May 14, 1946. F. R. HIGLEY ET AL 2,400,352

GRAVITY FURNACE

Filed Sept. 18, 1941 3 Sheets-Sheet 1

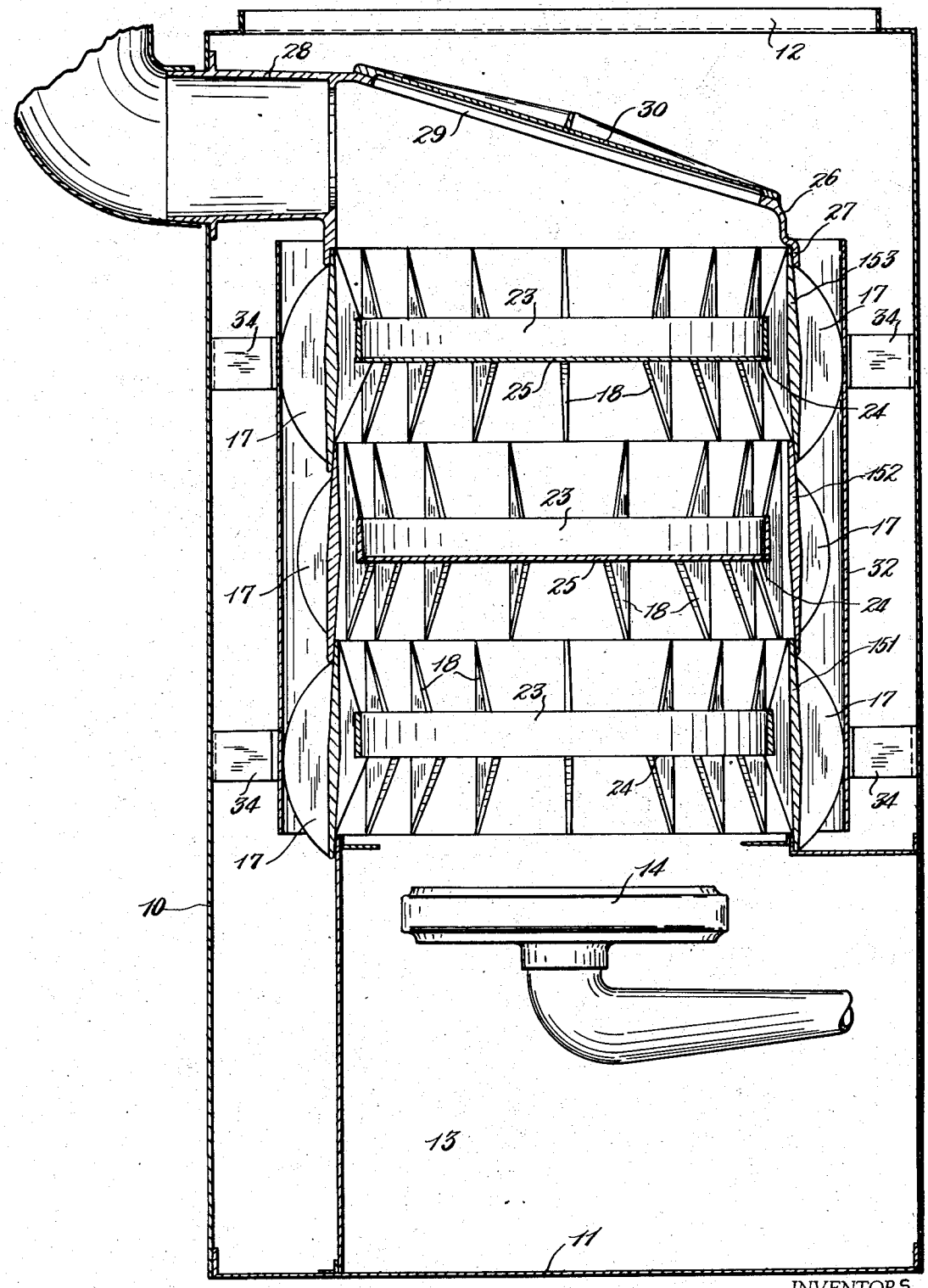


FIG. 1

INVENTORS
FRANK R. HIGLEY
PHILIP W. McCOY
BY Kuris Hudson & Kent
ATTORNEYS

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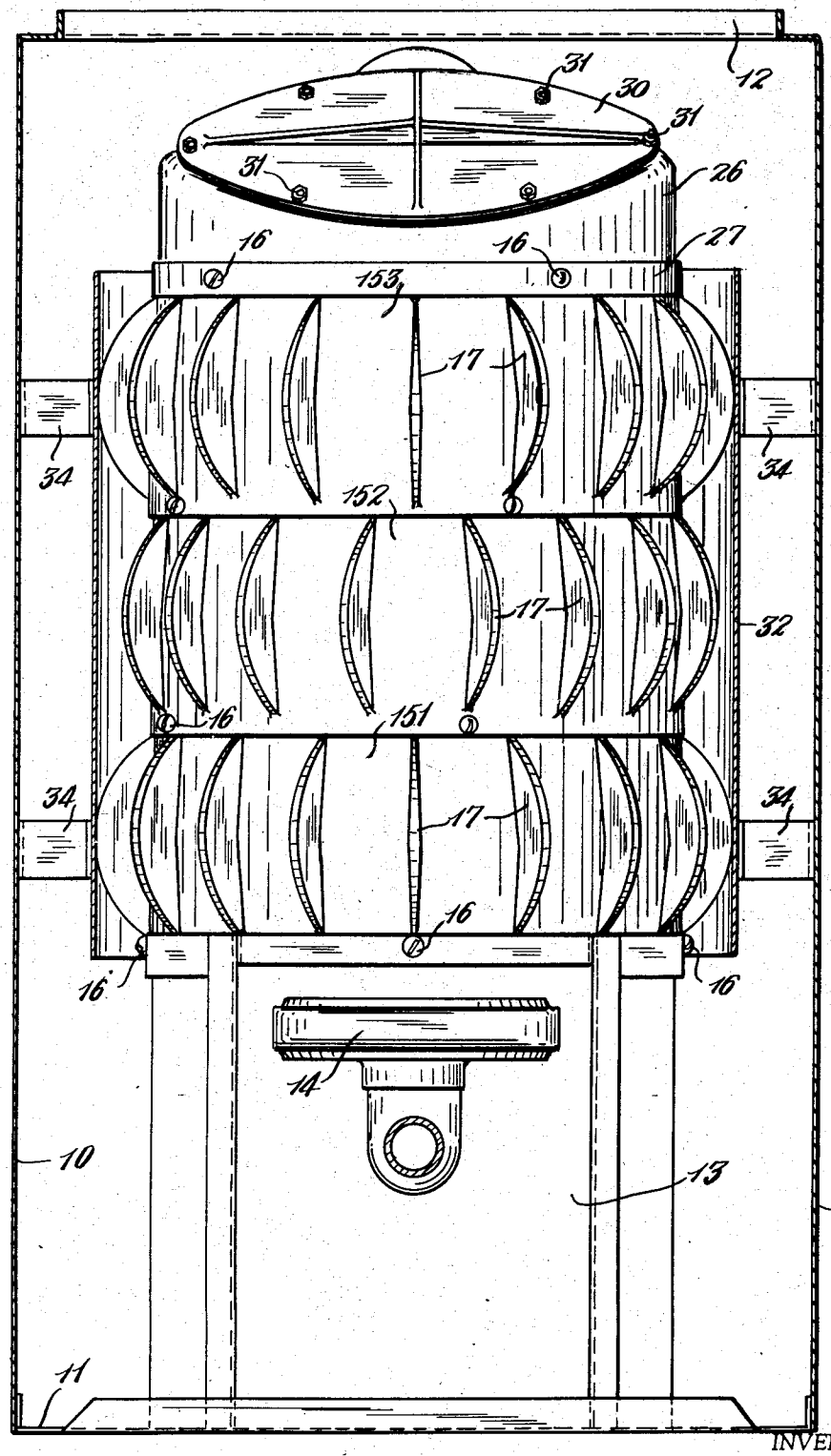


FIG. 2

INVENTORS
FRANK R. HIGLEY
PHILIP W. McCOY

BY Kuris Hudson & Kent

ATTORNEYS

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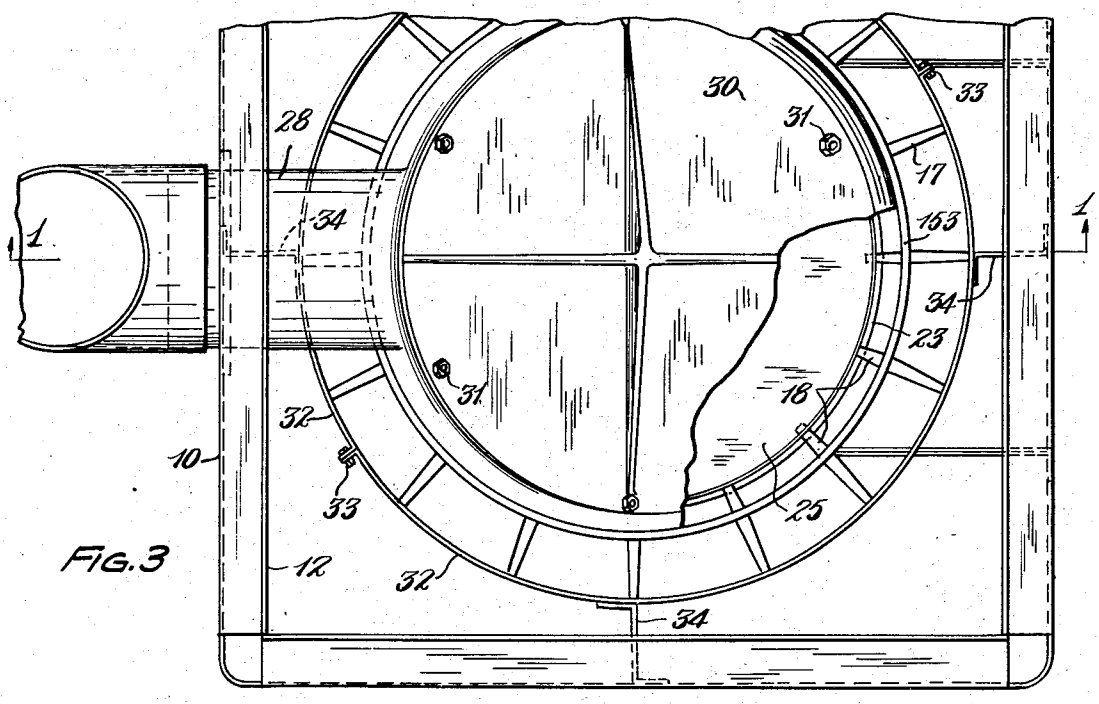


FIG. 3

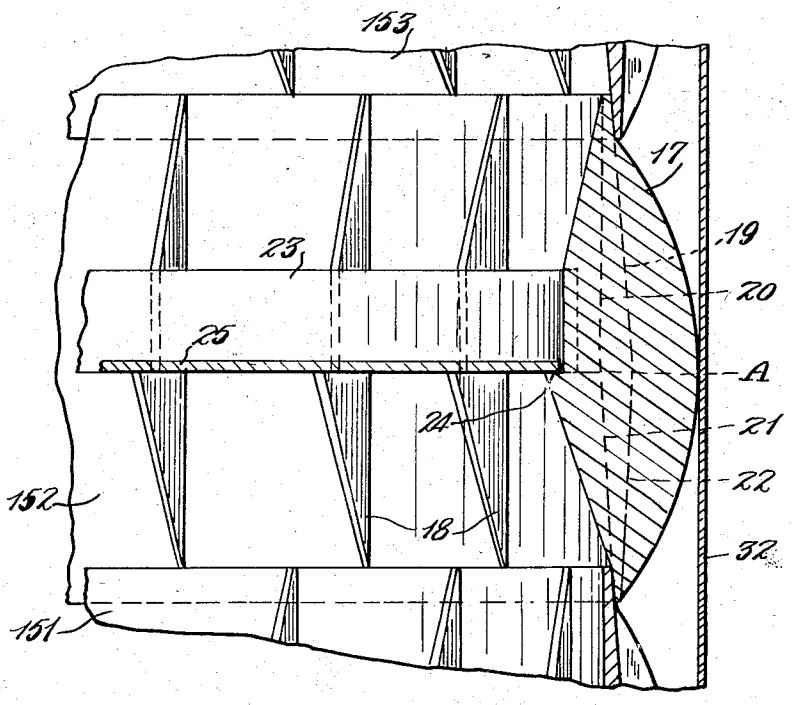


FIG. 4

INVENTORS
FRANK R. HIGLEY
PHILIP W. McCOY

BY Kuris Hudson & Kent
ATTORNEYS

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UNITED STATES PATENT OFFICE

2,400,352

GRAVITY FURNACE

Frank R. Higley, Cleveland Heights, and Philip W. McCoy, South Euclid, Ohio, assignors to The Bryant Heater Company, Cleveland, Ohio, a corporation of Ohio

Application September 18, 1941, Serial No. 411,368

12 Claims. (Cl. 126—116)

This invention relates to improvements in gravity furnaces, and has to do with furnaces of extreme simplicity and low cost, constituted largely of identical units which may be assembled in varying numbers, thereby determining the capacity of the furnace.

One of the objects of the invention is the provision of furnace units of identical shape and size, two or more of which may be assembled to constitute a furnace of a given desired capacity.

Another object is the provision of a furnace of this type having baffle plates which are removable for cleaning or replacement and for exposing the inner walls of the furnace for cleaning.

Another object is the provision of a furnace of the type indicated comprising a series of metal rings superposed one upon another of identical size and form, having fins of graduated width with baffle plates arranged to concentrate the hot gases on the ring walls opposite the maximum width of fins.

Other objects and features of novelty will appear as we proceed with the description of that embodiment of the invention which, for the purposes of the present application, we have illustrated in the accompanying drawings, in which

Fig. 1 is a vertical central sectional view of a gravity furnace embodying the invention.

Fig. 2 is an elevational view at right angles to Fig. 1 with the furnace casing and certain other parts broken away in order to more clearly illustrate the invention.

Fig. 3 is a top plan view of the furnace, and

Fig. 4 is a fragmental detail view of one of the rings on a larger scale.

In the drawings, a generally rectangular outer casing is illustrated at 10 having a suitable base 11 and having a large opening 12 at the top through which warm air is distributed into a system of conductors, not shown, leading to the rooms to be heated.

In the lower part of the casing there is formed a combustion chamber 13 wherein is mounted the furnace burner, which may be of any desired type but is here illustrated as a gas burner 14. Surrounding a hole in the top of the combustion chamber and extending upwardly therefrom is a ring 151 of cast metal. This ring may be attached to the combustion chamber by any suitable means as by a series of fastenings 16, extending through holes drilled in the ring and registering holes in flanges struck up from the top wall of the combustion chamber. The upper, outer side wall of ring 151 is tapered somewhat toward the top so that another ring 152, identical in form and size with ring 151, may be fitted over the latter ring. A third ring 153, also identical with ring 151, fits over ring 152. Although three of these rings are illustrated herein, a greater or lesser number may be employed, the number used being dependent upon the desired capacity of the furnace.

Each of the rings has a series of integral external fins 17 in vertical radial planes and a series of integral internal fins 18 arranged preferably in the same planes with fins 17. The fins of one ring are offset with respect to those of the rings above and below. Fins 17 stop short of the upper and lower edges of the rings, their upper ends constituting stops which are useful in assembling the rings, that is in bringing them into alignment before they are pressed together. The fins of the inner and outer sets are widest where they meet the horizontal plane indicated by the dotted line A in Fig. 4. This plane corresponds with the parting plane established for the molding of the casting, and the fins have draft in respect to fin thickness as well as width, both starting from this plane. The draft of the ring wall also starts from the same plane. However, we have adopted a novel wall form because of the fact that the overlapping portions of the ring walls must have a taper in order to permit the tight fit which we employ between the rings, while at the same time the draft must be kept at a minimum so as to hold down the weight of the casting.

In accordance with the present invention the top half of the ring above the parting plane has an external wall 19 which tapers upwardly providing a slope that is considerably greater than the necessary draft and an internal wall with a slope which provides the minimum necessary draft. On the lower half of the ring, on the contrary, the inside wall 21 is provided with the same slope or taper as the upper outer wall 19, while the outer lower wall 22 is almost parallel to the ring axis, that is it has the minimum necessary draft and is parallel to wall 20. Thus, there is provided a conical surface 21 on the lower half of each ring which is adapted to fit onto the conical surface 19 of the upper half of the ring next below, these two conical surfaces having the same slope so that when the rings are pressed together an exceedingly tight fit results.

As an integral part of the casting we form a hoop 23, located entirely in the upper half above the plane A, and spaced from the inner wall of the casting by the fins 18. The heat which the hoop absorbs may, of course, be transferred

to the fins through the integral connection of the hoop therewith.

Certain of the fins 18 are provided with shoulders 24 projecting inwardly beyond the hoop 23 which constitute supporting ledges for a horizontal baffle plate 25. This plate is ordinarily not used with the lowermost ring 151, but is used with all rings above the lowermost. Its function is to deflect the hot gases to the sides of the ring, where they must flow through the constricted annular passage between the wall of the casting and the hoop 23 in the zone where the fins 17 and 18 are widest and thickest and therefore best adapted to transfer heat to the air outside the casting. These baffle plates fit loosely within the hoops 23.

Above the topmost ring we mount a header 26 with a bottom offset flange 27 which overlaps the upper edge of the ring 153 and is secured thereto by fastenings 16. The top of this header may be inclined as shown, and from its higher side wall a flue connection 28 extends through a suitable hole in the casing 10. An opening 29 in the inclined top of the header is closed by a cover plate 30 which may be held in place by bolts or screws 31. The opening 29 is of a size sufficient to clear the baffle plates 25. Hence, when the furnace needs cleaning, the cover plate 30 may be removed after which the uppermost plate 25 may be lifted off the shoulders 24 of the corresponding ring and withdrawn through the opening 29. Thereafter the plate or plates 25 below the uppermost one may be swing into vertical planes and lifted and removed one at a time. Thus, not only the plates 25 but also the inner surfaces of the rings as well as the fins 18 are exposed for cleaning, and are easily reached through the large opening 29. All of the joints between rings, between the lowermost ring and the combustion chamber and between the uppermost ring and the header may be sealed with furnace cement, not shown, so that no leakage of hot gases into the air stream is permitted. The fit between rings is, however, so tight that ordinarily no cement is needed in those joints. Furthermore any leakage would be away from the air stream rather than into it, so that no harm could result from small cracks or openings.

As illustrated, we provide a radiant heat guard consisting of two semi-cylindrical sheets 32 that are flanged and secured together at their vertical edges, the fastening means 33 serving also to draw these guard sheets into close engagement with the fins 17 upon which they are supported. The whole structure may be braced by means of angle plates 34 between the casing and the cylindrical sheets 32.

In the operation of the furnace air enters the lower end of the casing outside of the combustion chamber 13 and flows upwardly around the perimeter of the rings 151—153, both within and without the radiant heat guard 32. The air thus becomes heated and is discharged into the room conductors from the opening in the upper end of the casing.

In accordance with the invention, the number of unlike parts necessary for the construction of furnaces of several different capacities, that is by utilizing different numbers of ring units, is unusually small, which, of course, has an important bearing upon the cost of construction.

Having thus described our invention, we claim:

1. In a furnace, a plurality of horizontal rings fitted together, outstanding fins on the outer surfaces of said rings, each fin being of maximum width near the central horizontal plane of the ring, a combustion chamber upon which the bottom ring is supported, horizontal baffle plates carried by certain of said rings near their central horizontal planes with clearance between the plates and rings for the passage of hot gases, and a conductor for air to be heated surrounding said rings.

2. In a furnace, a plurality of horizontal rings relatively thin at their top and bottom edges and thick at the middle, the upper outer and the lower inner surfaces of said rings being sufficiently conical to permit the rings to be fitted together, with each ring overlapping the one next beneath, outstanding fins on the outer surfaces of said rings, the upper ends of the fins terminating below the tops of the rings, each ring above the bottom one overlapping the one next beneath with its bottom edge just above the upper ends of the latter's fins, a combustion chamber upon which the bottom ring rests, means carried by certain of the rings for directing hot gas flow through annular horzontal zones adjacent the ring walls, and a conductor for air to be heated surrounding said rings.

3. In a furnace, a plurality of rings superposed one upon another and tightly joined together, internal fins on said rings, a concentric hoop integral with the fins of each ring and spaced thereby inwardly from the wall of the ring, a combustion chamber beneath the superposed rings, certain of the rings carrying horizontal baffle plates fitting within the hoops and serving with the hoops to force combustion gases into the annular spaces between the hoops and rings, and a conductor for air to be heated surroundng said rings.

4. In a furnace, a plurality of identical rings superposed one upon another, a combustion chamber beneath the rings, a flue connection at the top of the rings, and a conductor for air to be heated surrounding the rings, each ring having a greatest thickness zone approximately midway of its vertical dimension and having an outer conical wall extending upwardly from said zone and an inner conical wall extending downwardly from said zone, said conical walls having the same slope approximately, whereby the rings may be joined together with a close fit.

5. In apparatus of the class described, a cast ring having a parting plane perpendicular to its axis and intermediate its ends, internal and external fins arranged in radial planes through said axis, said ring and said fins having draft extending in opposite directions from said parting plane, and a baffle plate of smaller diameter than the internal diameter of the ring mounted concentrically in the ring substantially in said parting plane.

6. In apparatus of the class described, a cast ring having a parting plane perpendicular to its axis and intermediate its ends, internal and external fins arranged in the same radial planes through said axis, said ring and said fins having draft extending in opposite directions from said parting plane, and a baffle plate mounted substantially in said parting plane and spaced from the ring walls by said internal fins.

7. In apparatus of the class described, a cast ring having a parting plane perpendicular to its axis and intermediate its ends, internal and external fins arranged in radial planes through said axis, said ring and said fins having draft extending in opposite directions from said parting plane,

certain of said internal fins having inwardly extending shoulders directly beneath said parting plane, and a circular baffle plate resting upon said shoulders.

8. In apparatus of the class described, a cast ring having a parting plane perpendicular to its axis and intermediate its ends, internal and external fins arranged in radial planes through said axis, said ring and said fins having draft extending in opposite directions from said parting plane, a hoop cast integral with said internal fins spaced from the ring wall with its lower edge substantially in said parting plane, and a circular baffle plate mounted within the hoop also substantially in said plane.

9. In apparatus of the class described, a cast ring having a parting plane perpendicular to its axis and intermediate its ends, internal and external fins arranged in radial planes through said axis, the outer wall of the ring above said plane and the inner wall below said plane being sufficiently conical to permit joining of the ring with other identical rings above and below by close-fitting overlapping surfaces.

10. In apparatus of the class described, a cast ring having a parting plane perpendicular to its axis and intermediate its ends, internal and external fins arranged in radial planes through said axis, the outer wall of the ring above said plane and the inner wall below said plane being sufficiently conical to permit joining of the ring with other identical rings above and below by close-fitting overlapping surfaces, the inner wall above said parting plane and the outer wall below said plane having minimum draft.

11. In apparatus of the class described, a cast ring having a parting plane perpendicular to its axis and intermediate its ends, internal and external fins arranged in radial planes through said axis, the outer wall of the ring above said plane and the inner wall below said plane being sufficiently conical to permit joining of the ring with other identical rings above and below by close-fitting overlapping surfaces, the outer fins terminating short of the upper end of the ring and the inner fins terminating short of the lower end of the ring.

12. In apparatus of the class described, a cast ring having a parting plane perpendicular to its axis and intermediate its ends, internal and external fins arranged in radial planes through said axis, said fins having their greatest cross-section in said parting plane and tapering therefrom both as to thickness and width, and means carried by certain of the rings for directing hot gas flow through annular horizontal zones adjacent the ring walls substantially in said parting plane.

FRANK R. HIGLEY.
PHILIP W. McCOY.