



US008439085B2

(12) **United States Patent**
Liebson et al.

(10) **Patent No.:** **US 8,439,085 B2**
(45) **Date of Patent:** ***May 14, 2013**

(54) **SEMI-RIGID FLEXIBLE DUCT**

(56)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 736 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/645,517**

(22) Filed: **Dec. 23, 2009**

(65) **Prior Publication Data**

US 2010/0154914 A1 Jun. 24, 2010

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/717,411, filed on Mar. 13, 2007, now abandoned, which is a continuation-in-part of application No. 11/389,623, filed on Mar. 24, 2006, now abandoned.

(51) **Int. Cl.**
F16L 11/00 (2006.01)

(52) **U.S. Cl.**
USPC **138/133**; 138/125; 138/127; 138/131;
138/134; 138/149; 428/36.91

(58) **Field of Classification Search** 138/125,
138/127, 131, 133, 134, 149; 428/36.91

See application file for complete search history.

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Primary Examiner — James Hook

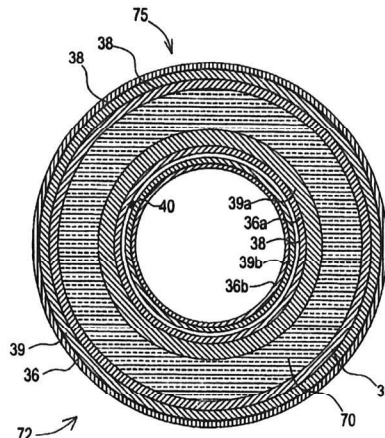
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(57)

ABSTRACT

A semi-rigid, flexible duct including a pair of coaxial sleeves, namely an inner sleeve and an outer sleeve disposed parallel to and about the inner sleeve and a resilient wound element disposed between the sleeves. Each of the inner sleeve and the outer sleeve constitutes an aluminum foil ribbon. The wound element imparts corrugations to the two-sleeves, such that the duct is extendible between a compacted configuration suitable for storage and for shipping and an extended configuration suitable for installation in a gas transport arrangement. Both the inner sleeve and the outer sleeve are of a predetermined thickness rendering the duct substantially rigid when in an extended configuration and enabling the duct to maintain its substantial rigidity upon extension from a compacted configuration. Optionally, at least one of the sleeves further includes a second, plastic layer bonded to the aluminum foil ribbon layer.

44 Claims, 17 Drawing Sheets





US008469062B2

(12) **United States Patent**
Liebson et al.

(10) **Patent No.:** **US 8,469,062 B2**
(45) **Date of Patent:** ***Jun. 25, 2013**

(54) **DURABLE SEMI-RIGID FLEXIBLE DUCT**

(76) Inventors: **Steven Allan Liebson**, Ein Sarid (IL);
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Anthony Liebson, Ein Sarid (IL)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 723 days.

This patent is subject to a terminal dis-
claimer.

(21) Appl. No.: **12/692,612**

(22) Filed: **Jan. 24, 2010**

(65) **Prior Publication Data**

US 2010/0139801 A1 Jun. 10, 2010

Related U.S. Application Data

(63) Continuation-in-part of application No. 12/645,517,
filed on Dec. 23, 2009, which is a continuation-in-part
of application No. 11/717,411, filed on Mar. 13, 2007,
now abandoned, which is a continuation-in-part of
application No. 11/389,623, filed on Mar. 24, 2006,
now abandoned.

(51) **Int. Cl.**
F16L 11/00 (2006.01)

(52) **U.S. Cl.**
USPC **138/133; 138/125; 138/127; 138/131;**
138/134; 138/149; 428/36.91

(58) **Field of Classification Search**
USPC 138/125, 127, 131, 133, 134, 149; 428/36.91
See application file for complete search history.

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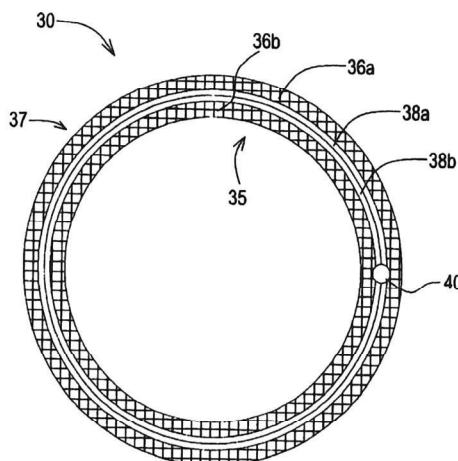
Primary Examiner — James Hook

(74) *Attorney, Agent, or Firm* — Edward Langer, Adv. and
Patent Attorney

(57) **ABSTRACT**

A durable, semi-rigid, flexible duct including a pair of coaxial
sleeves, namely an inner sleeve and an outer sleeve disposed
parallel to and about the inner sleeve and a resilient wound
element disposed between the sleeves. Each of the inner
sleeve and the outer sleeve constitutes an aluminum foil rib-
bon. The wound element imparts corrugations to the two
sleeves, such that the duct is extendible between a compacted
configuration suitable for storage and for shipping and an
extended configuration suitable for installation in a gas trans-
port arrangement. Closely and evenly-spaced ridges that are
situated in between the corrugations, add rigidity and dura-
bility to the duct. Both the inner sleeve and the outer sleeve are
of a predetermined thickness rendering the duct substantially
rigid when in an extended configuration and enabling the duct
to maintain its substantial rigidity upon extension from a
compacted configuration.

29 Claims, 25 Drawing Sheets





US008997796B2

(12) **United States Patent**
Liebson et al.

(10) **Patent No.:** **US 8,997,796 B2**
(45) **Date of Patent:** **Apr. 7, 2015**

(54) **DURABLE SEMI-RIGID SINGLE-LAYER FLEXIBLE DUCT**

(56) **References Cited**

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(71) Applicants: **Steven Allan Liebson**, Ein Sarid (IL);
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(72) Inventors: **Steven Allan Liebson**, Ein Sarid (IL);
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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 132 days.

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(21) Appl. No.: **13/740,204**

(22) Filed: **Jan. 13, 2013**

(65) **Prior Publication Data**

US 2013/0153076 A1 Jun. 20, 2013

Related U.S. Application Data

(63) Continuation of application No. 12/692,612, filed on Jan. 24, 2010, now Pat. No. 8,469,062.

(51) **Int. Cl.**

F16L 11/00	(2006.01)
F16L 11/24	(2006.01)
B21C 37/15	(2006.01)
D06F 58/20	(2006.01)
F16L 11/08	(2006.01)
F16L 11/112	(2006.01)
F24F 13/02	(2006.01)

(52) **U.S. Cl.**

CPC **F16L 11/24** (2013.01); **B21C 37/154** (2013.01); **D06F 58/20** (2013.01); **F16L 11/081** (2013.01); **F16L 11/112** (2013.01); **F24F 13/0218** (2013.01)

(58) **Field of Classification Search**

USPC 138/125, 127, 131, 133, 134, 149; 428/36.91

See application file for complete search history.

FOREIGN PATENT DOCUMENTS

GB 1142471 5/1969

Primary Examiner — James Hook

(74) *Attorney, Agent, or Firm* — Edward Langer

(57)

ABSTRACT

A durable, semi-rigid, single-layered flexible duct having a sleeve made of a single aluminum layer and a resilient wound element disposed at the mid-point of the overlap region of the aluminum layer. The wound element imparts corrugations to the sleeve, such that the duct is extendible between a compacted configuration suitable for storage and for shipping and an extended configuration suitable for installation in a gas transport arrangement. Closely and evenly-spaced ridges that are situated in between the corrugations, add rigidity and durability to the duct. The inward-facing surface of the aluminum ribbon is substantially smooth and featureless except for the helical corrugations imparted by wire winding and the closely and evenly-spaced ridges. The aluminum sleeve is of a predetermined thickness rendering the duct substantially rigid when in an extended configuration and enabling the duct to maintain its substantial rigidity upon extension from a compacted configuration.

27 Claims, 28 Drawing Sheets

