

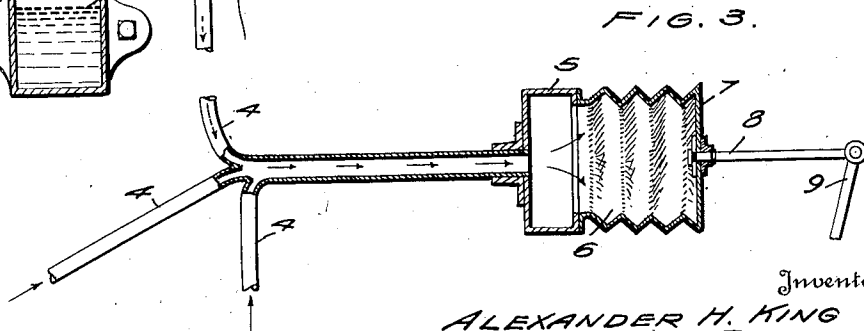
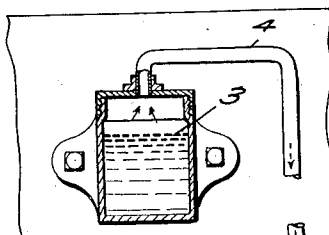
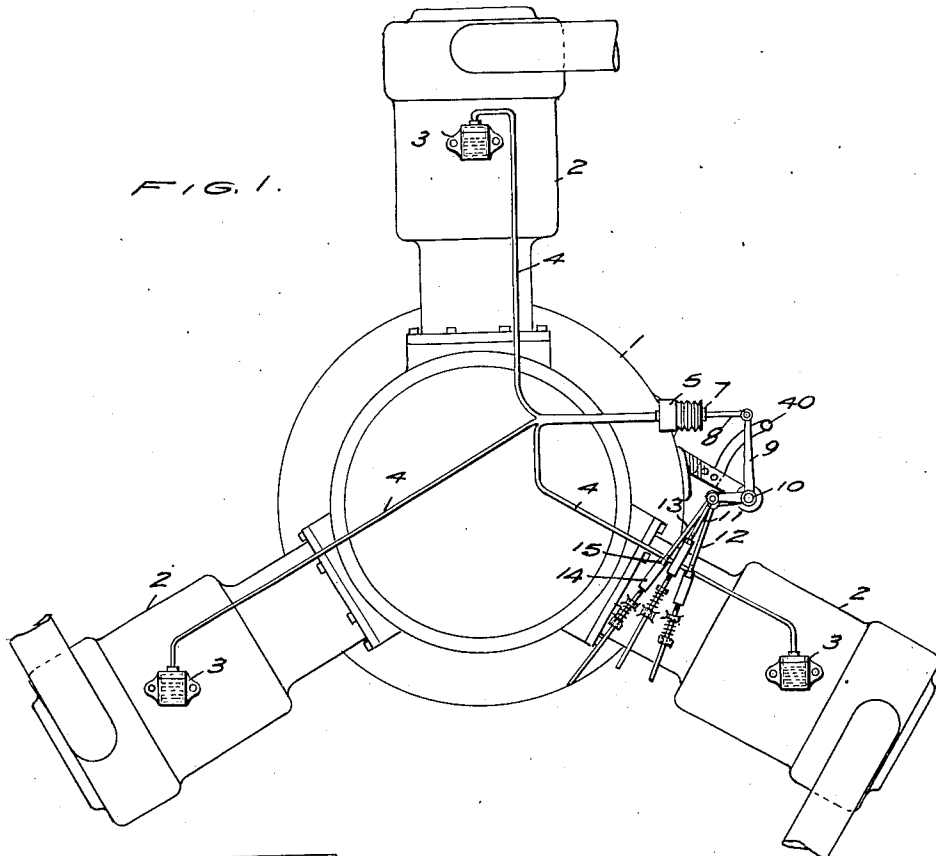
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INTERNAL COMBUSTION ENGINE

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INTERNAL COMBUSTION ENGINE

Application filed June 5, 1928. Serial No. 283,082.

This invention relates in general to internal combustion engines and is more particularly concerned with thermostatic controls governing the operation of the same between certain ranges of cylinder temperatures, this invention comprising an improvement in the structure shown in my application, Serial Number 283,081, filed June 5, 1928, on internal combustion engine.

The structure shown in earlier invention is particularly adapted for use in water cooled internal combustion engines wherein, by the nature of the cooling system, the cylinders are maintained at substantially equal temperatures, and thus requires the use of but one thermostat and control rod mechanism. It may, of course, be used for controlling air cooled motors, especially if a plurality of thermostats are used, one for each cylinder; each thermostat having means for connecting the same to one or more of the engine control rods. Such causes for overheating as affect all of the cylinders of such an engine can be satisfactorily taken care of with a single thermostat, placed on the cylinder which, on account of its position, experience teaches to be the one running at highest temperature.

In the case of an air-cooled engine, there is comparatively little heat transfer from one engine cylinder to another, especially in air cooled engines of the radial and rotary types. If any disturbance, individual to any one cylinder, occurs it may be highly desirable to have the thermostatic control take effect, even though the remaining cylinders are at normal temperatures. Again it may be desirable to have the thermostatic control effective only when the average of all the cylinders reaches a degree above that of safety.

It is the prime object of this invention to provide a thermostatic control system for controlling the degree of advance of the throttle or spark, or both, or the proportions of the mixture or any combination of the three controls, such as may operate to actuate the means for retarding the throttle or spark or enriching the mixture when any cylinder reaches a temperature above that considered safe for successful operation of the engine.

Another object of our invention is to pro-

vide a means whereby the thermostatic control may be made to become effective only when the average temperature of all the cylinders reaches a degree considered to be unsafe.

Other objects of our invention will appear in the accompanying specification and claims and will be disclosed in the accompanying drawing, in which:

Figure 1 is an end elevation of a radial air cooled motor showing our control;

Figure 2 is a detail in vertical section of our thermostat bulb;

Figure 3 is a detail of our header arrangement.

Referring now with greater particularity to the drawing, and first to Figure 1, it will be seen that our device is comprised as follows:

An engine 1 having a plurality of cylinders 2 has fixedly secured thereto, by any suitable means, adjacent to or on the heads or barrel of each of said cylinders, a thermostat bulb 3. Each of these thermostats is provided with a tube 4 leading into a header 5 of a thermostatic device 6 provided with an expandible bellows 7 suitably mounted on the engine. One end of the bellows is fixedly connected to and in communication with the header 5, while the other end is freely movable under the influence of fluid pressure. The free end of the bellows 7 is connected to a rod 8, pivotally, or otherwise, connected to a rod 9 which operates to connect the rod 8 to the engine controls, nameiy, the throttle, the spark control, and the mixture control. The rod 9 is disclosed as one arm of a bell-crank lever pivotally supported at 10 to a bracket mounted on the engine crank case. The other end of the bell-crank lever 9 has pivotally secured thereto, three rods 11, 12 and 13 for operatively connecting the bell-crank lever to the several engine controls. Each of these rods 11, 12 and 13 is formed of two parts securable to each other by means of glands 14 and held in adjusted position by means of lock nuts 15. This structure is to permit of adjustability of the effective length of the rods 11, 12 and 13 to influence to a greater or lesser degree, the effect of the expansion of the bellows on the engine controls. The rods 11, 12 and 13 are

not shown as actually connected to the engine controls but are shown broken away. Neither are the well known engine controls illustrated. It is believed that the description in this and in the preceding applications makes such a showing unnecessary to any person skilled in this art.

It is obvious that a diaphragm, or a piston and cylinder may be used to accomplish the purpose of the bellows shown, without departing from the spirit of our invention.

In these figures we have disclosed our apparatus as including a thermostatic control comprised of a bulb containing liquid material. The liquid employed is of a substance of a boiling point substantially the same as that of the danger temperature of the engine cylinder. All of the thermostats and leads are filled with their liquids at substantially room temperatures. If any one cylinder reaches a point above that of safety it will boil and the resulting gas pressure will operate the bellows 7 for its intended purpose. Thus any one cylinder, by reaching an excessive temperature, will operate to effect a retardation of the throttle and spark controls and an enriching of the mixture. A stop may be provided to prevent excess motion of the control rods under influence of the thermostat.

In the structure illustrated the thermostat, as has been disclosed, acts when any one of the engine cylinders reaches an excessive temperature. If gas be substituted for the liquid in the bulbs 3 the gas pressure originating, due to excess temperature in any one cylinder, will be equalized between the remaining bulbs and the bellows. Thus the actuation of the bellows to affect the setting of the engine controls will be affected only by the average of all the cylinders.

It is believed that the operation of our device has been fully described in the particular description of the apparatus and that no fuller description is necessary to a complete understanding of its operation. By the term "engine operating controls" as it appears in the claims accompanying this specification, we mean those controls which normally govern its operation characteristics as distinguished from stopping and starting switches, shutter controls, variable oil pressure regulating devices and the like. Rather this term refers to the spark, throttle and fuel mixture controls, taken separately or in any combination thereof.

Having thus described our invention what we claim is—

1. In combination, with an internal combustion engine having a plurality of cylinders, fluid thermostats having fluid containing bulbs mounted in thermal communication with said cylinders, engine controls, a bellows having a header in communication with each of said bulbs, and means operatively connect-

ing said bellows with said engine controls to actuate the latter when the engine temperature reaches a predetermined point.

2. In combination, with an internal combustion engine having a plurality of cylinders, fluid thermostats having fluid containing bulbs mounted in thermal communication with said cylinders, engine controls, a bellows having a header in communication with each of said bulbs, and means operatively connecting said bellows with said engine controls to actuate the latter when the engine temperature reaches a predetermined point, and means for adjusting said last named means to vary the effective action of said bellows upon said engine controls.

3. In combination, with an internal combustion engine having a plurality of cylinders, fluid thermostats having fluid containing bulbs mounted in thermal communication with said cylinders, engine controls, a bellows having a header in communication with each of said bulbs, and means operatively connecting said bellows with said engine controls to actuate the latter when the engine temperature reaches a predetermined point, said thermostat being actuated to influence said bellows when any one of said cylinders overheats.

4. In combination, with an internal combustion engine having a plurality of cylinders, fluid thermostats having fluid containing bulbs mounted in thermal communication with said cylinders, engine controls, a bellows having a header in communication with each of said bulbs, and means operatively connecting said bellows with said engine controls to actuate the latter when the engine temperature reaches a predetermined point, and means for adjusting said last named means to vary the effective action of said bellows upon said engine controls, said thermostat being actuated to influence said bellows when any one of said cylinders overheats.

5. In combination, with an internal combustion engine having a plurality of cylinders, gas thermostats having gas containing bulbs mounted in thermal communication with said cylinders, engine controls, a bellows having a header in communication with each of said bulbs, and means operatively connecting said bellows with said engine controls to actuate the latter when the average temperature of all cylinders is excessive.

6. In combination, with an internal combustion engine having a plurality of cylinders, gas thermostats having gas containing bulbs mounted in thermal communication with said cylinders, engine controls, a bellows having a header in communication with each of said bulbs, and means operatively connecting said bellows with said engine controls to actuate the latter when the average temperature of all cylinders is excessive, and means for adjusting said last named means

to vary the effective action of said bellows upon said engine controls.

7. In combination with an internal combustion engine having a plurality of cylinders, a fluid operated thermostatic device having a plurality of thermostatic bulbs, one in thermal communication with each of said cylinders, engine operating controls, means operatively connecting said device to said controls, said device being adapted to actuate said engine controls when any one of said cylinders overheats.

8. In combination, with an internal combustion engine, a fluid thermostat in thermal communication with said engine, an engine throttle control, and means operatively connecting said thermostat to said throttle control to actuate the latter when the fluid in said thermostat has reached a predetermined degree of vapor pressure induced from the heat of the engine, the thermostat acting to close the throttle on increases in engine temperatures and open the throttle upon decreases in engine temperatures.

9. In combination, with an internal combustion engine, a fluid thermostat in thermal communication with said engine, a fuel mixture proportioning control, and means operatively connecting said thermostat to said fuel mixture proportioning control to actuate the latter when the fluid in said thermostat has reached a predetermined degree of vapor pressure induced from the heat of the engine, the thermostat acting to enrich the mixture upon increases in engine temperatures and lean the mixture upon decreases in engine temperatures.

10. In combination, with an internal combustion engine, a fluid thermostat in thermal communication with said engine, an engine throttle control and a spark adjusting control, and means operatively connecting said thermostat to said controls to actuate the latter when the fluid in said thermostat has reached a predetermined degree of vapor pressure induced from the heat of the engine.

11. In combination, with an internal combustion engine, a fluid thermostat in thermal communication with said engine, an engine throttle control and a fuel proportioning control, and means operatively connecting said thermostat to said controls to actuate the latter when the fluid in said thermostat has reached a predetermined degree of vapor pressure induced from the heat of the engine, the thermostat acting to enrich the mixture and close the throttle upon engine temperature increases and lean the mixture and open the throttle upon engine temperature decreases.

12. In combination, with an internal combustion engine, a fluid thermostat in thermal communication with said engine, an engine throttle control, a spark adjusting con-

trol, and a fuel proportioning control, and means operatively connecting said thermostat to said controls to actuate the latter when the fluid in said thermostat has reached a predetermined degree of vapor pressure induced by the heat of the engine.

13. In combination, with an internal combustion engine, a fluid thermostat in thermal communication with said engine, an engine throttle control, and means operatively connecting said thermostat to said throttle control to actuate the latter only when the fluid in said thermostat has reached a predetermined degree of vapor pressure induced from the heat of the engine, the thermostat acting to close the throttle on increases in engine temperature and open the throttle upon decreases in engine temperature.

14. In combination, with an internal combustion engine, a fluid thermostat in thermal communication with said engine, an engine throttle control and means operatively connecting said thermostat to said throttle control, said thermostat and said means being normally ineffective upon said throttle control at or below any predetermined normal operating temperature of said engine, but effective to close the throttle on increases of the engine temperature beyond such predetermined normal operating temperature and to open the throttle on a decrease of the engine temperature to said predetermined normal operating temperature.

In testimony whereof we affix our signatures.

ALEXANDER H. KING.
EARLE A. RYDER.