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(54) **EXHAUST STACK HAVING A CO-AXIAL SILENCER**

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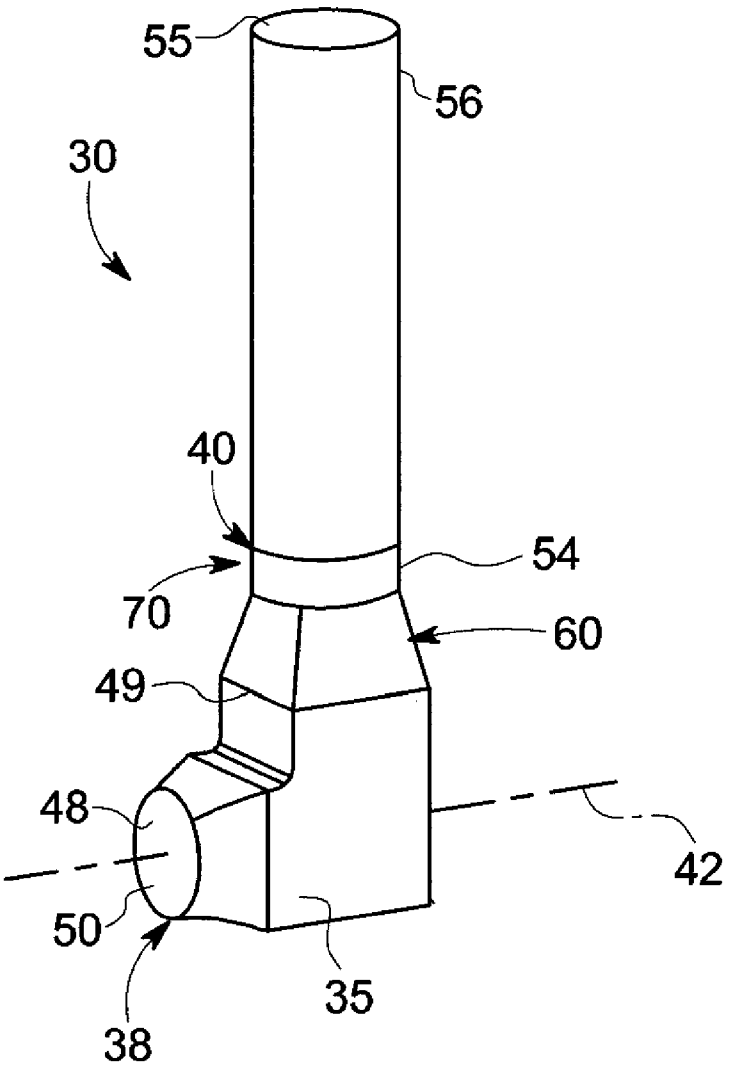
(57) **ABSTRACT**

An exhaust stack includes an inlet section extending along a first axis and an outlet section extending along a second axis. A co-axial silencer is arranged in one of the inlet section and outlet section. The co-axial silencer includes a plurality of concentric baffles configured and disposed to absorb acoustics generated by fluid flow through the exhaust stack.



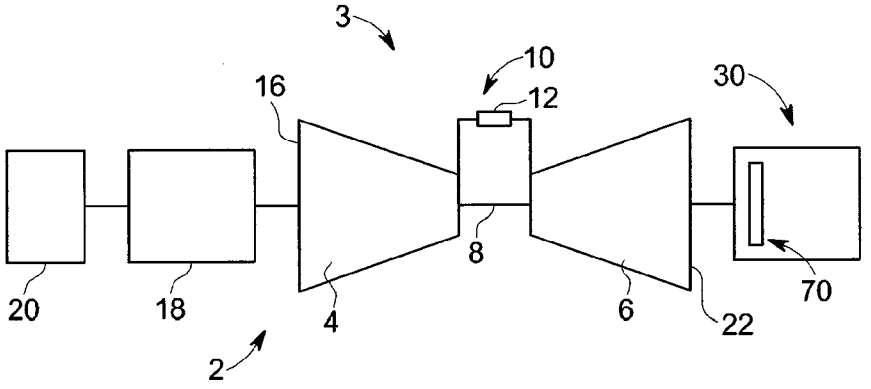


FIG. 1

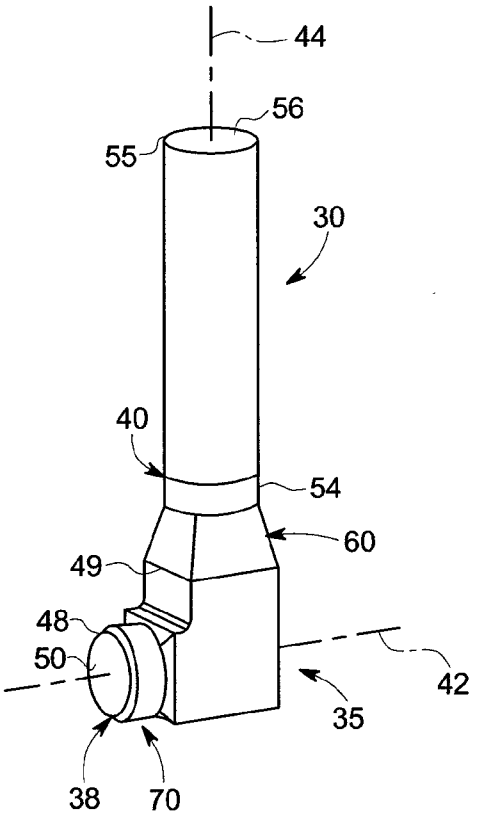


FIG. 2

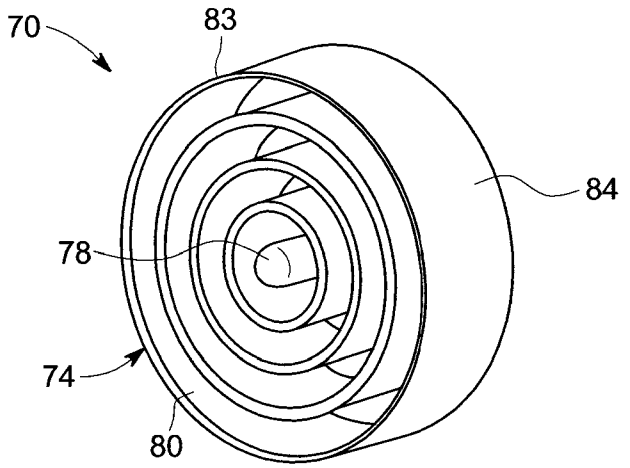


FIG. 3

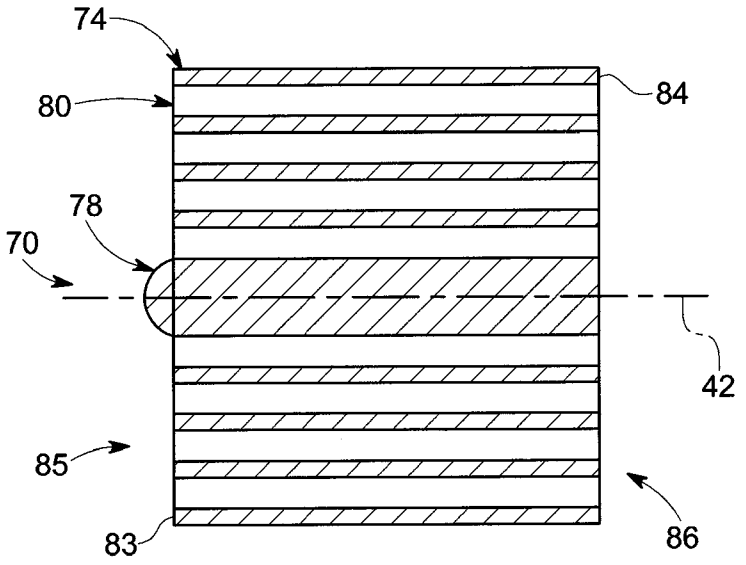


FIG. 4

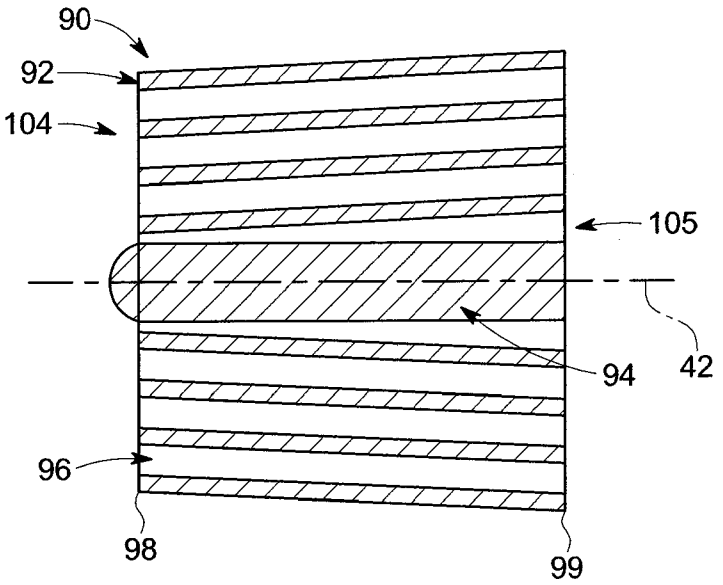


FIG. 5

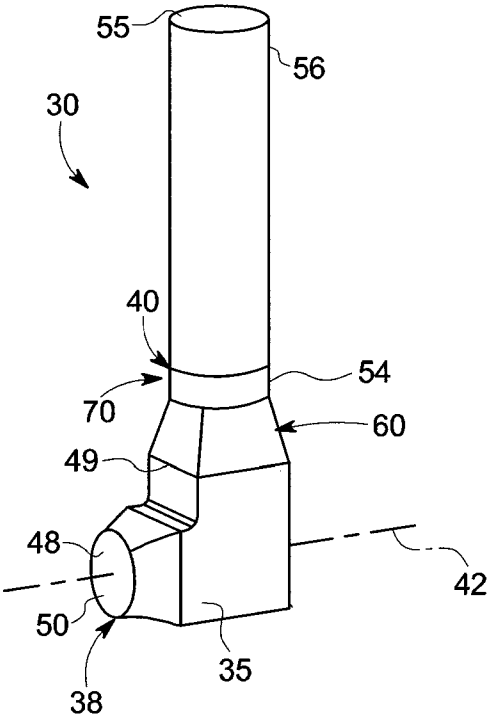


FIG. 6

EXHAUST STACK HAVING A CO-AXIAL SILENCER

BACKGROUND OF THE INVENTION

[0001] The subject matter disclosed herein relates to the art of exhaust stacks and, more particularly, to an exhaust stack having a co-axial silencer.

[0002] In general, exhaust stacks are fluidically connected to an internal combustion engine, a furnace or other system that produces exhaust gases. The exhaust stack delivers the exhaust gases from the system to ambient. In some cases, the exhaust stack includes filters that entrap particulate in the exhaust gases. The exhaust stack may be sized to affect a cooling of the exhaust gases prior to being expelled to ambient. In some cases, the exhaust stack includes a silencer that absorbs sounds produced by flowing exhaust gases. The silencer includes a plurality of sound absorbing baffles arranged in parallel along a flow path of the exhaust stack.

BRIEF DESCRIPTION OF THE INVENTION

[0003] According to one aspect of an exemplary embodiment, an exhaust stack includes an inlet section extending along a first axis and an outlet section extending along a second axis. A co-axial silencer is arranged in one of the inlet section and outlet section. The co-axial silencer includes a plurality of concentric baffles configured and disposed to absorb acoustics generated by fluid flow through the exhaust stack.

[0004] According to another aspect of an exemplary embodiment, a turbomachine includes a compressor portion and a turbine portion operatively connected to the compressor portion. The turbine portion includes an exhaust outlet. A combustor assembly includes at least one combustor fluidically connected to the compressor portion and the turbine portion. An exhaust stack is fluidically connected to the exhaust outlet of the turbine portion. The exhaust stack includes an inlet section extending along a first axis and an outlet section extending along a second axis. A co-axial silencer is arranged in one of the inlet section and outlet section. The co-axial silencer includes a plurality of concentric baffles configured and disposed to absorb acoustics generated by fluid flow through the exhaust stack.

[0005] According to yet another aspect of an exemplary embodiment, a turbomachine includes a compressor portion, and a turbine portion operatively connected to the compressor portion. The turbine portion includes an exhaust outlet. A combustor assembly includes at least one combustor fluidically connected to the compressor portion and the turbine portion. A generator is operatively connected to the compressor portion. An exhaust stack is fluidically connected to the exhaust outlet of the turbine portion. The exhaust stack includes an inlet section extending along a first axis and an outlet section extending along a second axis. A co-axial silencer is arranged in one of the inlet section and outlet section. The co-axial silencer includes a plurality of concentric baffles configured and disposed to absorb acoustics generated by fluid flow through the exhaust stack.

[0006] These and other advantages and features will become more apparent from the following description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0007] The subject matter, which is regarded as the invention, is particularly pointed out and distinctly claimed in the claims at the conclusion of the specification. The foregoing and other features, and advantages of the invention are apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

[0008] FIG. **1** is schematic diagram of a turbomachine system including an exhaust stack having a co-axial silencer, in accordance with an exemplary embodiment;

[0009] FIG. **2** is a perspective view of the exhaust stack of FIG. **1**;

[0010] FIG. **3** is a perspective view of a co-axial silencer, in accordance with an aspect of the exemplary embodiment;

[0011] FIG. **4** is a cross-sectional side view of the co-axial silencer of FIG. **3**;

[0012] FIG. **5** is a cross-sectional side view of a co-axial silencer, in accordance with another aspect of an exemplary embodiment; and

[0013] FIG. **6** is a perspective view of an exhaust stack having a co-axial silencer arranged in accordance with another aspect of an exemplary embodiment.

[0014] The detailed description explains embodiments of the invention, together with advantages and features, by way of example with reference to the drawings.

DETAILED DESCRIPTION OF THE INVENTION

[0015] A turbomachine system, in accordance with an exemplary embodiment, is indicated generally at **2**, in FIG. **1**. Turbomachine system **2** includes a turbomachine **3** having a compressor portion **4** operatively connected to a turbine portion **6** through a common compressor/turbine shaft **8**. Compressor portion **4** is also fluidically connected to turbine portion **6** through a combustor assembly **10** having one or more combustors **12**. Compressor portion **4** includes a compressor inlet **16** that is fluidically connected to an air intake system **18**. Compressor portion **4** may also be connected to a generator **20**. Of course, the particular connection of generator **20** to turbomachine **2** may vary. Turbine portion **6** includes a turbine portion outlet **22** that delivers exhaust gas to an exhaust stack **30**.

[0016] As shown in FIG. **2**, exhaust stack **30** includes a base section **35** having an inlet section **38** and an outlet section **40**. Inlet section **38** extends along a first axis **42**. Outlet section **40** extends along a second axis **44** that is generally perpendicular to first axis **42**. Inlet section **38** extends from a first end **48** to a second end **49** that is coupled to base section **35**. First end **48** includes an opening **50** that receives exhaust gas from turbine portion outlet **22**. Outlet section **40** extends from a first end **54** to a second end **55**. First end **54** of outlet section **40** is coupled to base section **35** and second end **55** is provided with an opening **56**. A transition section **60** is arranged between base section **35** and outlet section **40**. Transition section **60** provides an interface between a generally rectangular section (base section **35**) and a generally tubular section (outlet section **40**). In accordance with an exemplary embodiment, exhaust stack **30** includes a co-axial silencer **70** arranged along inlet section **38**.

[0017] As shown in FIGS. **3** and **4**, co-axial silencer **70** includes a plurality of concentric baffles **74** that are arranged about a central member **78**. Concentric baffles **74** are spaced one, from another, and from central member **78**, to form a plurality of generally annular flow passages, one of which is

indicated at **80**. Central member **78** is formed from an acoustic attenuating material. Co-axial silencer **70** extends from a first end **83** to a second end **84**. First end **83** defines an inlet **85** and second end **84** defines an outlet **86**. In the exemplary embodiment shown, each concentric baffle **74** and central member **78** are generally circular and include a substantially constant cross-section. More specifically, a diameter of concentric baffles **74** is generally consistent between first and second ends **83** and **84**.

[0018] FIG. **5** illustrates a co-axial silencer **90** in accordance with another aspect of the exemplary embodiment. Co-axial silencer **90** includes a plurality of concentric baffles **92** that are arranged about a central member **94**. Concentric baffles **92** are spaced one, from another, and from central member **94**, to form a plurality of generally annular flow passages, one of which is indicated at **96**. Co-axial silencer **90** extends from a first end **98** to a second end **99**. First end **98** defines an inlet **104** and second end **99** defines an outlet **105**. In the exemplary embodiment shown, each concentric baffle **92** and central member **94** taper outwardly from first end **98** to second end **99**. More specifically, a diameter of co-axial silencer **90** at first end **98** is less than a diameter at second end **99**.

[0019] At this point it should be understood that the exemplary embodiments describe a co-axial silencer for an exhaust stack. A co-axial silencer, in accordance with the exemplary embodiments, leads to a lower pressure drop across an exhaust diffuser which provides enhanced turbomachine system performance. In addition to a lower pressure drop, the co-axial silencer has a smaller footprint while also providing an increase in effective sound attenuation surfaces by virtue of the concentric baffles. The reduced footprint enables an exhaust stack to have a shorter height without sacrificing performance. Further, it should be understood that while shown arranged at the inlet section, the co-axial silencer, in accordance with any of the embodiments, may be arranged along the outlet section, as shown in FIG. **6**, wherein like reference numbers represent corresponding parts in the respective views. Also, while shown and described as being fluidically connected to a turbomachine system, the exhaust stack, with co-axial silencer, may be used in a wide range of systems spanning any number of technologies. Finally, while shown and described as being generally circular, the co-axial silencer may take on a variety of geometries including oblong, oval, elliptical, rectangular, and the like.

[0020] While the invention has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. Additionally, while various embodiments of the invention have been described, it is to be understood that aspects of the invention may include only some of the described embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

What is claimed is:

1. An exhaust stack comprising:
an inlet section extending along a first axis;
an outlet section extending along a second axis; and
a co-axial silencer arranged in one of the inlet section and outlet section, the co-axial silencer including a plurality of concentric baffles configured and disposed to absorb acoustics generated by fluid flow through the exhaust stack.

2. The exhaust stack according to claim **1**, wherein each of the plurality of concentric baffles includes a substantially constant diameter.

3. The exhaust stack according to claim **1**, wherein each of the plurality of concentric baffles taper from a first end to a second end.

4. The exhaust stack according to claim **3**, wherein each of the plurality of concentric baffles taper outwardly from the first end to the second end.

5. The exhaust stack according to claim **4**, wherein the first end defines an inlet of the co-axial silencer.

6. The exhaust stack according to claim **1**, wherein the plurality of concentric baffles extend about a central member.

7. The exhaust stack according to claim **6**, wherein the central member is formed from an acoustic attenuating material.

8. The exhaust stack according to claim **6**, wherein the central member includes a substantially constant diameter.

9. The exhaust stack according to claim **1**, wherein the co-axial silencer is arranged in the inlet section.

10. The exhaust stack according to claim **1**, wherein the co-axial silencer is arranged in the outlet section.

11. A turbomachine comprising:
a compressor portion;
a turbine portion operatively connected to the compressor portion, the turbine portion including an exhaust outlet;
a combustor assembly including at least one combustor fluidically connected to the compressor portion and the turbine portion; and
an exhaust stack fluidically connected to the exhaust outlet of the turbine portion, the exhaust stack comprising:
an inlet section extending along a first axis;
an outlet section extending along a second axis; and
a co-axial silencer arranged in one of the inlet section and outlet section, the co-axial silencer including a plurality of concentric baffles configured and disposed to absorb acoustics generated by fluid flow through the exhaust stack.

12. The turbomachine according to claim **11**, wherein each of the plurality of concentric baffles includes a substantially constant diameter.

13. The turbomachine according to claim **11**, wherein each of the plurality of concentric baffles taper from a first end to a second end.

14. The turbomachine according to claim **13**, wherein each of the plurality of concentric baffles taper outwardly from the first end to the second end.

15. The turbomachine according to claim **11**, wherein the co-axial silencer is arranged in the inlet section.

16. A turbomachine system comprising:
a compressor portion;
a turbine portion operatively connected to the compressor portion, the turbine portion including an exhaust outlet;
a combustor assembly including at least one combustor fluidically connected to the compressor portion and the turbine portion;
a generator operatively connected to the compressor portion; and
an exhaust stack fluidically connected to the exhaust outlet of the turbine portion, the exhaust stack comprising:
an inlet section extending along a first axis;

an outlet section extending along a second axis; and

a co-axial silencer arranged in one of the inlet section and outlet section, the co-axial silencer including a plurality of concentric baffles configured and disposed to absorb acoustics generated by fluid flow through the exhaust stack.

17. The turbomachine system according to claim **16**, wherein each of the plurality of concentric baffles includes a substantially constant diameter.

18. The turbomachine system according to claim **16**, wherein each of the plurality of concentric baffles taper from a first end to a second end.

19. The turbomachine system according to claim **18**, wherein each of the plurality of concentric baffles taper outwardly from the first end to the second end.

20. The turbomachine system according to claim **16**, wherein the co-axial silencer is arranged in the inlet section.

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