised therein to deck level and lowered therethrough to water bed level, with the stem of the T-shaped alleyway enabling the elevator-connected end of the material discharge pipe to be pivotally raised and lowered in response to movement of the elevator.

A further object of the invention is to provide an elevator type of pressure, rather than suction, dredge adapted to operate at greater depths and to handle a higher percent of solids than the conventional type of ladder-suction dredges.

Still a further object of the invention is the provision for a dredge of the type described, of a novel suspension and anchoring system for the elevator platform to enable raising and lowering of said platform and the use of the same at selected depths while protecting the elevator and elements carried thereby, including a length of vertically disposed discharge pipe, from laterally directed strains and stresses.

And yet a further object of the invention is to provide a hydraulic dredge with a novel mooring and swing-like system whereby a dredge may be more efficiently moved as dredging cuts are being made by it.

These and other objects and advantages of the invention will be apparent from the following description taken in conjunction with the drawings forming part of this specification, and in which:

Figure 1 is a view in side elevation of the dredge of the invention, with portions of the hull and hull superstructure broken away;

Figure 2 is an enlarged view, also in side elevation, of the elevator platform system of the dredge;

Figure 3 is an enlarged view in stern elevation of the dredge of Figure 1, with portions of the hull superstructure being broken away to show the elevator platform system of the dredge;

Figure 4 is a view in section taken along lines 4—4 of Figure 3;

Figure 5 is a detailed view of a portion of the elevator system of Figure 1, showing how the vertically disposed discharge line is lengthened as the dredging depth is increased;

Figure 6 is a semi-schematic plan view of the dredge, showing the guy system for the platform and the swing and anchor line system for the dredge;

Figure 7 is a semi-schematic view in perspective of the elevator platform for the dredge and the suspension and support system for operating the same;

Figure 8 is a view in perspective of a portion of the stabilizing system for the elevator platform;

Figure 9 is a schematic view illustrating the manner and mode of operation of the dredge in relation to the area to be dredged; and

Figure 9A is a schematic diagram illustrating an inherent advantage of the mooring and swing line system of the invention.

Referring to the drawings, the dredge comprises a floatable hull 10 having a stern end 12, bow end 14, starboard side 16, and port side 18, with said hull being provided with a truss-type reinforcing superstructure which may be enclosed by wall sidings 22. Extending through the hull 10 in adjacently disposed relation to the stern end 12 thereof is a well 24 through which a platform 26 is adapted to be raised and lowered by means, hereinafter described in detail, supported by crane 28 which is supported by wheels 30 mounted on tracks 32 forming a part of superstructure 20.

Centrally disposed on platform 26 is a vertical dredge type submersible pump and motor unit 34 which may be of the type illustrated and described in U.S. Patent No. 2,466,324. The pump is provided with a short suction piece 36 and, preferably, with two discharge outlets connected through elbows 38 and 40 to the branches of Y-shaped conduit 42, the latter having its outlet end connected through one or more vertically disposed discharge pipe sections 44 to an elbow 46 which, in turn, is connected through a ball joint 48 to conduit section 50. Conduit section 50, reinforced by truss 52 supported thereby, is connected through ball joint 54 to a short section of horizontally disposed conduit 56, the latter being connected through ball joint 58 to discharge line 60 which is supported by pontoons 62 (Figure 9) and terminates at a selected shore location, not shown.

Formed in the hull as the stem of a T, of which the well 24 may be considered to be the crosshead, is an alleyway 64 adapted to accommodate conduit section 50 when platform 26 is raised and lowered during operation of the dredge.

Ball joint 48 is constrained to travel in a vertical plane, when it is caused to move by vertical movement of the platform 26, by roller-bearing arm members 66 carried thereby which extend into vertically disposed channel guides 68 connected to the superstructure and hull. This guide arrangement for ball joint 48 resists any thrust the pontoon supported line 60 might transmit along the discharge pipe tending to upset the perpendicular position, or plumb, of the elevator and parts carried thereby. Ball joints 54 and 58 are supported for horizontal sliding movement, in response to a change in the horizontal component of length of conduit section 50 as ball joint 48 is raised and lowered, by arm member 67 carried thereby which extend into horizontally disposed channel guides 69 carried by the hull. As indicated in Figure 5, the vertically disposed discharge line 44 is adapted to be lengthened by the addition thereto of one or more sections, such as 44*a* corresponding in length to additional increments 70 in the operational dredging depth. As further indicated in Figure 5, section 44*a* may be connected to Y-shaped conduit 42 by ball joint 45, the latter being adapted to prevent the elevator platform 26 from transmitting lateral stresses to line 44.

The platform 26 further carries a pair of rotatable cutter heads 72 and 74 adapted, respectively, to be driven by electric motors 76 and 78 of the submersible type. The motors 34, 76 and 78 are connected by suitable conduit electric cable, not shown, to the electrical power system of the dredge, also not shown.

The platform 26 is adapted to be raised and lowered by the crane and suspension cable system best shown in Figures 2, 3 and 8. Carried by the crane 28 is a pair of spaced head blocks 80 and aligned therewith and secured to the platform 26 is a pair of spaced tail blocks 82. Cables 84 are reeved around the sets of blocks 80 and 82 and have their ends secured to haul drums 86 and store drums 88, said haul drums being secured to shaft 90 for rotation therewith and said store drums being similarly secured to shaft 92. Shafts 90 and 92 are journalled for rotation on crane 28. Shaft 90 and haul drums 86 carried thereby are adapted to be selectively rotated in either direction by reversible motor 94, motor output shaft 96, gear reducer 98, pinion gears 100, and bull gears 102 secured to shaft 90 and in mesh with pinion gears 100. Sprockets 104 are sleeve mounted on shaft 90 and are adapted to be secured to said shaft for rotation therewith by selectively operable clutch means semi-schematically illustrated at 106. Sprockets 104 are connected by chain drives 108 to sprockets 110 which are fixedly secured to store drum shaft 92. Means, not shown, are provided to selectively lock shaft 92 and store drums 88 carried thereby against rotation.

The platform 26 is lowered and raised by the described suspension system in the following manner. When the platform is in a raised position, the cables 84 are stored on drums 88, with haul drums 86 being empty except for a relatively minor number of cable turns thereon required to insure fastening of the cables to the drums 86. To commence the platform lowering operation, clutch means 106 are engaged and the locking means for store drums 88 and shaft 92 is released. Motor 94 is then started to transfer onto the haul drums 86 from the store drums 88 an amount of cable sufficient to lower the platform 26 the required distance when said amount of cable is thereafter unwound from drums 86. During this transfer operation, platform 26 remains stationary. When the cable transfer is completed, clutch means 106 are disengaged and the locking means for drums 88 and shaft 92 are engaged. Brake means, not shown, associated with motor output shaft 96 are then released to enable the paying out of cable from drums 86 and the consequent lowering of the platform 26 a desired distance. The haul drums are braked to maintain the platform in position. This operation is repeated for successive loweringsof the platform to sucecssive digging depths.

In reversing this operation and raising the platform through successive increments of distance, the motor 94 is operated in a reverse direction to, first reel the cable onto drums 86 a sufficient amount to raise the platform through one increment of distance, and the cable is then transferred from drums 86 to store drums 88, and so on until the platform is in a fully raised position, with the cable being fully stored on drums 88.

To support and position the platform 26 during the digging, or dredging, operation, guy, or stabilizer, lines 112, 114, 116 and 118 are provided, said lines being secured adjacent the corners of the platform 26 and extending over saddles 120 carried at the sides of the dredge hull to deck-positioned adjustably arrangeable line tensioning and releasing means, which, as shown in Figure 4, may comprise wheel-mounted cable ties 113 movable on tracks 115 by screw shafts 117 actuated by a gear motor and control system therefor, not shown. The control means for the stabilizer lines are preferably synchronized with crane motor 94, the arrangement being such that the lines 112, 114, 116 and 118 are not under tension when the platform and load carried thereby is being lowered by the crane suspension system. Conversely, when the platform has been adjusted to a digging position, the tensioning of the stabilizer lines takes over the function of supporting the platform and the equipment disposed thereon. The platform is preferably further provided with auxiliary stabilizer lines 119 and 121 which pass over the bow end of the hull and are otherwise the same in details and mode of operation as the primary stabilizer lines 112, 114, 116 and 118. As shown in Figure 3, the stabilizer line saddles 120 may be carried by removably mounted hull wing frames 123 for the purpose of selectively increasing the included angle between lines 112, 114, 116 and 118 and the vertical so that a more stable platform support may be provided as the dredging depth is increased toward the maximum. These wing frames may be removed when the dredge is to be taken through relatively narrow canals, and the like.

The platform 26 is further provided, for a purpose which will hereinafter be made clear, with additional line supports 122 and 124 which are connected to the platform adjacent the port and starboard edges thereof and at points disposed aft of the transverse center line 126 (Figure 7). Lines 122 and 124 are connected to tail blocks 128, the latter being supported by cables 130 from head blocks 132 which are in turn suspended from a ceiling girder 134. Cables 130 are reeved around tail and head blocks 128 and 132 and are connected to store drums 136 and over sheaves 138 to drum 140. Store drum shafts 142, mounted for rotation on crane support girders 144 (Figure 2), carry sprockets 146 which are connected by chain drives 148 to sprockets 150 secured to shaft 90. Drum shaft 152 carries sprocket 154 which is connected by chain drive 156 to sprocket 158 which is driven through a gear reducer, not shown, by reversible torque motor 160.

During rotation of the haul drums 86 to pay out cable 84 and lower platform 26, store drums 136 are rotated by haul drum shaft 90 to pay out cable 130 and lower tail blocks 128 in company with the downward movement of platform 26. When the direction of dredging swing of the dredge is to port, torque motor 160, which may be synchronized with the port swing gear, has rotated drum 140 in a clockwise direction, as viewed in Figure 7, to place equalizing line 122 under tension and line 124 under slack, store drums 136 being maintained stationary by operation of the brake of crane motor 94. When line 122 is thus put under tension, torque motor 160 is stalled and a brake, not shown, associated therewith thereafter maintains the tension in line 122. When the starboard swing gear for the dredge is actuated to initiate a starboard dredging swing, the torque motor 160 may be operated reversely to place equalizing line 124 under tension and line 122 under slack. It is to be understood that the foregoing is by way of example. Under certain conditions of dredge operation, depending upon the external force conditions encountered, the starboard equalizer line 124 will be placed under tension when the port swing line is placed under tension, and the port equalizer line 122 will be placed under tension when the starboard swing line is placed under tension, the object at all times being to stabilize the hull with respect to the platform.

The various elements of the platform suspension system are so arranged to provide a centrally clear area above the platform for discharge pipe section 44 and for maintenance of the discharge line and the equipment carried by the platform, and for the addition of extra pipe sections (Figure 5) to this vertically disposed discharge line section and removal of sections therefrom.

The crane 28, which is mounted on wheels 30 for movement on tracks 32 transversely of the hull, is adapted not only to raise and lower the elevator but also to transfer the elevator, when it is raised above the deck of the hull, to port or starboard for the replacement of parts or repair. Such selective transverse motion of the crane is effected by a drive system comprising a motor and rotatable screw

shafts, not shown. It is here pointed out that the equalizer line system (122, 124, etc.) may be mounted on the movable crane 28, as indicated in Figure 1, or may, as shown in Figures 2 and 3, be mounted on the hull superstructure. With the latter arrangement, it will, of course, be necessary to disconnect the lines 122 and 124 from the platform before the latter is moved laterally for repair, maintenance, and the like.

The means for controlling the dredging movement of the dredge comprise a stern anchor line 162 connected to a motor driven deck winch 164, a bow anchor line 166 connected to a motor driven deck winch 168, port swing line 170 which passes through sheave 172 carried by platform 26 and extends upwardly through well 24 to pass over deck sheave 174 to winch 176, and starboard swing line 178 which passes through sheave 180 carried by platform 26 and also extends upwardly through the well 24 to pass over deck sheave 182 to winch 184. While not shown, it is to be understood that winches 164, 168, 176 and 184 are provided with suitable drive means which may, for example, comprise a motor, a brake controlled gear reducer driven thereby, and a bull gear carried by the winch, or drum, in mesh with a pinion gear of the gear reducer.

It will be noted from Figures 1 and 7 that the swing line sheaves 172 and 180 carried by platform 26 are shown as being disposed forwardly of the transverse center line 126 of the platform, such placement, which may be altered as required under actual conditions, enabling the torque exerted by the machinery carried by the elevator platform to be reacted in part by the horizontal force applied to the platform through the sheaves under a given set of external force conditions encountered during dredging.

Referring now to Figure 9 for a description of the manner and mode of operation of the dredge, and assuming that the area defined within dredge positions *a, b, c* and *d* constitutes the channel to be cut, or dredged, the dredge is initially positioned with its longitudinal axis disposed along center line *e* of the channel, with points *f, g, h* and *i* designating, respectively, the positions of the stern, bow, port and starboard anchors. It is intended that the bow line 166 be the longest of the anchor and swing lines, and that stern line 162 be the shortest, with the port and starboard lines 170 and 178 being of equal length, but greater in length than the stern line. For example, for a 300 foot wide channel to be dredged, the following line lengths are contemplated: 500 feet for the port and starboard lines from their respective anchors to the center line *e* of the channel; 300 feet for the stern line; and about 970 feet for the bow line.

With the dredge initially positioned half way between dredge positions *a* and *b* of Figure 9, and with the bow, stern and breast lines in a taut condition, the elevator is lowered to the desired digging depth with the cutting and suction gear in operation. The winch brakes for stern line 162 and port line 170 are then released, and the winch for starboard line 178 is positively driven to move the dredge to position *a*. As this position is reached, the starboard winch is de-energized and the winch for port line 170 is energized to swing the dredge to the position *b*. During this operation, while both cutters 72 and 74 are rotating, cutter 74 does the work during the half swing to position *a*, while cutter 72 does the work during the return swing to position *b*. During any point of dredging operation, the inactive cutter from the work standpoint, assists the swing gear in moving the dredge.

After position *b* has been reached, the winch for bow line 166 is operated to shorten bow line a distance approximately equal to half of the diameter of the cutters, and then the starboard swing line winch is operated to swing the dredge to the opposite side of the channel, where the bow line is again shortened so the cutters may take a further dredging cut. This shortening of the bow line in step by step fashion is continued, while maintaining the initial swing line anchor points *h* and *i*, until the cut *j—k* is taken, whereupon the swing line anchors are moved to positions *h*–1 and *i*–1, said latter positions being in line with the chord of the shallow arcuate cut *j—k*, similar to the initial alignment of the swing lines and anchors with the chord 1 of the initial cut *a—b*. When the breast anchors are moved to positions *h*–1 and *i*–1, the bow anchor is moved an equal distance to position *g*–1.

In like manner, the breast anchors are moved to positions *h*–2 and *i*–2, and bow anchor moved to position *g*–2, when dredging cut position *m—n* is reached and, similarly, the anchors are moved to *h*–3, *i*–3, and *g*–3 for cut *c—d*. After the successive cuts for these final anchor positions have been made to complete the first depth cut of the channel, the dredge is returned to its starting point, that is, mid-way of initial cut *a—b*, and the cutting and suction gear is lowered for the next increment of depth. This routine is followed until the channel has been dredged to the desired depth.

An alternative dredging routine is to dredge to final depths for each setting of the breast anchors. The operation is the same as above-described until the cut *j—k* is taken, whereupon the dredge is returned by the stern line to its starting point. The dredging means is then lowered for the next increment of cut. This routine is followed until the portion of the channel being worked has been dredged to the desired depth, at which point the dredging means is raised to the original depth and the breast anchors are moved to *h*–1 and *i*–1.

The particular mooring and swing lines system above described offer a number of very definite advantages as far as hydraulic dredging is concerned. First, the dredge is swung about a very long radius, and this provides a shallow arcuate cut, the end points of which are almost normal to the channel bank. Thus, the banks of the channel, or dredging cut, can be well defined, there being an efficient clean up at both ends of each cut. Secondly, the swing lines and control systems therefor are such as to enable the obtaining of a sharply defined channel with minimum power lost. The control system for the port and starboard swing lines is such that when the port winch is de-energized the starboard winch is automatically energized, and vice versa. This enables good channel cut control. Further, and this point is best illustrated in Figure 9A, when the dredge is being moved from the starboard side of the channel to the port side by the port swing gear, or from the port side of the channel to the starboard side by the starboard swing gear, the initial included angle θ_1 between the tangent to the tangent to the arcuate line of travel of the cutters and the swing line about to be used is less than the correspond angle θ_2 between the tangent to the cutter travel arc and the swing line about to become inoperative when the end of the particular cut has been reached. Thus, this angle is smallest, meaning that the effective swinging force is maximum, when an accelerating force is required to move the dredge and initiate the cut, while the angle is the largest, meaning that the effective swinging force is at a minimum, or, stated otherwise, the efficiency of application of the swinging force is at a minimum when the end of the cut is reached and deceleration is in order to terminate the swing of the dredge. When this included angle reaches approximately 27° in magnitude, as indicated in Figure 9, the efficiency of the swinging operation has reached a point calling for repositioning of the breast and bow anchors.

In discussing the equalizing lines 122 and 124 and their control systems, as best shown in Figure 7, it was pointed out, by way of example, that the starboard equalizing line 124 may be placed under tension when the dredge is being swung by starboard swing line 178, and, alternately, that port equalizing line 122 may be placed under tension when the dredge is being swung by port line 170. As the dredge is being swung in either direction, the dredge hull offers a certain resistance

to movement through the water. This resistance tends to upset the otherwise balanced force pattern applied to platform 26, and the tensioning of the particular equalizing cable 122 or 124 preserves this equilibrium against the hull resistance factor mentioned. It can be mathematically illustrated that, with equal and fixed included angles between the stabilizer lines 112, 114, 116 and 118 and the vertical, the tension force to be applied to either equalizing line 122 or 124, depending upon the direction of movement of the hull and the set of external forces encountered, is proportional to the resistance offered by the hull to such movement.

The control system for the torque motor 160 is arranged so that, for example, tension in line 124 is relaxed and the slack in the line system for line 122 is taken up, prior to the placing of line 122 under tension, just before the tension on starboard swing line 178 is relaxed at the end of the swing. The relaxing of tension on line 124 is an aid to the deceleration of the motion of the hull in the water, so that when the tension is relaxed on swing line 178, the hull will be stationary. When this occurs, line 122 is placed under tension, and this is an aid to the acceleration of the hull in a port direction when the port swing line 170 is, simultaneously with the relaxing of tension in the starboard swing line, placed under tension.

Since the resistance of the hull to swinging movement in the water will vary with water and current conditions, it may be desirable under certain circumstances to provide a sensing control for the equalizer line system so that the tensioning of either one of the two equalizing lines can be made directly proportional to the hull resistance. This may be done by regulating the voltage input to the torque motor 160 in accordance with the lateral force condition sensed by a strain, or level, detector positioned, for example, in association with the vertically disposed discharge line section 44 where this line section passes through well 24.

While a complete embodiment of the dredge of the invention has been shown and described, it is to be understood that all substantial equivalents thereof are within the spirit and scope of the invention.

What is claimed is:

1. A dredge comprising a hull, an elongated opening T-shaped in plan form extending through said hull, a platform, means carried by said hull and disposed thereabove operable to raise and lower said platform with a solely vertical component of movement through the head portion of said T-shaped opening, guy wires extending uniformly outwardly and upwardly from said platform connected to said hull and means for adjusting the length of said wires and for making said wires taut to support said platform at digging depths, dredging means carried by said platform, and a material discharge line connected to said platform and disposed in material receiving relation to said dredging means, the stem portion of said T-shaped opening being adapted to accommodate a portion of said discharge line.

2. A dredge as set forth in claim 1 wherein said dredging means comprises a pump having an inlet extending beneath said platform, and drive means for said pump disposed on said platform.

3. A dredge as set forth in claim 2 wherein said dredging means comprises, further, a vertically disposed rotatable cutter head carried by said platform and extending therebeneath into adjacently disposed relation with said pump inlet, and drive means for said cutter head disposed on said platform, said cutter head being adapted to loosen material to be dredged and said pump being adapted to suck loosened material into said inlet and transmit it through said discharge line.

4. A dredge comprising a hull, a well formed in said hull and extending therethrough, a platform, dredging means including a pump carried by said platform, elevator means carried by said hull operable to raise and lower said platform with a solely vertical component of movement through said well to and from dredging depths, separate non-compressive support means adapted to suspend said platform from said hull and stably support it at dredging depths, a material discharge pipeline having a horizontally disposed portion slidably supported by said hull, a vertically disposed portion supported by said platform having a lower end in material receiving relation with said dredging means, and an intermediate portion having a ball joint connection with said horizontally disposed portion and having a ball joint and elbow connection with said vertically disposed portion, said latter ball joint having associated therewith means contraining it to move in a vertical plane when said platform is lowered, said intermediate pipeline portion being swingable in response to up and down movement of said platform from an upwardly inclined position to a downwardly inclined position, and an alleyway formed through said hull in communicating relation with said well adapted to accommodate said intermediate pipeline portion as it is pivotally swung downwardly past a horizontal position.

5. A dredge according to claim 4, said pump having an inlet extending beneath said platform, and a submersible motor carried by said platform in driving relation with said pump.

6. A dredge according to claim 5, said dredging means comprising, further, a vertically disposed rotatable cutter head carried by said platform and extending therebeneath into adjacently disposed relation with said pump inlet, and a submersible motor carried by said platform in driving relation with said cutter head, said cutter head being adapted to loosen material to be dredged and said pump being adapted to feed loosened material into said pipe inlet and through said discharge pipeline.

7. A dredge according to claim 5, said material discharge pipeline extending from said hull to a point remote from said hull, with the portion of said pipeline extending from said hull being supported by spaced pontoons and having a ball joint connection with said hull supported horizontally disposed pipeline portion.

8. A dredge comprising a hull, a well extending therethrough, a platform associated with said well and means for lowering and raising said platform with a solely vertical component of movement through said well to and from a dredging position, adjustable and non-rigid means interconnecting said platform and said hull adapted to stably support said platform in dredging positions, material dredging means and material discharge means carried by said platform, a single anchor line connected to the midpoint of the bow end of said hull, means for paying out and taking up said line, selectively operable, port and starboard anchor lines having sliding connections with the port and starboard sides of said platform, and means carried by said hull for selectively paying out and taking up said port and starboard lines to cause a horizontal pendulous swinging movement of said hull with respect to the anchor end of said bow line.

9. A dredge according to claim 8, said dredging means being of a vertically disposed rotary type and imparting a torque moment to said platform tending to rotate said platform about a vertical axis, said port and starboard lines having their connections with said platform positioned to adapt said lines to offset said torque moment when placed under tension.

10. A dredge according to claim 8, said lines being arranged, when said hull is positioned for dredging, to have said bow line extending from said hull a distance substantially in excess of the degree of extension of said other lines, with said port and starboard lines extending substantially equal distances from said hull.

11. A dredge according to claim 8, said means for lowering and raising said platform comprising a crane and suspension cable system, said adjustable and non-rigid means comprising a plurality of stabilizer lines extending upwardly and outwardly from said platform and over

hull-mounted guides to pay out and take up means carried by said hull, said stabilizer lines being adapted to be placed under tension when said platform is disposed at a dredging depth to remove substantially all of the load from said crane and suspension cable system.

12. A dredge according to claim 11, said platform having further attached thereto a pair of vertically disposed equalizer lines, one of said lines being attached to said platform adjacent the port side thereof and the other of said lines being attached to said platform adjacent the starboard side thereof, and means for selectively placing one of said equalizer lines under tension and for relieving the other equalizer line from tension when said port anchor line is being taken up to swing the hull in a port direction and for placing said other equalizer line under tension and for relieving said one equalizer line from tension when said starboard anchor line is being taken up to swing the hull in a starboard direction, said equalizer lines being tensioned sufficiently to offset the platform equilibrium upsetting force offered by the resistance to swinging movement of the hull in the water.

13. A dredge comprising a rectangular hull, a rectangular well formed through said hull rearwardly of the port-starboard center line of the hull and disposed symmetrically with respect to the bow-stern center line of the hull, a rectangular platform, a cable type elevator means operable to raise and lower said platform in a solely vertical direction through said well to and from dredging positions, a vertically disposed pump and submersible motor therefor carried by said platform, a vertically disposed cutter head carried by said platform at each of the port and starboard sides of said pump, platform-mounted submersible motors for said heads adapted to rotate said heads in opposite directions, port and starboard swing lines connected to said platform, a bow swing line connected to said hull along the bow-stern center line thereof, means selectively operable to pay out one of said port and starboard swing lines and take up the other, and adjustable and non-rigid guy lines attached to the corners of said platform and extending upwardly and outwardly therefrom to points of connection with said hull operable to stably support said platform in dredging positions.

14. A dredge according to claim 13, said platform having further attached thereto a pair of vertically disposed equalizer lines, one of said lines being attached to the platform at the port side thereof and the other of said lines being attached to the platform at the starboard side thereof, and means for selectively placing one of said equalizer lines under tension when said port swing line is being taken up and for placing the other of said equalizer lines under tension when said starboard swing line is being taken up.

15. A dredge of the suction type comprising a hull, a well extending therethrough, a platform and crane means for raising and lowering said platform through said well with a solely vertical component of movement, pump and cutter means mounted on said platform and a material discharge line connected to said pump, and a stabilizer system for said platform comprising a plurality of guy wires extending upwardly and outwardly from said platform and attached to said hull operable to take over the support of said platform from said crane means for dredging operation.

16. A dredge as set forth in claim 15 comprising, further, adjustable anchorages for said guy wires mounted on said hull, whereby the working depth of said platform may be adjustably varied.

17. A dredge as set forth in claim 15 comprising, further, horizontally disposed extension wings mounted on the sides of said hull and terminating in guides for said wires, whereby the included angles between said guy wires and the vertical axis of said platform may be increased to obtain a more stable support for said platform at the deeper dredging levels.

18. Apparatus of the class described comprising a hull having sides and a deck, a platform disposed beneath said hull, guy wires connected to said platform adjacent the corners thereof extending upwardly and outwardly to said hull, and upwardly along the sides of said hull to wire anchorages mounted on said deck, port and starboard swing lines having immediate and sliding connections with said platform and take-up and pay-out connections with said hull adapted to selectively move said platform to cause said platform to laterally move said hull through said guy wires, a pair of vertically disposed lines interconnecting said platform and hull, and means for selectively placing said vertically disposed lines under sufficient tension to offset the platform equilibrium upsetting force offered by the resistance to lateral movement of the hull in the water.

19. Apparatus of the class described comprising a hull, a platform, dredging means disposed on said platform, a plurality of guy wires extending upwardly and outwardly from said platform and attached to said hull and serving as suspension means for said platform, and means for paying out and taking up said guy wires whereby said dredging means may be operatively disposed at any desired dredging depth, said wires terminating at their points of connection with said platform.

20. Dredging apparatus comprising a hull, dredging means, and means interconnecting said hull and dredging means for the support of said dredging means, said interconnecting means consisting of a plurality of members inclined outwardly and upwardly from said dredging means to said hull, said members being incapable of withstanding compression and bending forces, and means for varying the vertical and horizontal components of length of said members, said interconnecting means terminating at their points of connection with said platform.

21. Dredging apparatus comprising a hull, dredging means carried thereby and adjustably disposable therebeneath including a pump, a contiguously assembled discharge line having its inlet connected to said pump and its outlet disposed remotely from said hull, said discharge line consisting of rigid and inextensible conduit members interconnected by ball joints permitting angular movement of said members with respect to each other, said members being in part hull-supported and in part pontoon-supported, said hull-supported members being each bodily movable with respect to said hull but being constrained by other hull-supported means so that changes in their overall angular configuration may be made only in a vertical plane, with a change in said angular configuration in a vertical plane of said hull-supported members being effective to impart a change in the angular configuration of said pontoon-supported members in a horizontal plane.

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