Sept. 24, 1957 O. W. SCOTT 2,807,327

HYDRAULIC CONTROL FULL FEATHERING PROPELLER

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Fig. 1.

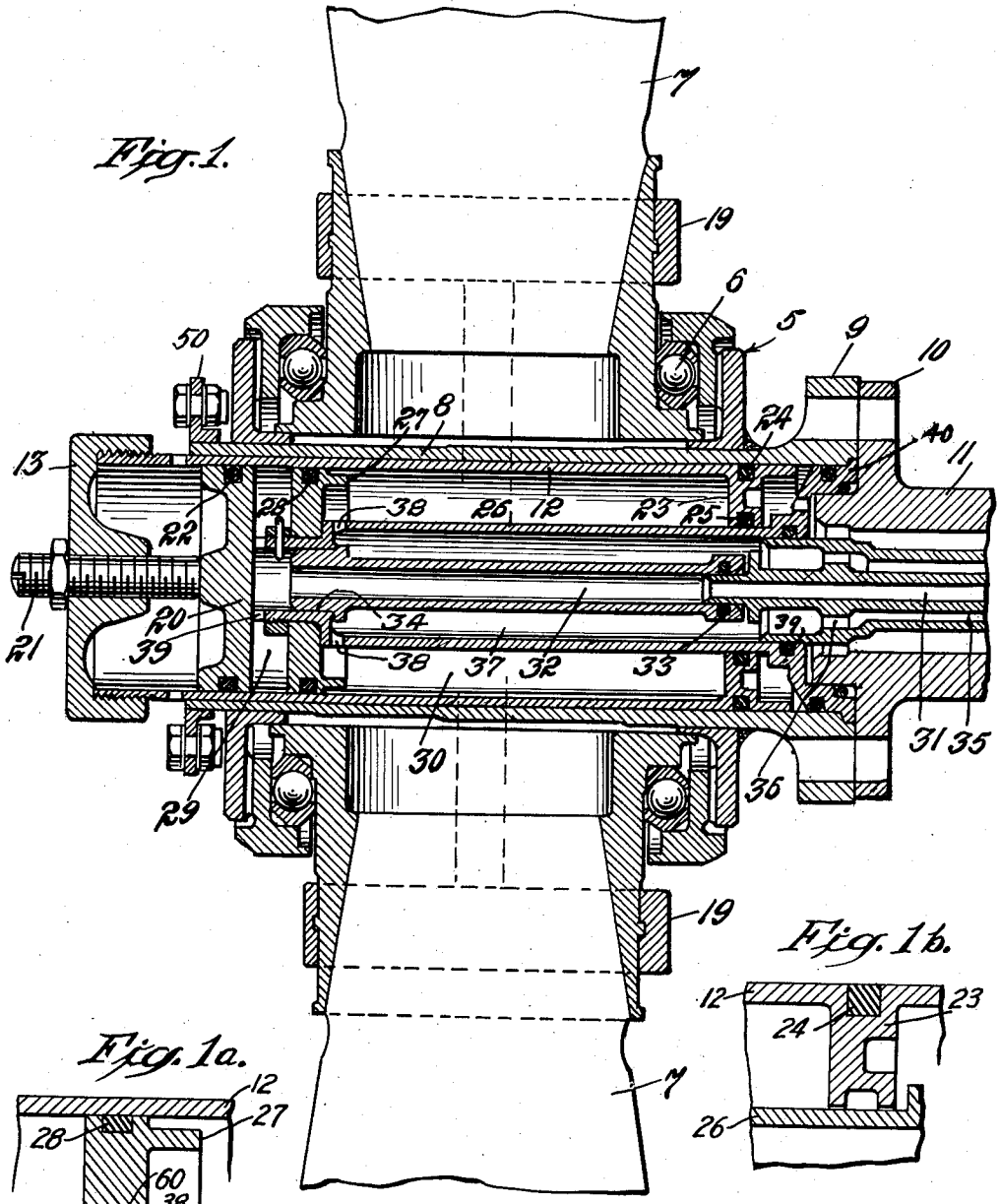


Fig. 1a.

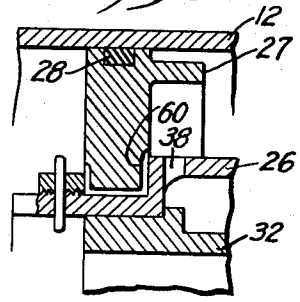


Fig. 1b.

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Fig. 2.

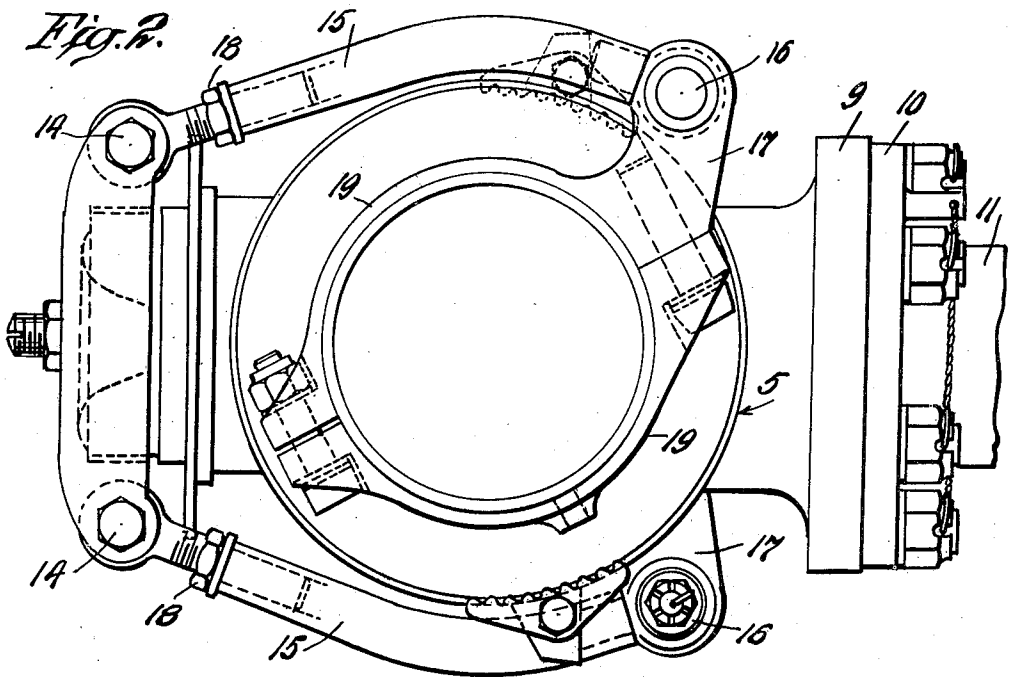
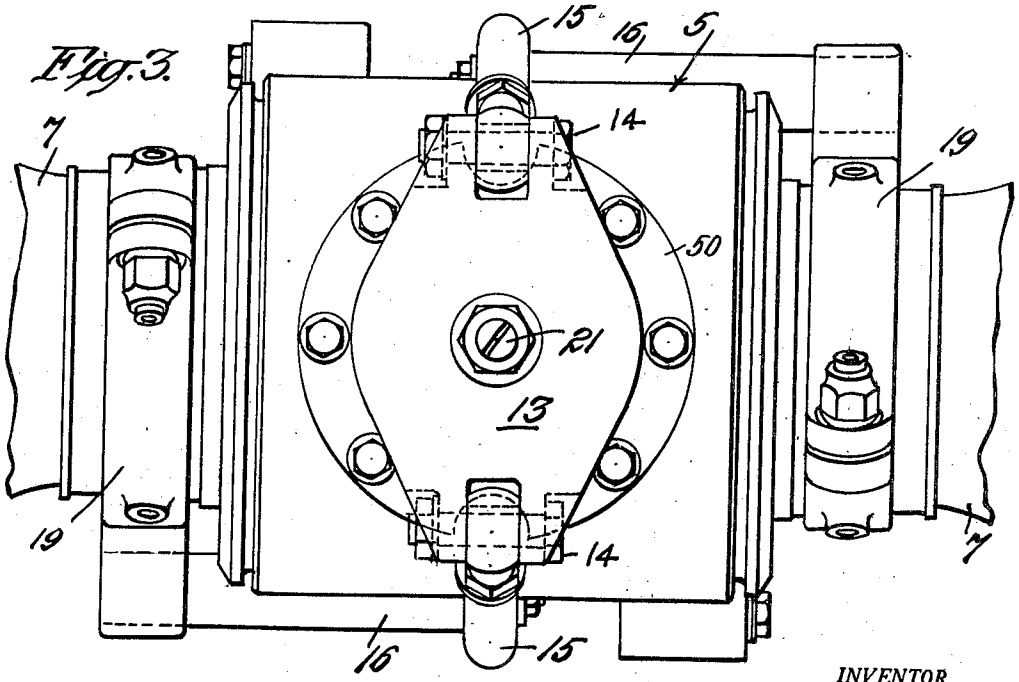


Fig. 3.



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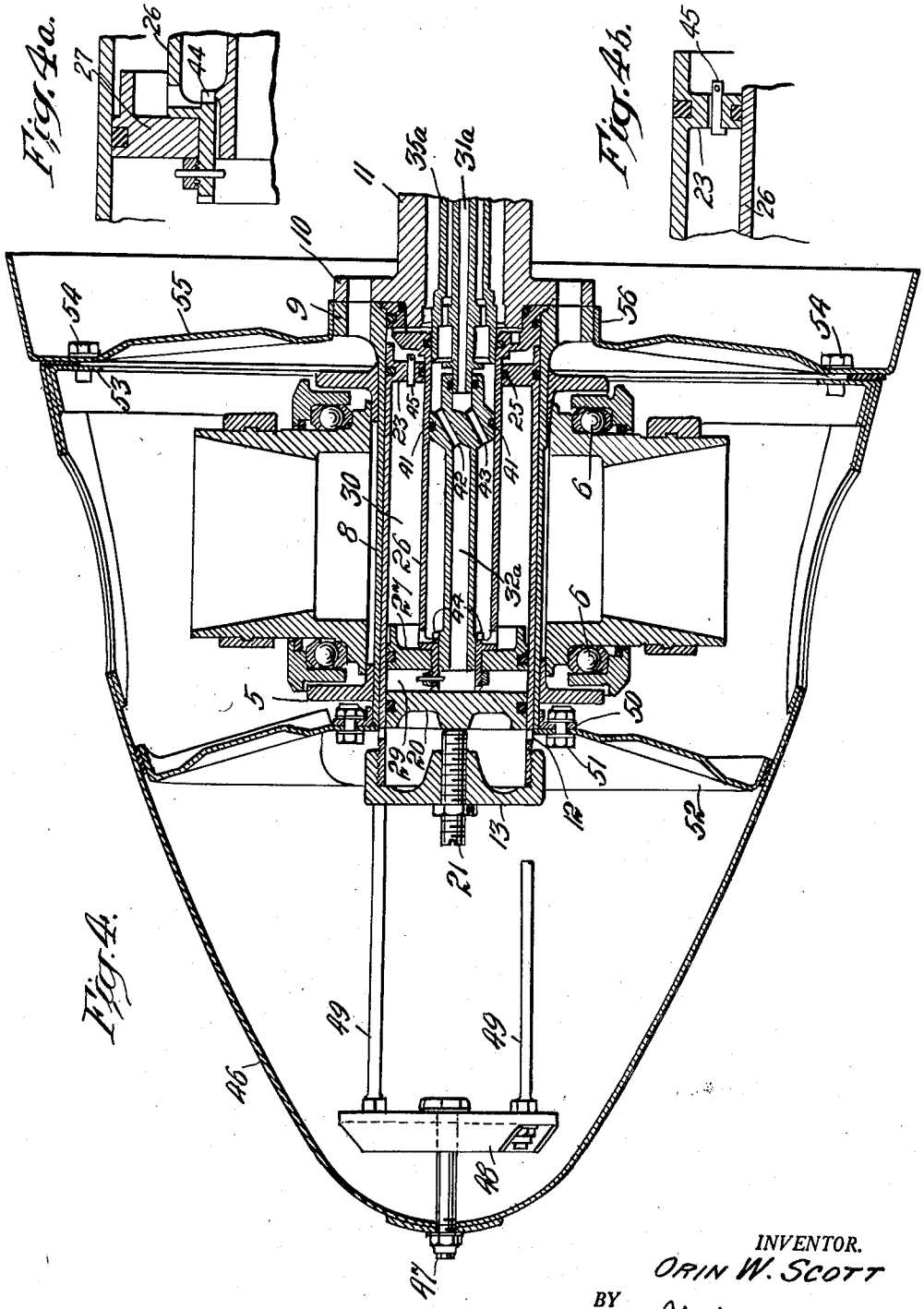
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HYDRAULIC CONTROL FULL FEATHERING PROPELLER

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Application July 16, 1954, Serial No. 443,769

4 Claims. (Cl. 170—160.32)

The invention disclosed in this patent application is a hydraulically operated full feathering propeller.

Objects of the invention are to provide hydraulic mechanism of simple construction and consisting of few parts and compact and small enough to be combined with and practically wholly contained within the hub of the propeller.

Further objects of the invention are to provide such a construction in a well balanced symmetrical form, readily manufactured and installed, easily adjusted, reliable and quickly responsive in action.

A further object of the invention is to provide hydraulic control mechanism of the character indicated which can be combined in a propeller hub of the flange mounted type.

Other desirable objects attained by the invention and the novel features of construction, combination and relation of parts through which the purposes of the invention are accomplished are set forth and will appear more fully in the following specification.

The drawings accompanying and forming part of the specification illustrate present commercial embodiments of the invention. Structure, however, may be modified and changed as regards the immediate illustration, all within the true intent and scope of the invention as hereinafter defined and claimed.

Fig. 1 in the drawings is a broken longitudinal sectional view taken through the center of the hub of the propeller;

Fig. 2 is a broken plan view looking down on the parts as they appear in Fig. 1;

Fig. 3 is a front end elevation, the blades shown broken away.

Fig. 4 is a broken sectional view similar to Fig. 1, illustrating a modified form of the invention.

Figs. 1*a*, 1*b* and 4*a*, 4*b* are broken sectional details of different forms of control orifices.

In the several views the body or hub of the propeller is designated **5**, it being shown as carrying bearings **6** for the blades **7** and as having a drive sleeve **8** extending therethrough and provided with a mounting flange **9** at the back attachable to the flange **10** of the engine shaft **11**.

In the present invention the central drive sleeve **8** is finished interiorly as a containing cylinder for the longitudinally shiftable working cylinder **12**, and the latter is shown as carrying a cross yoke **13** at the outer, forward end to which are pivoted, at **14**, links **15**, pivoted at **16** to the adjusting arms **17** of the blades.

The drag links **15** are shown as longitudinally adjustable at **18**, Fig. 2, and the pivotal connections **16** at the inner or rearward ends of the links are shown as rigid studs, Fig. 3, extending from split rings **19** clamped on the base portions of the blades to a diametrical center at opposite sides of the rotational axis.

The outer end of working cylinder **12** is shown adjustably closed by a partition **20** longitudinally shiftable for low pitch adjustment by a screw **21** seated in yoke **13**.

This adjustable partition or cylinder head is shown sealed by an O-ring **22**.

The inner end of operating cylinder **12** is shown closed by an annular cylinder head **23** sealed in sliding engagement in the containing cylinder by an outer O-ring **24** and slidingly sealed by an inner O-ring **25** over a longitudinally fixed tubular piston rod **26**.

The latter carries at the outer end a piston **27** sealed to the interior of sliding cylinder **12** by O-ring **28**.

The construction described provides a working chamber **29**, Fig. 1, between stationary piston head **27** and movable cylinder head **20** for outward or forward movement of the cylinder and an annular working chamber **30** between fixed piston head **27** and the inner annular cylinder head **23** for creating inward cylinder movement.

Oil or other actuating fluid is led to chamber **29** in the first illustrated form of the invention, Figs. 1, 2 and 3, through center conduit **31** and conducting tube **32** sealed over the end of the conduit, at **33**, and seated in the center of the piston head at the other end, at **34**.

Actuating fluid for the cylinder retracting chamber **30** is shown supplied through an annular conduit **35** surrounding the center conduit **31** and connected by channels **36** with the annular space **37** between the center tube **32** and tubular piston rod **26**, ports **38** in the latter admitting fluid to outer annular chamber **30**.

By proper control of the fluid under pressure supplied to chambers **29** and **30**, the blades may be positively shifted in either direction and held in adjusted relation from low pitch to fully feathered condition. If desired these pressures may be balanced as required to maintain constant speed. If the net force applied by the blades and oil pressure in chamber **29** are higher than net forces applied by the blades and pressure in chamber **30**, the cylinder will move forward to shift the blades to higher pitch. If net forces are reversed the blades will be shifted in the low pitch direction.

Control may be automatic, as by governor, feathering pump or the like, or be semi-automatic or manual.

Necessary adjustments are readily effected. The drag links are exposed at the sides of the hub, fully accessible for adjustment of length. The low pitch adjusting screw **21** is exposed at the front of the hub for quick and easy adjustment. In making this adjustment the cylinder may first be set all the way in, with the head or partition **20** against the stop **39** provided by the end of the tubular piston rod.

If desired a control orifice may be provided, as at the mounting of the piston on the tubular piston rod as indicated at **60**, Fig. 1*a*, affording limited connection between the opposed pressure chambers, thus to maintain continuous circulation of oil to keep the oil warm at all times of propeller operation.

The structure is made up of but relatively few simple parts and action is direct and immediate. Practically all parts are housed within the propeller hub and the full diameter of the drive sleeve is utilized for pressure operation so the action, while sensitive, is positive and powerful. Parts are symmetrical and balanced, and the construction can be made up at reasonable cost as a complete unit and readily installed, inspected and serviced.

The compact symmetrical arrangement of parts enables the device to be made up for a flange mounted propeller, an advantage for quick assembly and servicing purposes. This flange-to-flange meeting enagement of propeller hub and engine shaft simplifies necessary hydraulic connections and mounting of the piston rod, the latter shown in Fig. 1 as sealed at **39** in engagement over the end of the outer conduit **35** and as having an enlarged base flange **40** sealed at the meeting flanges of drive shaft and hub.

In the modified form of the invention illustrated in Fig.

4, the center supply tube here designated 32*a* has an enlarged base sealed in the stationary piston tube **26**, at **41**, which is ported through from the back to the center, at **42**, to pass oil to the forward expansion chamber **29**, and ported through from the center on an outward incline, at **43**, to furnish oil to the annular expansion chamber **30**.

In this particular instance the inner or center conduit 31*a* supplies oil for the annular chamber **30** and the outer annular conduit 35*a* supplies the fluid under pressure for the forward expansion chamber **29**.

A bleed or oil warming vent between expansion chambers may be provided by omitting O-ring **25** as shown in Fig. 1*b*.

Other orificing means may be provided as by slight clearance or fine notches at **44** in the fit between the inner tube 32*a* and piston head **27**, Fig. 4, Fig. 4*a* or, by provision of a loose fitting sliding pin or plug **45** Fig. 4*b* in the inner annular cylinder head **23**. Either or both or any combination of such means may be utilized.

The hub **5** with the drive sleeve **8** extending centrally therethrough and having the mounting flange **9** at the back, may be made up of separate parts or all formed in the single integral unit.

The adjusting arms **17** may be connected with the blades by split clamps such as shown at **19**, Fig. 2, or any other satisfactory form of connection may be employed.

Fig. 4 illustrates a method of mounting a spinner **46** by means of a central tension bolt **47** connected with a bridge piece **48** spanning the yoke and carried by rods **49** fastened to the flange **50** on the outer end of the center sleeve **8**.

Also attached to this flange, by bolts **51**, is a centering flange **52** for the spinner.

The base end of the spinner is shown flanged at **53** and bolted at **54** to a mounting flange **55** having an inner hub or collar **56** centered over the mounting flange **9**.

In some instances it has been found practical to omit bridge piece **48** and extend the rods **49** through the spinner, the latter then equipped with bushings or openings for the rods and fastening nuts applied to exposed ends of the rods at opposite sides of the center.

What is claimed is:

1. Hydraulic pitch control propeller mechanism comprising the combination of a hub body having propeller blades mounted for angular adjustment therein, said hub body having an axially extending rigid drive tube extending therethrough and open at the front end and finished interiorly as a fixed guide cylinder, a movable power cylinder slidingly guided in said fixed guide cylinder, connections extending from the front end of said movable power cylinder back to the blades for translating sliding movement of the power cylinder into angular adjustment of the blades, a tubular piston rod fixedly supported in the back end of the stationary guide tube and extending forwardly into said movable power cylinder, a stationary piston on the forward end of said tubular piston rod in cooperative relation with the movable cylinder slidably operating thereover, a cylinder head at the forward end of the movable power cylinder in opposition to said stationary piston and forming therewith an expansion chamber in front of the stationary piston, an annular cylinder head at the inner end of the movable power cylinder in slidingly sealed engagement with the stationary tubular piston rod and forming in cooperation with said rod and piston an expansion chamber in back of the stationary piston, a center supply tube within the tubular piston rod in communication at the front end with the expansion chamber in front of the piston and spaced from tubular rod to provide an annular supply passage, said piston rod being ported at the forward end in back of the piston to provide communication between said annular supply passage and the expansion chamber in back of the piston and fluid pressure conduits in communication with said center supply tube and with said annular supply passage about the same for admitting and releasing actuating fluid to and from said expansion chambers in front and in back of the stationary piston.

2. The invention according to claim 1 in which said cylinder head at the forward end of the power cylinder is longitudinally adjustable therein and engageable with the forward end of the stationary piston rod to limit inward motion of the movable power cylinder and in which externally accessible means are provided for effecting longitudinal adjustment of said movable cylinder head in the power cylinder.

3. The invention according to claim 1 with orificing means providing limited communication between the two expansion chambers for warming actuating fluid under operating conditions.

4. The invention according to claim 3 in which said orificing means includes a leakage permitting connection between the opposing expansion chambers.

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