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TRANSPORT ROLLER FOR INDUSTRIAL FURNACES

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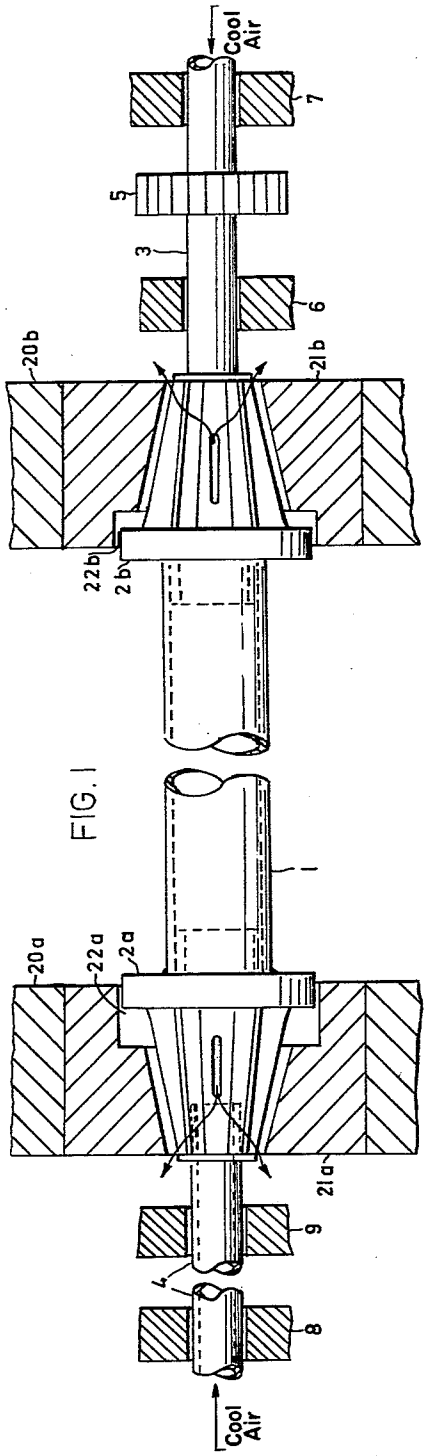


FIG. 1

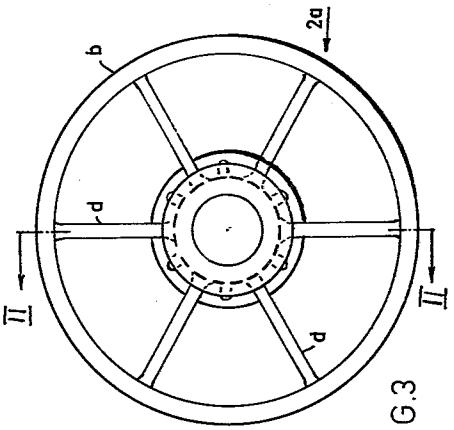


FIG. 3

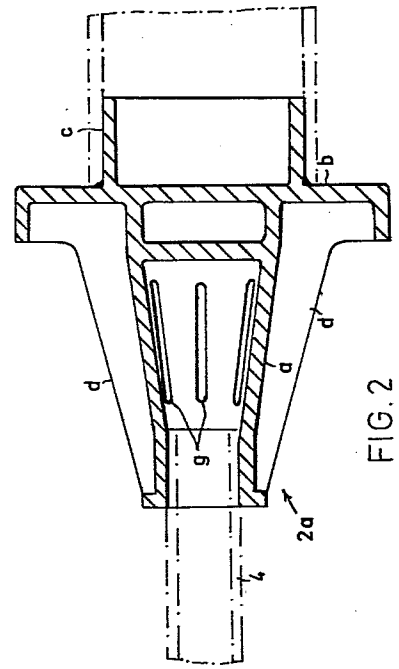


FIG. 2

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TRANSPORT ROLLER FOR INDUSTRIAL FURNACES

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The present invention relates to rollers as used in the interior of industrial furnaces for the transportation of white-hot steel bars and other objects maintained at high temperatures.

This application is a continuation-in-part of my application Ser. No. 660,918 filed May 22, 1957, now Patent No. 2,986,386 issued May 30, 1961.

In the mounting of any elongated body, such as a roller, for rotation about its axis it has been standard practice to provide a single bearing at each extremity of the body in order to have a statically determinate system comparable to a simple beam. Were such body constrained at both ends, as by the addition of an extra bearing to form the equivalent of a double cantilever beam, a statically indeterminate system would result wherein a rigid roller could not be rotated without setting up undue centrifugal stresses tending to destroy the bearings or to rip them from their moorings.

This mode of mounting has, on the other hand, been found unsatisfactory for the transport rollers of industrial furnaces which, in operation, are subject to strong thermal and mechanical stresses adapted to cause their deformation. To allow for a certain amount of thermal expansion it has, therefore, been proposed to mount a tubular roller loosely at each end on a driven trunnion traversed by a cooling fluid, the entrainment of the roller by the trunnions being accomplished by loose coupling with the aid of suitable dogs or the like. A drawback of this arrangement, apart from its limited mechanical stability which restricts its load-bearing capacity, is the fact that the loose contact between the roller and its trunnions impedes the heat exchange therebetween, hence the necessity for using a highly heat-resistant body of great wall thickness, thus of considerable weight, for the tubular roller.

An object of the present invention is to provide an improved roller construction for the purpose set forth wherein the above-indicated disadvantages are avoided.

Another object of this invention is to provide means for effectively cooling and rotatably supporting a transport roller of an industrial furnace in such manner as to afford maximum load-bearing capacity along with dependable operation.

It has been found, in accordance with this invention, that a transport roller, rigid at normal temperature but operating in the heated interior of an industrial furnace no longer behaves as a completely rigid body and that, accordingly, it becomes feasible to mount such roller in double-cantilever fashion, i.e. with each end thereof constained by means of a pair of axially spaced-apart bearings. According to a more specific feature of the invention, the constrained extremities or end portions of the roller are in the shape of trunnions rigidly joined (as by welding) to its central tubular body, each trunnion preferably forming a thermal radiator, such as a centrifugal blower, rotatably lodged in a ventilator housing inserted into the furnace wall or constituted by a portion of the latter.

The invention will be described in greater detail with reference to the accompanying drawing in which:

FIG. 1 is a fragmentary sectional view of an industrial furnace, showing in side elevation a transport-roller assembly according to the invention;

FIG. 2 shows, on a larger scale, the left-hand trunnion

of the assembly of FIG. 1, in axial section taken on the line II—II of FIG. 3; and

FIG. 3 is an end-elevational view of the left-hand trunnion of FIG. 1, drawn to the same scale as in FIG. 2.

In FIG. 1 there are shown the walls **20***a*, **20***b* of an industrial furnace, spanned by the central tubular body **1** of a transport roller embodying the invention. Ventilator housings **21***a*, **21***b*, inserted in these walls, are suitably recessed at **22***a*, **22***b* to receive a pair of thermal radiators in the form of centrifugal blowers **2***a*, **2***b* which, together with respective hollow shafts **4** and **3** extending beyond the furnace walls, constitute a pair of trunnions rigid with the roller body **1**. Although the members **1**, **2***a*, **2***b*, **3** and **4** could be interconnected by any suitable means, they have been shown in the drawing as joined together by welding. Body **1** and the blower portions **2***a*, **2***b* of its trunnions are preferably made of a highly refractory material; shafts **3** and **4**, located outside the heating chamber enclosed by the walls **20***a*, **20***b*, may be made of ordinary steel. It will be noted that the recesses **22***a*, **22***b* are of generally frustoconical configuration, diverging toward the heating chamber.

As best seen in FIGS. 2 and 3 for the radiator **2***a*, each blower comprises a generally frustoconical rotor *a* provided at its inwardly facing base with a flanged disk *b* substantially sealing the recesses **22***a*, **22***b* against the interior of the furnace. A short collar *c* extends beyond disk *b* to enter the roller body **1**, as indicated in dot-dash lines in FIG. 2. Shaft **4** enters the frustoconical blower rotor at *a* at its small end, as likewise illustrated in dot-dash lines. Radial vanes *d* extend at regular angular intervals along the outer periphery of rotor member *a* and terminate at the disk *b*; between these vanes the member *a* is provided with axially oriented peripheral slots *g* through which, during rotation, the heated air from the interior of roller body **1** is automatically expelled into the recess **22***a* which opens into the surrounding atmosphere. Relatively cool ambient air, or some cooling fluid supplied under pressure, is drawn in through hollow shaft **4** (and, on the opposite end, through hollow shaft **3**) as indicated by the arrow in FIG. 1. It will be understood that valves or the like may be provided for controlling, manually or automatically, the supply of such cooling fluid, e.g. in such manner as to admit the fluid in the event of a critical rise in temperature (e.g. when rotation of the roller is stopped).

Two axially spaced-apart bearings **6** and **7** support the shaft **3**, shaft **4** being similarly supported by bearings **8** and **9**. Rotation is imparted to the roller unit **1**—**4** via a gear **5** keyed onto shaft **3** between bearings **6** and **7**. It will be appreciated that, with this constraining arrangement, the roller body **1** will be positively restored to its straight form whenever, in its white-hot condition, it is caused to sag by the weight of the load.

The invention is, of course, not restricted to the specific embodiment described and illustrated but may be realized in various modifications thereof.

I claim:

1. In an industrial furnace of the type having a heating chamber with two side walls, said chamber being operable at white-heat temperatures, in combination, a single unitary cylindrical body comprising a central portion traversing said heating chamber and end portions passing through said side walls and extending beyond said heating chamber, said body being rigid at normal temperatures but flexible at white-heat temperatures, bearing means outside said heating chamber comprising two pairs of axially spaced bearings each located on one side of said heating chamber and supporting a respective end portion of said body; and drive means for rotating said body.

2. In an industrial furnace of the type having a heating chamber with two side walls, said chamber being operable

at white-heat temperatures, in combination, a single unitary cylindrical body comprising a central portion traversing said heating chamber and end portions welded to said body, said extremities passing through said side walls and extending beyond said heating chamber, said body being rigid at normal temperatures but flexible at white-heat temperatures, bearing means outside said heating chamber comprising two pairs of axially spaced bearings each located on one side of said heating chamber and supporting a respective end portion of said body; and drive means for rotating said body.

3. In an industrial furnace of the type having a heating chamber with two side walls, said chamber being operable at white-heat temperatures, in combination, a single unitary tubular body comprising a central portion traversing said heating chamber and end portions passing through said side walls and extending beyond said heating chamber, said body being rigid at normal temperatures but flexible at white-heat temperatures, bearing means outside said heating chamber comprising two pairs of axially spaced bearings each located on one side of said heating chamber and supporting a respective end portion of said body; drive means for rotating said body; and means for circulating a cooling fluid through said body.

4. In an industrial furnace of the type having a heating chamber with two side walls, said chamber being operable at white-heat temperatures, in combination, a single unitary tubular body comprising a central portion traversing said heating chamber and end portions welded to said body, said extremities passing through said side walls and extending beyond said heating chamber, said body being rigid at normal temperatures but flexible at white-heat temperatures, bearing means outside said heating chamber comprising two pairs of axially spaced bearings each located on one side of said heating chamber and supporting a respective end portion of said body; drive means for rotating said body; and means for circulating a cooling fluid through said body.

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