United States Patent [19]

Walter et al.

[11] **3,792,697**

[45] **Feb. 19, 1974**

[54] **COOLING FANS FOR LIQUID-COOLED INTERNAL COMBUSTION ENGINES**

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[22] Filed: **Apr. 17, 1972**

[21] Appl. No.: **244,632**

[30] **Foreign Application Priority Data**

July 31, 1971 Great Britain.....36117/71

[52] **U.S. Cl.**..... **123/41.12**, 123/41.46, 192/82 T, 192/89 B, 192/96, 192/109 A, 236/35, 416/39

[51] **Int. Cl.**..... **F01p 7/08**

[58] **Field of Search**..... 123/41.12, 41.46; 192/82 T, 192/89 B, 96, 109 A; 236/35; 416/39, 169

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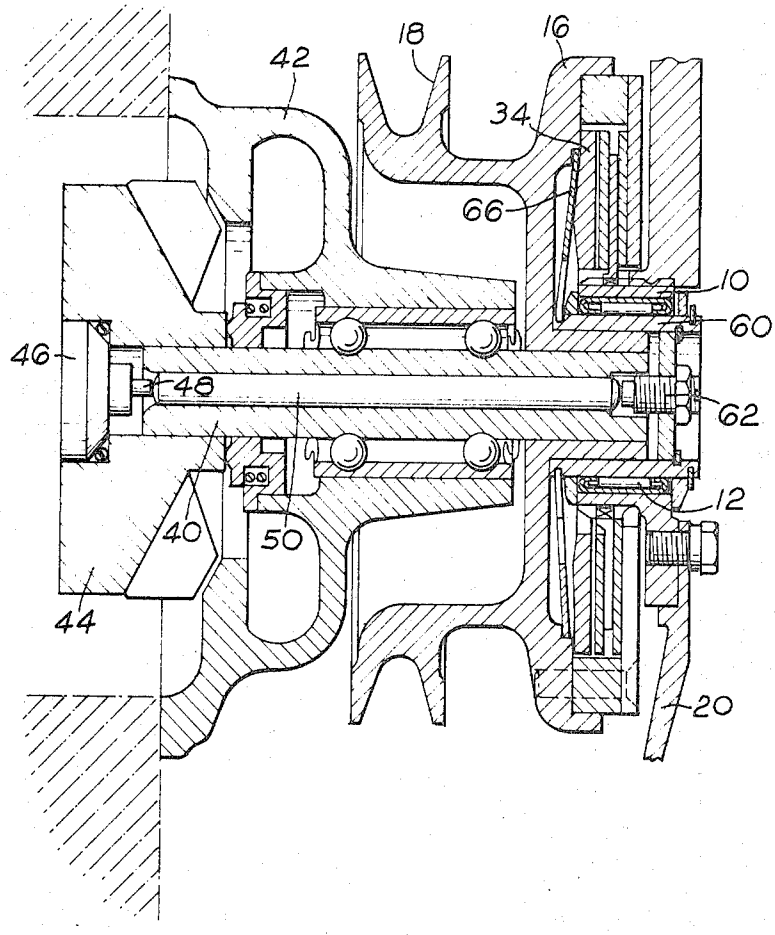
[57] **ABSTRACT**

A hollow drive spindle fast with a pulley is drivingly connected to a pump impeller, and a fan assembly is mounted for rotation with respect to said pulley and said drive spindle. Friction clutch means comprising clutch plates respectively drivingly connected to the fan assembly and to the pulley is provided with a pressure plate operable to frictionally engage said clutch plates and thereby drivingly connect the pulley and the fan assemply. A wax cell thermostat is mounted in the pump impeller for exposure to coolant fluid, and a rod slidably received in said hollow drive spindle is axially moved therein by expansion and contraction of the thermostat. A part fast with said pulley has a diametral bore, and a diametrally extending member is loosely received in said bore and is engageable with said pressure plate. Said rod is engageable with said member, in response to expansion of said thermostat, to displace said member axially and thereby displace the pressure plate to operate the clutch means.

2 Claims, 4 Drawing Figures



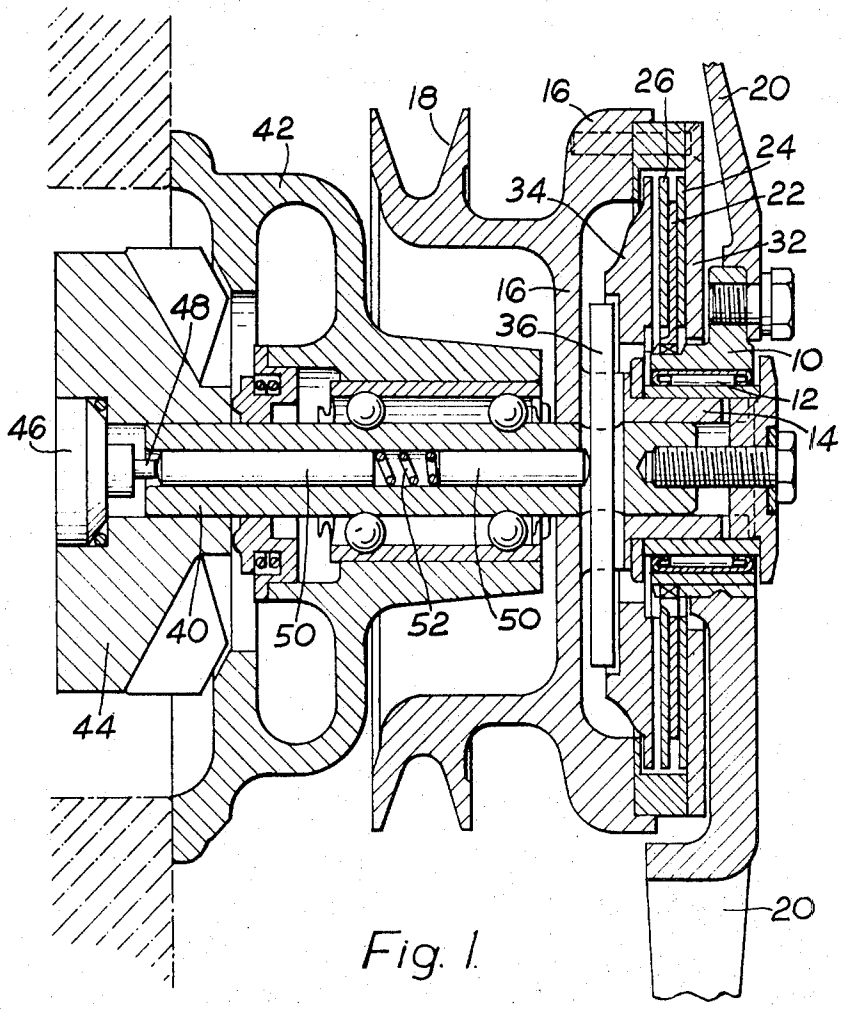


Fig. 1.

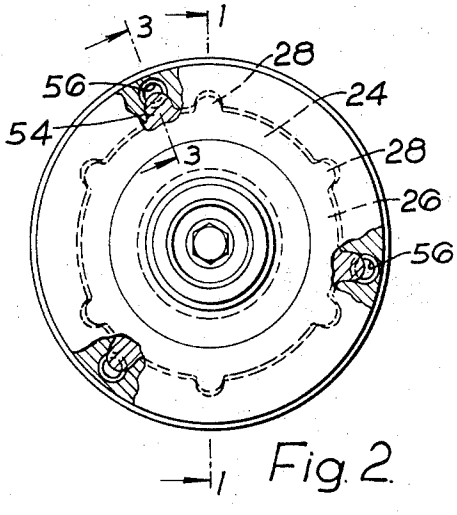


Fig. 2.

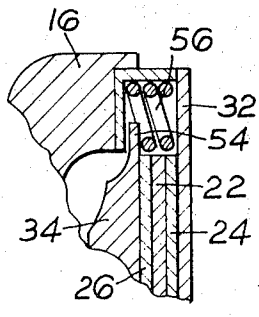


Fig. 3.

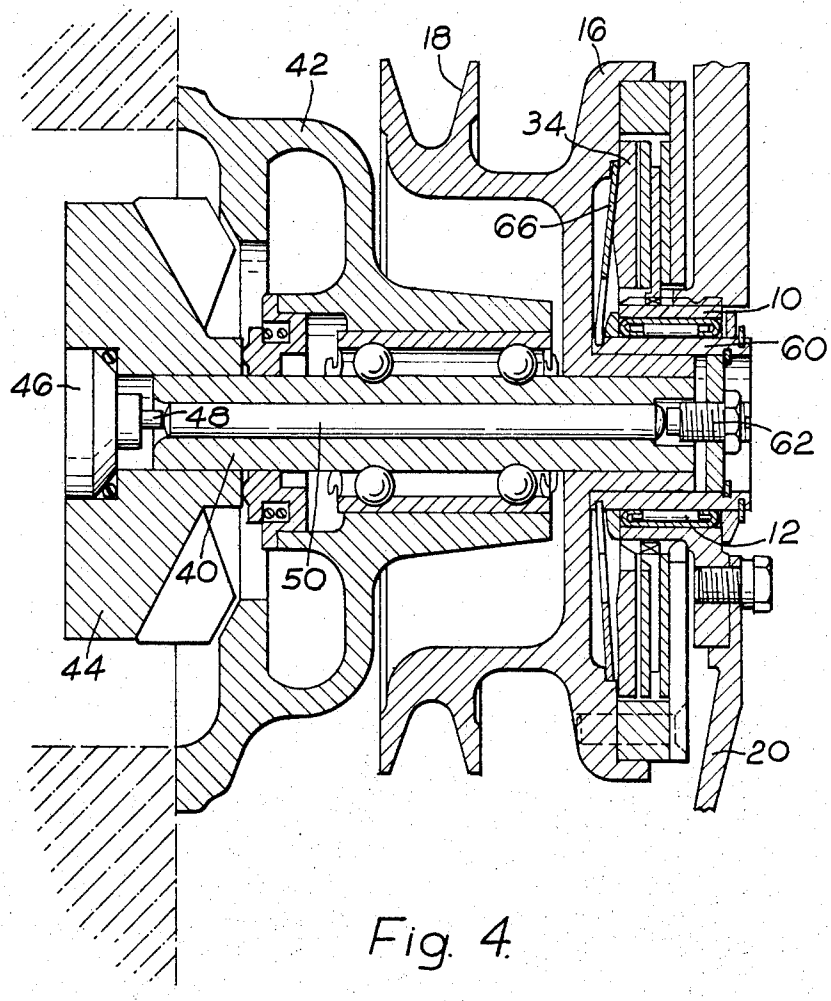


Fig. 4

COOLING FANS FOR LIQUID-COOLED INTERNAL COMBUSTION ENGINES

BACKGROUND OF THE INVENTION

This invention relates to cooling fans for liquid-cooled internal combustion engines particularly of the kind in which coolant is circulated through a heat-exchanger matrix and air flow through that matrix is aided by the fan.

It is well known that at times when the engine is below operating temperature, the fan is unnecessary or even undesirable because it slows down the rise to operating temperature, delays effectiveness of any coolant heated vehicle interior heater, and absorbs power. Various proposals to render the fan effective only when necessitated by rising temperatures, have been put forward. The object of the invention is to provide an improved device for this purpose.

SUMMARY OF THE INVENTION

In accordance with the invention, a cooling fan for an internal combustion engine comprises a member supporting a set of fan blades and mounted adjacent a drive transmitting pulley or the like, a pump impeller mounted on a drive spindle fixed to said pulley or the like, a wax cell thermostat mounted in said impeller and exposed for heat transmission from coolant flowing about said impeller, and a rod slidable in the said spindle and adapted to be displaced axially by thermostat action, said rod being connected to the fan blades and actuating a clutch to transmit drive thereto from the pulley or the like, so that said fan is effective only when the rod is displaced by the thermostat.

Preferably the fan comprises fixed pitch blades mounted on a hub journalled relative to the pulley or the like, and a friction clutch is interposed, comprising a stack of plates which are held together in drive transmitting relation by the displaced rod, and spring released therefrom on cooling of the thermostat and on axial return of the rod.

Wax-cell thermostats are well known per se and comprise a capsule, which in use in the present invention will be secured in position in a waterway e.g. in the water pump impeller end face, and a stem which is displaced axially by the cell as ambient temperature rises. Such cells may be relatively sensitive over relatively narrow ranges, and operate on the increase in volume of the cell contents (usually a wax) when a phase change from solid to liquid of the wax occurs. Hence the stem is displaced at or about the melting point or melting zone of the was.

Where the cell is such as to provide a stem displacement over a temperature range which is not precisely that required, lost motion means may be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional of the first embodiment, taken on the line 1—1 of FIG. 2;

FIG. 2 is a front elevation, with parts omitted, and parts broken away, and on a smaller scale;

FIG. 3 is a fragmentary section taken on the line 3—3 of FIG. 2; and

FIG. 4 is a view generally similar to FIG. 1, but of a second embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the first embodiment, the fan hub **10** is journalled by needle rollers **12** on a drive hub **14** which itself forms part of a drive member **16** including a pulley **18** or sprocket by which drive is transmitted to the drive hub and can also be transmitted to the fan. A clutch is effective between the fan hub and the pulley or the like. Hence when the clutch is disconnected the drive hub may rotate with the pulley and the fan idle, or the fan may windmill under air pressure, but without absorbing power in its rotation. Portions of two fan blades are shown at **20**, these being fixed to hub **10**.

The clutch comprises a driven plate **22** keyed or splined to the fan hub and loosely sandwiched between a pair of friction plates **24, 26** which may be truly annular or have peripheral lugs engaged in axially extending slots in a ring fast with the puelly or the like so as to be rotatable with the pulley or the like at all times. FIG. **2** shows these plates and their lugs **28**.

On one side of the stack of plates is an annulus **32**, bolted at its rim to the pulley or the like and forming an abutment for the plates stack. On the other side of the plates stack is a clutch pressure plate **34**, also annular in form, which when displaced may hold the stack lightly together and against the annulus to transmit drive to the fan hub.

Located between the clutch pressure plate **34** and the drive member **16**, and extending through a diametric bore in the drive hub is a cross member **36**.

Fixed to the pulley or the like is a drive spindle **40**, which is journalled in a casing **42**, and carries at the end opposite to the drive hub, with which it is co-axial, a water pump impeller **44**. In the face of the impeller exposed to coolant water (or the like) is the thermostat cell **46**, and the stem **48** of the latter projects within a co-axial bore in the drive spindle. In said bore is a rod **50**, made in two parts separated by a coil spring **52**. The stem **48** abuts the rod, and the rod abuts the cross-member, so that expansion of the cell contents displaces the rod to apply pressure to the plates stack.

In order to ensure disconnection of drive on cooling, the pressure plate **34** has a number of peripheral lugs **54** which engage throw-off springs **56** trapped between those lugs and annulus **32**. These springs are compressed during drive transmission, and extend when thermostat pressure is relaxed, to release the plates stack from pressure.

In the second embodiment, FIG. **4**, the arrangement is generally similar save for the rod **50** being in one piece, and the fan hub is journalled on an intermediate collar **60** which is axially slidable on the drive hub. The collar incorporates a central screw **62** which is adjustable towards or away from the rod, so as to enable the temperature at which clutch drive begins, to be adjusted to suit requirements, the space between screw and rod (in the extreme position) constituting lost motion before operation.

Further a dished diaphragm or Bell Ville type spring **66** is engaged at its inner periphery with the intermediate member **60** and contacts the pressure plate **34** at its outer periphery, and hence when rod movement (axially) under cell expansion takes the rod and screw into abutment, continued axial movement displaces the spring centre and pressurises the plate stack. This diaphragm spring serves to return the assembly when cool-

ing occurs, the the separate throw-off springs are eliminated.

We claim:

1. A cooling fan and water pump assembly for an internal combustion engine comprising a drive pulley, a hollow drive spindle fast with said pulley and drivingly connected to a pump impeller, a fan assembly mounted for rotation with respect to said pulley and said drive spindle, friction clutch means comprising clutch plates respectively drivingly connected to the fan assembly and to the pulley and a pressure plate operable to frictionally engage said clutch plates and thereby drivingly connect the pulley and the fan assembly, a wax cell thermostat mounted in the pump impeller for exposure to coolant fluid, and a rod slidably received in said hollow drive spindle, which is axially moved therein by expansion and contraction of the thermostat, wherein the improvement comprises a collar which is slidably mounted on a hub that is fast with the drive pulley, an annular diaphragm spring which is carried by said collar and is engageable with said pressure plate, and an axially adjustable element which is carried by said collar, said rod being engageable with said element, in response to expansion of said thermostat, to displace said collar axially and thereby displace the pressure plate to operate the clutch means.

2. An assembly according to claim 1 wherein the diaphragm spring resiliently opposes displacement of said rod, in response to expansion of said thermostat, when the rod and said element are in engagement.

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