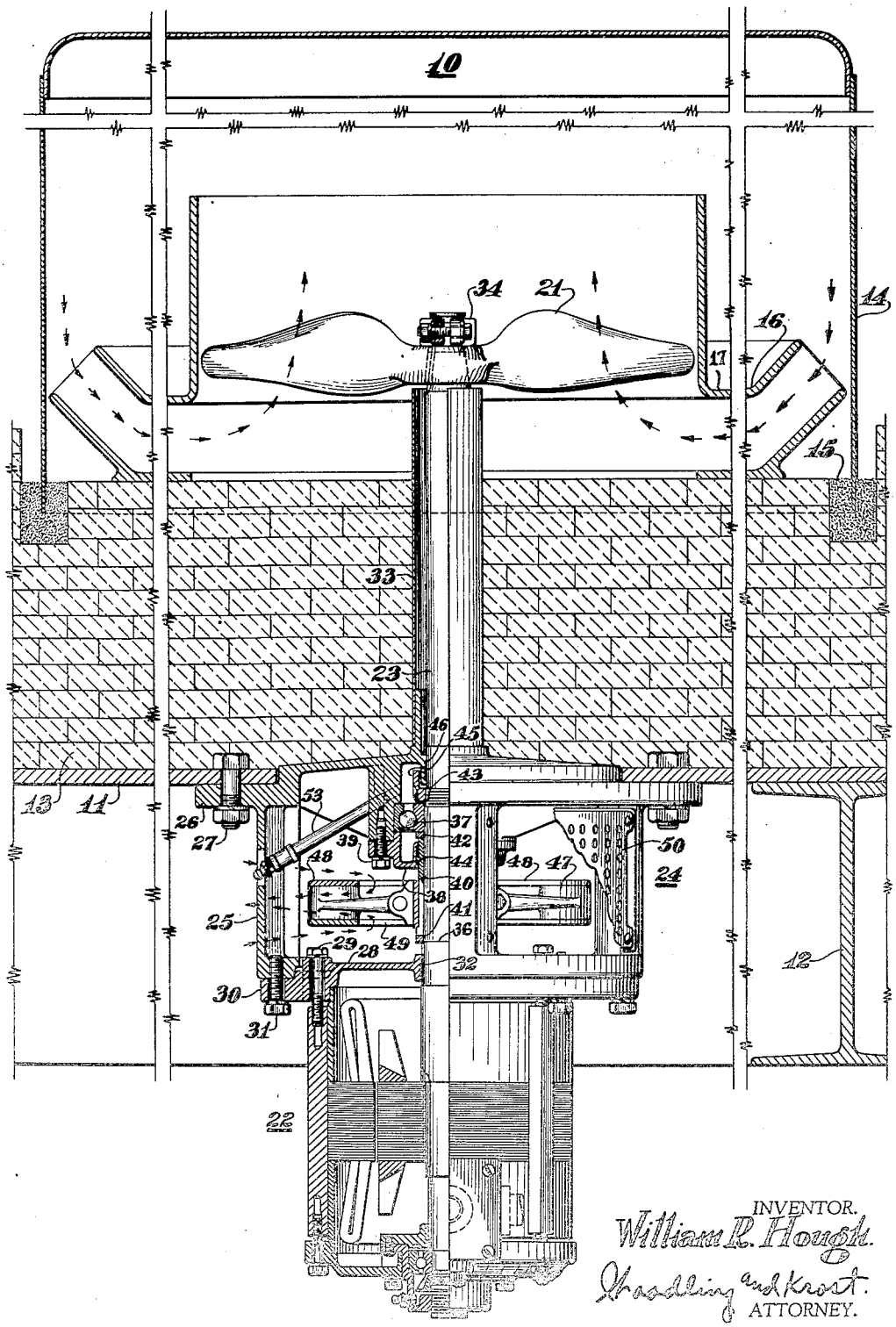
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MOTOR APPLICATION FOR HEATED COMPARTMENTS

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MOTOR APPLICATION FOR HEATED COMPARTMENTS

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My invention relates in general to minimizing the operating temperature of bearing means which supports an extension shaft having its extended end exposed to high temperature.

There are a large number of applications requiring a motor driven fan to circulate gases or atmosphere inside of ovens or furnaces. For simplicity, it is desirable to have the fan or blower mounted directly on the extension shaft of the electric motor. Because of the high operating temperatures in the ovens or furnaces, which may be in the neighborhood of 1600 degrees Fahrenheit, it is necessary to mount the motor outside of the ovens or furnaces and extend the shaft of the electric motor into the ovens or furnaces. With this method of mounting, the electric motor is insulated from the high oven or furnace temperature by a partition of insulating brick or other suitable means. However, there still remains the problem of disposing of the heat conducted along the motor shaft without making the extension shaft beyond the bearing means too long. If an attempt is made to minimize the heat conducted along the shaft to the bearing means, by making the extension shaft extra long, then the problem arises of increasing the cross-sectional area of the extension shaft to withstand the strain of the load, in which case an increase in the cross-sectional area of the shaft means that more heat is conducted along the extension shaft to the bearing means, defeating the very purpose to be accomplished.

My invention is based upon the treatment of this problem to make the extension shaft beyond the bearing as short as possible and to permit of the greatest possible temperature gradient between the heated end, which is in the oven or furnace, and the bearing supporting the shaft extension.

Therefore, an object of my invention is to provide for restricting the heat conduction along the extension shaft from the hot end positioned in the oven or furnace to the bearing which supports the extension shaft.

Another object of my invention is to provide for liberal facilities in disposing of the heat from the region of the bearing which supports the extension shaft to give a minimum temperature gradient.

Another object of my invention is to provide for liberal facilities in disposing of the heat from the region of the bearing which supports the extension shaft.

Another object of my invention is to provide for restricting the flow of heat back along the extension shaft to the bearing supporting the extension shaft; for aiding the flow of heat from the bearing along the shaft on the opposite side of the bearing, and for disposing of the heat which is aided to flow from the bearing.

Another object of my invention is to divorce the electric motor from the oven or furnace, or other heated compartment.

Another object of my invention is the provision of an air cooling department located between the electric motor and the furnace or oven and arranged to dispose of the heat conducted back along the motor extension shaft having its end extending into the furnace or oven.

Other objects and a fuller understanding of my invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

The figure represents a cross-sectional view of my invention shown in relation with a furnace.

With reference to the drawing, the furnace or oven or other heated compartment, to which my invention may be applied, is represented by the reference character 10 and may comprise generally a base 11 suitably supported by an arrangement of beams 12, a foundation of fire and insulating brick 13, a hollow dome cover 14 having its lower peripheral edge imbedded in a sand seal 15, and a supporting housing 16 having ducts through which the heated gases or atmosphere within the furnace may be circulated. The material to be treated in the furnace is arranged to rest upon the portion indicated by the reference character 17. As the heated gases or atmosphere is circulated within the furnace, it is caused to come in intimate contact with the material which is being treated. In accordance with usual practice, the gases or atmosphere within the cover 14 may be heated to a temperature in the neighborhood of 1600 degrees Fahrenheit by the application of external heat against the dome cover 14.

In my invention, I provide for circulating the heated gases or atmosphere within the furnace by means of a suitable fan 21 electrically driven by an electric motor 22 having a shaft 23 that extends from the motor through the brick 13 and to the fan. Interposed between the electric motor 22 and the base 11 of the furnace or oven, is an air cooling compartment indicated generally by the reference character 24. The air cooling compartment 24 may be of any suitable construction and, as illustrated, comprises a housing 25 having at its uppermost end a lateral flange 26 which may be securely fastened to the underneath

side of the furnace base 11 by means of suitable nuts and bolts 27. The lower end of the cooling compartment 24 may be separated from the electric motor by means of a separating member 28 having an outer lateral flange 30 secured to the lower peripheral edge of the housing 25 by means of threaded members 31. The frame of the electric motor 22 may be securely suspended from the separating member 28 by means of threaded members 29. As illustrated, the uppermost end of the motor frame may be arranged to snugly fit within an internal shoulder as the threaded members 29 are drawn tight. The shoulder arrangement provides a good stable connection for insuring that the shaft of the motor is properly centered with reference to the other parts of the assembly. The central opening of the separating plate 28 through which the shaft 23 passes makes a close clearance fit with the shaft and is arranged to have annular grooves 32 to prevent oil and other foreign matters from passing through the clearance space. Positioned above the housing 25 of the air cooling compartment 24 and surrounding the extension shaft 23 is a sleeve 33 which guards the extension shaft 23 from the brick 13. As illustrated, the circulating fan 21 may be connected to the upper end of the extension shaft 23 by a locking arrangement 34. With the above described arrangement, the electric motor is divorced from the oven or furnace, and therefore the motor application is quite normal in temperature and insulation requirements.

Mounted in the upper end of the housing 25 of the air cooling compartment 24 is a bearing 37 which is secured in the housing by means of a bearing cap 38 fastened to the housing by means of threaded members 39. Upon the lower side of the bearing 37 and snugly engaging the shaft 23 is an aluminum sleeve 40, around which is secured an aluminum fan 47 that rotates with the shaft 23. The lower end of the aluminum sleeve 40 abuts against an annular square shouldered ring 41 having its lower edge resting against the shoulder 36 upon the shaft 23. A similarly constructed annular square shouldered ring 42 is positioned between the upper end of the aluminum sleeve 40 and the lower edge of the inner race of the bearing 37. A lock nut 43 which threadably engages the extension shaft 23 is arranged to securely press the inner race of the bearing 37, the annular ring 42, the aluminum sleeve 40 and the annular ring 41 which abuts against the shoulder 36 of the shaft, closely together to form one complete assembly about the shaft which rotates therewith. As illustrated, the bearing cap 38 is provided with an upwardly extending flange which makes a close clearance fit with the aluminum sleeve 40 and which is provided with annular grooves 44 to prevent the escape of lubricant through the clearance space. In order to prevent the escape of lubricant from above the bearing 37, the housing 25 of the air cooling compartment 24 is provided with a downwardly extending flange which makes a close clearance fit around the extension shaft 23 and which is provided with annular grooves 46 to prevent the escape of the lubricant through the clearance. In addition, the lock nut 43 is provided with a peripheral upwardly extending flange 45 that closely surrounds the downwardly extending flange of the housing 25. The lubricant for the bearing 37 may be fed to the bearing through means of a lubricant duct 53 having a fitting upon the end thereof for the application of a lubricating dispensing device.

The aluminum fan 47 may comprise a plurality of blades shrouded upon both sides by side members 48 having a central opening 49. The outer peripheral surface of the housing 25 may be provided with a perforated cover 50, and accordingly as the fan 47 is rotated, air is drawn in through the perforations and from there it enters the central openings 49 of the side members 48 of the fan 47, after which it is expelled by the fan blades substantially radially outwardly through the perforations. The cover 50 may comprise perforated plates suitably fastened to the housing 25. For the purpose of clarity, the plates upon the underneath side of the housing are removed. The arrows representing the incoming and outgoing air are drawn to show the travel of the air as it would appear if the perforated plate over the cut-away section were present. The aluminum sleeve 40 and the aluminum fan 47 have a high heat conductivity and provide for a maximum of heat conduction from the bearing 37 for a minimum temperature differential between these parts. The aluminum fan 47 is particularly effective in dissipating heat from its surface when it is running. Also, due to its large surface area, it is highly effective in dissipating heat by radiation and natural convection when not running. The employment of the aluminum fan 47 and the aluminum sleeve 40 provides liberal facilities in disposing of the heat from the bearing 37.

The restriction of heat conduction through the extension shaft 23 from the hot fan 21 is accomplished by the use of a steel having a low heat conductivity and having a minimum cross-sectional area consistent with adequate mechanical strength. In actual practice, I find that the heat resisting alloys of chromium, nickel and steel are suitable for restricting the flow of the heat from the fan 21 to the bearing 37. These steels have a low heat conductivity and have the properties of high physical strength at elevated temperatures. In making the extension shaft 23 of these steels, the shaft can be of a minimum diameter for the given length and will have minimum heat conductivity for any given temperature differential along its length. The shaft 23 is therefore designed to have a minimum length between the bearing 37 and the fan 21 for any given temperature gradient between the bearing 37 and the fan 21.

In my invention, the bearing 37 is guarded from excessive heat in two ways: First, the conduction of the heat to the bearing 37 from the hot fan 21 is restricted by utilizing a steel shaft having a low heat conductivity. Second, the heat which finally reaches the bearing 37 is quickly dissipated by the aluminum sleeve 40 and the aluminum fan 47. Thus, on one side of the bearing 37, the heat is restricted from flowing thereto and upon the other side of the bearing the heat is liberally dissipated. By arranging the aluminum sleeve 40 and the aluminum fan 47 beneath the bearing 37, I am able to position the bearing 37 closer to the fan 21 than what would be the case if the aluminum sleeve 40 and the aluminum fan 47 were not utilized. By positioning the bearing 37 as close as possible to the fan 21, the overall length of the extension portion of the shaft 23 is materially reduced. A reduction in the overall length of the extension portion of the shaft 23 means that the cross-sectional area of the shaft 23 may be materially reduced. A reduction in the cross-sectional area of the shaft 23 accordingly reduces the heat con-

duction from the fan 21 to the bearing 37. Therefore, my design makes possible satisfactory bearing operation with the shortest possible distance between the bearing 37 and the high temperature fan 21 without any auxiliary cooling system. As a specific illustration of the effectiveness of my invention, I find that, if the fan 21 is operated in the neighborhood of 1600 degrees Fahrenheit, the bearing 37 may be maintained at approximately 200 degrees Fahrenheit, with the distance between the fan 21 and the bearing 37 in the neighborhood of 16 inches and with an extension shaft diameter of one and one-half inches.

Summarizing, my invention minimizes the temperature of the bearing 37 by restricting the flow of the heat along the extension shaft 23 to the bearing, aiding the flow of heat from the bearing along the shaft on the motor side of the bearing, and disposing of the heat which is aided to flow from the bearing.

Although I have described my invention with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without department from the spirit and scope of the invention as hereinafter claimed.

I claim as my invention:

1. The combination with an electric motor arranged to drive a device positioned in a region of high temperature, of an extension shaft extending from the motor to the driven device, an air cooling compartment having a housing positioned between the motor and the driven device, bearing means supporting the extension shaft, means for mounting the bearing means in the housing of the cooling compartment, a hollow member having a high heat conductivity positioned in the housing and closely surrounding the extension shaft between the bearing and the motor, a fan having a high heat conductivity positioned in the housing and mounted upon the hollow member to dispose of the heat conducted from the driven device along the extension shaft to the bearing means, said shaft extension comprising a metal having a low heat conductivity to restrict the flow of heat from the driven device along the extension shaft to the bearing means.

2. The combination with an electric motor positioned on the outside of a heated compartment and arranged to drive a device within the heated compartment, of an extension shaft extending from the motor into the heated compartment to the driven device, an air cooling compartment having a housing positioned between the motor and the heated compartment, means for supporting the said housing relative to the heated compartment, means for supporting the motor to the said housing, bearing means supporting the extension shaft, means for mounting the bearing means in the said housing, a heat conduction member having a high heat conductivity positioned in the said housing and closely surrounding the extension shaft in close heat transfer relation to the bearing means, a fan having a high heat conductivity positioned in the housing and driven upon the rotation of the extension shaft, said fan being mounted in close heat transfer relation to the heat conduction member to dispose of the heat conducted from the driven device along the extension shaft to the bearing means, said extension shaft comprising a metal having a low heat conductivity to restrict the flow of heat from the driven device along the extension shaft to the bearing means.

3. The combination with an electric motor positioned on the outside of a heated compartment and arranged to drive a device within the heated compartment, of an extension shaft extending from the motor into the heated compartment to the driven device, an air cooling compartment having a housing positioned between the motor and the heated compartment, means for supporting the said housing relative to the heated compartment, means for supporting the motor to the said housing, bearing means supporting the extension shaft, means for mounting the bearing means in the said housing, a fan having a high heat conductivity positioned in the housing and driven upon the rotation of the extension shaft, said fan being mounted near and in close heat transfer relation to the bearing means to dispose of the heat conducted from the driven device along the extension shaft toward the bearing means, said extension shaft comprising a metal having a low heat conductivity to restrict the flow of heat from the driven device along the extension shaft toward the bearing means.

4. The combination with an electric motor having an extension shaft with its extended end exposed to high temperature, of bearing means for supporting the extension shaft intermediate its extended end and the motor, said extension shaft comprising a metal having a low heat conductivity to restrict the flow of heat from its extended end toward the bearing, and heat conduction and radiation means positioned upon the extension shaft on the motor side of and in close heat transfer relation to the bearing means to dispose of the heat in the region of the bearing means said heat conduction and radiation means having a portion positioned relatively close to the bearing means to thermally divert heat from the shaft and comprising a metal having a high heat conductivity to dissipate through conduction and radiation such heat as reaches the bearing.

5. The combination with an electric motor positioned on the outside of a heated compartment and arranged to drive a device within the heated compartment, of an extension shaft extending from the motor into the heated compartment to the driven device, bearing means for supporting the extension shaft in the neighborhood where it enters the wall of the heated compartment, and heat conduction and radiation means having a high heat conductivity positioned about the extension shaft in close heat transfer relation to the bearing means to dispose of the heat in the region of the bearing means, said extension shaft comprising a metal having a low heat conductivity to restrict the flow of heat to the bearing means.

6. The combination with an electric motor having an extension shaft with its extended end exposed to high temperature, of bearing means for supporting the extension shaft intermediate its extended end and the motor, said extension shaft comprising a metal having a low heat conductivity to restrict the flow of heat from its extended end toward the bearing, and heat conduction and radiation means positioned upon the extension shaft and in close heat transfer relation to the bearing means to dispose of the heat in the region of the bearing means said heat conduction and radiation means having a portion positioned relatively close to the bearing means to thermally divert heat from the shaft

and comprising a metal having a high heat conductivity to dissipate through conduction and radiation such heat as reaches the bearing, said heat conduction and radiation means also constituting a fan to aid in disposing of the heat.

7. The combination with an extension shaft having its extended end exposed to high temperature, of bearing means for supporting the extension shaft intermedite its ends, said extension shaft comprising a metal having a low heat conductivity to restrict the flow of heat from its extended end toward the bearing, and heat conduction and radiation means upon the extension shaft near the bearing and in close heat transfer relation to the bearing to dispose of the heat in the region of the bearing, said heat conduction and radiation means comprising metal having a high heat conductivity.

8. The combination with an extension shaft arranged to drive a device within a heated compartment, of means positioned on the outside of the heated compartment to drive the extension shaft, an air cooling compartment having a housing positioned between the driving means and the heated compartment, means for supporting the said housing, bearing means supporting the extension shaft, means for mounting the bearing means in the said housing, a fan having a high heat conductivity positioned in the housing and driven upon the rotation of the extension shaft, said fan being mounted near and in close heat transfer relation to the bearing means to dispose of the heat conducted from the driven device along the extension shaft toward the bearing means, said extension shaft comprising a metal having a low heat conductivity to restrict the flow of heat from the driven device along the extension shaft toward the bearing means.

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