



US 20210362207A1

(19) **United States**

(12) **Patent Application Publication**  
**BOTA**

(10) **Pub. No.: US 2021/0362207 A1**

(43) **Pub. Date: Nov. 25, 2021**

(54) **APPARATUS AND METHOD FOR FORMING  
A SEALING PORTION ON DUCT MEMBERS**

**Publication Classification**

(71) Applicant: **CLEVELAND TOOL & MACHINE,  
INC.**, BrookPark, OH (US)

(51) **Int. Cl.**  
**B21C 37/10** (2006.01)  
**B21D 17/04** (2006.01)

(72) Inventor: **Victor BOTA**, Middleburg Heights, OH  
(US)

(52) **U.S. Cl.**  
CPC ..... **B21C 37/101** (2013.01); **B21D 17/04**  
(2013.01)

(73) Assignee: **Cleveland Tool and Machine, LLC**,  
Brook Park, OH (US)

(21) Appl. No.: **16/962,885**

(57) **ABSTRACT**

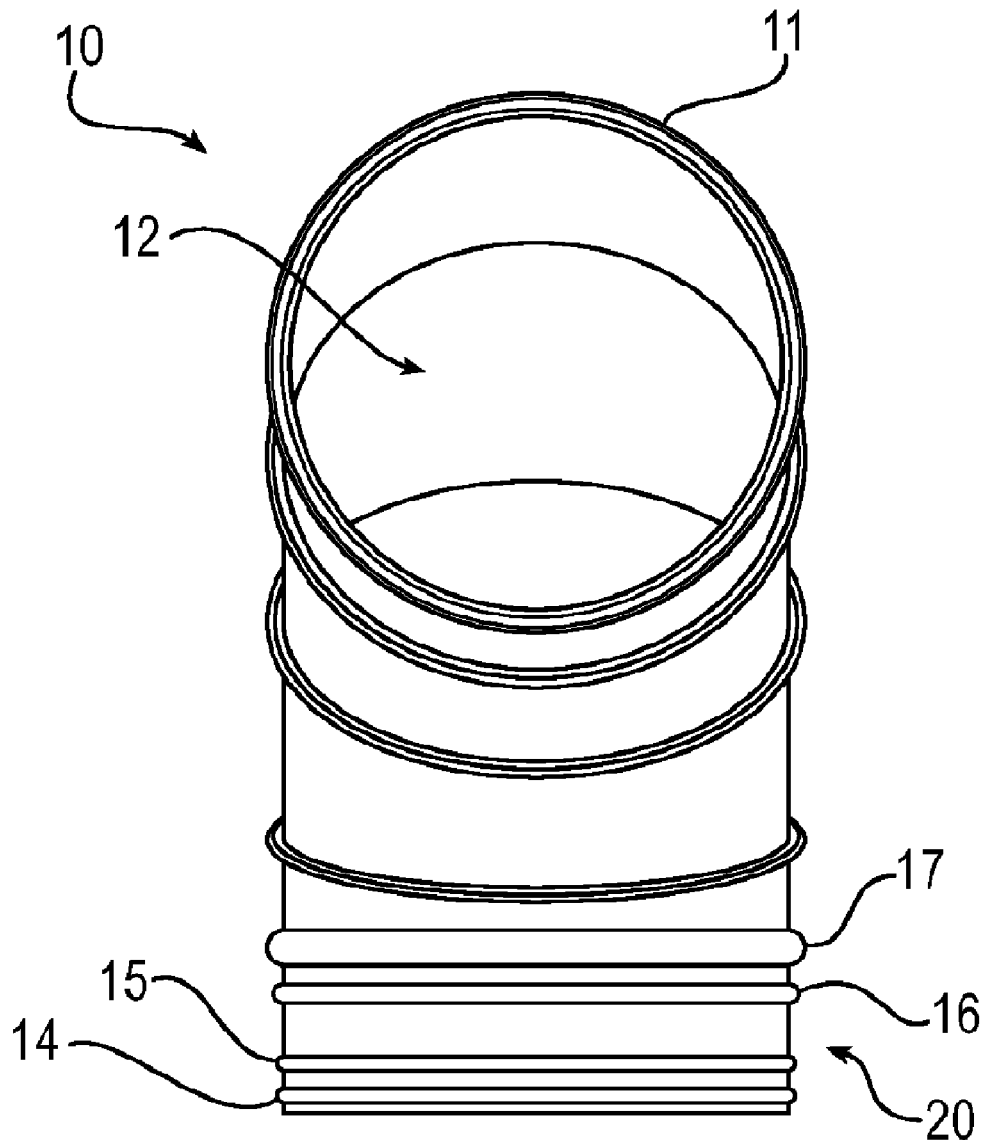
(22) PCT Filed: **Jan. 19, 2018**

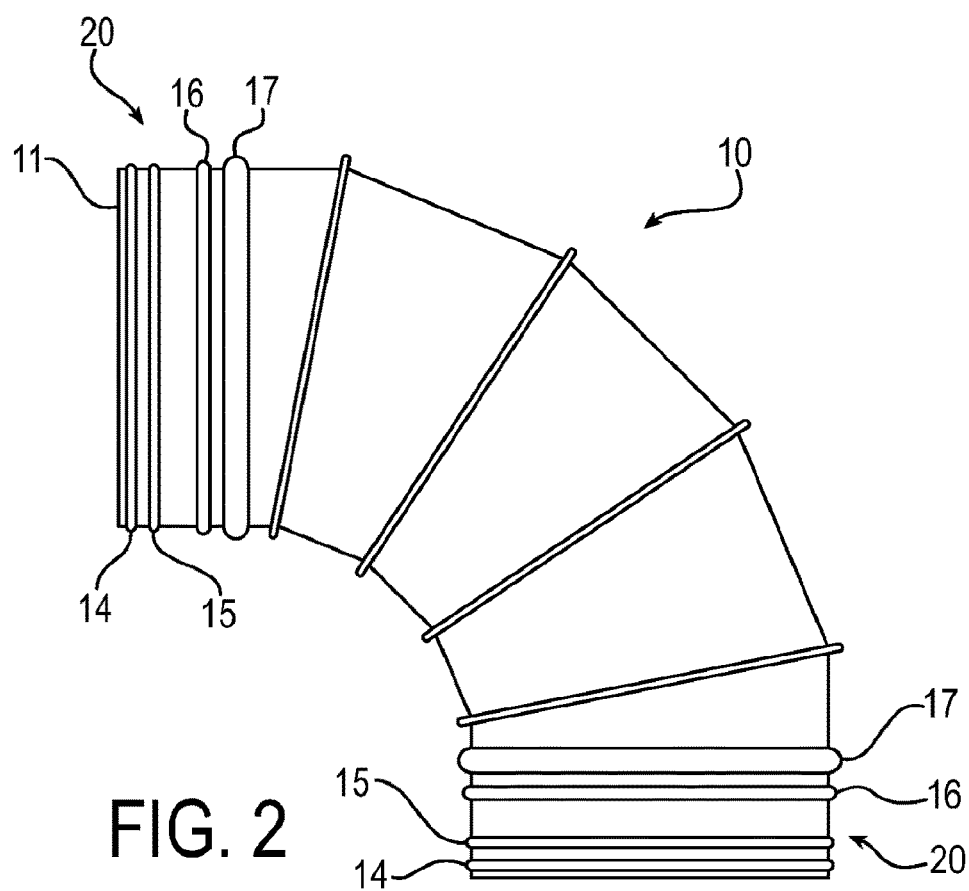
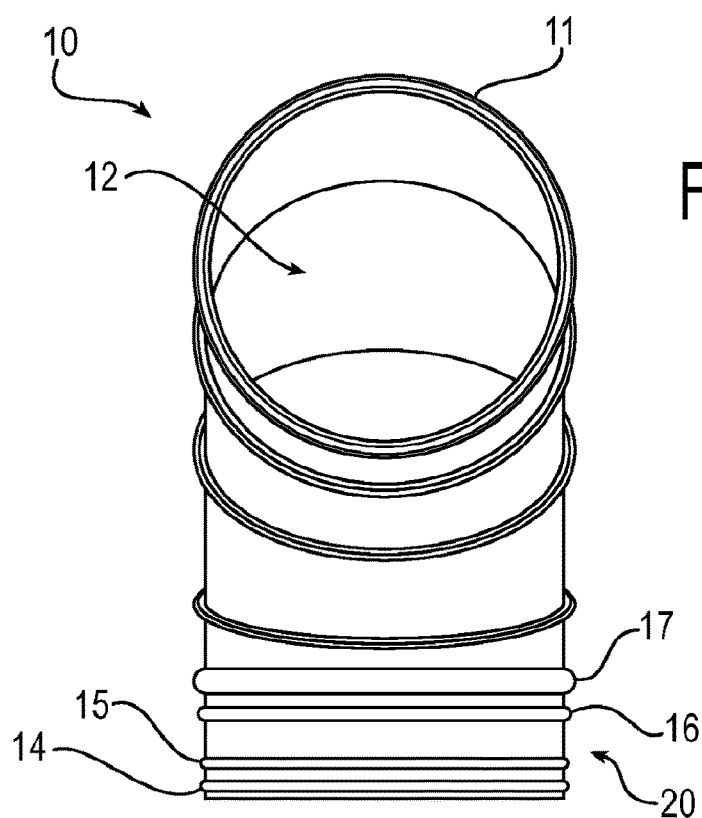
(86) PCT No.: **PCT/US18/14343**

§ 371 (c)(1),

(2) Date: **Jul. 17, 2020**

An apparatus and method for forming a sealing portion on a duct member for use in connection to another duct member, with the connection between the duct members being substantially sealed from the egress of air in an air handling system.





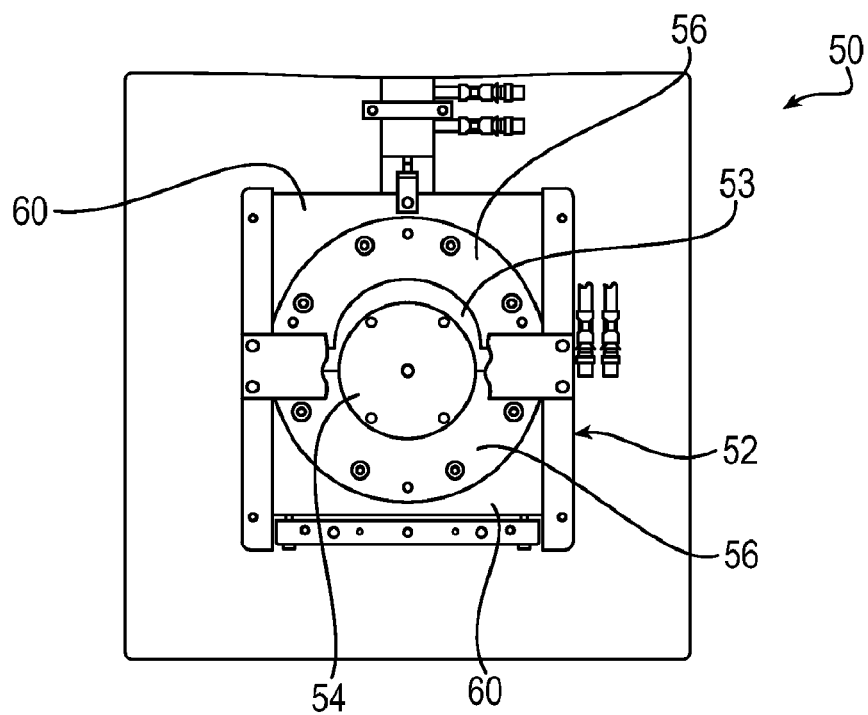


FIG. 3

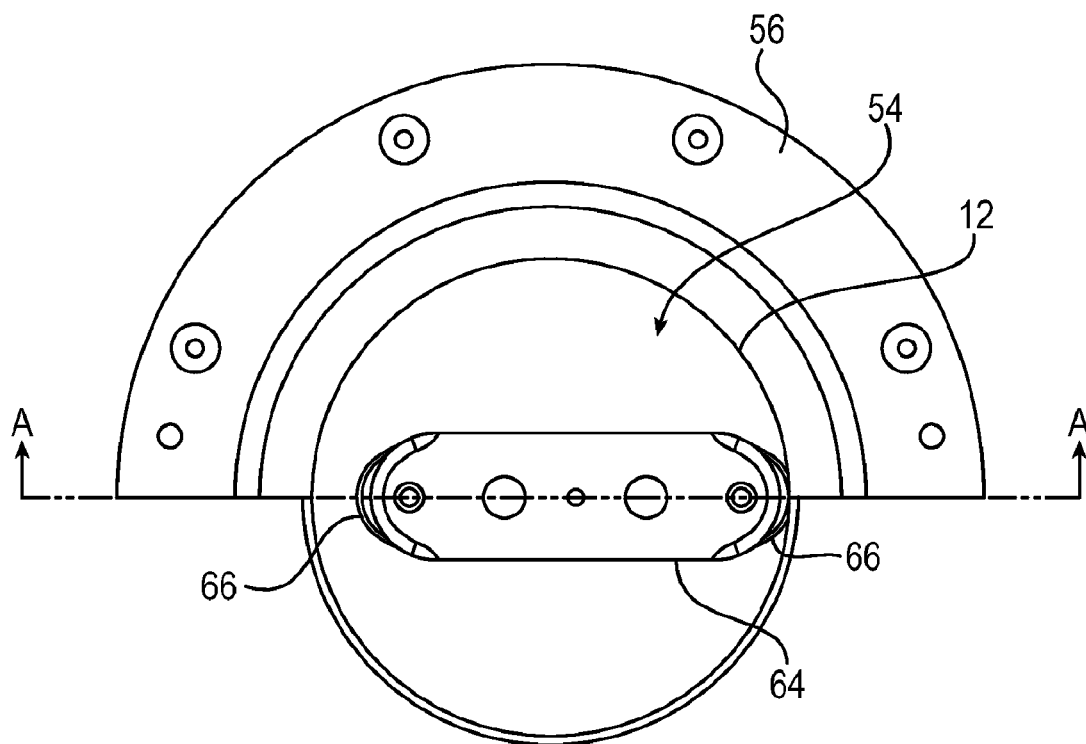


FIG. 4

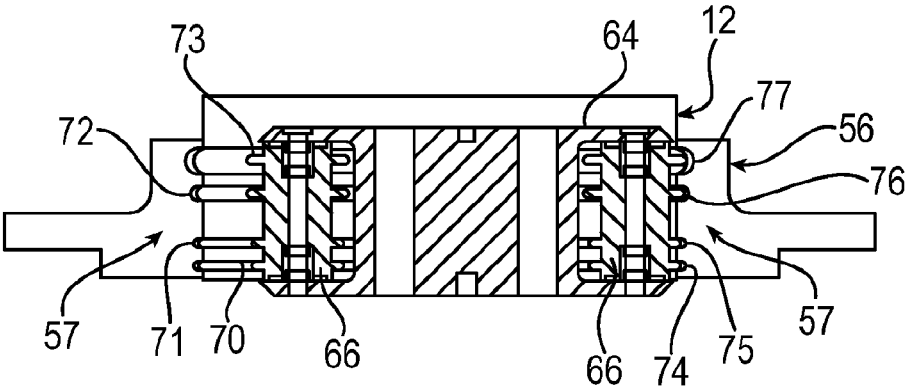


FIG. 5

## APPARATUS AND METHOD FOR FORMING A SEALING PORTION ON DUCT MEMBERS

### CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a national phase application of PCT International Application No. PCT/US2018/014343, filed Jan. 19, 2018, which is herein incorporated by reference in its entirety.

### TECHNICAL FIELD

[0002] The invention relates generally to an apparatus and method for production of a sealing portion on duct members.

### BACKGROUND

[0003] In general, duct work is commonly used in forced air heating and air-conditioning systems for buildings and the like, with the duct work providing a distribution system to various areas of the building from a furnace and/or air-conditioning system. The duct work is generally formed from cylindrical tubing which extends to various portions of the building or the like. Duct members include specialized sections such as elbows, reducers/increasers, angles, connectors, tees, wyes, and the like, which are coupled to one another to form the ductwork for supplying forced air to different regions of a building or the like. Typically, such ducts include a cylindrical portion or length of cylindrical tubing outlet which is coupled to another duct member inlet opening. Such duct members may be prone to loss of air at the connections between duct members. As air circulates through the duct system, air dissipates through the connections, which in turn, causes a loss of energy and thus creates a less efficient system. Sealing of the connections between duct increases the efficiency of the HVAC system, and conserves energy, which is highly desirable. The sealing of connections between such duct members has generally been performed after installation using tape or mastic at the connection for example, which though helping to prevent the egress of air, is not particularly efficient and increases the cost of installation. There have been attempts to seal the connections between duct members, such as by the use of a rubber type seal mounted in a groove near the end of the duct member connecting portion, but the use of a rubber type seal adds the cost of this extra member, and requires installation thereof. There is thus a need to have an apparatus and method for automated manufacture of sealing portion portions in ducts that allow sealing of the connections between duct members in a simplified manner.

### SUMMARY

[0004] The invention is therefore directed in one respect to an apparatus for forming a sealing portion on a duct member for use in an air handling system. The apparatus comprises at least one work station adapted to accommodate a work piece. A forming assembly is configured to form a sealing bead in the work piece in a predetermined manner adjacent an end of the duct member. The forming assembly includes a forming member and at least one die member to form a sealing bead in the work piece that will cooperate to connect and seal the end of the duct member to another duct member. A control system is provided for controlling operation of the forming assembly.

[0005] The invention also relates to a method of automated manufacturing of a sealing portion on a duct member. The method includes providing a work piece having a cylindrical end configuration and positioning the end of the work piece in a work station at a first predetermined position. A clamping system includes a first clamp to secure the work piece in a first predetermined position, and a forming assembly including a turning head is engaged to the interior of the work piece end section. The turning head includes a forming wheel that produces a at least one sealing bead to seal with the inner diameter of another duct member, and may include a plurality of sealing beads with increased radius away from the end of the work piece. The clamp is then opened to release the work piece.

[0006] These and other features of the claimed invention, as well as details of illustrated examples thereof, will be more fully understood from the following description and drawings.

### BRIEF DESCRIPTION OF DRAWINGS

[0007] FIG. 1 is a plan view of a duct member with end portions as formed according to an example of the invention;

[0008] FIG. 2 is a cross-section of the duct member taken along line A-A of FIG. 1;

[0009] FIG. 3 is a top view of a forming machine according to an example, to produce the sealing portion in the duct member of FIG. 1;

[0010] FIG. 4 is a partial top view of an example of the apparatus of FIG. 3, showing operation of a forming cassette and wheels in the example machine; and

[0011] FIG. 5 is a partial cross-sectional view taken along line A-A of FIG. 4.

### DESCRIPTION OF EXAMPLES OF THE INVENTION

[0012] Turning now to FIGS., an example of the invention is directed at producing a sealing portion 20 in conjunction with a duct member 10 such as shown in FIGS. 1 and 2, wherein the duct member 10 is formed from a cylindrical tube. The duct member 10 includes an end 11 with an opening 12 and sealing portion 20 adjacent thereto, adapted to be coupled with another duct member in a duct system. The sealing end 20 facilitates connection of the duct member 10 with another duct member in a manner to seal the connection therebetween. As an example, the tubular sealing portion 20 of the duct member 10 is operated on by the apparatus and methods of the invention. The opening 12 and sealing portion 20 are designed to have a predetermined diameter for use in the apparatus and methods of the invention, but any suitable particular dimensional characteristics of the work piece can be accommodated. The sealing portion 20 includes a series of sealing beads extending from adjacent opening 12 to a spaced distance from the end 11. In this example, the sealing bead configuration includes a first sealing bead 14 adjacent the opening 12, having a first radius from a center of the tube or member 10. A second sealing bead 15 is positioned a small distance from bead 14 and may have a similar or slightly larger radius than sealing bead 14. A third sealing bead 16 is positioned a larger spaced distance from sealing bead 15 on sealing portion 20 and has a larger radius than sealing bead 15. A fourth bead 17 is positioned a small distance from sealing bead 16 and has a slightly larger radius than bead 16. In an example, the

bead 17 serves as a stop bead to prevent further movement of a further duct member onto sealing end 20. At least one sealing bead 14-17 is dimensioned to engage the inner portion of another duct member in a sealing fashion. In this example, the sealing bead configuration enables the sealing portion 20 to be inserted into another duct member, with beads 14 and 15 first engaging the other duct member to center it on sealing portion 20. As the further duct member is pushed onto the sealing portion 20, the inner surface is then successively engaged by at least sealing bead 16, and is tightly sealed in association with the other duct member to substantially prevent the egress of air. The stop bead 17 prevents further movement of the other duct member onto the sealing portion 20 of duct member 10.

[0013] The apparatus and methods of the invention may be operated to take the duct member 10 and produce the sealing portion 20 in the duct member 10 automatically and into the final preferred form, which may be performed without operator intervention.

[0014] Turning now to FIGS. 3-5, an example of the apparatus 50 for forming the sealing portion 20 is shown. The forming apparatus 50 includes a work piece nest 52 having a circular opening or channel 53 for receipt of the end portion 20 of the work piece or duct member 10. The nest 52 and associated structures may be provided on a stand to position the nest 52 at a standing working height for example. The forming machine 50 is activated by an operator after positioning of the work piece 10 into the channel 53 of nest 52. The end 11 of duct member 10 is seated on a support surface in nest 52 at a proper height relative to a forming assembly 54 situated in the nest 52. First and second forming plates 56 with die portions 57 formed therein are provided on opposing sides of nest 52. An actuator 58 moves top sliding plate 60 along with a forming plates 56 toward and into contact with the duct member 10, thereby clamping member 10 into position between the forming plates 56. A forming assembly 54 rotates to form the sealing bead configuration on the sealing portion 20 of the duct member 10 as shown in FIG. 1, as will be described hereafter. Upon activation, the machine 50 automatically forms the desired sealing bead configuration in end portion 20. The dies 57 in this example are provided in a forming plates 56, but other suitable configurations are contemplated, to form the sealing bead configuration on end portion 20.

[0015] As seen in FIG. 4, the forming assembly 54 may include a rotating head 62 with a cassette 64 mounted therein. The cassette 64 carries forming wheels or rollers 66 that are movable into engagement with the work piece 10, such as by cam biasing of the cassette 64. The die portions 57 in forming plates 56 provide grooves or channels that cooperate with rollers 66 to push the material of duct member 10 into the die portions 57 and form the sealing beads 14-17 in end portion 20. A drive shaft causes turning of rotating head 62, and also transfers drive to a cam interface that engages cassette 64, and causes deployment of a forming roller 66 into engagement with the duct member 10, as shown in FIGS. 4 and 5. The structure and operation of the forming assembly 54 and rotating head 62 may be similar to that described in Patent Cooperation Treaty Application No. PCT/US17/037451, or U.S. Pat. Nos. 9,561,536 and 7,096,585 as examples, which are hereby incorporated by reference. The rotating head 62 may be rotated at a speed

to allow the forming operation to be achieved very quickly in conjunction with rollers 66 extending from head 62 upon movement of cassette 64.

[0016] In this example, the cassette 64 carries rollers 66 at each end. The cassette 64 is inserted into a slot on the rotating head 62, and is controlled by a drive to move a roller 66 into engagement with the interior surface of duct member 10, to force material into the dies 57 in forming plates 56 to a predetermined dimension. In this example, at least one first sealing bead 14-17 is formed near the opening 12, and at least one second sealing bead 14-17 is spaced from the opening 12. The at least one first sealing bead 14-17 has a first dimension in terms of the distance it projects from the surface of duct member 10, while the at least one second sealing bead 14-17 has a second dimension in terms of the distance it projects from the surface of duct member 10. The second dimension is greater than the first dimension, and corresponds to the inside diameter of the duct member 10. In an example, the second dimension is slightly larger than the inside diameter of the duct member 10, and deforms slightly upon insertion of the end portion 20 into a duct member 10 by engagement of the sealing bead with the inside diameter of the duct member, to provide a tight seal with the inside diameter. In this example, there is also provided a stop bead 17, which is dimensioned to prevent further movement of another duct member being joined onto the sealing end 20 of duct member 10. The stop bead 17 is positioned adjacent sealing bead 16, which engages and seals the duct member 10 to the interior surface of the adjoining duct member attached to sealing end 20.

[0017] The machine 50 may include safety features, such as a part sensor to only allow operation of machine 50 when a part is mounted in the channel 53, safety guards, foot pedal operation or the like. Deactivation of the forming assembly may be initiated by a kill switch, or other safety mechanisms could be used, such as dual activation switches. The control system may allow adjustment of machine operation, such as to modify the dimension of the sealing beads 14-17, controlling clamping and unclamping the work piece in the machine 50, or other functions.

[0018] As seen in FIG. 5, in this example for forming sealing beads 14-17, the rollers 66 include first through fourth beading portions 70, 71, 72 and 73, while die portions 57 include first through fourth forming groove portions 74, 75, 76 and 77 corresponding to the first through fourth beading portions 71, 71, 72 and 73 to form the sealing beads 14-17 in end portion 20. The first through fourth beading portions 71, 71, 72 and 73 are formed to allow material of the end portion 20 to deform into the first through fourth forming groove portions 74, 75, 76 and 77 to the desired dimension. As previously described, the sealing beads 14 and 15 may be of smaller dimension than sealing beads 16 and 17, and sealing bead 17 may have a larger dimension than the other sealing beads. The movement of cassette 64 may be adjustable to modify the dimensions of the formed sealing beads 14-17, to allow the user to fine tune the sealing beads 14-17 for the particular work pieces being used, differing material thicknesses or other variables in the work pieces or operation.

[0019] While the above description has been presented with specific relation to particular examples of the systems and methods, it is to be understood that the claimed invention is not to be limited thereby. Illustrative embodiments have been described, hereinabove. It will be apparent to

those skilled in the art that the above devices and methods may incorporate changes and modifications without departing from the general scope of the claimed subject matter. It is intended to include all such modifications and alterations within the scope of the claimed subject matter. Furthermore, to the extent that the term “includes” is used in either the detailed description or the claims, such term is intended to be inclusive in a manner similar to the term “comprising” as “comprising” is interpreted when employed as a transitional word in a claim.

What is claimed is:

1. An apparatus for forming a sealing portion in a duct member comprising,
  - at least one work station adapted to accommodate a first duct member having at least one end configured to connect to a second duct member in formation of a duct,
  - the at least one work station including a forming assembly to form at least one extending sealing bead in a duct member in a position adjacent at least one end of the duct member a spaced distance from the at least one end of the first duct member, where the at least one sealing bead has a diameter substantially corresponding to the diameter of the second duct member at a position adjacent the end of the second duct member to frictionally engage the second duct member when connected for use, to substantially seal the connection between the first and second duct members from the egress of air.
2. The apparatus of claim 1, where the at least one sealing bead extends outwardly from the side of the first duct member.
3. The apparatus of claim 1, wherein the forming assembly forms a plurality of sealing beads adjacent the at least one end of the first duct member.
4. The apparatus of claim 3, wherein the plurality of sealing beads extend outwardly from the side of the first duct member.
5. The apparatus of claim 3, where the plurality of sealing beads change in diameter as the distance from the at least one end of the first duct member increases.
6. The apparatus of claim 5, where the plurality of sealing beads extend outwardly from the side of the first duct member and the outside diameter of the plurality of sealing beads increases as the distance from the at least one end of the first duct member increases.
7. The apparatus of claim 1, where the forming assembly forms at least one stop bead spaced from the end of the first duct member.
8. The apparatus of claim 1, where the forming assembly includes at least one die member that engages with the side of the first duct member.
9. The apparatus of claim 1, where the forming assembly includes at least one die member that is repositionable between an operational and a non-operational position.
10. The apparatus of claim 9, where the forming assembly includes at least one die member that engages with the side of the first duct member in the operational position.
11. The apparatus of claim 8, where the forming assembly includes at least one forming wheel mating with the at least one die member to form the at least one sealing bead.

12. The apparatus of claim 8, where the forming assembly includes at least one forming wheel mating with the at least one die member wherein the at least one forming wheel includes a plurality of beading sections mating with a plurality of forming grooves in the at least one die member to form a plurality of sealing beads with different diameters.

13. The apparatus of claim 8, where there are a plurality of forming wheels mating with forming grooves in the at least one die member to form a plurality of sealing beads in spaced positions from the at least one end of the first duct member.

14. An apparatus for forming a sealing end portion on a duct member comprising,

a work station including a clamping assembly to clamp a first duct member and a forming assembly to form at least one outwardly extending bead in the first duct member in a spaced position adjacent at least one open end of the duct member a predetermined distance from the at least one open end of the duct member, where the at least one sealing bead has an outer diameter substantially corresponding to the inside diameter of the end of a second duct member at a position adjacent the open end of the second duct member to frictionally engage the inside diameter when connected for use, to substantially seal the connection between the first and second duct members from the egress of air.

15. The apparatus of claim 14, where forming assembly forms a plurality of spaced apart sealing beads on the at least one end of the first duct member.

16. The apparatus of claim 15, where the outside diameter of the plurality of sealing beads increase as the distance from the at least one end of the duct member increases.

17. The apparatus of claim 14, wherein the forming assembly forms at least one stop bead spaced from the end of the duct member.

18. The apparatus of claim 14, where the forming assembly includes at least one forming wheel with a plurality of beading sections mating with a plurality of forming grooves in at least one die member to form a plurality of sealing beads with different outside diameters.

19. The apparatus of claim 14, where the forming assembly includes at least one die member that is movable to engage the outside of the first duct member and mating with at least one forming wheel to form the at least one sealing bead.

20. A method of sealing the connection between first and second duct members comprising:

- a) providing a first duct member having a cylindrical configuration and providing at least one sealing bead extending from the side of the first duct member in a position adjacent at least a first end of the first duct member a spaced distance from the at least first end of the first duct member,
- b) providing a second duct member having a cylindrical configuration and an end configured to be connected to the first end of the first duct member,
- c) connecting the end of the second duct member to the first end of the first duct member until the at least one sealing bead frictionally engages the second duct member, to substantially seal the connection between the first and second duct members from the egress of air.

\* \* \* \* \*