June 27, 1933. A. NEVELING 1,915,331

SPUD FOR DREDGES

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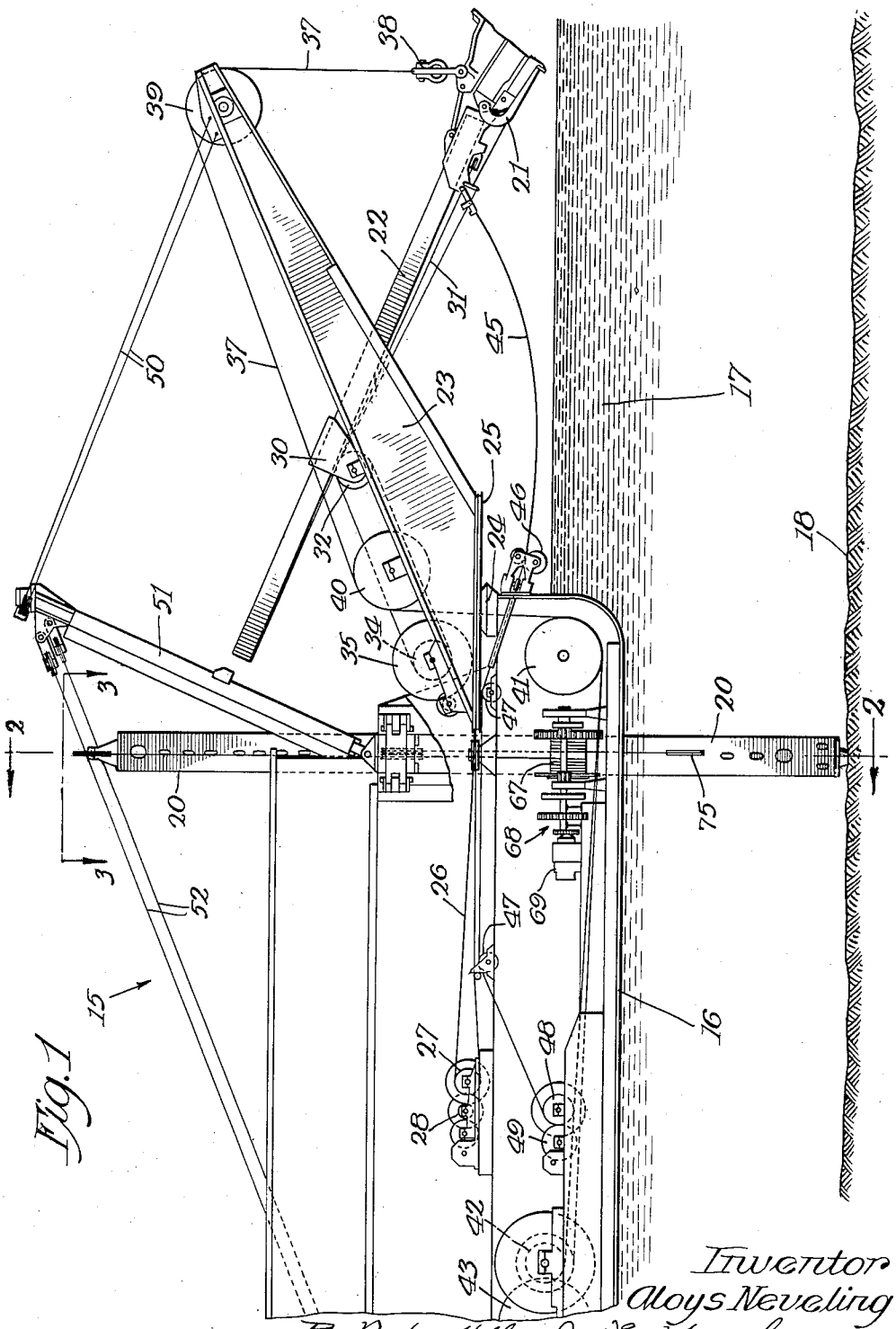



Fig. 1

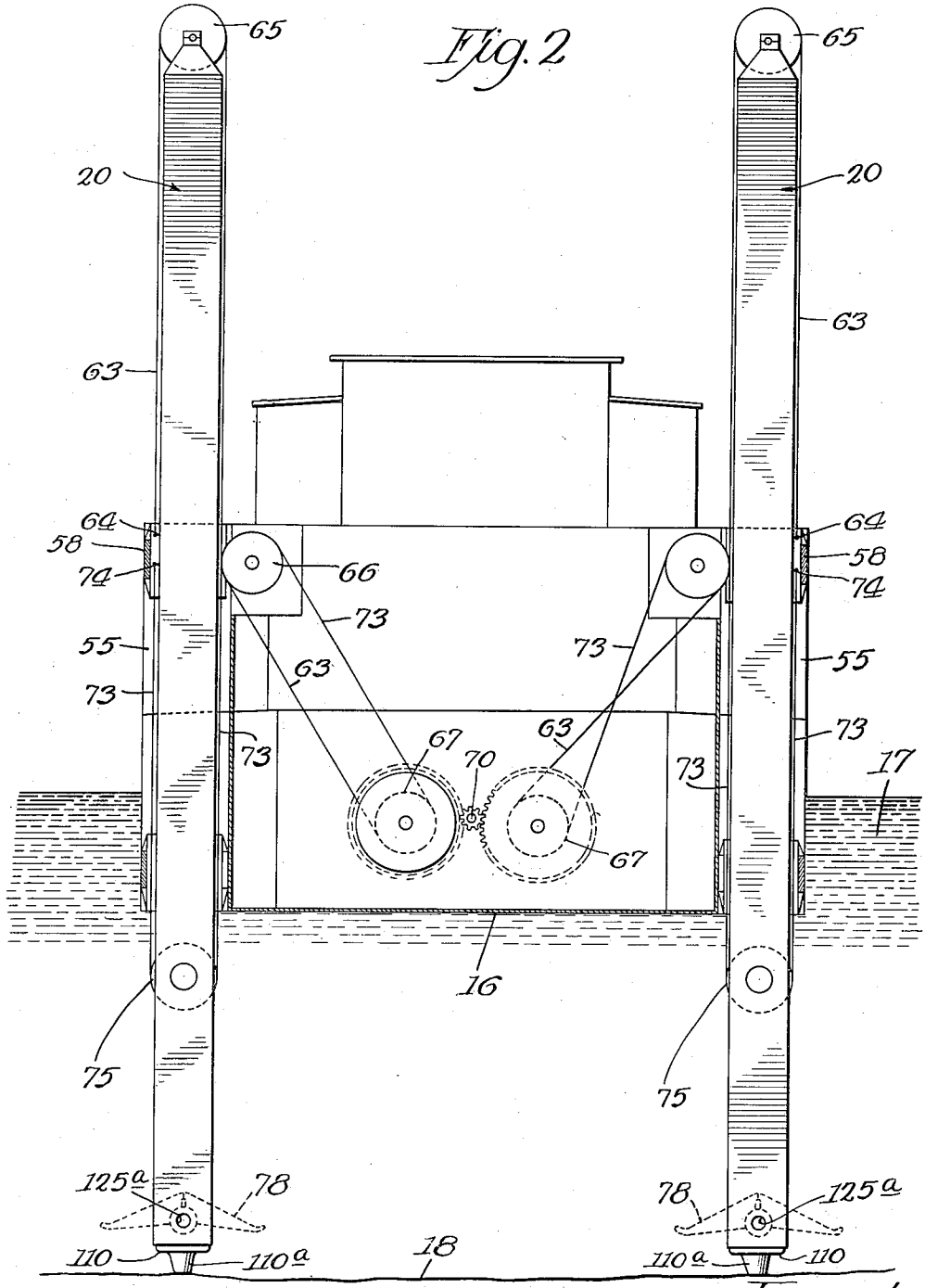
Inventor
Aloys Neveling
By Rector, Hibben, Davis & Macauley, Attys.

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SPUD FOR DREDGES

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Fig. 2



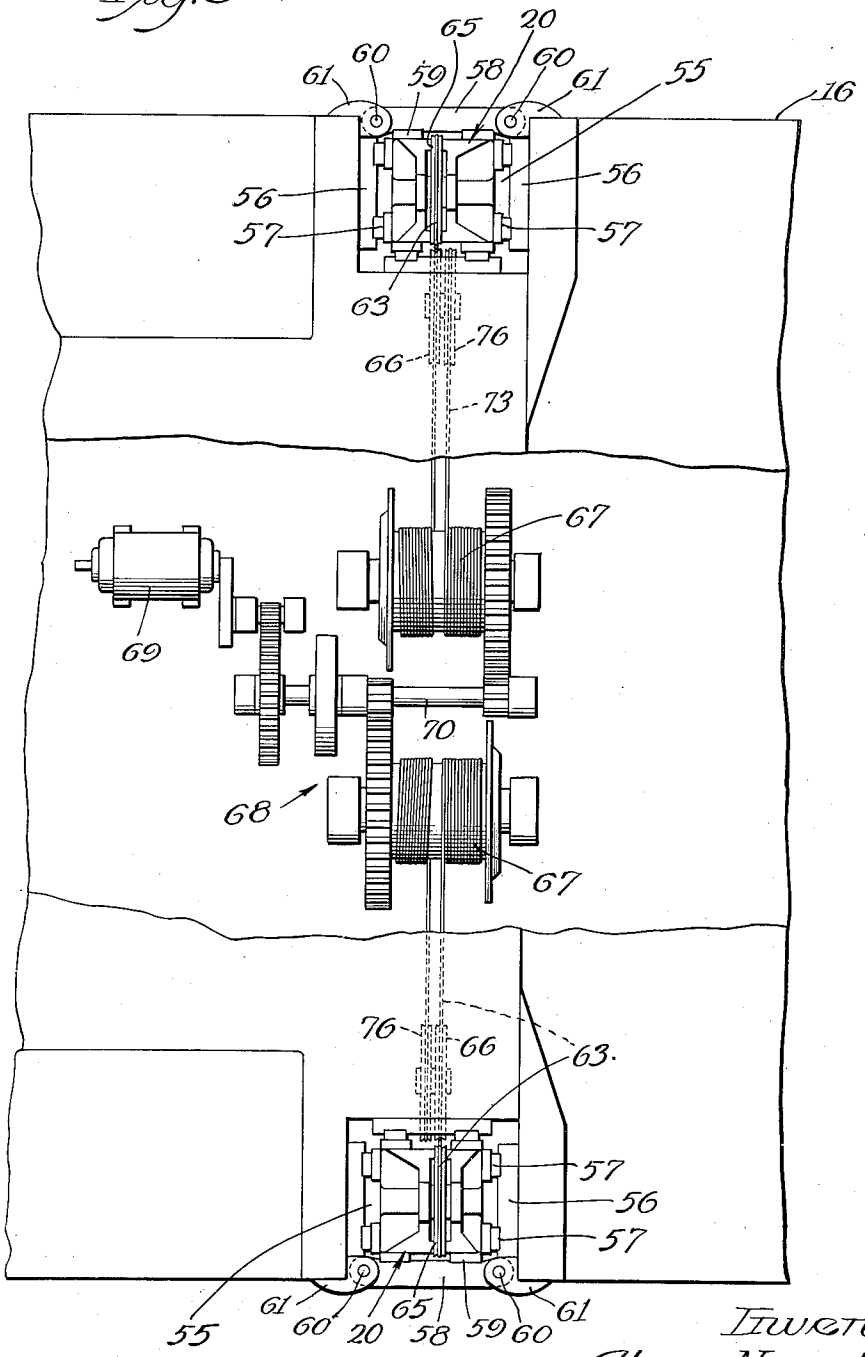

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SPUD FOR DREDGES

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Fig. 3




Inventor
Aloys Neveling
By Rector, Hibben, Davis & Macauley, Attys.

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Fig. 4

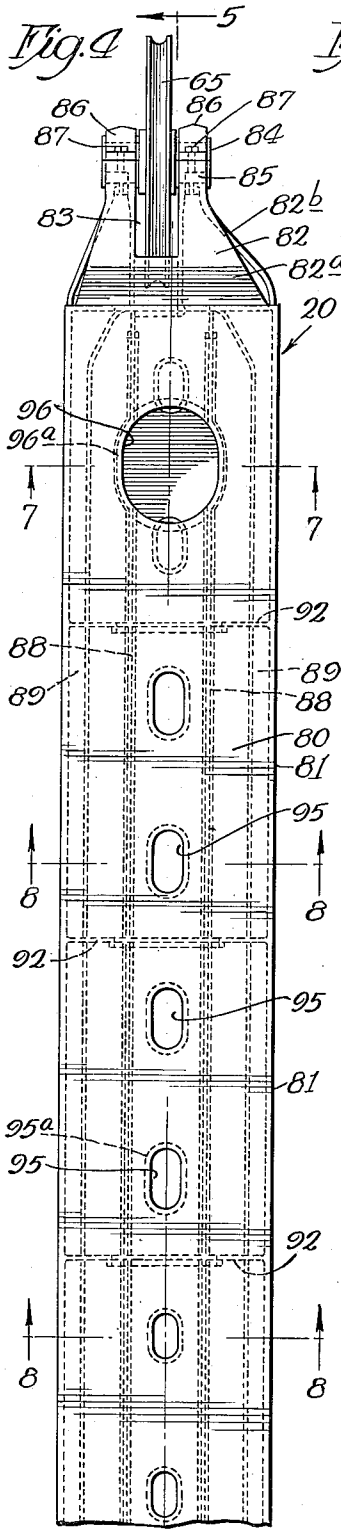



Fig. 5

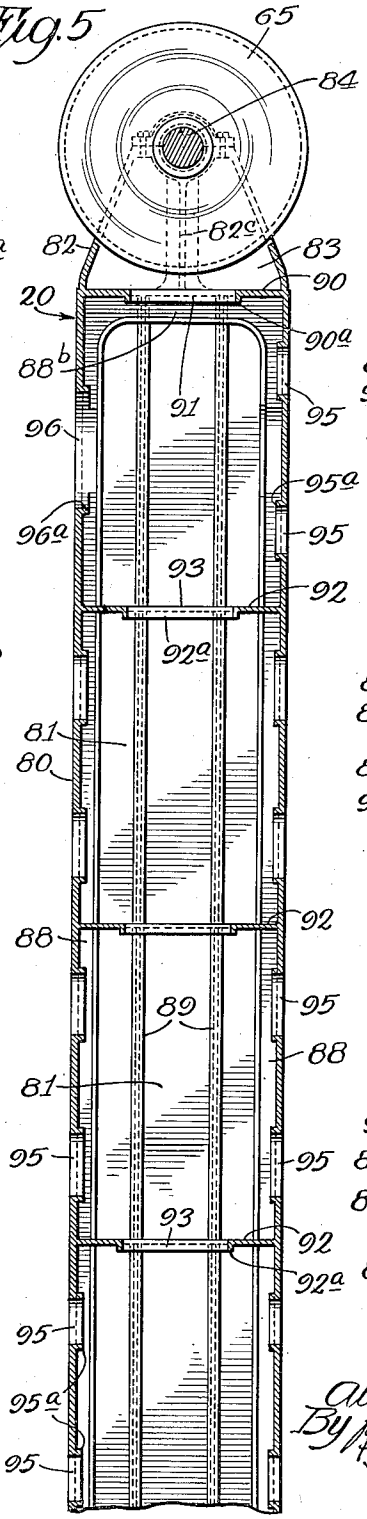



Fig. 6

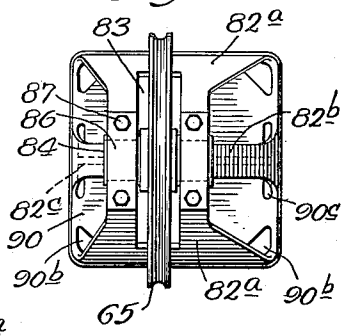



Fig. 7

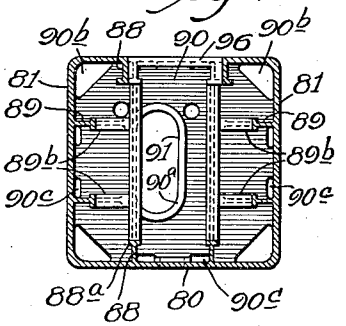
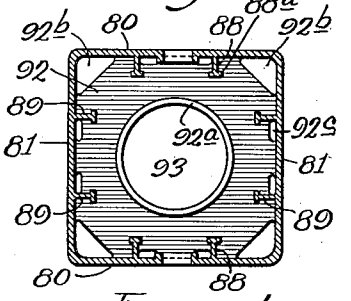



Fig. 8




Inventor
Aloys Neveling
By Rector, Hibben, Davis
and Macauley, Attys

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Fig. 4a

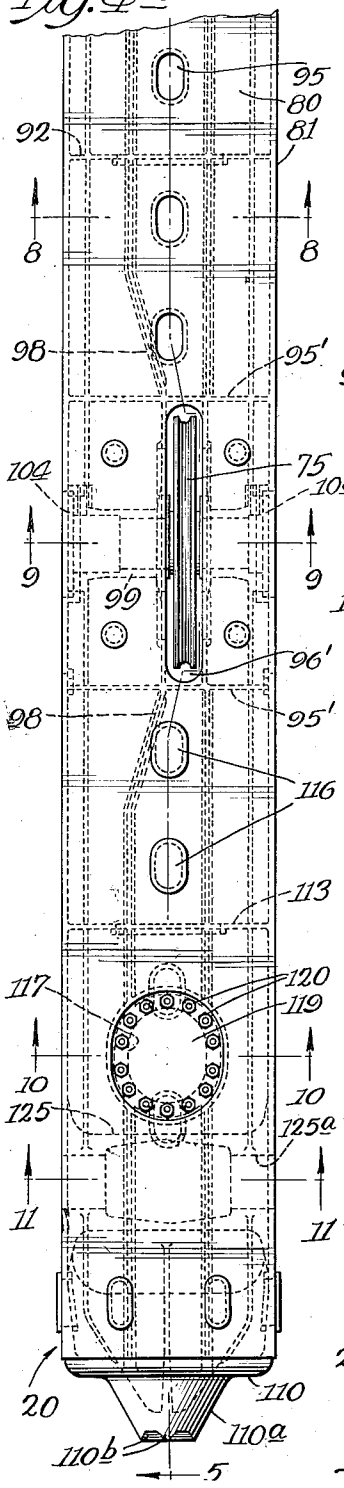



Fig. 5a

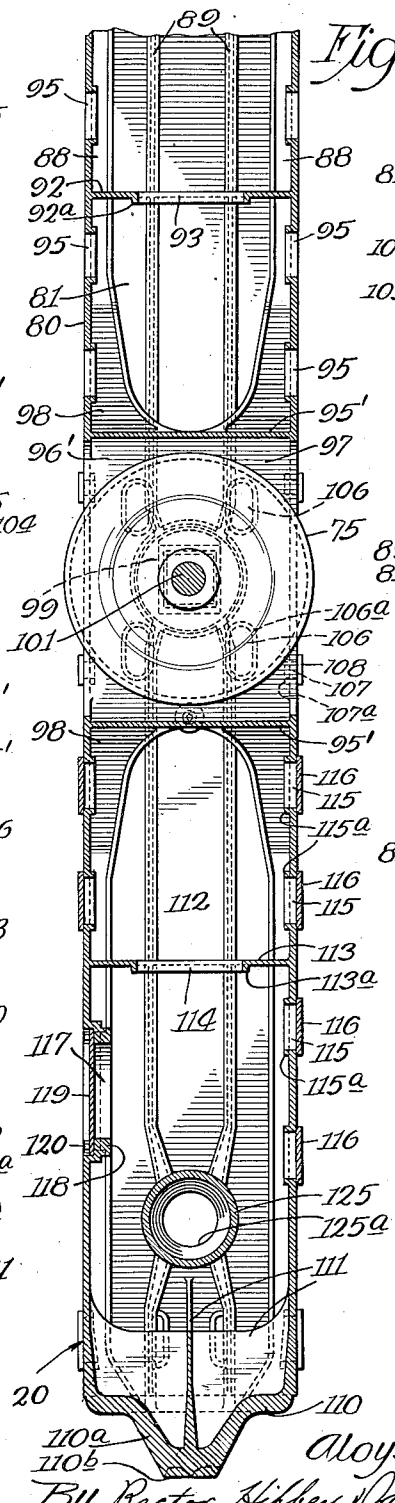



Fig. 9

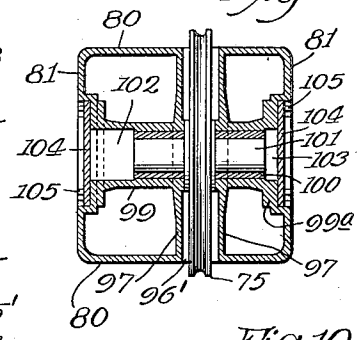



Fig. 10

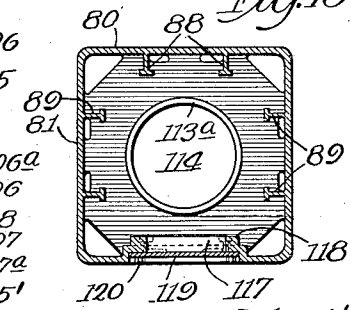



Fig. 11

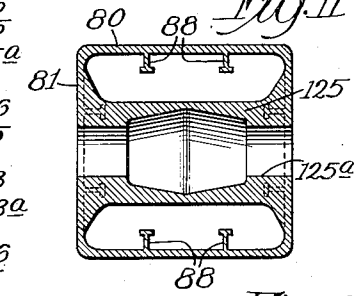
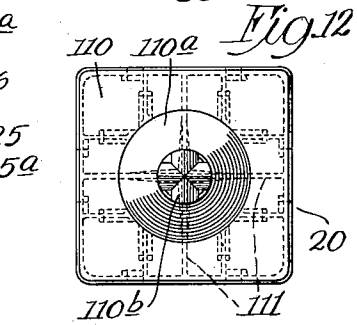



Fig. 12




Inventor

Aloys Neveling

By Rector, Hibben, Davis & Macauley, Attys.

Patented June 27, 1933 1,915,331

# UNITED STATES PATENT OFFICE

ALOYS NEVELING, OF CHICAGO, ILLINOIS

## SPUD FOR DREDGES

Application filed April 20, 1932. Serial No. 606,411.

This invention relates to improvements in dredges and particularly to a improved form of supporting member, commonly known as a spud, which is movable vertically with respect to the hull of the dredge for sustaining it against the bottom of a river or harbor in which the dredge is operating, so that the dredge is supported independently of its buoyancy upon the water during the operation of the digging bucket or other dredging mechanism. These spuds are commonly employed upon dredges and are adjustable vertically therein so that they may be moved downwardly and held against the bottom of the river or harbor by a cable mechanism or the like to provide a firm support for the hull of the dredge. They have heretofore been constructed of steel plates and bars of various shapes which have been united with each other by riveting, but it has been found that these spuds of fabricated steel construction are unsatisfactory because of their liability to break off, usually just below the hull of the dredge, under the influence of the severe lateral strains to which they are subjected by the operation of the dipper handle of the dredge and the dipper or bucket carried thereby during the dredging operation, and, also, because the severe torsional strains to which these spuds are subjected tends to shear off large numbers of the numerous rivets which are employed for holding the steel parts together, with the result that it has been necessary, at frequent intervals, to replace these rivets at great expense. If the parts of a structural steel spud be made strong enough to withstand the strains to which the spud is subjected when in use, the structure is so heavy and unwieldy that it is difficult to operate and the original cost is excessive, without avoiding the necessity of replacing the rivets at intervals.

The principal object of the present invention is to provide a cast steel spud for dredges, comprising an integral one piece structure having adequate strength to withstand the strains to which the spud is subjected in practice without excessive weight. A further object of the invention is to provide a cast steel spud having great buoyancy as compared with other spuds heretofore used. A further object of the invention is to provide a hollow cast steel spud reenforced on its inner side by a plurality of ribs and diaphragms which are integrally united with the walls of the spud. Still another object of the invention is to provide an integral cast steel spud having an inner chamber therein for giving buoyancy to the structure when it is submerged in the water. A further object of the invention is to provide a cast steel spud having provisions for attaching operating pulleys or sheaves thereto. Still another object of the invention is to provide a cast steel spud equipped with means for attaching thereto a shoe or plate for increasing the bearing surface of the spud upon the bottom of the river or harbor. Other objects relate to various features of construction and arrangement which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying drawings in which one embodiment is illustrated.

In the drawings,—

Figure 1 shows a somewhat diagrammatic side elevation of the front portion of a dredge equipped with the improved spuds of the present invention;

Fig. 2 shows a somewhat diagrammatic transverse vertical section taken on the line 2—2 of Fig. 1;

Fig. 3 is a partial top plan view of the dredge within the limits indicated by the line 3—3 in Fig. 1;

Figs. 4 and 4ª, taken together, show, on an enlarged scale, a complete side elevation of the improved spud of the present invention;

Figs. 5 and 5ª show a complete vertical section through the improved spud, taken on the line 5—5 of Figs. 4 and 4ª;

Fig. 6 shows a top plan view of the improved spud shown in Fig. 4;

Fig. 7 shows a transverse section taken on the line 7—7 of Fig. 4;

Fig. 8 shows a transverse section taken on any one of the lines 8—8 of Figs. 4 and 4ª;

Fig. 9 shows a transverse section taken on the line 9—9 of Fig. 4ª;

Fig. 10 shows a transverse section taken on the line 10—10 of Fig. 4[a];

Fig. 11 shows a transverse section taken on the line 11—11 of Fig. 4[a]; and

Fig. 12 shows a bottom plan view of the improved spud shown in Fig. 4[a].

As illustrated in the drawings, the invention is applied to a dredge 15 comprising a hull 16 which is adapted to rest upon and partially within the water 17 overlying the bottom 18 of the river or harbor in which the dredging operations are taking place. The hull 16 is adapted to be supported against the bottom 18, during the dredging operations, by a plurality of spuds or vertical supporting members 20, embodying the features of the present invention, which are vertically adjustable so that they may be withdrawn and carried well above the bottom 18 when the dredge is being moved from one location to another. When the supporting members or spuds 20 are lowered against the bottom 18, they are held in that position by a suitable cable mechanism or the like and thus sustain the hull 16 against movement downwardly in the water during the manipulation of the dipper or digging bucket 21 which is carried at the end of the usual dipper handle 22. The dipper handle 22 is movably mounted upon a hoisting crane 23 comprising a boom or frame which projects outwardly and upwardly from the forward end of the dredge, in cantilever fashion, with the lower end thereof mounted in a vertical bearing 24 carried by the hull of the dredge so that the crane may be swung about a vertical axis to vary the position of the dipper or bucket 21. A large pulley 25 is mounted around the lower part of the crane 23 and the cable 26 extends around this pulley and rearwardly to a drum 27, operated by mechanism 28, so that the position of the boom may be varied by power driven mechanisms when desired. The stem of the dipper handle 22 is slidably mounted in a carriage 30 which is pivotally mounted upon the frame of the crane 23, substantially midway between the ends thereof. The handle 22 is capable of being moved endwise through the carriage 30 by a cable 31 which is attached to the lower end of the handle and which passes around a pulley 32 mounted in the carriage. This cable 31 passes around a drum 34 mounted at the lower end of the crane and driven by an engine or motor 35, mounted on the lower end of the crane 23. The dipper 21 and lower end of the dipper handle 22 are capable of being raised vertically by a cable 37 which is attached to a yoke 38 having pivotal connection with the upper side of the dipper. This cable 37 extends around a pulley or sheave 39 mounted at the outer end of the boom of the crane 23. From this point the cable 37 extends downwardly and inwardly and around another pulley 40 mounted upon the inner part of the crane 23. The cable 37 then extends downwardly and around a pulley 41 located in the hull 16, after which it is carried rearwardly and around a hoisting drum 42 positioned within the hull and operated by a power driven mechanism 43. The bucket or dipper 21 may be pulled inwardly toward the hull 16, with a corresponding pivotal movement of the dipper handle 22, by means of a cable 45 which is attached to the lower part of the dipper arm and which is carried inwardly through a set of sheaves 46 attached to the forward end of the hull. This cable 45 then extends rearwardly over pulleys 47 and then downwardly around a drum 48 driven by power mechanism 49. In this way the bucket or dipper 21 is capable of various movements with respect to the crane 23 which is itself capable of being swung about a vertical axis with respect to the forward end of the hull 16. The outer end of this crane 23 is supported by cables 50 which are connected to the upper end of a supporting beam 51. This beam is also connected rearwardly to the rear or intermediate portion of the hull by cables 52.

The hull 16 is provided on its lateral side, adjacent its forward end, with inwardly extending recesses 55 in which the supporting members or spuds 20 are adapted to move vertically, as shown particularly in Figs. 2 and 3. A similar recess or channel is provided toward the rear end of the dredge for another spud 20 which is located midway between the sides of the hull, thus providing a three point support for the hull when these spuds are moved downwardly and held against the bottom 18. Each channel 55 is provided adjacent the upper and lower ends thereof with a series of bars 56 carrying rollers 57 which are adapted to coact with the outer walls of the spud during its vertical movements. Each spud is retained in its channel by removable bars 58 carrying rollers 59 which coact with the outer faces of the spuds, these bars being held in position by pins 60 engaging brackets 61. Each spud 20 is moved downwardly and held against the bottom 18 by means of a cable 63 which has its outer end secured in fixed position on the hull as shown at 64 in Fig. 2 and which is then carried upwardly and around a sheave or pulley 65 mounted upon the upper end of the spud, as shown in Figs. 2 and 3. This cable 63 is then carried downwardly on the inner side of the spud and is passed partially around a pulley 66 rotatably mounted on the hull adjacent the upper part thereof. From this point, the cable 63 extends downwardly and inwardly and around a drum 67 forming a part of a winch 68 which is driven by a motor or engine 69 for the purpose of winding up the cable and thereby forcing the spud downwardly. As shown in Fig. 3, the shaft

70 of the winch is connected through gears to both drums 67 so that the cables 63 for depressing the spuds on both sides of the hull are operated simultaneously by the same power driven mechanism.

Each spud 20 is elevated by a separate cable 73 having its outer end secured at a fixed point on the hull as shown at 74. This cable 73 extends downwardly and around a sheave or pulley 75 which is rotatably mounted within a slot formed in the lower portion of the spud, as illustrated in Figs. 1 and 2. Each cable 73 is then carried upwardly on the inner side of the spud and is passed around a pulley 76 located alongside the pulley 66 previously referred to. From the pulley 76, the cable 73 is passed downwardly and around the previously described drum 67 located adjacent that side of the hull. The cables 73 are wound on the drums 67 in a direction opposite to the winding of the cables 63 so that when the drums are operated to wind up the cables 73 and thereby elevate the spuds 20, the other cables 63 are simultaneously unwound from the same drums. A shoe 78, shown in Fig. 2, may be detachably mounted upon the lower end of each spud in order to increase the bearing surface when the bottom 15 of the river or harbor is formed of mud or other soft material.

Each spud 20 is of the form illustrated particularly in Figs. 4 to 12, inclusive, and comprises a pair of oppositely disposed flat side walls 80 which are integrally united with opposite disposed front and rear walls 81, these walls being arranged to form a rectangular enclosure which, in this embodiment, is substantially square in form with the corners thereof somewhat rounded at the points where the walls are united with each other. At the upper end of the spud, the four rectangular walls are tapered inwardly to form an integral bracket 82, having side walls $82^a$ and right angularly disposed walls $82^b$, the latter being reenforced by ribs $82^c$. These walls have parts thereof cored out to form a slot 83 adapted to receive the sheave 65 previously referred to. This sheave has trunnions 84 formed integrally therewith and these trunnions are journaled in bearings 85 carried by the upper end of the bracket 82 on opposite sides of the slot 83. Separate bearing caps 86 are secured to the lower portions of these bearings by bolts 87. The sheave 65 is thus journaled in the upper end of the spud and it is of such a diameter that the opposite sides thereof project beyond the side walls of the spud, as shown in Fig. 5 to permit the cables 63 to extend parallel to these side walls without contact therewith in normal operation.

The side walls 80 of the spud are each provided with a pair of inwardly extending reenforcing ribs 88 which extend longitudinally of the side walls parallel to each other, being provided with transverse flanges $88^a$ at their inner edges, so that they are T-shaped in cross-section. Each of the front and rear walls 81 of the spud is similarly provided with a pair of longitudinal reenforcing ribs 89 spaced apart in parallel relation and having transverse flanges at their inner edges to give them T-shaped cross-sections. At the upper end of the spud, beneath the sheave or pulley 65, the walls 80 and 81 are united by an integral end wall or diaphragm 90 having a central oval aperture 91 therein which is surrounded by an integral or annular rib $90^a$ formed as a part of the wall or diaphragm 90. The ribs 88 are extended transversely across the spud and united with the wall or diaphragm 90 as shown at $88^b$ and the longitudinal ribs 89 on the front and rear walls of the spud are extended inwardly across the end wall 90 and united with the other ribs 88 as shown at $89^b$ in Fig. 7. Other transverse walls or diaphragms 92, similar to the end wall 90, are formed integrally with the walls 80 and 81 and spaced apart at intervals from the upper end of the spud to a point toward the lower end thereof where their form is modified as hereinafter described. These diaphragms 92 are in the form of flat walls extending at right angles to the walls 80 and 81 and having apertures 93 through the central parts thereof which are circular in form and surrounded by annular flanges $92^a$ formed on the diaphragms 92. These transverse walls or diaphragms 93 are united integrally with the longitudinal reenforcing ribs 88 and 89. The side walls 80 of the spud are provided between the end wall 90 and the first diaphragm 92, and also between adjacent diaphragms 92 with cored holes 95 which are elongated in the direction of the longitudinal axis of the spud, being surrounded by inwardly extending flanges $95^a$ formed integrally with side walls. Two of these holes 95 are preferably provided between two adjacent diaphragms 92, but between the upper diaphragm 92 and the end wall 90, a single large hole 96 is provided in one side wall 80 to serve as a manhole through which a man may enter the interior of the spud to remove the cores of sand or the like which are employed in casting. Having entered through the hole 96, which is surrounded by an annular flange $96^a$, the workman may move longitudinally of the spud through the holes 93 which are large enough for that purpose. Substantially triangular openings $90^b$ and $92^b$ may be provided at the corners of the diaphragms 90 and 92, respectively, and other small elongated openings $90^c$ and $92^c$ may be formed through the diaphragms 90 and 92, respectively, between the pairs of ribs 88 and 89, as shown in Figs. 7 and 8, to facilitate the casting of the construction in

one piece without danger of cracking the diaphragms.

The lowermost diaphragm 92, of the form shown in Fig. 8, is located a short distance above the sheave or pulley 75 previously referred to. At points immediately above and below the sheave 75, the rectangular walls 80 and 81 of the spud are united by integral transverse diaphragms 95′, which are solid continuous walls extending between oppositely disposed vertical walls of the spud. Between the transverse walls or diaphragms 95′, the spud is provided with a transverse vertical slot 96′ adapted to receive the sheave or pulley 75 previously referred to. This slot 96′ extends completely through the vertical side walls 80 of the spud and is bounded on its lateral sides by parallel vertical walls or webs 97, shown particularly in Figs. 4ª and 9, these walls 97 being formed integrally with the side walls 80 and also with the transverse diaphragms 95′. One of these walls 97 is in alignment with the ribs 88 formed on the side walls and the other side wall 97 of the slot is in alignment with the ends of two other pairs of ribs 88 which are deflected inwardly as shown at 98 in Fig. 4ª. The front and back walls 81 of the spud and the walls 97 of the slot 96′ are also formed integrally with a hub 99 which has bushings 100 mounted therein to serve as journals for the shaft 101 which forms a bearing for the sheave or pulley 75. The hub 99 is enlarged at its ends to form rings 99ª which are integrally united with the end portions of the longitudinal reenforcing ribs 89, as shown in Fig. 5ª. Cylindrical blocks 102 and 103 are mounted in the hub at the ends of the shaft 101 and are retained in place against the ends of the bushings 100 by means of circular plates 104 seated in the counterbored outer ends of the hub 99 and held in place by means of studs 105. In this way the sheave or pulley 75 is detachably mounted within the lower part of the spud and may be readily removed by detaching the cover plates 104 and withdrawing the shaft 101. The walls 97 forming the sides of the slot 96′ are provided with cored holes 106 surrounded by annular flanges 106ª, as shown in Fig. 5ª. Circular cored holes 107 are formed in the side walls 80 of the spud between the transverse diaphragms 95′, with annular flanges 107ª extending inwardly around them. These holes are preferably closed by cover plates 108 which are welded in place.

The portion of the spud lying below the lower diaphragm 95′ is constructed to provide an air chamber which is adapted to give buoyancy to the spud when it is submerged below the surface of the water, thus counterbalancing a portion of its weight and reducing the energy required to effect the adjustment thereof. At its extreme lower end, the spud is provided with a transverse end wall 110 which is preferably relatively thick and which is provided with a downwardly tapered projection 110ª, provided with sharpened edges 110ᵇ at its lower extremity for engagement with the surface of rock or the like which lies on the bottom of the river or harbor. This projection 110ª is reenforced on the inner side of the spud by intersecting ribs 111 which are formed integrally with the end wall 110 and with the walls 80 and 81 of the spud so that forces are transmitted from the end wall to the vertical walls of the spud when it is pressed against the bottom 18. The region between this end wall 110 and the lowermost transverse diaphragm 95′ constitutes an air chamber 112 which is intersected at an intermediate point by a transverse diaphragm 113 similar in construction to the diaphragm 92 in the upper part of the spud. This diaphragm has an aperture 114 therethrough surrounded by an annular rib 113ª. The ribs 88, formed on the walls 80, are continued through this part of the spud and are enlarged at their upper and lower ends where they are united with the lower diaphragm 95′ and the bottom wall 110, respectively. The reenforcing ribs 89 on the front and rear walls of the spud are also continued through the air space 112. The side walls 80 of the spud are provided with cored holes 115 which are surrounded by flanges 115ª directed inwardly. These holes are closed, after the cores have been removed from the interior of the spud, by plates 116 which are welded in position thereover. At the extreme lower end of the spud, two of these holes 115 are provided in each of the front and rear walls 81 and these are similarly closed by plates 116. One of the side walls 80 of the spud is provided with a manhole 117, surrounded by an enlarged ring of metal 118 which is counterbored to receive the coverplate 119 held in place by a series of cap screws or stud bolts 120. By removing this plate 119, a workman may get into the air chamber 112 for the purpose of removing the cores at the end of the casting operation, and the hole 114 in the diaphragm 113 is large enough to permit him to work in the upper part of the air chamber.

Adjacent its lower end, the spud 20 is provided with a transverse hub 125 which is formed integrally with the side walls 80 and arranged to extend continuously through the spud, as shown in Fig. 11. The ends of this hub are provided with cylindrical bearing portions 125ª, adapted to be engaged by a pin or bolt for securing in place a shoe 78, such as that shown in Fig. 2, which is adapted to increase the bearing surface of the lower end of the spud when operating over a bottom formed of soft mud or the like.

The improved spud described above has adequate strength to withstand all of the

stresses to which it is subjected when in use without excessive weight and the effective weight of the spud when it is partially submerged is greatly reduced by the provision of the air chamber in the lower part thereof. The novel construction and arrangement of the transverse diaphragms reenforces the spuds against the effects of lateral stresses and this reenforcement is accomplished without interfering with the removal of cores and the like at the conclusion of the casting operation. It has been found that a spud of this construction three or four feet in cross-section, sixty feet long and weighing thirty-five tons or more, may be cast as one integral construction without defects in any of its parts and, not only does the original cost of such a spud compare favorably with the previously used spud made up of plates and bars riveted together, but the cost of maintenance is very greatly reduced because there are no parts which become loose and have to be replaced.

Although one form of the invention has been shown and described by way of illustration, it will be understood that it may be constructed in various other embodiments within the scope of the appended claims.

I claim:

1. A spud for dredges comprising a single cast steel member having an integral sheave bracket at the upper end thereof and an integral sheave supporting hub toward the lower end thereof.

2. A spud for dredges comprising integrally united vertical walls having integrally formed reenforcing ribs on the inner sides thereof.

3. A spud for dredges comprising vertical walls cast integrally with each other and provided on their inner sides with integral parallel longitudinal ribs.

4. A spud for dredges comprising vertical walls cast integrally with each other and provided on their inner sides with integral parallel longitudinal ribs having transverse flanges along their inner edges.

5. A spud for dredges comprising integrally united vertical walls having longitudinal reenforcing ribs on the inner sides thereof, and transverse diaphragms integrally united with said walls and with said ribs.

6. A spud for dredges comprising integrally united vertical walls having longitudinal reenforcing ribs on the inner sides thereof, and transverse diaphragms integrally united with said walls and with said ribs, said diaphragms and certain of said walls having holes therethrough surrounded by inwardly extending annular flanges.

7. A spud for dredges comprising integrally united cast vertical walls, a pair of transverse diaphragms extending continuously between and united with said walls, two of said walls being provided between said diaphragms with longitudinal slots, and integral webs extending between said diaphragms to form side walls extending between the edges of said slots.

8. A spud for dredges comprising integrally united cast vertical walls, a pair of transverse diaphragms extending continuously between and united with said walls, two of said walls being provided between said diaphragms with longitudinal slots, integral webs extending between said diaphragms to form side walls extending between the edges of said slots, and integral hub portions united with said webs and with two of said side walls for supporting a sheave inserted between said webs and projecting through said slots.

9. A spud for dredges comprising integrally united vertical walls, a pair of transverse walls extending continuously between and united with said vertical walls, said vertical walls having cored holes therethrough, and a relatively large manhole, coverplates welded over said cored holes, and another coverplate detachably secured over said manhole.

10. A spud for dredges comprising integrally united vertical walls, a pair of transverse walls extending continuously between and united with said vertical walls, said vertical walls having cored holes therethrough, a relatively large manhole, coverplates welded over said cored holes, another coverplate detachably secured over said manhole, and an integral bearing hub extending continuously between two of said vertical walls and united therewith.

In testimony whereof, I have subscribed my name.

ALOYS NEVELING.