Oct. 22, 1935. R. CHILTON 2,018,012

SPINNER COWL

Filed Feb. 9, 1933 2 Sheets-Sheet 1

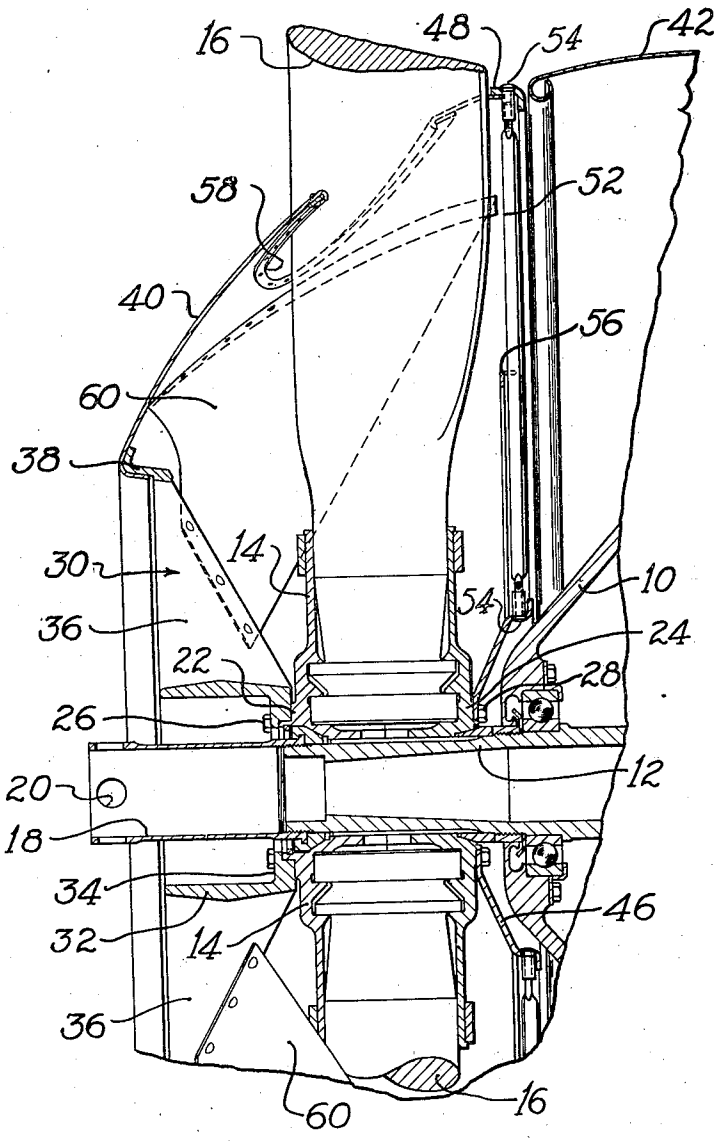

Fig. 1

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Filed Feb. 9, 1933 2 Sheets-Sheet 2

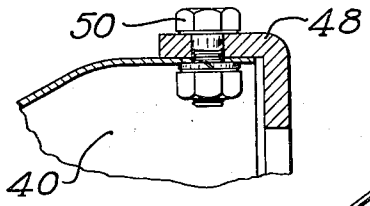

Fig. 3

Fig. 2

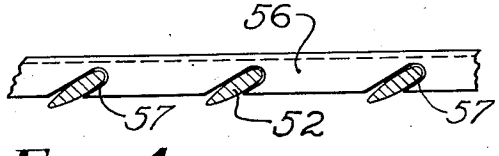

Fig. 4

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UNITED STATES PATENT OFFICE

2,018,012

SPINNER COWL

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Application February 9, 1933, Serial No. 655,917

8 Claims. (Cl. 244—31)

This invention relates to means for improving the cooling air-flow over the radiation means of engines and is particularly adaptable for use on engines equipped with propellers as in aircraft.

This invention comprises an improvement over the structure disclosed in my Patent No. 1,896,222, and in my copending application, Serial No. 539,026. As set forth in the specifications of the documents referred to, the air-flow behind the propeller hub and the roots of the propeller blades of aircraft engines tends to become inadequate at high engine outputs because these parts have little or no air-foil section and pitch, and, therefore, set up a serious radial distortion of the air-flow due to centrifugal action.

Actual test experience with the structures disclosed in the patent and application mentioned, has demonstrated a very substantial increase in air-flow and, therefore, in cooling, by enclosing the engine in a stationary cowling and carrying out the nose of this cowling in streamline form by means of a large hollow spinner secured for rotation with the propeller and having a relatively small axial air intake ahead of the propeller hub. However, this experience has shown that the stresses encountered in practice on such a large spinner are extremely severe and the present invention comprises an improved mechanical structure greatly increasing the strength against centrifugal, aerodynamic and vibration loads.

A high speed member of large diameter, which is stressed principally due to its own mass, may not be effectively reinforced by mere increase in its sectional area since its mass and centrifugal loading are thereby proportionately increased. It, therefore, becomes necessary to resist centrifugal loads by means of a small diameter member not subject to high centrifugal stresses due to its own mass and velocity. In this invention this requirement is combined with the requirement of minimum obstruction to the air-flow by a novel spinner structure including a rim supported from a hub by streamlined spokes set in pitched disposition.

An object of the invention is to provide streamlined spokes for assuming the centrifugal loads imposed on a hollow rotating spinner cowl through which air is adapted to flow.

A further object is to provide spokes which may be set with an initial tension to reduce deformation of the cowl under the influence of centrifugal loads.

A further object is to organize the spokes mentioned to assist in producing air-flow through the spinner cowl.

Further objects will become apparent from a reading of the annexed specification and from a consideration of the drawings, in which:

Fig. 1 is a fragmentary axial section showing the front end of the engine crankshaft, the propeller, and the spinner structure;

Fig. 2 is an end elevation of the rear supporting member;

Fig. 3 is an enlarged section on the line 3—3 of Fig. 2; and

Fig. 4 is an enlarged section on the line 4—4 of Fig. 2.

Referring first to Fig. 1, 10 designates the front end or "nose" of the engine crankcase through which there protrudes the end of the crankshaft 12. On this there is mounted a conventional propeller hub 14 having the usual blades 16, all assembled in the usual manner except that the propeller hub nut 18 is lengthened for convenient application of a bar to the usual holes 20 for tightening up. The hub is of the conventional type equipped with annular faces or flanges 22 and 24 at the front and rear, which flanges are tapped for studs 26 and 28 originally intended for securing the small spinners now sometimes used. Such old type spinners, however, have been of relatively small diameter and organized for cooling air-flow over the exterior surface of the spinner, and are closed at their front end.

In the present invention there is secured to the front face 22 of the hub 14 by the studs 26 a front spinner member 30 comprising a hub 32 flanged inwardly at 34 and drilled for the aforesaid studs 26. Preferably integral with the hub 32 are the arms 36 and the rim 38. The arms 36 are given a pitched disposition whereby they comprise a fan. The spinner shell 40 is a one-piece spinning of sheet metal, suitably secured to the rim 38 and comprising with the fixed engine cowl 42 a streamline cowling for the entire engine (not shown, but placed within the cowl 42) and the central portion of the propeller comprised of blades 16 and hub 14.

Secured to the rear face 24 of the propeller hub 14 is the backplate assemblage shown partially in elevation in Fig. 2. This member consists of a hub 46 secured to the propeller hub 14 by the previously mentioned bolts 28 and a preferably jointless rim member 48 which embraces a cylindrical rear terminal portion of the spinner shell 40, which may be detachably located as by bolts 50, Figs. 2 and 3. The hub 46 and the rim 48 are united by a large number of streamlined section spokes 52 secured in the respective members by tensioning nipples 54 to comprise a structure reminiscent of a wire wheel having a single row of spokes. It will be seen that the spaces between the spokes 52 afford ports or openings for the flow of air through the spinner to the engine, as set forth in my copending applications, and these spokes are further set in pitched or angular relation so as to comprise a large number of air-foils or fan blades assisting the air-flow. The spokes are located in the required pitched at-

titude by a light angular ring **56**, which has angular slots **57** conformed to the profile of the streamlined spokes as shown in enlarged detail in Fig. 4.

The pitched attitude of the spokes **52** is preferably set so that each spoke, acting as a fan blade, will give added impetus to air passing through the spinner **40**, so that, instead of blocking air-flow, as conventional spokes would do, they assist the air-flow. Any drag occasioned by their rotation, instead of being parasitic, is therefore helpful.

It will be realized that, due to the very large diameter and high rotational speed of the cowl and due to the weakening effect of the slots for the propeller blades (shown at **58**, Fig. 1), the ring **48** is subject to very high centrifugal stresses due not only to its own weight but to that portion of the shell **40** which it is designed to restrain against centrifugal force.

Initial tests with the back member comprised of a one-piece plate having ports cut out for the air-flow, leaving material in between ports comprising radial arms, showed a satisfactory structure from a strength point of view, provided relatively wide arms were used. However, it was found that the required width to the arms restricted the port area, and subsequent attempts to use only a pair of arms placed behind the propeller blades developed mechanical troubles due to inadequate support of the rim **48**. In the present structure the spokes **52** are given a substantial initial tension at assembly whereby they relieve the ring **48** of the excessive centrifugal tension experienced in the single spoke design, while at the same time the spoke structure of this invention assists instead of interferes with the air-flow.

Pitched blower fan blades **60** may be secured inside the spinner to cooperate with the pitched arms **36** of the front member and the pitched spokes **52** in enforcing an augmented air blast over the engine within the fixed cowl **42**.

The openings **58** in the spinner **40** for the propeller blade **16** have been indicated (near numeral **48**) as comprising closed holes. Alternatively, these openings may comprise slots extended through the extreme rear edge of the shell **40**. In the latter case the assembled propeller is removed from the spinner by removing the spoked back member complete as an assemblage by withdrawing the locating bolts **50** and the bolts **28** by which the hub member of the assembly is secured through the propeller hub. The assembled propeller may then be withdrawn from the spinner through the open-ended slots **58** after removal of the front bolts **26**.

In case it is preferred to leave continuous metal in the shell back of the openings **58** (in the zone near the numeral **48** of Fig. 1), it becomes necessary to split the propeller hub **14** in the usual way for individual withdrawal of the blades inwardly through the openings **58** after the backplate assemblage of **52** has been removed in its entirety. From a structural point of view this procedure is preferred. However, the requirement of quick demountability without disturbing the propeller blade settings may in practice overrule, but either method is obviously within the scope of the invention.

While I have described my invention in detail in its present preferred embodiment, it will be obvious to those skilled in the art, after understanding my invention, that various changes and modifications may be made therein without departing from the spirit or scope thereof. I aim in the appended claims to cover all such modifications and changes.

What is claimed is:

1. A spinner for a propeller comprising front and rear members secured respectively in front of and behind the propeller hub, each member having pitched spokes, a shell secured to both members, and vanes secured within the spinner and to said front member spokes.

2. In a spinner, a means of resisting the centrifugal loads of the spinner comprising a relatively small diameter hub member, a rim embracing the spinner and spokes elongated in cross section set in initial tension between the hub and the rim the longer sides of said spokes being set in pitched disposition to the local airflow.

3. In a spinner for a propeller having a rim member, means for supporting and strengthening said rim member without obstruction to air-flow through the spinner, comprising a hub member and streamlined spokes tensioned between the hub member and the rim and means to locate said spokes in pitched disposition.

4. In a hollow propeller spinner arranged for flow of air therethrough, a hub member, a plurality of streamlined wire spokes extending therefrom and attached at their outer ends to said spinner, each said spoke having pitched disposition to augment air flow through said spinner, and means engaging said spokes intermediate their length for retaining the pitched disposition thereof.

5. In a hollow propeller spinner, a hub member, a plurality of tensioned spokes extending therefrom and attached at their outer ends to said spinner, ferrules for adjustably anchoring said spokes to said spinner and hub, and means engaging all said spokes for holding them in their adjusted position.

6. In a hollow propeller spinner, a hub member, a plurality of streamlined tensioned spokes extending therefrom and attached at their outer ends to said spinner, means at the ends of said spokes for adjusting the initial tension thereof and to permit of the adjustment thereof to a pitched disposition, and means engaging said spokes for anchoring them in their pitched disposition.

7. In a hollow propeller spinner, a hub member, a plurality of streamlined tensioned spokes extending therefrom and attached at their outer ends to said spinner, means at the ends of said spokes for adjusting the initial tension thereof and to permit of the adjustment thereof to a pitched disposition, and an angularly slotted annular member engageable with said spokes, each spoke being engageable within a slot thereof whereby said spokes are retained in pitched disposition.

8. In a spinner for a propeller, relatively strong pitched spokes extending from the forward portion of said spinner to the hub of said propeller, and auxiliary blower vanes extending rearwardly within said spinner, said vanes being attached to said spinner and to said spokes.

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