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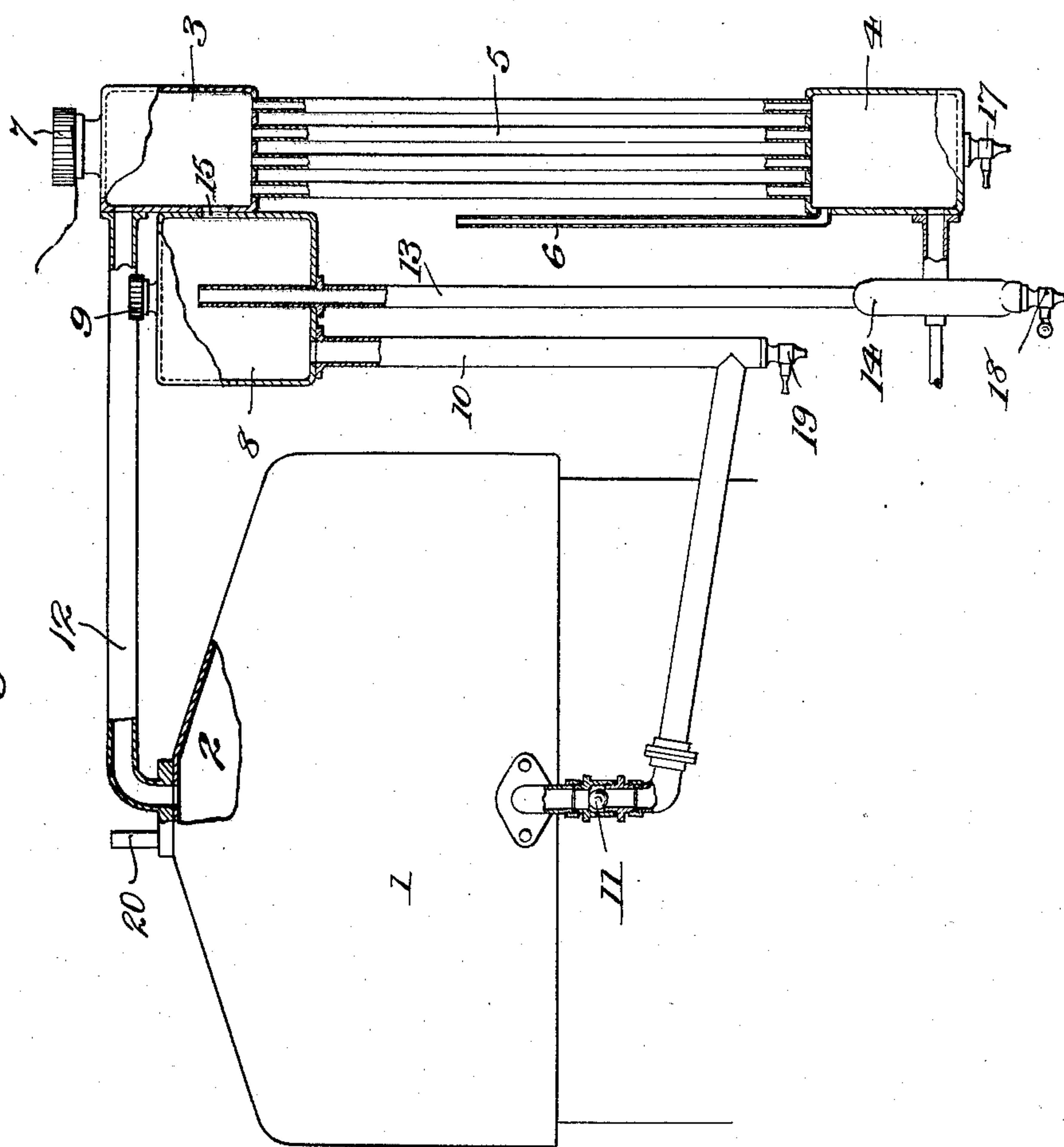
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COOLING SYSTEM FOR INTERNAL COMBUSTION ENGINES

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Fig. 1.



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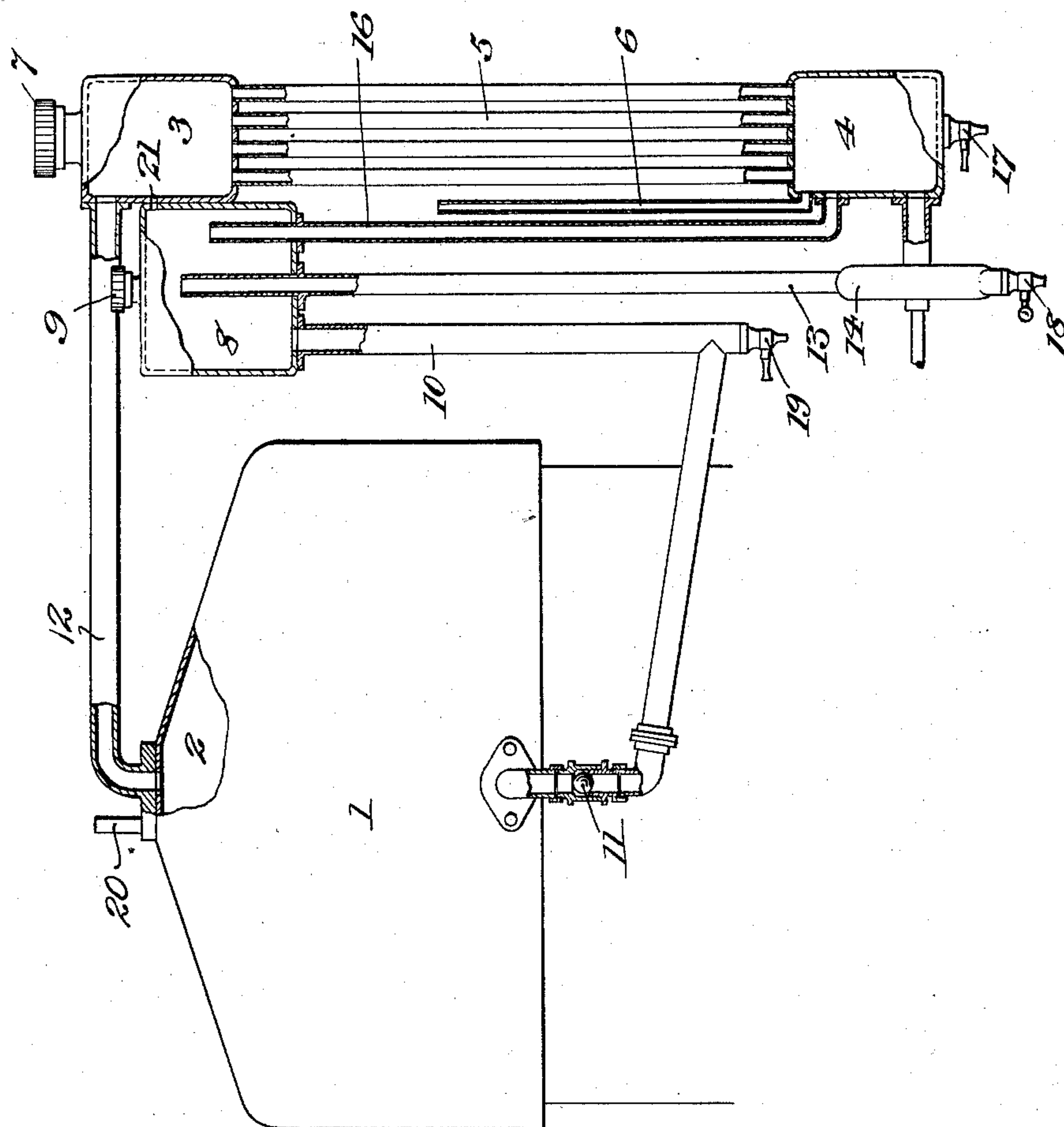
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Fig. 2.



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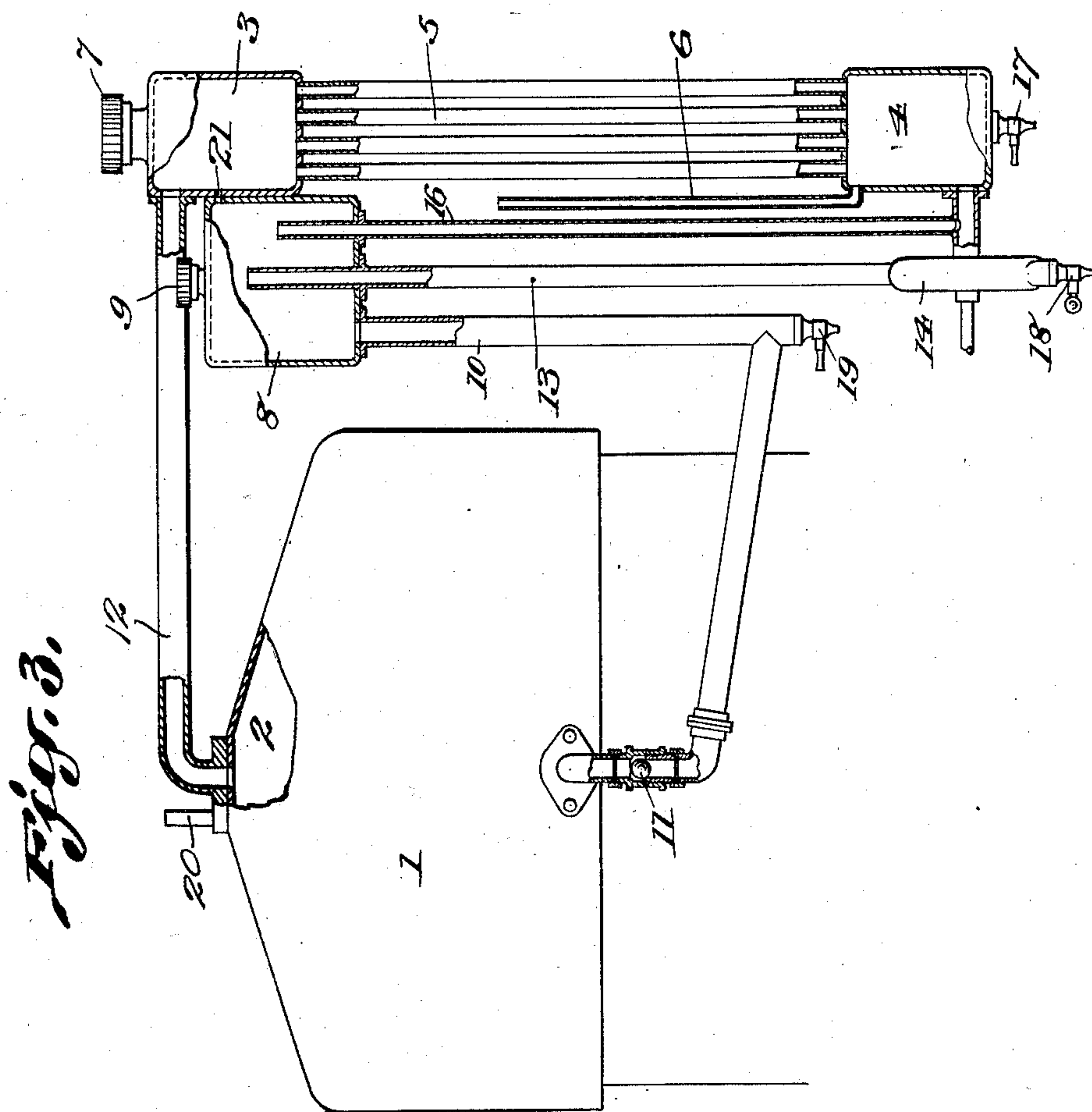
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COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES

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The object of our invention is to provide a novel vapor cooling system for internal combustion engines, especially automobile engines, which system is capable of quickly obtaining and thereafter maintaining the engine cooling medium at a high temperature in the engine cylinder jacket for ensuring the most efficient and economical operation of the engine.

This system includes a liquid reservoir, a condenser and an engine cylinder jacket in intercommunication; means being provided for circulating the liquid through the reservoir and for maintaining the liquid at a predetermined level in the reservoir so that the liquid may, by the action of gravity, be maintained at about a predetermined level in the cylinder jacket under normal operating conditions, thus avoiding the circulation of the liquid through the jacket, this result being obtained by providing a liquid overflow outlet for the reservoir located at a predetermined height above its bottom and also by properly fixing the height of the reservoir with respect to the top of the cylinder jacket and means such as a pump driven from the engine for raising the liquid which overflows from the reservoir, and the liquid of condensation, into the reservoir.

Practical embodiments of our invention are represented in the accompanying drawings, in which

Fig. 1 represents one embodiment partly in side elevation and partly in section.

Fig. 2 represents a similar view of another embodiment.

Fig. 3 represents a similar view of a third embodiment.

The engine cylinder jacket is denoted by 1, the top of which forms a vapor space 2.

The condenser may be of any well known or approved construction. In the present instance we have shown the condenser as comprising an upper chamber 3 and a lower chamber 4 connected by the usual cooling passages 5. The lower chamber 4 may also be provided with an uprising passage 6 acting both as an air escape and as a liquid overflow for the condenser. The upper

chamber 3 of the condenser may be provided with the usual filling cap 7.

The reservoir for supplying the liquid required by the cylinder jacket to replace that lost by evaporation is denoted by 8 and is so placed in reference to the cylinder jacket as to provide about the desired liquid level in the same. The reservoir may be provided with a filling cap 9. A liquid supply passage 10 for the cylinder jacket 1 leads from the bottom of the reservoir 8. A non-return valve 11 of any well known or approved form is provided in this passage 10 for preventing the pressure in the vapor space of the cylinder jacket from forcing the liquid fed thereto, or vapor generated therein, back through the passage 10 into the reservoir 8. A vapor escape passage 12 leads from the vapor space 2 in the top of the cylinder jacket 1, to the upper chamber 3 of the condenser.

A liquid return passage 13 leads from the lower chamber 4 of the condenser through suitable means such as an engine driven pump 14, upwardly into the reservoir 8.

In the form shown in Fig. 1, the liquid overflow passage 15, which is located at a predetermined height above the bottom of the reservoir, leads directly from the reservoir 8 into the upper chamber 3 of the condenser and preferably below the upper end of the liquid return passage 13. In the form shown in Fig. 2, the liquid overflow passage 16 leads from a similar point within the reservoir downwardly into the lower chamber 4 of the condenser. In the form shown in Fig. 3, the liquid overflow passage 16 instead of leading into the lower chamber 4 of the condenser, leads into the passage 13 which connects the lower chamber 4 of the condenser with the reservoir 8 through the liquid elevating pump 14. These are only three of many different forms for bringing the overflow outlet of the reservoir into communication with the condenser on the intake side of the pump so that the pump will raise the reservoir overflow liquid and the liquid of condensation into the reservoir without passing through the cylinder jacket.

While we have shown an engine driven pump for raising the overflow and condensed

liquid into the reservoir through the return passage 13, it is obvious that any means may be employed which will be operative for this purpose.

5 If desired, the condenser may be provided with a drain cock 17, the pump with a drain cock 18 and the cylinder jacket liquid supply pipe with a drain cock 19. Also the top of the cylinder jacket may be provided with a
10 two-way safety valve denoted conventionally by 20, operable in case of a possible stoppage in any of the passages. In the forms shown in Figs. 2 and 3, equalization of pressure is provided for by communication between the
15 reservoir 8 above its liquid level and anywhere in the vapor space, as for instance, by a passage 21 leading from said reservoir into the upper chamber 3 of the condenser.

In the form shown in Fig. 1, the overflow
20 passage 15 serves for this purpose.

In operation: Presupposing the system to be supplied with the proper amount of liquid: When the engine is started, the pump
25 14 will raise the liquid through the return passage 13 into the reservoir 8. It will be seen that this does not circulate through the cylinder jacket 1, but escapes through the overflow passage to the intake side of the pump either through the condenser as shown
30 in Figs. 1 and 2 or directly to the return passage 13 as shown in Fig. 3. There being no circulation of the liquid through the cylinder jacket 1, the liquid in the jacket will become rapidly heated to the boiling point
35 and the vapor therefrom will escape through the passage 12 into the upper chamber 3 of the condenser. This vapor will become condensed and the liquid of condensation, together with the reservoir overflow liquid, will
40 be raised by the pump 14 back into the reservoir 8.

It will be understood that the reservoir should be so placed with respect to the cylinder jacket and that the overflow outlet in
45 the reservoir should be so placed that the level of the cooling liquid in the reservoir will be such that it will maintain, by gravity, substantially the desired level of the liquid in the cylinder jacket under normal operating conditions. Also this will preclude the
50 return flow of liquid from the cylinder jacket through the vapor escape passage of the cylinder jacket. Furthermore, the overflow outlet will take care of any surplus liquid raised
55 to the reservoir by the pump, returning the surplus liquid to the intake side of the pump to be again raised into the reservoir. This circulation of the excess liquid through the reservoir maintains a constant supply of liquid to replace, by gravity, the liquid lost
60 from the cylinder jacket by evaporation. Thereby the circulation of liquid through the cylinder jacket is avoided.

It is evident that any suitable liquid may
65 be employed and it is also evident that vari-

ous changes may be resorted to in the construction, form and arrangement of the several parts of the system without departing from the spirit and scope of our invention; hence, we do not wish to be limited to the particular embodiments herein shown and described, but

What we claim is:—

1. In a cooling system for internal combustion engines, a liquid reservoir, a condenser
75 and a cylinder jacket in intercommunication, the cylinder jacket having a vapor escape passage leading directly to the condenser, and the reservoir having a liquid supply passage leading to the cylinder jacket, a liquid over-
80 flow passage leading to the condenser and a liquid return passage leading from the condenser, and means in the last named passage for raising the overflow and condensed liquid back into the reservoir whereby the
85 liquid in the reservoir may be maintained at a predetermined level to thereby cause the liquid in the cylinder jacket to be maintained by gravity at substantially a predetermined level under normal operating conditions. 90

2. In a cooling system for internal combustion engines, a liquid reservoir, a condenser in communication therewith, said condenser having upper and lower chambers and their connecting condensing passages, a cylinder
95 jacket in communication with the reservoir and also in direct communication around the reservoir with the upper chamber of the condenser, and means for raising the liquid from the lower chamber of the condenser into
100 the reservoir.

3. In a cooling system for internal combustion engines, a liquid reservoir, a condenser in communication therewith, said condenser having upper and lower chambers and their
105 connecting condensing passages, a cylinder jacket in communication with the reservoir through a liquid supply passage and in direct communication with the upper chamber of the condenser through an escape passage
110 for vapor only, and means for raising the liquid from the lower chamber of the condenser into the reservoir.

4. In a cooling system for internal combustion engines, a liquid reservoir, a con-
115 denser in communication therewith, said condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket in communication with the reservoir and also in direct communication
120 with the upper chamber of the condenser, and means for maintaining the liquid at a predetermined level in the reservoir including a reservoir liquid overflow outlet in communication with the condenser. 125

5. In a cooling system for internal combustion engines, a liquid reservoir, a condenser in communication therewith, said condenser having upper and lower chambers and their
130 connecting condensing passages, a cylinder

jacket in communication with the reservoir through a liquid supply passage and also in direct communication with the upper chamber of the condenser through a vapor escape passage, and means for maintaining the liquid at a predetermined level in the reservoir including a reservoir liquid overflow outlet in communication with the condenser.

6. In a cooling system for internal combustion engines, a liquid reservoir, a condenser in communication therewith, said condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket in communication with the reservoir and also in direct communication with the upper chamber of the condenser, means for maintaining the liquid at a predetermined level in the reservoir including a reservoir liquid overflow outlet in communication with the condenser, and means for raising the overflow and condensed liquid back into the reservoir.

7. In a cooling system for internal combustion engines, a liquid reservoir, a condenser in communication therewith, said condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket in communication with the reservoir through a liquid supply passage and also in direct communication with the upper chamber of the condenser through a vapor escape passage, means for maintaining the liquid at a predetermined level in the reservoir including a reservoir liquid overflow outlet in communication with the condenser, and means for raising the overflow and condensed liquid back into the reservoir.

8. In a cooling system for internal combustion engines, a liquid reservoir, a condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket, the reservoir having a liquid overflow outlet in communication with the condenser and a liquid supply outlet in communication with the cylinder jacket, the cylinder jacket having a vapor outlet in direct communication with the upper chamber of the condenser and the lower chamber of the condenser having a liquid outlet in communication with the reservoir, and means for raising the overflow and condensed liquid back into the reservoir.

9. In a cooling system for internal combustion engines, a liquid reservoir, a condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket, the reservoir having a liquid overflow outlet in communication with the condenser and a liquid supply outlet in communication with the cylinder jacket, the cylinder jacket having a vapor outlet in direct communication with the upper chamber of the condenser, the lower chamber of the condenser having a liquid outlet in communication with the reservoir, and means

for raising the overflow and condensed liquid back into the reservoir, the said reservoir and its overflow outlet being so located with respect to the cylinder jacket as to prevent the passage of liquid from the cylinder jacket through its vapor outlet.

10. In a cooling system for internal combustion engines, a liquid reservoir, a condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket, the reservoir having a liquid return passage leading from the lower chamber of the condenser, a liquid overflow passage leading to the condenser and a liquid supply passage leading to the cylinder jacket, the cylinder jacket having a vapor escape passage leading directly to the upper chamber of the condenser, and means in the liquid return passage for raising the overflow and condensed liquid back into the reservoir.

11. In a cooling system for internal combustion engines, a liquid reservoir, a condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket, the reservoir having a liquid return passage leading from the lower chamber of the condenser, a liquid overflow passage leading to the condenser and a liquid supply passage leading to the cylinder jacket, the cylinder jacket having a vapor escape passage leading directly to the upper chamber of the condenser, and means in the liquid return passage for raising the overflow and condensed liquid back into the reservoir, the said reservoir and its overflow passage being so located with respect to the cylinder jacket as to prevent the passage of liquid from the cylinder jacket through its vapor escape passage to the condenser.

12. In a cooling system for internal combustion engines, a liquid reservoir, a condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket, a liquid return passage leading from the lower chamber of the condenser to the reservoir, a vapor escape passage leading from the cylinder jacket directly to the upper chamber of the condenser, a liquid supply passage leading from the bottom of the reservoir to the cylinder jacket, a liquid overflow passage bringing the reservoir into communication with the condenser, and means for raising the overflow and condenser liquid back into the reservoir through the first named passage.

13. In a cooling system for internal combustion engines, a liquid reservoir, a condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket, the reservoir, condenser and cylinder jacket being in intercommunication, said cylinder jacket having a vapor escape passage in direct communication with the upper chamber of the condenser and the reservoir having a liquid overflow outlet, the said reser-

voir and its overflow outlet being so located with respect to the cylinder jacket as to prevent the circulation of liquid through the cylinder jacket and means for raising the overflow and condensed liquid back into the reservoir.

14. In a cooling system for internal combustion engines, a liquid reservoir, a condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket, said reservoir, condenser and cylinder jacket being in intercommunication, the cylinder jacket having a vapor escape passage in direct communication with the upper chamber of the condenser and the reservoir having a liquid overflow outlet located below the vapor passage outlet to the upper condenser chamber, the said reservoir and its overflow outlet being so located with respect to the cylinder jacket as to prevent the circulation of liquid through the cylinder jacket and means for raising the overflow and condensed liquid back into the reservoir.

15. In a cooling system for internal combustion engines, a liquid reservoir, a condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket and its vapor space, a vapor escape passage leading from the vapor space to the upper chamber of the condenser, a liquid supply passage leading from the reservoir to the cylinder jacket, a liquid overflow passage, a liquid return passage leading from the lower chamber of the condenser to the reservoir, and means for raising the overflow and condensed liquid back into the reservoir through said last named passage, the said overflow passage leading from the reservoir to the intake side of said liquid raising means.

16. In a cooling system for internal combustion engines, a liquid reservoir, a condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket and its vapor space, a vapor escape passage leading from the vapor space to the upper chamber of the condenser, a liquid supply passage leading from the reservoir to the cylinder jacket, a liquid overflow passage, a liquid return passage leading from the lower chamber of the condenser to the reservoir, and means for raising the overflow and condensed liquid back into the reservoir through said last named passage, the said overflow passage leading from the reservoir to the condenser.

17. In a cooling system for internal combustion engines, a liquid reservoir, a condenser having upper and lower chambers and their connecting condensing passages, a cylinder jacket and its vapor space, a vapor escape passage leading from the vapor space to the upper chamber of the condenser, a liquid supply passage leading from the reservoir to the cylinder jacket, a liquid overflow passage, a liquid return passage leading from the lower

chamber of the condenser to the reservoir, and means for raising the overflow and condensed liquid back into the reservoir through said last named passage, the said overflow passage leading from the reservoir to the lower chamber of the condenser.

In testimony, that we claim the foregoing as our joint invention, we have signed our names this 19th day of February, 1927.

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