Sept. 23, 1930. A. R. GROSS 1,776,726

OIL COOLER

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Fig. 1.

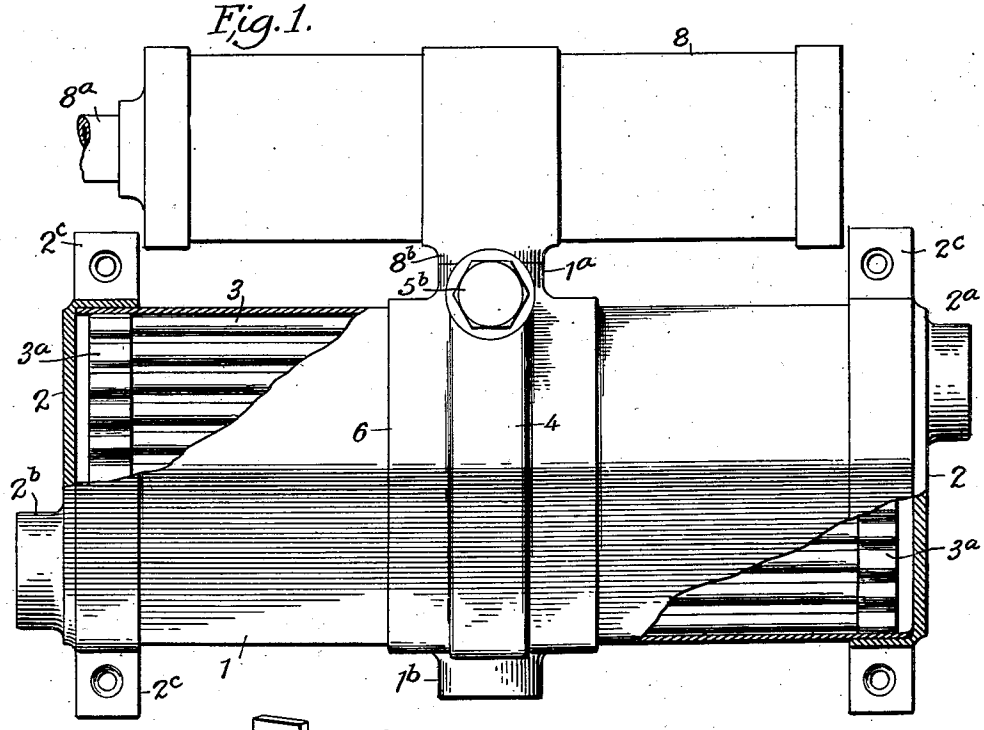



Fig. 2.

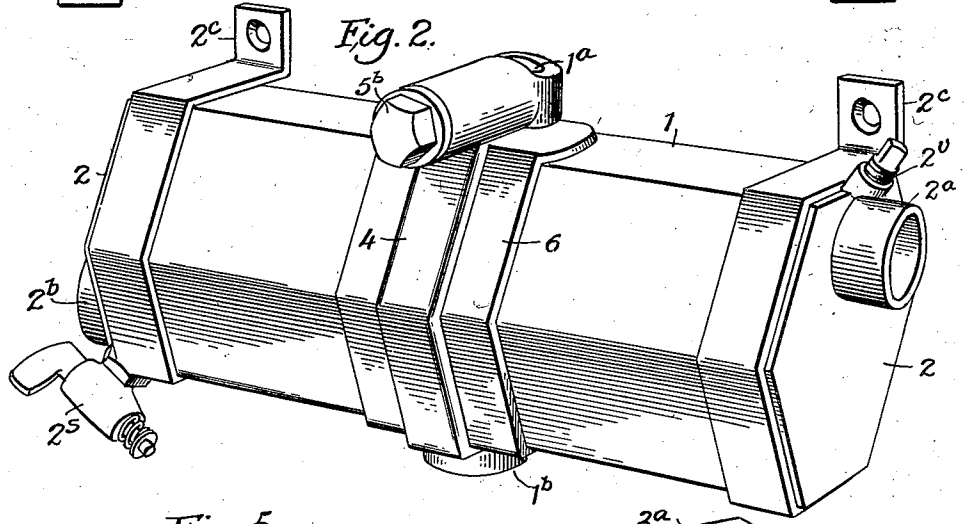
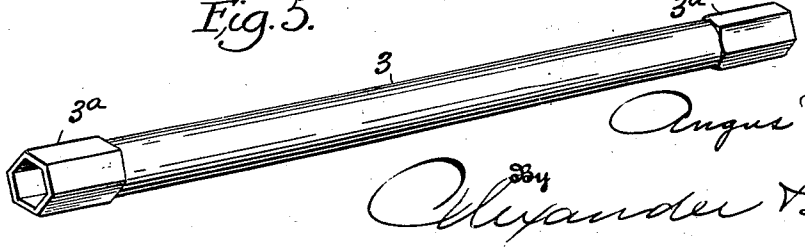



Fig. 5.




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Fig. 3.

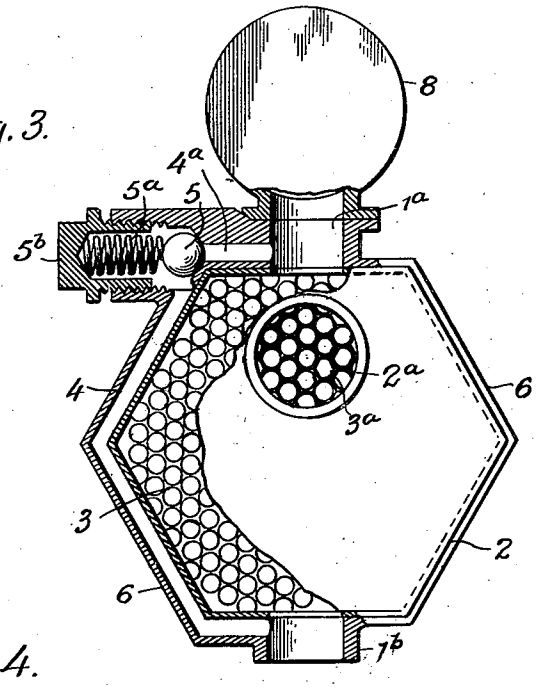
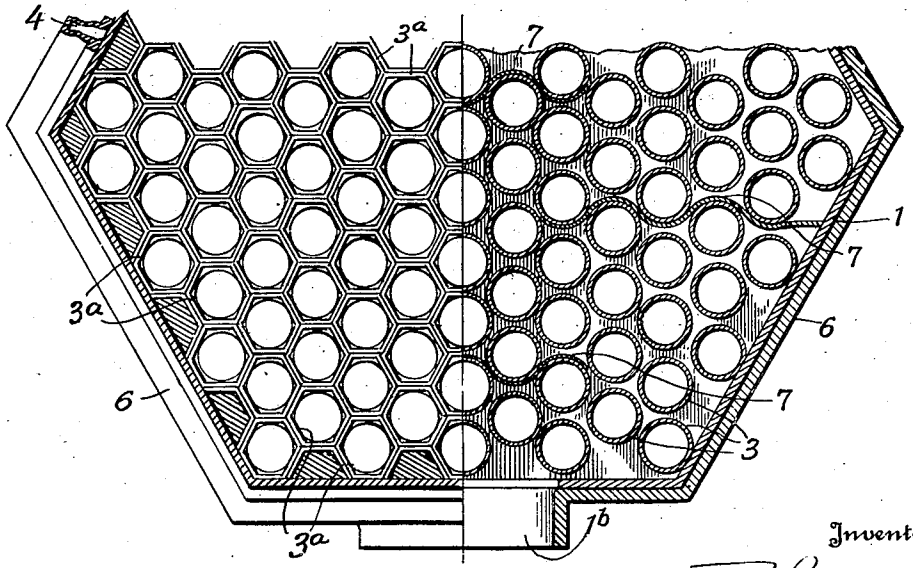



Fig. 4.




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# UNITED STATES PATENT OFFICE

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## OIL COOLER

Application filed March 27, 1929. Serial No. 350,229.

This invention is a novel cooler of the condenser type, for cooling lubricating oil or other liquids. One object of the invention is to provide a cooler in which the different parts may be readily assembled and secured in place and preferably united by solder to form a unitary structure. Another object is to provide a cooler having a maximum extent of cooling surface and capacity for a given size; another object is to make a cooler having a core formed of similar parallel tubular members arranged preferably in quincunx order and having slightly enlarged polygonal heads at their ends which fit neatly together side by side; said heads slightly separate the bodies of the assembled members so that the fluid to be cooled can circulate exterior to and around them; and the heads when properly united form partitions which will prevent passage of liquid between the adjacent faces of the heads, but permit water or other cooling liquid to be passed through the members. Such core when assembled is entered in a casing which preferably has its ends internally shaped to conform to the headed ends of the core. The ends of the casing are closed by heads preferably having flanges fitted to the ends of the casing, said heads being respectively provided with openings for the inlet and the outlet of the cooling medium. The casing is provided at one side intermediate its ends with an inlet for the oil and at the other side with an outlet therefor. In the preferred form of the invention the casing is provided with a by-pass between the oil inlet and outlet, and with automatic means whereby cold oil will be permitted to flow through the by-pass, but heated oil will flow through the casing and around the said tubular members. To prevent the cooler becoming clogged with impurities I also preferably provide a filter through which the oil is passed before it enters the cooler; said filter being conveniently mounted upon the cooler.

I will explain the invention with reference to the accompanying drawings which illustrate one practical embodiment of the invention, to enable others to adopt and use the same. In the claims are summarized the novel features of the construction, and novel combinations of parts, for which protection is desired.

In said drawings;

Fig. 1 is a side view of the combined cooler and filter.

Fig. 2 is a perspective view of the cooler detached.

Fig. 3 is a part end elevation and part transverse section of the cooler.

Fig. 4 is an enlarged detail transverse section, part at center of cooler and part near one end thereof.

Fig. 5 is a perspective view of one of the core members.

The casing 1 may be of any suitable contour, preferably polygonal in cross-section, and is provided with a preferably centrally located inlet $1^a$ and diametrically opposed outlet $1^b$. The ends of the casing 1 are closed by heads 2 respectively provided with an inlet $2^a$ and an outlet $2^b$; said heads preferably have flanges fitted to the ends of the casing 1 and preferably secured thereto by solder. The heads 2 may also be provided with perforated lugs $2^c$ for attaching the cooler to a wall or support (not shown).

Within the casing is a core preferably formed of a plurality of metal tubes 3 (Fig. 5) preferably circular in cross section and somewhat shorter than the casing. Each tube has an enlarged polygonal head $3^a$ on each end preferably formed by expanding such ends. Preferably the tubes 3 are made of thin copper, or like metal, which will act to readily exchange heat between the oil and the cooling medium; and of such size as will give a maximum area of water and oil contact surfaces for a given size of cooler.

A number of such tubes are assembled parallel with their heads fitted closely together laterally, as in Fig. 4, and each face of each polygonal head $3^a$ contacts with a similar face of an adjacent head, and the contacting faces of the heads are securely united to bond the tubes into a core which is placed in the casing. The heads are shown as hexagonal in cross section, therefore the tubes will naturally be arranged in quincunx order. The

heads of the assembled tubes are secured together, preferably by dipping in solder.

The exterior contour of the mass of heads at each end of the core preferably conforms to the interior section of the adjacent inner wall of the casing and is preferably connected thereto by solder so that the assembled heads at the ends of the core form transverse partitions in the casing when the core is secured therein. These partitions are however slightly spaced from the adjacent heads of the casing as shown in Fig. 1 so that cooling fluid can readily flow from the inlet at one end of the casing, through the tubes 3 to the outlet at the other end thereof.

One of the heads may be provided with an air vent opening closed by a suitable plug, as indicated at $2^v$ in Fig. 2, and the other head may be provided with a drain opening closed by a suitable valve, indicated at $2^s$ in Fig. 2.

The oil inlet $1^a$ is preferably in the upper side of the casing, and at one side of this inlet and communicating therewith is an opening $4^a$ which communicates with one end of a by-pass passage 4 that extends around the wall of the casing to the oil outlet $1^b$ with which it communicates. The inlet of oil to the by-pass is normally closed by a valve 5, which may be of any suitable construction, being shown as a ball valve, that is normally seated by an expansion spring $5^a$, the tension of which can be adjusted by a screw $5^b$. This screw may be calibrated so that the amount of pressure by which the valve is held to the seat can be readily regulated. When valve 5 is opened oil can flow from the inlet $1^a$ into the by-pass 4 and through it to the oil outlet $1^b$. The by-pass 4 and the by-pass valve casing may be formed in an annular casting 6 interiorly shaped to conform to the exterior contour of the casing 1 and slipped thereon and secured thereto by soldering or other suitable means. This construction enables the body of the casing to be made out of sheet metal; and the member 6 to be cast.

It is not necessary to cool the oil unless it is undesirably heated. More pressure is required to circulate oil when it is cold than is required when it is hot, therefore the valve 5 can be so adjusted that in starting up, when the oil is cold and stiff, the valve will open and permit the cold oil to pass through the by-pass, but as soon as the oil warms up to a point where cooling is required valve 5 will close the by-pass and the hot oil, thinned by the heat, will pass through the cooler and be cooled thereby. The by-pass valve acts automatically, and can be adjusted so as to regulate the pressure required to open it.

In order to prevent impurities entering the cooler I preferably provide an oil filter 8 which may be of any suitable construction shown as mounted upon and supported by the cooler, and having an oil inlet $8^a$ and an oil outlet $8^b$ connected directly to the inlet of the casing 1; as shown in Figure 1.

The water or other cooling medium is preferably circulated through the tubes from the inlet to the outlet as indicated in Fig. 1. While the oil or other fluid to be cooled is preferably circulated through the casing and around the tubes from inlet to outlet.

If desired one or more baffle plates 7 may be placed in the core between the oil inlet and outlet, to disseminate the oil throughout the core and obtain a maximum cooling effect.

Oil coolers constructed in the above manner are inexpensive to manufacture. The soldered joints are strong and water tight. No screws or bolts are required in assembling the parts.

The invention is not limited to the specific form shown in the drawings and the cooler may be used for cooling other liquids and fluids than lubricating oil.

In this application I have claimed the cooler in connection with means whereby the cold oil may be short circuited, so as to avoid injury to the cooler tubes, until the oil has become sufficiently heated to flow readily therethrough. In companion application Serial No. 297,997 filed August 7, 1928, the cooler is claimed irrespective of the bypass.

I claim:

1. An oil cooler; comprising a casing; a core therein composed of tubular members having enlarged heads on their ends, said heads being united to form partitions in the casing adjacent the ends thereof, said partitions being united to the casing; said casing being provided with inlet and outlet openings for fluid passing through the tubes, and with inlet and outlet openings whereby oil can be passed around the tubes; all of the separately formed parts of the casing and of the core and the core and casing being united by solder to form a unitary structure and seal all joints fluid tight and a bypass between the oil inlet and the oil outlet, and means for normally closing said bypass.

2. An oil cooler; comprising a casing, a plurality of tubular members having their ends united to form partitions in the casing adjacent the ends thereof; said casing being provided with inlet and outlet openings for fluid passing through the tubes, and with inlet and outlet openings whereby oil can be passed around the tubes intermediate the said perforations; a bypass between the oil inlet and the oil outlet, and means for normally closing said bypass.

3. An oil cooler, comprising a tubular casing, heads closing the ends of the casing, a series of parallel tubular members in the casing having expanded ends laterally united to each other and the ends of the exterior tubular members being also laterally united to the casing, the united series of expanded ends forming partitions in the casing adjacent the

ends thereof; said casing having openings for inlet and outlet of cooling fluid passing through the tubular members and partitions, and inlet and outlet openings whereby oil can be passed around the tubes intermediate the said partitions; a bypass between the oil inlet and oil outlet, and automatic means for normally closing said bypass.

4. An oil cooler; comprising a casing formed of a tubular body, and heads closing the ends of the body and having flanges fitted to the ends of the body and united thereto by solder; a series of parallel tubular members in the casing having expanded ends laterally united to each other by solder, the united expanded ends forming fluid tight partitions in the casing and united to the interior walls of the casing body by solder; said casing being provided with openings for inlet and outlet of fluid passing through the tubular members, and also provided with inlet and outlet openings intermediate said partitions whereby oil can be admitted into the casing and passed around the tubes intermediate the said partitions; all the parts being connected by solder and all joints being sealed fluid tight with solder and a bypass between the oil inlet and the oil outlet, and means for normally closing said bypass.

5. A cooler comprising a casing polygonal in cross section, a plurality of parallel tubes within the casing having enlarged polygonal heads on their ends, said heads being closely fitted together laterally and united by dipping in solder and the outermost heads being also closely fitted to the inner wall of the casing, the united heads forming partitions in the casing adjacent the ends thereof and united thereto by solder; heads provided with flanges fitted over the ends of the casing and united thereto by solder and provided with openings for inlet and outlet of fluid passing through the tubes, said casing having an inlet and outlet intermediate the said partitions for the passage of fluid around and exterior to the tubes; a by pass between the casing inlet and the casing outlet, and automatic means for normally closing said bypass.

6. A cooler comprising a casing polygonal in cross section, a plurality of parallel tubes within the casing having enlarged polygonal heads on their ends, said heads being closely fitted together laterally and united by dipping in solder and the outermost heads being also closely fitted to the inner wall of the casing, the united heads forming partitions in the casing adjacent the ends thereof and united thereto by solder; heads provided with flanges fitted over the ends of the casing and united thereto by solder and provided with openings for inlet and outlet of fluid passing through the tubes, said casing having an inlet and outlet intermediate the said partitions for the passage of fluid around and exterior to the tubes; an annular casting attached to the casing having a by-pass communicating at one end with the casing inlet and at the other end with the casing outlet, and means for normally closing said bypass.

7. A cooler comprising a casing body polygonal in cross section, a plurality of parallel tubular members within the body placed side by side, said members having enlarged heads at their ends adjacent the ends of the body, said heads being closely fitted together laterally and the outermost heads being also closely fitted to the inner wall of the body so that the heads form partitions therein adjacent the ends thereof, said tube heads being firmly united to each other and to the walls of the casing by dipping in solder; heads having flanges fitted to the ends of the body and secured thereto by solder, said heads closing the ends of the body, and respectively provided with an inlet and an outlet for fluid to be passed through the tubes; said body having an inlet and an outlet intermediate the said partitions for the passage of fluid around and exterior to the tubes, all joints being sealed by solder; a bypass between the body inlet and the body outlet, and automatic means for normally closing said bypass.

8. A cooler comprising a casing body polygonal in cross section, a plurality of parallel tubular members within the body placed side by side, said members having enlarged heads at their ends adjacent the ends of the body, said heads being closely fitted together laterally and the outermost heads being also closely fitted to the inner wall of the body so that the heads form partitions therein adjacent the ends thereof, said tube heads being firmly united to each other and to the walls of the casing by dipping in solder; heads having flanges fitted to the ends of the body and secured thereto by solder, said heads closing the ends of the body, and respectively provided with an inlet and an outlet for fluid to be passed through the tubes; said body having an inlet and an outlet intermediate the said partitions for the passage of fluid around the exterior to the tubes, all joints being sealed by solder; an annular casting attached to the body having a bypass communicating at one end with the body inlet and at the other end with the body outlet, and means for normally closing said bypass.

ANGUS R. GROSS.