United States Patent

Hugoson

[15] **3,657,882**

[45] **Apr. 25, 1972**

[54] COMBUSTION APPARATUS

[72] Inventor: **Birger O. Hugoson,** Wallingford, Pa.

[73] Assignee: **Westinghouse Electric Corporation,** Pittsburgh, Pa.

[22] Filed: **Nov. 13, 1970**

[21] Appl. No.: **89,396**

[52] U.S. Cl. **60/39.31,** 60/39.37

[51] **Int. Cl.** **F02c 3/00**

[58] **Field of Search** 60/39.31, 39.37, 39.69

[56] **References Cited**

UNITED STATES PATENTS

2,608,057	8/1952	Boyd	60/39.37
2,702,454	2/1955	Brown	60/39.31
2,748,567	6/1956	Dougherty	60/39.37
3,018,624	1/1962	Bonsall	60/39.37

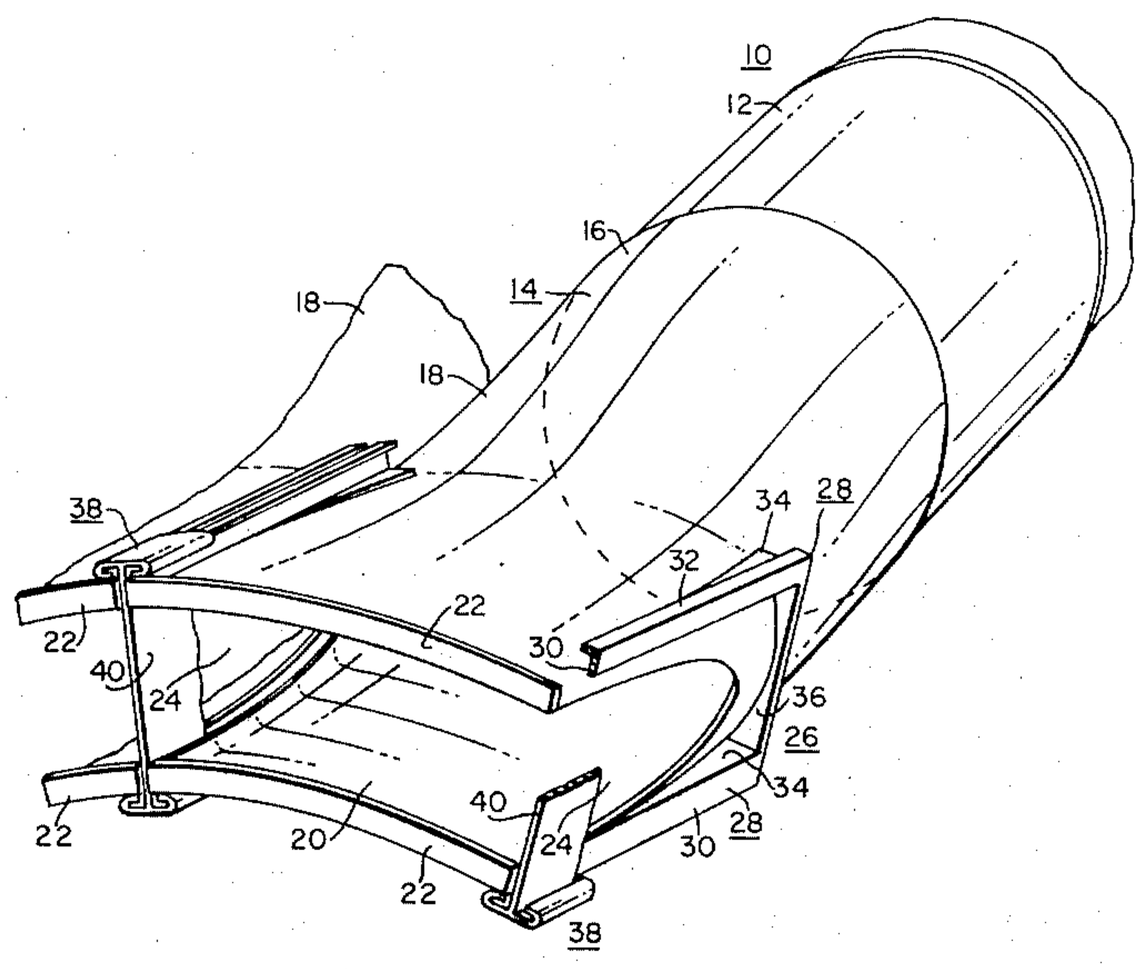
Primary Examiner—Douglas Hart

Attorney—A. T. Stratton, F. P. Lyle and F. Cristiano, Jr.

[57] **ABSTRACT**

In a gas turbine, the transition pieces of the combustor baskets are retained in assembled relation, and the joint between adjacent transition pieces sealed by means of seal frames, attached to the transition pieces, and seal members which slidably engage adjacent seal frames. The structure reduces the tendency of the side walls of the transition pieces to buckle and simplifies the assembling of the transition pieces.

10 Claims, 5 Drawing Figures



PATENTED APR 25 1972

3,657,882

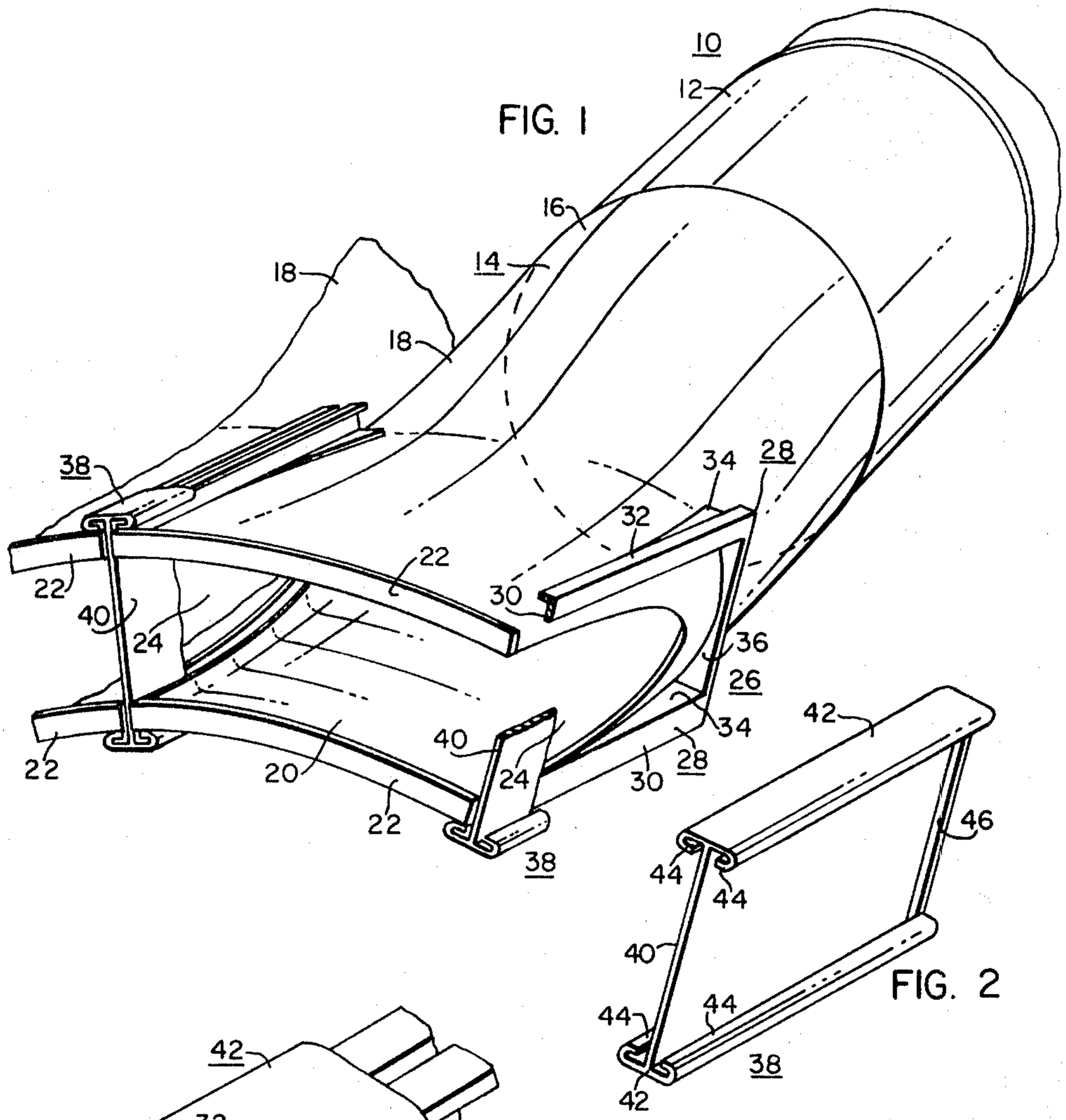


FIG. 1

FIG. 2

FIG. 3

FIG. 4

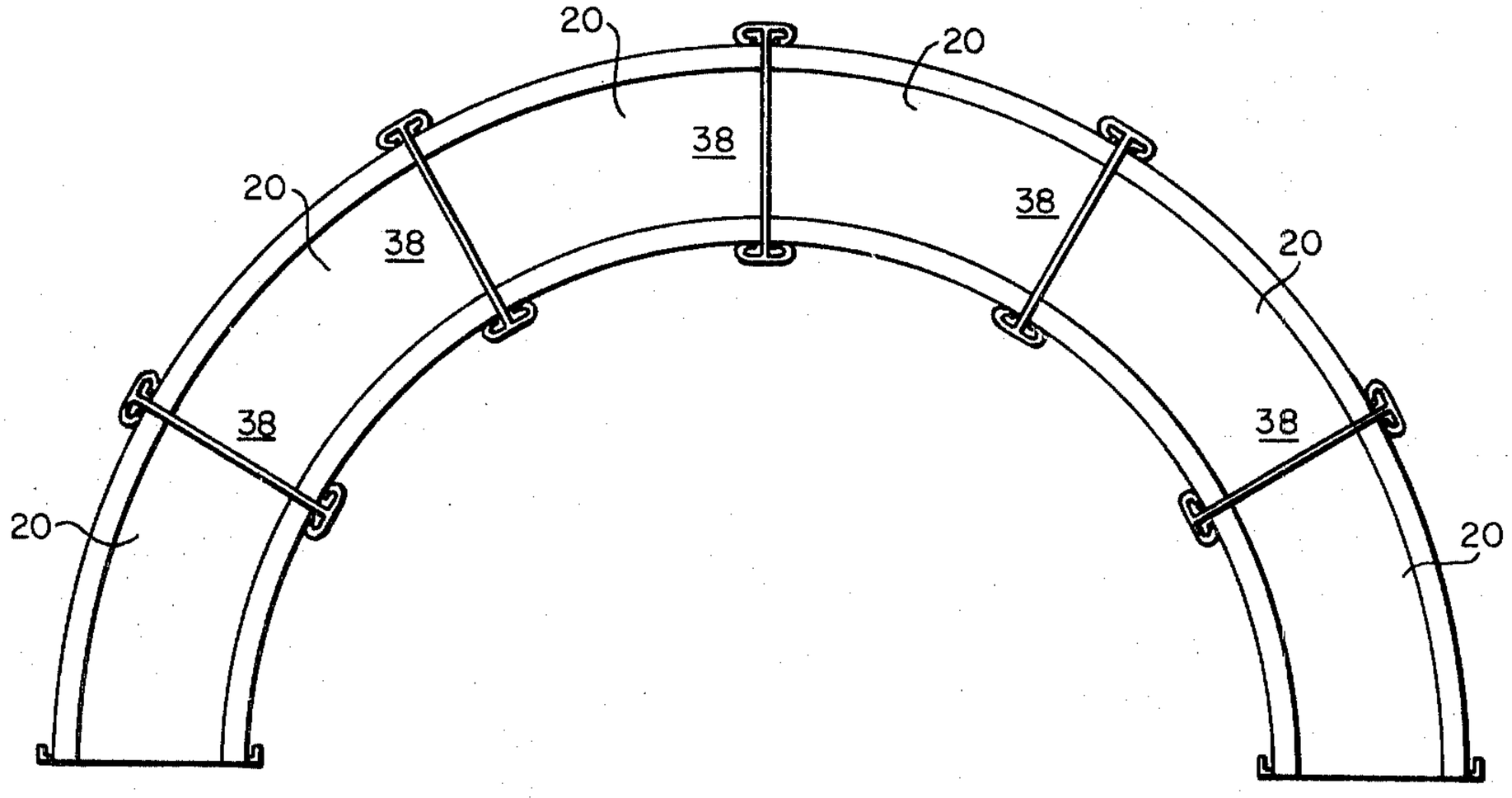
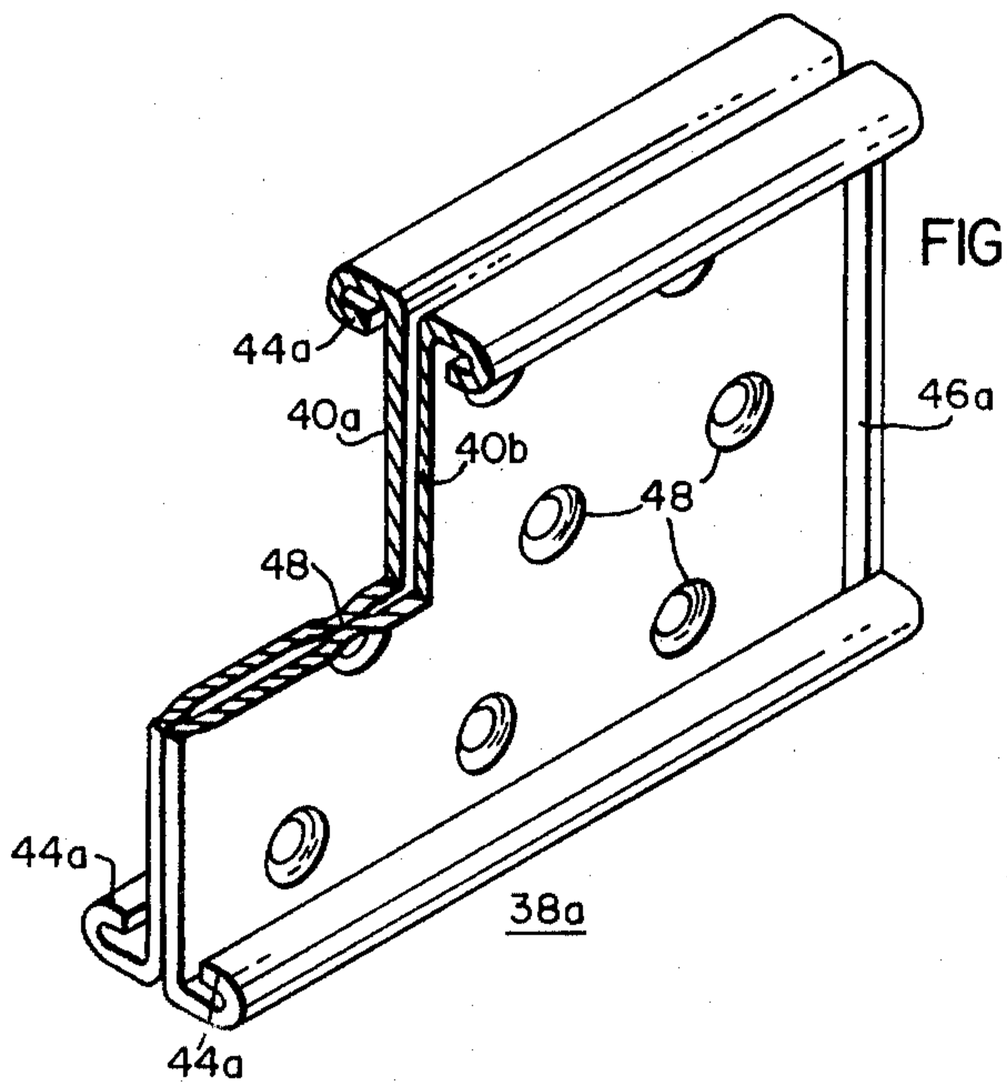


FIG. 5



COMBUSTION APPARATUS

BACKGROUND OF THE INVENTION

This invention relates, generally, to combustion apparatus and, more particularly, to combustion apparatus for a gas turbine power plant.

Under certain circumstances it becomes desirable to utilize a large number of relatively small combustor baskets in a gas turbine instead of a small number of relatively large baskets. One consideration is cost of testing and availability of testing facilitates. Another, is the mechanical strength of the different sizes of baskets and transition pieces. When the number of baskets utilized in a turbine of a certain size is increased, the wedge shaped open space between baskets is reduced, creating a situation where the sides of the transition pieces are close to each other and having an extended area of flat side walls. When conventional seal methods are used between the transition pieces and the first stage turbine stator ring, the side walls are in danger of buckling since they are exposed to the pressure drop across the combustor, and the temperature gradient in the walls works in the same direction as the pressure load. This invention provides a gas turbine combustor transition structure that reduces the tendency of the side walls to buckle, and, at the same time, simplifies the assembling of the transition pieces in the turbine.

BRIEF SUMMARY OF THE INVENTION

In accordance with one embodiment of the invention, flanged seal frames are secured to adjacent sides of gas turbine combustor transition pieces at their outlet ends. Inturned flanges on a seal member, which is generally like an I-beam in shape, slidably engage the flanges on adjacent seal frames to retain the transition pieces in assembled relation. The web portion of the seal member is disposed between adjacent seal frames to close off adjacent openings in sides of the transition pieces. The seal member is exposed to substantially the same pressure and temperature on both sides, thereby reducing the buckling tendency.

BRIEF DESCRIPTION OF THE DRAWING

For a better understanding of the nature of the invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawings, in which:

FIG. **1** is an isometric view of portions of adjacent combustor baskets and seal members embodying principal features of the invention;

FIG. **2** is an isometric view of one of the seal members utilized for retaining adjacent transition pieces of combustor baskets in assembled relation;

FIG. **3** is an enlarged fragmentary view of a portion of the structure shown in FIG. **1**;

FIG. **4** is a view, in elevation, of half of an annular array of combustor baskets for a gas turbine assembled in closely spaced relation, and

FIG. **5** is an isometric view of a modified seal member, a portion being broken away for clearness.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawing, particularly FIG. **1**, the structure shown therein comprises a portion of a combustor basket **10** which is of the canister type suitable for supplying a hot motivating fluid to the rotor of a gas turbine power plant in a manner well known in the art. The portion of the combustor basket **10** shown includes a generally cylindrical intermediate section **12** and a transition piece **14** having a generally cylindrical upstream end portion **16** joined to the intermediate section **12**, and a downstream portion **18** that progressively changes in contour from circular cross section as the jointure with the cylindrical intermediate section **12** to arcuate cross section at its outlet end portion **20**.

As shown more clearly in FIG. **4**, the arcuate extent of the outlet **20** is such that, jointly with the outlets of the other combustor baskets, a complete annulus is provided for admitting the hot products of combustion from the combustor baskets **10** to the blades of a gas turbine (not shown), thereby providing full peripheral admission of motivating gases to the turbine. The arcuate ends of the transition piece **18** may be strengthened by outwardly extending flanges **22** secured to the ends of the transition piece.

As explained hereinbefore, when a relatively large number of combustor baskets are provided for a gas turbine, the wedge shaped open space between baskets is reduced, approaching a situation where the sides of the transition pieces are very close to each other and having an extended area of flat side walls. Heretofore, when conventional seal methods between the transition pieces and the first stage stator ring of a turbine were utilized, the side walls were in danger of buckling since they were exposed to the pressure drop across the combustor. Also, the temperature gradient in each side wall was working in the same direction as the pressure load on the side wall.

In order to overcome this buckling problem, a portion of each side wall of each transition piece **18** is cut away to provide openings **24** in the side walls of the transition pieces. Each opening **24** is disposed within a seal frame **26** secured to the side wall of the transition piece **18**. Each seal frame **26** comprises two angle members **28** each having one leg **30** attached to the side wall of a transition piece **18** and the other leg **32** providing an inwardly extending flange spaced from the transition piece. The end of the leg **30** disposed nearest the outlet **20** of the transition piece is secured directly to the transition piece, as by welding, and the other end of the leg **30** is spaced from and attached to the transition piece by means of a generally triangular shaped gusset plate **34**. The space between the ends of the angle members **28** which are spaced from the transition piece **18** is closed by a gusset plate **36** having a concave edge secured to the transition piece **18**, as by welding.

In order to retain the transition pieces **18** in assembled relation, and to close off adjacent openings **24** in the transition pieces, a seal member **38** is provided. As shown more clearly in FIG. **2**, the seal member **38** is generally like an I-beam in shape having a web portion **40** and flanges **42** formed integrally with the web **40**. The edges of each flange **42** are turned inwardly to form inturned flanges **44** spaced from the web **40**.

As shown more clearly in FIG. **3**, the flanges **44** on the seal member **38** slidably engage the flanges **32** on adjacent seal frames **28** when the web **40** of the seal member is moved into position between two adjacent seal frames. Seal strips **46** are secured to the web **40**, as by welding, to engage the gusset plates **36** when the seal member **38** is installed.

In this manner adjacent openings **24** in adjacent transition pieces **18** are closed off by the web **40** of the seal member **38** and the motivating fluid is prevented from escaping around the seal frame **28** by the gusset plates **34**, **36** and the seal strips **46**. The transition pieces **18** are retained in assembled relation by the flanges **32** on the seal frames **28** which are engaged by the inturned flanges **44** on the seal member **38**. The clearance between adjacent transition pieces makes allowance for circumferential growth of the transition pieces. Since the seal member **38** between adjacent transition pieces is exposed to substantially the same pressure and temperature on both sides, the buckling tendency is reduced.

In the modification of the invention shown in FIG. **5**, the web portion of the seal member **38***a* comprises two plates **40***a* and **40***b* secured together in spaced relation to permit air circulation between the plates. As shown, oppositely disposed indentations **48** on the plates may be secured together, as by spot welding. The ends of the plates **40***a* and **40***b* may be secured together, as by welding. The edges of the plates have inturned flanges **44***a* which function in the same manner as the flanges **44** to slidably engage the flanges **32** on adjacent seal

frames **28** when the seal member **38***a* is installed. In this manner air is permitted to circulate between adjacent transition pieces, thereby aiding in cooling the transition pieces.

From the foregoing description it is apparent that the invention provides an improved combustor transition piece arrangement and seal members which simplify the assembling of the transition pieces of combustor baskets in a gas turbine. The seal frames and seal members retain the transition pieces in assembled relation and prevent escapement of the motivating fluid from the transition pieces. Furthermore, tendency of the transition pieces and the seal members to buckle is reduced.

I claim:

1. In combustion apparatus for a gas turbine power plant, in combination,

an annular array of combustor baskets having transition pieces disposed in closely spaced relation,

flanged seal frames secured to adjacent sides of the transition pieces at their outlet ends, and

a seal member having inturned flanges slidably engaging the flanges on adjacent seal frames to retain the transition pieces in assembled relation.

2. The combination defined in claim **1**, wherein

each seal frame comprises two angle members and gusset plates secured to the transition pieces.

3. The combination defined in claim **2**, wherein

one end of each of the angle members is secured directly to a transition piece and the other end is spaced from the transition piece by a triangular shaped gusset plate.

4. The combination defined in claim **3**, including

a gusset plate disposed at the ends of the angle members spaced from the transition piece and having a concave edge secured to the transition piece.

5. The combination defined in claim **2**, wherein

each seal member is generally like an I-beam in shape with a web portion and inturned flanges slidably engaging the angle members of two adjacent seal frames.

6. The combination defined in claim **5**, wherein

the web portion of each seal member is disposed between adjacent sides of two transition pieces.

7. The combination defined in claim **6**, wherein

adjacent sides of the transition pieces have openings therein within the seal frames to communicate with each other, and the web portions of the seal members close off said openings.

8. The combination defined in claim **4**, including

seal strips on the seal members engaging the gusset plates having concave edges.

9. The combination defined in claim **5**, wherein

the web portion of each seal member comprises two plates secured together in spaced relation.

10. The combination defined in claim **9**, wherein

the plates of the web portion are spaced apart by oppositely disposed indentations in the plates and are welded together at said indentations.

* * * * *