May 16, 1933. R. CHILTON 1,908,820

ENGINE COWLING

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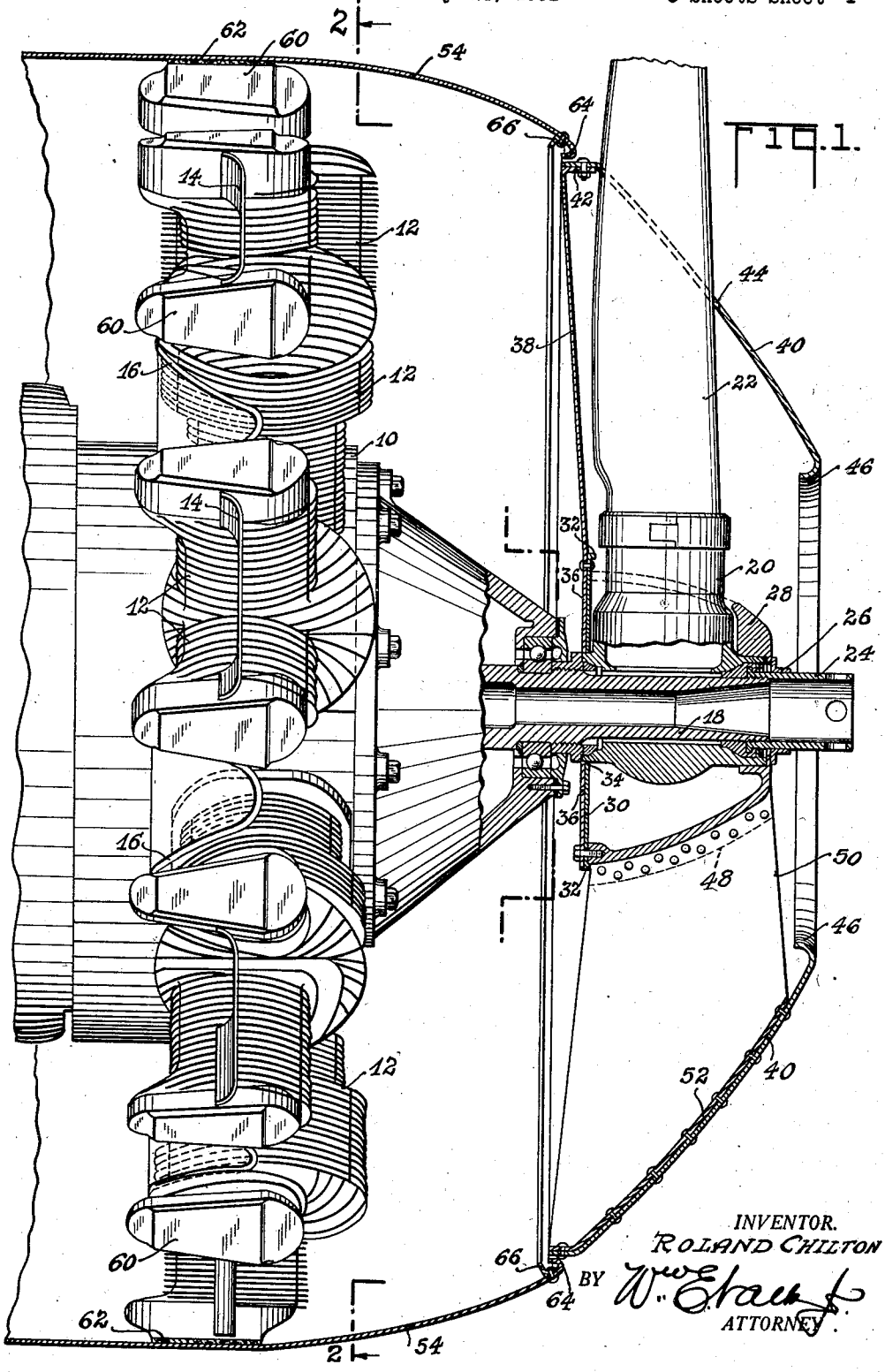

FIG. 1.

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Fig. 2.

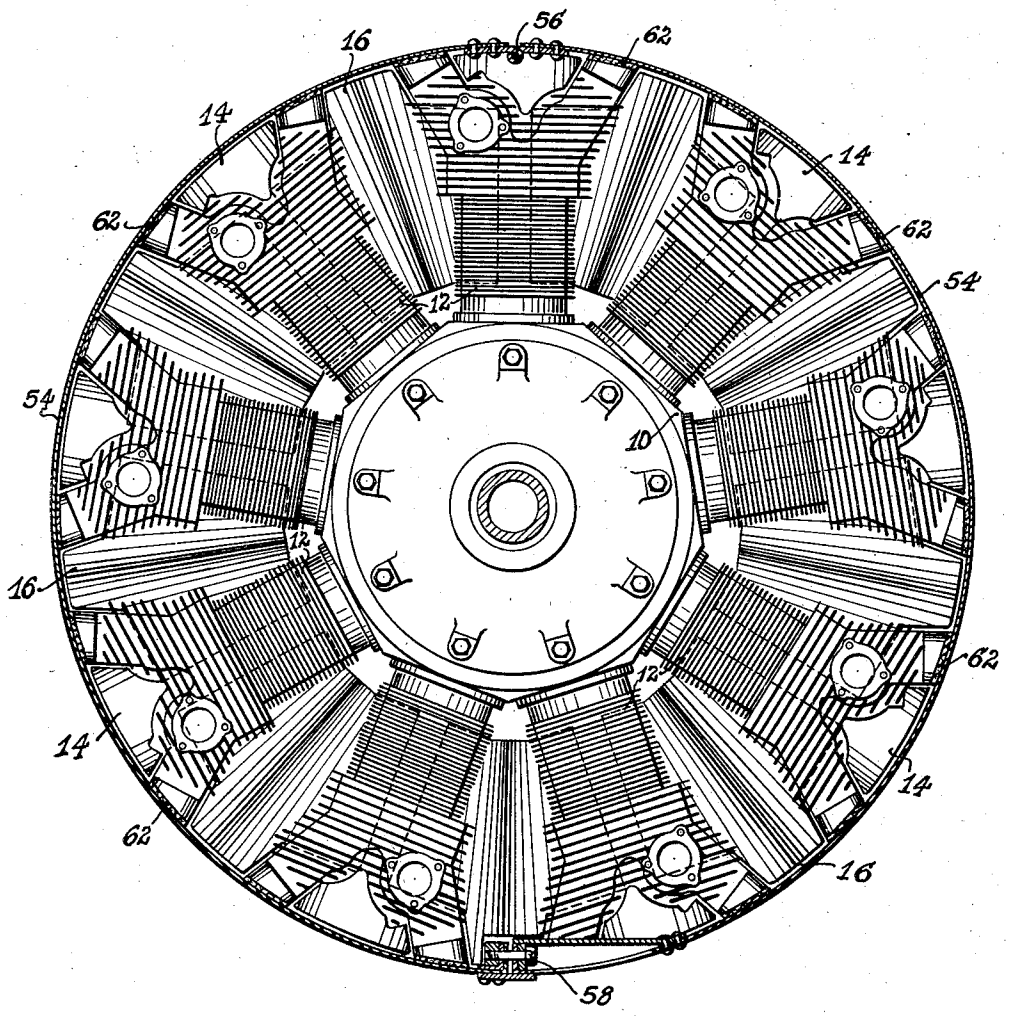

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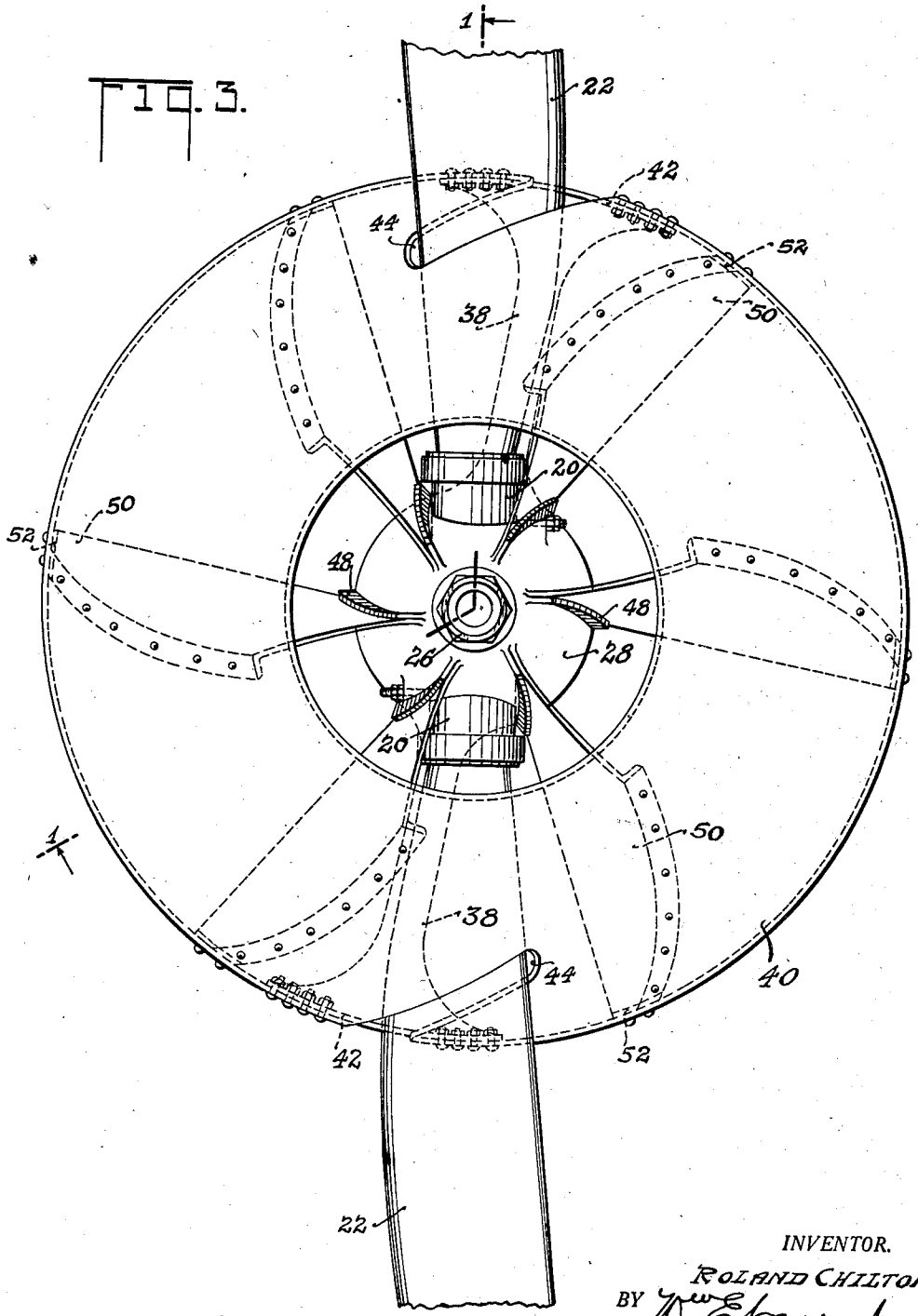
Fig. 3.



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UNITED STATES PATENT OFFICE

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ENGINE COWLING

Application filed May 21, 1931. Serial No. 539,026.

This invention comprises improvements in the cooling and cowling of aircraft engines of the general type disclosed in my copending application Serial No. 501,789, filed December 12, 1930. The present invention accordingly relates to a streamline cowling for an engine wherein the nose portion of the cowling comprises a spinner or cooling air blower organized for rotation with the propeller. In such constructions the rotating or spinner part of the cowl is slotted for the propeller blades, and reinforcement against centrifugal bursting at the slot is one of the problems involved. In the showing of the copending case this was achieved by means of a backplate having a flange embracing the outside of the spinner, the plate being provided with circumferential air delivery ports, leaving spokelike portions of the disc between the ports to provide the necessary reinforcement. Experience has shown that greater exit area for the air than there provided will increase the efficiency of the device, and the present invention accordingly provides an improved construction giving greater strength against bursting and much enlarged air flow areas.

While the construction shown in the copending case has been found to give better than normal cooling with the assistance of an air blast as encountered in actual flight, it is desired to improve the efficiency until equal cooling is obtained in still air such as is encountered in ground testing the engine. In the tests of the previous construction, the propeller blades themselves were at first relied on to act as vanes to impress rotation on the air in order to develop centrifugal pumping action, although it was known that the air displacement could be increased by the use of additional vanes so that the spinner is divided into more than two compartments, and so that the considerable "slippage" due to the failure of the standard propeller blade to fill the spinner is eliminated. The tests have shown that to give better-than-normal cooling in still air, such increased displacement is necessary; and accordingly the present invention provides a construction whereby a plurality of blower vanes may be associated with a standard propeller within a large spinner whilst maintaining the necessary strength against bursting.

In the drawings:

Fig. 1 is a longitudinal section through the cowling and spinner on the line 1—1 of Fig. 3, with the engine cylinders indicated in outside view.

Fig. 2 is a front elevation of the engine in section through the fixed part of the cowl on line 2—2 in Fig. 1.

Fig. 3 is a front elevation of the assembled cowl propeller.

Referring first to Fig. 1, 10 designates the engine crankcase and 12 the cylinders thereon, the intercylinder spaces being blanked off by baffles 14 and 16 adapted to restrict the air flow to the finned periphery of the engine cylinders and thus reduce the total volume of air required. The crankshaft of the engine projects at 18 in the usual way and is equipped with a standard propeller hub 20 having standard propeller blades 22, it being an object of this invention to equip existing engines without change to the propeller or other parts.

The propeller hub nut 24, however, may be lengthened in order to accommodate an additional nut 26 by which the blower vane hub 28 may be pinched onto the propeller hub. It will be seen that this blower vane hub 28 is cut out on two opposite sides to pass the propeller blade bosses of the propeller hub. To reinforce the blower vane hub 28 a plate 30 having an external flange 32 fitted over a pilot turned on the blower vane hub 28 is provided, the plate 30 being piloted on the propeller hub at 34 to maintain the parts in concentric relation. A second plate 36 is secured to the plate 32 and provided with a pair of arms 38 located substantially behind the propeller blades 22 and these arms or spokes extend to the periphery of the spinner shell 40 whereat the arms are provided with arcuate extensions 42 which are bolted to the spinner to form a demountable reinforcing bridge closing the end of the slots 44 which must be cut in the spinner 40 to permit assembly of the propeller. It should be noted that the arms or spokes 38 and their arcuate ends 42

reinforce the spinner against both radial and circumferential loads. It will be seen that the spinner 40 is inwardly beaded at 46 to define an axial air inlet.

The blower vane hub 28 is provided with a plurality of helically disposed ribs 48, to which are riveted the inner ends of a plurality of pitched blower vanes 50. These vanes are provided with flanges 52 at their outer ends, accurately conformed to the desired streamline contour of the spinner shell 40, to which these flanges 52 are firmly secured by riveting. Preferably the vanes 50 are first riveted to the helical ribs 48 and then the hub 28 is located on a jig having an accurate arcuate contour over which the flanging operation 52 may be done on each blade in succession and to insure the uniformity essential for true running of the spinner.

The best pitch angle for the vanes 50 depends upon the relative air velocity and, theoretically, they will be more nearly parallel to the axis of rotation for the best results in a flight cowl and will have a greater helix angle in a cowling for ground testing. Experiments to date, however, indicate that a compromise angle may be found which will give satisfactory results in both conditions. In actual service a compromise in favor of the flight condition is best because it is advantageous that the cooling on the ground should be less effective to assist in quick warming up of the engine. An angle somewhat steeper than the pitch angle of the propeller blades themselves is at present indicated as most desirable.

It will now be seen that by the construction here provided, the spinner is reinforced against centrifugal stresses with a minimum of obstruction to the air flow and that a construction is provided whereby great accuracy and rigidity are given to the surface of the spinner. This is important because a slight wabble in the spinner is very noticeable in operation, causing a very bad appearance and being apt to upset the balance which must be accurately maintained.

The fixed part of the cowling comprises a shell 54 comprising halves hinged at 56 and provided with draw bolts at 58, so that the entire cowl may be clamped around the outside of the engine, for which purpose the rocker box covers 60 are provided with flat tops having pads 62. The front portion of the fixed cowl is shaped to conform to the curvature of the spinner 40 so that the whole provides a streamline engine nose and the fixed cowl may be suitably reinforced at its front end as by the bead 64 and angle ring 66.

Although the drawings illustrate this invention on an air-cooled engine, it should be understood that it may be applied to any cooling means. For example: a radiator for a suitable cooling liquid may be disposed within the cowling so as to be subject to the air blast from the spinner-blower.

I claim as my invention:

1. A cowling and cooling blower for an engine having a propeller comprising in combination, a rotary shell affording a streamline nose to said cowling having an axial air entrance opening, a vane hub secured to the propeller, and a plurality of blower vanes each secured to said hub and to said shell to reinforce the blower.

2. The combination with an engine-driven propeller, of a truncated conical shell slotted for assembly about said propeller, and an armed member mounted on the hub of the propeller and having arcuate ends secured to the shell to bridge said slots.

3. The combination with an aircraft engine propeller, of a cooling air blower comprising an open-ended spinner shell having slots through which the blades of the propeller project, bridge pieces reinforcing the otherwise open end of said slots, and arms on the bridge pieces extending to the hub of the propeller.

4. In apparatus of the class described, in combination, an open-ended conical shell having helical slots at its larger diameter, a propeller having blades extending through said slots, a vane hub secured to the propeller, and vanes secured to said hub and to said shell.

5. In apparatus of the class described, in combination, an open-ended conical shell having helical slots towards its larger diameter, a propeller having blades extending through the said slots, a vane hub secured to the propeller, vanes secured to said hub and to said shell, and a radial armed member secured to the hub and having reinforcing bridges secured across the otherwise open ends of said slots.

6. The combination with an aircraft engine propeller, of a vane hub slotted to accommodate the roots of the blades of said propeller, means to reinforce the slotted end of said vane hub, and blower vanes secured to said hub.

7. The combination with an aircraft engine propeller, of a vane hub slotted to accommodate the roots of the blades of said propeller, means to reinforce the slotted end of said vane hub, blower vanes secured to said hub, and means to secure said hub coaxially with the propeller.

8. The combination with an aircraft engine propeller, of a vane hub slotted to accommodate the roots of the blades of said propeller, means to reinforce the slotted end of said vane hub, blower vanes secured to said hub, means to secure said hub coaxially with the propeller, and a shell secured to the outer ends of said vanes and having slots through which the blades of said propeller project.

9. The combination with an aircraft en-

gine propeller, of a vane hub slotted to accommodate the roots of the blades of said propeller, means to reinforce the slotted end of said vane hub, blower vanes secured to said hub, means to secure said hub coaxially with the propeller, a shell secured to the outer ends of said vanes and having slots through which the blades of said propeller project, and radial arms extending from said reinforcing means and secured to the shell across the slots.

10. As a unit structure, a detachable spinner for an aircraft propeller including a spinner hub adapted to embrace the propeller hub, an outer shell through which the propeller blades extend, and vanes extending from one to the other of and fastened to said spinner hub and shell.

11. A spinner for an aircraft propeller including a spinner hub, an outer shell having slots formed therein through which the propeller blades extend, means extending radially out from said hub to reinforce said shell in the vicinity of said slots, and vanes extending from one to the other of and fastened to said hub and shell.

12. A spinner for an aircraft propeller including a spinner hub, an outer shell through which the propeller blades extend, and blower vanes pitched at a steeper angle than the pitch angle of the propeller blades extending from one to the other of said spinner parts, said vanes, hub and outer shell being bodily removable as a unit.

13. A spinner for an aircraft propeller including a spinner hub, an outer shell provided at its forward end with an air inlet opening, and blower vanes extending radially out from said hub and fastened to said shell behind said opening, said hub, shell and blower vanes being adapted for attachment to and removal from said propeller as a unit.

14. The combination with an engine driven aircraft propeller of a unitary freely detachable cooling air blower comprising an outer circular shell, blower vanes attached to and extending inwardly from said shell, and means at the inner ends of said vanes for joining said vanes and for attaching said blower to the hub of said propeller.

15. The combination with an engine driven air craft propeller of a unitary freely detachable cooling air blower comprising an outer circular shell, blower vanes attached to and extending inwardly from said shell, and means at the inner ends of said vanes for joining said vanes and for attaching said blower to the hub of said propeller, said shell and said means having openings for receiving the blades of said propeller.

16. The combination with an engine driven aircraft propeller of a unitary freely detachable cooling air blower comprising a substantially streamline hub adapted to be attached to and to enclose the hub of said propeller, and blower vanes attached to and extending outwardly from said hub.

17. The combination with an engine driven aircraft propeller of a unitary freely detachable cooling blower comprising a substantially streamline hub adapted to be attached to and to enclose the hub of said propeller, blower vanes attached to and extending outwardly from said hub, and a circular enclosing shell attached to the outer ends of said vanes, said hub and said shell having openings formed therein for the passage of the propeller blades therethrough, and said vanes lying substantially in the plane of the blades of said propeller.

In testimony whereof I hereunto affix my signature.

ROLAND CHILTON.