

July 15, 1952

R. C. PIERCE

2,603,316

BRAKE ROTOR

Filed Feb. 12, 1949

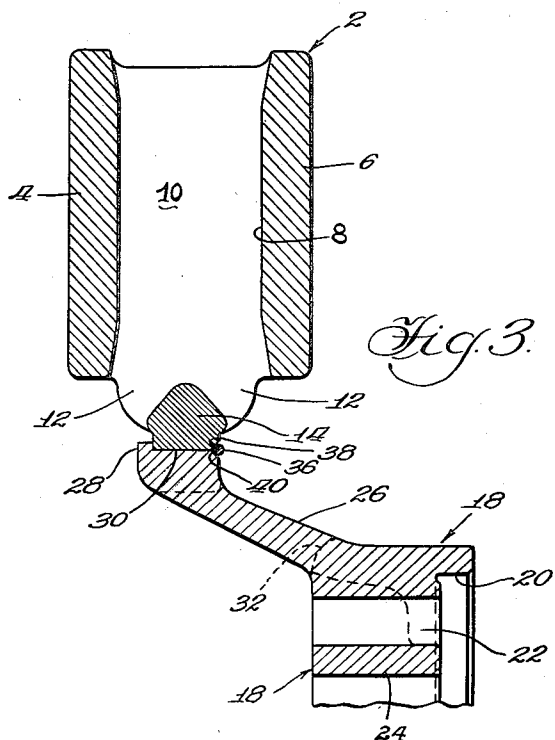
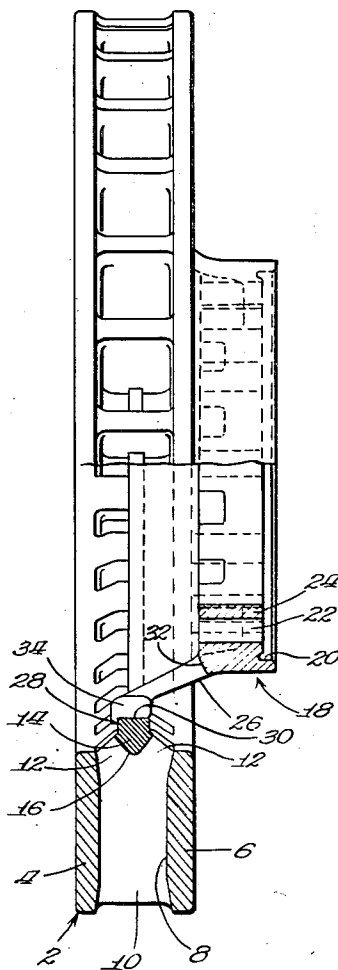
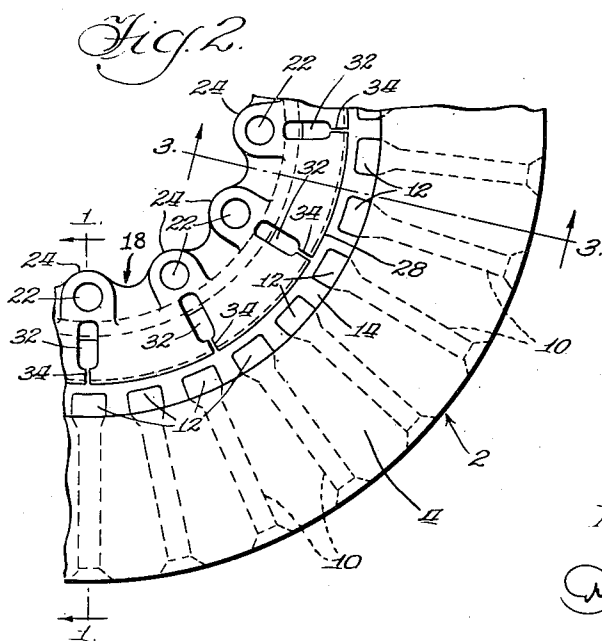


Fig. 1.



INVENTOR.
Raymond C. Pierce
BY
Wm O. S. Quinner
Att'y.

UNITED STATES PATENT OFFICE

2,603,316

BRAKE ROTOR

Raymond C. Pierce, Chicago, Ill.

Application February 12, 1949, Serial No. 76,035

13 Claims. (Cl. 188—218)

1

This invention relates to rotor structures and more particularly to a novel method and means for fabricating a rotor such as is commonly connected to the wheel and axle assembly of a railway car truck for cooperation with associated brake means to decelerate the truck.

A general object of the invention is to devise a novel rotor and method of fabricating the same to afford a strong yet readily releasable bond between the brake ring and the rotor hub which affords means for connection to the related wheel and axle assembly.

A more specific object of the invention is to provide a brazed connection between the ring and the hub capable of withstanding the torque stresses encountered in railway service.

A further object of the invention is to devise a brazed connection by means of which the hub, commonly formed of cast or forged steel, may be connected to a cast iron brake ring having more suitable friction characteristics than steel.

Still another object of the invention is to accommodate thermal expansion and contraction of the brake ring, such as occurs in railway service, without excessively stressing the brazed joint between the ring and the hub.

Still another object of the invention is to fabricate a rotor structure of the above-described type wherein the hub is connected to the ring by a plurality of spaced hub fingers, thereby accommodating expansion and contraction thereof in response to expansion and contraction of the iron brake ring which is subjected to greater thermal expansion and contraction than that of the steel hub.

The foregoing and other objects and advantages of the invention will become apparent from a consideration of the following specification and the accompanying drawings, wherein:

Figure 1 is an edge elevational view, partly in section on the line 1—1 of Figure 2, showing a brake rotor fabricated according to the invention;

Figure 2 is a fragmentary face elevational view taken from the left of Figure 1; and

Figure 3 is an enlarged sectional view on the line 3—3 of Figure 2.

Describing the invention in detail and referring first to the novel rotor structure shown in the drawings, the device comprises a brake ring, generally designated 2, having a plurality of annular plates or webs preferably two in number and indicated in the drawings at 4 and 6, said webs defining a fluid chamber 8 therebetween and being connected by a plurality of vanes 10

2

forming a centrifugal or peripheral blower structure adapted upon rotation of the ring to draw fluid, generally air, into the inner perimeter of the chamber 8 and to expel said fluid through the outer perimeter of the chamber 8 to cool the annular plates 4 and 6 which are commonly subjected to heat due to the development of braking friction against the remote surfaces thereof.

The radially inner perimeters of the vanes 10 are provided with fillets 12 affording connection to an annulus or mounting ring 14 integrally formed as part of the brake ring casting which is preferably iron. It may be noted that the ring 14 tapers toward its radially outer perimeter as at 16 to afford smooth flow of fluid through the chamber 8.

The novel rotor also comprises a hub, generally designated 18, having at one end thereof a bore 20 adapted to receive an associated rotatable structure, such as a railway car truck wheel hub (not shown), to which the hub 18 may be attached by suitable connecting means, such as studs (not shown) extending through a plurality of openings 22 formed within bosses 24 on the inner perimeter of the hub 18 adjacent one end thereof.

The hub 18 also comprises a generally conical or bell-shaped web 26 projecting into the brake ring 2 and preferably formed with a flange 28 engageable with one side of the ring 14 to afford a convenient seat therefor. The ring 14 and web 26 are in tight abutment along complementary smooth surfaces at 30 formed on the radially inner perimeter of the ring 14 and the radially outer perimeter of the web 26 respectively, this connection preferably being a press fit. It may be noted that the surfaces at 30 are flat, as seen in the radial cross-sectional view of Figure 3, to accommodate the press fit between the ring 14 and the web 26.

The hub 18 is preferably formed as a steel casting or forging having a plurality of generally oval openings or perforations 32 and before the ring 14 and web 26 have been brazed at 30, as hereinafter described in connection with the fabrication of the rotor, the web 26 is slotted, as by sawing, from each opening 32 to the outer perimeter of the web 26, as best seen at 34 in Figures 1 and 2. The oval shape of the openings prevents undue stress concentration at the inner ends of the slots 34. Thus the web 26 is divided into a plurality of fingers accommodating expansion and contraction of the web in response to thermal expansion and contraction of the brake

ring 2 due to heat developed therein as the result of braking applications in service.

The novel rotor structure is fabricated by first casting the iron brake ring 2 and the steel hub 18, the latter being cast with the before-mentioned openings 32. The mating surfaces at 30 are then machined and the hub is bored at 20 and is drilled to provide the before-mentioned holes 22. The web 26 is then slotted at 34, and thereafter the web surface at 20 is remachined to cut off a few thousandths of an inch to ensure concentricity, inasmuch as the release of stresses in the web 26 by slotting thereof may cause slight eccentricity. The brake ring 2 is then press fitted on the hub and is seated against the shoulder 28 of the web 26. An annular segment of wire 36 (Figure 3) is then inserted within a recess formed by converging diagonal surfaces 38 and 40 of the ring 14 and web 26 respectively, said wire being formed of any suitable brazing material such as, for example, any desired silver or copper alloy, as will be readily understood by those skilled in the art. The wire 36 is then heated to brazing temperature as by an induction coil or by heating the entire structure in a suitable furnace whereupon the brazing alloy brazes the mating surfaces at 30 by capillary action, as is well known in the art.

It will be understood that by means of the novel process of fabrication, as above described, the brazed surfaces at 30 are united in a strong bond fixing the brake ring 2 to the hub 18. Stresses on this bond due to thermal expansion and contraction of the brake ring in service are relieved by dividing the web 26 into a plurality of fingers, as above described, thereby accommodating flexing of the web which, not being directly subject to heating, is subjected to less expansion and contraction than that of the iron ring.

If desired, the flange 28 may be eliminated thereby facilitating the above-described slotting operation which preferably occurs before brazing of the brake ring 2 to the hub web 26. It may be noted that the slotting operation, if preferred, may be performed subsequent to fitting of the brake ring 2 on the web 26.

I claim:

1. A brake rotor comprising a cast iron brake ring including spaced friction plates defining a fluid chamber therebetween, said ring comprising a plurality of blower vanes extending between said plates and comprising a mounting ring integrally formed with said vanes and disposed radially inwardly of said plates, and a cast steel hub having a portion externally of the ring adapted for connection to an associated rotatable member, said hub having a conical annular web connected at one end thereof to said portion and flaring therefrom into said brake ring, said web being press fitted within said mounting ring along coaxial cylindrical surfaces rectilinear, as seen in radial cross-section, a bond connecting said surfaces to each other, and slots through said web interrupting its surface.

2. A fabricated brake rotor comprising a cast iron brake ring including a plurality of annular plates, and integral vanes interconnecting the plates, and a mounting ring integrally formed with the radially inner perimeters of said vanes, said rotor comprising a steel hub having a web press fitted in the mounting ring along coaxial cylindrical surfaces which are rectilinear, as seen in radial cross-section, and a brazed con-

nection between said surfaces, said web having slots interrupting its surface and extending radially inwardly therefrom, thereby dividing the web into a plurality of spaced fingers accommodating expansion and contraction of the web in response to thermal expansion and contraction of the brake ring without overstressing said connection.

3. A fabricated brake rotor comprising a brake ring with friction surfaces on the remote sides thereof, a fluid chamber between said surfaces, a plurality of blower vanes in said chamber, a mounting ring disposed externally of said chamber and connected to the radially inner extremities of said vanes, a web press fitted within said ring along complementary coaxial cylindrical surfaces of the web and ring rectilinear in radial cross-section, a bond between said surfaces and slots through the web interrupting its surface and extending radially inwardly therefrom, said web having means radially inwardly of said slots for connecting the web to an associated rotatable member.

4. A brake rotor comprising a cast iron brake ring having friction surfaces on the remote sides thereof and having integral vanes extending between said surfaces, a mounting ring formed integrally with said vanes and a steel support hub having a tapered annular web connected at its outer perimeter to said mounting ring along coaxial surfaces, the inner perimeter of the web being disposed externally of the ring and having means for connection to an associated rotatable member, said web having radial slots extending to and interrupting its outer perimeter, thereby dividing said outer perimeter thereof into a plurality of fingers adapted to accommodate circumferential thermal expansion and contraction of the iron ring as the result of heat developed in said ring due to braking forces exerted against said surfaces to decelerate rotation of said rotor and member.

5. A fabricated brake rotor comprising a brake ring having spaced friction surfaces, a fluid chamber therebetween, blower vanes in said chamber, and a mounting ring integrally formed with said vanes, and a hub comprising a web press fitted in said mounting ring along axial surfaces rectilinear, as seen in radial cross-section, said surfaces being bonded to each other, said web being tapered from said mounting ring and having a plurality of slots extending to and interrupting the radially outer perimeter of the web.

6. The method of fabricating a brake rotor which comprises forming an iron brake ring with an inner cylindrical wall, forming a steel hub with a frusto-conical web having its outer periphery formed with a cylindrical surface for snug engagement within said inner cylindrical wall, slotting said web inwardly from said cylindrical surface to define a plurality of radially disposed arms, and brazing the ends of said arms to the inner cylindrical wall of the brake ring.

7. A fabricated rotor comprising a brake ring with axially spaced friction surfaces at opposite sides thereof, a conical hub bonded to said ring along coaxial cylindrical surfaces, slots formed in said hub and extending to and interrupting the radially outer perimeter thereof, and means for connecting the hub to an associated rotatable member.

8. A method of fabricating a brake rotor comprising, press fitting a brake ring on the outer periphery of a continuous annular web along coaxial cylindrical surfaces, and slotting said web

5

inwardly from its cylindrical surface to define a plurality of radially disposed arms.

9. A method of fabricating a brake rotor comprising, slotting a frusto-conical web having openings therethrough, said slots extending from said openings to the outer periphery of the web, then press fitting a brake ring on said periphery along coaxial cylindrical surfaces, and then bonding said brake ring to said periphery along said coaxial cylindrical surfaces.

10. A method of fabricating a brake rotor comprising the steps of press fitting a brake ring onto the outer periphery of a frusto-conical perforated web at a point intermediate its ends and along coaxial cylindrical surfaces of the ring and web, then bonding said surfaces to each other, and then slotting the web from its perforations to said ring.

11. A brake rotor comprising a friction ring, a hub having a web press fitted into the inner perimeter of the ring along coaxial cylindrical surfaces, and slots through said web extending to and interrupting the radially outer perimeter thereof.

12. A brake rotor comprising a brake ring, a hub press fitted therein along coaxial cylindrical

6

surfaces and bonded together along said surfaces, and slots dividing the hub into a plurality of spaced fingers contacting the brake ring.

13. A method of fabricating a brake rotor comprising press fitting a brake ring onto the outer perimeter of an annular perforated hub along coaxial cylindrical surfaces of the ring and hub, and then slotting the hub from its perforations to the outer perimeter thereof.

RAYMOND C. PIERCE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,513,202	Wemp	Oct. 28, 1924
1,659,289	Gamble	Feb. 14, 1928
1,995,697	Whitacre	Mar. 26, 1935
2,141,164	Brehm	Dec. 27, 1938
2,182,238	Rasmussen	Dec. 5, 1939
2,215,420	Eksergian	Sept. 17, 1940
2,243,334	Eksergian	May 27, 1941
2,350,970	Tack	June 6, 1944
2,423,056	Tarbox	June 24, 1947