(No Model.) 6 Sheets—Sheet 1.

H. BRINKMANN.

MEANS FOR ADJUSTING BLADES OF SCREW PROPELLERS.

No. 571,745. Patented Nov. 24, 1896.

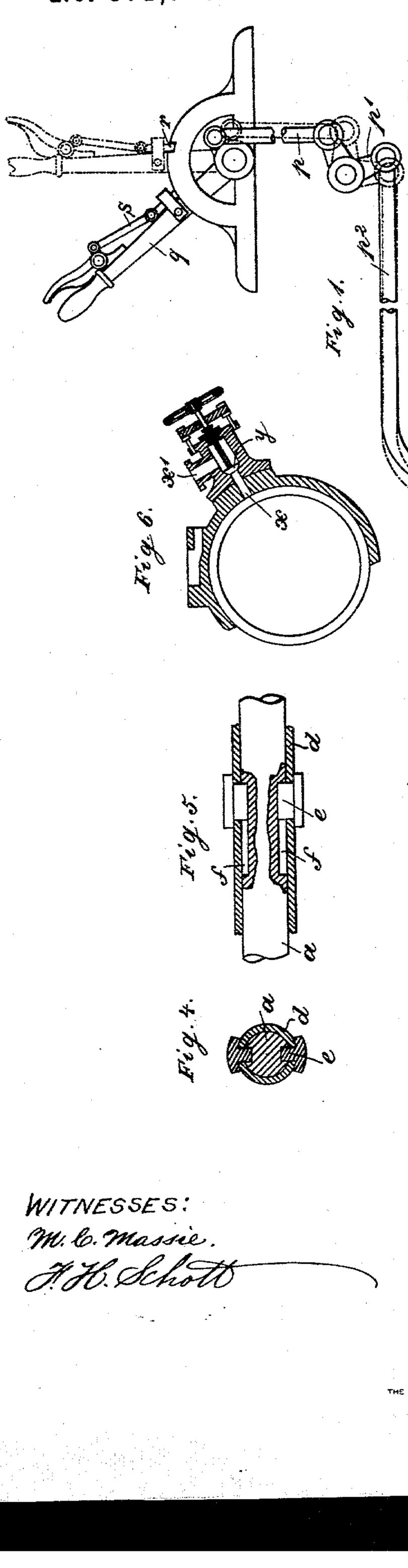

Fig. 1.

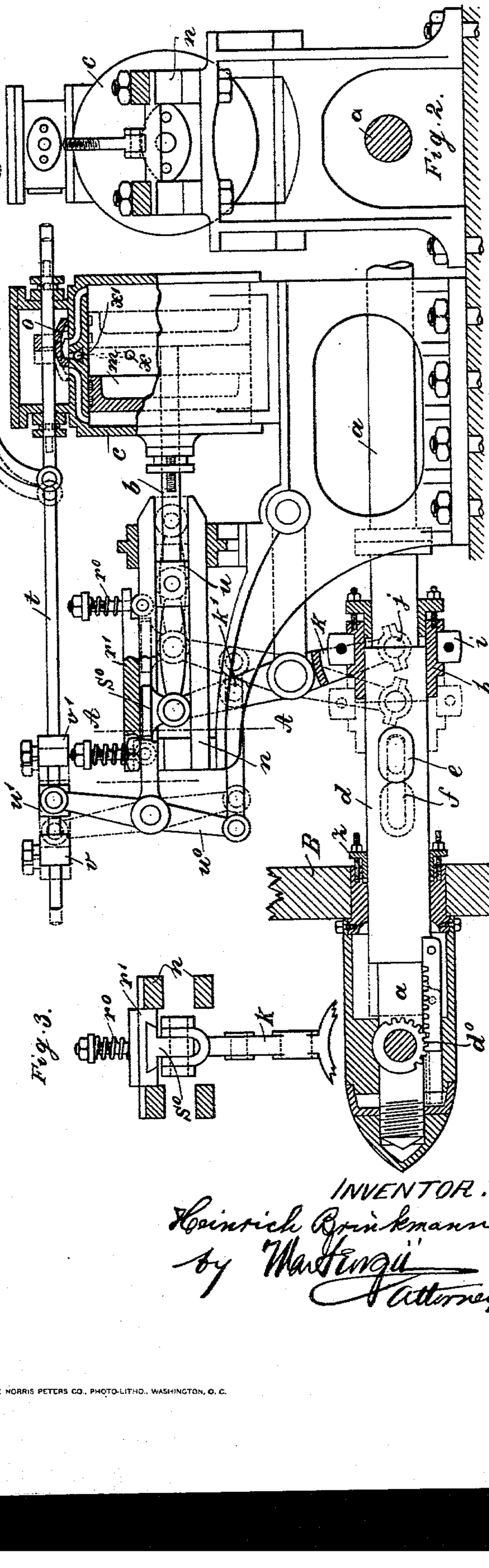

Fig. 2.

Fig. 6.

Fig. 5.

Fig. 4.

Fig. 3.

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(No Model.) 6 Sheets—Sheet 2.

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MEANS FOR ADJUSTING BLADES OF SCREW PROPELLERS.

No. 571,745. Patented Nov. 24, 1896.

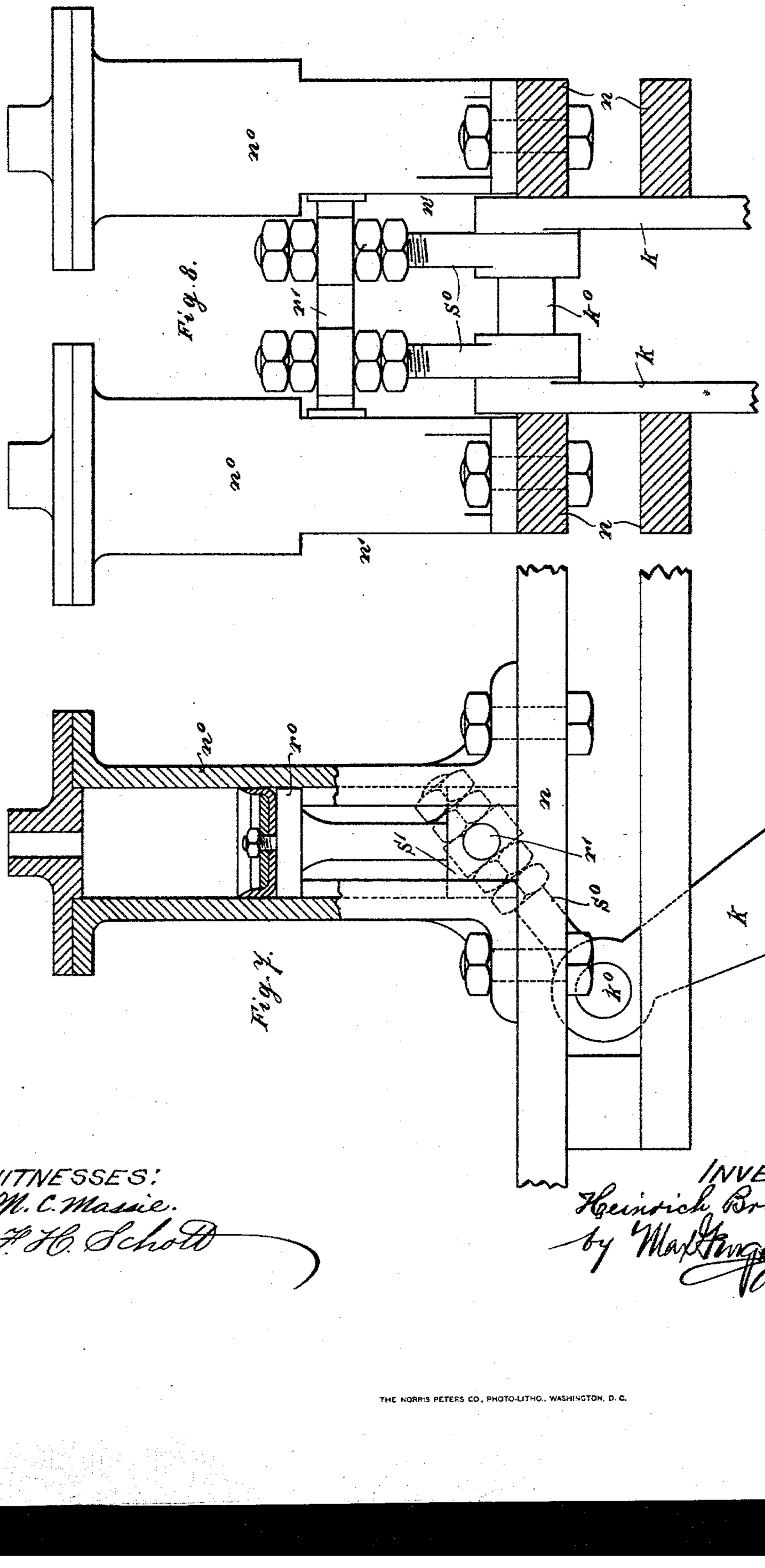

Fig. 8.

Fig. 9.

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(No Model.) 6 Sheets—Sheet 3.

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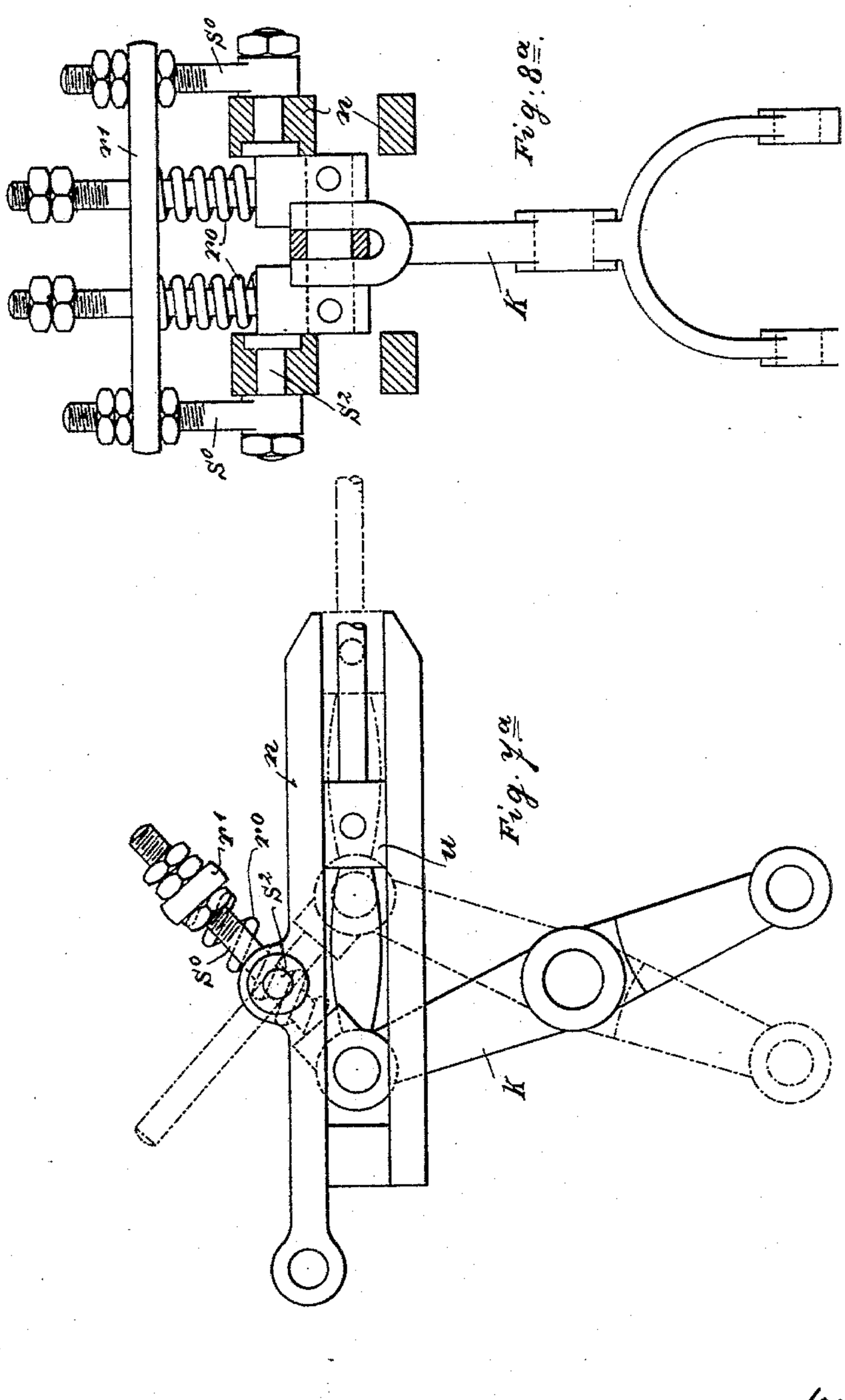
MEANS FOR ADJUSTING BLADES OF SCREW PROPELLERS.

No. 571,745. Patented Nov. 24, 1896.



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(No Model.) 6 Sheets—Sheet 4.

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MEANS FOR ADJUSTING BLADES OF SCREW PROPELLERS.

No. 571,745. Patented Nov. 24, 1896.

Fig. 6b

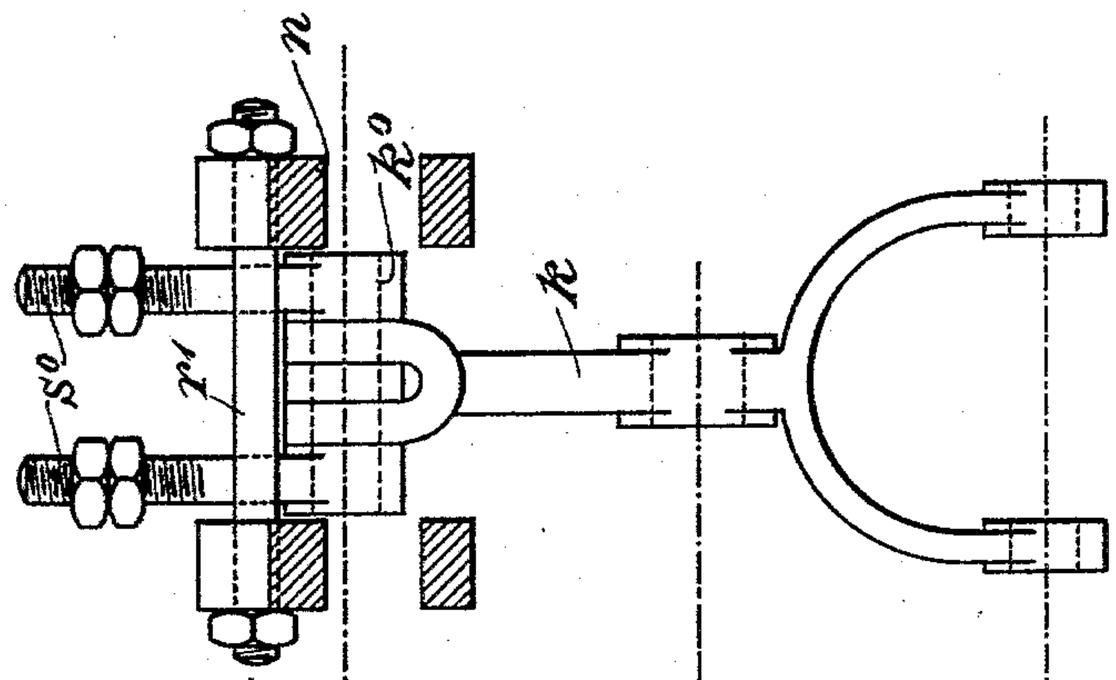
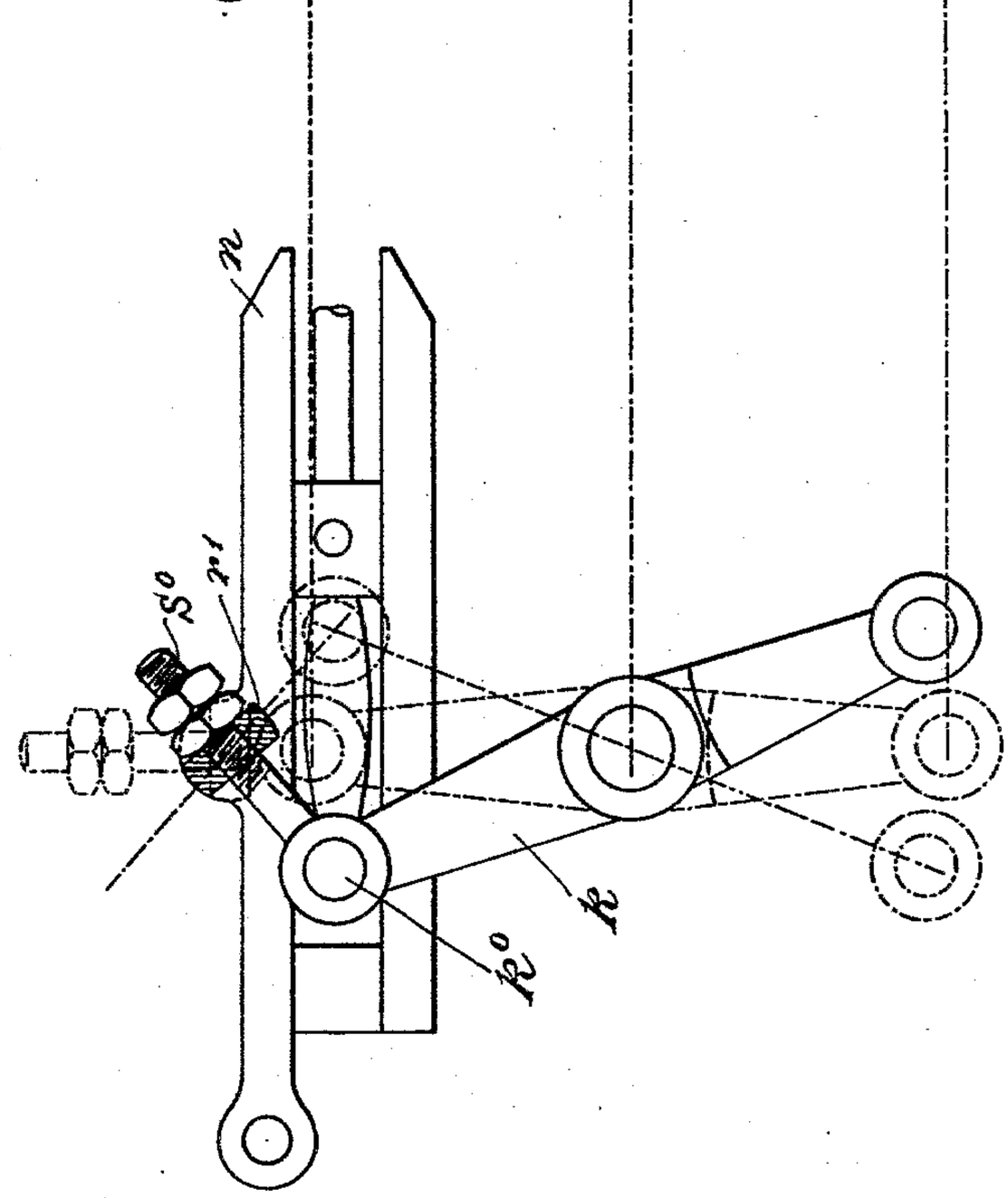


Fig. 7b



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(No Model.) 6 Sheets—Sheet 5.

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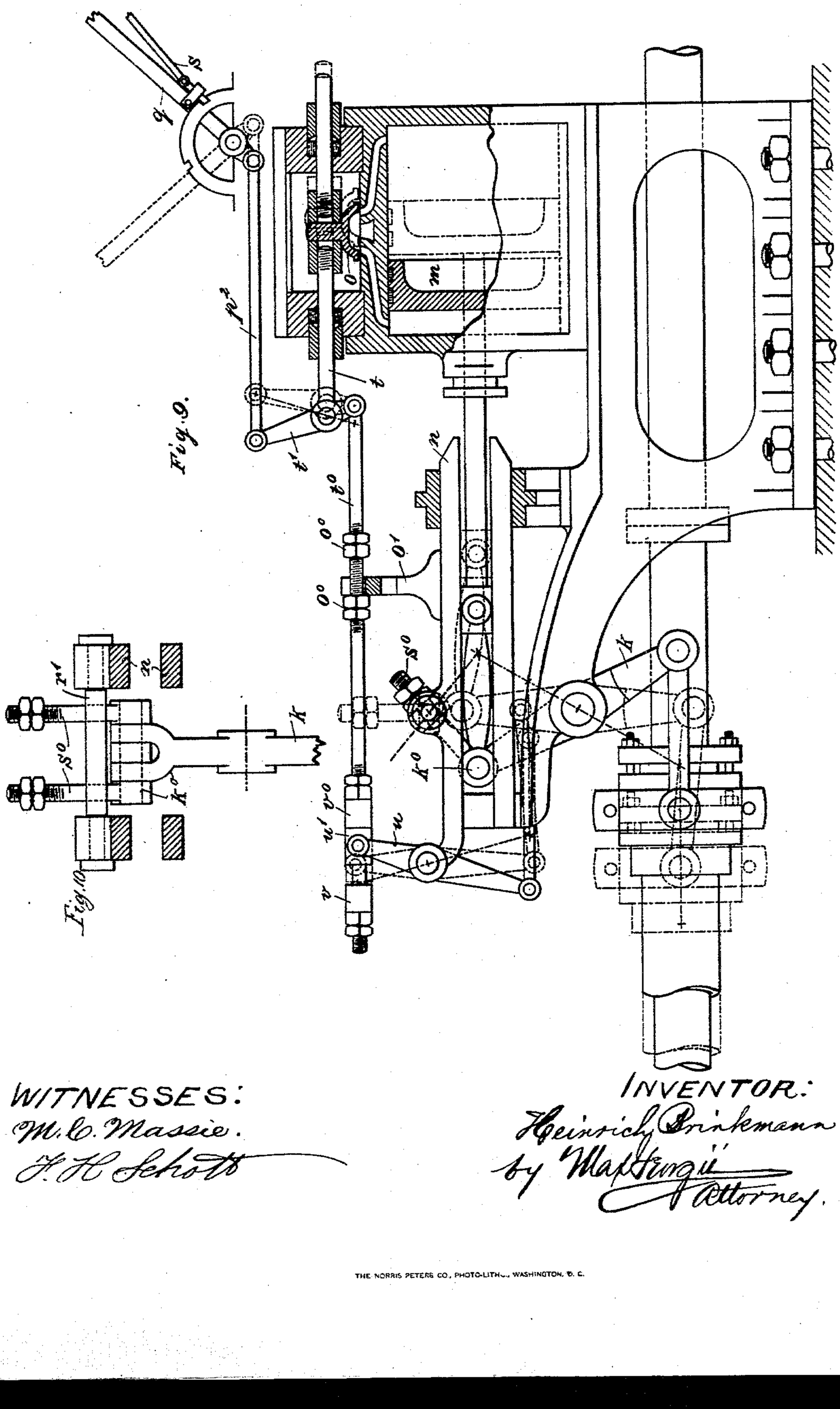
MEANS FOR ADJUSTING BLADES OF SCREW PROPELLERS.

No. 571,745. Patented Nov. 24, 1896.



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(No Model.) 6 Sheets—Sheet 6.

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MEANS FOR ADJUSTING BLADES OF SCREW PROPELLERS.

No. 571,745. Patented Nov. 24, 1896.

Fig. 12

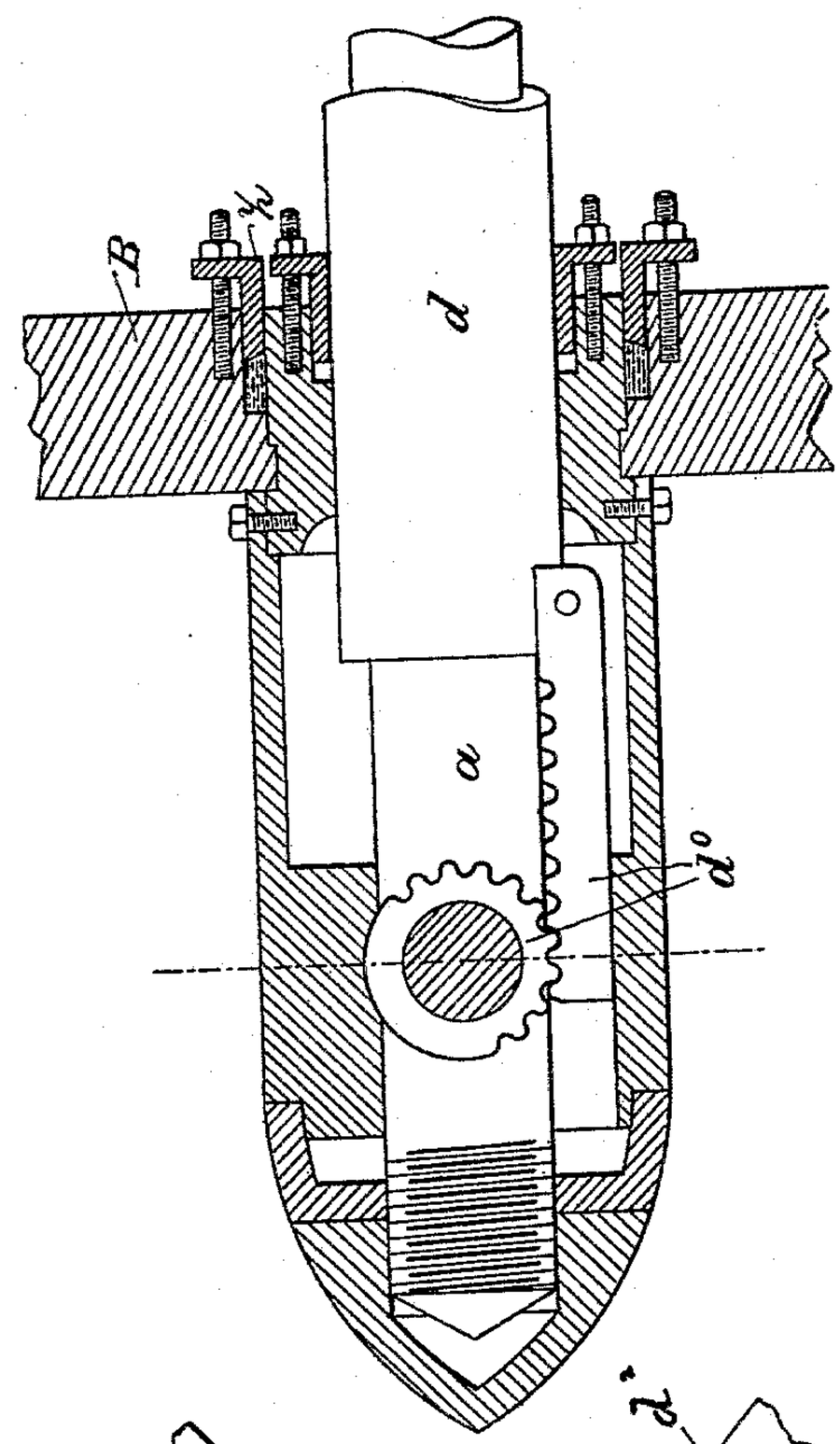

Fig. 11

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UNITED STATES PATENT OFFICE.

HEINRICH BRINKMANN, OF MUNICH, GERMANY.

MEANS FOR ADJUSTING BLADES OF SCREW-PROPELLERS.

SPECIFICATION forming part of Letters Patent No. 571,745, dated November 24, 1896.

Application filed December 24, 1895. Serial No. 573,201. (No model.) Patented in Germany September 14, 1893, No. 82,319; in England December 29, 1894, No. 25,258; in France July 9, 1895, No. 248,771; in Italy September 9, 1895, No. 39,324, and in Spain September 28, 1895. No. 17,774.

To all whom it may concern:

Be it known that I, HEINRICH BRINKMANN, merchant, of Munich, Kingdom of Bavaria, Empire of Germany, at present of Hamburg, Germany, have invented certain new and useful Improvements in Marine Engines, (patented in Germany, No. 82,319, dated September 14, 1893; in England, No. 25,258, dated December 29, 1894; in France, No. 248,771, dated July 9, 1895; in Italy, No. 39,324, dated September 9, 1895, and in Spain, No. 17,774, dated September 28, 1895,) of which the following is a specification.

This invention relates to devices forming part of the propeller-actuating mechanism of marine engines; and its object is to provide means for adjusting and fixing the blades of screw-propellers while the vessel is in motion or at rest. For this purpose my invention consists in the means, details of construction, and combinations of parts hereinafter set forth, and pointed out in the claims.

In the drawings accompanying this description, Figure 1 is a side elevation, partially in section. Fig. 2 is a rear elevation, also partially in section, of the propeller-blade adjusting and fixing mechanism. Fig. 3 is a vertical section on the plane of line A A, Fig. 1. Figs. 4 and 5 are detail sectional views. Fig. 6 is a detailed view, in transverse vertical section, of one arrangement of valve employed for partly taking the pressure from the piston. Fig. 7 is a detail side elevation, partly in section, of a modified form of compressor or brake employed in connection with my invention, the section being taken through the center of one of the brake-cylinders. Fig. 8 is a detail front elevation of the same, partly in section. Figs. 7^a and 8^a are similar views of still another modified form of such compressor. Figs. 7^b and 8^b are views of another form of compressor. Fig. 9 is a side elevation, partly in section, of a modification of the propeller-blade adjusting and fixing mechanism. Fig. 10 is a detail view of the same. Figs. 11 and 12 are detail views of the propeller.

The construction of my machine is as follows:

Upon the propeller-shaft *a* is mounted a sleeve *d*, encircling the same, whose rear end is connected with the blade-adjusting device d^0, consisting of levers, rack-bars, or the like. The sleeve *d* passes through the stern-post B into the interior or hold of the vessel, and is there connected with the shaft, so as to be longitudinally adjustable or capable of sliding thereon, by means of studs *e*, attached thereto and engaging grooves *f* in the shaft. The length of these grooves determines the arc or angle of rotation of the propeller-blades on their own axes. This rotation of the propeller-blades is accomplished by means of racks d^0, secured to the sleeve *d* and engaging pinions d^0, fixed on the propeller-blades d^2, which are revoluble in a head d^3, connected to the propeller-shaft *a*, and bolted to a bushing d^4, revoluble in the stern-post B, said bushing being packed by glands *z*, as clearly shown in Figs. 11 and 12. Upon the end of the sleeve *d* which is within the hold of the vessel is screwed the collar *h*, whose thread is arranged so as to work in a direction opposite to the direction of motion of the marine engine, *i. e.*, for machines rotating to the right, it is provided with a left-hand thread, and vice versa, so that the collar is always drawn tight when the machine is in operation, in a manner similar to wagon-axles.

The collar *h* is provided at the joint with a stuffing-box to prevent the ingress or leakage of water, a similar stuffing-box being provided on the sleeve at the stern-post. In an annular groove at an intermediate point of the collar is mounted a ring *i*, composed of two sections or halves, within which ring the collar *h* and the propeller-shaft revolve. The ring *i* is provided with two opposite gudgeons or pivots *j*, to which is connected the forked end of the shifting-lever *k*. The other end of the lever is coupled or connected with the piston-rod *b* of the steam or pressure cylinder *c*, which is guided in a cross-head guide *n u*. The pressure-cylinder *c* is permanently connected with a compressed-air or gas receiver located in the machine or furnace chamber and arranged to impart a suitable pressure.

The slide-valve *o* of the pressure-cylinder *c* is controlled from the bridge by means of the rods *p* p^2 and bell-crank p'. For regulat-

ing the motion of the slide-valve a rock-lever u^0 is provided, which is connected at its lower end by a link with the main or shifting lever k by a pivot k', the opposite end of said rock-lever being secured to the sleeve u', movable upon the rod t, pivotally connected to the slide-valve rod p^2. The rock-lever u^0, as well as the lever k, is arranged vertically over the axis of the propeller-shaft and is pivoted in an extension of the cross-head rails or slide n.

The full lines in Fig. 1 of the drawings represent the parts at the instant when the blades or wings of the propeller stand in a position to propel the vessel forward and the slide-valve o has been pushed backward. At this moment the piston completes its stroke, the rock-lever k thrusts the sleeve d to the rear, as shown in dotted lines, and the couplings on the propeller-blades cause the latter to revolve through an arc of from one hundred to one hundred and twenty degrees, according to the inclination of the blades, the latter being, as already stated, limited by the grooves f. As soon as the lever u^0 traverses its arc of motion it causes the slide-valve o to move to the middle of its stroke (indicated in dotted lines) through the medium of the adjusting-rings v v', secured to the rod t. Owing to the fact that the slide-valve is capable of closing both inlet-ports against the entry of the motive fluid when said valve is in its middle or intermediate position the steam or compressed air is cut off and the pressure is taken off from the piston m by the exit of the air or steam through the outlet x in the cylinder. The controlling-lever q on the bridge, connected to the slide-actuating gear, is manifestly also returned to the middle position, (indicated in dotted lines in Fig. 1,) where it is arrested and locked by a spring latch or detent s, engaging notches r on the lever-guiding segment. An accidental displacement of the slide-valve is thus prevented. The watch on the hurricane deck or bridge is by this automatic return of the slide-gear apprized of the fact that the apparatus has completed its shifting stroke. Errors with the slide-gear are absolutely excluded, inasmuch as the same cannot be drawn to the rear when the propeller-blades have been backed, and vice versa, as is obvious from the drawings.

In order to completely avoid the contingency of a movement of reversal on their axes of the propeller-blades by impact of the waves or through other similar influences when the vessel is moored in port or the like or when the machinery is otherwise at rest, or even during the trip, there is arranged over the cross-head rails or slide n a compressor or brake r', which by the springs r^0 is urged to exert a pressure upon the upper end of the lever k, standing in an oblique position. This pressure is sufficient to completely exclude the possibility of any accidental or intentional movement of said lever k, and consequently of the reversing-sleeve. The pressure of the brake or compressor upon the lever k is transmitted by the sliding block s^0, pivotally connected to the latter and guided during its movement of reversal in a groove in the compressor.

The propeller-blades are arrested at the end of their stroke by the studs e in the sleeve d engaging the grooves f in the propeller-shaft, as already stated. This gives rise to the necessity of partially relieving the pressure from the piston m when the same has traversed more than one-half of its stroke. For this purpose outlet x' is connected with the interior of the cylinder by a channel x, while the piston m is provided with two independent packing-rings arranged at the proper distance one from the other. The pressure may also be partly taken off from the piston by a valve y, Fig. 6, which is arranged to remain open permanently to the necessary extent and according to need.

In Figs. 7 and 8 I have represented what I consider the improved form of the compressor for the blade-reversing lever k, combined with an arrangement for adjusting the pitch of the propeller-blades by the said reversing-lever according to desire or necessity. The drawings show this construction in a side elevation, partially in section, in Fig. 7, and a front elevation in Fig. 8. In the latter figure the reversing-lever k is assumed to occupy the middle position. As appears from Fig. 8, the upper portion of the reversing or rock lever k is composed of two arms or prongs, which arms are connected by a wrist-pin k^0. Upon the latter are loosely mounted two rods s^0, forming a pitman device, and which carry a cross-axle r', upon whose two ends are loosely mounted or pivoted the guide-blocks or cross-heads s'. These guide-blocks are arranged within two vertical cylinders n', mounted upon the slides n, said cylinders being provided at both sides with openings or mortises n' to give the necessary play to the cross-axle r' in its vertical movement. Upon the guide-blocks are secured the pistons r^0 by means of short rods.

After each reversal of the propeller-blades the chamber of the cylinder over the pistons r^0 is filled with compressed air from any suitable source supplied through the opening in one of the cylinder-heads, whereby the pistons r^0 and guide-blocks s' are kept depressed in their lowermost position, and thereby lock the rods s^0 and the rock-lever k rigidly in the position indicated in Fig. 7, or the opposite position. It will be readily understood that in reversing the rock-lever k the cross-axle r', together with the pistons, will be raised and lowered by means of the rods s^0, the guide-blocks s', sliding in the cylinders, serving to guide the same in a straight vertical line. The pressure in this construction is not directly exerted upon the lever k in a perpendicular direction, but from the side opposite to the position which the lever occupies, and nearly perpendicular to the middle

of the same, whereby an accidental or intentional reversal of the same is prevented in a far more effectual manner than under the construction of brake or compressor first described. Obviously the pistons r^0 may, if desired, be replaced by spiral springs. This construction at the same time takes the place of the device for limiting the stroke of the rock-lever k and the arc of motion of the propeller-blades, which in Fig. 1 is shown to consist of the studs and grooves $e\,f$, arranged on the sleeve d and propeller-shaft a. This action of limiting the stroke is due to the fact that the pistons r^0 are held fast in their lowermost positions by the compressed air, and hence prevent a movement of the rock-lever k beyond the desired position and retain the same rigidly in this position. Moreover, this construction not only serves as a substitute for the same stroke-limiting and brake device, but also enables the stroke of this lever k to be varied as desired, and thus makes it possible to adjust or regulate the pitch of the blades as required. All that is necessary for this purpose is to raise or lower the cross-axle r' by means of the nuts mounted on the rods s^0, whereby their length is increased or reduced and the stroke of k is consequently changed. According as the stroke of k is greater or smaller the arc of motion, and consequently the pitch, of the propeller-blades will be greater or smaller.

In Figs. 7ª and 8ª I have represented still another form of compressor or brake for holding the shifting-lever or rock-lever k in the position to which it is thrown. As will appear from the drawings, the upper end of the lever k is connected to the ends of two rods r^2, which are movable through openings in a cross-bar r', the said cross-bar having its ends secured to links s^0, pivoted on studs s^2, fixed in the guides n. Between the ends of the rods r^2 and the cross-bar r' are placed springs r^0, surrounding said rods r^2 and arranged to be compressed as the lever k moves from one position to the other. By this arrangement if the propeller-blades are struck by the waves with force sufficient to shift them, as well as the adjusting mechanism, the lever k will be permitted to move slightly, owing to the yielding of the springs r^0, and as soon as the force on the blades of the propeller has diminished the parts will all be returned to their adjusted position by the reaction of said springs. Moreover, the arrangement for adjusting the stroke of lever k, and hence the pitch of the propeller-blades, consisting of parts s^0 and r' and the nuts, may be employed alone, as such, and without acting as a brake or compressor, in which case the piston m of the main cylinder remains under pressure to hold the lever k in position.

Fig. 9 represents a modified arrangement of levers and rods for actuating the mechanism for controlling the propeller-blades represented in Fig. 1, the object of which is, first, to effect an automatic locking of the slide-valve rod upon the return of the slide-valve and when the same occupies its intermediate position; second, to work with a more advantageous transmission of power from the reversing-lever to the slide-gear, which is of importance, especially with the larger sizes of slide-valves, and, third, to provide another form of device, in lieu of the compressor, for regulating the stroke of k and thereby the arc of motion of the propeller-blades. In this construction, as shown in the drawings, the slide-valve rod t consists of two parts, and between the lower portion t^0 of the same and the rod p^2 or the lever q of the upper deck there is interposed an intermediate lever t', to which is attached, a little above the portion t^0, the part t of the slide-valve rod, which is connected with the slide-valve. If the lever mechanism is in the position indicated in full lines and the slide-valve o is drawn to the right (indicated in dotted lines) by the system of levers $q\,p^2\,t'$, for the purpose of reversing the propeller-blades, the rod t^0 forms the support or fulcrum for the lever t'. As will be readily apparent, the movement of the slide requires but little exertion, in view of the advantageous arrangement of the lever for the transmission of the power from the lever q to the slide-valve rod.

When the piston m and the levers $k\,u$ have reached their middle position and the piston has passed its middle position, the lever u takes hold at v, thereby drawing the rod t^0 to the left, whereby the lever t' is brought into the position indicated by the dot-and-dash line and the slide-valve o into the middle or cut-off position. In this movement the rod p^2 serves as a support for the lever t'. Upon the rod t^0 are threaded or mounted at suitable distances from each other the adjustable nuts or collars o^0, which, during the reciprocation of the rod t^0 or the slide-valve, alternately strike against a fork o', secured to the cross-head guide n, and thereby limit the stroke of this rod and the movement of the slide-valve to such an extent that it is impossible for said slide-valve to pass beyond its middle position on returning.

Inasmuch as the slide-valve, as already stated above, cannot begin its return movement toward the middle of its stroke until the piston has passed the middle of its stroke, the remaining construction of the reversing device remains the same in general, so that only a device for arresting the slide-valve rod against passing beyond the middle position on the return of the slide is necessary, which is accomplished by the nuts o^0 and the detent or fork o'. The reverse-lever or detent-lever under this arrangement does not return to its initial position upon the return of the slide-valve, but is retained in both extreme positions by an automatic spring latch or detent engaging suitable notches in the lever-guiding segment.

The construction of the arrangement for regulating or adjusting the lever k is the fol-

lowing in the present case: The lever k is connected with one or two rods s^0 by a cross-axle k^0, said rods s^0 being guided in a cross-bar r', journaled on the slide n, as shown in cross-section in Figs. 7^b, 8^b, and 10. The rods s^0 are provided with nuts above the cross-bar r', which in both extreme positions of the lever k rest on the cross-bar and thus limit its stroke. This serves also to limit the arc of motion of the propeller-blades, whose pitch may be adjusted to any degree desired by adjusting the nuts or collars upon the rods s^0.

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

1. The combination, with a propeller-adjusting device, and a cylinder provided with inlet and outlet ports, of a piston within the cylinder and connected to the propeller-adjusting device, a valve arranged to close both inlet-ports at once when in its central position, a hand-lever for operating said valve, and mechanism automatically operated by the propeller-adjusting device for returning the valve to its intermediate position, substantially as set forth.

2. The combination, with a propeller-adjusting device, and a cylinder provided with inlet and outlet ports, of a piston within the cylinder and connected to the propeller-adjusting device, a valve arranged to close both inlet-ports at once when in its central position, a hand-lever for operating said valve, mechanism operated by the propeller-adjusting device for throwing the hand-lever to return the valve to its intermediate position, and means for locking the hand-lever when thus thrown, substantially as set forth.

3. The combination, with a propeller-adjusting device and means for operating the same; of mechanism independent of the operating means connected to said means and tending to force it in the direction it was last thrown, substantially as set forth.

4. The combination, with a propeller-adjusting device and means for operating the same, of yielding mechanism independent of the operating means connected to said means and tending to force it in the direction it was last thrown; substantially as set forth.

5. The combination, with a propeller-adjusting device, and a shifting-lever connected to the propeller-adjusting device and mechanism for throwing the shifting-lever into two opposite positions, of means acting on said lever and tending to keep it out of its position intermediate said two opposite positions, substantially as set forth.

6. The combination, with a propeller-adjusting device, a shifting-lever for operating the same and means for throwing the shifting-lever, of mechanism acting on one end of the shifting-lever and tending to rotate it on its fulcrum in the direction it was last thrown, substantially as set forth.

7. The combination, with a propeller-adjusting device, a lever for operating the same, and means for actuating said lever, of a pitman device connected to one end of the lever, a pair of guides, and means movable in the guides, and connected to the pitman device, for transmitting pressure to the lever, substantially as set forth.

8. The combination, with a propeller-adjusting device, a lever for operating the same, and means for actuating said lever, of a pitman device connected to the end of said lever, a cross-head connected to the end of the pitman, guides in which the cross-head moves, and means for pressing the cross-head toward the lever, substantially as set forth.

9. The combination, with a propeller-adjusting device, a shifting-lever for operating the same, a piston connected thereto, and a cylinder within which the piston moves, said cylinder having inlet and outlet ports, of a valve arranged to close the inlet-ports when in its intermediate position, a valve-stem, a valve-operating lever connected to the shifting-lever, and a pair of stops adjustably secured to the valve-stem and arranged to contact with the valve-operating lever, whereby the valve is thrown to its intermediate position upon the shifting of the propeller-blades from one position to another, substantially as set forth.

10. The combination, with a cylinder having live-steam and exhaust ports, of a piston within the cylinder, a slide-valve arranged to close both steam-ports when in its intermediate position, a valve-stem connected to the valve, a shifting-lever operated by the piston, a valve-operating lever connected to the shifting-lever, a pair of stops attached to the valve-stem and in the path of the valve-operating lever, and a hand-lever connected to the valve-stem, whereby by using the hand-lever the shifting-lever will be thrown by the piston and then the valve will be moved to its intermediate position, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

H. BRINKMANN.

Witnesses:
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