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INTERNAL COMBUSTION ENGINE

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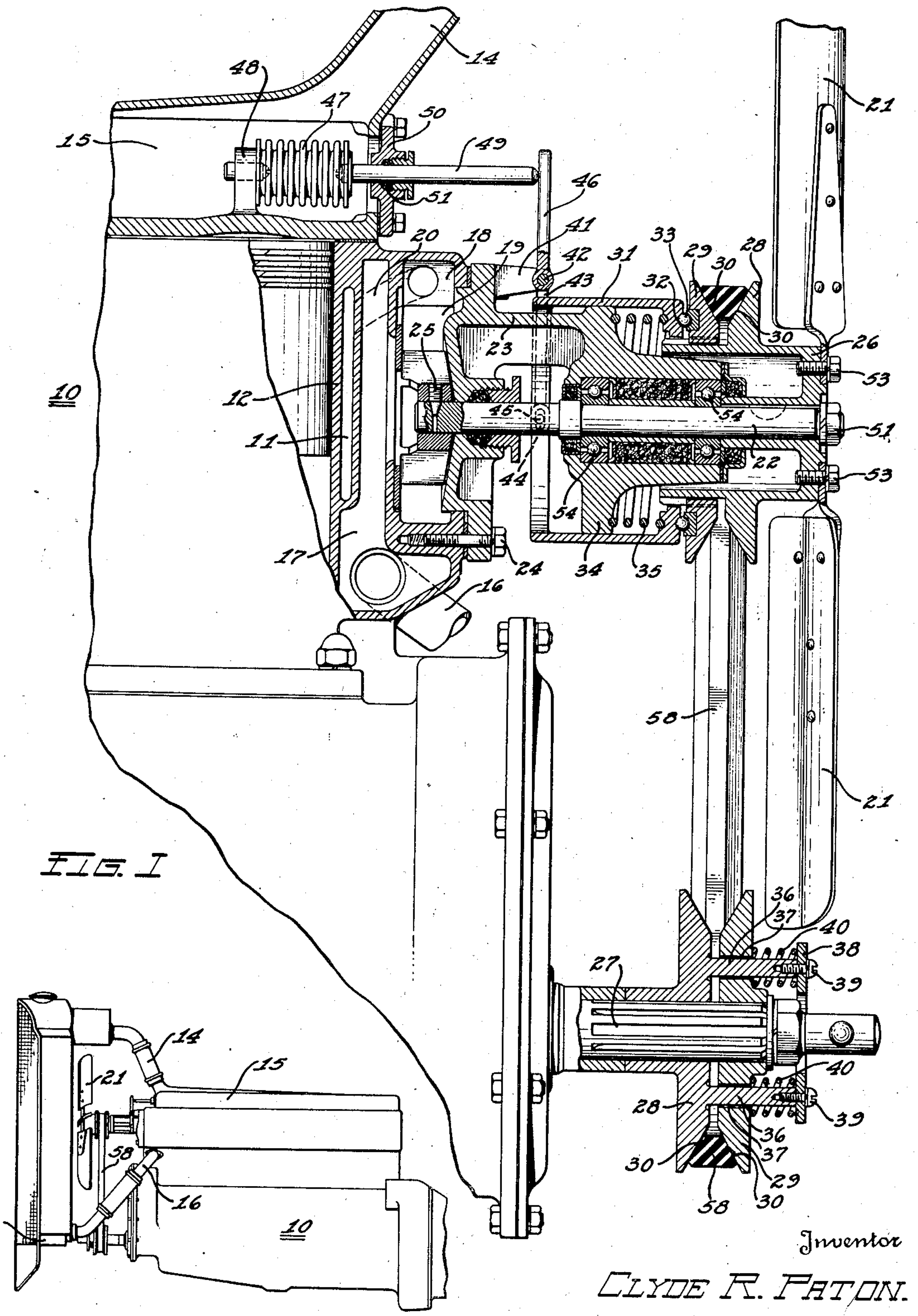

FIG. I

FIG. 2

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INTERNAL COMBUSTION ENGINE

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7 Claims. (Cl. 74—230.17)

This invention relates to cooling mechanism and more particularly to driving mechanism for internal combustion engine fans.

An object of the invention is to provide a new and novel automatically controlled fan mechanism for maintaining a substantially uniform engine temperature.

Another object of the invention is to provide mechanism for driving a fan at a speed varying in accordance with engine temperature.

A further object of the invention is to provide driving mechanism for a fan which is thermostatically controlled in order to regulate the speed of operation.

Still another object of the invention is to provide a driving mechanism in which the diameter ratio of a pair of pulleys, connected by a belt, is automatically varied to change the speed of rotation.

Other objects of the invention will appear from the following description taken in connection with the drawing, which forms a part of this specification, and in which:

Fig. 1 illustrates a fragmentary portion of an engine and a cooling system, partly in section and partly in elevation, illustrating the invention;

Fig. 2 is an elevational view of an engine having a cooling system incorporating my invention associated therewith;

Referring now to the drawing by characters of reference, 10 indicates generally an internal combustion engine having a water chamber 11 substantially surrounding cylinders as indicated at 12. Forwardly of the engine is arranged a radiator 13 which is connected at its upper end by means of a conduit 14 with the upper outlet portion 15 of the water chamber. A connection 16 extends from the lower end of the radiator to a housing 17, formed at one end of the engine casting, which is in communication with a housing 18 containing a pump 19. There is an outlet connection, as indicated at 20, extending from the pump housing to the water chamber. Water is drawn from the radiator by the pump through the connection 16 and housing 17 into the pump chamber 18. The pump forces the water from its chamber through the connection 20, the water chamber 11 and through the connection 14 to the radiator. Water circulating through the cooling system is cooled as it passes through the radiator by air circulated by the blades 21 of a fan structure.

The fan and the pump are preferably mounted to be rotated by a shaft 22 extending through a supporting member or bracket 23 which is secured to the engine by bolts as indicated at 24. One wall of the bracket forms a closure for the front end of the pump housing. Suitable bearing means 54 are carried within the bracket for rotatably supporting the shaft 22. One end of this shaft projects into the pump housing and is secured to the pump by means of a set screw, as indicated at 25, and the other end of the shaft projects beyond the bracket and has the hub 26 of the fan splined thereto and fixed axially by a bolt 51. The fan blades 21 are secured to the hub by suitable means such as bolts 53.

Extending from the engine in parallel relation with the driven shaft 22 is a drive shaft 27 which is rotated by the engine through suitable mechanism (not shown). On each of the shafts 22 and 27 I propose to provide a pulley, such pulleys being encircled by a belt 58 for the purpose of transmitting power.

Ordinarily such a drive mechanism produces a constant speed ratio between the associated shafts so that the pump and the fan will be rotated in a definite speed relation irrespective of the engine speed. Under several conditions of engine operation, such a constant speed relation between the engine and the pump and fan will not properly take care of removing the heat units from the fluid in the cooling system in order to maintain the temperature of the engine such that the most efficient operation will be had. In order to overcome this difficulty and to provide for the transfer of heat units from the cooling system so as to maintain a substantially constant engine temperature, I propose to provide driving mechanism of a character such that the speed relation between the driven shaft and the driving shaft can be automatically varied in accordance with engine temperature.

In the embodiment illustrating one form which my invention may take, I propose to construct the pulleys so that the ratio of their effective diameters engaging with the belt can be varied, and preferably by means thermostatically controlled. Each pulley is formed in two sections 28 and 29 which are fixed to rotate with the shafts 22 and 27. The two sections of the pulley structure associated with the shaft 27 are splined thereto and the section 29 is axially movable thereon. The section 28 of the pulley structure associated to rotate with the shaft 22 is preferably formed as an integral part of the fan hub 26 while the section 29 of such pulley structure is preferably splined to the fan hub and axially movable thereon. The adjacent faces of the two sections of each pulley are formed with oppositely extending angular faces 30 against which the side faces of the belt 58 engage.

Surrounding a portion of the bracket 23 is a cylindrical regulating member 31 having an end face 32 extending parallel with and adjacent the rear end of the movable section 29 of the driven pulley. Bearing means 33 is arranged between such faces to permit the regulating member to co-operate with the adjacent rotatable pulley without undue friction. Intermediate a shoulder 34 on the bracket 23 and the wall 32 of the cylindrical regulating member is a coil spring 35 which creates pressure in a direction urging the adjacent pulley member 29 in an axial direction toward the pulley section 28.

The pulley section 28 on the shaft 27 is provided with posts 36 arranged to project through openings 37 in the adjacent pulley section 29. A ring member 38 is secured to the ends of the posts by screws 39 and coil springs 40 encircle the posts, such springs bearing at one end against the pulley section 29 and at the other end against the ring member. These springs exert pressure against the axially movable pulley section in a direction urging it toward the adjacent pulley section 28. The spring 35 exerts a greater pressure than the springs 40 and exerts pressure against the regulating member 31 which will maintain the driving faces of the fan pulley in their closest position and thereby maintain the diameter of the driving face of this pulley maximum. The springs 40 being weaker than the spring 35 will allow the belt to move radially with respect to the pulleys but will exert sufficient pressure to establish a driving relation between the belt and the pulley on the shaft 27. In this way, the relation of the belt with the driving faces of the pulleys is automatically shifted.

Associated with the regulating member 31 is mechanism for automatically shifting the same to regulate the distance between the driving faces of the two part fan pulley. Projecting from the wall of the bracket 34 I provide a pair of ears, as indicated at 41, between which a shifter member extends and is pivotally mounted on a pin 42. This shifter member includes a yoke 43 having arms which extend around a portion of the cylindrical member 31. The end portions of the arms are provided with slots, as indicated at 44, through which pins 45 extend, such pins being fixed to the cylindrical member. The upper portion of the shifter member is in the form of a lever 46 which can be rocked by a suitable temperature responsive means to establish the axial position of the regulating member.

In order to automatically control the shifter member, I provide a thermostat 47 which operates in response to engine developed temperature. In the present instance, the thermostat is anchored at one end to a bracket 48 and carries at its other end a pin 49 which engages the lever 46. This thermostatic control means is thus arranged so that it is responsive to the temperature of the fluid circulating in the cooling system of the engine, and, as a more uniform temperature is present in the outlet manifold 15, I preferably locate the thermostat therein. The pin 49 extends through the removable wall 50 and suitable packing, as indicated at 51, is provided to prevent water leakage at this point.

It will be seen that the thermostat contracts and expands in accordance with temperature of the engine cooling fluid and thus reciprocates the pin 49. Forward movement of the pin 49 will rock the shifter member to move the regulating member toward the engine cylinder and, when the pin moves rearwardly, the action of the spring 35 against the regulating member will cause the shifter member to follow the pin and remain in contact therewith.

In Fig. 1, the pulley regulating mechanism is illustrated in the position it assumes when the engine is cold and, under such circumstances, the spring 35 through pressure against the regulating member will hold the adjacent pulley section 29 close to its mating section 28 so that the diameter of this pulley as engaged by the driving belt will be maximum. Under such circumstances, the belt will spread the faces of the pulley sections on the shaft 27 a maximum distance which is permitted by the fact that the springs 40 are weaker than the springs 35 and, under such circumstances, the shaft 22 will be driven at the minimum rate of speed relative to the shaft 27. When the temperature of the cooling fluid increases, the thermostat 47 expands moving the pin 49 forwardly and rocking the shifter member in a direction moving the control member rearwardly. Such movement of the regulating member overcomes the force of the spring 35 sufficiently to permit the spring 40 to urge the associated pulley section 29 toward the adjacent section 28 and thus bodily move the belt radially of the pulley so that the ratio of the diameters is changed. Under such circumstances, the driving diameter of the fan pulley is decreased and that of the driver pulley is increased. The shaft 22 is thus driven at a faster rate of speed so that the pump and fan will rotate faster relative to the speed of engine rotation and will cause a faster rate of water circulation and an increased volume of air passing through the radiator in a given length of time. Under such circumstances, the tendency is to reduce the temperature of the cooled fluid.

When the thermostat contracts, the force of the spring 35 will overcome the force of the spring 40 to an extent permitted by the movement of the regulating member 31 toward the front and thus the diameter of the driving face of the fan pulley will be increased while the diameter of the driving face of the pulley on the shaft 27 will be decreased. Under such circumstances, the rotation of the pump and the fan relative to the engine speed is reduced and the temperature of the cooling fluid will consequently rise. It will be understood that the thermostat can be set so that it will be effective only above a predetermined temperature, if so desired. It will thus be seen that, through changing the ratio of the diameters of the driving faces of a pair of pulleys connected by a belt, I am able to vary the temperature of the fluid in the cooling system of an engine. It will also be seen that such mechanism is controlled automatically through means of a thermostat so that a substantially constant engine temperature can be maintained.

Although the invention has been described in connection with a specific embodiment, the principles involved are susceptible of numerous other applications which will readily occur to persons skilled in the art. The invention is therefore to be limited only as indicated by the scope of the appended claims.

What I claim is:

1. Driving mechanism comprising a shaft, a sectional pulley having two sections mounted to rotate with the shaft one of which is movable longitudinally of the shaft, said pulley sections hav-

ing angularly extending adjacent faces, a driving belt engaging the angular faces of said pulley, yieldingly acting means tending to move the sections together, and automatic means for causing variations in the spaced relation of said sections independently of the load and thereby shifting the position of the belt therewith radially.

2. Driving mechanism comprising a drive shaft, a fan shaft, a pulley on each shaft having two sections mounted to rotate at all times with the shaft and provided with angular adjacent faces, one of said sections of each pulley being movable axially, a belt extending around the pulleys in contact with the faces, spring means urging the movable section of the pulleys into engagement with the belt, and thermostatically operable means connected to regulate the distance between the sections of one pulley.

3. Driving mechanism comprising a drive shaft, a fan shaft, a pulley fixed to rotate with each shaft, said pulley including two sections mounted to rotate at all times with the shaft and provided with adjacent faces extending angularly in opposite directions and one of the sections being axially shiftable, a V-type belt around the pulleys and engaging the angular faces, spring means urging the movable pulley sections into frictional engagement with the belt, and shifter means connected with one of the movable pulley sections operable to regulate its distance from the associated pulley section.

4. Driving mechanism comprising a driving pulley, a driven pulley, a belt engaging the pulley, said pulleys each being formed in two sections connected to rotate together at all times one of which is movable axially, spring means associated with each pulley normally urging the axial movable section toward the other section, and means operable to regulate the axial position of the movable section of one of the pulleys, the spring means of the regulated pulley being stronger than the spring means of the other pulley.

5. Driving mechanism comprising a driving shaft, a driven shaft, a sectional pulley on one of said shafts having two sections one of which is mounted to rotate with the shaft and one of which is movable axially, spring means tending to move the axially movable section toward the other section, and means for relieving the axially movable section from the action of said spring.

6. Driving mechanism comprising a driving pulley, a driven pulley, a belt engaging the pulleys, said pulleys each being formed in two sections one of which is movable axially, spring means associated with each pulley normally urging the axially movable section toward the other section, the spring means of one of said pulleys being stronger than the spring means of the other pulley and means for relieving the axially movable section of the former pulley from the action of the spring means associated therewith to regulate the relative positions of the sections of said pulley.

7. Driving mechanism for an engine cooling fan comprising a driving shaft, a driven shaft, a pulley on one of said shafts having two sections one of which is mounted to rotate with the shaft and one of which is movable axially on said shaft, spring means tending to move the axially movable pulley section toward the other pulley section and means responsive to engine temperature for relieving the axially movable pulley section from the action of said spring.

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