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**United States Patent**  
**Elliott , et al.****11,326,724**  
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Pipe with alternating sections

**Abstract**

A plastic drain pipe for drainage includes a first end, a second end, and a pipe sub-section between the first end and the second end. The pipe sub-section includes a collapsible section of corrugated pipe, a first non-collapsible section of corrugated pipe, and a second non-collapsible section of corrugated pipe. The collapsible section of corrugated pipe has a first joining area and a second joining area. The first non-collapsible section of corrugated pipe is connected to the collapsible section of corrugated pipe at the first joining area, and the second non-collapsible section of corrugated pipe is connected to the collapsible section of corrugated pipe at the second joining area.

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### *Parent Case Text*

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#### REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. application Ser. No. 15/949,175, filed Apr. 10, 2018 and entitled PIPE WITH ALTERNATING SECTIONS, which claims the benefit of U.S. Provisional Application No. 62/483,796, filed Apr. 10, 2017, and entitled PIPE WITH ALTERNATING SECTIONS, both of which are hereby incorporated by reference in their entireties.

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### *Claims*

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That which is claimed is:

1. A plastic drain pipe for drainage comprising: a first end; a second end; and a pipe sub-section between the first end and the second end comprising: a collapsible section of corrugated pipe having a first joining area and a second joining area; a first non-collapsible section of corrugated pipe connected to the collapsible section of corrugated pipe at the first joining area, wherein the first non-collapsible section comprises a first plurality of corrugations; and a second non-collapsible section of corrugated pipe connected to the collapsible section of corrugated pipe at the second joining area and such that the collapsible section is between the first non-collapsible section and the second non-collapsible section, wherein the second non-collapsible section comprises a second plurality of corrugations.
2. The plastic drain pipe of claim 1, wherein the pipe sub-section is a first pipe sub-section, and wherein the plastic drain pipe comprises a plurality of pipe sub-sections, each pipe sub-section comprising a collapsible section of corrugated pipe connected to two non-collapsible sections of corrugated pipe.
3. The plastic drain pipe of claim 1, wherein an end of the first non-collapsible section of corrugated pipe opposite the first joining area is the first end of the plastic drain pipe, and wherein an end of the second non-collapsible section of corrugated pipe opposite the second joining area is the second end of the plastic drain

pipe.

4. The plastic drain pipe of claim 1, wherein the pipe sub-section is foldable into a packaged configuration such that the collapsible section of corrugated pipe forms a bend and the first non-collapsible section of corrugated pipe is positioned adjacent to the second non-collapsible section of corrugated pipe.
5. The plastic drain pipe of claim 1, wherein a length of the collapsible section of corrugated pipe is less than a length of the first non-collapsible section of corrugated pipe and less than a length of the second non-collapsible section of corrugated pipe.
6. The plastic drain pipe of claim 1, wherein a length of the collapsible section of corrugated pipe is approximately the same as a length of the first non-collapsible section of corrugated pipe and approximately the same as a length of the second non-collapsible section of corrugated pipe.
7. A method of packaging a plastic drain pipe for drainage comprising: directing a collapsible section of corrugated pipe of a pipe sub-section between a first end and a second end of the plastic drain pipe to form a bend; and moving a first non-collapsible section of corrugated pipe connected to the collapsible section of corrugated pipe at a first joining area to be adjacent to a second non-collapsible section of corrugated pipe connected to the collapsible section of corrugated pipe at a second joining area of the collapsible section opposite the first joining area, wherein the first non-collapsible section comprises a first plurality of corrugations, wherein the second non-collapsible section comprises a second plurality of corrugations.
8. The method of claim 7, wherein the pipe sub-section is a first pipe sub-section, wherein the plastic drain pipe comprises a plurality of pipe sub-sections, each pipe sub-section comprising a collapsible section of corrugated pipe connected to two non-collapsible sections of corrugated pipe, and wherein the method further comprises directing each collapsible section of corrugated pipe to form a bend and moving the non-collapsible sections of corrugated pipe adjacent to one another.
9. The method of claim 8, wherein forming the bend in each collapsible section of corrugated pipe and moving the non-collapsible sections of corrugated pipe comprises forming a cuboid.
10. The method of claim 9, wherein the cuboid is square or rectangular.
11. The method of claim 7, wherein a length of the collapsible section of corrugated pipe is less than a length of the first non-collapsible section of corrugated pipe and less than a length of the second non-collapsible section of corrugated pipe.
12. The method of claim 7, wherein a length of the collapsible section of corrugated pipe is approximately the same as a length of the first non-collapsible section of corrugated pipe and approximately the same as a length of the second non-collapsible section of corrugated pipe.
13. A package of plastic drain pipe for drainage comprising: a drain pipe comprising: a first end; a second end; and a pipe sub-section between the first end and the second end comprising: a collapsible section of corrugated pipe having a first joining area and a second joining area; a first non-collapsible section of corrugated pipe connected to the collapsible section of corrugated pipe at the first joining area, wherein the first non-collapsible section comprises a first plurality of corrugations; and a second non-collapsible section of corrugated pipe connected to the collapsible section of corrugated pipe at the second joining area, wherein the second non-collapsible section comprises a second plurality of corrugations, and wherein the collapsible section of corrugated pipe forms a bend and the first non-collapsible section of corrugated pipe is adjacent to the second non-collapsible section of corrugated pipe.
14. The package of claim 13, wherein the pipe sub-section is a first pipe sub-section, wherein the drain pipe comprises a second pipe sub-section between the first pipe sub-section and the second end, wherein the second pipe sub-section comprises: a collapsible section of corrugated pipe having a first joining area and a second joining area; a first non-collapsible section of corrugated pipe connected to the collapsible section of corrugated pipe at the first joining area; and a second non-collapsible section of corrugated pipe connected to the collapsible section of corrugated pipe at the second joining area, wherein the collapsible section of corrugated pipe forms a bend and the first non-collapsible section of corrugated pipe is adjacent to the





FIG. 14 is a front view of the configuration of FIG. 11.

FIG. 15 is a perspective view of another exemplary packaging configuration for the pipe of FIG. 1.

FIG. 16 is a top view of the configuration of FIG. 15.

FIG. 17 is a side view of the configuration of FIG. 15.

FIG. 18 is a front view of the configuration of FIG. 15.

## DETAILED DESCRIPTION

The subject matter of embodiments of the present invention is described here with specificity to meet statutory requirements, but this description is not necessarily intended to limit the scope of the claims. The claimed subject matter may be embodied in other ways, may include different elements or steps, and may be used in conjunction with other existing or future technologies. This description should not be interpreted as implying any particular order or arrangement among or between various steps or elements except when the order of individual steps or arrangement of elements is explicitly described. Directional references such as "up," "down," "top," "left," "right," "front," and "back," among others are intended to refer to the orientation as illustrated and described in the figure (or figures) to which the components and directions are referencing.

FIG. 1 illustrates a drain pipe 100 according to aspects of the present disclosure. The drain pipe 100 includes a first end 102 and a second end 104. A distance from the first end 102 to the second end 104, or a length of the drain pipe 100, can vary and should not be considered limiting on the current disclosure. In some examples, the ends 102 and 104 include cuffs and/or fittings (not shown) for connecting the pipe 100 to other devices and components. The cuffs and fittings may be integrally formed with the pipe 100 or may be separate components that attach to the pipe 100.

As illustrated in FIG. 1, the drain pipe 100 includes alternating sections of collapsible corrugated pipe 106 and non-collapsible corrugated pipe 108 that are integrally or monolithically formed with one another through a suitable molding or other forming process. The number of sections of collapsible corrugated pipe 106 and non-collapsible corrugated pipe 108 can vary and is not limited to the illustrated arrangement.

Referring to FIG. 2, each section of collapsible corrugated pipe 106 includes a plurality of annular corrugations of alternating smaller, minimum or minor diameter rings 110 separated by larger, maximum or major diameter rings 112. The minor diameter rings 110 are connected to the major diameter rings 112 by alternating static walls 116 and tuck walls 118, which permit the section of pipe 106 to be in an extended state (see FIG. 2), a collapsed state, or a curved or directed state (see FIGS. 3-18). Generally, the pipe 106 is compressed (i.e. in the compressed state or the curved state) when the corrugations are collapsed such that at least some of the tuck walls 118 are folded inward against the static walls 116. The pipe 106 is expanded when the tuck walls 118 are folded outward and apart from the static walls 116 to the extent possible. For example, in some examples, a maximum angular orientation between the tuck walls 118 and the static walls 116 may be about 90.degree., although in other examples, the maximum angular orientation may be less than about 90.degree. or greater than about 90.degree..

Still referring to FIG. 2, each section of non-collapsible corrugated pipe 108 includes a plurality of annular corrugations of alternating smaller, minimum or minor diameter rings 122 separated by larger, maximum or major diameter rings 120. Unlike the collapsible corrugated pipe 106, adjacent walls 121 of the non-collapsible corrugated pipe 108 are not collapsible or expandable relative to each other. Compared to the collapsible corrugated pipe 106, a bend radius (or a minimum radius that a pipe can be bent) of the non-collapsible pipe 108 is greater than a bend radius of the collapsible corrugated pipe 106.

In various examples, an outermost diameter of the collapsible corrugated pipe 106 (formed by the major diameter rings 112) is approximately the same as an outermost diameter of the non-collapsible corrugated pipe 108 (formed by the major diameter rings 120). In some examples, an innermost diameter of the collapsible corrugated pipe 106 is approximately the same as an innermost diameter of the non-collapsible corrugated pipe 108, although it need not be. In some configurations, the innermost diameter of the



section of corrugated pipe.

EC 2. The plastic drain pipe of any of the preceding or subsequent example combinations, wherein the pipe sub-section is a first pipe sub-section, and wherein the plastic drain pipe comprises a plurality of pipe sub-sections, each pipe sub-section comprising a collapsible section of corrugated pipe connected to two non-collapsible sections of corrugated pipe.

EC 3. The plastic drain pipe of any of the preceding or subsequent example combinations, wherein an end of the first non-collapsible section of corrugated pipe opposite the first joining area is the first end of the plastic drain pipe, and wherein an end of the second non-collapsible section of corrugated pipe opposite the second joining area is the second end of the plastic drain pipe.

EC 4. The plastic drain pipe of any of the preceding or subsequent example combinations, wherein the pipe sub-section is foldable into a packaged configuration such that the collapsible section of corrugated pipe forms a bend and the first non-collapsible section of corrugated pipe is positioned adjacent to the second non-collapsible section of corrugated pipe.

EC 5. The plastic drain pipe of any of the preceding or subsequent example combinations, wherein a length of the collapsible section of corrugated pipe is less than a length of the first non-collapsible section of corrugated pipe and less than a length of the second non-collapsible section of corrugated pipe.

EC 6. The plastic drain pipe of any of the preceding or subsequent example combinations, wherein a length of the collapsible section of corrugated pipe is approximately the same as a length of the first non-collapsible section of corrugated pipe and approximately the same as a length of the second non-collapsible section of corrugated pipe.

EC 7. A method of packaging a plastic drain pipe for drainage comprising: directing a collapsible section of corrugated pipe of a pipe sub-section between a first end and a second end of the plastic drain pipe to form a bend; and moving a first non-collapsible section of corrugated pipe connected to the collapsible section of corrugated pipe at a first joining area to be adjacent to a second non-collapsible section of corrugated pipe connected to the collapsible section of corrugated pipe at a second joining area of the collapsible section opposite the first joining area, wherein an outermost diameter of the collapsible section of corrugated pipe is approximately the same as an outermost diameter of the first non-collapsible section and an outermost diameter of the second non-collapsible section.

EC 8. The method of any of the preceding or subsequent example combinations, wherein the pipe sub-section is a first pipe sub-section, wherein the plastic drain pipe comprises a plurality of pipe sub-sections, each pipe sub-section comprising a collapsible section of corrugated pipe connected to two non-collapsible sections of corrugated pipe, and wherein the method further comprises directing each collapsible section of corrugated pipe to form a bend and moving the non-collapsible sections of corrugated pipe adjacent to one another.

EC 9. The method of any of the preceding or subsequent example combinations, wherein forming the bend in each collapsible section of corrugated pipe and moving the non-collapsible sections of corrugated pipe comprises forming a cuboid.

EC 10. The method of any of the preceding or subsequent example combinations, wherein the cuboid is square.

EC 11. The method of any of the preceding or subsequent example combinations, wherein the cuboid is rectangular.

EC 12. The method of any of the preceding or subsequent example combinations, wherein a length of the collapsible section of corrugated pipe is less than a length of the first non-collapsible section of corrugated pipe and less than a length of the second non-collapsible section of corrugated pipe.

EC 13. The method of any of the preceding or subsequent example combinations, wherein a length of the collapsible section of corrugated pipe is approximately the same as a length of the first non-collapsible



