CLAIMS

1. An impingement apparatus associated with a conveyor, the impingement apparatus comprising:

(a) a shell supporting an impinger; and

(b) a coolant delivery apparatus enclosed within the shell, the coolant delivery apparatus comprising a gas circulation device for directing a coolant to the impinger;

the impinger comprising:

(i) an impingement plate comprising openings for directing impingement jets toward the conveyor;

(ii) at least one non-circular cam in mechanical communication with the at least one conveyor and rotatable when the conveyor is in motion; and

(iii) at least one connector in mechanical communication with the at least one cam and the impingement plate, the connector displaceable during rotation of the at least one cam to elevate and lower the impingement plate.

2. The impingement apparatus of claim 1, wherein the impingement jets are capable of breaking through a thermal boundary layer of an item being cooled.

3. The impingement apparatus of claim 1, further comprising a coolant supply in communication with at least one aperture in the shell.

4. The impingement apparatus of claim 1, wherein the coolant comprises nitrogen or carbon dioxide.

5. The impingement apparatus of claim 1, wherein the shell comprises a top, opposed edges and opposed side walls supporting the impinger.

6. The impingement apparatus of claim 1, wherein the impingement plate comprises a plurality of holes in the impingement plate, through which the impingement jets are directed.

7. The impingement apparatus of claim 1, wherein the impingement plate comprises open, elongated channels constructed and arranged between a plurality of rails forming the impingement plate, through which the impingement jets are directed.

8. The impingement apparatus of claim 1, wherein the gas circulation device is selected from the group consisting of an impeller, a blower, and an axial flow fan.

9. The impingement apparatus of claim 1, wherein the impingement apparatus is mounted in a food freezer.

10. The impingement apparatus of claim 1, wherein the at least one non-circular cam comprises a plurality of lobes.

11. An apparatus for cooling or freezing items comprising:

a housing comprising a ceiling, a floor and side walls defining a chamber within the housing;

at least one conveyer extending into the chamber between the ceiling and the floor; and

at least one impingement apparatus disposed in the chamber and above the conveyor,

the impingement apparatus comprising:

(a) a shell supporting an impinger; and

(b) a coolant delivery apparatus enclosed within the shell, the coolant delivery apparatus comprising a gas circulation device for directing a coolant to the impinger;

the impinger comprising:

(i) an impingement plate comprising openings for directing impingement jets toward the conveyor;

(ii) at least one non-circular cam in mechanical communication with the at least one conveyor and rotatable when the conveyor is in motion; and

(iii) at least one connector in mechanical communication with the at least one cam and the impingement plate, the connector displaceable during rotation of the at least one cam to elevate and lower the impingement plate.

12. The apparatus of claim 11, wherein the impingement jets are capable of breaking through a thermal boundary layer of the items.

13. The apparatus of claim 11, further comprising a coolant supply in communication with the coolant delivery apparatus.

14. The apparatus of claim 13, wherein the coolant supply is in communication with at least one aperture in the shell.

15. The impingement apparatus of claim 11, wherein the coolant comprises nitrogen or carbon dioxide.

16. The apparatus of claim 11, wherein the shell comprises a top, opposed edges and opposed side walls supporting the impinger.

17. The apparatus of claim 11, wherein the impingement plate comprises a plurality of holes in the impingement plate, through which the impingement jets are directed.

18. The apparatus of claim 11, wherein the impingement plate comprises open, elongated channels constructed and arranged between a plurality of rails forming the impingement plate, through which the impingement jets are directed.

19. The apparatus of claim 11, wherein the gas circulation device is selected from the group consisting of an impeller, a blower, and an axial flow fan.

20. The apparatus of claim 11, wherein the apparatus is mounted in a food freezer.

21. The apparatus of claim 11, further comprising a plurality of modules within the housing chamber, each one of the plurality of modules including at least one impingement apparatus associated with the conveyor.

22. The apparatus of claim 11, wherein the at least one non-circular cam comprises a plurality of lobes.