

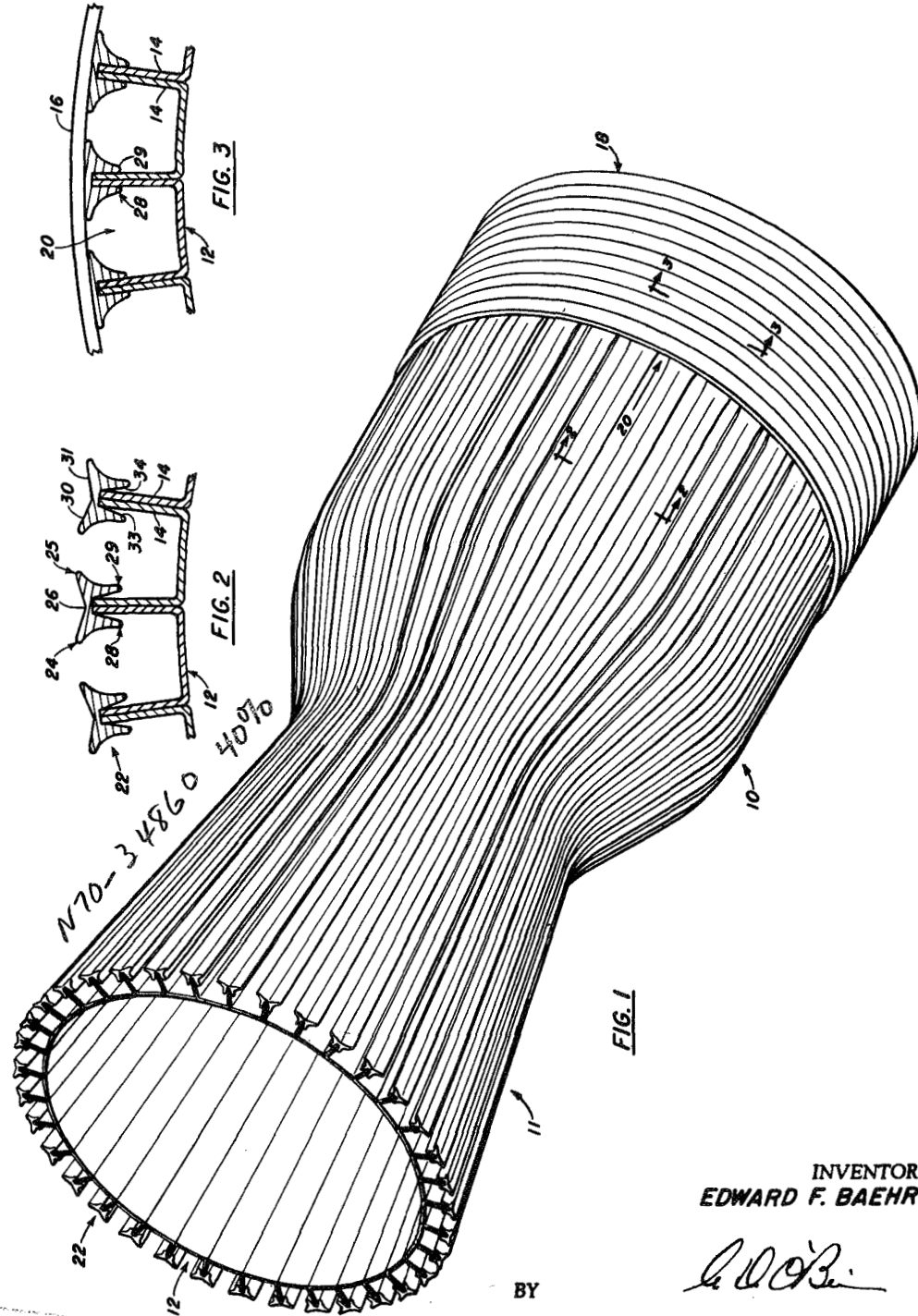
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CHANNEL-TYPE SHELL CONSTRUCTION FOR ROCKET ENGINES AND THE LIKE

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CHANNEL-TYPE SHELL CONSTRUCTION FOR ROCKET ENGINES AND THE LIKE

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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to a lightweight wall construction utilizing contiguous structural components bent to a predetermined configuration, and more particularly to an improved channel-type shell having capstrips at the joints between adjacent channels.

The invention is primarily concerned with the type of structure shown in Patent No. 2,943,442 which discloses a chamber comprising a plurality of contiguous channels with the abutting ribs extending radially outward and binding means such as wire encircling the exterior of the chamber to form a skin for strengthening the structure. The wrapping wire is secured to the edges of the ribs to form a series of passages surrounding the chamber and extending longitudinally thereof through which propellant is circulated for regeneratively cooling the chamber. For optimum heat transfer the thickness of the channels in the shell structure must be as thin as possible. However, in the structure illustrated in the above patent this thickness is determined by the amount of material required to provide the necessary joint strength from the butt braze of the rib edges to the wire wrap. Because this joint limits the allowable stress in the channel material to a value much lower than the yield strength, the weight of the material for a given operating pressure is normally excessive.

It is, therefore, an object of the present invention to provide an improved wall structure utilizing extremely thin channels contiguously arranged with a skin enclosing the channels to form coolant passages.

Another object of the invention is to utilize capstrips in a regeneratively-cooled combustion chamber which provides for increased shear area between the structural components of the chamber and the enclosing skin.

A further object of the invention is to provide an improved wall structure by interposing a capstrip between contiguous channels and the adjacent strengthening members for increasing the bonding area between the ribs of the channels and the skin formed by the strengthening members to enable the material of the channels to be used efficiently at high working stress levels.

Other objects of the invention will be apparent from the specification which follows and from the drawings wherein like numerals are used throughout to identify like parts.

In the drawings:

FIG. 1 is a perspective view of a chamber that is constructed in accordance with the invention showing the assembly at the fabrication stage preparatory to forming an outer skin;

FIG. 2 is an enlarged sectional view of a portion of the shell construction taken from the position indicated by the line 2-2 in FIG. 1; and

FIG. 3 is an enlarged sectional view of a portion of the shell construction taken from the position indicated by the line 3-3 in FIG. 1.

The aforementioned objects are achieved by providing a combustion chamber with a plurality of elongated channels contiguously arranged and secured together to form a hollow enclosure with the ribs of the channel extending

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radially outward. Binding means in the form of strengthening members encircle the exterior of the enclosure adjacent the ends of the ribs to form a skin which defines with the channels a series of coolant passages that surround the enclosure and extend longitudinally thereof. In accordance with the invention, a capstrip is interposed between contiguous pairs of the channels and the skin to provide increased shear area. Each capstrip includes a pair of opposed flanges having flat faces for contacting the skin and a pair of legs having planar surfaces for engaging the sides of the channel rib. The flanges are connected by a web that is deformable so that as the capstrip is formed, the planar surfaces on the legs are spread apart for positioning on the contiguous channel ribs. After assembly, the capstrip is rolled to move the flat surfaces into coplanar relationship thereby pinching the channel ribs between the planar faces.

Referring now to FIG. 1, there is shown a combustion chamber 10 and nozzle 11 for a rocket motor fabricated from a plurality of structural components such as channels 12 formed from a material capable of withstanding the operating temperatures as well as the corrosive action of the rocket propellants. The channels 12 are contiguously arranged and secured together to form a hollow enclosure which constitutes the combustion chamber and nozzle.

Each of the channels 12 has a pair of parallel ribs 14 which extend radially outward from the hollow enclosure, as shown in FIG. 2. The ribs 14 of adjacent channels 12 abut one another and are secured together by a suitable brazing material during the fabrication of the enclosure. A ribbon 16 shown in FIG. 3 of a high strength material is wrapped about the assembled channels 12 to form an outer skin 18 shown in FIG. 1. The skin 18 defines with the channels 12 a series of coolant passages 20 around the enclosure which extends longitudinally for the circulation of propellants during regenerative cooling of the combustion chamber 10 and nozzle 11.

According to the invention, a plurality of capstrips 22 are interposed between the channels 12 and the skin 18 to provide a greater bonding area. Each capstrip 22 comprises a pair of opposed flanges 24 and 25 connected by a centrally disposed web 26. A pair of spaced legs 28 and 29 extend downwardly from the web 26, as shown in FIGS. 2 and 3. The leg 28 is integral with the flange 24 while the leg 29 is likewise integral with the flange 25.

The flange 24 has a generally flat surface 30 for engaging the inner surface of the skin 18 while the opposed flange 25 has a similar surface 31. A generally planar surface 33 is provided on the leg 28 while a similar surface 34 is provided on the leg 29 for engaging the sides of a pair of adjacent ribs 14.

Each capstrip 22 is roll-formed or extruded in a long continuous length that is subsequently cut to the required lengths by suitable means such as an abrasive cut-off wheel to prevent the distortion of the cross section. After the capstrip 22 is formed, it may be electroplated with copper or other suitable brazing alloy before or after cutting. The alloy may also be applied to the ribs 14 in the form of a ribbon or foil.

Because of its thickness the web 26 is deformable and as the capstrip 22 is formed the surfaces 30 and 31 on the flanges 24 and 25, respectively, are angularly disposed to each other. Inasmuch as the planar surface 33 is normal to the flat surface 30 and the planar surface 34 is normal to the flat surface 31, the planar surfaces 33 and 34 are angularly disposed to one another as the capstrip 22 is formed. This enables the capstrip 22 to be readily assembled over the ribs 14, as shown in FIGS. 1 and 2.

After the capstrip 22 is assembled on the abutting ribs of the contiguous channels 12, the flat surfaces 30 and 31 are rolled to remove the dihedral therefrom by moving

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these surfaces into a coplanar relationship. This moves the surfaces 33 and 34 into a parallel relationship which pinches these surfaces against the faces of the abutting ribs 14, as shown in FIG. 3, because the spacing between the surfaces 33 and 34 in the parallel position is equal to the distance between the faces of the abutting ribs.

The ribbon 16 is wrapped around the contiguous channels 12 from the end of the combustion chamber 10 to the end of the nozzle 11 to form the skin 18 after all of the capstrips 22 have been secured to the ribs 14. The ribbon 16 has a brazing alloy on the surface which contacts the surfaces 30 and 31 of the capstrips 22, and the entire assembly is heated to a temperature adequate for brazing after the channels 12 have been completely wrapped. If desired, the brazing alloy may be in ribbon form and applied before the channels are wrapped.

While the preferred embodiment of the invention has been disclosed and described, it will be appreciated that various modifications may be made to the disclosed structure without departing from the spirit of the invention or the scope of the subjoined claims. For example, a high strength wire, the type described in U.S. Patent No. 2,943,442 may be substituted for the ribbon 16 shown in FIGS. 2 and 3.

What is claimed is:

1. A rocket motor casing comprising, an assembly of elongated channel members extending longitudinally and arranged in contiguous annular relation, the webs of said channel members constituting the inner surfaces of the wall of said casing, the ribs of said channel members extending generally radially outward with adjacent ribs secured together to produce a unitary construction,

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a ribbon encircling said assembly and adapted to define with said channel members a plurality of longitudinally extending passages for regenerative cooling, a plurality of elongated cap strips in engagement with the outer portions of said ribs for providing a greater bonding area between said ribbon and said assembly, each cap strip including

a pair of opposed flanges for facewise contact with the inner surface of said ribbon,

a pair of substantially parallel legs for facewise contact with the side walls of adjacent ribs,

a deformable web between said flanges providing said cap strip with an initial configuration wherein said legs extend at a slight acute angle to each other and a final configuration wherein said legs lie in substantially parallel closely spaced planes,

means rigidly securing said flanges to said closure means when said cap strip has said final configuration, and

means rigidly securing said legs to said ribs when said cap strip has said final configuration.

2. A rocket motor casing as claimed in claim 1 wherein the flanges have substantially planar contact faces to achieve maximum bonding.

3. A rocket motor casing as claimed in claim 1 wherein the legs have substantially planar contact faces to achieve maximum bonding.

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