(No Model.) 5 Sheets—Sheet 1.

# E. GRIFFON.

## APPARATUS FOR THE PROPULSION OF SHIPS OR VESSELS.

No. 381,235. Patented Apr. 17, 1888.

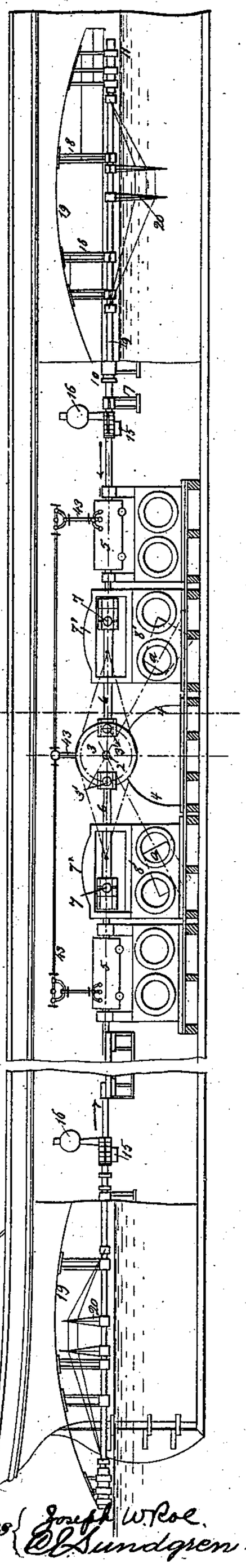

Fig. 1.

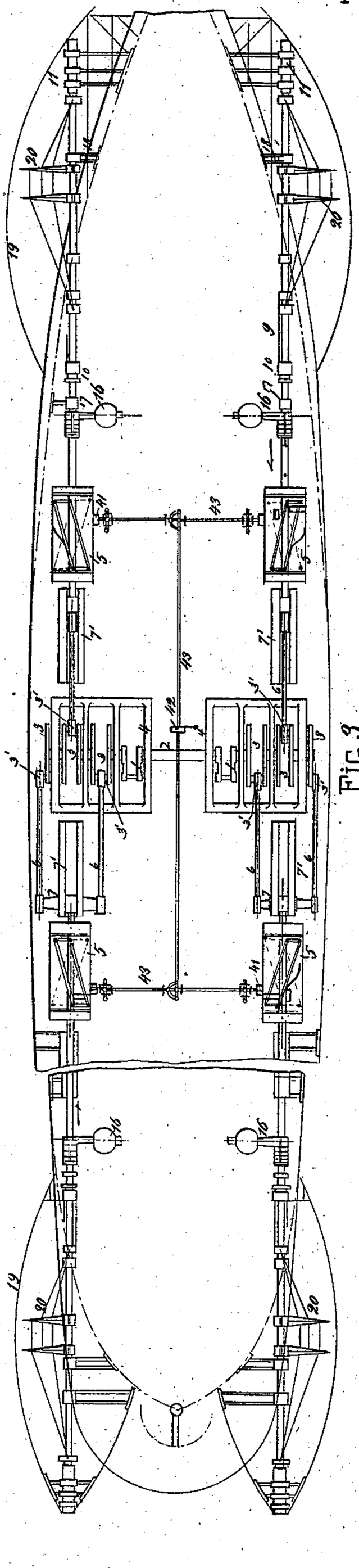

Fig. 2.

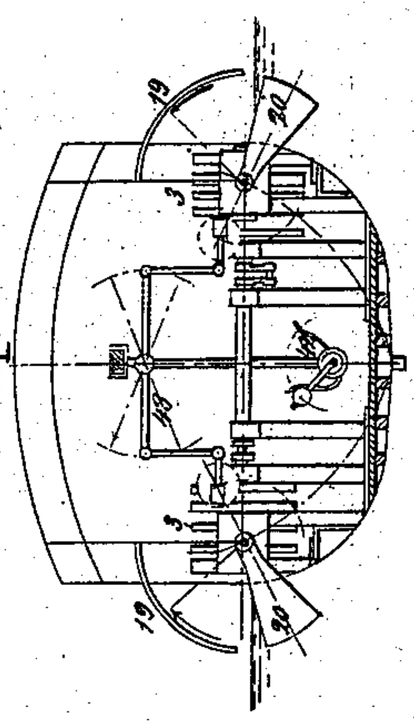

Fig. 3.

Witnesses { Joseph W. Roe. E. L. Sundgren.

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(No Model.) 5 Sheets—Sheet 2.

# E. GRIFFON.

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FIG. 4.

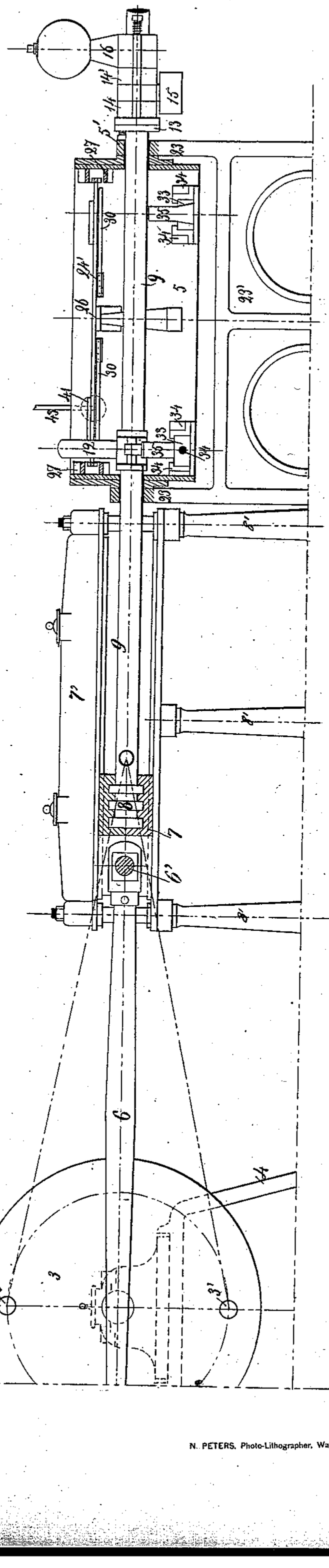
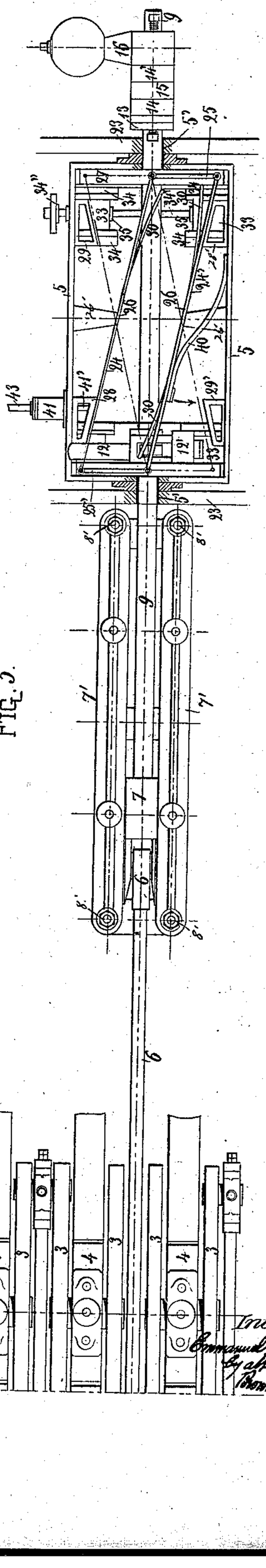


FIG. 5.



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(No Model.) 5 Sheets—Sheet 3.

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## APPARATUS FOR THE PROPULSION OF SHIPS OR VESSELS.

No. 381,235. Patented Apr. 17, 1888.

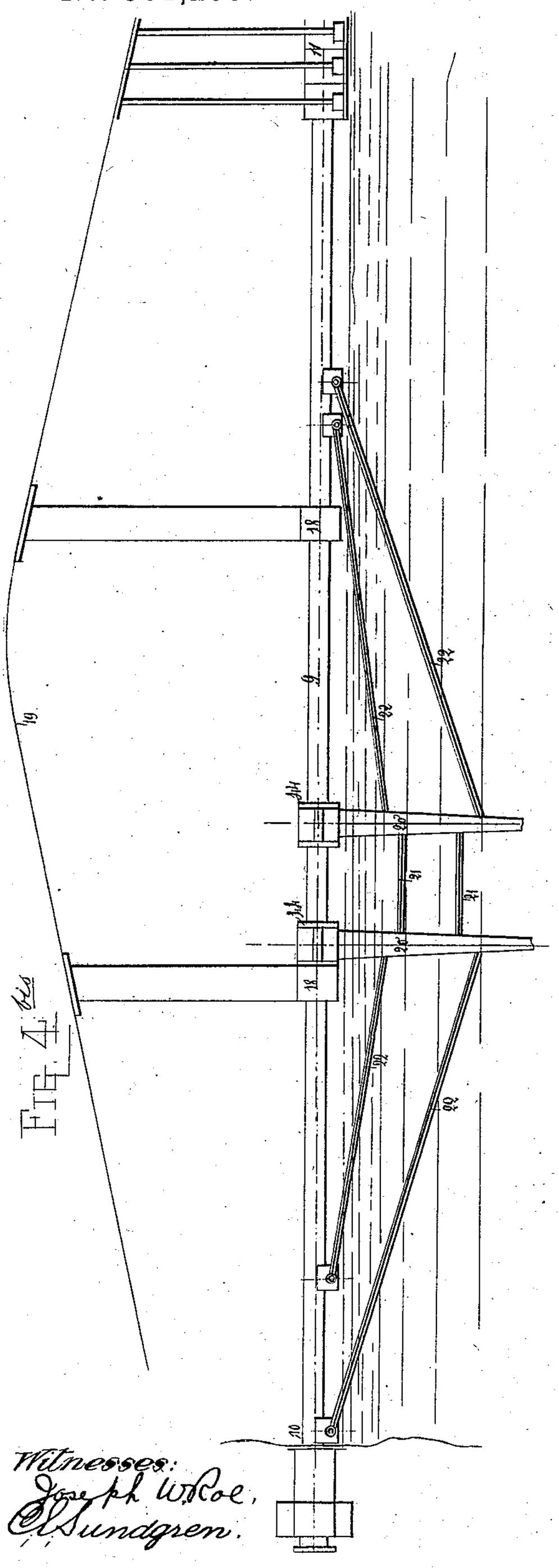


FIG. 4.

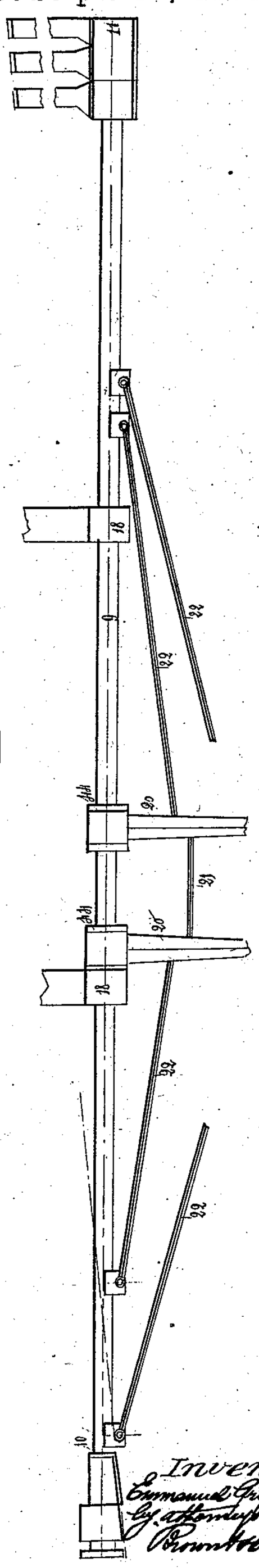


FIG. 5.

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(No Model.) 5 Sheets—Sheet 4.

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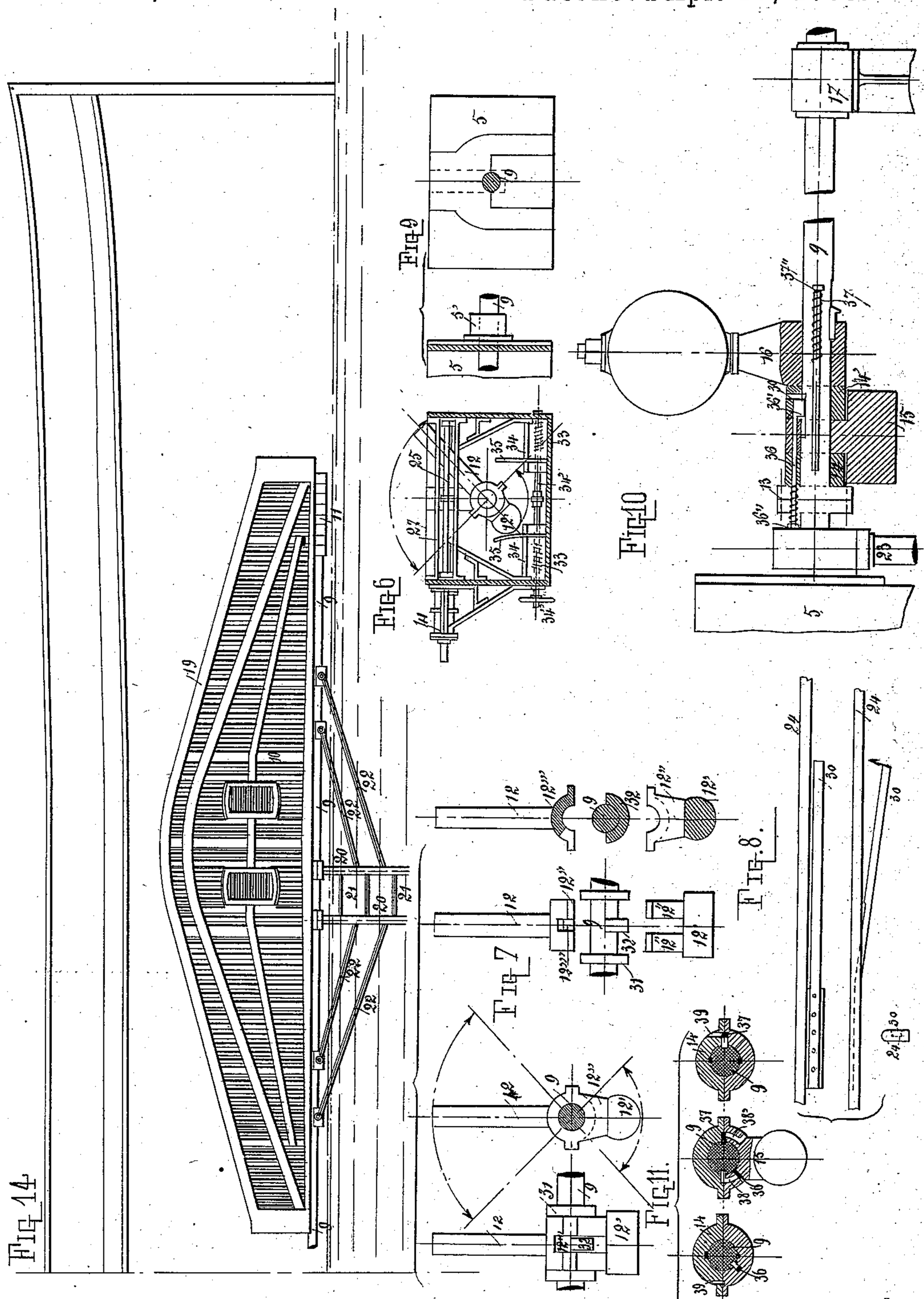
## APPARATUS FOR THE PROPULSION OF SHIPS OR VESSELS.

No. 381,235. Patented Apr. 17, 1888.

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(No Model.) 5 Sheets—Sheet 5.

# E. GRIFFON.

## APPARATUS FOR THE PROPULSION OF SHIPS OR VESSELS.

No. 381,235. Patented Apr. 17, 1888.

FIG. 13.

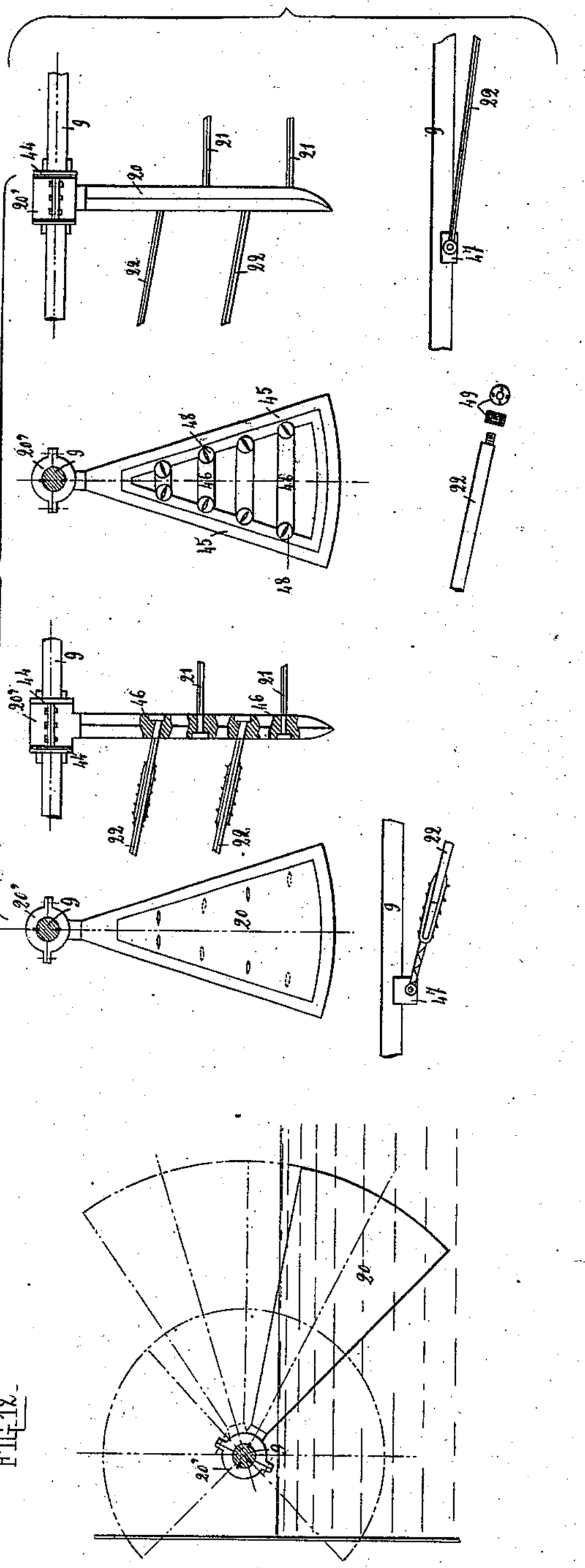


FIG. 12.




Witnesses:
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Inventor:
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by attorneys.
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# UNITED STATES PATENT OFFICE.

EMMANUEL GRIFFON, OF BORDEAUX, FRANCE.

## APPARATUS FOR THE PROPULSION OF SHIPS OR VESSELS.

SPECIFICATION forming part of Letters Patent No. 381,235, dated April 17, 1888.

Application filed October 18, 1887. Serial No. 252,716. (No model.)

*To all whom it may concern:*

Be it known that I, EMMANUEL GRIFFON, a citizen of the Republic of France, residing at Bordeaux, in said Republic, have invented a new and useful Improvement in Apparatus for the Propulsion of Ships and other Vessels, of which the following is a specification, reference being had to the accompanying drawings.

The principal feature of my invention is a propeller consisting of a shaft or rod to which are attached on one side of its axis propelling blades or paddles, and which, being arranged horizontally and parallel, or nearly so, with the length of the ship or other vessel, has imparted to it both an oscillating or rocking motion about its axis, by which the paddles are caused to be alternately submerged in the water and to rise above the surface thereof, and a rectilinear reciprocating motion, which is made in one direction while the paddles are submerged and in the other direction while they are above the surface of the water. The advantages of such a propeller are manifold; but among the most important may be mentioned that almost the whole of the power applied to it is rendered directly effective for propulsion, and that by a reversing-gear applied to the shaft or rod of the propeller itself, whereby the submergence of the blades or paddles is caused to take place while the rectilinear movement is backward or forward, the direction of the propulsion of the vessel may be changed at pleasure, and hence the necessity of a link-motion or complicated reversing-gear on the propeller-engine is dispensed with.

This improved propeller may be arranged at the bow or at the stern of the ship or vessel; or such propellers may be arranged both at the bow and at the stern—one on each side.

The invention also consists in certain details, hereinafter described and claimed, of the construction of the propeller itself; also, in certain means, hereinafter described and claimed, for controlling the operation of the propeller.

Figure 1 in the accompanying drawings is a side view, and Fig. 2 a plan view, of a vessel having two of my improved propellers at the bow and two at the stern, parts of the hull being broken away to expose to view the engine and the mechanism for controlling the operation of the propellers. Fig. 3 represents a transverse section of the vessel. Fig. 4 is an elevation, partly in section, on a larger scale than Figs. 1, 2, and 3, of the mechanism for operating one of the forward propellers. Fig. 5 is a plan corresponding with Fig. 4. Figs. $4^{bis}$ and $5^{bis}$ are side views of the propeller. Fig. 6 represents a cross section corresponding with Figs. 4 and 5 of the mechanism for producing the oscillating movement of the propeller-shaft. Figs. 7, 8, and 9 show, on a larger scale, some of the details of the mechanism last mentioned. Fig. 10 is a longitudinal sectional view of what is hereinafter termed the "roll-counterpoise." Fig. 11 exhibits transverse sections corresponding with Fig. 10. Fig. 12 is a diagram illustrating the range of the oscillating movement of the propellers. Fig. 13 comprises detail views illustrating the construction of the paddles of the propeller. Fig. 14 is a side view illustrating the construction of the paddle-protecting drum.

Similar letters of reference designate corresponding parts in all the figures.

As various types of steam-engines might be employed to drive my propeller, I have not thought it necessary to represent any engine in full. I, however, prefer to use engines with inclined cylinders, as rudely indicated at *a a* in Fig. 1, the pistons of such engines being connected with cranks 1 1, Fig. 2, on the driving-shaft 2, which is arranged crosswise of the vessel in bearings in the framing 4, and on which are secured crank-disks 3 3, which carry the crank-pins 3′, for producing the reciprocating movement of the propeller shafts or rods 9 9, the said crank-pins being connected by connecting-rods 6 6 with cross heads 7 7, which work in fixed horizontal slideways 7′ 7′, secured upon supports 8′ 8′.

As the system of propellers illustrated by Figs. 1, 2, 3, 4, $4^{bis}$, and $5^{bis}$ is composed of four exactly similar combinations of parts, I shall only mention one of either of said combinations with reference to those figures, but shall at the same time point out the peculiarities of the system when viewed as a whole.

The cross-head 7, with which the propelling shaft or rod 9 is connected, is composed of two parts like an ordinary journal-bearing, the up-

per part or cap of which is secured in place by bolts. The head of the shaft or rod 9 is made with a series of collars, as shown at 8 in Fig. 4, and the bearing in the cross-head contains corresponding recesses. The cross-head is thereby made capable of imparting the reciprocating rectilinear motion to the shaft or rod, while the latter is left free to turn in the cross-head.

The rod 9 projects through a stuffing box, 10, in the dead-work of the hull of the vessel, as shown in Figs. 1, 2, $4^{bis}$, and $5^{bis}$, and terminates in a supporting and guiding bearing, 11, secured on the outside of the hull. The paddles 20, of which two are represented, but of which there may be one or more, are secured rigidly to the rod 9, all on one side of the axis. The said rod is further supported in guide-bearings 18 outside of the hull fore and aft of the paddles. The paddles are represented as braced to the rod 9 by diagonal braces 22 and as braced together by parallel braces 21.

The inboard portion of the rod 9 passes through a frame or case, 5, which may be termed the "rolling frame" or "oscillating case," which rocks in bearings in a fixed frame, 23, and which contains mechanism for producing the oscillating movement of the propeller and for reversing its operation. Within this rolling frame 5 there is arranged upon the rod 9 a lever, 12, which I call the "tilting lever," (see Figs. 4, 5, 6, and 7,) which will be hereinafter fully described. Outside of the framing 23′ in Figs. 4 and 5 there are shown on the rod 9 flanges 13, which connect two of the sections or lengths of which the said rod is composed. Beyond these flanges there is secured on the shaft or rod 9 a collar, 14, which will be presently described, and between this and a similar collar, 14′, there is arranged what I term the "roll-counterpoise," 15, which is confined lengthwise of the propeller-rod between said collars, but which is capable of oscillation on the rod. Beyond the collars 14′ there is fast upon the propeller-rod the "paddle-counterpoise" consisting of a lever, 16, which is so arranged on the rod and so loaded by a ball at its end as to exactly balance the weight of the paddles. Beyond this paddle-counterpoise there is provided within the hull a bearing, 17, for the propeller-rod.

The propeller-driving cranks 3′ on the driving-shaft 2 are so arranged that when one pair—that is to say, the two near either end of the vessel—is moving in one direction the other pair is moving in the opposite direction. The apparatus provided in the rolling frame 5 for producing the oscillation of the propellers is so arranged that when the paddles of one pair of propellers are in the water those of the other pair are out of the water, each pair being in the water while the other pair enters the water, the pair which has the paddles in the water always moving at that time in the direction to propel the vessel in the desired direction.

I will now describe with reference to Figs. 4, 5, 6, 7, 8, and 9 the mechanism contained in the oscillating or rolling frame or case 5 for producing and controlling the oscillating movement of the propellers and the alternate dipping and raising of their paddles. Each end of this case or frame is provided with a hollow trunnion, 5′. These trunnions rest in bearings or plumber-blocks 23, fitted upon the framing 23′. In order to cause the rolling frame to remain in the vertical position whatever the intensity of the rolling of the sea may be, its lower part must be made heavier than its top portion by means of cast-iron or lead blocks. The propeller-rod 9 enters the rolling frame, passing with very slight friction though the hollow trunnions 5′ and extended right through it. In the rolling frame is placed a parallelogram consisting of two long smooth and round rods, 24 and 24′, jointed to each other by means of the small traverse-rods 25 and 25′, Figs. 4, 5, and 6. The long rods 24 24′ are each mounted at the middle of its length upon a pivot, 26, secured in a support, 25′, attached to the sides of the frame 5, the two smaller sides of the parallelogram resting upon a metal platform, 27, therein. The end of each of the rods 24 24′ bears against supports 28 and 28′ or 29 and 29′, fixed to the longitudinal sides of the oscillating frame 5 for the ahead motion against 28 and 28′ and for the astern motion against 29 and 29′. By carefully examining these positions it will be seen that the rod 24, Fig. 5, forms an acute angle with the axis of the propeller-rod 9, and the rod 24′ also forms an acute angle to the axis of the propeller-rod 9 equal to that formed by rod 24, only the vertices of these two acute angles point in opposite directions. This being understood, it is further expedient to note that the tilitng lever 12 is shown in Figs. 4 and 5 in its neutral situation—that is to say, at the beginning of its stroke—and resting upon the rod 24, thus forming an angle of forty-five degrees to the perpendicular. If, therefore, propeller-rod 9 be caused to advance, the lever 12 being drawn along with it, it will follow rod 24, (which forms an oblique line in relation to the longitudinal axis of the propelling-rod 9,) and in resuming its normal position will cause the rod 9 as it advances to turn on its axis, this operation continuing until the lever gets into the vertical position at the point forming the extremity of the rectilinear motion just performed when it is in perfect equilibrium. Now, in this position the said lever is ready to be tilted upon rod 24′, in which tilting motion it will describe an arc of a circle of forty-five degrees. In order to secure its tilting effect a spring, 30, which is fixed upon and under each rod 24 and 24′, after having been compressed by the said tilting lever toward the end of the stroke of propeller-rod 9, expands, when the latter reaches the dead-point at the termination of the stroke, and causes the lever to tilt. (See Figs. 4, 5, and 8.)

In the aforesaid operation the tilting lever, as a matter of fact, described an arc of ninety degrees, moving, however, at different veloci-

ties. The first forty-five degrees are run over at a speed exactly proportioned to that of the propeller-rod, while the remaining forty-five degrees are traveled through instantaneously, partly in accordance with the laws of the fall of bodies and partly in consequence of the impetus given by the spring 30. The paddles 20 20, being keyed on the said rod, will also describe an arc of ninety degrees. As the angles formed by the rods 24 24′ of the parallelogram and the longitudinal axis of the propeller-rod had opposite vertices, it follows that the tilting lever 12, in coming alternately in contact with each vertex, will overturn now upon rod 24 and then upon rod 24′, and the paddles 20 20 will accordingly rise and sink.

I will now explain how the tilting lever 12 is arranged upon the propeller rod 9. By carefully examining the position of the tilting lever 12, (assumed in Figs. 4 and 5 to be at its neutral point,) and bearing in mind the situation of the paddles, it will be understood that the latter will have to perform exactly the same movement as the said lever in traveling along the rod of the parallelogram, which thus acts as its guide. From such an arrangement serious inconveniences might result—that is to say, a gradual movement of the paddles tending to withdraw them each from the water might take place, which would have an objectionable effect on the pressure that each paddle must exercise on the water, and the propelling surface would change and decrease by degrees during the stroke of the propelling-rod 9 until the paddle was wholly immersed; but a still greater drawback would be in the fact that the paddles upon issuing from the water, when they should produce no effect whatever, would soon dip into it again without allowing those paddles which are effecting actual propulsion the time necessary to finish their stroke, the consequence being that the paddles which should rise above the water without effect, being partly immersed already, would propel the vessel in a direction opposite to that required.

The tilting lever consists of two portions—viz., an upper one, 12, and a lower one, 12′—which constitute an extension of the said lever below the shaft or rod 9. The bottom of the upper portion and the top of the lower one are made in the shape of a bearing, or, rather, a coupling-socket, Fig. 7, which enables the two sections to be tightly fitted upon the propeller-rod 9 between the collars 31 31 of the said rod.

Upon the propeller-rod 9 a shoulder, 32, is provided between collars 31. The tilting lever 12, being bolted together with its counterpart 12′, forms to the right and to the left two collars, 12″, capable of revolving freely between shoulder 32 and collar 31 31. The middle portion, 12‴, of the lower part of the lever 12 is of equal width with the shoulder 32, forming an integral part of the propeller-rod 9, and it represents exactly one-half of the collars 12′. The central part or upper shoulder, 12‴, is cut at an angle of forty-five degrees and forms an open space equal to the thickness of the lower shoulder, 32, whereby (when lever 12 is in operation) it is caused to come into contact with shoulder 32 alternately on the right and on the left, Fig. 7. By this means it is rendered impossible for the tilting lever 12 to oscillate without effect upon rod 9 at an angle greater than forty-five degrees. The effect of such an arrangement of lever 12 is that as it leaves the neutral point, Figs. 4 and 5, and advances along guide-rod 24 it will by degrees resume its upright position until it reaches the point where the propeller-rod 9 terminates its course, at which point its position will be perfectly vertical, Figs. 4, 5, and 6. Thus during the whole of this movement it will have described without effect an angle of forty-five degrees around rod 9, so as to finally touch shoulder 32 either on the right or on the left hand side.

Directly the lever 12 has reached the end of its course and resumed the vertical position the spring 30 expands and pushes the said lever, and at once causes the propeller-rod 9 to turn about at an angle of forty-five degrees and carry with it the paddles, which dip into the water or emerge therefrom, as the case may be, the same operation recurring over and over again alternately and in opposite directions.

The weight of the tilting lever 12 must be greater than that of its counterpart 12′, and this for two reasons—first, to overcome the resistance due to friction, and, second, to permit the overturning motion. To adjust, therefore, the weight of the tilting lever 12, it is sufficient to provide an internal empty space, wherein molten lead may be poured until the lever is seen to overturn the propeller-rod easily. If desired, a ball may be provided at the top of lever 12, which ball shall be mounted upon a screw with an expanding spiral spring, as is usual in certain weighing-machines. By turning the said ball the power of the lever 12 may then be increased or diminished at will and with mathematical precision. The counterpart 12′ of the tilting lever 12 is made in the shape of a cap, the bottom portion of which has a semi-cylindrical form.

In order to prevent a shock similar to the blow of a hammer taking place at each end of its propulsive stroke, I have arranged in the lower part of the rolling frame 5 a small apparatus which I term the "self-acting brake" of the tilting lever. This apparatus (shown in Figs. 4, 5, and 6) is composed of a number of rectangular blocks, 33, capable of a reciprocating motion, thus enabling them to perform the desired action, and, arranged in pairs against the sides of the rocking frame 5, their reciprocating motion takes place between guides 34, produced by means of a screw-threaded rod, 34′, operating both blocks 33 33 together. This screw-threaded rod 34′ is made in two parts for the convenience of fitting, and is connected by a socket. The ends of each portion are square and concealed within the socket. To each of these rectangular blocks I fix ver-

tically, by means of bolts, a spring-metal plate, 35, having a bending power proportional to the excess of weight necessary to make the lever 12 tilt freely. The said screw-threaded spindle 34′ is confined longitudinally within the rotary frame 5, and is provided outside the said frame with a hand-wheel, 34″. When this hand-wheel is turned to the right or to the left, the screw-spindle 34′ will revolve in its own place; but as the screw-threads provided within each block 33 are cut in opposite directions the said blocks will advance toward or recede from each other by sliding in their guides 34.

It will have been inferred from the preceding statements that what I term the "brake" is in this instance the spring-metal plate 35, against which the counterpart 12′ of the tilting lever rubs at the end of the descent of the tilting lever 12. The cylindrical body which terminates the counterpart 12′ acts tangentially to the said spring-plate; but it will be readily understood that the more the latter advances within the arc described by the counterpart 12′ the greater will be the resistance it will oppose to friction upon the said cylindrical portion. It might even by this means entirely annihilate the shock due to the fall of the tilting lever. On the other hand, the farther it recedes from the end of the said arc described by counterpart 12′ the less will its action be felt. By means of screw-rod 34′ the required amount of friction of the spring-plate against the cylindrical body of counterpart 12′ may be adjusted at will. This adjustment must be effected in such a manner that the tilting lever in falling should at the end of its descent take up its position at a distance of three or four degrees from the guide-rod 24 or 24′, with which it must come in contact. This self-acting brake is double, as is shown in the drawings. At the end of each stroke the tilting lever acts alternately upon one of the springs 35 35, situate on the opposite sides.

When the lever 12 falls, it tightens the spring-plate 35, but only for an inappreciable moment, for the propelling-rod, as soon as it reaches the end of its stroke, moves back in the opposite direction; and the tension on the spring 35 even tends to facilitate the breaking of its contact with counterpart 12′, as it presses it in its turn against the latter when the propelling-rod moves back in the opposite direction.

In the drawings the lever 12 is everywhere represented at its neutral point—that is to say, at the commencement or at the end of its propelling-stroke—with the exception, however, of Fig. 7, where its three chief positions may be seen.

It may be useful to explain here what would be the objectionable consequence of the application of a stationary frame instead of the pivoted or oscillating or rolling frame 5.

I have mentioned above that the lever 12, when it has reached the end of its propelling motion, describes an arc of forty-five degrees before it can resume its vertical position. The ship begins to roll and is inclined at an angle of fifteen degrees on the side opposite to that to which the lever has been tilted. Under such circumstances the lever could not possibly be set right nor the wrong movement retarded, owing to the fact that this would require a much greater pressure of the spring 30. Then there would, besides, be the greater inconvenience that as the propeller-rod would move back in the opposite direction, and as the tilting lever could not be set right, the propeller-paddles would remain immersed in the water and tend to propel the vessel in a direction opposite to that in which it is intended to go until the end of the stroke of the said rod is reached.

I now come to the description of the roll-counterpoise 15, arranged upon the propeller-rod 9. Its object is to maintain the propeller-rod 9 constantly in a normal position in relation to the plane of the water during its reciprocating motion, however heavy the rolling of the ship may be.

I have hereinbefore described the pressing-spring 30, which is attached to the guide-rods at about two-thirds of its length. The result of this arrangement is that at about two-thirds of its stroke the tilting lever is in contact with the pressing spring 30, and the latter, by reason of its oblique position, will oppose a resistance to the tilting lever and have the tendency to turn it over; but, owing to the roll-balance 15, which permanently maintains the propelling-rod in the same plane, no such overturning ensues. As soon as the lever 12 has taken up its vertical position, the pressure-spring 30 will be entirely compressed and leveled in a parallel direction below the guide-rod. The said spring being thus tightened, it will not expand and press the tilting lever until the propeller-rod reaches the dead-point. It will be understood that the counterpoise has sufficient weight enabling it not only to compel the propelling-rod 9 to retain its normal position at each rolling movement of the vessel, but it should also resist the thrusting effect of the tightened spring 30 while it is in contact with lever 12.

The construction of the roll-counterpoise will be easily understood by reference to Figs. 4 and 5 and to Figs. 10 and 11, representing, on an enlarged scale, the arrangement thereof in longitudinal section. This counterpoise 15 consists of a metal piece of any determined weight, according to circumstances. It is provided with a collar in two parts, made in the shape of a journal-box. The lower part of the said collar is integral with the counterpoise, so that when the two parts of the collar have been firmly attached together by bolts or otherwise the collar, with the counterpoise, may be made to turn freely around the propeller-rod 9; but in the present instance the order is reversed, the propelling-rod oscillating in the collar, while the counterpoise, by reason of its weight, always retains its vertical position.

In order to prevent the propeller-rod from turning during its longitudinal stroke, the said counterpoise must be firmly attached to the said rod; but at the moment when the rod reaches the dead-point it must have complete freedom and momentary independence, so that it may be turned over by the tilting lever 12. The two collars 14 14′ on the propeller-rod, between which the roll-counterpoise is placed, are for the convenience of their construction and mounting each made of two equal parts coupled by means of bolts. Each collar 14 14′ is firmly keyed upon the propeller-rod, and forms practically one piece with it. The collar or hub of the counterpoise 15 is fitted somewhat tightly between the said collars 14 14′.

At 36 and 37, Figs. 10 and 11, two keys are shown. These keys are movable, and their object is to connect the collar of the counterpoise to the propeller-rod during the whole or the reciprocating motion of the latter; but when at the end of the said motion the dead-point is reached those keys are to disconnect the said collar again, so as to make it independent of propeller-rod 9. The stem of the left-hand key, 36, passes through the connecting-socket 13, shoulder 14, and collar 15, and, lastly, the end portion of bit 36′ of the key 36, when the disconnection takes place, remains within the collar 14. The head of each key is formed of a collar, 36″ or 37″, and screwed upon the stem. The stem of each is, moreover, surrounded with a spiral spring. The spring of 36 has its fulcrum or points of support on one side against the head of the key and on the other side on the collar 14, and is at the same time located in a hole bored in the thickness of the shaft-flanges 13. The result obtained by this arranged is that if during the motion of the propeller-rod the left-hand key, 36, be engaged by its bit 36′ within the part 15 of the collar of the counterpoise, it will connect the latter with the propeller-rod; but if upon arriving at the end of its stroke the key 36 bears against the plumber-block 23 of the rolling frame support 23′ with its head 36″, its bit 36′ will be pressed back into the hollow counterpart provided within the collar 14′, which position it is supposed to occupy in Fig. 10 of the drawings. At the moment when the propelling-rod terminates its stroke, thereby disconnecting itself from the counterpoise 15, the pressing-spring 30, Figs. 4, 5, 8, will expand and forcibly push the tilting lever 12, and thereby turn the propeller-rod through an arc of forty-five degrees, together with the propelling device.

The stem of each key 36 and 37 is located close against the propelling-rod, and at the time when the disconnection takes place—that is to say, when the propelling-rod freely oscillates, describing an arc of forty-five degrees within the collar 15 of the counterpoise—the said stem of each key 36 and 37 turns around in one of two grooves, 38 and 38′, (see Fig. 11,) provided in the collar of the counterpoise a distance equal to the conversion movement of the propeller-rod 9. The bit 36′ will then continue to bear against the collar of the counterpoise 15 during the time necessary for the propelling-rod 9, with its compressing-spring, to complete its stroke; but when the key 36 disengages or comes out of gear the reverse oscillating motion of propeller-rod 9 brings the opening of the groove 38′ opposite the bit 37′ of key 37, whose spiral spring then immediately expands and rapidly throws the said key-bit 37′ into gear with the collar of the counterpoise. These operations are repeated at the end of each stroke alternately in the two directions of the tilting lever 12, and consequently of the propelling-rod 9. The keys 36 and 37, as shown in Figs. 10 and 11, are arranged in opposite directions to each other, so as to bear at the end of each opposite stroke the one 36 against the plumber-block 23 of the large support 23′, and the other, 37, against the plumber-block of the bracket 17. Owing to the said roll-counterpoise, then, it will be seen that however strong the rolling motion of the vessel may be the propelling-paddles will always retain their normal position in the water. Were no such counterpoise used the same inconvenience as is inherent to ordinary paddle-wheels would here be felt in the case of rough sea—that is to say, the wheels are either totally immersed in the water or work entirely out of it—an extremely serious drawback as regards the motive engine, in consequence of the shocks and the twisting strains to which the driving-shaft is subject. Should, moreover, the propeller-paddles follow the rocking motion of the vessel the larboard and the starboard apparatus would each in its turn work far above the water or sink deeper into it than is desirable; but the most serious point is that the paddles in rising, when they should produce no effect whatever, will, if they be on the side toward which the ship is inclined, remain under the water, and therefore propel the ship in the wrong direction.

It is hardly necessary to say that for navigation on rivers or canals the rolling frame may be modified or replaced altogether by an ordinary stationary frame. The roll-counterpoise would not, as a matter of course, be required in such case.

I will now describe the reversing-gear by which I provide for the reversing of the movements of the propeller for propelling the vessel ahead or astern, referring first to Figs. 4, 5, 6. Above one of the supports, 26′, in the rolling frame 5 (see Fig. 5) there is placed horizontally a spring-plate, 40, of which one end is permanently secured to one of the sides of the rolling frame, while the other end is free, but engages in a groove provided on the oblique guide-piece 24′ of the parallelogram. Secured in this manner, the spring, while its horizontal position cannot vary, can be bent without any difficulty when it sustains the strain due to a pressing force, to be presently described. Supposing, now, it is desired to have the paddles propel in a sternwise direc-

tion, it will be sufficient for the parallelogram to take up a position (shown in dotted outlines in Fig. 5) contrary to that which it first occupied, (shown in unbroken lines,) the consequences being that the inclined guide 24 will leave 28 and turn to 29, where it will rest. In the same way the inclined guide 24′ will leave the point 28′ and bear on point 29′ instead, Fig. 5. To accomplish this change, the oblique guide 24 is pushed toward the desired point until the position is reversed. During such pushing action the guides 24 and 24′ move on their pivots 26 through the medium of small transverse and jointed rods 25 and 25′, describing a large curve. These small rods are supported by a metal platform, 27, in the frame 5, and as the inclined guides 24 and 24′ are likewise supported in their central portion by their pivots 26 the result is that the parallelogram may move without any strain and with the greatest facility. It is evident that when the parallelogram is caused to assume the reverse position the spring-plate 40 is bent until the said parallelogram reaches the desired point. The reversing of the parallelogram is effected by means of a piston or plunger, 41′, in a small cylinder, 41, bolted to one side of the rolling frame 5, the rod of the said piston 41′ (see Fig. 5) bearing against the oblique guide 24. If steam or compressed air be now admitted through the bottom of the small cylinder 41 at a pressure greater than the power of resistance of the spring 40, the piston will advance and cause the piston-rod, which is in free contact with the oblique guide 24, to push the latter and press back the spring 40 until the parallelogram bears against the points 29 29′. The parallelogram will be retained in this position so long as the pressure continues within the cylinder 41; but the moment when such pressure ceases, in consequence of the steam or compressed air being allowed to escape, the parallelogram will almost instantly resume its original position under the automatic pressure of spring 40, thereby enabling the vessel to move ahead.

To admit steam or compressed air into or let them escape from the small cylinder 41 any suitable system of three-way cock 42 or valve may be used, one of the ways of said cock or valve communicating with the fluid under pressure, the second with cylinder 41 by means of the jointed tubes 43, Fig. 2, and the third with the exhaust.

The reversing-cock 42 should be placed in the engine-room within easy reach of the engine-driver, as shown in Fig. 2, or it may, if preferred, be located on the bridge within the captain's reach, thereby enabling the latter to reverse the motion of the vessel without even communicating with the engine-driver.

The shape of the paddles and their arrangement are chiefly represented in Fig. 13. The head of each paddle is rounded like a pillow-block, and is made in two parts permanently bolted together.

The body of each paddle may be made of wrought-iron, or, preferably, of steel, so that strength being the same it may be comparatively lighter, or it may be made of a single piece and form two longitudinal branches, 45 45, connected with transverse arms 46. The two longitudinal branches 45 are provided with holes for the cross-ties and the stays or tie-rods. The open space between the said longitudinal branches 45 and the transverse arms 46 may be filled by some tightly-fitting wood-work, and the paddle will then be perfectly solid, while its weight will be much less than if it were wholly made of iron. The edges of each paddle should be beveled all around, so that they enter the water the same as a knife would do, encountering as little resistance as possible.

Each propeller is represented as covered by a drum or protecting-case, 19, which is built into the hull of the vessel.

I may add that although the gear operating the various devices is identical, two of the said devices (those located at the stern of the ship) possess, nevertheless, some peculiarities which must be pointed out.

The propeller-rods operating the propeller devices placed at the fore part of the ship are actuated by a single connecting-rod, while the two propeller-rods operating the devices situated at the stern are actuated by "twin" connecting-rods. This arrangement is necessary, in order that the propeller-rods fore and aft may have one longitudinal axis in common. (See Fig. 2.)

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A propeller for a vessel, consisting of a shaft or rod and paddles attached thereto on one side only of its axis, said shaft or rod receiving a longitudinal rectilinear reciprocating motion in a fore-and-aft direction or lengthwise of the vessel and an oscillating movement about its own axis, substantially as herein described.

2. The combination, with the rectilinearly-reciprocating propeller-shaft 9, of the mechanism herein described for producing the oscillating motion of said shaft, said mechanism consisting of two rods or ways, 24 24′, arranged obliquely to the axis of said shaft, the tilting lever 12, fitted to the shaft to have a limited oscillating movement independently thereof, and the springs 30 30, attached to the said rods or ways 24 24′, all substantially as herein set forth.

3. The combination, with the rectilinearly-moving propeller-shaft, the tilting lever, and the rods or ways 24 24′, arranged obliquely to said shaft, of the rolling frame 5, furnished with trunnions through which said shaft passes and fixed bearings for said trunnions, substantially as and for the purpose herein set forth.

4. The combination, with the rectilinearly-reciprocating propeller-shaft 9, of the rolling frame 5, the rods or ways 24 24′, pivoted in said rolling frame and furnished with springs

30 30, the rods 25 25′, connecting said pivoted rods 24 24′ to form a movable parallelogram, the tilting lever 12, the cylinder 41 and piston 41′, and the spring 40, the whole forming a reversible mechanism for producing the oscillation of the shaft in either direction relatively to the reciprocating rectilinear movement thereof, substantially as herein set forth.

5. The combination, with the oscillating and rectilinearly-reciprocating propeller shaft or rod 9, the rods or ways 24 24′, arranged obliquely to the axis of said shaft or rod, and the tilting lever 12, which is fitted to said shaft or rod to have a limited oscillating movement independently thereof, and is provided with an extension, 12′, below the said shaft or rod, and which runs on said rods or ways, of the adjustable brake for controlling the fall of said tilting lever, said brake consisting of the adjustable blocks 33 33 and spring-plates 35 35, attached to said blocks for acting upon the said extension 12′ of the said lever, and the screw 34′, for adjusting the said blocks, all substantially as herein described.

6. The combination, with the propeller-shaft 9 and the tilting lever 12, for turning it on its axis, of the roll-counterpoise consisting of the counterpoise 15, fitted to the shaft, and the spring-actuated keys 36 37, for causing the engagement of the counterpoise 15 with the shaft during the reciprocating movements of the latter and their disengagement at the end of each stroke of the shaft, substantially as herein described.

7. The combination, with the oscillating and rectilinearly-reciprocating propeller-shaft and the paddles projecting radially and perpendicularly therefrom, of the braces 21, parallel with the shaft and connecting the paddles together, and the oblique braces 22, connecting the paddles with the shaft, substantially as herein described.

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

EMMANUEL GRIFFON.

Witnesses:
J. NICOLAS,
BERNARD ABADA.