Oct. 25, 1949. L. G. FAIRHURST 2,486,016

SCREW PROPELLER

Filed Aug. 18, 1944 3 Sheets-Sheet 1

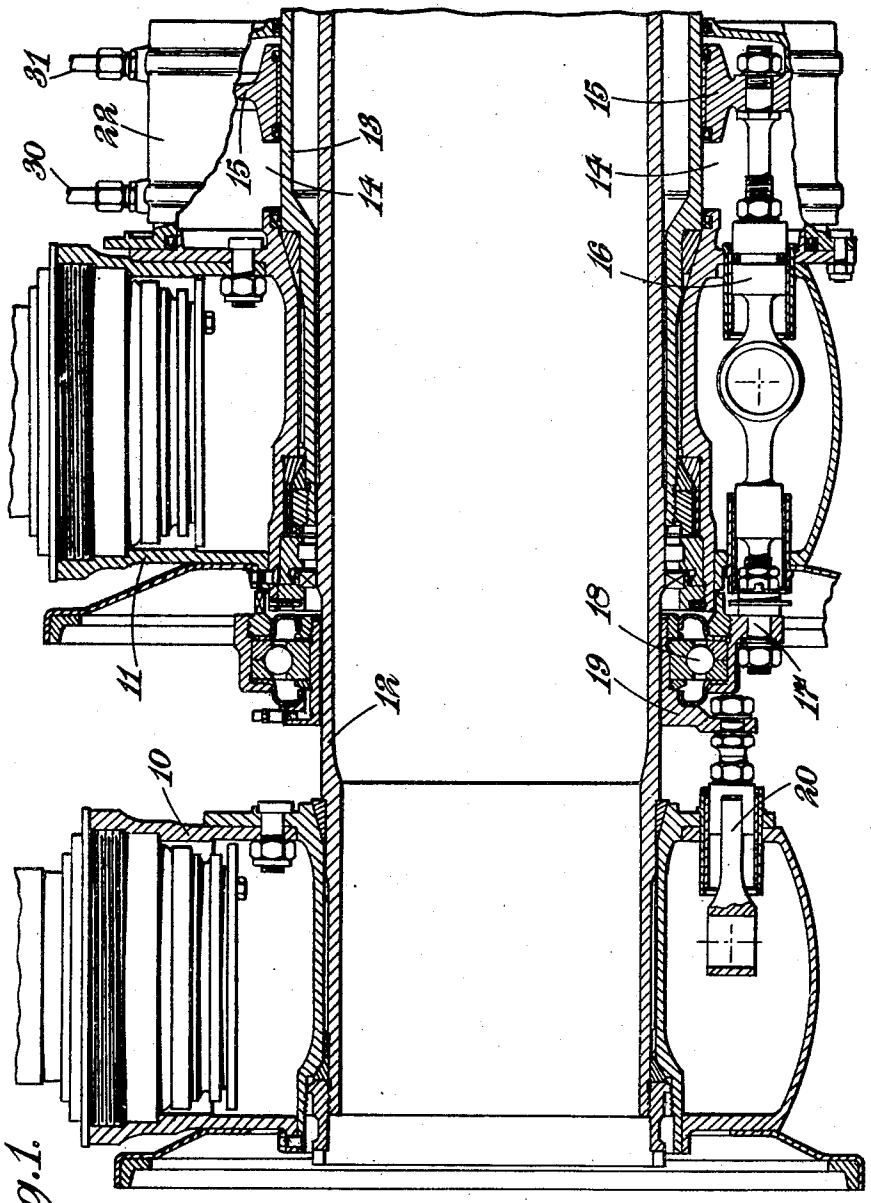


Fig. 1.

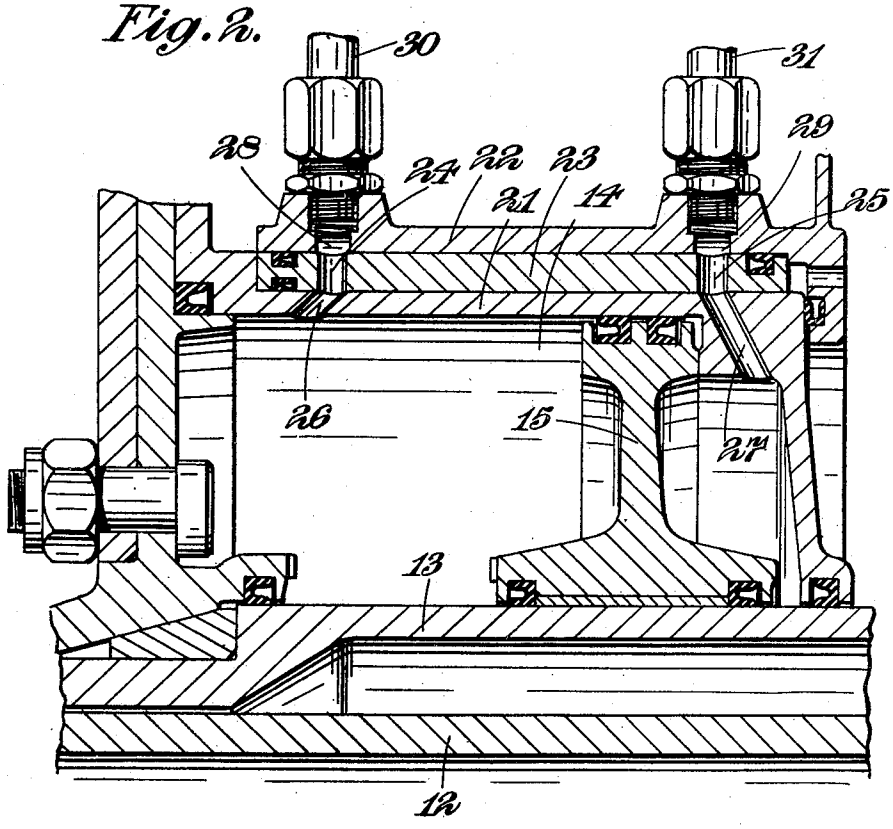
INVENTOR
LEONARD G. FAIRHURST
by
Wilkinson & Mawhinney
attys.

Oct. 25, 1949. L. G. FAIRHURST 2,486,016

SCREW PROPELLER

Filed Aug. 18, 1944 3 Sheets-Sheet 2

Fig. 2.



INVENTOR
LEONARD G. FAIRHURST
by Wilkinson, Mawhinney & Theobald
Attorneys

Oct. 25, 1949. L. G. FAIRHURST 2,486,016

SCREW PROPELLER

Filed Aug. 18, 1944 3 Sheets-Sheet 3

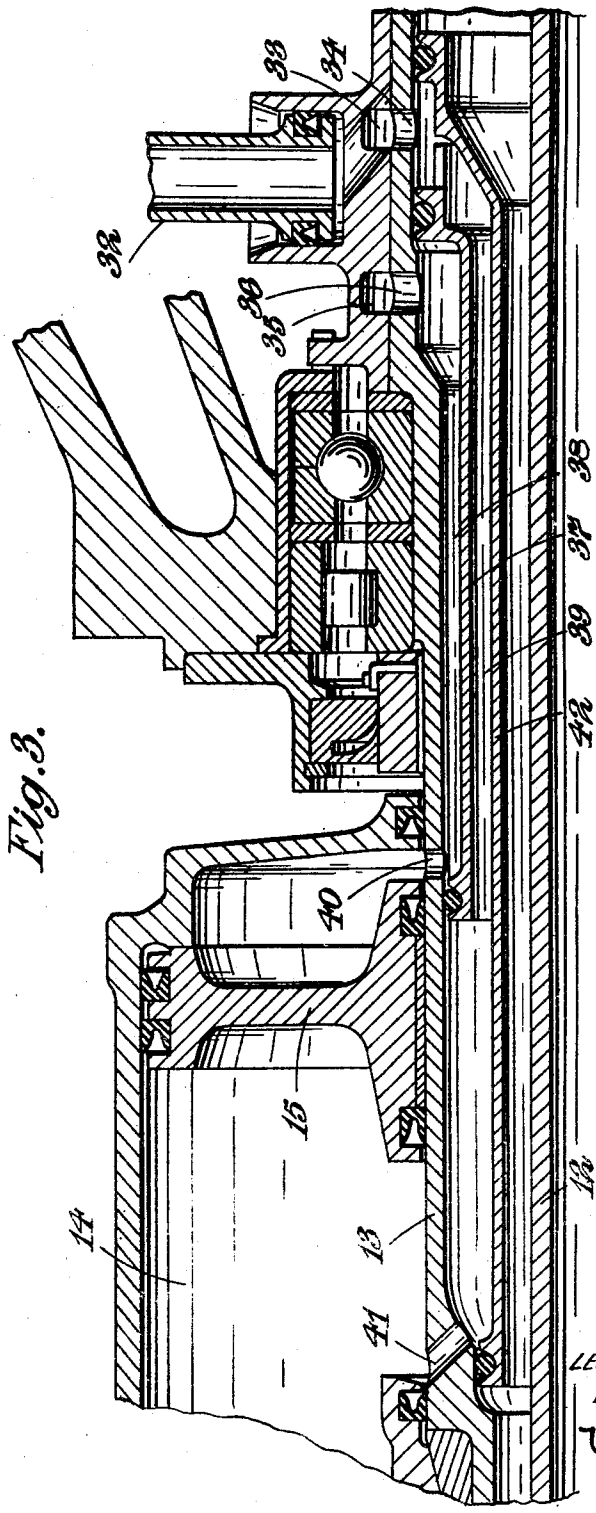


Fig. 3.

INVENTOR
LEONARD G. FAIRHURST
BY
Wilkinson Thomas Dunney
ATTORNEYS

Patented Oct. 25, 1949 2,486,016

UNITED STATES PATENT OFFICE

2,486,016

SCREW PROPELLER

Leonard Gaskell Fairhurst, Gloucester, England, assignor to Rotol Limited, Gloucester, England, a British company

Application August 18, 1944, Serial No. 550,051
In Great Britain November 13, 1942

2 Claims. (Cl. 170—135.27)

1

This invention relates to variable-pitch screw-propellers of the hydraulically-operated type.

Propellers of this type at present in use have a hydraulic operating mechanism for changing the pitch of the blades mounted in front of and rotating with the propeller. This mechanism in one well-known form comprises a relatively reciprocable piston and cylinder the axially moving member of which is coupled to each of the blades by simple links.

Pressure-fluid, usually the engine oil, is conveyed to the propeller through the hollow propeller-shaft which necessitates the use of one or more oil tubes.

When the propulsion system comprises a pair of contra-rotating co-axial propellers the hydraulic pitch-changing mechanism is mounted on the propeller carried by the inner shaft, the pitch-changing movements being transferred to the other propeller by an extension of the link system above referred to.

One object of this invention is to provide a simple hydraulic pitch-changing mechanism for a single propeller, or for a pair of contra-rotating co-axial propellers of the general type referred to above, which mechanism is so arranged as to enable a clear axial space or passage to be left through the propeller-shaft.

A further object is to reduce the overhanging mass at the front of the propeller or propellers, this being particularly desirable in the case of contra-rotating co-axial propellers.

According to this invention, in a hydraulically-operated variable-pitch propeller-installation, the pitch-changing mechanism comprises an annular cylinder surrounding a hollow driving-shaft, fluid-supply-ducts communicating with it and providing a clear axial space through them and the driving-shaft, an annular piston in the cylinder and means coupling the piston to the blades to effect pitch-changing movements thereof.

According to another feature of this invention, the fluid-supply-ducts are disposed outside the driving-shaft, and in such a construction there may be provided the combination with a cylinder secured on the hub of means providing a clear axial space through the cylinder and hub and also providing communication to each end of the cylinder, said means comprising a running gland of which the outer surface of the cylinder forms part.

According to another feature of this invention, the annular cylinder may have its inner wall

2

spaced away from the shaft, in combination with fluid-supply-ducts which open to the cylinder through the said inner wall.

In the case of an installation comprising co-axial contra-rotating propellers, the supply of of working fluid to the cylinder may be delivered to it through the annular space between the inner driving-shaft of the front propeller and the outer driving-shaft of the rear propeller, and the outer driving-shaft may constitute the inner wall of the annular cylinder.

The fluid-supply-ducts may be constituted by a tube or tubes dividing the annular space between the shaft and the inner wall of the cylinder for a single propeller, or between the two shafts of contra-rotating propellers into two ducts communicating respectively with the two ends of the cylinder.

In the accompanying drawings:

Figure 1 is a general arrangement viewed mainly in section showing one form of this invention applied to a co-axial contra-rotating propeller-installation,

Figure 2 is a sectional detail view of a part of Figure 1 to a larger scale showing the means for supplying working fluid to the annular cylinder, and

Figure 3 is a similar view of an alternative construction of the fluid-supply means.

Referring first to Figure 1, the driving shafts for the two propellers whereof the hubs are indicated at 10, 11 respectively, are indicated at 12 and 13. In the case of tractor airscrews the front one is carried by the shaft 12 and the rear one by the shaft 13, but it will be appreciated that in the case of pusher airscrews the descriptions "front" and "rear" of the two airscrews would be interchanged.

The hydraulic pitch-changing mechanism comprises a cylinder 14 which is secured to the rear face of the hub 11 and is of annular form, its inner wall being constituted by the outer driving-shaft 13. Within this annular cylinder there is mounted a piston 15 which is connected by a suitable linkage 16 to eccentric pins on the roots of the blades in the hub 11 to effect their pitch-changing movements by movement of the piston 15 in the cylinder 14. The linkage 16 is extended at 17 to engage a thrust race 18 whereby the pitch-changing movements of the blades are transmitted to a sleeve-member 19 coupled by a suitable linkage 20 to the blades of the front propeller carried by the shaft 10.

The means for supplying pressure-fluid to the cylinder 14 is illustrated in Figure 2. The outer

cylindrical wall 21 of the cylinder 14 is preferably ground and a stationary housing 22 surrounds it with a floating bush 23 arranged between them. The bush is formed towards each end with rows of suitable openings 24, 25 to provide communication with ports 26, 27 respectively, opening into the two ends of the cylinder, and they also open into grooves 28, 29 respectively formed in the housing 22 which have suitable pipe connections 30, 31 respectively with a fluid-pump or governor-unit of the kind ordinarily used with hydraulically-operated variable-pitch propellers.

Suitable glands or packing and connections to drain are provided to deal with any leakage which may occur of the working fluid.

The cylinder may be of such axial length as will permit the piston to move over a range that will allow the blades of the propellers to be feathered and/or reversed if so desired.

When this invention is applied to a single propeller installation, a similar arrangement may be used but in this case there would be no inner driving shaft 12 as the propeller would be mounted on the shaft 13.

When the supply of pressure-fluid is effected in the manner illustrated in Figure 2, using the outer wall 21 of the cylinder as part of the running gland, the rotational speed of the cylinder wall 21, which rotates with the propeller, may be somewhat high and it is preferred to use the arrangement illustrated in Figure 3 in which the supply of fluid takes place through the inner wall of the annular cylinder. The arrangement shown in Figure 3 is applied to a two-propeller installation in which the two driving-shafts are indicated by the references 12, 13, and in this case the supply is effected through the annular space between the two shafts. For this purpose a suitable running gland conveys oil from the pump connection 32 by way of a groove 33 and openings 34 in the shaft 13 to the annular space between the shafts; two of these connections are provided spaced around the shaft, the second groove and communicating holes being shown at 35, 36 respectively. A tube 37 is provided between the two shafts to divide the space into two ducts 38, 39 respectively which communicate by ports 40, 41 with the two ends of the annular cylinder 14, the ends of the tube 37 being suitably packed to prevent leakage. It is preferred also to provide a second tube 42 to constitute one wall of the duct 39 so that it is not necessary to use the whole of the annular space between the shafts as this duct, and the packing arrangements can be considerably simplified.

If it is desired to use this arrangement with a single-propeller-installation, the propeller would be mounted on the shaft 12 and the shaft 13 which constitutes the inner wall of the annular cylinder would be provided by a separate part which would rotate with the cylinder and receive the rotary hydraulic joints at 34, 36 for the supply of fluid.

In yet another construction, instead of dividing the annular space between the shafts 12, 13 into two co-axial ducts, there could be provided a slotted or grooved sleeve whereof the grooves communicate at one end with suitably spaced apertures in the wall of the cylinder and at the other end with a running joint of the type above referred to.

It will be seen that with any of the constructions above described, in either single or two-propeller-installations there is provided a clear axial space through the propeller-shaft which permits the mounting of a gun to fire through the shaft. Also there is a very considerable benefit in the disposition of the weight in that the hydraulic cylinder is mounted between the propeller and the engine, leading to compactness and avoidance of a large overhanging weight at the forward end of the propeller.

I claim:

1. A hydraulically-operated variable-pitch propeller installation comprising a pair of contra-rotating propellers each having a hub and a plurality of blades carried by the hub, a pair of hollow driving shafts one to carry each propeller, said shafts being concentric and spaced apart one within the other to form an annular passage therebetween, an annular cylinder arranged exteriorly of the propeller hubs and surrounding the outer driving shaft, a piston in said cylinder, means coupling said piston to the blades of the propellers to effect pitch-change movements of said propellers and fluid-supply ducts communicating one each with the two ends of the cylinder through the annular passage between the shafts.

2. A hydraulically-operated variable-pitch propeller installation comprising a pair of contra-rotating propellers each having a hub and a plurality of blades carried by the hub, a pair of hollow driving shafts one to carry each propeller, said shafts being concentric and spaced apart one within the other to form an annular passage therebetween, an annular cylinder arranged exteriorly of, and carried by the hub of one propeller and surrounding the outer driving shaft, a piston in said cylinder, fluid supply ducts connected with said cylinder through the annular passage between the shafts said fluid supply ducts being constituted by at least one tube dividing the annular space between said driving shafts into two ducts communicating respectively with the two ends of the cylinder and means coupling the piston to the blades of said propellers to effect pitch-change movements of said propellers.

LEONARD GASKELL FAIRHURST.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,132,481	King	Oct. 11, 1938
2,258,094	Keller	Oct. 7, 1941
2,280,713	Martin	Apr. 21, 1942
2,341,730	McNab	Feb. 15, 1944
2,377,457	Stalker	June 5, 1945

FOREIGN PATENTS

Number	Country	Date
463,985	Great Britain	Apr. 9, 1937
519,261	Great Britain	Mar. 20, 1940
536,816	Great Britain	May 28, 1941
546,291	Great Britain	July 6, 1942