Aug. 8, 1933. C. BROSSMAN 1,921,864

UNDERFEED ROTARY GRATE STOKER

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Fig. 1.

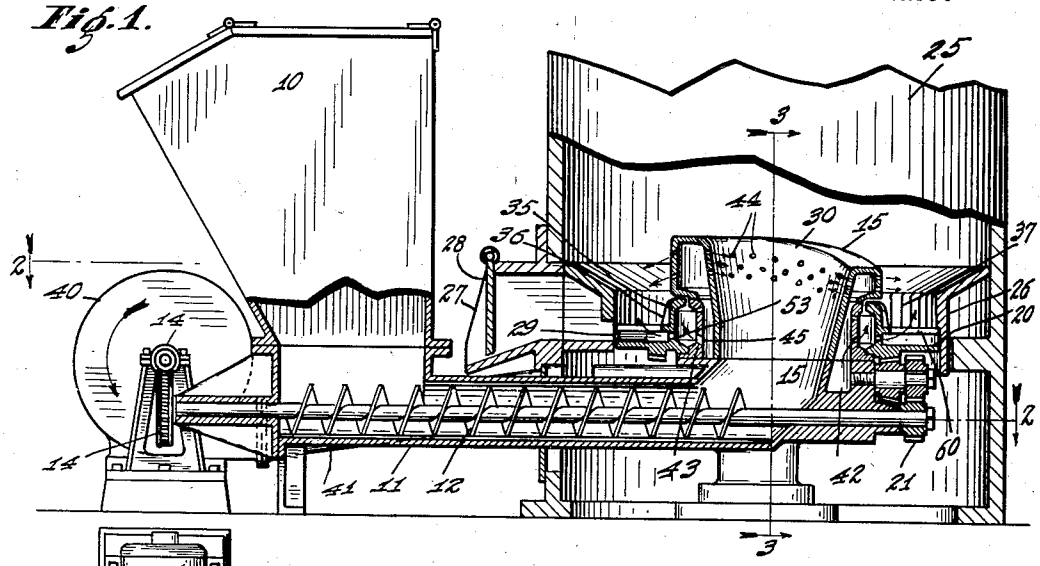


Fig. 2.

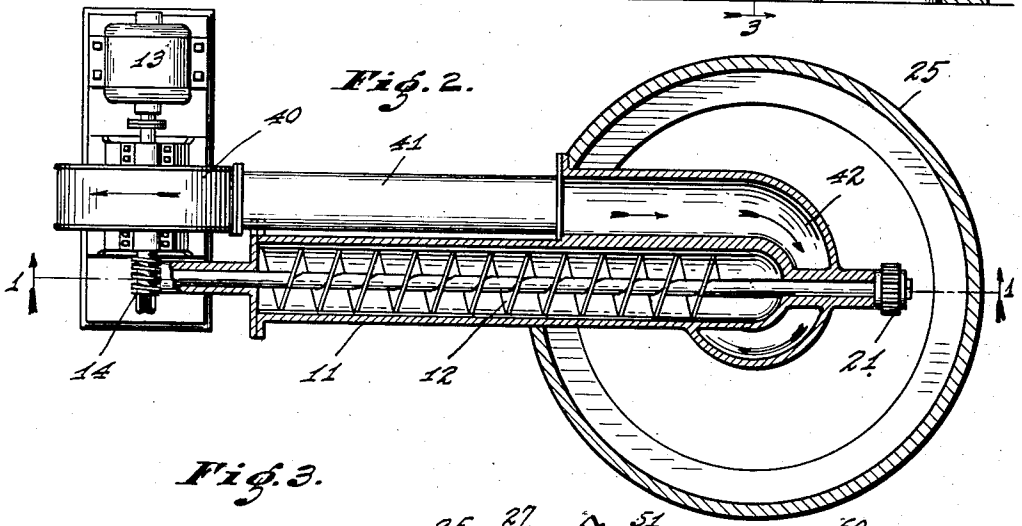


Fig. 3.

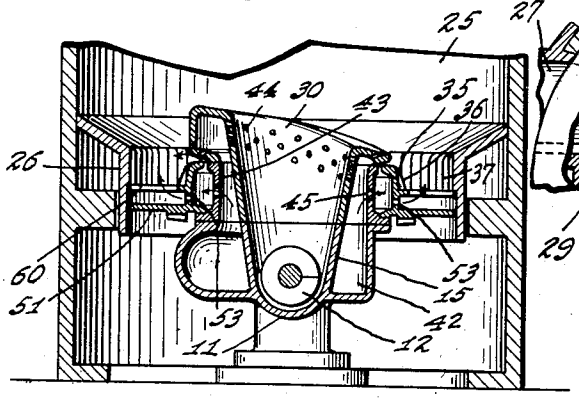
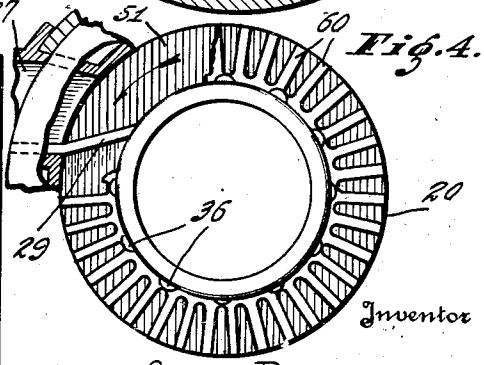


Fig. 4.



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Fig. 5.

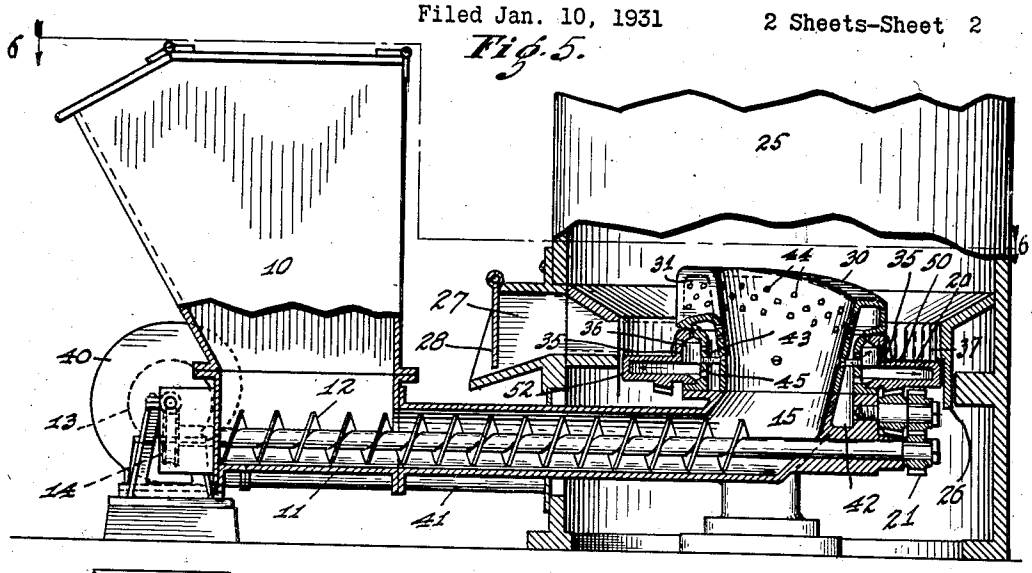


Fig. 6.

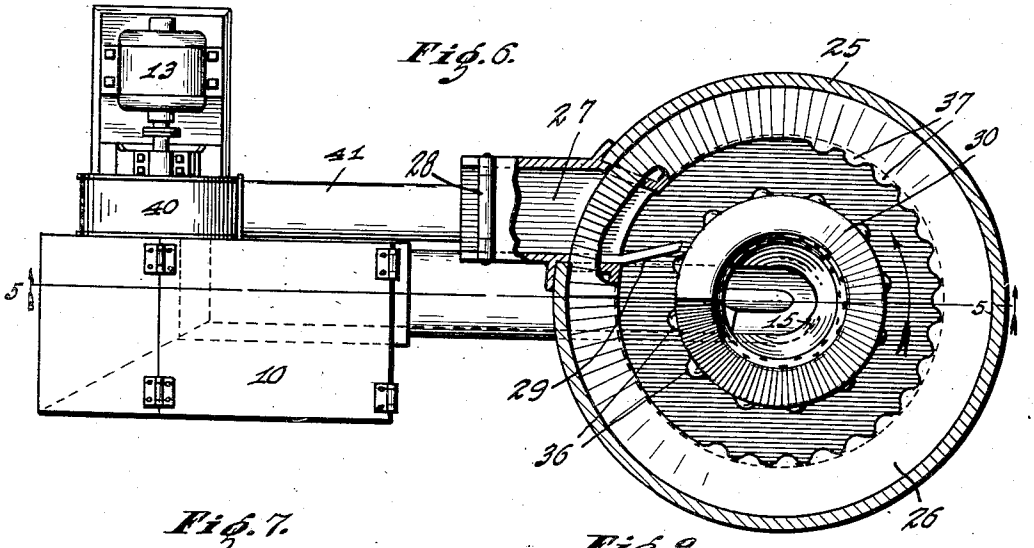


Fig. 7.

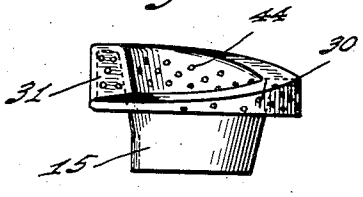
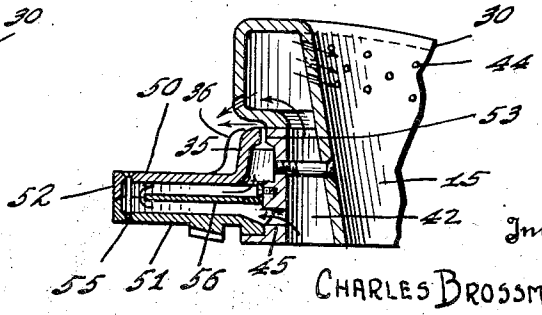


Fig. 8.



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UNDERFEED ROTARY GRATE STOKER

Charles Brossman, Indianapolis, Ind.

Application January 10, 1931. Serial No. 507,803

15 Claims. (Cl. 110—36)

My invention relates to underfeed rotary grates, and particularly to automatic fuel-feeding, fuel-distributing, and ash-removing mechanisms, especially for domestic furnaces.

In carrying out my invention, I provide a rotary grate through which rises a central hollow feed-riser which is supplied at the lower end with fuel, such as coal or coke, desirably by a screw-feed. At its upper end this feed-riser has some points on its periphery lower than others, conveniently with the whole in the shape of a one-turn helix; so that fuel from the riser will for the most part fall on the grate at or near a given position with respect to a riser, and will be carried around on the rotating grate from that position to a discharge point, where the ashes will be removed by a suitable scraping finger. In addition, I provide certain air passages and discharge outlets for cooling the metal parts while in addition furnishing air for the combustion.

The accompanying drawings illustrate my invention: Fig. 1 is a vertical section, in partial elevation, through a grate and its stoking mechanism embodying my invention in a preferred form, the section being taken substantially on the line 1—1 of Fig. 2; Fig. 2 is a horizontal section substantially on the line 2—2 of Fig. 1; Fig. 3 is a vertical section substantially on the line 3—3 of Fig. 1; Fig. 4 is a partial plan, of the rotating grate and the ash-removing finger, with part of the adjacent fire-box; Fig. 5 is a vertical section generally similar to Fig. 1, but showing a modified construction of the rotary grate, the section being taken on the line 5—5 of Fig. 6; Fig. 6 is a horizontal section on the line 6—6 of Fig. 5; Fig. 7 is an elevation of the hollow central riser; and Fig. 8 is a fragmental view showing in vertical section similar to that in Figs. 1 and 3 a modified construction of the rotary grate and of the air-distributing means associated therewith.

A main hopper 10 in which a supply of fuel, such as coal or coke, is maintained discharges at the bottom to one end of a screw-conveyor 11, in which a screw 12, suitably driven by an electric motor 13 as through a worm drive 14, carries coal from the lower end of the hopper 10 to the bottom of a stationary hollow feed-riser 15. This riser 15 may be made in two or more pieces, if desired; of which the lower part may be integral with the casing of the screw-conveyor 11, and the upper part may be separable.

Surrounding the stationary feed-riser 15 is a substantially horizontal rotary grate 20 which is suitably driven to rotate about the stationary riser 15, in a counterclockwise direction as shown. The drive for the grate 20 may be of any suitable character, such as the gearing 21 shown at the right of each of Figs. 1 and 5; by which, through certain intermediate parts, the shaft of the feed-screw 12 co-operates with a bevel-gear on the under side of the rotary grate 20 to drive the latter.

The riser 15 and rotary grate 20 are located within and substantially concentric with a furnace shell 25; within which is suitably mounted a fire-pot 26 which fits fairly closely around the periphery of the grate 20. The fire-pot has a lateral outlet chute 27, at substantially the same level as the grate, for the discharge of ashes. The outer end of this outlet chute may be closed by a swinging door 28, hinged at the top to swing open to let ashes pass out to fall into any suitable ash-receiver. The outlet chute 27 has on one side a scraping finger 29 which projects inward over the grate 20 to or near the inner edge thereof, to scrape ashes off the rotating grate into the outlet chute.

This arrangement of the scraping finger and the ash discharge chute very conveniently provides for the discharge of ashes at a point at substantially the grate-level and above the floor of the room in which the furnace is set, so that ashes may be received directly from the furnace in some receptacle, and the necessity of shoveling or otherwise lifting the ashes from the floor level is eliminated.

The upper end 30 of the riser 15 is lower at some points than at others, desirably by being in the shape of a one-turn helix, as is perhaps most clear from Fig. 7. The two ends of the single turn of such helix are of course vertically separated, but are joined by a substantially vertical web or wall 31. Because of this helical shape of the upper end 30 of the riser 15, the coal that is pushed upward through such riser tends for the most part to fall over the upper edge of the riser at the low point provided by such helix, so that the rotating grate will receive coal for the most part at substantially one place with relation to the riser, or at one point in its rotation. This low point of the riser-top, assuming the direction of rotation to be counter-clockwise as indicated in Fig. 6, is just slightly in the counter-clockwise direction from the finger 29. In consequence, fresh coal is fed to the grate at this general location, and is carried around the furnace by the rotation of the grate,

burning as it goes, and the ashes are scraped off by the finger 29 into the outlet chute 27.

Desirably the rotating grate 20 has an inner annular wall 35, which is provided with rounded teeth 36 or other projections which project in general radially outward therefrom. The inner surface of the fire-pot 26 has similar rounded teeth 37 which project generally radially inward. These co-operating rounded teeth 36 and 37 act as clinker-crushers, to grind between them any clinkers or large pieces of coal which may happen to get on the rotating grate; for the teeth 37 are stationary and the teeth 36 move generally counter-clockwise.

Desirably a blast of air is supplied under pressure, both to keep the metal parts cool and to furnish air for combustion. This air may be supplied by a blower 40, conveniently on the shaft of the motor 13; and this blower supplies air through an air conduit 41 to an annular air-chamber 42 surrounding the stationary riser 15 and having its upper portion between outer and inner walls of the riser. The outer wall of the intermediate part of this air chamber 42 is formed by an annulus 43 which at its lower end has a flat flange on which the rotating grate 20 is mounted. The annulus 43 is conveniently a stationary member, on which the grate 20 is rotatably mounted; but if desired it may be arranged to rotate with such grate. The air chamber 42 is provided with various air outlets, including apertures 44 through the upper part of the inner wall of the riser 15, and through the vertical wall 31, to discharge into or over the burning coal, and also including holes 45 which lead into an annular air space within the rotating grate.

The rotating grate itself may take various forms, as shown in Figs. 1 to 4 inclusive, 5 and 6, and 8 respectively. In the arrangement shown in Figs. 5 and 6, the rotating grate consists of a one-piece construction, in which there are upper and lower flat plates 50 and 51, peripherally joined by an edge wall 52 which is integral with both. The inner edge of the upper plate 50 joins the lower edge of the annular wall 35; and the air space into which the openings 45 discharge air lies between the plates 50 and 51 and between the annular wall 35 and the annulus 43. The flow of air through this air space tends to keep the grate cool. Air escapes from such air space by way of suitable openings 53, which may be arranged in the annular wall 35, and as a circular slit between the upper edges of the annular wall 35 and the annulus 43. The air that escapes through this latter slit keeps clear of coal dust and joint between the overhanging outer edge of the riser 15 and the upper edge of the annular wall 35, which move relatively to each other.

In the form of rotating grate shown in Fig. 8, the upper and lower plates 50 and 51 are made of separate pieces, fastened together by screws 55; and the edge wall 52 is of two parts, one integral with each of such two plates, as is clear from Fig. 8. This two-piece construction is provided to permit a central baffle 56 to be inserted in the space between the two plates 50 and 51, so that air which passes by the openings 45 into the space within the rotating grate will be compelled to pass outward below such baffle and around the outer edge thereof before it reaches any of the air-escape openings, which may be provided as already indicated.

In the forms of grate shown in Figs. 5 and 6, and 8, the finger 29 which scrapes off the ashes co-operates directly with the upper plate 50 to scrape ashes therefrom.

In the arrangement of grate shown in Figs. 1 to 4 inclusive, there are again upper and lower plates; but the upper plate is in the form of grate fingers 60, shown as radial fingers although not necessarily so. The lower plate 51 is a solid plate, as before, with a space between the two plates; and the lower solid plate 51 is not joined peripherally to the outer edges of the fingers 60. The fingers 60 provide grate bars, which carry coal that is unburned; but the ashes drop through between the fingers 60 on to the solid plate 51 beneath. With this construction the finger 29 lies in a horizontal plane between that of the finger 60 and the lower plate 51, and scrapes ashes off of such lower plate 51 into the outlet chute 27. This arrangement has the advantage that if any coal is unburned, and still of sufficient size to prevent it from falling through between the fingers 60, it is not scraped off by the finger 29, but remains on the rotating grate for a second rotation thereof, during which it burns with other coal that is received upon such grate from the riser 15. It also has the advantage that with it the ash removing finger and discharge chute need not be located at any particular point with respect to the point at which coal is received by the rotating grate, although they are desirably spaced a considerable distance from such coal receiving point along the path of grate rotation.

While I have illustrated my invention in a device in which the blower, the coal-feeding action, and ash-removing action are continuous and simultaneous, such actions need not be continuous nor simultaneous, and may be intermittent in accordance with time, or with the temperature of the furnace or of some heated space, or with other factors; and the different actions may be independent and separately or relatedly controlled by the same or different factors.

I claim as my invention:

1. In a furnace, the combination of a central hollow feed-riser, means for feeding fuel upward through said riser, and a substantially horizontal rotary grate surrounding said riser, the upper end of said riser having some parts lower than others so that the fuel will in large part be discharged from the riser on to the rotary grate at a definite location with respect to the riser.

2. In a furnace, the combination of a central hollow feed-riser, means for feeding fuel upward through said riser, and a substantially horizontal rotary grate surrounding said riser, the upper end of said riser being substantially in the form of a one-turn helix, so that the fuel will in large part be discharged from the riser in the neighborhood of the lower part of said helix.

3. In a furnace, the combination of a hollow central feed-riser through which fuel is fed upwardly, and a rotary grate surrounding said feed-riser, and a scraping finger co-operating with said grate for scraping ashes therefrom as the grate rotates, the upper end of said riser being shaped to discharge fuel on to said grate mainly at a place near said scraping finger but beyond it in the direction of grate-rotation.

4. In a furnace, the combination of a hollow central feed-riser through which fuel is fed upwardly, and a rotary grate surrounding said feed-riser, a scraping finger co-operating with

said grate for scraping ashes therefrom as the grate rotates, the upper end of said riser being shaped to discharge fuel on to said grate mainly at a place near said scraping finger but beyond it in the direction of grate-rotation, and a fire-pot within which said grate rotates, said fire-pot being provided with a lateral outlet-chute into which said finger scrapes ashes from the rotating grate for discharging ashes from said furnace at substantially the grate-level thereof.

5. In a furnace, the combination of a hollow central feed-riser, means for feeding fuel upward through said riser a substantially horizontal rotary grate surrounding said riser beneath the top thereof, and a fire-pot within which the rotary grate is located, said rotary grate having an inner upstanding annular wall, and said inner annular wall of said grate and the wall of the fire-pot being provided with opposed projections which co-operate as clinker-crushers.

6. In a furnace, the combination of a hollow central riser through which fuel is fed upwardly, a rotary grate surrounding said riser, said rotary grate including a fuel-supporting upper plate and a lower plate spaced from said fuel-supporting plate, and means for forcing air into the space between said two plates to cool them, said lower plate substantially preventing downward escape of such air.

7. In a furnace, the combination of a hollow central riser through which fuel is fed upwardly, a rotary grate surrounding said riser, said rotary grate including a fuel-supporting upper plate and a lower plate spaced from said fuel-supporting plate, means for forcing air under pressure into the space between said upper and lower plates to cool them, said lower plate substantially preventing downward escape of such air, and a stationary scraping finger co-operating with the upper plate to scrape ashes therefrom as the rotary grate rotates.

8. In a furnace, the combination of a hollow central riser through which fuel is fed upwardly, a rotary grate surrounding said riser, said rotary grate including a fuel-supporting upper plate and a lower plate spaced from said fuel-supporting plate, said upper plate being formed of spaced bars or fingers to provide means for supporting unburned fuel while permitting ashes to drop through to the lower plate, and a stationary scraping finger co-operating with the lower plate to scrape ashes therefrom as the grate rotates.

9. In a furnace, the combination of a hollow central riser through which fuel is fed upwardly, a rotary grate surrounding said riser, said rotary grate including a fuel-supporting upper plate and a lower plate spaced from said fuel-supporting plate, said upper plate being formed of spaced bars or fingers to provide means for supporting unburned fuel while permitting ashes to drop through to the lower plate, a stationary scraping finger co-operating with the lower plate to scrape ashes therefrom as the grate rotates, and means for supplying air under pressure to the space between said two plates.

10. The combination set forth in claim 8 with the addition of a discharge chute associated with said scraping finger and leading to an ash discharge point at substantially the grate-level.

11. In a furnace, the combination of a hollow central feed riser through which fuel is fed upwardly, a rotary grate surrounding said riser, a fire pot in which the feed riser and grate are located, said rotary grate including an inner annular wall surrounding said feed riser and a plate projecting therefrom below the top thereof substantially to the wall of the fire pot, said plate being formed of spaced bars or fingers for supporting unburned fuel while permitting ashes to drop therethrough, and said inner annular wall above said plate and the wall of the fire pot being provided with projections which co-operate as clinker crushers, a second plate below and spaced from said fuel supporting plate for receiving the ashes, and means co-operating with the second plate to scrape ashes therefrom as the grate rotates.

12. In a furnace, the combination of a hollow central feed riser through which fuel is fed upwardly, a rotary grate surrounding said riser, and a fire pot in which the feed riser and grate are located, said rotary grate including an inner annular wall surrounding said feed riser and a plate projecting therefrom below the top thereof substantially to the wall of the fire pot, said plate being formed of spaced bars or fingers for supporting unburned fuel while permitting ashes to drop therethrough, and said inner annular wall above said plate and the wall of the fire pot being provided with projections which co-operate as clinker crushers.

13. In a furnace, a fire pot having a reduced diameter at its lower end, a rotary annular grate located therein, an upstanding wall at the inner edge of said annular grate and rotatable therewith, and means for feeding fuel through the central opening defined by said upstanding wall, said grate including a plate formed of spaced bars or fingers for supporting unburned fuel while permitting ashes to drop therethrough and extending substantially to the wall of the fire pot at said reduced portion, said upstanding wall and the wall of the fire pot being provided with projections which co-operate as clinker crushers.

14. In a furnace, a fire pot, a rotary annular grate located therein, an upstanding wall at the inner edge of said annular grate and rotatable therewith, and means for feeding fuel through the central opening defined by said upstanding wall, said grate including a plate formed of spaced bars or fingers for supporting unburned fuel while permitting ashes to drop therethrough and extending substantially to the wall of the fire pot, said upstanding wall and the wall of the fire pot being provided with projections which co-operate as clinker crushers.

15. In a furnace, the combination of a hollow central riser through which fuel is fed upwardly, a rotary grate surrounding said riser, said rotary grate including a fuel-supporting upper plate and a lower plate spaced from said fuel-supporting plate, means for forcing air under pressure into the space between said upper and lower plates to cool them, said lower plate substantially preventing downward escape of such air, and a stationary scraping finger co-operating with said grate to remove ashes therefrom as the rotary grate rotates.

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