

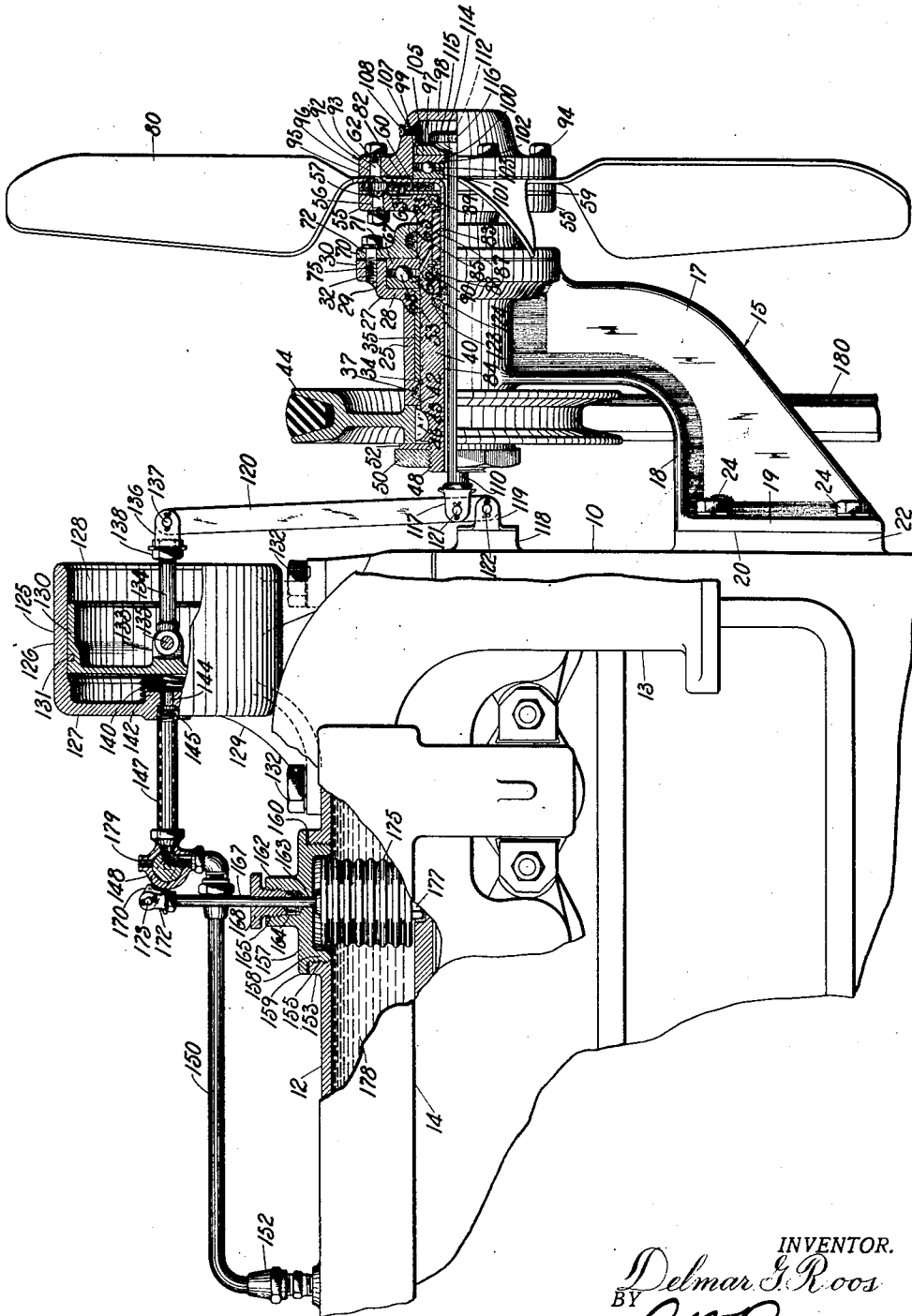
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This invention relates to improvements in cooling fans for internal combustion engines, and has for its principal object the provision of mechanism for disconnecting the fan from its power drive whenever the action of the fan is not required for proper cooling of the engine.

A further object lies in the provision of mechanism for positively connecting the fan to its power drive whenever the temperature of the engine is above a predetermined limit.

A still further object lies in the provision of vacuum actuated means for connecting the fan with and disconnecting it from its power drive.

It is also an object to provide sensitive thermostatic means directly subject to engine temperature for controlling said vacuum actuated means.

An additional object lies in the provision of mechanism of the character described which is simple and economical to manufacture, easy to install and which will not readily get out of order in use.

Other objects and advantages will appear as the description proceeds.

In the accompanying drawing in which like reference numerals are used to indicate similar parts throughout, I have illustrated a satisfactory mechanical embodiment of the idea of the invention. The drawing, however, is for the purpose of illustration only and is not to be considered as limiting the invention, the scope of which is to be measured entirely by the scope of the sub-joined claims.

In the accompanying drawing forming a part of this specification, the single figure illustrates a fragmentary portion of an internal combustion engine having a cooling fan mounted thereon and my improved mechanism for connecting the fan with and disconnecting it from its power source according to the cooling requirement of the engine, certain parts of the engine and of the improved mechanism being broken away to better illustrate the construction thereof.

Referring to the drawing in detail, the numeral 10 indicates the cylinder block of an internal combustion engine upon which are mounted a cylinder head 12, an exhaust manifold 13, an intake manifold 14 and a fan bracket 15.

The fan bracket 15 as illustrated is an angularly bent member of substantially T cross section having a web portion 17 and a flange portion 18 along one edge of the web portion and a pair of flanges, one of which is indicated at 19, along one end of the web portion 17. The flanges 19 provide a mounting surface by means of which the fan bracket is secured against the vertical

wall 20 of an extension 22 formed on the cylinder block 10 by means of the stud bolts 24.

At the upper end thereof the fan bracket 15 terminates in a cylindrical journal member 25 having an enlarged annular portion 27 upon one end thereof. This annular portion 27 is formed by a radially extending flange 28 and an annular flange 29 joined to the radial flange around the periphery thereof. The annular flange 29 is provided upon the exterior thereof with a radially extending annular portion 30 provided with spaced screw-threaded apertures, one of which is indicated at 32 for a purpose to be later described. The tubular journal portion 25 is provided interiorly thereof with an annular shoulder 34 and a bearing bushing 35 is firmly secured in the journal and extends from the shoulder 34 to the interior wall of the radial flange 28. Between the annular shoulder 34 and the adjacent end of the journal portion, I have provided an annular groove 37 adapted to contain packing material to provide an oil seal between that end of the journal member and a member 40 rotatably mounted in the journal member. The member 40 as illustrated is a tubular shaft provided at one end thereof with a bearing portion 42 upon which is mounted a fan belt pulley 44 and a keyway 45 adapted to receive a key 46 to secure the fan belt pulley 44 against rotation upon the shaft 40. Beyond the bearing portion 42 the shaft is provided with screw threads 48 upon which is threaded a nut 50 to secure the fan belt pulley 44 against axial movement upon the shaft 40. A thrust washer 52 is interposed between the nut 50 and the adjacent surface of the fan belt pulley 44. Intermediate its length the shaft 40 is provided around the exterior thereof with oil grooves indicated at 53 which cooperate with the bushings 35 to provide a substantially anti-friction bearing for the shaft. At the end thereof opposite the screw threads 48, the shaft 40 is provided with a radially extending flange 55 provided with apertures, one of which is indicated at 56. Headed screws as indicated at 57 extend through the apertures 56 and secure a washer-shaped plate or disc 59 against the exterior surface of the flange 55. A washer-shaped piece of friction material 60 is secured to the plate 59 by means of rivets 62 and is held by means of the plate and the screws 57 in fixed relation against the outer surface of the flange 55. It will be observed that the flange 55 may be provided with apertures as indicated at 63 to accommodate the inner ends of the rivets 62.

An annular shoulder 65 is provided in the outer

surface of the shaft 40 so located as to lie substantially in the plane of the enlarged end of the journal member 25. A thrust bearing comprising races 66 and 67 and balls 68 is located between this shoulder 65 and the adjacent surface of the radial flange 28. A member 70 comprising a flange portion 71 provided with spaced apertures 72 and an enlarged annular portion provided with a groove 73 is secured to the enlarged end of the bushing 35 by means of bolts 75 extending through the apertures 72 and screw-threaded into the apertures 32 provided in the annular extension 30 on the flange 29. Packing material is compressed in the groove 73 and forms an oil seal between the member 70 and the shaft 40. It will thus be seen that I have provided in connection with the journal 25 a pair of spaced oil seals 37 and 73 between which are located the bushing 35 and the thrust bearing including the races 66 and 67 and the balls 68.

From a further inspection of the drawing forming a part of this specification, it will be observed that the fan 80 is provided centrally thereof with a flat portion 82 of substantially the same circumference as the plate 59 and that centrally of the portion 82 the fan is provided with an axial sleeve 83 which in the assembled position of the device extends into the bore 84 provided in the tubular shaft 40. An offset 85 is provided in the bore 84 of the shaft 40 and a roller bearing 87 is positioned in this offset and interposed between the outer surface of the sleeve 83 and the interior of the tubular shaft 40. Oil seals 88 and 89 are positioned at each end respectively of the roller bearing 87 and oil channels as indicated at 90 are provided in the shaft 40 extending from the thrust bearing comprising the races 66 and 67 and balls 68, to the roller bearing 87.

A cap member generally indicated at 92 is mounted against the surface of the portion 82 of the fan 80 on the side thereof opposite the sleeve 83 and is secured thereto by means of the headed screws 93 and nuts 94. This cap member 92 comprises an exterior flange portion 95 provided with spaced apertures 96 for the screws 93, and a central aperture or well 97 closed by an end wall 98. The annular wall of the well 97 is provided with an annular shoulder 99 and between this shoulder and the adjacent surface of the portion 82 of the fan 80 there is located a thrust bearing 100 comprising races 101 and 102 and balls 103, and a thrust washer 105 located on the opposite side of the thrust bearing 100 from the portion 82 of the fan. A lubricating aperture 107 is provided in the cap 92 communicating with the well 97 and this aperture is normally closed by a screw-threaded plug 108.

A rod 110 extends through the bore 84 of the shaft 40 and is provided within the well 97 in the cap 92 with a screw-threaded end 112 upon which is threaded a nut 114 provided with a rounded surface 115 adapted to bear against a corresponding rounded surface provided in the thrust washer 105. Suitable means such as a pin 116 are provided to prevent rotation of the nut 114 upon the rod 110. The end of the rod 110 adjacent to the engine, when the rod is mounted in assembled relation, is provided with an apertured clevis 117. A bracket 118 provided with an apertured clevis 119 is rigidly mounted upon the forward portion of the cylinder block 10 immediately below the clevis 117. A lever member 120 is so mounted that its lower end passes through the apertured clevises 117 and 119 and the lower end of this lever member 120 is opera-

tively connected with the clevises by means of pins 121 and 122 respectively.

An annular groove 123 is provided in the bore of the shaft 40 and this groove is provided with packing material 124 to provide an oil seal between the shaft 40 and the rod 110.

A cup-shaped casting generally indicated at 125 having an annular portion 126 and a closed end portion 127 and an open end 128 directed toward the fan 80 is mounted upon the top of the cylinder head 12 by means of an integral stand or bracket 129 and stud bolts 132. Slidably mounted in the cup-shaped cylinder 125 is a piston 130 with a sealing ring 131 and a pair of spaced, apertured, centrally located ears indicated at 133. The ears 133 are connected to the upper ends of the lever member 120 by means of a connecting rod 134, a pin 135 extending through an aperture provided in the end of the rod and through the apertured ears 133, a clevis 136 operatively connected to the upper end of the lever member 120 by the pin 137 and an adjustable connection 138 between the clevis 136 and the connecting rod 134. A coiled compression spring 140 is disposed between the piston and the inner surface of the closed end 127 of the cup-shaped cylinder 125 and surrounds a boss 142 provided on the inner surface of the end 127. An aperture 144 is provided through the center of the boss 142 and the outer end of this aperture is provided with internal screw threads as indicated at 145. A tube 147 is screw-threaded into the end of the aperture 144 and extends to a three-way valve 148. A second tube 150 extends from the valve 148 to a connection 152 by means of which the tube is pneumatically connected with the interior of the intake manifold 14. An upwardly extending boss 153 is provided on the top of the cylinder head surrounding an aperture provided with screw threads 155. A cap member 157 closes the aperture and has a downwardly extending flange 158 provided with screw threads which correspond with the screw threads 155 and with a radially extending flange 159 between which and the upper surface of the boss 153 there is positioned a gasket 160. The cap 157 is provided centrally thereof with an upstanding boss 162 through which extends an aperture 163 provided with an enlarged portion 164 and a screw-threaded portion 165. A rod 167 extends through the aperture 163, packing material is disposed in the enlarged portion 164 of the aperture and a gland nut 168 is screw-threaded into the screw-threaded portion 165 of the aperture to compress the packing material about the rod 167 to provide a water-tight packing between the rod and the cap 157.

The three-way valve 148 is provided with an actuating lever 170 and the rod 167 is operatively connected to the free end of the operating lever 170 by means of an apertured clevis 172 and a pin 173. The lower end of the rod 167 is rigidly secured to the upper end of a bellows-type thermostat 175, the lower end of which is rigidly secured to the bottom of the cylinder head 12 by a suitable means such as the screw-threaded plug indicated at 177. The thermostat 175 is substantially totally submerged in the body of water 178 contained in the hollow cylinder head and is therefore sensitive to changes in the operating temperature of the internal combustion engine.

The operation of the device is substantially as follows:

When the engine is cold the thermostat 175 will be contracted, thereby pulling the rod 167

downwardly through the aperture 163 and moving the actuating lever 170 of the valve 148 to a position to connect the tube 147 with the vent 179 which connects the interior of the cylinder 125 with the atmosphere. In this condition the spring 140 will force the piston 130 outwardly relative to the cylinder 125 thereby moving the lever member 120 in a direction to cause the rod 110 to move axially forwardly through the bore 84 of the shaft 40 to relieve any operating pressure between the portion 82 of the fan and the friction material 60. If the engine operates at a temperature at which the thermostat 175 remains contracted, the fan belt 180 will drive the fan belt pulley 44 and the shaft 40, but the friction material 60 will rotate relative to the fan and there will be no rotation of the fan.

As the temperature of the engine increases the thermostat 175 will expand, moving the rod 167 and the lever 170 until at a predetermined engine temperature the valve 148 assumes the position illustrated in the accompanying drawing at which time the tube 147 is connected by the tube 150 to the interior of the intake manifold 14. The intake manifold vacuum will then be applied to the piston 130 drawing it inwardly relative to the cylinder 125 against the pressure of the spring 140. This action of the piston 130 through its connection by means of the connecting rod 134 with the upper end of the lever member 120 will move the lever member 120 in a direction to move the rod 110 rearwardly through the bore 84 of the shaft 40. This rearward motion of the rod 110 will move the nut 114 to place pressure upon the thrust washer 105 and the thrust bearing 102. This pressure will be exerted against the portion 82 of the fan 80 and cause this portion 82 to bear against the adjacent surface of the friction material 60. As the shaft 40 and friction material 60 is being rotated by the fan belt 180 and fan belt pulley 44, a friction drive will be set up between the fan and friction material which will tend to rotate the fan and force a stream of air through the cooling mechanism of the internal combustion engine.

The device is effective to release the fan from its power drive whenever the temperature of the engine is sufficiently low so that the cooling action of the fan is not necessary. This condition will occur in cold weather and the action of the mechanism in releasing the fan drive will materially aid in a quick warming up of the engine after starting, and will also greatly reduce the tendency of the cooling water to freeze in the cooling system of the engine. The fan will also be released from its power drive at high vehicle speed when the speed of the vehicle causes a sufficient volume of air to flow through the cooling system of the engine without the assistance of the fan. Under these conditions a considerable percentage of the engine power will be released from driving the fan and converted to a higher top speed for the vehicle. The use of vacuum actuated mechanisms to control the fan clutch as illustrated and described in this invention does not place any drain upon the battery or electrical system of the vehicle and does not reduce the power of the engine, and at the same time is quick, silent and positive in operation.

While I have illustrated and described a particular mechanical embodiment of the idea of the invention, it is to be understood that such changes in the size, shape and arrangement of parts may be made as come within the scope of the subjoined claims.

Having now described my invention so that others skilled in the art may clearly understand the same, what I desire to secure by Letters Patent is as follows.

What I claim:

1. In combination with an internal combustion engine, a cooling fan therefor, and a power drive for said fan, thermostatically controlled vacuum actuated means for releasing said fan from its power drive whenever the action of the fan is not necessary for the proper cooling of the engine and for connecting said fan with its power drive whenever the temperature of the engine is above a predetermined limit.

2. In combination with an internal combustion engine, a cooling fan therefor, and a power drive for said fan, a clutch between said fan and its power drive, and thermostatically controlled vacuum actuated means for actuating said clutch to release said fan from its power drive whenever the action of the fan is not necessary to the proper cooling of the engine and to connect said fan with its power drive whenever the temperature of the engine is above a predetermined limit.

3. In combination with an internal combustion engine, a cooling fan therefor, and a power drive for said fan, a friction clutch between said fan and its power drive, and thermostatically controlled vacuum actuated means for actuating said clutch to release said fan from its power drive whenever the action of the fan is not necessary to the proper cooling of the engine and to connect said fan with its power drive whenever the temperature of the engine is above a predetermined limit.

4. In combination with an internal combustion engine, a cooling fan therefor, and a power drive for said fan, a clutch between said fan and its power drive, a vacuum cylinder mounted on said engine, a piston in said cylinder operatively connected with said clutch, a pneumatic connection between said cylinder and a vacuum containing element of said engine, and thermostatic means controlling the application of vacuum to said piston, whereby said piston will be rendered inoperative to actuate said clutch to connect said fan with its power drive whenever the temperature of said engine is below a predetermined limit.

5. In combination with an internal combustion engine, a cooling fan therefor, and a power drive for said fan, a clutch between said fan and its power drive, a vacuum cylinder mounted on said engine, a piston in said cylinder operatively connected with said clutch, a pneumatic connection between said cylinder and the intake manifold of said engine, a valve in said connection and a thermostat responsive to engine temperatures for actuating said valve to control the application of vacuum to said piston, whereby said piston will be rendered inoperative to actuate said clutch to connect said fan with its power drive when the temperature of said engine is below a predetermined limit.

6. In combination with an internal combustion engine, a cooling fan therefor, and a fan belt pulley, a fan bracket having a journal therein, a tubular fan shaft rotatably mounted in said journal, said fan belt pulley being non-rotatably mounted on said shaft and said fan being rotatably mounted thereon, a two-part clutch having one element secured to said fan shaft and the other element secured to said fan, a vacuum cylinder mounted on said engine, a piston in said cylinder movable therein in response to pressure

changes in said cylinder, and means extending through said tubular fan shaft operatively connected to said piston and said clutch whereby said clutch will drivingly connect said fan with
 5 said fan shaft and release said fan from said fan shaft in response to movements of said piston.

7. In combination with an internal combustion engine, a cooling fan therefor, and a fan belt pulley, a fan bracket having a journal therein,
 10 a tubular fan shaft rotatably mounted in said journal, said fan belt pulley being non-rotatably mounted on said shaft and said fan being rotatably mounted thereon, a two-part clutch having
 15 one element secured to said fan shaft and the other element secured to said fan, a vacuum cylinder mounted on said engine, a piston in said cylinder movable therein in response to pressure changes in said cylinder, and means extending
 20 through said tubular fan shaft operatively connected to said piston and said clutch whereby said clutch will drivingly connect said fan with said fan shaft and release said fan from said fan shaft in response to movements of said piston,
 25 and a thrust bearing between said fan shaft and said fan bracket to oppose the axial reaction of said clutch.

8. In combination with an internal combustion engine, a cooling fan therefor, and a fan belt pulley for driving said fan, a fan bracket, a tubular fan shaft rotatably mounted in said fan bracket, a clutch between said fan and said fan shaft, a rod operatively connected at one end to said clutch extending through said fan shaft, a vacuum cylinder mounted on said engine,
 35 a piston in said cylinder movable therein in response to changes in the pressure in said cylinder, and a pivoted lever member operatively

connecting said piston to the end of said rod opposite said clutch, whereby movement of said piston will actuate said clutch to provide a driving connection between said fan shaft and said fan.

9. In combination with an internal combustion engine, a cooling fan therefor, and a fan belt pulley for driving said fan, a fan bracket, a tubular fan shaft rotatably mounted in said bracket, a thrust bearing between said fan shaft and fan bracket, a journal bearing between said fan and said fan shaft, a clutch between said fan and said fan shaft, a clutch operating member extending through said fan shaft and a thrust bearing between said clutch operating member and said clutch for operating said clutch and restraining said fan against axial motion relative to said fan shaft.

10. In combination with an internal combustion engine, a cooling fan therefor, a fan belt pulley for driving said fan, and a body of cooling fluid surrounding certain parts of said engine, a fan bracket, a fan shaft rotatably mounted in said fan bracket driven by said fan belt pulley, a clutch between said fan and said fan shaft, a clutch actuating member, vacuum actuated means for operating said clutch actuating member, and a thermostat immersed in said body of cooling fluid operatively connected with said vacuum actuated means to control the application of vacuum thereto, whereby said clutch will be actuated to provide a driving connection between said fan and said fan shaft and to release said fan from its driving connection with said fan shaft in response to changes in the temperature of said body of cooling fluid.

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