No. 826,868. PATENTED JULY 24, 1906.

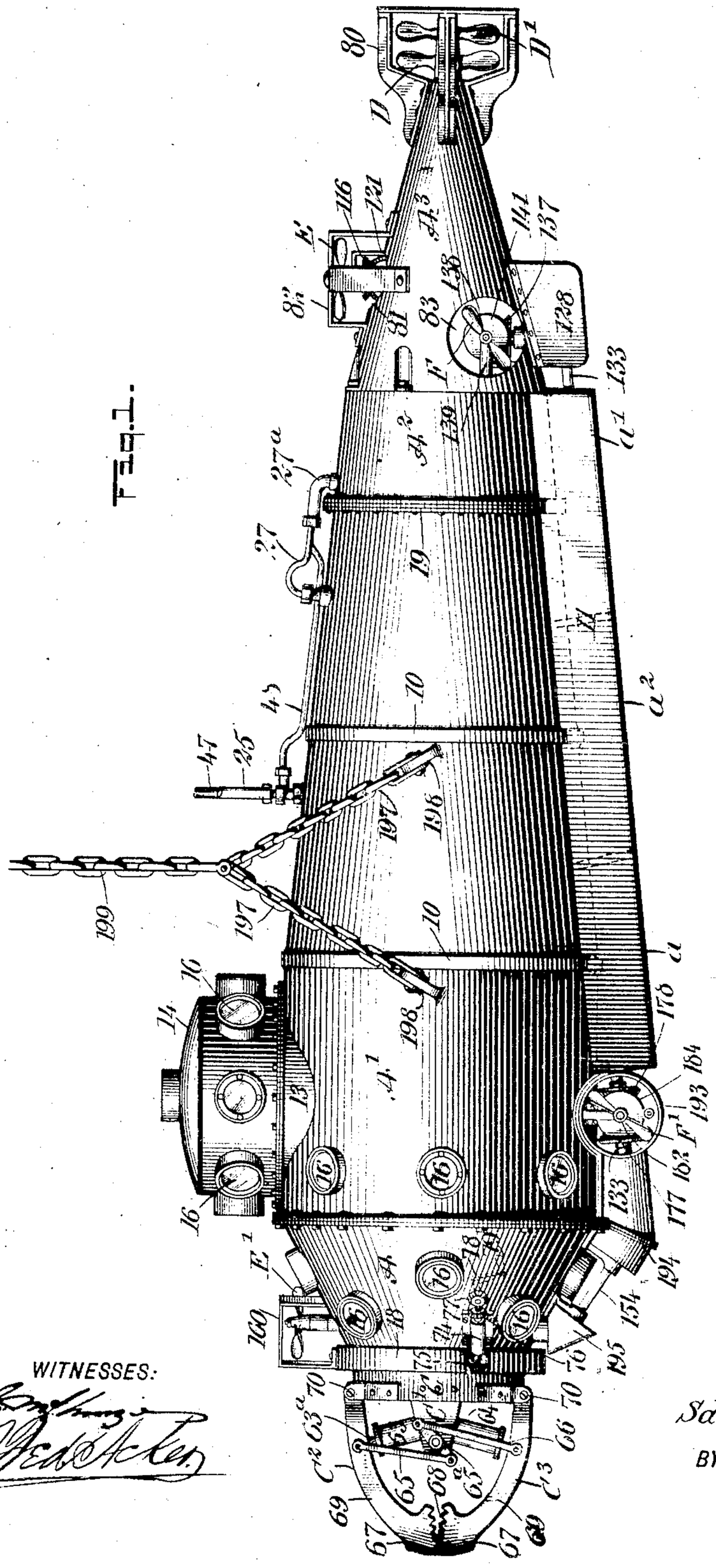
S. NEVES.

SUBMARINE VESSEL.

APPLICATION FILED AUG. 9, 1905.

6 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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BY Munn & Co

ATTORNEYS

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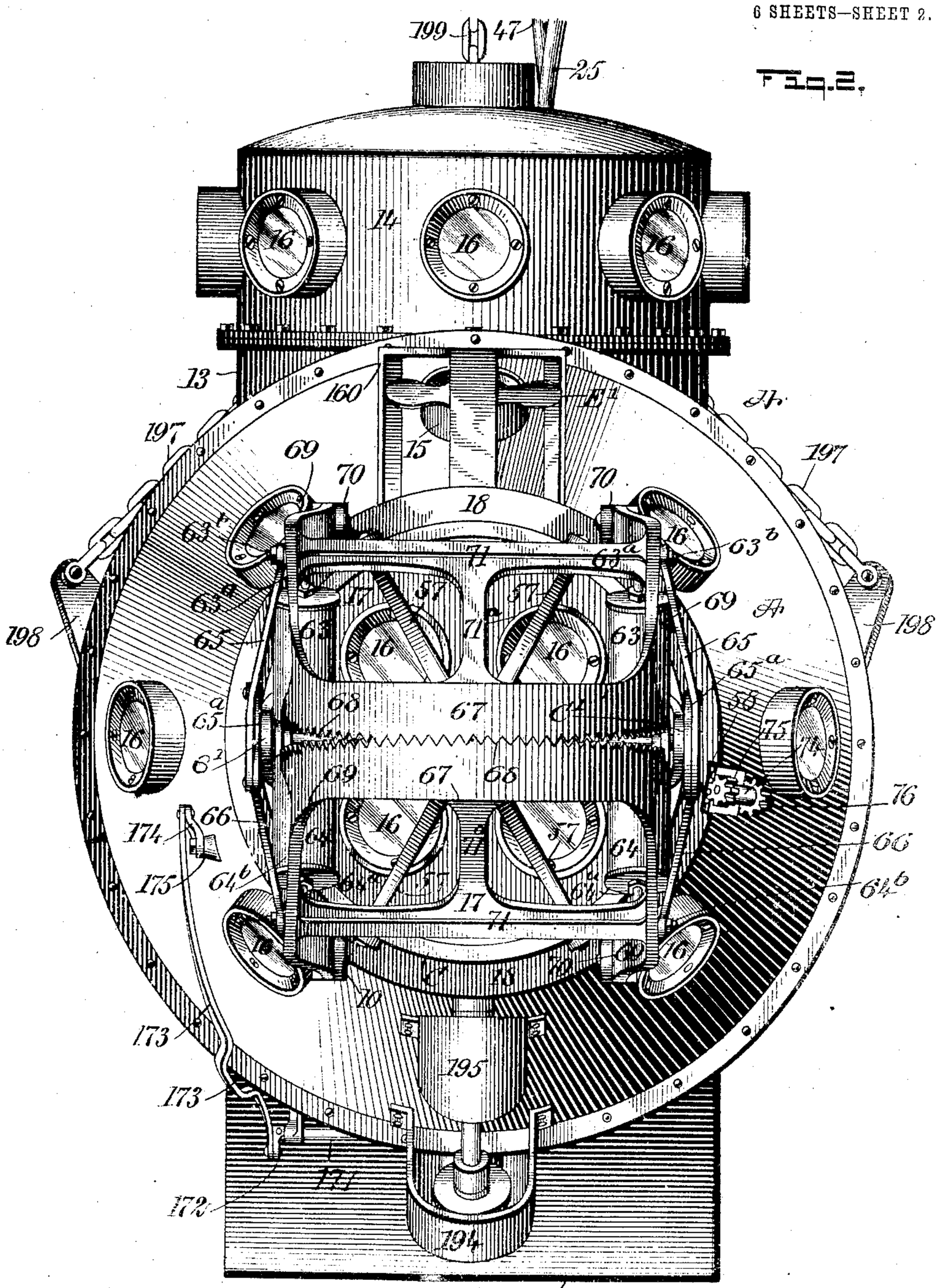
6 SHEETS—SHEET 2.

Fig. 2.



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6 SHEETS—SHEET 3.

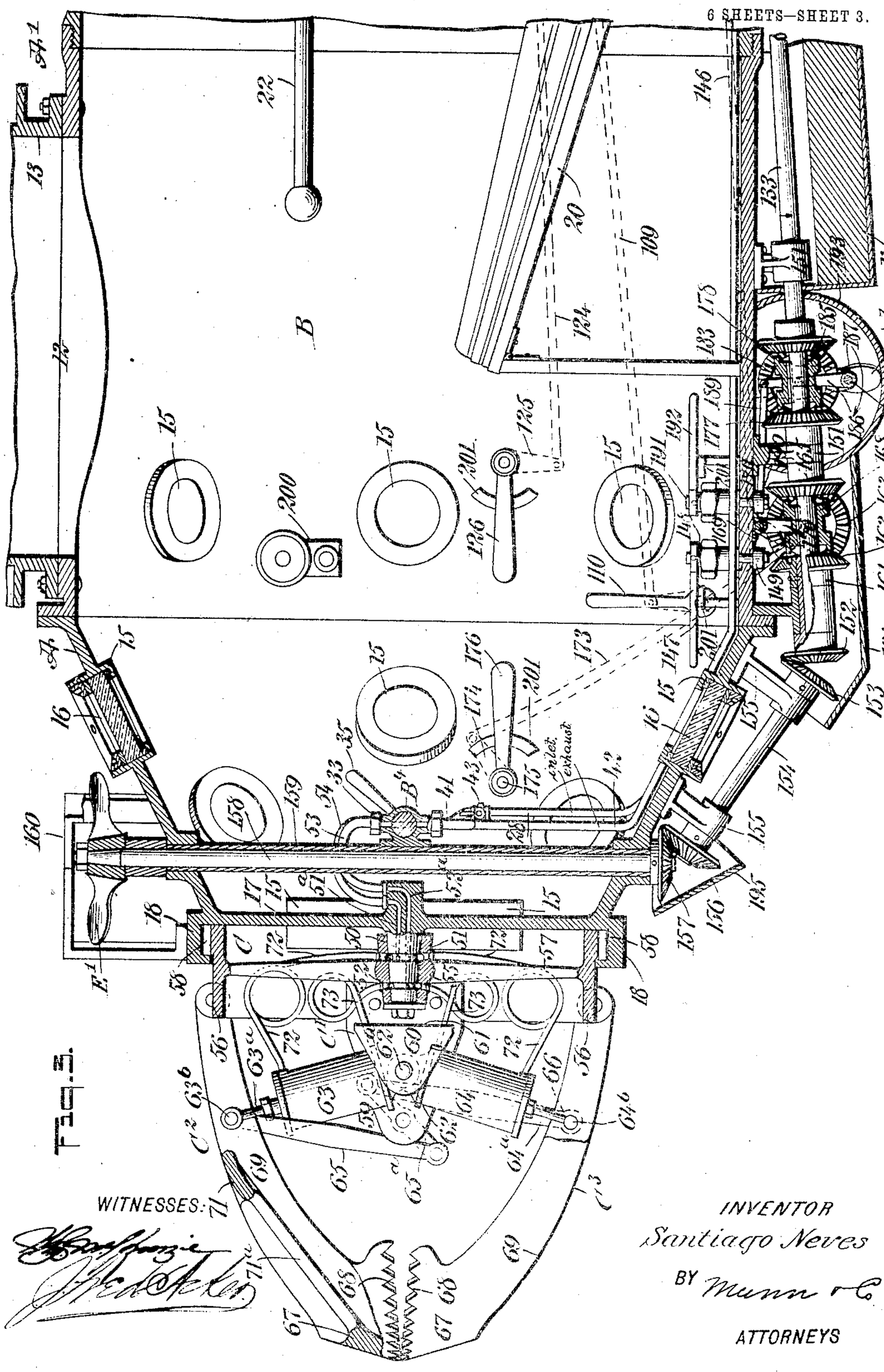

FIG. 2.

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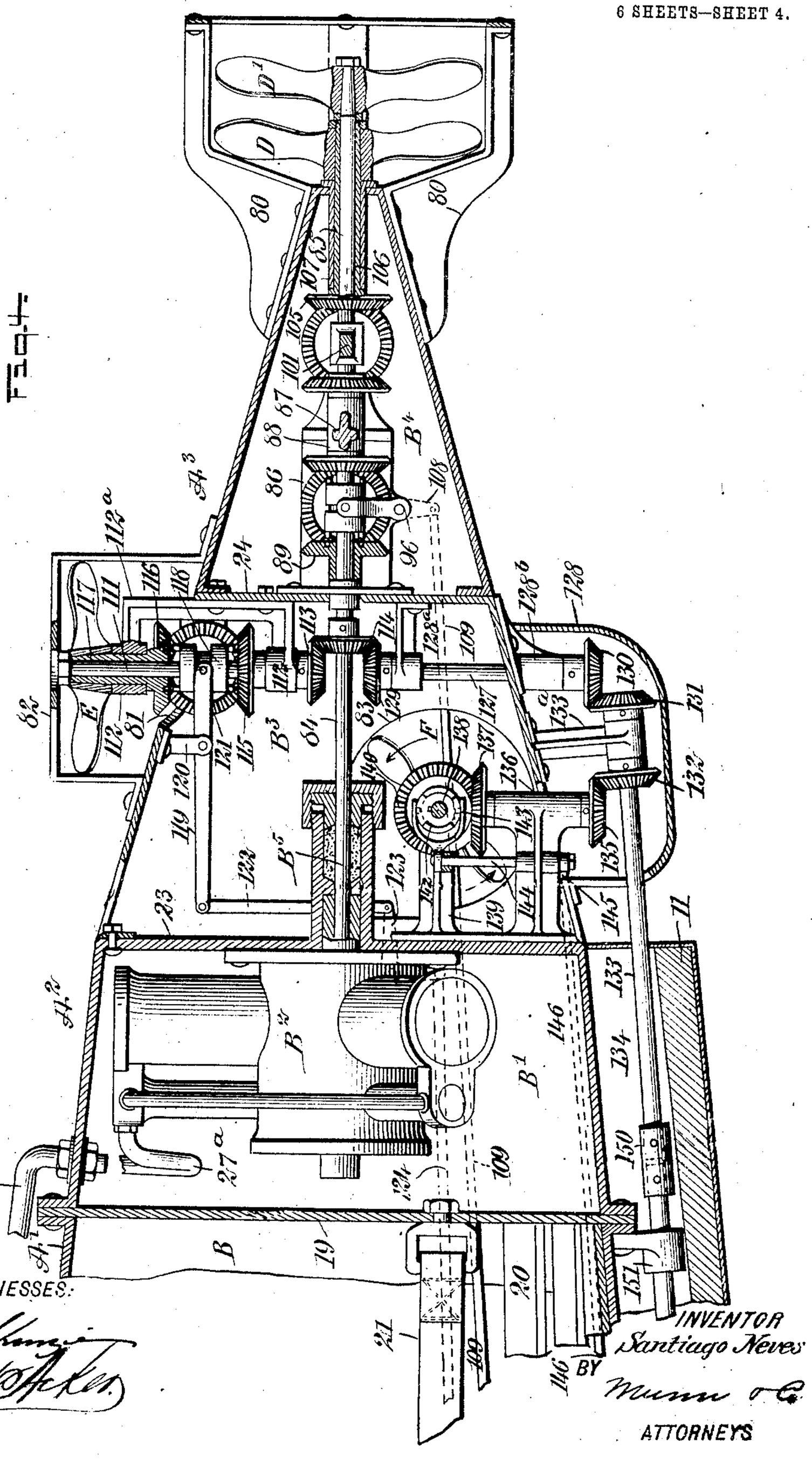
6 SHEETS—SHEET 4.

FIG. 4.



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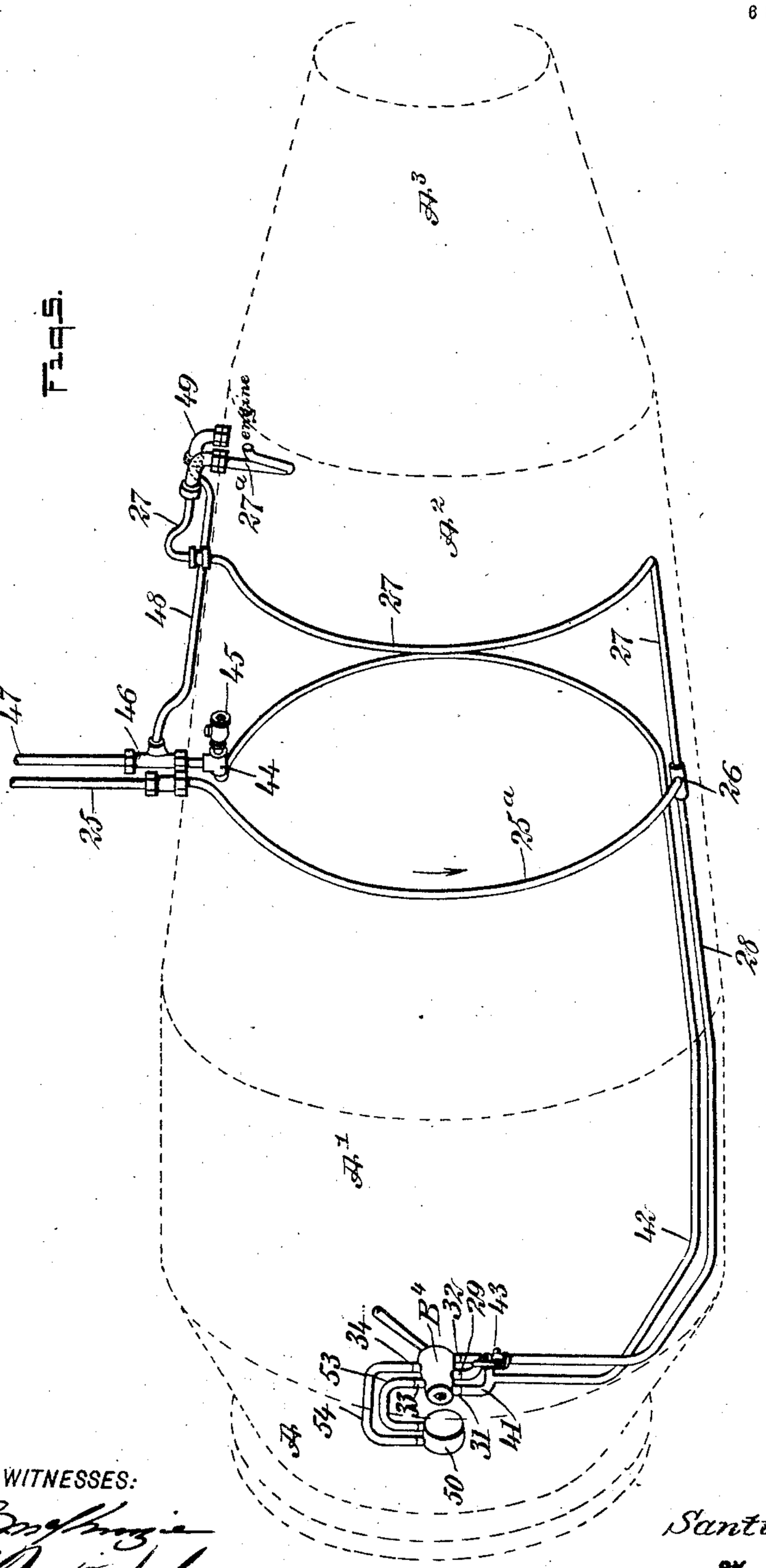
6 SHEETS—SHEET 5.

FIG. 5.



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6 SHEETS—SHEET 6.

Fig. 6.

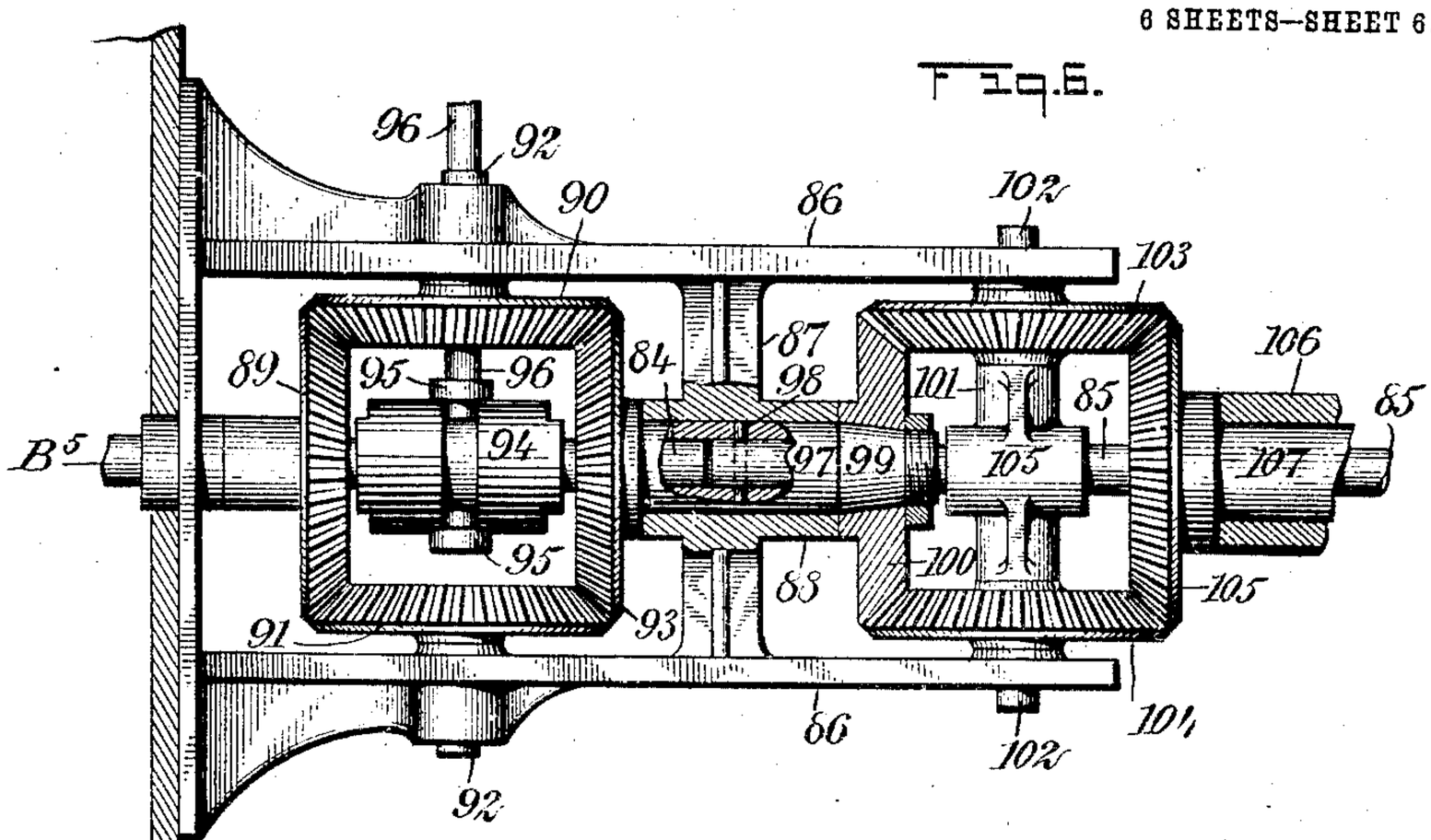

Fig. 7.

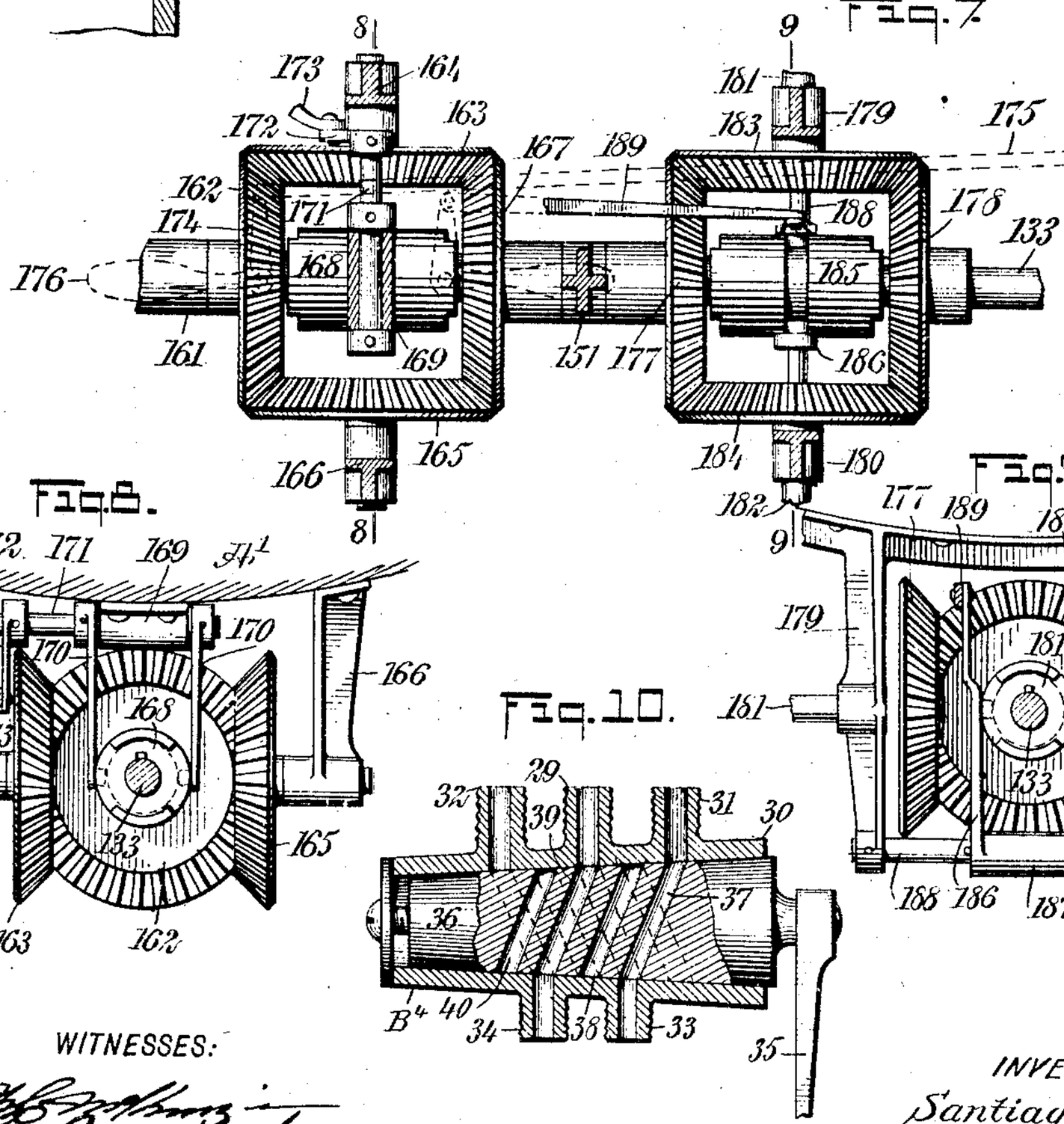

Fig. 8.

Fig. 9.

Fig. 10.

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UNITED STATES PATENT OFFICE.

SANTIAGO NEVES, OF VALPARAISO, CHILE.

SUBMARINE VESSEL.

No. 826,868. Specification of Letters Patent. Patented July 24, 1906.

Application filed August 9, 1905. Serial No. 273,376.

To all whom it may concern:

Be it known that I, SANTIAGO NÈVES, a citizen of the Republic of Chile, and a resident of Valparaiso, Chile, have invented a new and Improved Submarine Vessel, of which the following is a full, clear, and exact description.

The purpose of my invention is to provide a submarine vessel adapted to contain a single individual, who is kept supplied with atmospheric air from above the water-level and who may have telegraphic or telephonic communication with attendants on the surface of the water, and to provide a simple, economic, and reliable means for propelling the boat ahead, sternward, or to starboard or port, or up or down, thus enabling a person to descend to depths unattainable by divers having the ordinary divers' apparatus, and whereby the person in the vessel having absolute control of the vessel can move in any required direction, the vessel at its bow being provided with suitable bull's-eyes, enabling the occupant of the vessel to observe upon all sides of the vessel, as an electric light may be provided within the vessel.

Another purpose of the invention is to provide a vessel especially adapted for submarine explorations or for operating tools or tackle at points below the water, being also adapted to raise heavy articles to the surface of the water or harness such objects, so that they may be otherwise raised.

A further purpose of the invention is to so locate the various steering-levers or the levers controlling the propellers that there will be no mistake in the selection of the proper lever, since they are constructed to move only in the direction that the propellers to which they belong will carry the vessel. Thus the levers controlling the propellers which move the vessel to starboard can be moved for that purpose only to the right, the levers controlling the propellers for moving the vessel to port can for that purpose be moved only to the left, the levers controlling the ascent move vertically upward, those controlling the descent move vertically downward, while the levers controlling the backward movement and the forward movement of the vessel are moved, respectively, in direction of the stern and in direction of the bow.

Another purpose of the invention is to provide jaws at the bow or forward end of the vessel, which jaws are capable of a rotary movement and of an opening and closing movement, all the said movements being accomplished by mechanism thoroughly under the control of the person within the vessel.

The invention consists in the novel construction and combination of the several parts, as will be hereinafter fully set forth, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of the improved vessel. Fig. 2 is a front elevation of the same. Fig. 3 is an enlarged longitudinal section through the forward portion of the vessel. Fig. 4 is an enlarged vertical longitudinal section through the after portion of the vessel. Fig. 5 is a diagrammatic view illustrating the arrangement of the air supply and exhaust pipes. Fig. 6 is a sectional plan view of the mechanism for throwing the rear propellers into and out of action and for reversing them. Fig. 7 is a similar view of the gears for throwing into and out of gear the forward, port, and starboard propellers and also the vertical forward propeller. Fig. 8 is a view of the gears taken on the line 8 8 of Fig. 7, the shaft only being in section. Fig. 9 is a view of the gears taken on the line 9 9 of Fig. 7, the shaft only being in section; and Fig. 10 is a longitudinal sectional view of the three-way valve controlling the gripping-jaws.

The hull of the vessel is cigar or fish shaped, being cylindrical in cross-section; but its head is given more or less of a conical formation. Preferably the construction of the hull embraces a conical front section A mentioned, a tapering main body-section A′, an intermediate tapering body-section A^2, and a diminishing stern-section A^3, all of which sections are suitably flanged and bolted together. The said body when necessary is strengthened by bands 10, placed wherever needed, and at about the central portion of the hull a keel 11 is constructed having no communication with the interior of the hull.

An opening 12 is made in the main body-section A′ at its upper portion near its forward end, surrounded by a collar 13, upon which collar a turret 14 is normally bolted. The operator enters the vessel through the said opening 12 when the turret is removed, the turret being again securely fastened before descent is made. Various port-holes 15

are made in the bow and in the main body-sections A and A′ and in the turret 14, and each port-hole is closed by a lens 16, lighted by any illuminating medium in the interior of the vessel—electric lights, for example.

The arrangement of the port-holes and their lenses is such that the occupant of the vessel can see ahead, up and down, and sidewise.

The conical bow-section A is closed by a bulkhead 17, having a forwardly-extending annular marginal flange 18, as is shown in Figs. 1 and 3, and a second bulkhead 19 is located where the main and intermediate sections of the hull connect, as is shown in Fig. 4, thus providing a forward main chamber B, extending from the bulkhead 17 to the bulkhead 19, and this chamber is to be occupied by a single individual whose duty it is to direct the vessel and work jaws at the bow of said vessel and to be hereinafter described.

A couch 20 is erected on the bottom of the chamber B, its foot being at the bulkhead 19, as shown in Fig. 4, and such couch extends far enough forward to permit the operator to operate various levers located at the forward portion of the said chamber B. The operator lies face downward upon said couch 20, and the forward end of the couch has an upward inclination, as is shown in Fig. 3, to elevate the body of the operator.

A suitable harness 21 is provided for the operator to prevent him slipping from the couch when the vessel assumes diagonal positions, and end bars 22 are secured to the sides of the chamber for the comfort of the occupant.

I desire it to be understood that I do not confine myself to any particular number of sections in the construction of the hull, nor to any particular way of fastening the sections together.

Where the hull-sections A^2 and A^3 connect a water-tight bulkhead 23 is located, as is shown in Fig. 4, forming a water-tight compartment B′, in which the engine B^2 is located and said engine is run by compressed air. A fourth bulkhead or compartment 24 is located in the stern-section A^3 of the hull, as is shown in Fig. 4, dividing said section into two compartments B^3 and B^4.

An air-supply pipe 25, connected with any approved air-compressor above the surface of the water, is led into the rear portion of the forward compartment B, as is shown in Fig. 5, and is carried downward in engagement with the side of said compartment to the bottom thereof, as is illustrated at 25^a in said figure, and by means of a suitable coupling 26 is connected with two branch pipes 27 and 28. The branch pipe 27 extends rearwardly and then up along the inside of the compartment B, out through the top of the hull, where it connects with a larger pipe 27^a, and the latter pipe extends through the hull and is connected with the engine B^2.

A branch supply-pipe 28 is carried forward along the bottom of the compartment B up to a connection with the central nipple 29 in the bottom portion of the casing 30 of a three-way valve B^4, which casing has also two exhaust-nipples 31 and 32 at its under surface, one at each side of the supply-nipple 29, and at the upper side of the casing 30 two nipples 33 and 34 are provided, which act either one as an exhaust factor according to the direction in which the handle 35 of a plug 36, mounted in the casing 30, is turned. The plug 36 is provided with four diagonal channels 37, 38, 39, and 40, as is shown in Fig. 10. The two exhaust-nipples 31 and 32 are connected by a bow-pipe 41, and the said bow-pipe, which is an exhaust-pipe, is connected with a main exhaust-pipe 42. It may be here remarked that air is supplied to the main compartment B through a valve 43 within convenient reach of the occupant of the vessel, which valve is located in the supply-pipe 28, as is shown in Figs. 3 and 5.

The main exhaust-pipe 42 is carried rearward at the bottom of the hull and then upward within the compartment B to a connection with a T-fitting 44, also in said compartment B, and an automatically-operating valve 45 is connected with this fitting, which valve will open when the air-pressure is too great in the compartment B to reduce the pressure, thus insuring a constant and uniform air-pressure in the living compartment of the vessel. The fitting 44 is connected with another fitting 46 outside of the hull, being located at the lower end of the exhaust-pipe 47, that leads to the surface of the water. This latter fitting 46 is also connected with a branch exhaust-tube 48, and said tube in its turn is connected with a gooseneck 49, the open end of which is in the engine-compartment B′, since the exhaust from the engine is preferably direct into said compartment.

A spud-axle 50 is formed at the central portion of the forward bulkhead 17, extending beyond both sides of the said bulkhead; and in the outer tapering end of the said axle or spindle 50 two annular grooves 51 and 52 are made, as is shown in Fig. 3. Also in the said spindle 50 two channels are produced, extending longitudinally thereof from the upper portion of its inner end, one channel 51^a being in communication with the groove 51 in said spindle and the other channel 52^a being in communication with the outer groove 52 in the spindle, as is also shown in Fig. 3. A pipe 53 connects the channel 52^a with the upper nipple 33 on the valve-casing 30, and a second pipe 54 connects the channel 51^a in the said spindle with the other upper nipple 34 of said valve-casing 30.

The hub 55 of a wheel C is mounted to turn on the spindle 50, the said wheel consisting of a wide rim 56 and spokes 57, connecting the rim with the hub, and the rear portion of the

rim of the wheel turns within the flange 18 of the bulkhead 17, as is shown in Fig. 3. This portion of the rim of the wheel C is provided with exterior teeth 58 for a purpose to be hereinafter described.

Brackets C′ are diametrically and oppositely located on the outer portion of the rim 56 of the wheel C. These brackets are of like construction, each consisting of an outer forwardly-extending member 59 and an inner forwardly-extending but shorter member 60, the two members being connected by a member 61, extending through the inner or bottom portion of the shorter member 60 to the inner face of the outer member 59. In connection with each bracket C′ two cylinders 63 and 64 are employed, placed end to end, and at opposing ends of the cylinders ears 62 are formed. The ears of each pair of cylinders are pivoted by the same pivot-bolt 62^a between the members 59 and 60 of the brackets C′, as is shown in Figs. 1 and 3, both sets of cylinders being shown in Fig. 2.

The piston-rods 63^a of the cylinders 63 are pivoted, by means of suitable pivot-pins 63^b, to the inner side faces of a jaw C^2, pivoted to the wheel C in a manner to be hereinafter described, and the piston-rods 64^a of the opposing cylinders 64 of a pair are pivotally connected by pivot-pins 64^b to the inner side faces of an opposing jaw C^3. These jaws are adapted to open and close, having simultaneous movement to and from each other, the said movement being accomplished by the cylinders 63 and 64 and their pistons.

In order that the action of each of the jaws shall be equal notwithstanding that the weight of the lower jaw tends to act to pull it from the upper jaw, I provide the following equalizing coupling connections between the cylinders of a pair. A link 65 is pivotally attached to the pivot-pin 63^b of each piston-rod 63^a at the outside of the jaw C^2, and these links 65 at their opposite ends are pivotally connected to an end of lever-arms 65^a, fulcrumed centrally between their ends on the outer faces of the outer members 9 of the brackets C′. Links 66, corresponding in length to the links 65, are pivotally attached to the opposite ends of the said lever-arms 65^a and to the pivot-pins 64^b of the pistons 64^a, the connection being made at the outer sides of the jaws C^3.

The construction of the jaws C^2 and C^3 is best shown in Fig. 2, wherein it will be observed they each consist of a curved or arched front member 67, and the opposing edges of these front members of the jaws are more or less convexed and are provided with teeth 68, so that when the teeth of one jaw meet the teeth of the opposing jaw at the central portion of their front members 67 a space will be between the teeth of the two jaws at their front side portions, so as to accommodate the biting qualities of the jaws to articles large and small. Side pieces 69 extend from the front members 67, and these side pieces at their rear ends are pivotally connected with lugs 70, which are secured upon the outer portion of the rim 56 of the wheel C. Finally each jaw is braced by a cross-bar 71, extending from side to side, and a second front bar 71^a, extending from the front members to the cross-bar 71.

Pipes 72 are carried from the outer ends of the cylinders 63 and 64 and are passed into apertures in the hub 55 of the wheel in such manner as to have communication with the circumferential groove or channel 51 in the spud-axle or spindle 50, and another pipe 73 is carried from the inner end of each cylinder 63 and 64. These latter pipes 73 are also passed through apertures in the hub of the wheel C to a communication with the groove or channel 52 in the said spindle or axle 50.

In operating the jaws when the plug 36 of the valve B^4 is in the position shown in Fig. 10 the compressed air entering the nipple 29 will pass up through the channel 39 in said plug to the nipple 34 and out from said nipple, through the pipe 54, and into the channel 51^a in the axle or spindle 50 and from thence to the groove 51 in said axle or spindle. The said compressed air will then find its way into the tubes 72 and will be conducted to a point above the piston-head in the cylinders 63 and 64, forcing the said piston-heads inward, thus drawing the jaws C^2 and C^3 in direction of each other, and the exhaust air will pass out through the pipes 73, connected with the inner ends of the cylinders, into the groove 52 in the axle or spindle 50, thence into the channel 52^a in the said axle or spindle, out therefrom through the pipe 53^a, and the exhaust will then enter the nipple 33 of the valve-casing 30 and pass down through the channel 37 in the plug into the exhaust-nipple 31 and from thence into the main exhaust-pipe 42. It will be observed that when the plug 36 of the three-way valve B^4 is in the position shown in Fig. 10, or in a position to effect a closing action of the jaws, the channels 37 and 39 only are brought into action, the alternate channels 38 and 40 being closed; but when the plug 36 is reversed to admit compressed air at the inner ends of the cylinders to force their pistons outward, and consequently open the said jaws C^2 and C^3, the channels 37 and 39, which were formerly in action, are carried out of action, and the channels 38 and 40 are the ones that are brought into service, as is shown by dotted lines in Fig. 10. Consequently the compressed air is carried through the channel 38 to the nipple 33, which was formerly the exhaust-nipple, and the nipple 34 becomes the exhaust-nipple, the exhaust passing through the channel 40 to the nipple 32 instead of through the nipple 31, as formerly.

The jaws are turned so as to bring their

mouth-sections in the most suitable position to grasp an object by means of the following mechanism or its equivalent, which is under the complete control of the operator within the vessel: A shaft 74 is journaled at one side of the front section A of the vessel, provided with a pinion 75 at one end, which meshes with the teeth 58 of the wheel C, as is shown in Figs. 1 and 2, and at the opposite end of the shaft 74 a bevel-gear 76 is secured, which meshes with a similar gear 77, secured to a shaft 78, which extends into the main compartment B and is turned as desired by an attached crank-handle 79 or by corresponding means.

At the rear end of the rear section A^3 of the hull a cage 80 is formed, and in the upper portion of the hull at the compartment B^3 an opening 81 is made, surrounded by a cage 82, which is secured at the upper portion of the hull, as is shown in Figs. 1 and 4. In the side walls of the same chamber B^4 opposing openings 83 are produced. Within the cage 80 the propellers are located which are adapted to force the vessel ahead or sternward, and in the cage 82 the rear propeller is located, adapted to raise or lower the vessel at the rear, while at the openings 83 the rear propellers are located, which give movement to the vessel starboard or port.

The drive-shaft B^5 from the engine extends through the rear or stern section A^3 of the hull to a point beyond its rear end and within the cage 80. This shaft B^5 is in two sections, (designated as 84 and 85,) as is particularly shown in Fig. 6.

Horizontal parallel frame-arms 86 are secured to the rear face of the bulkhead 24 in the hull-section A^3, as is shown in Figs. 4 and 6, and a cross-bar 87 connects these two frame-arms 86 at or about their centers, and said cross-bar has formed thereon a bearing 88, parallel with the arms 86, through which the drive-shaft passes.

Within the compartment B^4, adjacent to the bulkhead 24, a bevel-gear 89 is loosely mounted on the section 84 of the drive-shaft B^5, and the said gear 89 is made to mesh with beveled gears 90 and 91, mounted to turn on short shafts 92, carried by the frame-arms 86. The gears 90 and 91 mesh with a bevel-gear 93, which faces the gear 89. A double-faced clutch 94 is feathered on the section 84 of the drive-shaft B^5, having movement to and from the gears 89 and 93 to engage with either of them and cause either to turn with the section 84 of the said drive-shaft. The clutch 94 is shifted through the medium of a shifting-fork 95, which is carried by a shaft 96, journaled in suitable bearings in one of the frame members 86, as is shown in Figs. 4 and 6. The gear 93 is secured to a sleeve 97, and this sleeve crosses the two sections of the drive-shaft B^5 where they approach each other, as is shown in Fig. 6, and while the sleeve 97 is loosely mounted on the section 84 of the drive-shaft it is made fast to the outer section 85 of said drive-shaft by means of a pin 98 or its equivalent, as is shown in Fig. 6.

The rear end of the sleeve 97 is rendered exteriorly conical and threaded at its outer end, as shown at 99 in Fig. 6, in order to receive a bevel-gear 100, which is fast to the said sleeve and turns with the gear 93. A cross-bar 101, is located to the rear of the gear 100, and the cross-bar 101, is provided with cylindrical ends 102, which are loosely mounted in the frame-bars 86, and between said frame-bars 86, upon each end portion of the cross-bar 101, a bevel-gear is mounted to turn, being separated by the body portion of the cross-bar. These bevel-gears are designated as 103 and 104 and are in mesh with the gear 100.

The two bevel-gears 103 and 104 mesh with a bevel-gear 105, which faces the gear 100, and the said gear 105 is provided with a sleeve 107, loosely mounted on the section 85 of the drive-shaft B^5, as is shown in Fig. 4, and likewise mounted in a bearing 106, which extends forward from the rear end of the stern-section A^3 of the hull. The hub of a propeller D is secured to the sleeve 106, and a second propeller is secured to the outer end of the section 85 of the drive-shaft, as shown in Fig. 4. The blades of the said propellers are oppositely inclined, and the propellers turn simultaneously in opposite directions. When the clutch 94 is carried forward, engaging with the forward gear 89 of the chain of gearing described, motion is imparted to the gear 93 through the gears 90 and 91, turning said gear 93 in an opposite direction to the direction of rotation of the gear 89, and said gear 93 will turn the shaft portion 85, thus rotating the propeller D', attached thereto, and the gear 100 through the medium of the gears 103 and 104 will turn the gear 105 in an opposite direction to the direction of rotation of the shaft, and said gear will cause its attached propeller D to turn in the same direction with it.

The shifting of the clutch 94 is accomplished by securing a crank-arm 108 on the shaft 96, carrying the shifting-fork 95, and the said crank-arm is pivotally connected with a rod 109, which leads to the forward portion of the main chamber B, where it is connected with a lever 110 within convenient reach of the operator. When the lever 110 is pushed forward, the clutch 94 engages with the gear 89, as has been described, and the propellers act to carry the vessel ahead, and when the lever 110 is carried rearward the clutch 94 is made to engage with the gear 93, and the direction of rotation of both propellers is changed and they act to back the vessel.

With reference to the propeller located at the rear and adapted to either raise or lower

the vessel at that point the shaft 111 for this propeller, which propeller is designated as E, is journaled at its upper end in the upper portion of the cage 82 and between its ends in suitable bearings 112, extending from a bracket 112[a], secured to the forward face of the bulkhead 24 and extending out through the upper rear opening 81. A bevel-gear 113 is secured to the lower end of the shaft 111, and said bevel-gear 113 meshes with a bevel-gear 114, secured to the forward section 84 of the drive-shaft B[5]. Therefore the shaft 111 is always in motion while the drive-shaft is being turned; but the propeller E need be operated only when desired.

A bevel-gear 115 is loosely mounted on the shaft 111, and above the gear 115 a second bevel-gear 116 is likewise loosely mounted on said shaft. This upper gear 116 is provided with an upwardly-extending sleeve 117, to the upper end portion of which within the cage 82 the hub of the propeller E is suitably secured.

A clutch 118 is splined upon the shaft 111 and operates to and from both of the gears 115 and 116 to drive either one or the other, and when the clutch is between said gears neither of them is driven. When the clutch 118 is in engagement with the upper gear 116, the propeller E is turned in a direction to cause the rear portion of the vessel to rise, and when said clutch 118 engages with the lower gear 115 the direction of rotation of the propeller is reversed and the vessel is caused to descend.

It will be understood that an intermediate bevel-gear 121, suitably mounted on the bracket 112[a], engages with both the upper and the lower gears 116 and 115.

The clutch 118 is operated by means of a shifting-arm 119, having a fork which embraces the clutch, and the said arm is fulcrumed upon a bracket 120, extending down through the hull within the compartment B[3] thereof. This shifting-arm 119 is pivotally connected with a link 122, as shown in Fig. 4, and said link is pivotally connected with one end of a bell-crank lever 123. (Shown by dotted lines in Fig. 4.) This bell-crank lever at its opposite end is pivotally attached to a rod 124, which rod 124, as is shown in Fig. 3, is pivotally attached to a crank-arm 125, connected with a lever 126, suitably fulcrumed in the forward portion of the compartment B of the vessel; also within easy reach of the occupant.

When the lever 126 is pressed upward, the clutch 118 engages with the upper gear 116, and the tendency is to ascend. When the lever 126 is pressed downward, the clutch 118 engages with the gear 115, and the tendency at the rear portion of the vessel is to descend. It will be understood that the rear vertically-acting propeller controls the rear portion only of the vessel, another propeller being provided at the forward portion of the vessel to raise and lower said forward portion, which latter propeller is to be hereinafter described.

With reference to the rear propellers F, which are adapted to carry the vessel to port or starboard, as desired, a vertical shaft 127 is carried down through the bottom portion of the stern-section A[3] of the hull into a pocket 128, attached to the hull, as shown in Fig. 4, and a bevel-gear 129 at the upper end of this shaft meshes with the gear 114, fast on the section 84 of the drive-shaft B[5]. The said shaft 127 is journaled in suitable bearings 128[a] within the hull, a second bearing 128[b] being located below the hull. A bevel-gear 130 is secured to the lower end of the shaft 127, and this gear 130 meshes with a bevel-gear 131 on the rear end of what I term a "keel-shaft" 133, as said shaft passes into a channel 134 in the keel 11, and the rear end of the shaft 133, or that carrying the gear 131, is located within the pocket 128, being mounted to turn in a suitable bearing 133[a]. The said shaft 133 is also provided within the pocket 128 with a second bevel-gear 132, and this second bevel-gear 132 meshes with the bevel-gear 135, which is fast on a vertical shaft mounted to turn in a vertical bracket 136, secured to the bulkhead 23 within the compartment B[3], and at the upper end of this shaft a bevel-gear 137 is secured. A propeller-shaft 138 is journaled in suitable bearings 139, also secured to the bulkhead 23, and said propeller-shaft 138 extends to the openings 83 in the hull, and at said openings the propellers F are secured to the ends of said shaft 138. Opposing gears 140 and 141 are loosely mounted on the propeller-shaft 138 at about the central portion of said shaft, and between these two gears a double-faced clutch 142 is mounted to slide on the shaft, the clutch having a feather connection with said shaft 138. The clutch 142 is adapted to engage with either the gear 140 or the gear 141, so as to turn the shaft in a direction to move the rear of the vessel to starboard or to move the rear of the vessel to port, and said clutch 142 is operated through the medium of a fork 143, which is attached to the upper end of a shifting-shaft 144, mounted in the bracket or bearing 136, as is also shown in Fig. 4. This shaft 144 is provided with a crank-arm 145 at its lower end. The crank-arm 145 is attached to a rod 146, which is outside the hull of the vessel and is connected with a lever 147, suitably mounted at the bottom portion of the forward part of the chamber B within convenient reach of the operator, as is shown in Fig. 3. When the lever 147 is moved to the right, the clutch is carried in engagement with the right-hand gear 140 to carry the vessel to starboard, and when the lever 147 is moved to the left the clutch is made to engage with the gear 141 (shown in Fig. 1) in order to carry the vessel to port.

The preferred connection between the rod 146 and the lever 147 is best shown in Fig. 3, wherein it will be observed that the lever is attached to a vertical shaft 148, which extends down through suitable bearings through the bottom of the hull, which shaft is provided at its lower end with a crank-arm 149, to which the forward end of the said rod 146 is pivotally attached.

I desire it to be understood that horizontally-located side propellers are also employed at the forward portion of the vessel to direct such portion to the right or to the left and that these side propellers may be employed as steering-propellers.

The keel 11, as is indicated by dotted lines in Fig. 1, is divided into three compartments, two end compartments *a* and *a'* and a central compartment a^2. The end compartments are weighted by added metal of any description; but the central compartment is preferably preserved to contain water, and means will be provided—as, for example, a sea-cock—for emptying the central compartment when desired. The keel acts to impart stability to the vessel and to enable it to drop readily toward the bottom, and the addition of the water in the central compartment a^2 will make the descent much more rapid, and by discharging the water the ascent can be more readily made.

The keel-shaft 133 is shown in two parts connected by a coupling 150; but said shaft may be made in one piece up to a point at the forward portion of the vessel, if desirable. Provision is made in all the compartments of the keel for the passage of the shaft 134, and suitable bearings 151 are also provided therefor.

The forward end of the shaft 133 has a bevel-gear 152 loosely mounted thereon, which meshes with a bevel-gear 153 on a short shaft 154, located outside of the lower portion of the forward section A of the hull, suitable bearings 155 being provided for the said shaft 154, as is shown in Fig. 3, and at the forward end of the shaft 154 a bevel-gear 156 is secured, which bevel-gear meshes with a bevel-gear 157 on the end of a vertical shaft 158, which is held to turn in a tubular bearing 159, extending from top to bottom of the forward section A of the hull, and at the upper end of the shaft 158 a propeller E' is secured, located within the cage 160, erected upon the upper portion of said forward section A of the shell, and this propeller E' imparts a vertical movement up or down to the forward end of the vessel, acting in the same manner as does the rear propeller E.

The gear 152 is connected by a sleeve 161 with a bevel-gear 162, turning loosely on the shaft 133, as is shown in Figs. 3 and 7, and this gear forms a portion of the shifting and transmitting mechanism for revolving the propeller E' in a direction to carry the forward portion of the vessel upward or downward. The gear 162 meshes with a side gear 163, and the spindle of this side gear is mounted to turn in a hanger 164, extending downward from the bottom of the hull-section A', as is shown in Fig. 8. An opposing side gear 165 is likewise employed, and the spindle of this latter gear is mounted to turn in a hanger 166, also extending down from the bottom of the hull-section A'. The two gears 163 and 165 are in mesh with the gear 162, and a fourth gear 167 is employed, likewise loosely mounted on the shaft 133. The gear 167 faces the gear 162. A double-faced clutch 168 is mounted to slide on the shaft 133 and turn therewith between the gears 162 and 167, being adapted for locking engagement with either. A bearing 169 is secured to the bottom of the hull-section A' between the hangers 164 and 166, and in this bearing a shaft 171 is mounted to turn, which, shaft is provided with arms 170, which extend downward and engage with the clutch 168 for the purpose of shifting the same when desired. The shaft 171 is provided at its outer end with a crank-arm 172. This crank-arm 172 is attached to a link 173, which, as shown in Fig. 2, extends up alongside the outer face of the bow-section A of the hull and at its upper end is pivotally attached to a crank-arm 174, which is secured to a shaft 175, and this shaft extends into the main compartment B of the vessel, as is shown in Fig. 3, and is provided with a suitable lever-handle 176. When this lever-handle 176 is moved upward, the clutch 168 is shifted to cause the propeller E' to turn in a direction to carry the vessel upward, and when said lever-handle 176 is carried downward the clutch 168 operates, in connection with the chain of gearing described, to turn the propeller E' in a direction to carry the vessel downward.

With relation to the mechanism for driving the forward side propellers F', which propellers are for the purpose of carrying the forward portion of the boat to port or to starboard, as desired, a gear 177 is loosely mounted on the shaft 133 adjacent to the gear 167 belonging to the propelling mechanism for the propeller E'. A second gear 178, facing the gear 177, is also loosely mounted on the shaft 133, and two side gears 183 and 184 are also employed, meshing with the gears 177 and 178. The gear 183 is mounted on a shaft 181, which is journaled in a suitable hanger 179, as is shown in Figs. 7 and 9, and at the outer end of this shaft one of the aforesaid propellers F' is secured. The opposing side gear 184 is secured on a shaft 182, alining the shaft 181, and the shaft 182 is mounted to turn in a hanger 180, as is also shown in Figs. 7 and 9, and the other side propeller F' is secured to the outer end of this shaft 182.

A clutch 185 is mounted to slide on the shaft 133 and turn therewith, the clutch being located between the gears 177 and 178, and said clutch is double-faced, so as to have locking engagement with either of said gears. The shifting mechanism for this clutch is best illustrated in Fig. 9, wherein it will be observed that parallel arms 186 are carried upward from the hub 187, which arms are provided with pins to enter the annular groove in the said clutch. One of the arms 186 is much longer than the other.

The hub 187, to which the arms 186 are attached, is mounted to turn on a shaft 188, which is located in the lower ends of the hangers 179 and 180, and a bar 189 is connected with the upper end of the longer shifting-arm 186. This rod 189 is pivotally connected with a crank-arm 190, which is below the bottom of the vessel, as is shown in Fig. 3, and said crank-arm 190 is attached to the lower end of a shaft 191, which extends up into the main compartment B of the vessel. At the upper end of this shaft 191 a lever-arm 192 is secured. When this lever-arm 192 is moved to the right, the clutch 185 is brought into operation to cause the train of gearing just described to turn the propellers in a direction to carry the vessel to starboard, and when the lever-arm 192 is carried to the left the train of gearing will operate to turn the propellers in a manner to carry the vessel to port. It will be understood that as there are two propellers on different shafts and operated by the same train of gearing the blades of the propellers are twisted in opposite directions.

The side propellers F′ and the train of gearing immediately associated therewith are protected by a semicircular housing 193, attached to the bottom of the hull, being open at its ends, as is shown in Figs. 1, 2, and 3, and the group of intermeshing gearing which operates the forward propeller E′ and the gears on the shaft 133 near said train of gearing are protected by a shield 194, secured likewise to the bottom of the vessel, as is also shown in Figs. 1, 2, and 3. A third shield 195 is attached to the bottom of the vessel to protect the gears 156 and 157, as is shown in the same views of the drawings.

In order to lower the vessel or to raise it, chains 197 are attached to lugs 198 at the central side portion of the hull, and these chains at each side are connected with a single chain 199, which is carried up to the windlass or other approved winding device.

It is contemplated to provide means for establishing direct communication with persons at the surface of the water, and this can be done by extending into the vessel a pliable speaking-tube, or a telephone 200 may be placed in the compartment B, as is shown in Fig. 3, having suitably-wired connection with a receiver at the surface of the water or at any point distant from the vessel. It will be understood that telegraphic communication may be supplied, if so desired.

It is obvious that a vessel constructed as above described is thoroughly under the command of the individual it carries and that the individual can operate the jaws to grip any object in a satisfactory manner and to operate any tools which may be required to pry an object or to set tackles, &c., and that by reason of the lenses and the manner in which they are placed the operator has a full view of his surroundings on all sides, in front of and above and below the vessel. Furthermore, it is obvious that by reason of the arrangement of hand-levers and the particular arrangement of the gearing and propellers the vessel may be made to rise or fall or go ahead or back or move to port or starboard, as desired, and that the forward and downward movements and the side movements may be bodily accomplished throughout the vessel, or such movements can be accomplished at the stern or at the bow of the vessel, as occasion may demand, to raise the bow only of the vessel or only the stern of it.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In submarine vessels, a hull, jaws at the bow portion of the hull, an equalized pneumatic means for opening and closing the said jaws from the inside of the vessel, which means include independent cylinders for the jaws, fulcrumed couplings between the piston-rods of the cylinders, and valves controlling the passage of air to the cylinders and the exhaust of air therefrom.

2. In submarine vessels, a hull, jaws hinged at the forward end of the hull, lenses at the bow of the hull and at the top and bottom of its sides adjacent to the bow, which lenses are to the rear of the jaws, individual cylinders for the jaws, fulcrumed couplings for the piston-rods of the cylinders, and means for pneumatically operating the pistons of the cylinders simultaneously in opposite directions to simultaneously open and close the jaws, a support for the jaws mounted to revolve upon the hull, and devices operated from within the vessel for rotating said support.

3. In a submarine vessel, a hull, a rotatable factor mounted at the front of the hull, jaws hinged to the said rotatable factor, cylinders in pairs carried by the said rotatable factor, piston-rods for the cylinders, the rods for each pair of cylinders being pivotally connected with the jaw, a controlling-valve common to all of the cylinders, and means located within the vessel for admitting air to the controlling-valves and permitting exhaust therefrom, and devices for rotating the

support for the jaws, which devices are also operated from within the vessel.

4. In submarine vessels, a hull, jaws hinged at the forward end of the hull, cylinders in pairs pivoted to the front of the hull between the jaws, the piston-rods of the cylinders being pivotally connected with the jaws, a source of compressed-air supply, means located in the vessel for regulating said supply of air, which means are provided with supply and exhaust channels, and connections between said channels and the upper and lower ends of the cylinders.

5. In submarine vessels, a hull, jaws hinged at the forward end of the hull, cylinders in pairs pivoted to the front of the hull between the jaws, the piston-rods of the cylinders being pivotally connected with the jaws, a source of compressed-air supply, means located in the vessel for regulating said supply of air, which means are provided with supply and exhaust channels, connections between said channels and the upper and lower ends of the cylinders, and an equalizing device for the jaws and cylinders, comprising a lever-arm pivoted at its center to the hull at a point between the opposing ends of the cylinders of a pair, and links of equal length pivoted to the jaws at their points of connection with the piston-rods and pivoted at their opposite ends to the opposite end of the lever-arm.

6. In submarine vessels, the combination with the forward end of the hull, a spindle extending outwardly therefrom, having annular peripheral grooves, and channels leading from its inner end to the grooves, the inner end of the spindle being within the hull, a three-way cock having two upper openings connected with said channels and two lower connected exhaust-openings and an intermediate supply-opening, a compressed-air-supply pipe connected with the supply-opening, an exhaust-pipe connected with the exhaust-openings, and a toothed wheel mounted to turn on the said spindle, and means for turning the wheel from within the vessel, of jaws hinged to the said wheel, cylinders arranged in pairs, the pistons of which cylinders are pivoted to the jaws, and pipe connections between the annular grooves of the said spindle and the outer and inner end portions of the cylinders.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

SANTIAGO NEVES.

Witnesses:

GEORGE HUGHES,

J. FRED. ACKER.