Jan. 1, 1935. H. C. RICHARDS 1,986,219

COOLING MEANS FOR SHAFTS

Filed Dec. 30, 1933

Fig. 1.

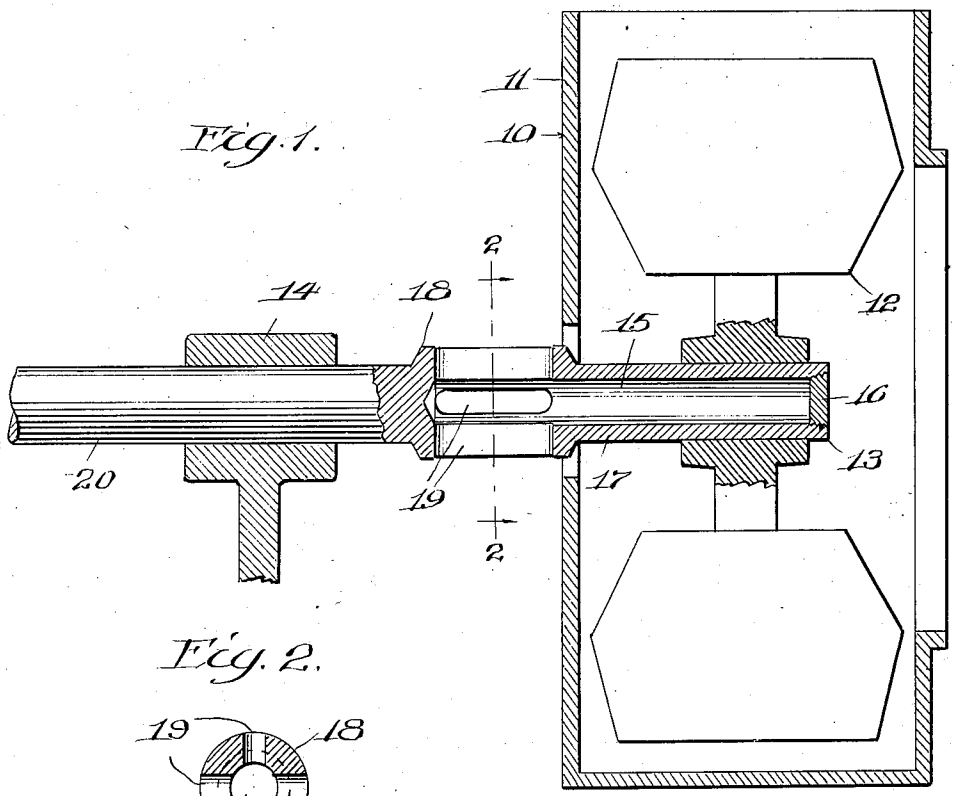


Fig. 2.

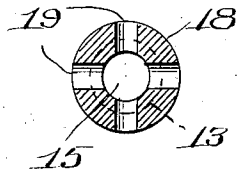


Fig. 3.

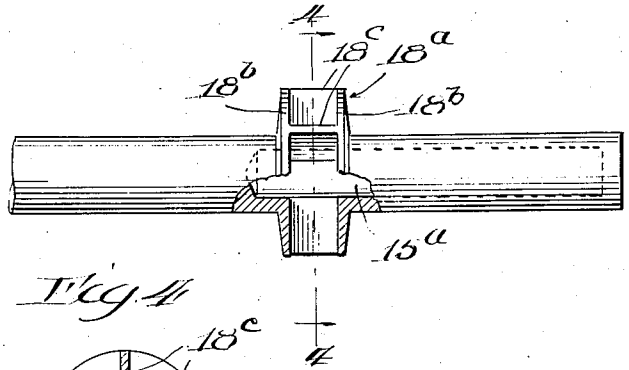
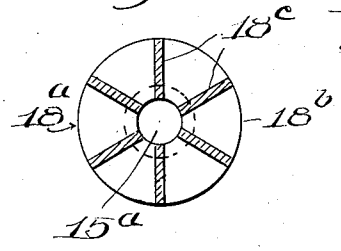


Fig. 4



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COOLING MEANS FOR SHAFTS

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8 Claims. (Cl. 308—77)

This invention relates to cooling means for shafts and its principal object is to minimize the thermotic conductivity of an abnormally heated part of the shaft, whereby the shaft may run free in an adjacent bearing.

In many situations, a blower is employed for handling hot gases, hot air and so forth, and that part of the fan shaft which extends into the blower becomes very hot, the heat developed in the shaft being conducted to adjacent bearings and abnormally heating them, causing friction and binding of the shaft in the bearings and endangering the latter to serious injury.

Another object is to provide air exhausting means on a high speed shaft operating to create a partial vacuum in the hollow portion of a shaft, whereby to minimize the thermotic conductivity of that part of the shaft, thereby preventing the heat, in a great measure, from being conducted back from the hot part of the shaft to adjacent bearings.

Other objects and advantages will appear in the course of this specification and with all of said objects and advantages in view, this invention consists in the several novel features hereinafter fully set forth and claimed.

The invention is clearly illustrated in the accompanying drawing, in which

Fig. 1 is a view, partly in side elevation and partly in section of a blower, a shaft and an adjacent bearing, illustrating a simple form of the invention applied to the shaft,

Fig. 2 is a detail cross-section taken on the line 2—2 of Fig. 1;

Fig. 3 is a side elevation, partly broken out, of a shaft illustrating a modification of the invention, and

Fig. 4 is a detail cross-section taken on the line 4—4 of Fig. 3.

Referring to said drawing and first to Figs. 1 and 2, the reference character 10 designates a blower or other hot air circulating apparatus such as is used in connection with ovens or other chambers in which abnormally high temperatures are developed. The blower shown is of conventional type having a casing 11 formed with inlet and discharge openings, a fan 12 in the casing and a shaft 13 on which the fan is mounted. The shaft is driven at high speed from an electric motor or other source of power, and is journaled in bearings, one of which is shown at 14 located exteriorly of the blower casing but adjacent thereto. The fan and that part of the shaft within the blower casing are subjected to the hot gases which are moved through the blower and with ordinary construction the heat is conducted through the shaft to the bearing, subjecting the same to the dangers of overheating.

In accordance with the present invention, the shaft is bored out from the end that enters the blower for a sufficient distance to leave part of the bore outside the blower casing when the shaft is installed. The cavity 15 thus formed is closed at the extremity of the shaft by a plug 16. The wall 17 of the hollow part of the shaft, therefore, extends from the hot interior of the blower casing to a point outside the same.

Surrounding the wall of the hollow portion of the shaft outside the blower casing is a head 18, usually cylindrical in form, and provided with one or more transverse ducts or passages 19 desirably in the form of slots, extending from the bore to the cylindrical face of the head and opening outwards at places beyond the circumference of the bore.

In operation, the wall of the hollow part of the shaft within the blower becomes hot and some of the heat, absorbed by the wall of the hollow shaft, is radiated into the relatively cool air outside the blower. As a result of the high speed of the shaft, and the centrifugal action on the air in the slots, the air in the bore or cavity in the hollow portion of the shaft is exhausted therefrom, thereby creating a partial vacuum therein through which the heat from the wall of the hollow part of the shaft is not appreciably conducted. As a result, the solid part 20 of the shaft remains relatively cool and runs free in the relatively cool adjacent bearing 14.

In the modified form of the invention illustrated in Figs. 3 and 4, the suction means for creating a partial vacuum in the closed bore or cavity 15^a of the shaft, comprises a fan wheel 18^a formed as a part of the shaft, or separately formed and joined to the shaft in any suitable manner. As shown the diameter of the fan wheel is somewhat greater than that of the shaft, and comprises two circular side walls or flanges 18^b that project from the hollow part of the shaft, and blades or vanes 18^c connecting said walls or flanges. The shape of blades or vanes may of course be varied as desired to give the greatest efficiency in exhausting the air from the closed bore in the shaft when the latter is rotated at high speed. As in the other form described the fan wheel exhausts air from the cavity of the hot part of the shaft, thereby creating a partial vacuum therein, and minimizing the

thermotic conductivity of the shaft and preventing overheating of adjacent bearings.

The principle of operation of the present invention differs from that of shaft cooling means now known. Instead of circulating air through the shaft, a partial vacuum is created in the bore or cavity in the hollow part of the shaft, thus minimizing the thermotic conductivity of that part of the shaft which is subject to the excessive heat in the blower. In installations where this invention is in use, the adjacent bearing remains cool and the shaft runs free in the bearing.

I claim as new and desire to secure by Letters Patent:

1. Shaft cooling means comprising in combination, a high speed shaft, a bearing in which the shaft is journaled, one end of said shaft extending beyond the bearing and entering a hot chamber in which it is subjected to high temperatures, there being a closed bore in said extended end of the shaft, providing a vacuum chamber, said bore having a transversely extending duct opening outward to the atmosphere and terminating beyond the circumference of the bore outside the high temperature zone, whereby when the shaft is rotated at high speed, air is exhausted and a partial vacuum is created in the bore of the shaft, thereby minimizing the thermotic conductivity of the bored part of the shaft.

2. Shaft cooling means comprising in combination a high speed shaft, one end of which extends into a hot chamber and is subjected to high temperatures therein, there being a closed bore in said end of the shaft providing a vacuum chamber, a bearing for said shaft disposed adjacent the bored extremity of the shaft, and an enlargement on said shaft disposed between said bored extremity and the shaft bearing and having transversely extending ducts leading outwardly from said bore to the surface of the enlargement and opening to the atmosphere, whereby when the shaft is rotated at high speed, air is exhausted and a partial vacuum is created in the bore of the shaft, thereby minimizing the thermotic conductivity of the bored part of the shaft.

3. Shaft cooling means comprising in combination, a sigh speed shaft, one end of which is subjected to high temperatures, there being a closed bore in said shaft, providing a vacuum chamber, a bearing for said shaft disposed adjacent the bored end of the shaft, a head on said shaft intermediate its bored extremity and the bearing end having ducts leading from the bore in the shaft and discharge outwardly to the atmosphere, whereby air is exhausted and a partial vacuum is created in the bore when the shaft is rotated at high speed and the thermotic conductivity is thereby minimized.

4. Cooling means for fan shafts of blowers handling hot gases, comprising vacuum producing means located exteriorly of the blower, operating to exhaust air from a closed bore in that part of the shaft which enters the blower and discharge the air to the atmosphere, whereby a partial vacuum is produced in said bore, and the thermotic conductivity of the bored part of the shaft is minimized.

5. The combination of a blower for handling hot gases, said blower having a high speed drive shaft, extending into the blower and a fan mounted on said end of the shaft, a bearing for said shaft located exteriorly of the blower, and a head on the shaft, located between the blower and bearing, there being a closed bore in said shaft, extending partly within and partly outside of the blower, said bore terminating in transversely extending ducts leading out through the head, whereby when the shaft is rotated at high speed, air is exhausted and discharged to the atmosphere and a partial vacuum is created in said bore, and the thermotic conductivity of the bored part of the shaft is thereby reduced to a minimum.

6. Shaft cooling means comprising a high speed shaft having a hollow end extension which is subjected to excessive heat, the cavity in the shaft being closed at both ends, and a fan wheel structure connecting the shaft with the end extension and being formed with spaced blades, the spaces between the blades opening to the cavity in the shaft, whereby when the shaft is rotated at high speed, the fan wheel structure serves to exhaust air and create a partial vacuum in the cavity in the shaft.

7. Shaft cooling means comprising a high speed shaft having a hollow end extension which is subjected to excessive heat, the cavity in the shaft being closed at both ends and there being an opening in the wall of the hollow portion of the shaft, fan blades extending outward from said opening and side walls extending out from the shaft at the sides of said opening, said side walls and fan blades connecting the shaft with its end extension and serving to exhaust air from the cavity in the end extension.

8. Shaft cooling means comprising a high speed shaft having a hollow end extension which is subjected to excessive heat, the cavity in the shaft being closed at both ends and opening out through the wall of the hollow portion of the shaft, and side walls and fan blades of a fan wheel structure forming a connection between the shaft and its end extension and being adapted to exhaust air from the cavity therein.

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