No. 740,945. PATENTED OCT. 6, 1903.

A. J. TAPLIN.

STEAM TURBINE.

APPLICATION FILED MAY 27, 1903.

NO MODEL. 5 SHEETS—SHEET 1.

Fig. 1.

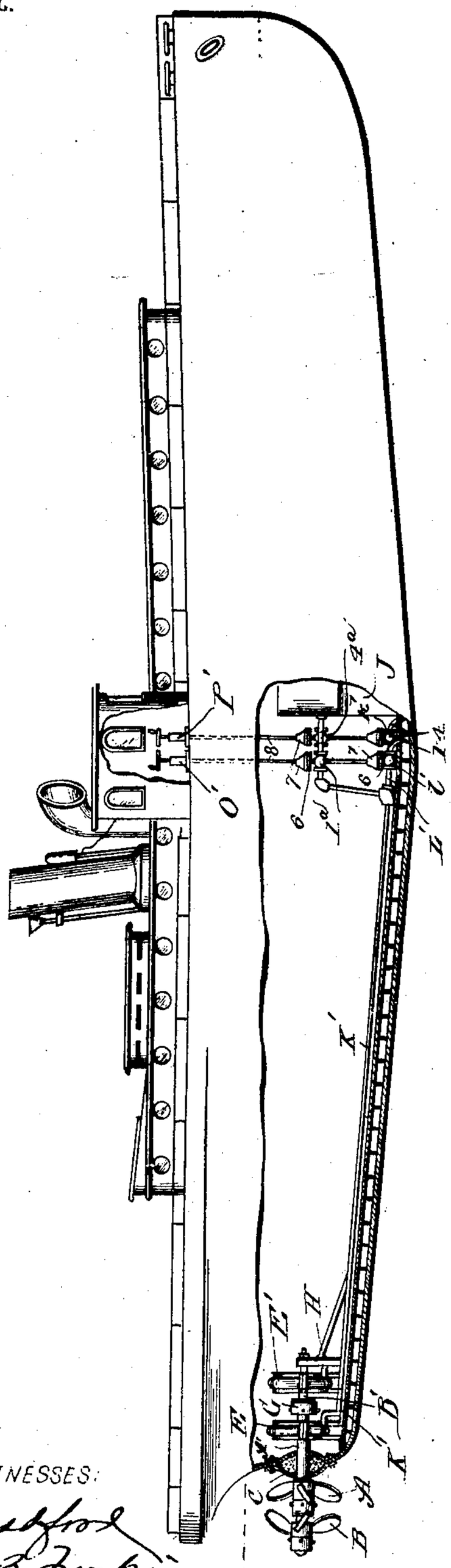
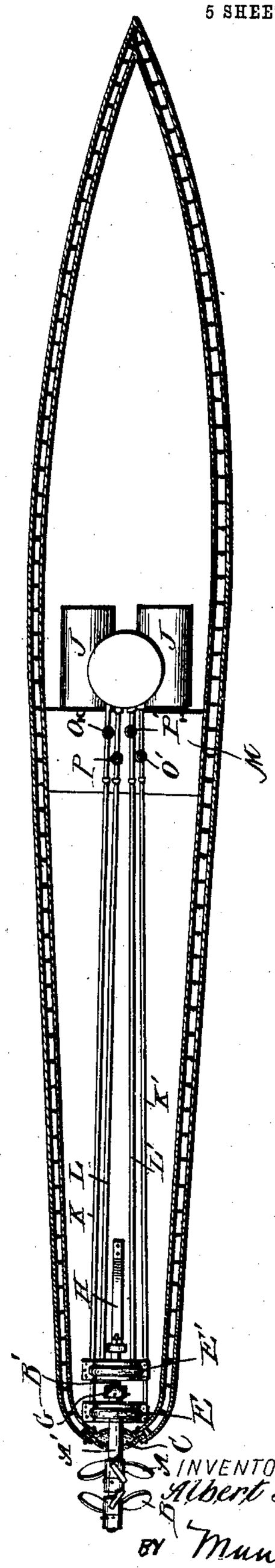


Fig. 2.



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NO MODEL. 5 SHEETS—SHEET 2.

Fig. 3.

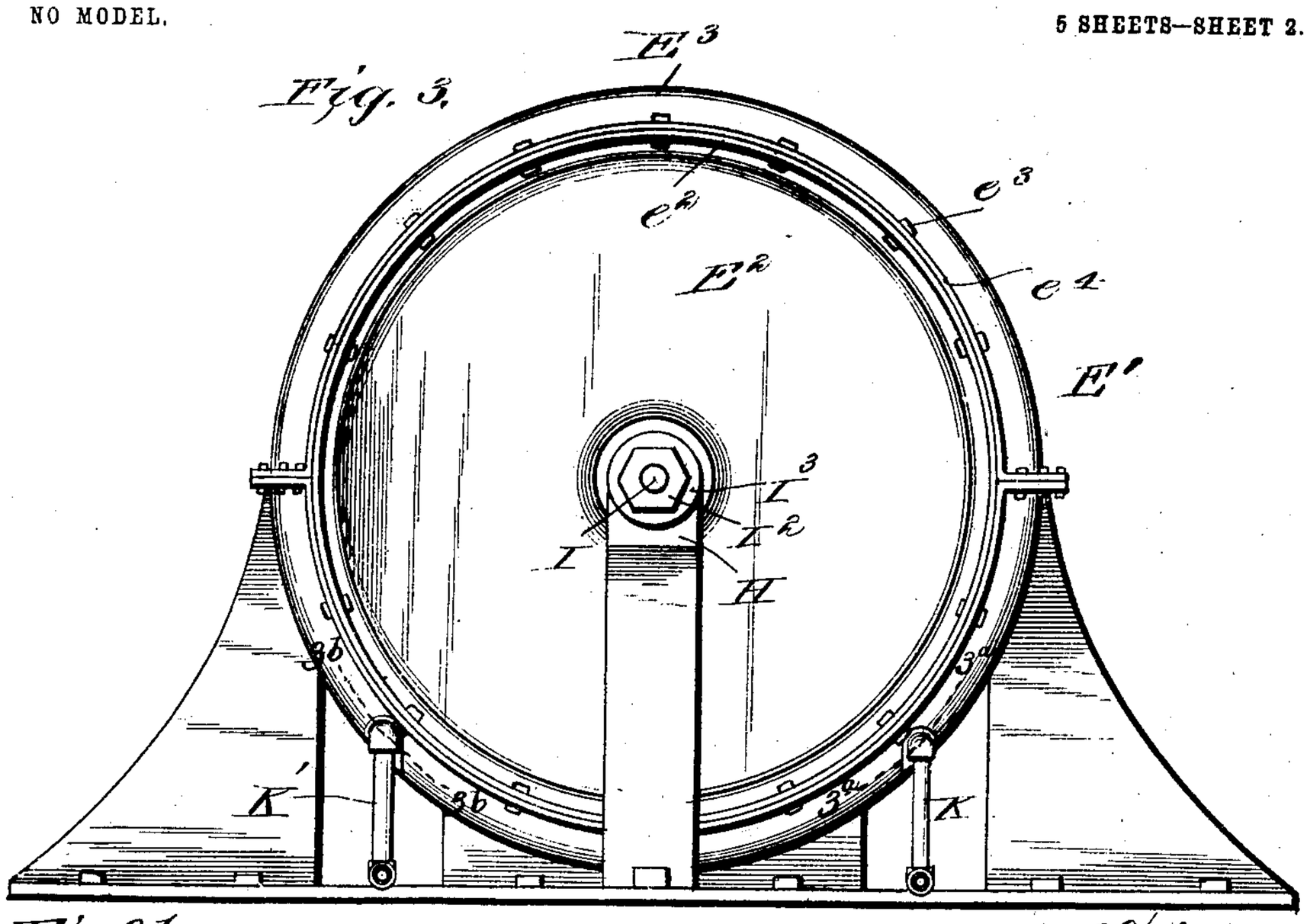


Fig. 3b.

Fig. 3a.

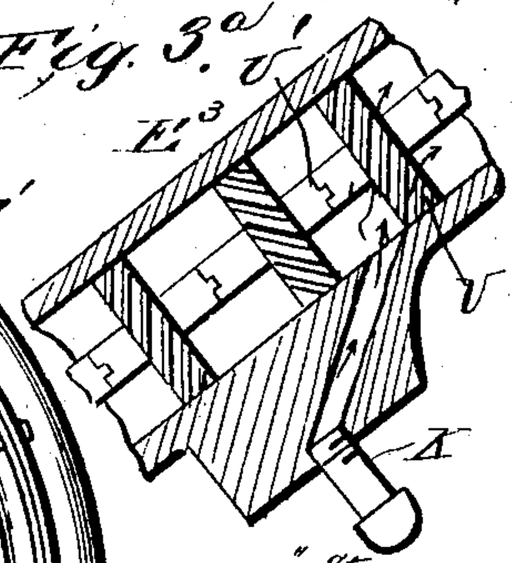
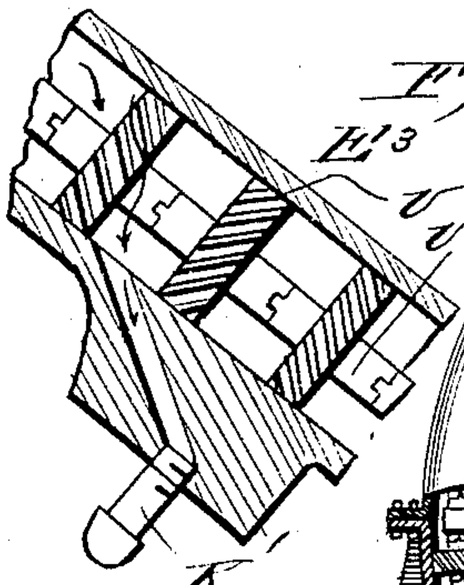
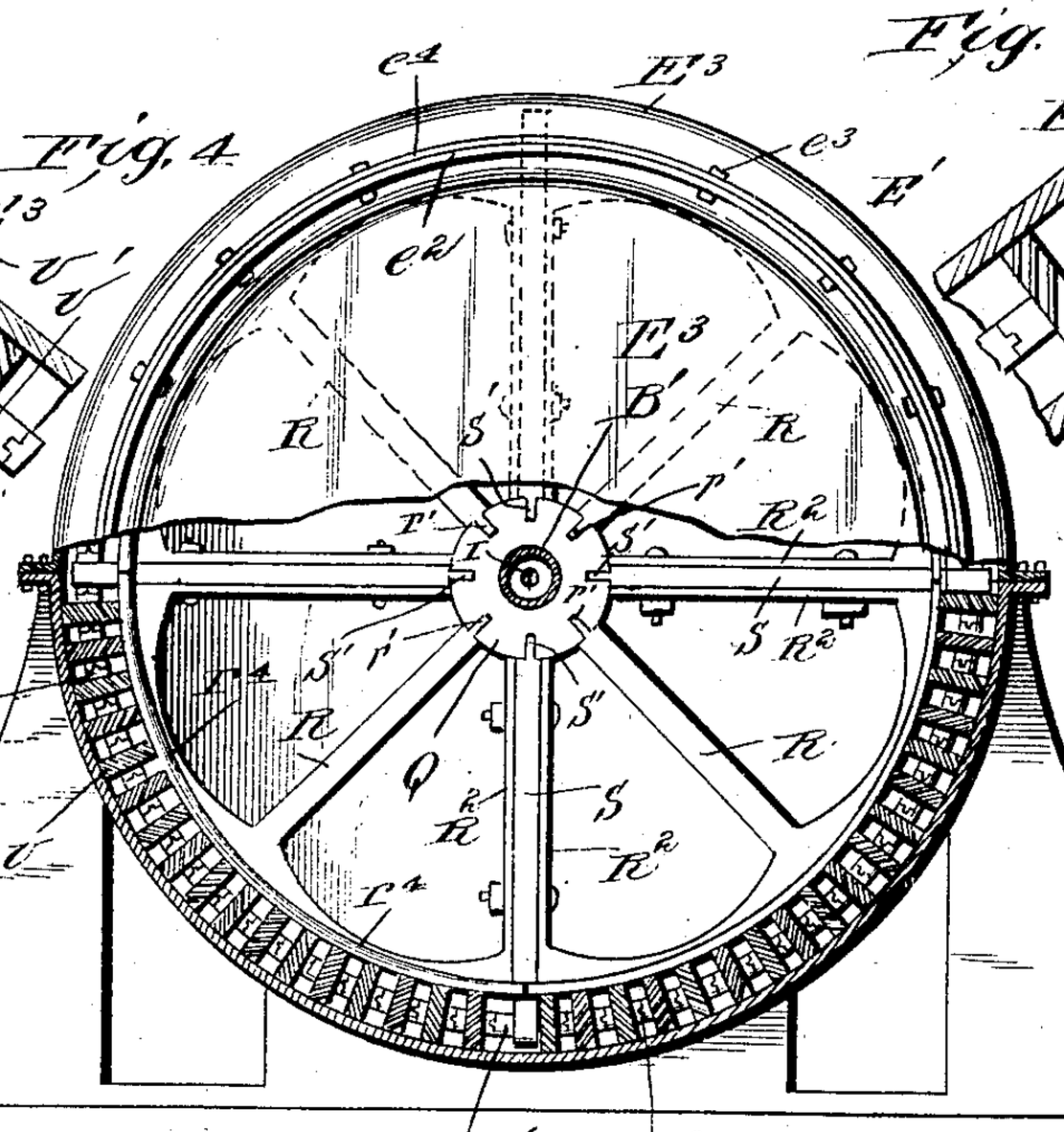


Fig. 4.





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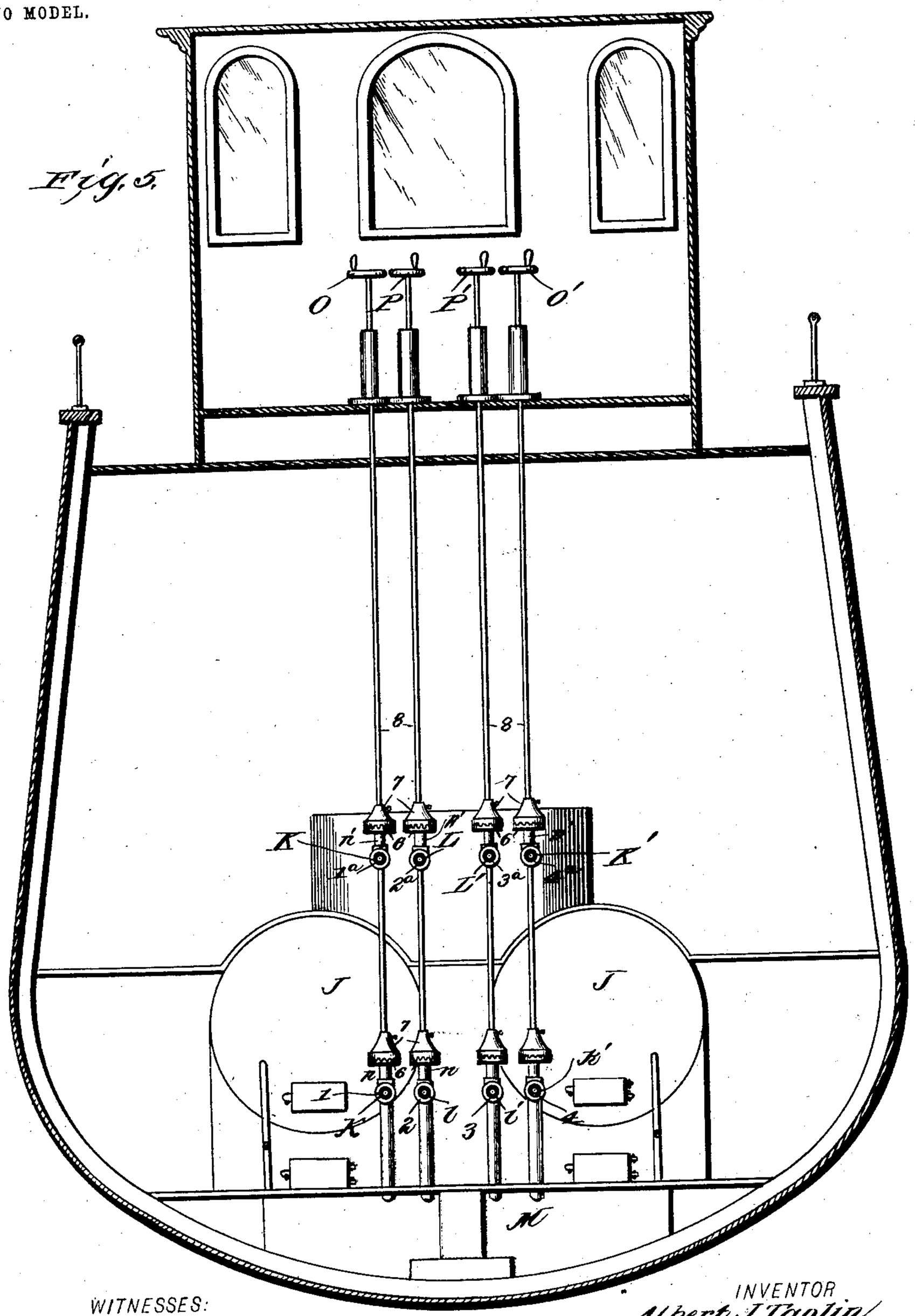
NO MODEL. 5 SHEETS—SHEET 3.

Fig. 5.



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APPLICATION FILED MAY 27, 1903.

NO MODEL. 5 SHEETS—SHEET 4.

Fig. 6.

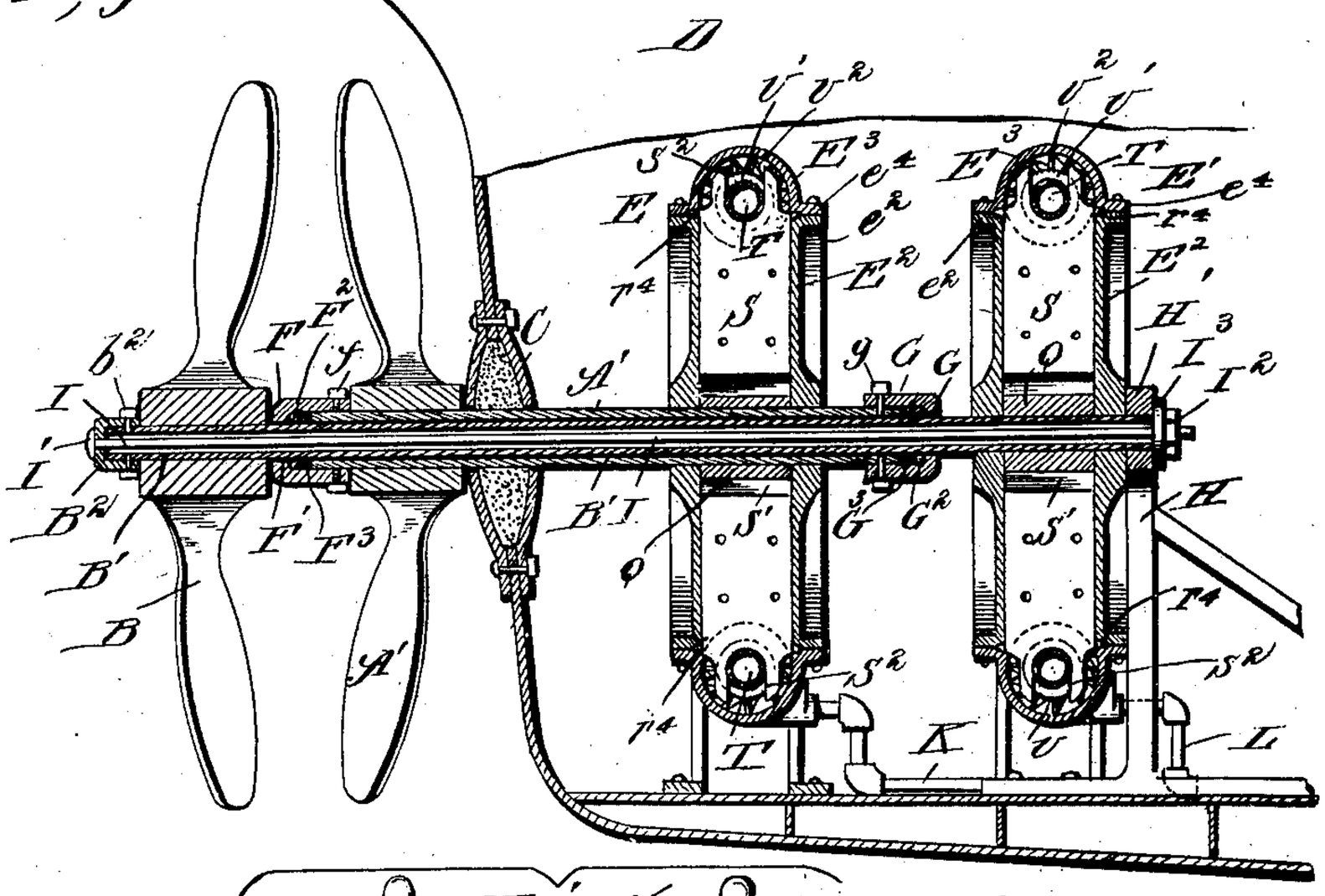
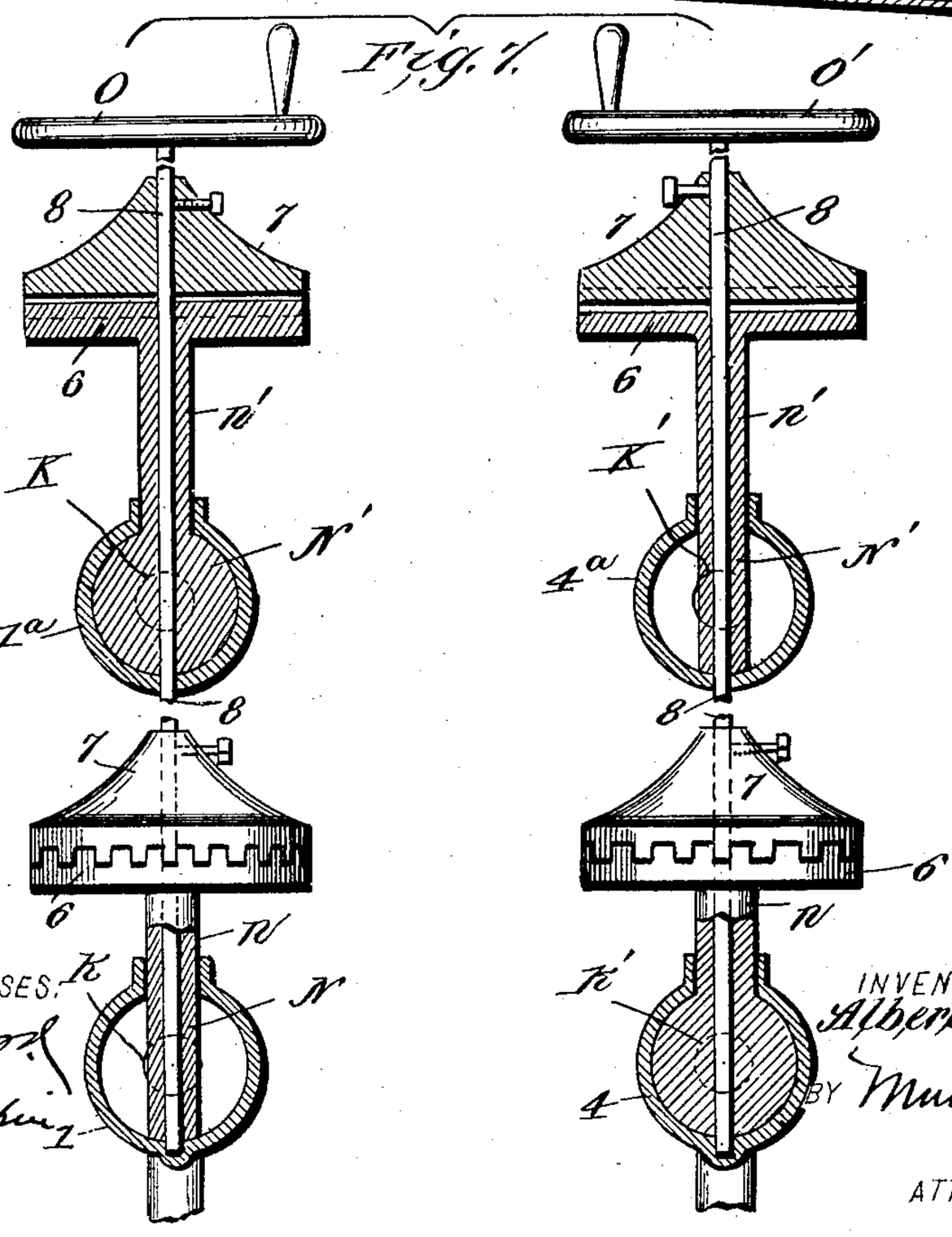


Fig. 7.



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APPLICATION FILED MAY 27, 1903.

NO MODEL. 5 SHEETS—SHEET 5.

Fig. 8.

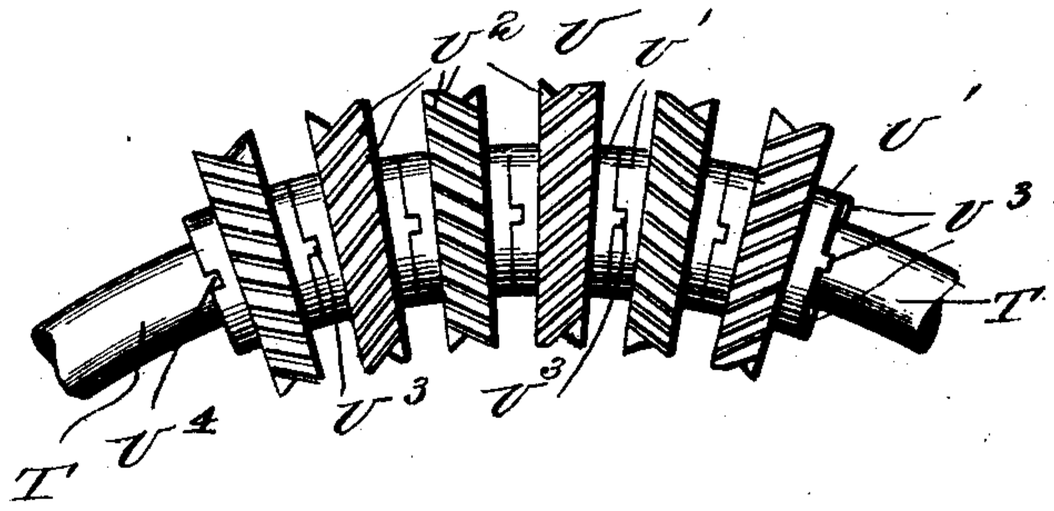

Fig. 9.

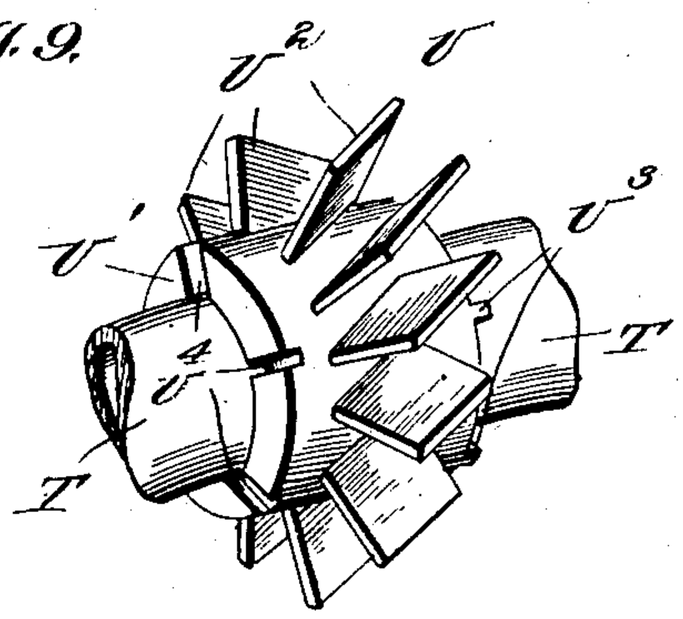

Fig. 10.

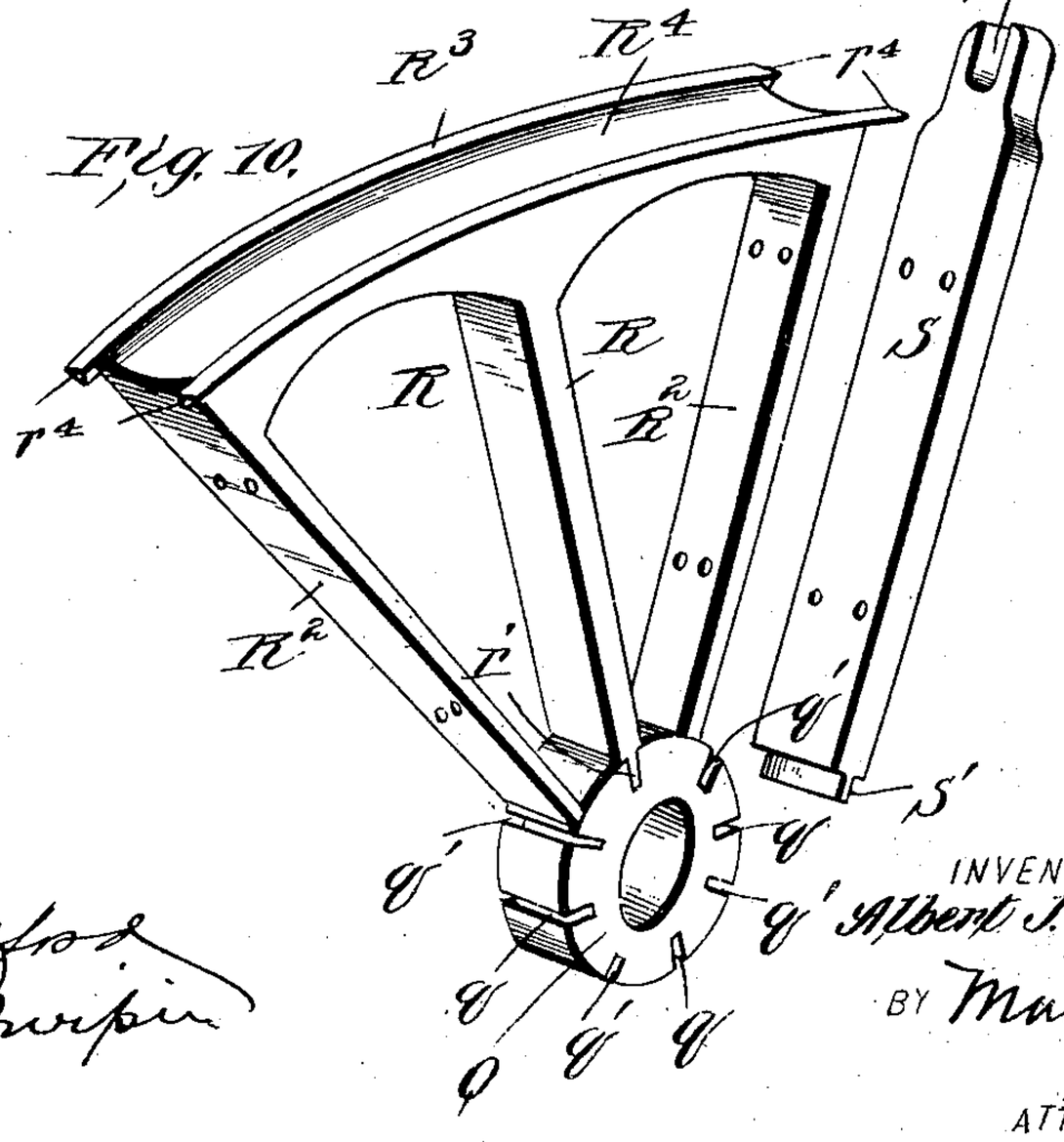

Fig. 11.

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No. 740,945. Patented October 6, 1903.

UNITED STATES PATENT OFFICE.

ALBERT J. TAPLIN, OF WASHINGTON, DISTRICT OF COLUMBIA.

STEAM-TURBINE.

SPECIFICATION forming part of Letters Patent No. 740,945, dated October 6, 1903.

Application filed May 27, 1903. Serial No. 158,948. (No model.)

To all whom it may concern:

Be it known that I, ALBERT J. TAPLIN, a citizen of the United States, and a resident of Washington, in the District of Columbia, have made certain new and useful Improvements in Steam-Turbines, of which the following is a specification.

My invention is an improvement in marine propulsion, having for an object to provide a novel construction for driving the propellers, to provide the propellers in pairs, one right and the other left, and to operate them independently so they may be used either singly or jointly for steering the vessel without the aid of a rudder, and to provide other improvements; and the invention consists in certain novel constructions and combinations of parts, as will be hereinafter described and claimed.

In the drawings, Figure 1 is a side elevation, partly in section, and Fig. 2 is a longitudinal horizontal section, of a vessel provided with my improvements. Fig. 3 is a detail elevation of one of the turbines. Fig. 3^a is a detail section on about line 3^a 3^a of Fig. 3. Fig. 3^b is a detail section on about line 3^b 3^b of Fig. 3. Fig. 4 is an elevation, partly in section, of one of the turbines. Fig. 5 is a cross-section on about the line 5 5 of Fig. 1. Fig. 6 is an enlarged vertical longitudinal section of the stern of the vessel provided with my improvement. Fig. 7 is a detail sectional view of the valve mechanism, parts being broken away. Fig. 8 is a detail edge view of a number of the blade-wheels on their carrying-rod. Fig. 9 is a detail perspective view of one of the blade-wheels. Fig. 10 is a detail perspective view of one of the quadrants in place on the hub, and Fig. 11 is a detail perspective view of one of the spoke-bars.

My invention provides mechanism designed to secure greater screw capacity and speed in a vessel and to control the flow of fluid vapor—such, for instance, as steam—in such manner as to readily and easily operate the reversible turbines and screws operated thereby to propel and steer a vessel without the use of a rudder, seeking to propel a vessel at the greatest speed attainable with safety, economy, and without vibration.

The right screw A and the left screw B may in general respects be of ordinary construction and are arranged concentrically and one in rear of the other, as shown in Figs. 1, 2, and 6. It is understood that if the right screw be revolved in the direction to propel the boat ahead its tendency will be to turn the bow of the boat to port, while if the left screw be turned in the direction to propel the boat ahead it will tend to turn the bow of the boat to the starboard, so that by the operation of these propellers either alone or jointly the bow may be steered in either direction without the use of the rudder. Thus by means of the right propeller when operated alone to propel the boat forward it will be steered to port, while the left screw operated to propel the boat ahead will steer the boat to starboard, and when these screws are reversed their steering tendency will be the opposite of that when they are given the direct motion, so that by driving one screw direct and the other reversed the steering effect upon the bow of the vessel will be increased.

In order to control and operate the screws independently, I support the same on independent shafts and provide means for driving these shafts independently in one or the other direction. In carrying out this feature of my invention I support the right screw A on a hollow shaft A′, having a bearing at C in a suitable stuffing-box construction provided at the stern of the vessel D. This hollow shaft A′ has the wheel A secured to it near its rear end and has also secured to it near its front end the turbine-wheel E, presently described. The shaft A′ extends at its rear end beyond the wheel A and at its front end in advance of the wheel E and receives the end casings F and G, which are bolted to the shaft A′ by the bolts *f* and *g*, said casings F and G having the inturned ends F′ and G′, which form ball-races for the balls F^2 and G^2, which bear between said inturned ends and collars F^3 and G^3, fitting around the inner hollow shaft B′ and against the ends of the outer hollow shaft A′, as best shown in Fig. 6 of the drawings.

The wheel E operates to turn the screw A in one direction or the other, as may be desired and as will be more fully described hereinafter.

The inner hollow shaft B′ has the screw B fixed to it near its rear end and extends in

advance of said screw forwardly through the hollow shaft A′ and bears at its front end in bearings H′ in the stand H, which may be suitably braced in the hull of the vessel, as shown in Fig. 6.

The rear end of the shaft B′ extends rearwardly beyond the screw B and has the end casing B^2 secured upon it by the bolts b^2. A tie-rod I has at its rear end a head I′ and is inserted through a suitable opening in the end casing B^2 and extends thence forwardly within the hollow shaft B′ to a point in advance of the stand H and is threaded at its front end to receive the nut I^2, which bears against the washer I^3, overlapping the front end of the shaft B′ and bearing against the front side of the bearing H′ in the stand H, as shown in Fig. 6. The turbine E′ is secured on the inner hollow shaft B′, near the front end of the latter, and is arranged in advance of the turbine E, as shown in Figs. 1, 2, and 6, and means are provided for driving these turbines E and E′ independently and in one direction or the other, so one of the screws A B may be turned in either direction without any movement of the other screw, or both said screws may be turned in the same direction or in opposite directions, as may be desired in securing the propulsion of the vessel ahead or astern or for steering the vessel in either direction or for turning the vessel, as may be desired by those in control.

As shown, I have provided for driving the turbines E and E′ by steam from suitably-installed boilers J, each of the turbines being provided with two steam-pipes, the steam-pipes of the turbine E being indicated by the letters K and K′, while those of the turbine E′ are lettered L and L′, the pipes K and L opening into the turbine-casings at one side and the pipes K′ and L′ opening into their casings at the opposite side, so the steam may be delivered through the pipes K and L to drive their respective wheels in one direction and through the pipes K′ and L′ to drive their wheels in the opposite direction, provision being made for the exhaust of the steam, in one instance through the pipes K′ and L′ and in the other case through the pipes K and L by means of the valves presently described. To this end the pipes K L and L′ and K′ are provided near their rear ends with exhaust-discharge branches *k l* and *l′* and *k′*, discharging to a suitable tank, as shown at M in Figs. 2 and 5, and these exhaust-discharge branches are provided with valve-casings 1, 2, 3, and 4, arranged directly below corresponding valve-casings 1^a, 2^a, 3^a, and 4^a in the corresponding steam-pipes K, L, L′, and K′, which connect with the boiler, and valves are provided in the said valve-casings and so arranged and connected that when the valve in the pipe K, for instance, is opened the valve in the corresponding exhaust-discharge pipe *k* will be closed, and vice versa. By this means by a proper manipulation of the valves when the pipe K is opened to discharge steam to its turbine E the exhaust-pipe *k′* will be opened and the steam-feed pipe K′ will be closed, and vice versa. Valves N are provided in the lower casings 1, 2, 3, and 4 and similar valves N′ in the upper casings 1^a, 2^a, 3^a, and 4^a, and as these valves and their operating means are alike the description of one set will answer for all.

I have shown in Fig. 7 the valve-casings in connection with the pipes K and K′ and their exhaust branches *k* and *k′*, and it will be noticed that when the valve N′ of the pipe K is closed the valve N of this exhaust-discharge branch *k* will be opened, and vice versa. Thus in the arrangement of parts shown in Fig. 7 steam will be delivered through the pipe K′ to the turbine E and will be exhausted through an exhaust-discharge branch *k* into the tank M, and if the valve N′ in the pipe K should be opened and the valve N′ in the pipe K′ be closed the steam would be delivered to the opposite side of the turbine E through pipe K and be exhausted through the exhaust-discharge branch *k′*. Any suitable provision may be made for utilizing the water collected from the exhaust in the tank M, and it may be desirable to use it as feed-water for the boiler, to which it may be conducted by any suitable system of pumps or injectors well known in this art.

For convenience in installing the valves N and N′, I may employ the construction shown in detail in Fig. 7, in which the stems *n* and *n′* of said valves are provided with toothed wheels 6, which are engaged by toothed wheels 7, suitably secured on the shafts 8 for operating the valves, said shafts being provided with hand-wheels O and O′, corresponding to the valves of pipes K and K′, and P and P′ corresponding to the valves of pipes L and L′, as will be understood from Figs. 1, 2, 5, and 7 of the drawings. Thus in the operation of the invention the operator in the steering-house can by properly manipulating the valves through the hand-wheels O, P, O′, and P′ control the admission of steam to the turbines E and E′ to regulate the movement of the vessel.

I will now describe the construction of the turbines which will be best understood from Figs. 3, 4, 6, 8, 9, 10, and 11 of the drawings.

As the turbines are constructed alike, the description of one will answer for both.

The turbine includes a casing and a wheel turning in the casing, the casing being provided with a circular cylinder for the rim of the turbine-wheel, and the turbine-wheel having its rim provided with a series of bladed wheels arranged transversely to the rim of the turbine-wheel and having their blades set at an angle, the angles of the blades of the adjacent wheels being reversed, so that the steam operating in the cylinder of the casing will cause the turbine-wheel to revolve in one direction or the other, according to the direction in which the steam is introduced into the cylinder of the casing, as before de-

scribed. The casing includes the side plates E^2, provided at their outer edges with the lateral flanges e^2, to which are secured by bolts or rivets e^3 the lateral flanges e^4 on the rim-section e^3 of the casing. This rim-section e^2 is curved to form the outer half of the cylindrical rim, the inner wall of said rim being supplied by the quadrants presently described. I thus provide a casing which consists of the side plates E^2 and the rim-section e^3, providing what may be termed a "cylindrical or rim section" to receive the bladed wheels on the rim of the turbine-wheel, which operates within the said section, as shown. The rim-section e^3 is provided with suitable connections for the pipes K and K', as will be understood from Fig. 3, so the steam can be admitted to and exhausted from the cylindrical rim of the casing at either side by the proper manipulation of the valves, as before described.

The turbine-wheel comprises the hub Q, quadrant-sections R, the spoke-bars S, the rim-bar T, and the bladed wheels S, arranged transversely on the rim-bar T and constructed as presently described. The hub Q has a central opening to receive the shaft 1, which it is designed to turn and to which it may be keyed or secured in any suitable manner. It is also provided with a series of radial notches q and q', the notches Q receiving tenons on the inner ends of the intermediate spokes of the quadrants R, and the notches Q' receiving tenons on the inner ends of the spoke-bars S, as will be understood from Figs. 4 and 10 of the drawings. The quadrants R, of which I use four, are constructed with the intermediate spokes R', having the tenons i' to fit in the slots q of the hub Q, the end spokes R^2, which abut at their inner ends the hub Q adjacent to the slots q' therein, and the rims R^3, which are curved at R^4 in their outer surface to conform to the bladed wheels U and are provided at the opposite edges of their ends with the projecting lugs r^4, which overlap the intermediate spoke-bars S, as will be understood from Figs. 4 and 10. The spoke-bars S are provided at their inner ends with tenons S' to fit in the slots q' of the hub Q and extend thence between the end spokes R^2 of the adjacent quadrants R, to which they may be bolted, as shown in Fig. 4, and project at their outer ends between the lugs r^4 of the rims R^4 across the cylindrical rim of the casing and are slotted in their outer ends at S^2 to receive the rim-bar T of the turbine, as will be understood from Figs. 4 and 7. The rim-bar T may be solid, as shown in Fig. 8, or hollow, as shown in Fig. 9, and extends around the rim of the wheel, fitting within the slots S^2 in the outer ends of the spoke-bars S, said spoke-bars operating to divide the transverse bladed wheels on the rim-bar T into four series. The bladed wheels U are fitted on the bar T and consist of the hubs U' and the blades U^2, the said blades being set at an angle to the direction of motion of the wheel as it revolves within the casing, as shown in Figs. 8 and 9 of the drawings, and the blades of the adjacent wheels being inclined in reverse directions, as shown in Figs. 4 and 8. The hubs U' are provided at one end with projecting lugs U^3 and at their opposite ends with slots U^4 to receive the lugs U^3 on the ends of the adjacent hubs, so the several hubs will be interlocked, as best shown in Fig. 8 of the drawings.

By the construction described I provide a turbine whose casing and wheel are formed in sections which can be easily reached and renewed or repaired as occasion may require without necessitating the renewing of the entire wheel and in which the steam or other vapor admitted at one side or the other will operate to drive the wheel in one direction or the other with great force, enabling me to secure power and speed in an economical manner, as is desired.

It will be noticed from Figs. 3^a and 3^b that the nozzles lead into the passages for the steam in such directions as to cause the steam or other fluid to operate upon the wheels U to drive the turbine the direction desired. By arranging the wheel-sections U with their blades U^3 inclined alternately I provide surfaces for impingement by the steam or other fluid, so that the latter may operate to drive the turbine in the use of the invention. The blades U^3 being inclined reversely in the adjacent series and spaced apart afford a passage for the steam or other vapor and at the same time provide surfaces for impact in order to secure the desired driving of the wheel.

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

1. A turbine-wheel provided with a series of bladed wheels arranged with their centers in a circular line and held from turning on their axes substantially as set forth.

2. The combination with a turbine-casing having side plates and a curved circumferential ring-plate forming a cylindrical rim, of the turbine-wheel operating in said casing and comprising the hub, the quadrants secured thereto and having the rim-section provided at the opposite edges of its ends with the projecting lugs, the spoke-bars secured between the ends of the adjacent quadrants and extending between the lugs at the ends of the rim thereof and provided in their outer ends with slots, the rim-bar fitting in said slots, and the bladed wheels fitting on said rim-bar and having their blades set at an angle to the direction of motion of the wheel, and the blades of the adjacent wheels being reversed, substantially as set forth.

3. A turbine-wheel having its rim provided with a series of transverse wheels arranged radially and provided with a series of inclined blades, substantially as set forth.

4. The combination in a turbine, of the casing having a cylindrical rim, and the wheel

provided with a series of bladed wheels operating in said rim and arranged radially and having their blades set at an angle to the direction of motion of the wheel, substantially as set forth.

5. A turbine comprising the casing having the side plates and the rim-section curved transversely, the wheel operating in said casing and having a circumferentially-grooved rim opposite the rim-section of the casing, and a series of bladed wheels operating in the rim-section of the casing and arranged radially to the wheel, substantially as set forth.

6. The combination in a turbine-wheel, with a rim-bar, of a series of wheels arranged transversely on said rim-bar, and provided with blades inclined to the direction of movement of the wheel, substantially as set forth.

7. The combination in a turbine-wheel, of the hub, the quadrant-sections and the spoke-bars secured thereto, the casing having a rim-section, the rim-bar, and the bladed wheels arranged transversely on said bar, substantially as set forth.

8. The combination in a turbine-wheel, with the rim-bar, of the bladed wheels arranged transversely thereon and having their hubs interlocked, substantially as set forth.

9. A turbine comprising a casing and a wheel turning therein, and provided at its rim with a plurality of series of blades inclined to the direction of movement of the wheel, the series of blades being arranged in a circular form, providing a plurality of bladed wheels ranging around the rim of the turbine-wheel, substantially as set forth.

10. The combination in a turbine, of the casing, a wheel operating therein, and having a circular rim-bar, and a plurality of inclined blades arranged in a number of circular series centering on said bar, substantially as set forth.

11. A turbine-wheel having a circular rim-bar, and a plurality of bladed wheels centering on and arranged transversely of the rim-bar, substantially as set forth.

12. A turbine-wheel having a circular rim-bar and a series of bladed wheels centering on and arranged transversely of the rim-bar, and held from turning thereon, substantially as set forth.

13. A turbine-wheel comprising a circular series of bladed wheels, said wheels being arranged radially and held from turning on their axes, substantially as set forth.

14. A turbine-wheel having a circular series of bladed wheels, said wheels being held from turning on their axes, and having their blades arranged at an angle with the angles of the blades of the adjacent wheels reversed, substantially as set forth.

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