CLAIMS

What is claimed is:

1. A method of cooling a glass ribbon formed using a fusion draw process, the method comprising:

forming a glass ribbon using the fusion draw process, the glass ribbon, once formed, passing vertically through a glass transition temperature region;

directing the glass ribbon through a protective plenum at least partially located in a bottom of the draw region;

directing a gas into the protective plenum and vertically along a relatively broad surface of the glass ribbon; and

directing the gas out of the protective plenum through at least one outlet slot formed through a sidewall of the protective plenum at no less than about 100 Nm^3/h.

2. The method of claim 1, wherein the step of directing the gas into the protective plenum occurs after the glass ribbon cools below its glass transition temperature.

3. The method of claim 1, wherein the glass transition temperature region includes at least part of the protective plenum.

4. The method of claim 3, wherein the outlet slot is located below the glass transition temperature region.

5. The method of claim 1, wherein the at least one outlet slot is a first outlet slot located facing a first relatively broad surface of the glass ribbon, the step of directing the gas out of the plenum includes directing the gas through a second outlet slot located facing a second relatively broad surface of the ribbon that is opposite the first relatively broad surface.

6. The method of claim 1, wherein the protective plenum includes a top opening and a bottom opening, the step of directing the gas into the protective plenum including gas entering through the bottom opening.

7. The method of claim 6, wherein the at least one outlet slot is located nearer the top opening than the bottom opening.

8. The method of claim 7, wherein the at least one outlet slot is located nearer the bottom opening than the top opening.

9. The method of claim 1, wherein the step of directing the gas into the protective plenum includes directing the gas through an inlet slot formed through the sidewall of the protective plenum.

10. The method of claim 1, wherein the step of directing the gas out of the protective plenum through at least one outlet slot includes directing the gas at between about 100 Nm^3/h and about 800 Nm^3/h through the at least one outlet slot.

11. A method of cooling a glass ribbon formed using a fusion draw process, the method comprising:

forming a glass ribbon using the fusion draw process, the glass ribbon, once formed, passing vertically through a glass transition temperature region;

directing the glass ribbon through a protective plenum at least partially located in a bottom of the draw region;

after the glass ribbon cools below its glass transition temperature, then directing a gas into the protective plenum and vertically along a relatively broad surface of the glass ribbon to further cool the glass ribbon; and

directing the gas out of the protective plenum through at least one outlet slot formed through a sidewall of the protective plenum.

12. The method of claim 11, wherein the gas is directed out of the protective plenum at no less than about 100 Nm^3/h.

13. The method of claim 11, wherein the glass transition temperature region includes at least part of the protective plenum.

14. The method of claim 13, wherein the outlet slot is located below the glass transition temperature region.

15. The method of claim 11, wherein the at least one outlet slot is a first outlet slot located facing a first relatively broad surface of the glass ribbon, the step of directing the gas out of the plenum includes directing the gas through a second outlet slot located facing a second relatively broad surface of the ribbon that is opposite the first relatively broad surface.

16. The method of claim 11, wherein the protective plenum includes a top opening and a bottom opening, the step of directing the gas into the protective plenum including gas entering through the bottom opening.

17. The method of claim 16, wherein the at least one outlet slot is located nearer the top opening than the bottom opening.

18. The method of claim 11, wherein the step of directing the gas into the protective plenum includes directing the gas through an inlet slot formed through the sidewall of the protective plenum.

19. A method of cooling a glass ribbon formed using a fusion draw process, the method comprising:

forming a glass ribbon using the fusion draw process, the glass ribbon, once formed, passing vertically through a glass transition temperature region;

directing the glass ribbon through a protective plenum at least partially located in a bottom of the draw region;

after the glass ribbon cools below its glass transition temperature, then directing a gas into the protective plenum through a bottom opening in the protective plenum through which the glass ribbon passes to further cool the glass ribbon; and

directing the gas out of the protective plenum through at least one pair of outlet slots including a first outlet slot formed through a sidewall of the protective plenum facing a first relatively broad surface of the glass ribbon and a second outlet slot formed through a sidewall of the protective plenum facing a second, opposite relatively broad surface of the glass ribbon.

20. The method of claim 19, wherein the pair of outlet slots are located below the glass transition temperature region.

CLAIMS

1. A method of cooling a glass ribbon formed using a fusion draw process, the method comprising:

forming a glass ribbon using the fusion draw process, the glass ribbon, once formed, passing vertically through a glass transition temperature region;

directing the glass ribbon through a protective plenum at least partially located in a bottom of the draw region;

directing a gas into the protective plenum and vertically along a relatively broad surface of the glass ribbon; and

directing the gas out of the protective plenum through at least one outlet slot formed through a sidewall of the protective plenum at no less than about 100 Nm^3/h.

2. The method of claim 1, wherein the step of directing the gas into the protective plenum occurs after the glass ribbon cools below its glass transition temperature.

3. The method of claim 1, wherein the glass transition temperature region includes at least part of the protective plenum.

4. The method of claim 3, wherein the outlet slot is located below the glass transition temperature region.

5. The method of claim 1, wherein the at least one outlet slot is a first outlet slot located facing a first relatively broad surface of the glass ribbon, the step of directing the gas out of the plenum includes directing the gas through a second outlet slot located facing a second relatively broad surface of the ribbon that is opposite the first relatively broad surface.

6. The method of claim 1, wherein the protective plenum includes a top opening and a bottom opening, the step of directing the gas into the protective plenum including gas entering through the bottom opening.

7. The method of claim 6, wherein the at least one outlet slot is located nearer the top opening than the bottom opening.

8. The method of claim 7, wherein the at least one outlet slot is located nearer the bottom opening than the top opening.

9. The method of claim 1, wherein the step of directing the gas into the protective plenum includes directing the gas through an inlet slot formed through the sidewall of the protective plenum.

10. The method of claim 1, wherein the step of directing the gas out of the protective plenum through at least one outlet slot includes directing the gas at between about 100 Nm^3/h and about 800 Nm^3/h through the at least one outlet slot.