E. OTIDYS.

APPARATUS FOR CLEANING THE HULLS OF VESSELS.

APPLICATION FILED NOV. 1, 1907. RENEWED SEPT. 28, 1908.

919,939. **Patented Apr. 27, 1909.**

6 SHEETS—SHEET 1.

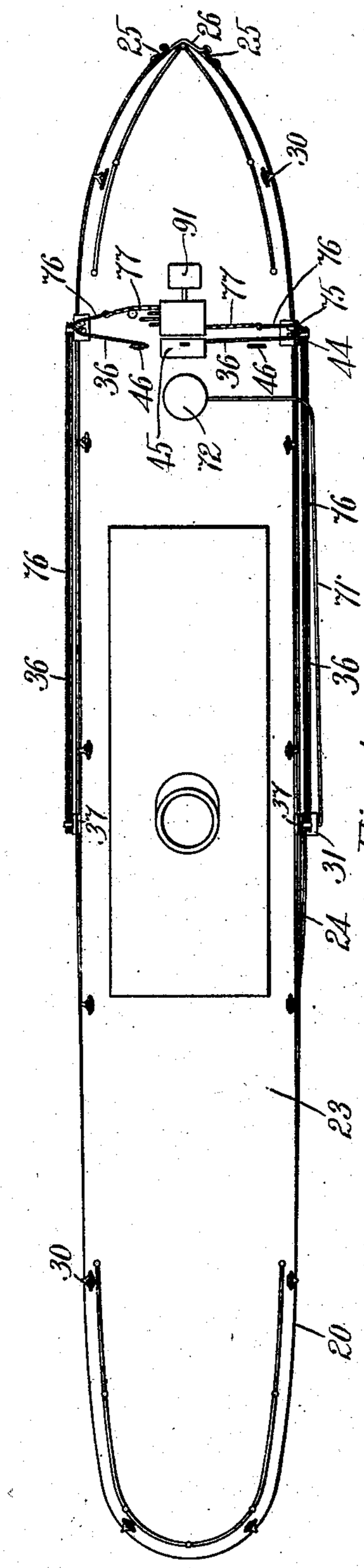

Fig. 1.

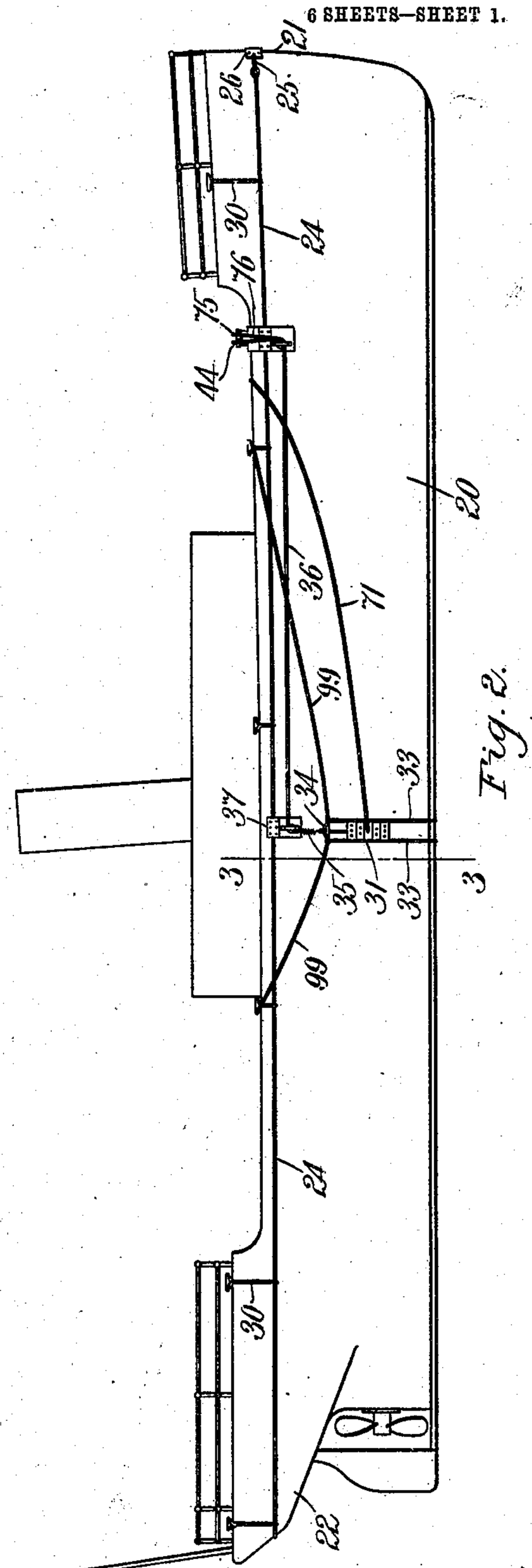

Fig. 2.

Witnesses.
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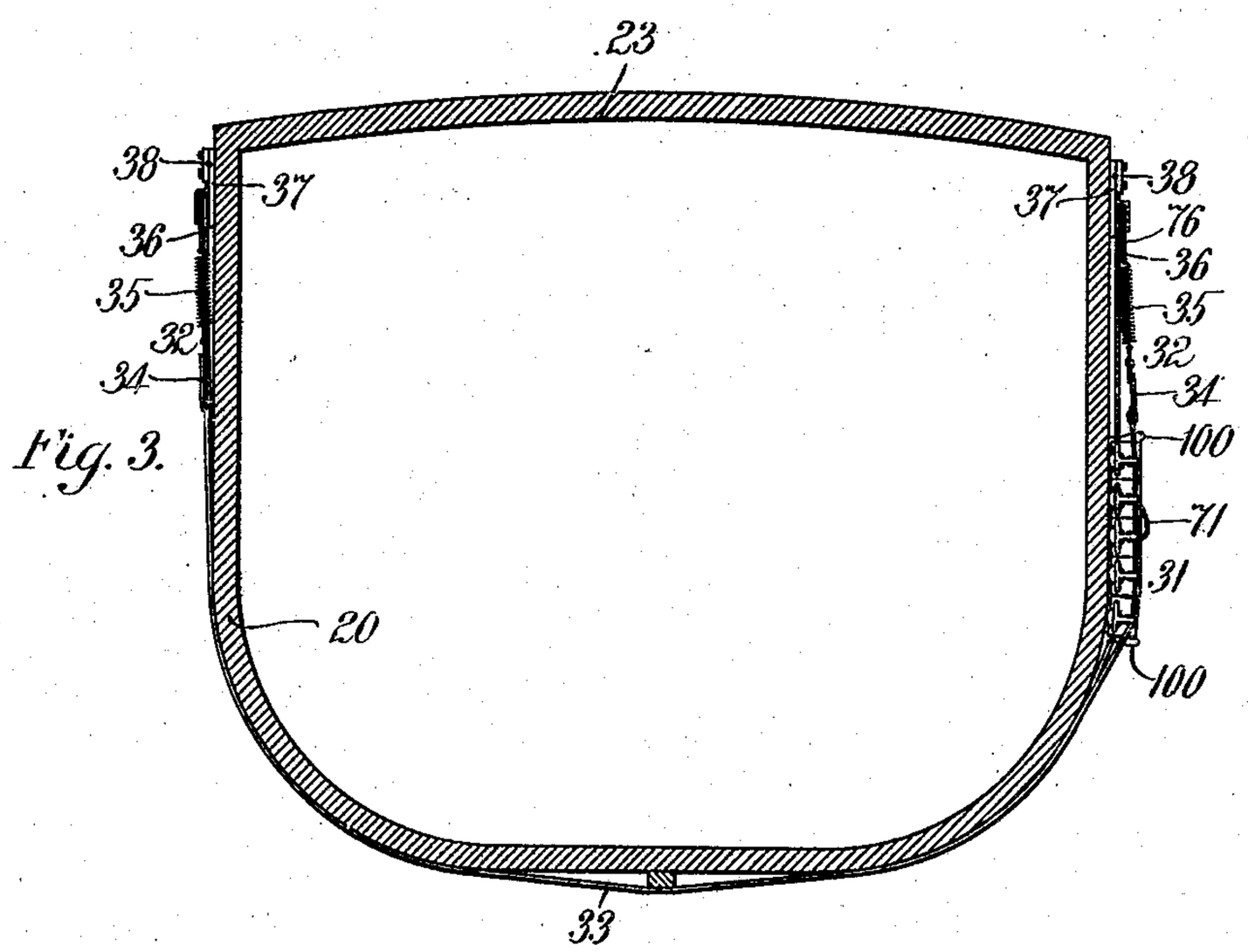

Fig. 3.

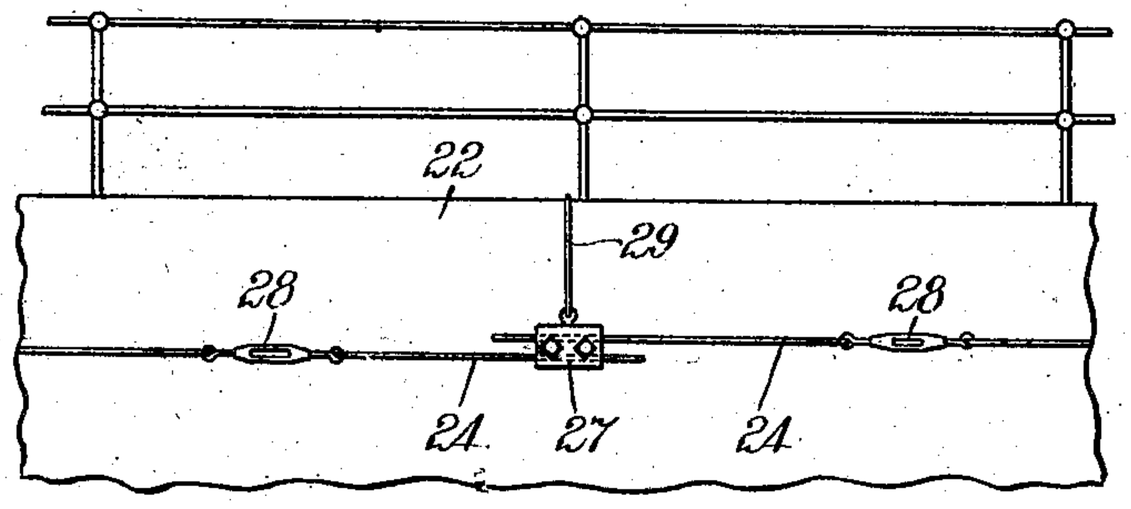

Fig. 4.

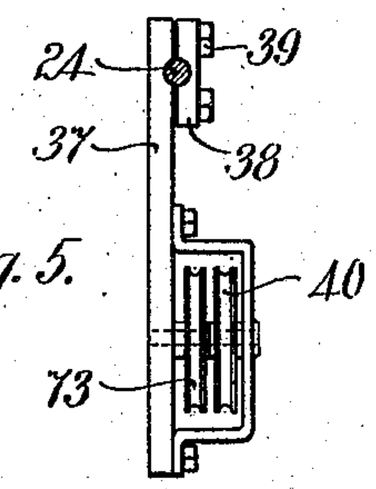

Fig. 5.

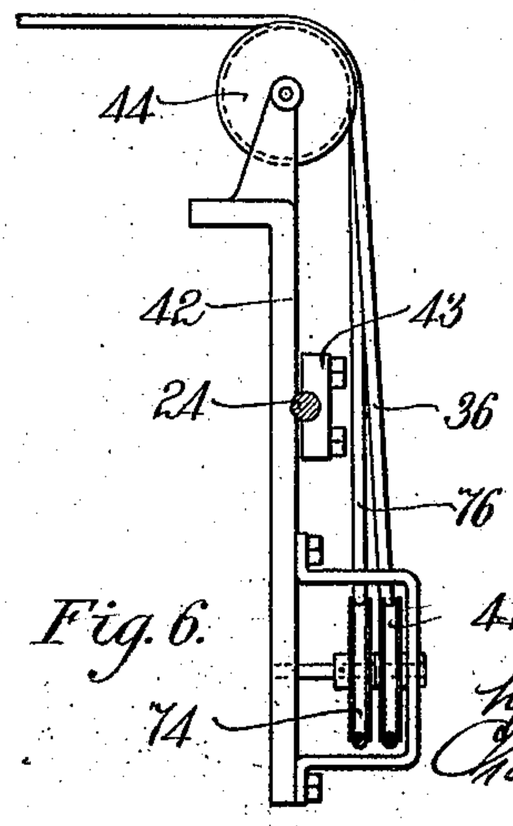

Fig. 6.

Witnesses.

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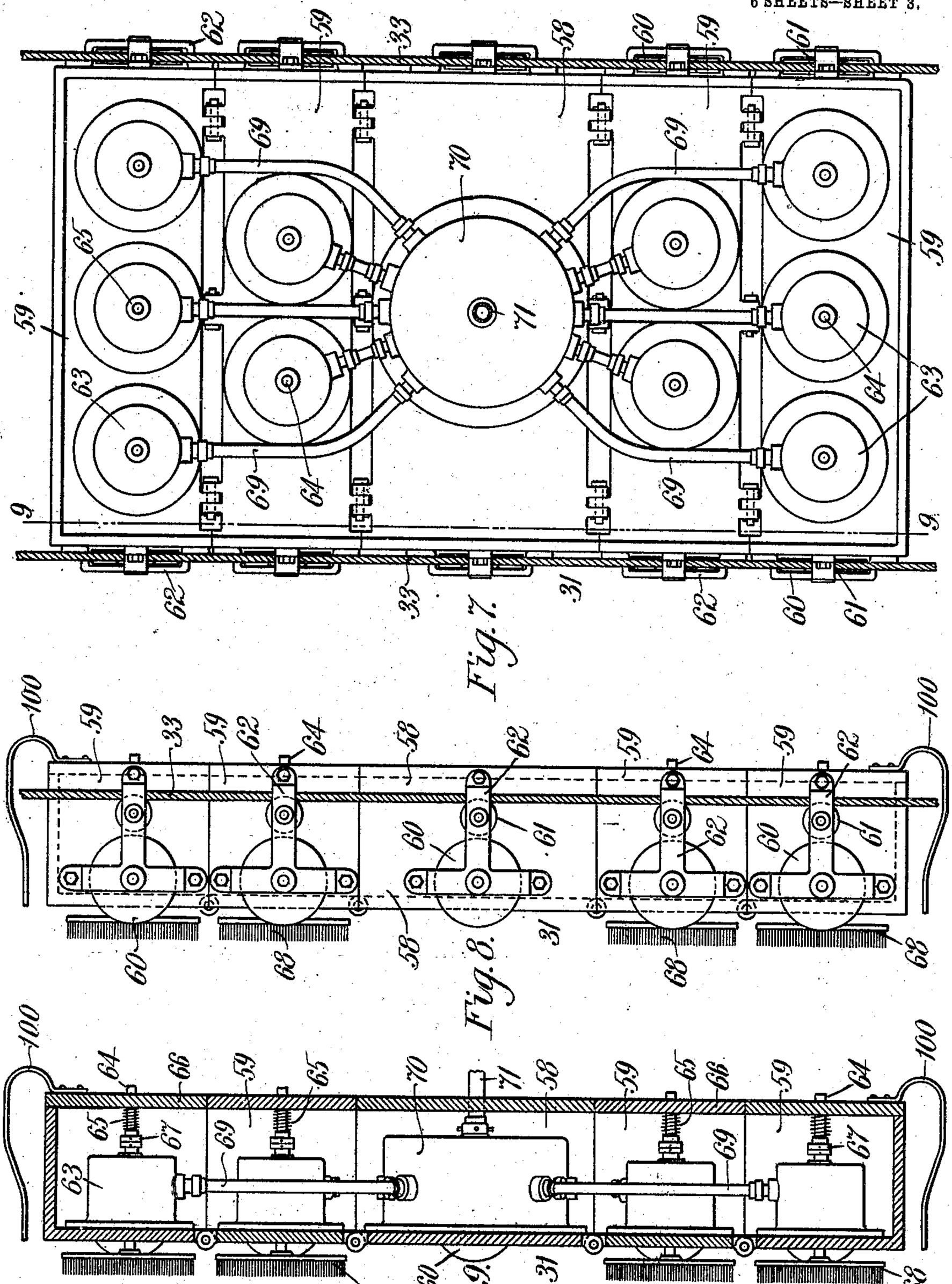

Fig. 7.

Fig. 8.

Fig. 9.

Witnesses.

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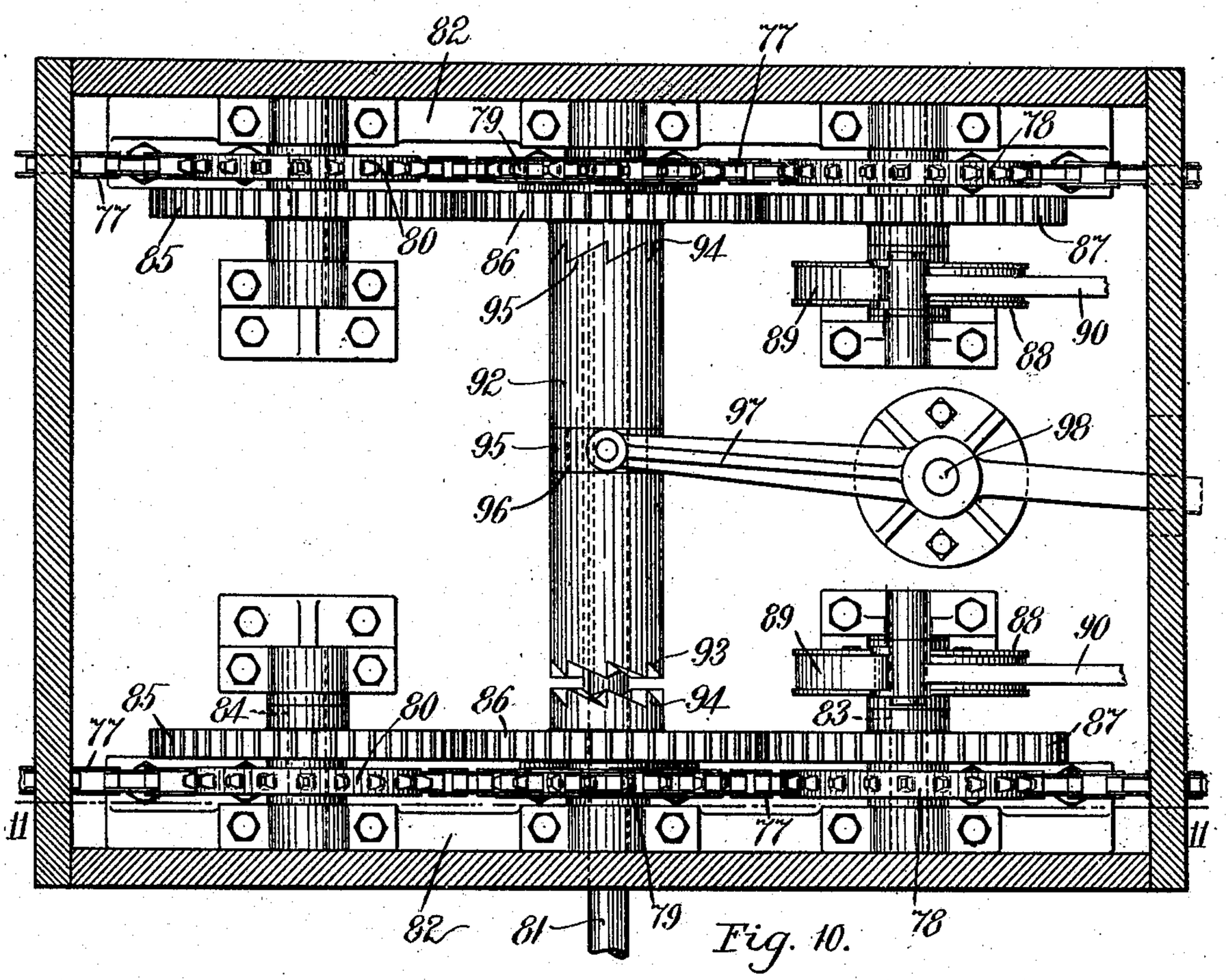

Fig. 10.

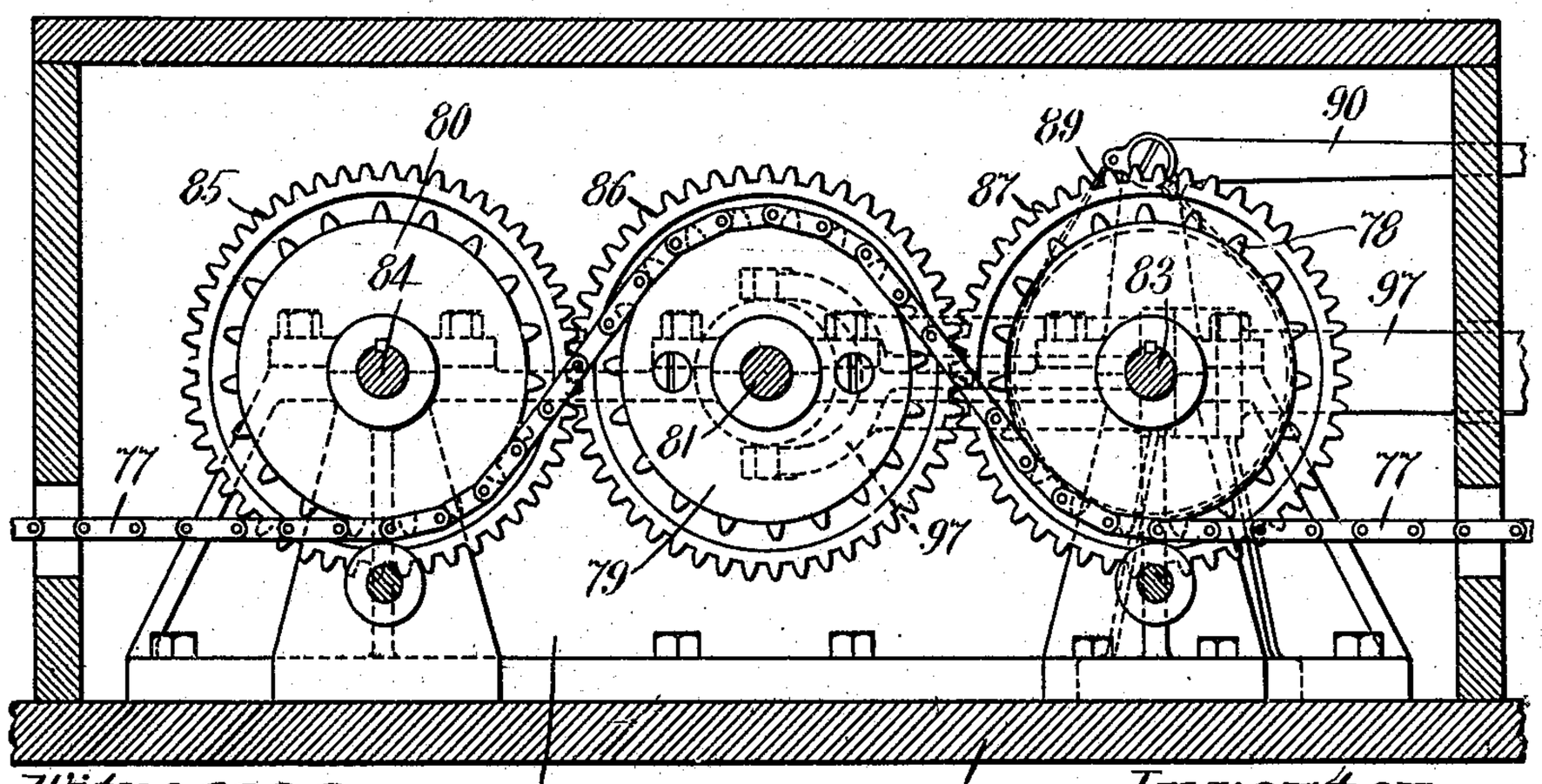

Fig. 11.

Witnesses.

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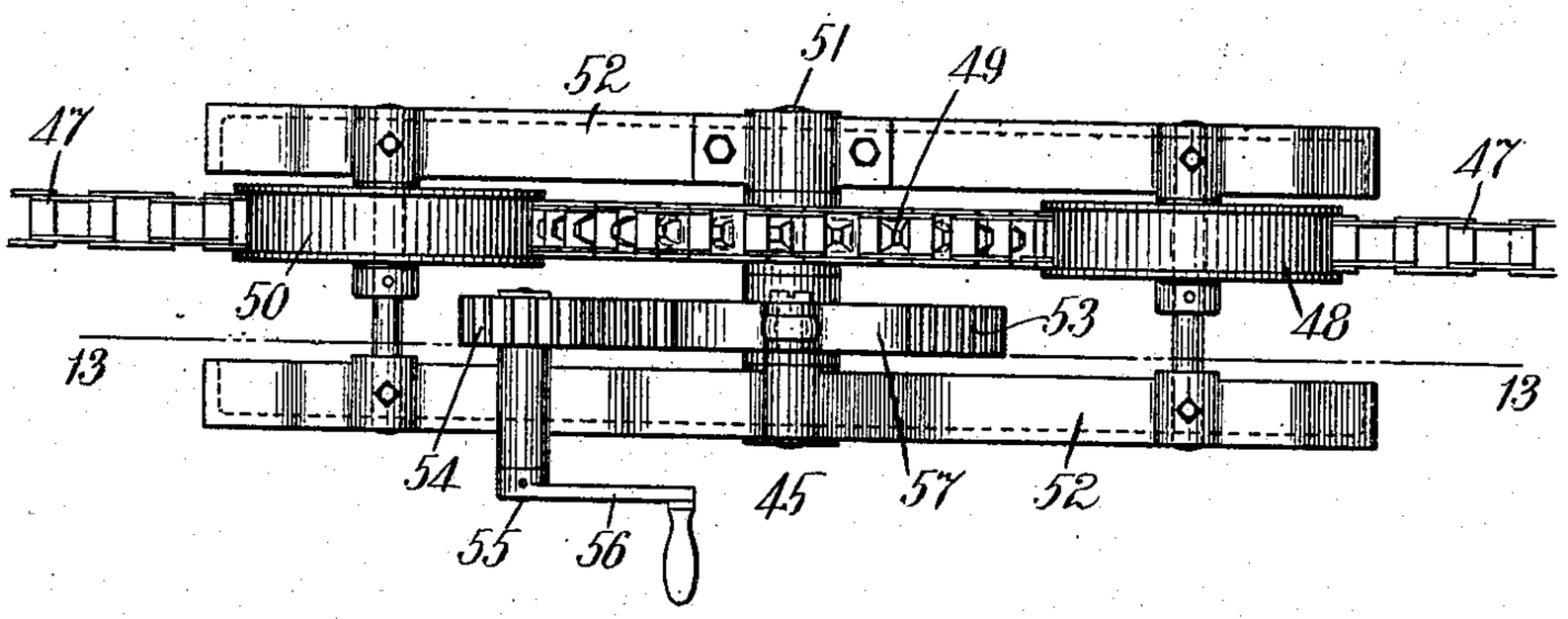

Fig. 12.

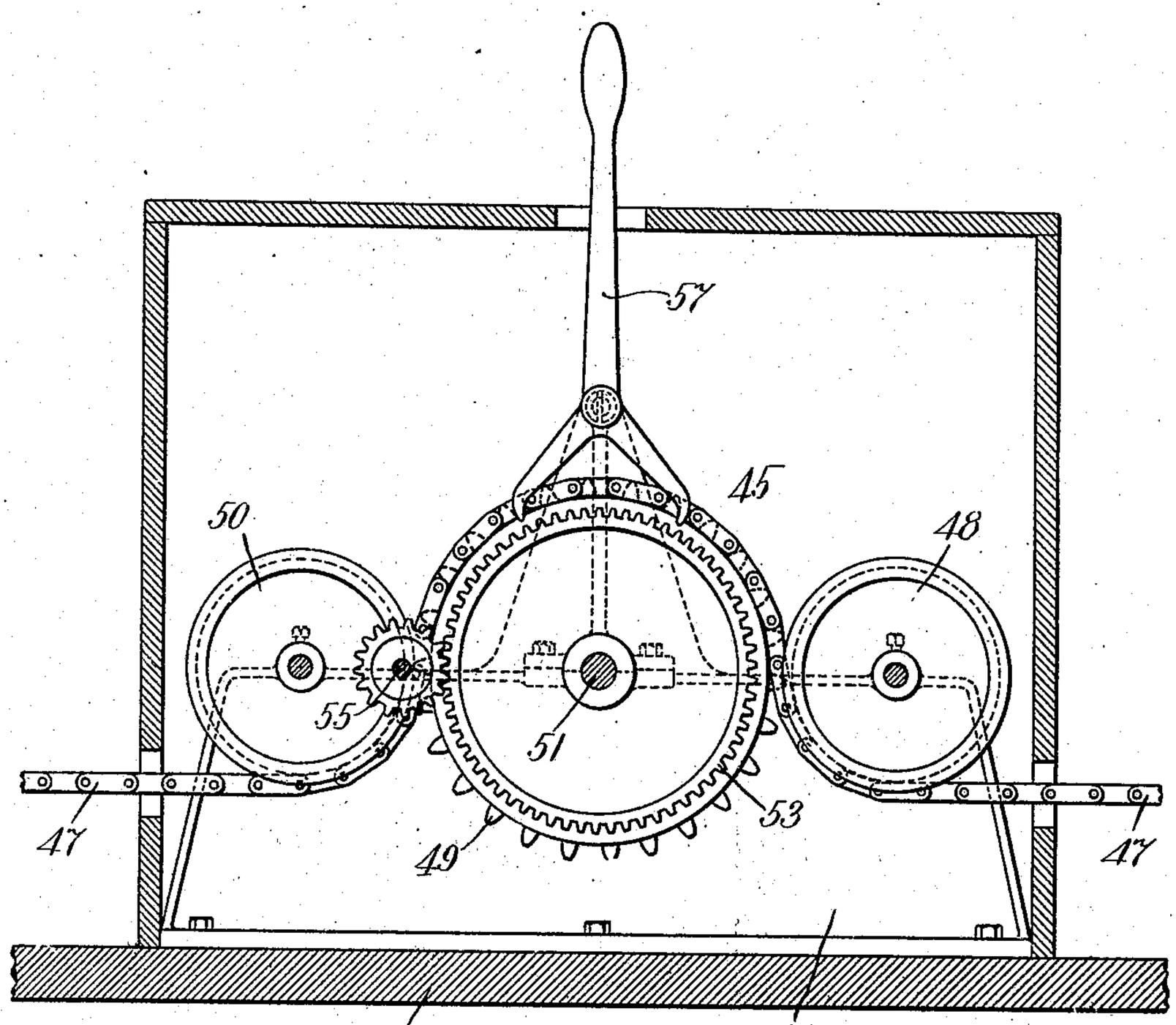

Fig. 13.

Witnesses.
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6 SHEETS—SHEET 6.

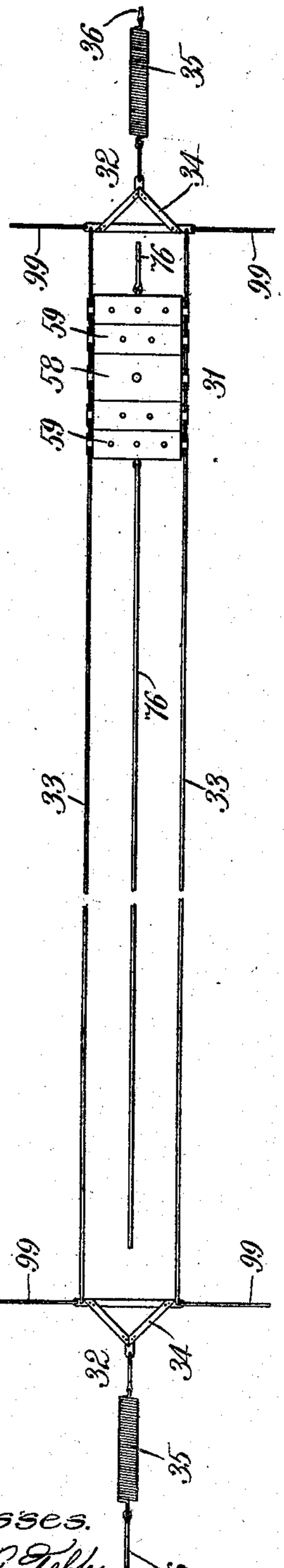

Fig. 14.

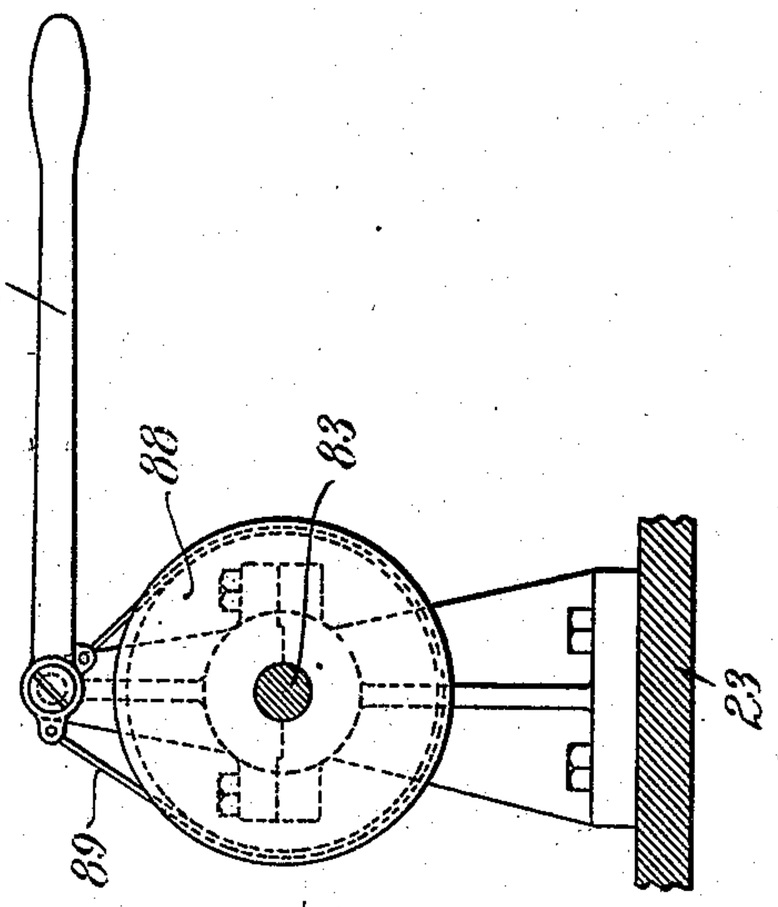

Fig. 15.

Witnesses.
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by his attorneys, Charles V. Gooding.

UNITED STATES PATENT OFFICE.

EVANGELO OTIDYS, OF LINDSAY, OKLAHOMA.

APPARATUS FOR CLEANING THE HULLS OF VESSELS.

No. 919,939. Specification of Letters Patent. Patented April 27, 1909.

Application filed November 1, 1907, Serial No. 400,303. Renewed September 28, 1908. Serial No. 455,029.

To all whom it may concern:

Be it known that I, EVANGELO OTIDYS, a citizen of the United States, residing at Lindsay, in the county of Garvin, State of Oklahoma, have invented new and useful Improvements in Apparatus for Cleaning the Hulls of Vessels, of which the following is a specification.

This invention relates to improvements in apparatus for cleaning the hulls of vessels, and the object is to provide an apparatus by means of which a vessel's hull may be cleaned without placing the vessel in a dry dock or hauling it out of the water, and one of the principal objects of the invention is to make it possible to locate the power instrumentalities at a convenient fixed point on the deck and to provide connections with the cleaning or scraping instrumentalities so arranged that the power is communicated to the scraping instrumentalities and said scraping instrumentalities are moved over the surface of the hull.

Other objects and advantages will appear hereinafter.

The invention consists in the combination and arrangement of parts set forth in the following specification and particularly pointed out in the appended claims.

In the drawings: Figure 1 is a plan of a vessel showing my improved cleaning or scraping apparatus attached thereto. Fig. 2 is a side elevation of the same. Fig. 3 is an enlarged detail cross sectional elevation taken on line 3—3 of Fig. 2, the portions of the vessel which are not essential to my invention being omitted. Fig. 4 is an enlarged detail elevation of a portion of the stern of the vessel showing the manner of joining the two side cables. Fig. 5 is an enlarged end elevation of one of the movable plates which carries a pair of sheave wheels. Fig. 6 is an enlarged end elevation of one of the stationary plates which carries four sheave wheels. Fig. 7 is an enlarged detail elevation of the cleaning machine, with the cap plates removed. Fig. 8 is an end elevation viewed from the left of Fig. 7. Fig. 9 is a sectional elevation taken on line 9—9 of Fig. 7, looking toward the right. Fig. 10 is an enlarged plan section of the mechanism for moving the cleaning machine along its guides from the water line to the keel. Fig. 11 is a detail sectional elevation taken on line 11—11 of Fig. 10. Fig. 12 is an enlarged detail plan section of the mechanism for tightening the guides, whereby the cleaning machine is moved into contact with the hull of the vessel. Fig. 13 is a sectional elevation taken on line 13—13 of Fig. 12. Fig. 14 is an underneath plan development of the cleaning machine and its guides, partly broken away to save space. Fig. 15 is a detail sectional elevation of one of the brakes.

In the drawings, 20 is the hull of a vessel having a stem 21, a stern 22, and a deck 23. Two flexible members 24, 24 preferably steel wire cables are located on opposite sides, respectively, of the hull 20 and are provided on their forward ends with hooks 25, 25 which are hooked into a plate 26 which may be secured to the stem 21 by means of set screws or other suitable fastening devices. The members 24 are connected together at the stern 22 by means of a clamp plate 27 by means of which said members are secured in such a manner as to be adjustable in relation to each other. Two turn buckles 28, 28 are arranged to tighten the members 24, 24. The clamp plate 27 is supported by means of a rope 29 which is secured at one end to said clamp plate and at its other end may be secured to any convenient point on the deck of the vessel. Supporting ropes 30 may be arranged at suitable intervals along the sides of the hull 20 to properly support the cables 24, 24.

A cleaning machine 31 is supported on a flexible member 32 which consists of two guide ropes 33, 33 preferably steel wire cables connected to two triangular frames 34, 34, said frames being connected by means of springs 35, 35 to two flexible wire ropes 36, 36, respectively. Two clamp plates 37, 37 may be fastened to the cables 24, 24, respectively, in any suitable manner as, for instance, by means of clamp plates 38, 38 secured thereto by means of screws 39, 39, whereby said plates are rigidly clamped to the cables 24, 24 and may be loosened therefrom and moved longitudinally thereof from time to time.

The ropes 36, 36 pass part way around sheave wheels 40, 40 journaled on the plates 37, 37, respectively, said ropes extending thence longitudinally of the hull 20 and passing part way around sheave wheels 41, 41 journaled on plates 42, 42 secured to the cables 24, 24 by clamp plates 43, 43 in a similar manner to which the plates 38 are secured to the plates 37. The ropes 36, 36 leading upwardly from the sheave wheels

41, 41 pass over sheave wheels 44, 44 journaled on the plates 42, 42, respectively, and thence one of said ropes passes to a tightening mechanism 45, while the other of said ropes is secured to a fixed point as, for instance, a cleat 46.

I will now proceed to describe the tightener mechanism shown in detail in Figs. 12 and 13. While the side of the vessel shown in Fig. 2 known as the starboard side is being cleaned the rope 36 of the starboard side is connected to a sprocket chain 47 which passes part way around a grooved wheel 48, part way around a sprocket wheel 49, and part way around a second grooved wheel 50 and thence the free end of said chain may be coiled up on the deck 23. The sprocket wheel 49 is fast to a shaft 51 journaled in suitable bearings in frames 52, 52 there being a gear 53 also fast to said shaft and meshing into a pinion 54 fast to a shaft 55 journaled in suitable bearings in the frames 52, 52. The shaft 55 may, if desired, be connected to a suitable source of power or it may have secured thereto a crank 56 by means of which said shaft may be rotated, whereby rotary motion is communicated to the sprocket wheel 49 and the chain 47 is moved in the direction of its length and thus the rope 36 of the starboard side is stretched taut and the spring 35 is subjected to a tension so that the cleaning machine 31 is moved into contact with the hull 20. When the spring 35 is thus placed under tension, said tension is maintained by means of a double-acting pawl 57 which is adapted to engage the teeth of the gear 53 and thus lock said gear against rotation, whereby movement of the chain 47 in the direction of its length is prevented and the cleaning machine 31 is maintained in proper working contact with the hull 20.

I will now proceed to describe the details of construction of the cleaning machine 31 shown in detail in Figs. 7, 8 and 9. The cleaning machine 31 has a frame made up of a plurality of sections comprising a central section 58 and a plurality of other sections 59, each of said sections being pivotally connected to the section next adjacent thereto, whereby said frame is made flexible to conform to the curvature of the hull 20 of the vessel. The section 58 and the sections 59 are provided with wheels 60 journaled on opposite ends thereof and arranged to roll in contact with the surface of the hull 20, there being a plurality of guide rolls or sheaves 61 journaled on said sections against which the guide ropes 33 are arranged to bear. Brackets 62 constituting bearings for the shafts of the wheels 60 and guide rolls 61 are arranged to prevent the guide ropes 33 from moving out of operative relation with the grooves of said guide rolls. On the sections 59 are mounted a plurality of series of motors 63 all identical in construction. The motors 63 may be of any type suitable for the use of fluid to operate them such as compressed air, steam, or water under pressure. In practice, I prefer to employ compressed air motors of the multiple-cylinder type which are commonly used for drilling and reaming and such work and which are well known to those skilled in mechanical arts. The power shafts 64 of the motors 63 are slidably arranged in their respective sections 59 so as to be freely movable in the direction of their length, there being springs 65 surrounding said shafts, respectively, and interposed between cap plates 66 fast to the section 59 and nuts 67 having screw-threaded engagement with said shafts fast to the shafts 64, whereby said springs are adapted to press rotary brushes 68 fast to said shafts against the surface of the hull 20. The brushes 68 which are shown in the drawings are merely typical representations of the brushes or scrapers which I employ and I do not limit myself to the specific device shown.

By reference to Figs. 8 and 9, it will be seen that the brushes 68 extend beyond the peripheries of the wheels 60 and it will be understood that when the cleaning machine 31 is pressed against the side of the hull 20, as hereinbefore described, the springs 65 yield until the peripheries of said wheels come into contact with the surface of said hull, and it will be seen that by reason of the fact that said brushes are thus resiliently mounted they conform to the various curvatures of said hull. The motors 63 are connected by supply pipes 69 to a supply chamber 70 mounted on the section 58, said supply chamber being connected by a main supply pipe 71 to a tank 72 adapted to contain water, air or steam under pressure. The supply pipes 69 and 71 are, of course, flexible so that the cleaning machine 31 may be easily moved from place to place on the hull 20 and so that said machine may conform to the curvature of said hull.

I will now proceed to describe the instrumentalities for moving the cleaning machine 31 longitudinally of the guide ropes 33. On the plates 37 adjacent to the sheave wheels 40 are located sheave wheels 73, while on the plates 42 adjacent to the sheave wheels 41 are mounted sheave wheels 74 and adjacent to the sheave wheels 44 are mounted sheave wheels 75. To the opposite ends of the cleaning machine 31 are fast ropes 76, 76 which pass upwardly part way around the sheave wheels 73, thence longitudinally of the hull 20, part way around the sheave wheels 74, and thence upwardly and part way around the sheave wheels 75. The free ends of the ropes 76, 76 are connected to sprocket chains 77, 77, respectively, which pass part way around sprocket wheels 78, 78, sprocket wheels 79, 79, and sprocket wheels 80, 80. The sprocket wheels 79 are loosely

mounted on a shaft 81 journaled in suitable bearings in a frame 82, while the sprocket wheels 78 are fast to shafts 83, 83, respectively, said shafts being journaled in suitable bearings in the frames 82 82 and in like manner the sprocket wheels 80, 80 are fast to shafts 84, 84, respectively, journaled in suitable bearings in said frames.

Gears 85, 85 fast to the shafts 84, 84 fast to the sprocket wheels 79, 79, respectively, and the gears 86, 86 mesh into gears 87, 87 fast to the shafts 83, 83, respectively. Brake drums 88, 88 fast to the shafts 83, 83, respectively, are surrounded by brake bands 89 connected in any usual or desired manner to brake levers 90, 90, respectively. The shaft 81 may be connected to any suitable source of power as, for instance, a motor 91 of the reversible type, whereby said shaft may be rotated in either direction. A clutch sleeve 92 slidably mounted on the shaft 81 is provided on its opposite ends with clutch teeth 93 which are adapted to engage corresponding teeth 94, 94 formed on the hubs of the gears 86, 86, respectively. A collar 95 located in an annular groove 96 in the sleeve 92 is pivotally connected to a clutch lever 97, said lever being pivoted at 98. When the clutch lever and clutch sleeve are in the position shown in Fig. 10 and the shaft 81 is rotated clockwise (Fig. 11) the rope 76 of the port side is hauled by the mechanism and the cleaning machine 31 is moved thereby from the position shown in Fig. 2 toward the keel and when the clutch sleeve 92 is moved into engagement with the clutch 94 of the opposite side and the shaft 81 is rotated clockwise (Fig. 11) the rope 76 of the starboard side is hauled and the cleaning machine 31 is moved from the keel toward the water line.

It will be understood that the sleeve 92 while free to slide on the shaft 81 is non-rotatably mounted thereon in any usual or desired manner as by means of a key. In order that the cleaning machine 31 together with its guide ropes 33, 33 may be moved longitudinally of the vessel, I preferably provide four ropes 99, 99 connected to the triangular frames 34, 34. On each of the ends of the cleaning machine 31, I provide springs 100 arranged to strike the keel of the vessel and act to cushion the blow when the machine brings up against the keel.

Having thus specifically described the apparatus, I will now proceed to describe its general operation. Assuming the parts to be in positions shown in Figs. 1 and 2 with the upper end of the cleaning machine 31 at or near the water line, the rope 76 of the port side is hauled inbound by the mechanism hereinbefore described and shown in Figs. 10 and 11 and in order to prevent the rope 76 on the starboard side from paying out too fast the operator moves the brake lever 90 to apply the brake band 89 which is operatively connected to the rope 76 of the starboard side. While the machine 31 is being drawn downwardly toward the keel the cleaning brushes 68 are rotated by their respective motors 63 and the barnacles and marine growth are thus removed from the surface of the hull 20. When the machine 31 has reached the keel the clamp plates 38, 38 are loosened and moved toward the bow or stern of the vessel a distance substantially equal to the width of the cleaning machine 31. During such movement it is, of course, necessary to slacken the ropes 36 and after the apparatus has been moved to its new position the plates 37 are once more secured to the cables 24, the rope 36 of the port side is made fast to its cleat 46 and the rope 36 of the starboard side is tightened, as hereinbefore described.

The rope 76 of the starboard side is then hauled inboard and the cleaning machine 31 is drawn from the keel toward the water line and so on the apparatus is moved longitudinally of the vessel and the cleaning machine is moved to and fro from the water line to the keel thus cleaning practically the entire wetted area of the vessel's hull. When it is desired to clean the port side of the vessel the ropes 36, 36 are slackened thus permitting the guide ropes 33, 33 to drop some distance below the keel and the cleaning machine 31 is then drawn from the starboard side across the keel to the port side and the operation of cleaning the port side is, of course, similar to that described in connection with the starboard side.

Having thus described my invention, what I claim and desire by Letters Patent to secure is:

1. In combination with a vessel's hull, two devices located on opposite sides, respectively, of said hull, a flexible member extending transversely of said hull therebeneath and connected to said devices, two other devices located on opposite sides, respectively, of said hull, said flexible member extending from said first-named devices longitudinally of said hull and connected to said two other members, a cleaning device supported on the transverse portion of said flexible member, and means connected to the free ends of said flexible member, whereby the same may be subjected to tension and whereby said cleaning device may be moved into contact with said hull.

2. In combination with a vessel's hull, two flexible members located on opposite sides, respectively, of said hull and extending longitudinally thereof, two plates secured to said members, respectively, a flexible member extending transversely of said hull therebeneath and connected to said plates, two other plates secured to said first-named flexible members, respectively, said second-named flexible member extending from said first two

plates longitudinally of said hull and connected to said two other plates, a cleaning device supported on the transverse portion of said second-named flexible member, and means connected to the free ends of said second-named flexible member, whereby the same may be subjected to tension and whereby said cleaning device may be moved into contact with said hull.

3. In combination with a vessel's hull, a flexible member extending transversely of said hull therebeneath, a carriage movable longitudinally of said member, said carriage made up of a plurality of flexibly connected sections, a plurality of rotary scraping devices mounted on said sections, respectively, and arranged with their axes substantially perpendicular to said hull, and means for rotating said devices.

4. In combination with a vessel's hull, a flexible member extending transversely of said hull therebeneath, a carriage movable longitudinally of said member, said carriage made up of a plurality of flexibly connected sections, a plurality of rotary scraping devices mounted on said sections, respectively, and arranged with their axes substantially perpendicular to said hull, and a plurality of fluid pressure motors connected to said devices, respectively.

5. In combination with a vessel's hull, a flexible member extending longitudinally of said hull, a plate fast to said member, a sheave wheel mounted on said plate, a second plate fast to said member, a second sheave wheel mounted on said second plate, a flexible member extending transversely of said hull therebeneath passing part way around said first wheel, thence extending longitudinally of said hull and passing part way around said second sheave wheel, a cleaning device supported on the transverse portion of said flexible member, a third sheave wheel mounted on said first plate, a fourth sheave wheel mounted on said second plate, a flexible member fast to said cleaning device and passing part way around said third wheel, thence extending longitudinally of said hull and passing part way around said fourth wheel, and means connected to the free end of said third member, whereby said device may be moved transversely of said hull.

6. In combination with a vessel's hull, a flexible member extending for a portion of its length transversely of said hull therebeneath and for a portion of its length longitudinally of said hull, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, and a second flexible member connected to said cleaning device extending for a portion of its length transversely of said hull and for a portion of its length longitudinally of said hull.

7. In combination with a vessel's hull, a flexible member extending for a portion of its length transversely of said hull therebeneath and for a portion of its length longitudinally of said hull, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, a second flexible member connected to said cleaning device extending for a portion of its length transversely of said hull and for a portion of its length longitudinally of said hull, and means connected to said second member, whereby said cleaning device may be moved longitudinally of said transverse portion.

8. In combination with a vessel's hull, a flexible member extending for a portion of its length transversely of said hull therebeneath and for a portion of its length longitudinally of said hull, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, a second flexible member connected to said cleaning device extending for a portion of its length transversely of said hull and for a portion of its length longitudinally of said hull, means connected to said second member whereby said cleaning device may be moved longitudinally of said transverse portion, and means connected to said first member, whereby the same may be subjected to a tension and whereby said cleaning device may be moved into contact with said hull.

9. In combination with a vessel's hull, a flexible member extending for a portion of its length transversely of said hull therebeneath and for a portion of its length longitudinally of said hull, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, a second flexible member connected to said cleaning device extending for a portion of its length transversely of said hull and for a portion of its length longitudinally of said hull, and means connected to said first member, whereby the same may be subjected to a tension and whereby said cleaning device may be moved into contact with said hull.

10. In combination with a vessel's hull, two pulleys located on one side of said hull, a flexible member extending for a portion of its length transversely of said hull therebeneath, part way around one of said pulleys and thence longitudinally of said hull, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, and a second flexible member connected to said cleaning device extending for a portion of its length

transversely of said hull, part way around the other of said pulleys and thence longitudinally of said hull.

11. In combination with a vessel's hull, a flexible member extending for a portion of its length transversely of said hull therebeneath and two portions thereof extending longitudinally of said hull on opposite sides, respectively, thereof, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, and two flexible members connected to said cleaning device extending for a portion of their lengths transversely of said hull and for a portion of their lengths longitudinally of said hull upon opposite sides, respectively, thereof.

12. In combination with a vessel's hull, a flexible member extending for a portion of its length transversely of said hull therebeneath and two portions thereof extending longitudinally of said hull on opposite sides, respectively, thereof, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, two flexible members connected to said cleaning device extending for a portion of their lengths transversely of said hull and for a portion of their lengths longitudinally of said hull upon opposite sides, respectively, thereof, and means connected to said first member, whereby the same may be subjected to a tension and whereby said cleaning device may be moved into contact with said hull.

13. In combination with a vessel's hull, a flexible member extending for a portion of its length transversely of said hull therebeneath and two portions thereof extending longitudinally of said hull on opposite sides, respectively, thereof, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, two flexible members extending for a portion of their lengths transversely of said hull and for a portion of their lengths longitudinally of said hull upon opposite sides, respectively, thereof, and means connected to said second-named members, whereby said cleaning device may be moved longitudinally of said transverse portion.

14. In combination with a vessel's hull, a flexible member extending for a portion of its length transversely of said hull therebeneath and two portions of its length extending longitudinally of said hull on opposite sides, respectively, thereof, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, two flexible members connected to said cleaning device extending for a portion of their lengths transversely of said hull and for a portion of their lengths longitudinally of said hull on opposite sides, respectively, thereof, means connected to said second-named members, whereby said cleaning device may be moved longitudinally of said transverse portion, and means connected to said first-named member, whereby the same may be subjected to a tension and whereby said cleaning device may be moved into contact with said hull.

15. In combination with a vessel's hull, two pulleys located on opposite sides, respectively, of said hull, a flexible member extending for a portion of its length transversely of said hull therebeneath, part way around said pulleys and thence longitudinally of said hull upon opposite sides, respectively, thereof, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, two other pulleys located on opposite sides, respectively, of said hull, and two flexible members connected to said cleaning device extending part way around said second-named pulleys, respectively, and thence longitudinally of said hull.

16. In combination with a vessel's hull, two pulleys located on opposite sides, respectively, of said hull, a flexible member extending for a portion of its length transversely of said hull therebeneath, part way around said pulleys and thence longitudinally of said hull upon opposite sides, respectively, thereof, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, two other pulleys located on opposite sides, respectively, of said hull, two flexible members connected to said cleaning device extending part way around said second-named pulleys, respectively, and thence longitudinally of said hull, means connected to said second-named members, whereby said cleaning device may be moved longitudinally of said transverse portion, and means connected to said first-named member, whereby the same may be subjected to a tension and whereby said cleaning device may be moved into contact with said hull.

17. In combination with a vessel's hull, two cables secured to said hull on opposite sides, respectively, thereof, two pulleys supported on said cables, respectively, a flexible member extending for a portion of its length transversely of said hull therebeneath part way around said pulleys and thence longitudinally of said hull upon opposite sides, respectively, thereof, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, two other pulleys lo-

cated on opposite sides, respectively, of said hull, and two flexible members connected to said cleaning device extending part way around said second-named pulleys, respectively, and thence longitudinally of said hull.

18. In combination with a vessel's hull, a flexible member extending for a portion of its length transversely of said hull therebeneath and for a portion of its length longitudinally of said hull, the transverse portion of said member constituting a guide, a cleaning device arranged to move longitudinally of said transverse portion and adapted to be guided thereby, a second flexible member connected to said cleaning device extending for a portion of its length transversely of said hull and for a portion of its length longitudinally of said hull, means connected to said first member, whereby the same may be subjected to a tension and whereby said device may be moved into contact with said hull, and a spring interposed between said means and said device.

19. In combination with a vessel's hull, a pair of substantially parallel flexible members extending transversely of said hull therebeneath, two frames to which opposite ends of said members are connected, said frames being disposed on opposite sides, respectively, of said hull, a cleaning device arranged to move longitudinally of said members and adapted to be guided thereby, a second pair of flexible members connected to said frames, respectively, said second members extending for a portion of their lengths transversely of said hull and for a portion of their lengths longitudinally of said hull, and a third member connected to said cleaning device extending for a portion of its length transversely of said hull and for a portion of its length longitudinally of said hull.

20. In combination with a vessel's hull, a flexible member extending transversely of said hull therebeneath and having one fixed end, a cleaning device arranged to move longitudinally of said member and adapted to be guided thereby, a rotatable drum to which said member is connected and by means of which said device may be moved into contact with said hull, means to lock said drum against rotation, a spring connected to said member and interposed between said drum and said fixed end, and a second flexible member connected to said cleaning device, whereby the same may be moved longitudinally of said first member.

21. In combination with a vessel's hull, a flexible member extending transversely of said hull therebeneath, a cleaning device arranged to move longitudinally of said member and adapted to be guided thereby, a second flexible member connected to said cleaning device, whereby the same may be moved longitudinally of said first member, a third flexible member connected to said cleaning device, and a frictional tensional device acting on said third member.

22. In combination with a vessel's hull, a carriage comprising a plurality of flexibly connected sections, a plurality of rotary cleaning devices mounted on said sections, respectively, with their axes substantially perpendicular to said hull, and means for rotating said devices.

23. In combination with a vessel's hull, a carriage comprising a plurality of flexibly connected sections, a plurality of rotary cleaning devices mounted on said sections, respectively, arranged with their axes substantially perpendicular to said hull, and a plurality of fluid pressure motors connected to said devices, respectively.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

EVANGELO OTIDYS.

Witnesses:
WALTER L. PIERCE,
LOUIS A. JONES.