April 8, 1924.

1,489,841

G. S. MacDONALD

VARIABLE PITCH FAN

Filed Oct. 2, 1922

2 Sheets-Sheet 1

Fig. 1.

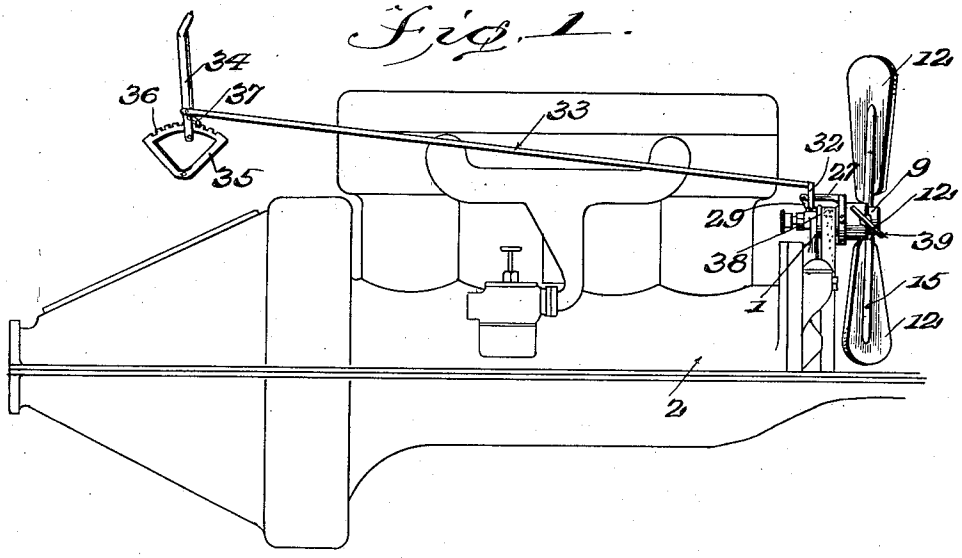


Fig. 2.

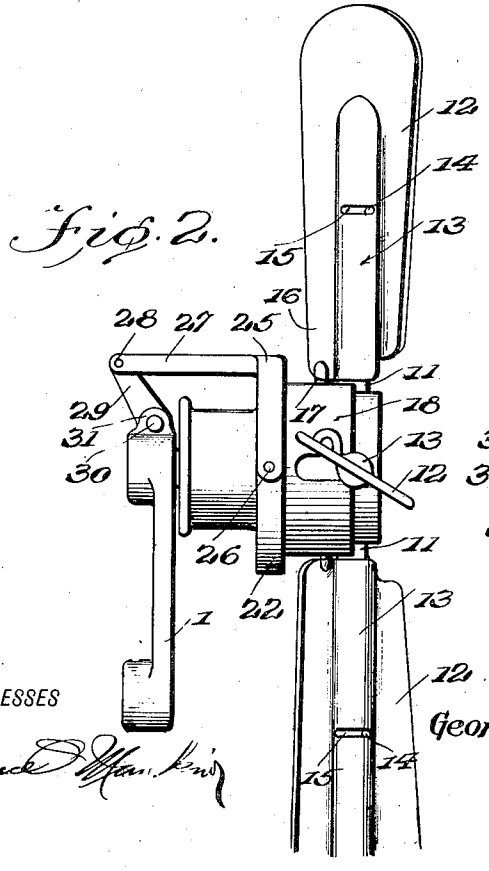
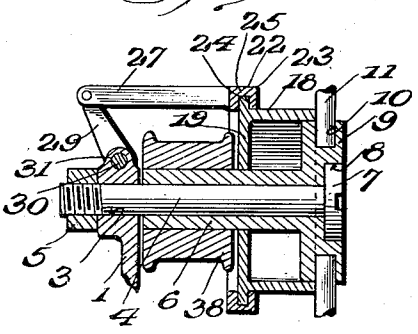


Fig. 4.



WITNESSES

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Fig. 3.

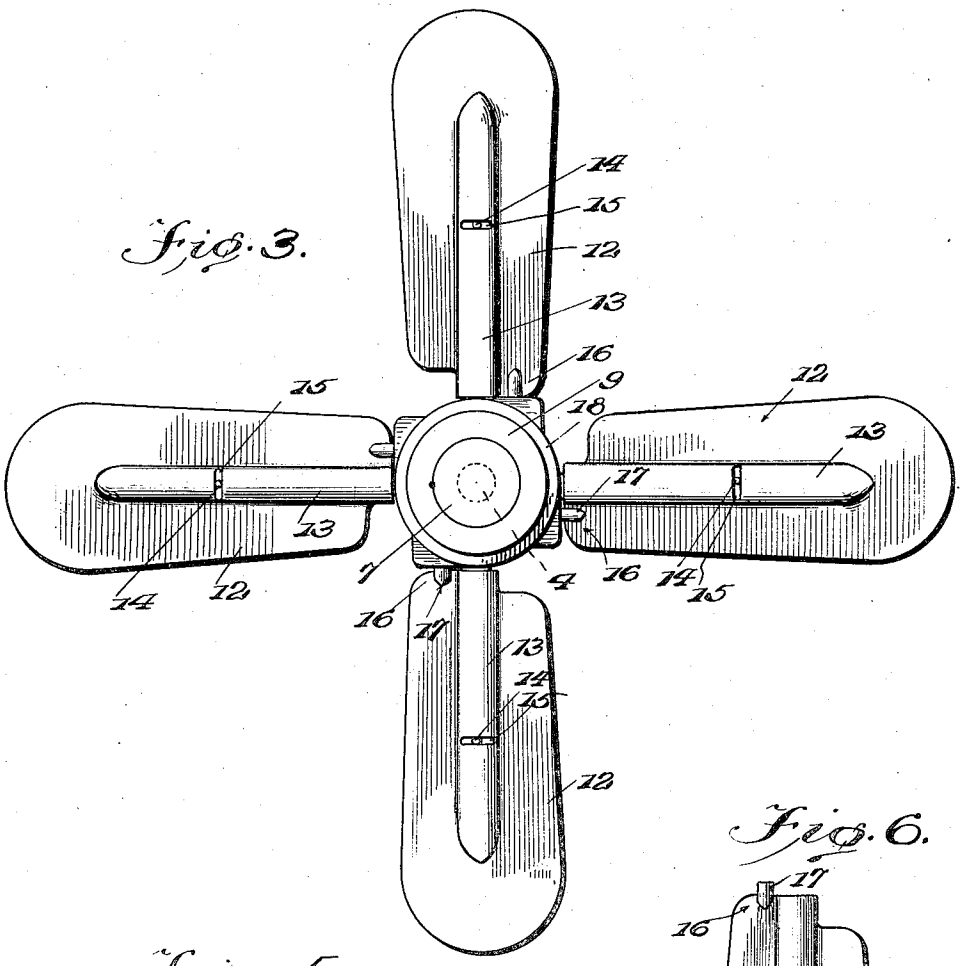


Fig. 6.

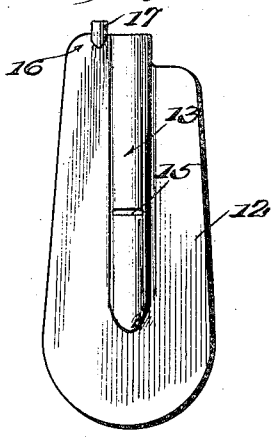
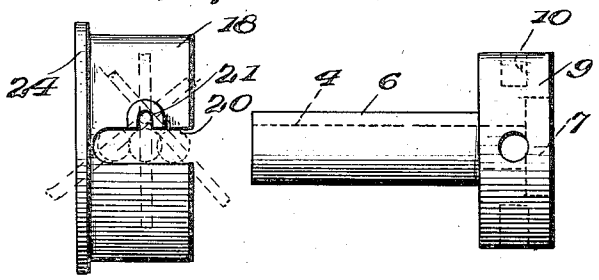


Fig. 5.



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Patented Apr. 8, 1924. 1,489,841

UNITED STATES PATENT OFFICE.

GEORGE STANLEY MacDONALD, OF PORTLAND, OREGON.

VARIABLE-PITCH FAN.

Application filed October 2, 1922. Serial No. 591,981.

To all whom it may concern:

Be it known that I, GEORGE STANLEY MacDONALD, a citizen of the United States, residing at Portland, in the county of Multnomah, State of Oregon, have invented certain new and useful Improvements in Variable-Pitch Fans, of which the following is a specification.

My invention relates generally to fans, more particularly to fans which are adapted to be associated with the cooling systems of internal combustion engines of automotive vehicles, and it consists in the combination, constructions and arrangements of parts hereinafter described and claimed.

An object of my invention is to provide a fan of the character described in which the pitch or angle of inclination of the blades may be varied at will to vary the volume of air displaced by the rotating fan, and if desired, to reverse the direction of air currents produced by the operation of the fan.

A further object of the invention is to provide a fan of the character described which embodies means operable while the fan is in operation and at a distance remote therefrom to vary the pitch of the fan blades as desired.

Other objects and advantages will be apparent from the following description and the novel features of the invention will be particularly outlined in the appended claims.

My invention is illustrated in the accompanying drawings forming a part of this application, in which:

Figure 1 is a view showing more or less diagrammatically an internal combustion engine and an embodiment of the invention associated therewith,

Figure 2 is a relatively enlarged side elevation of a fan embodying the invention, certain parts of the blade-adjusting mechanism comprised therein being omitted,

Figure 3 is an end view of the mechanism exhibited in Fig. 2,

Figure 4 is a fragmentary sectional view of a portion of the fan, the section being taken through the hub thereof,

Figure 5 is a detail view showing the fan hub and blade-adjusting sleeve comprised in the device in separated position, and

Figure 6 is a view showing one of the blades of the device in detached position.

As is well known, it is desirable to vary the volume of air displaced by a rotating fan associated with the internal combustion engine of an automobile to meet varying weather and operating conditions. In the winter, when the atmospheric temperature is low, it is desirable to permit very little air to pass through the radiator of the automobile into contact with the cylinders of the engine and in fact it may be of advantage to reverse the direction of the usual currents of air and to draw relatively warm air from the space surrounding the hot cylinders of the engine and to discharge such air into the radiator, thereby preventing the temperature of the cool fluid passing through the radiator to be unduly lowered. Again, it is of importance that the volume of air displaced by the rotating fan be decreased at the time the engine is being started for the reason that the engine and the fan are placed in operation co-incidentally, and as a result, the engine must run a relatively great length of time before the cylinder walls are heated sufficiently to permit efficient operation of the engine when any considerable volume of cold air is drawn in through the radiator at the time the engine is started.

My improved fan provides facilities for varying the volume of air displaced by the rotating fan as desired and for reversing the direction of the current of air produced by the operation of the fan so that air may be drawn inwardly through the radiator and discharged upon the engine block or drawn from the space surrounding the engine block and discharged into the radiator at will.

In carrying out my invention I make use of a supporting bracket arm 1, which is secured upon an engine block 2 in any suitable known manner or may be integral with the latter. The bracket arm 1 is shown as being vertically disposed and is provided adjacent to its upper end with a boss having a horizontal opening 3 formed therein, through which extends a fan shaft 4 which is removable but is normally held against displacement from the opening 3 through the agency of a nut 5 in threaded engagement with one end of the shaft. A hub 6 is rotatably mounted on the shaft 4 and is prevented from moving longitudinally of the shaft in one direction by the bracket 1, and in the opposite direction by an enlarged portion 7 at the outer end of the shaft, which enlarged portion is received within a counterbore 8 in the proximate face of a head 9 which is formed integrally with the hub 6.

The head 9 has a plurality of radial sock-

ets 10 formed in the periphery thereof in spaced-apart relation. A spindle or arm 11 of circular form in cross sectional contour is arranged with its inner end portion secured in each socket 10 and extends radially from the head 9.

Each of the spindles or arms 11 provides a journal for a fan blade 12, there being four of the spindles or arms and four fan blades in the embodiment of the invention illustrated. As shown each fan blade comprises a substantially flat body having the opposite faces thereof lying in substantially parallel planes and being formed with a longitudinal bearing or socket portion 13 extending from the inner end thereof along the longitudinal median line of the blade. The socket portions 13 receive the respective spindles or arms 11, and are rotatable thereon, being held against axial movement relative to the spindles or arms because of the engagement of set screws 14 or the like working in transverse slots 15 formed through the walls of the socket portions. Each of the fan blades 12 has an extension 16 at its inner end provided with an inwardly extending stud or pin projection 17 as clearly shown in Figures 3 and 6. The purpose of the pin projection 17 will be hereinafter more fully pointed out.

The means provided by my invention for rotating or shifting the blades 12 about the axes of the spindles or arms 11 to vary the pitch thereof includes a substantially cup-shaped adjusting sleeve 18 having a bottom or end portion 19 slidably and rotatably mounted upon the hub 6 and having a cylindrical portion slidably overlapping the adjacent end portion of the head 9. Longitudinal slots 20 are provided in the cylindrical portion of the cup-shaped adjusting member 18 and are adapted to permit of the passage of the spindles or radial arms 11 therein as the adjusting sleeve 18 is moved longitudinally of the hub 6 and of the head 9. It will be understood that the number and arrangement of the slots 20 correspond to the number and arrangement of the radial spindles or arms 11. Each of the slots 20 has a length considerably greater than the diameter of the spindle or arm 11 associated therewith so that a relatively great longitudinal movement of the adjusting sleeve 18 is permitted without the slots 20 disengaging the spindles or arms 11 and without further longitudinal movement of the adjusting member 18 being prevented because of contact of the spindles or arms 11 with the inner ends of the slots. In actual practice, the adjusting sleeve 18 is adjusted initially so that the spindles or arms 11 will always be in engagement with the slots 20 and in consequence the adjusting sleeve 18 is locked to the head 9 to rotate with the latter although being freely movable in the direction of its length and being capable of slight rotative movement independent of the head. Extending laterally from each of the slots 20 in the peripheral walls of the cylindrical portion of the adjusting sleeve is a notch or slot 21 in which one of the inwardly extending stud or pin projections 17 is received. Since each of the inwardly extending pins 17 is merged into the body of the fan blade at a point midway between the longitudinal axis of the fan blade and one side edge thereof, it will be obvious that longitudinal movement of the adjusting sleeve 18 will occasion rotation of the fan blades 12 about the axes of the respective spindles or radial arms 11 and the pitch or angle of inclination of such blades to a plane intersecting at right angles the axis of the fan shaft 4 may be varied as desired by shifting the adjusting sleeve 18 longitudinally of the fan hub.

It is desirable that means operable at a point remote from the fan shall be provided to shift the adjusting sleeve 18 as desired. Such a means includes a ring 22 having an annular groove 23 in its inner periphery in which an annular rib 24 on the cylindrical portion of the adjusting sleeve 18 is loosely received. A yoke 25 has a pair of forks or branches partially encircling the ring 22 and being pivotally attached at their extremities to the latter, as at 26. The yoke 25 also includes a stem portion 27 extending at right angles to the branches of the yoke and being pivotally attached at its end remote from the branches, as at 28, to the outer end of a rocker arm 29 which is integral with or rigidly secured to the one end of a rock shaft 30. The latter is journaled in a horizontal bore or opening 31 formed through the bracket arm 1 adjacent to the upper end of the latter. The rock shaft 30 is also provided with a rocker arm 32 extending radially thereof in a plane oblique to the plane of the first rocker arm and being pivotally attached at its outer end to a link 33 at one end of the latter. The other end of the link 33 is pivotally connected to a hand-lever 34 intermediately of the ends thereof, the hand-lever being fulcrumed at its lower end upon a sector plate 35 which is positioned at a distance remote from the fan and may be secured upon the dash or instrument board of an automobile with which the same is equipped. The sector plate 35 is provided with notches or teeth 36 adapted to be engaged by a spring-pressed pawl or latch 37 carried by the hand-lever 34 so that the hand-lever may be set in various positions to hold the fan blades 12 with the pitch thereof adjusted as desired. The hub 6 may be driven in any suitable known manner, as by means of a torque transmitted thereto through the agency of a pulley 38 secured upon the hub and a belt 39 trained about the

pulley and a rotating part, not shown, of the engine.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood.

In cold weather the fan blades are adjusted to displace but little if any air or in extremely cold weather the fan blades may be adjusted to draw air from the engine and to discharge the air into the radiator, as hereinbefore stated. It will be apparent that movement of the hand lever 34 about its fulcrum will occasion longitudinal movement of the adjusting sleeve 18 and that the pitch of the fan blades may be adjusted as desired by operation of the hand lever. This adjustment may be effected while the fan is in operation since the adjusting sleeve 18 and the hub of the fan, including the head 9, turn as a unit while the ring 22 is held stationary. During the longitudinal movement of the adjusting sleeve 18, the latter may turn about the axis of the hub a distance sufficient to prevent binding of the stud projections 17 and the walls of the notches or slots 21.

The device is relatively simple in structure and can be readily operated to carry out the purpose for which provided; namely, to maintain a uniform temperature adjacent to the working parts of internal combustion engines. It, of course, will be understood that the application of the fan is not limited to association with an internal combustion engine but is capable of general use in heating, cooling and ventilation.

The socket portions 13 of the respective fan blades are of relatively great lengths, and a bearing surface of relatively large area is thus provided, thereby precluding wear on the relatively moving surfaces of the blades and supporting spindles and thus rendering a fan embodying the invention durable.

Obviously, my invention is susceptible of embodiment in forms other than that which is illustrated in the accompanying drawings, and I, therefore, consider as my own all modifications and adaptations thereof which fairly fall within the scope of the appended claims.

I claim:—

1. A fan comprising a rotatably supported hub, a plurality of radial blades supported on said hub, each of said blades being revoluble about an axis lying in a plane intersecting the axis of said hub and each of said blades having a projection extending inwardly from its inner end, said projections being located at one side of the longitudinal axes of the respective blades, a sleeve loosely mounted on said hub and being provided with a slot for each projection, the respective projections extending into said slots, and a lever and link arrangement attached to said sleeve and operable at a distance remote from the latter for sliding said sleeve longitudinally of the hub to effect rotation of the said blades about their respective axes.

2. A fan comprising a rotatably supported hub, a plurality of spaced-apart radial spindles carried by said hub, a plurality of blades each having an axially extending socket portion receiving one of said spindles, there being a blade for each spindle, each of said blades having at its inner end an extension located off-center and provided with a projection at its inner end, a sleeve slidably disposed on said hub and having slots in the one end thereof embracing said spindles, said sleeve having other slots extending laterally of the first named slots and receiving said projections, and means for sliding the sleeve longitudinally of the hub to rotate the blades.

3. A fan comprising a rotatably supported hub, a plurality of spaced-apart radial spindles carried by said hub, a plurality of blades each having an axially extending socket portion receiving one of said spindles, there being a blade for each spindle, each of said blades having at its inner end an extension located off-center and provided with a projection at its inner end, a sleeve slidably disposed on said hub and having slots in the one end thereof embracing said spindles, said sleeve having other slots extending laterally of the first named slots and receiving said projections, a ring rotatably supported on said sleeve, a yoke having branches pivotally attached to said ring at diametrically opposite points, said yoke having a stem extending substantially at right angles to the plane of said branches, a rock shaft rotatably supported adjacent to said hub and having the axis thereof disposed parallel to the plane of said branches, a rocker arm carried by said rock shaft and being pivotally attached at its outer end to the end of said yoke stem, and means operable to rock said rock shaft to effect longitudinal movement of said sleeve on said hub.

GEORGE STANLEY MacDONALD.