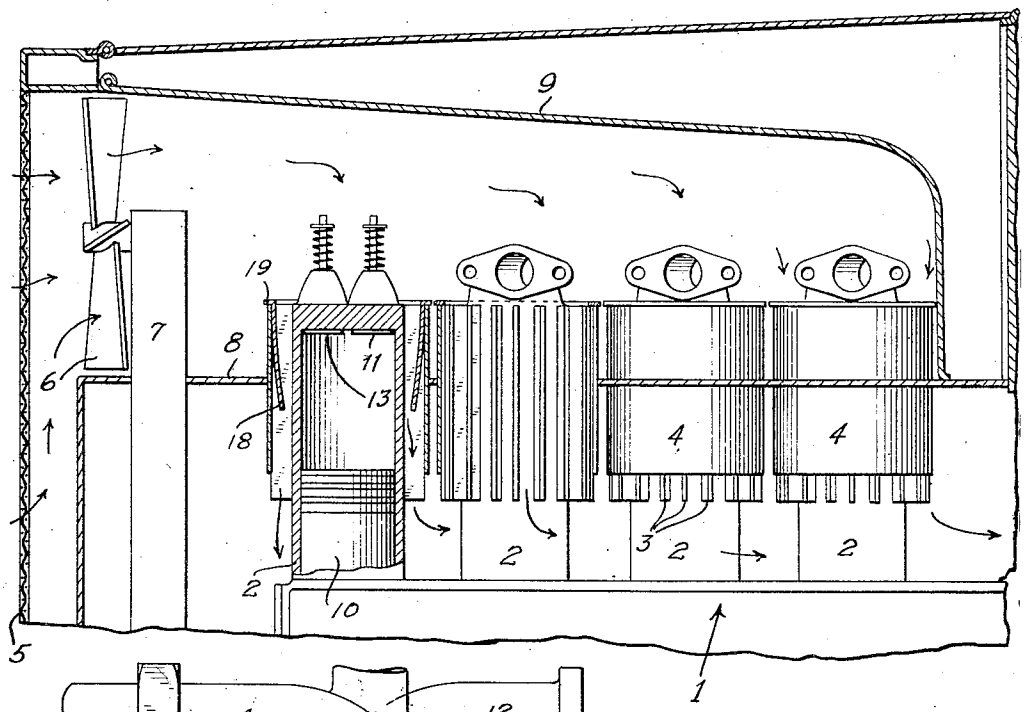
June 24, 1930. C. M. CREWS 1,766,608

AIR COOLED MOTOR

Filed Nov. 8, 1927 2 Sheets-Sheet 1

Fig. 1



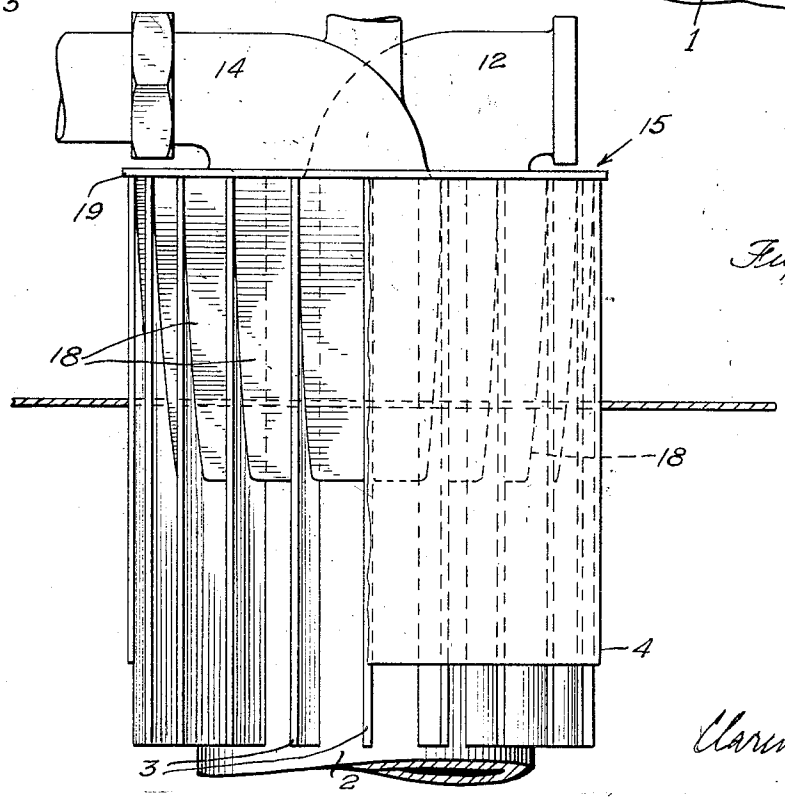


Fig. 2.

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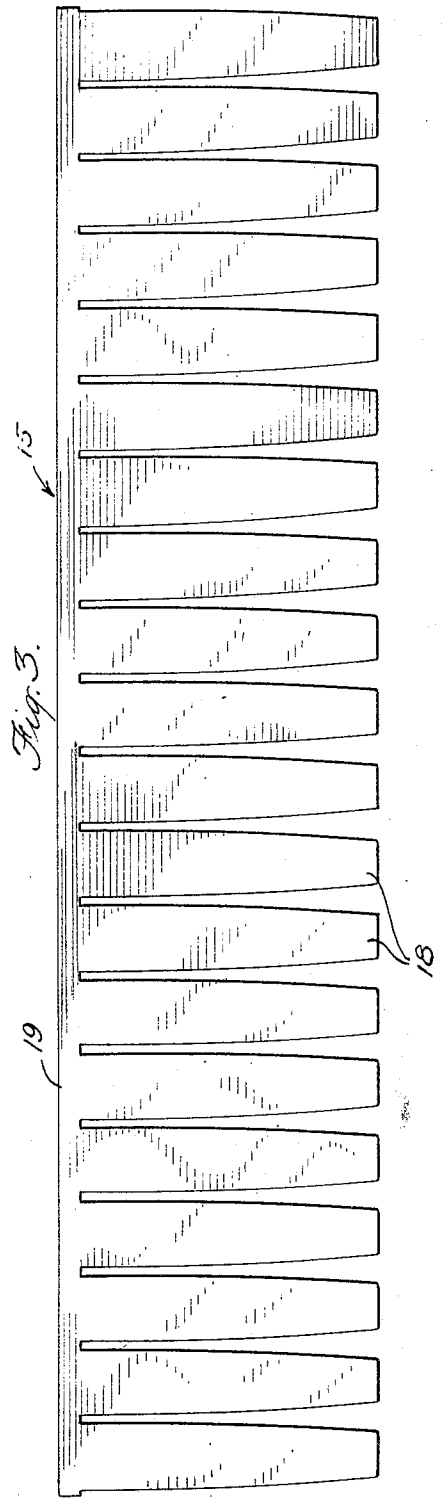


Fig. 3.

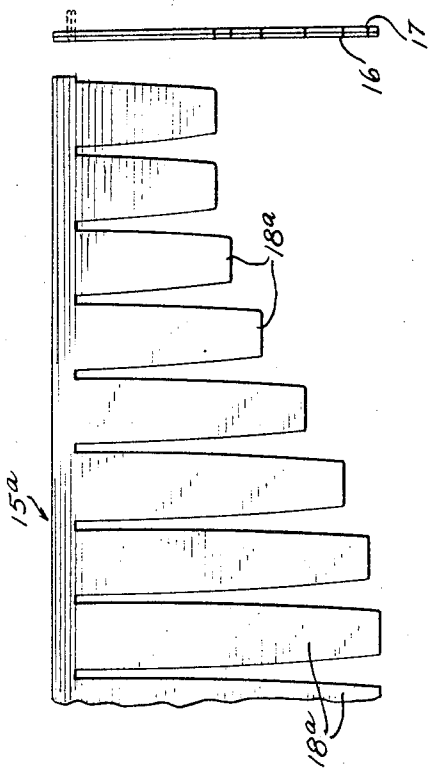


Fig. 5.

Fig. 6.

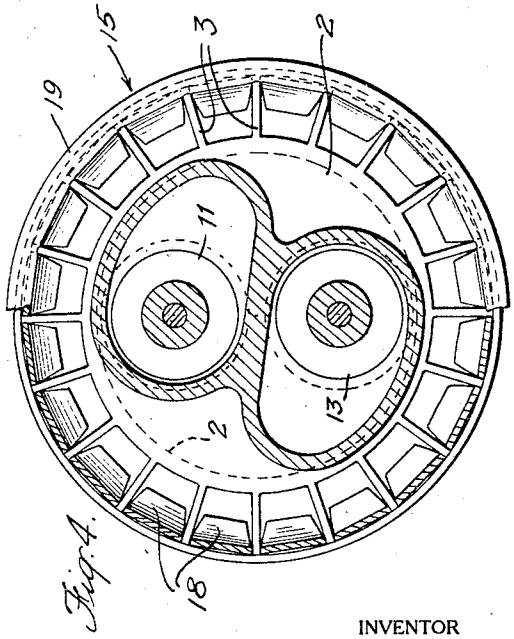


Fig. 4.

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UNITED STATES PATENT OFFICE

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AIR-COOLED MOTOR

Application filed November 8, 1927. Serial No. 231,871.

This invention relates to air-cooled motors, and more particularly to air-cooled internal combustion motors employed in motor vehicles.

The air-cooled motor has marked advantages over the water-cooled motor, both for automobiles and for air-craft, such advantages including notably freedom from danger of freezing and the saving of weight due to the fact that the need for employing a water jacket, a radiator and cooling liquid therein is obviated.

The air-cooled motor, as heretofore constructed, has, however, had serious disadvantages as compared with the water-cooled motor, due principally to the fact that there is no circulatory cooling medium tending to keep all of the parts at a substantially uniform operating temperature. As a result of this lack of temperature equalizing means, it frequently happens that the several cylinders, which are necessarily exposed to identical external conditions, operate at widely different temperatures, and also that different portions of the periphery of a single cylinder become unequally heated.

It is an important object of the present invention to provide means for overcoming or at least for reducing in a large measure these inequalities of operating conditions in the various parts of an air-cooled motor, so that all of the parts will be ordinarily maintained at approximately the same temperature, which temperature may be that at which the motor is designed to operate most efficiently.

It is a further object of the invention to avoid subjecting the motor cylinders to widely varying operating temperatures, as external temperatures change with the climate or with the seasons or from day to day.

To these ends provision is desirably made, as shown in the illustrative embodiment of the invention, of themostatic means for individually throttling the air channels between the cooling fins on the motor cylinders, each throttle being individually controlled by the temperature conditions existing in the particular portion of the cylinder adjacent which it lies.

With such an arrangement, if the motor as a whole is too cold, all of the channels will be throttled, and the blast of cooling air which is ordinarily supplied from a propeller pump or fan will be partially choked back until all parts of the cylinders have been raised to the desired operating temperature. In cold weather the throttles will never, as a rule, open completely.

Regardless of weather conditions, any part of the motor which remains below the predetermined temperature will receive less than the full amount of air which would be supplied to it with full throttle opening, and the air thus choked back will be diverted to increase the cooling effect in other channels where the parts are disposed to overheat, so that such parts will be more effectively cooled than heretofore.

This feature may be of especial value, for example, in case one cylinder is missing. According to prior constructions, the missing cylinder, though cold, would receive just as much air as usual, and the active cylinders, though overloaded and therefore disposed to overheat, would receive no more air than usual.

The invention will also tend to promote uniformity of operating conditions in spite of variations of load, or grade, or the gear in which the vehicle is being operated.

Other objects and advantages will hereinafter appear.

In the drawings forming a part of this specification:

Figure 1 is a longitudinal, vertical, sectional view showing the cylinders and cooling means of an air-cooled motor having the improvements of the present invention incorporated therein;

Figure 2 is a sectional elevation of a single cylinder, the sleeve surrounding the cylinder being partly broken away;

Figure 3 shows a sheet of bi-metallic material cut out to form throttle tongues, but not yet turned into cylindrical form;

Figure 4 is a horizontal section taken just above a cylinder and showing the present invention applied to the cylinder;

Figure 5 is a view similar to Figure 3 but

showing how the lengths of the throttle tongues can be varied to meet varying local conditions characteristic of different portions of the circumference of the cylinder; and

Figure 6 is a sectional view on the line 6—6 of Figure 5 looking in the direction of the arrows.

The invention is illustrated as embodied in or applied to an internal combustion motor 1 of a motor vehicle which motor comprises cylinders 2 having radially extending cooling fins 3 thereon, and sleeves or jackets 4 surrounding the fins and defining with the fins and the cylinders channels for the passage of cooling air.

The air for cooling the cylinders is drawn in at the front of the motor through a grid or shutter structure 5 by any suitable pumping means such as a fan 6 driven through a chain or belt 7 from the crank shaft of the motor, but at considerably higher speed than the rotary speed of said crank shaft. The fan 6 is desirably geared, and designed to deliver air more rapidly for cooling the cylinders than has been customary in the past, it being feasible to provide for an oversupply of cooling air because the temperature controlling means of the present invention will choke back the surplus air and prevent objectionable over-cooling.

The air drawn in by the fan 6 is forced by the fan under pressure into an upper chamber defined by a horizontal partition 8 and a cover 9. The air passes thence through the air channels defined jointly by the cylinders 2, the cooling fins 3 and the sleeve 4, and is finally discharged below the partition 8. The provision of an adequate supply of air may be assisted, if desired, by the provision of a fan driven from the rear end of the crank shaft and arranged to suck the air out of the chamber defined below the partition 8.

The illustrative motor, proper, is of conventional design and includes pistons 10 operating in the cylinders 2, which cylinders are equipped with intake valves 11 for placing the cylinders in communication with intake pipes 12, and with exhaust valves 13 for placing the cylinders in communication with exhaust pipes 14.

For the purpose of providing individual throttles for the air channels around the cylinders, provision is made of throttle sleeves 15.

Each throttle sleeve is made from a bi-metallic sheet 16, 17 consisting of a sheet 16 of one metal and a sheet 17 of another metal, which sheets are welded or otherwise suitably secured together. The sheet 17 has a substantially higher co-efficient of expansion than the sheet 16, so that the composite bi-metallic sheet 16, 17 is distorted by changes in temperature. The composite bi-metallic sheet is punched in the manner shown in Figure 3 to form a multiplicity of tapered tongues 18 which remain connected together by an upper marginal band 19 of the sheet that remains uncut. The tongues 18 are of such width at their upper ends adjacent the band 19 that they will fit snugly between the cylinder fins 3 at the outer extremities of said fins adjacent the sleeves 4. The tongues taper continuously toward their lower ends, the lower ends being of such width that they can be received snugly between the cylinder fins 3 at the inner extremities of the fins adjacent the walls of cylinders 2.

When the sheet 15 has been stamped, as shown in Figure 3, it is turned or folded to form it into a cylinder, and the opposite ends of the band 19 are welded or otherwise suitably secured to one another. This sleeve or cylinder 15 is placed within the sleeve 4 so that each tongue 18 extends into one of the air channels between adjacent cylinder fins 3 and the notches between the upper ends of the tongues embrace and rest upon the fins. Each cylinder is provided with one of the sleeves 15.

The bi-metallic sheet is desirably initially so formed that the tongues 18 are curled at atmospheric temperature, this curling being sufficient to cause the lower ends of the tongues to lie substantially in contact with the cylinder walls when the throttle sleeve is put in place at atmospheric temperature.

It will be seen that as the motor is started into operation, each tongue 18 is exposed to the air passing into the channel which it is designed to control, and that its lower end will be gradually drawn outward toward the sleeve 4 as the particular part of the cylinder adjacent which it lies warms up.

The tongues have distortion characteristics, due to the difference in the co-efficients of expansion of metals used, such that they will be completely straightened out when the portions of the cylinder adjacent which they lie become heated to the desired operating temperature. Under these conditions the tongues become ineffective and the air is allowed to pass without obstruction through the air channels for cooling the motor. The tongues are of such length that they will be able to move from the fully closed to the fully open position when subjected to such heating.

Should any of the parts of the cylinder remain below this desired temperature after other parts have reached such temperature, the tongues lying in the channels alongside the relatively cool parts will remain curled inward to throttle the air in their respective channels and enable the cool parts of the cylinder to be brought up to the same temperature as the other parts.

Similarly if one of the cylinders is operating "cold", the throttle tongues controlling the air passages around such cylinder will all remain partially curled inward until the cold cylinder is warmed up to the desired temperature. In either of these cases the air which is restrained from passing through the partially closed channels will be diverted and become available for cooling the hottest parts of the motor, so that there will be relatively little tendency toward overheating of any part.

It will be observed, of course, that in cold weather none of the throttles will open completely except under extraordinary conditions of overloading of the engine. Under such conditions the surplus air which would normally be delivered past the cylinders may in part be forced through and result in a somewhat lower general temperature but a part will also escape back past the fan.

In Figure 6 disclosure is made of a modified form of throttle device 15^a wherein certain of the tongues 18^a are cut shorter than others. This expedient may be desirable in some installations for inducing a freer delivery of air past the hot sides of the cylinders, where the exhaust valves are located, than is provided for at other parts of the cylinders.

It will be seen that in accordance with the present invention provision is made of simple, reliable, durable, and inexpensive means for equalizing the temperatures of the several cylinders and of the several parts of the individual cylinders, and for avoiding operation under widely varying temperature conditions due to seasonal or climatic changes. It is obvious, of course, that the control device herein disclosed may be supplemented by a manually or thermostatically controlled means for varying the total amount of air supplied in accordance with seasonal or climatic variations.

Some of the advantages derivable from the present improvement may be briefly noted and are as follows:

There is a saving of fuel because the unnecessary dissipation of heat is avoided, and because better vaporization is assured under adverse conditions.

Uneven or lopsided expansion of the cylinders is avoided, with the result that no extra clearance has to be provided in the design of the cylinders and pistons to allow for such expansion. Loss of compression and oil leakage may therefore be reduced.

The liability of the occurrence of high temperature conditions peculiar to a single cylinder is materially reduced, so that the likelihood of pre-ignition is reduced and a design of motor using higher compression and therefore developing more power may be adopted than has heretofore been practical in air-cooled motors.

The fact that there is no danger of overcooling any part of the motor makes practical the employment of air supplying means of greater capacity than heretofore, and consequently the maintenance of the hottest parts at a much lower temperature. This is also a factor in enabling higher compression to be used and more power to be developed.

Cylinders which are missing when the motor first starts and which, if permitted to remain cold would continue to miss, are enabled to be gradually heated up by the other parts of the motor to a point where, in some instances, firing may begin.

While I have illustrated and described in detail certain preferred forms of my invention, it is to be understood that changes may be made therein and the invention embodied in other structures. I do not, therefore, desire to limit myself to the specific constructions illustrated, but intend to cover my invention broadly in whatever form its principle may be utilized.

I claim:

1. In an air-cooled motor, a cylinder, radiating fins on the cylinder extending longitudinally thereof and having air channels therebetween, and means for individually throttling the air channels.

2. In an air-cooled motor, a cylinder, and temperature responsive means controlled respectively by the temperatures of different segments of the cylinder for controlling the passage of cool air over the different segments of the cylinder to promote uniform heating circumferentially of the cylinder.

3. In an air-cooled motor, in combination, a cylinder having radiating fins thereon, a sleeve surrounding the fins and with the fins defining air channels along the cylinder, and a series of thermostatic throttles disposed one in each channel.

4. In an air-cooled motor, in combination, a cylinder having radiating fins extending longitudinally thereof, a sleeve surrounding the fins and with the fins defining air channels along the cylinder, and a throttle sleeve including a marginal portion engaging the ends of the fins and bi-metallic tongues projecting into the air channels.

5. In an air-cooled motor, in combination, a cylinder, radial cooling fins extending longitudinally thereof, and thermostatic throttles adapted to close the passages between the cooling fins when the motor is cold, and to move gradually to positions to leave the passages open as the motor warms up.

In testimony whereof I have affixed my signature to this specification.

CLARENCE M. CREWS.