Claims

1. An commercial air cooled apparatus and a large diameter axial flow fan combination comprising:

~~a~~ said commercial air cooled apparatus ~~(4, 5, 6, 7)~~ generating an air flow for cooling; and

~~a~~ said large diameter axial flow fan ~~(2)~~ mounted on said air cooled apparatus for generating said air flow in said air cooled apparatus for said cooling, ~~characterized in that:~~

wherein said fan ~~(2)~~ has a diameter ~~(11)~~ of at least four feet (1.2 meters), said fan comprising a plurality of blades ~~(10)~~, wherein each of said blades comprises a leading edge ~~(13)~~ opposite a trailing edge ~~(15)~~, wherein the entire of said leading edge ~~(13)~~ of each of said blades is linear and forward swept, and wherein each blade comprises a metallic outer surface ~~(39)~~, a forward spar and a rear spar interconnected to the forward spar by a connecting spar, wherein said fan is a Super Low Noise fan.

2. The combination of claim 1, wherein the commercial air cooled apparatus is selected from the group of air cooled apparatuses consisting of air cooled heat exchangers ~~(4)~~, radiator coolers ~~(5)~~, air cooled steam condensers ~~(7)~~, and cooling towers ~~(6)~~.

3. The combination of claim 1 or 2, wherein each of the blades is made from sheet metal stressed skin.

4. The combination of claim 3, wherein said sheet metal is aluminum.

5. The combination of any of claims 1 to 4, wherein the fan ~~(2)~~ has a diameter ~~(11)~~ of at least 9 feet (2.74 meters).

6. The combination of any of claims 1 to 4, wherein the fan ~~(2)~~ has a diameter ~~(11)~~ of at least 10 feet (3.04 meters).

7. The combination of any of claims 1 to 4, wherein the fan ~~(2)~~ has a diameter ~~(11)~~ of at least 11 feet (3.35 meters).

8. The combination of any of claims 1 to 4, wherein the fan ~~(2)~~ has a diameter ~~(11)~~ of at least 12 ~~feet~~ (3.65 meters).

9. The combination of any of claims 1 to 4, wherein the fan ~~(2)~~ has a diameter ~~(11)~~ of at least 13 feet (3.96 meters).

10. The combination of any of claims 1 to 4, wherein the fan ~~(2)~~ has a diameter ~~(11)~~ of at least 14 feet (4.26 meters).

11. The combination of any of claims 1 to 10, wherein the fan ~~(2)~~ has at least 3 blades ~~(10)~~.

12. The combination of any of claims 1 to 10, wherein the fan ~~(2)~~ has at least four blades ~~(10)~~.

13. The combination of any of the preceding claims ~~1~~, wherein the fan comprises a hub ~~(26)~~, and wherein the blades ~~(10)~~ are resiliency mounted to the hub ~~(26)~~.

14. The combination of any of the preceding claims ~~1~~, wherein each blade ~~(10)~~ is filled with foam.

15. The combination of any of the preceding claims ~~1~~, wherein the entire trailing edge ~~(15)~~ of each blade ~~(10)~~ is linear.

16. The combination of any of claims 1 to 15, wherein each blade ~~(10)~~ has a length ~~(17)~~ of about 42 inches (1.067 meters).

17. The combination of any of claims 1 to 15, wherein each blade has a length ~~(17)~~ of about 48 inches (1.219 meters).

18. The combination of any of the preceding claims ~~1~~, wherein each blade has an average chord length ~~(19)~~ of about 48 inches (1.219 meters).

19. The combination of claim 1, wherein the fan sound power level in dBA is determined as follows:

$$\mathbf{PWL = C + 30^{*} \log_{10}(TS/1000) + 10^{*} \log_{10}(HP) + Add}$$

~~Where~~where:

PWL = Fan Sound Power Level in dBA

C = Fan baseline noise level in dBA which is a function of blade design

TS = Fan tip speed in ft/minute which is equal to π * Fan RPM * Fan Diameter

HP = Fan Shaft Horsepower

Add = Additional noise due to entry and installation effects

wherein **C** for the fan is not greater than 45 dBA.

20. The combination of claim 19, wherein **C** for the fan is in the range of 43 to 45 dBA.

21. The combination of claim 19, wherein **C** for the fan is in not greater than 43 dBA.

22. The combination of any of the preceding claims ~~1~~, wherein each blade leading edge ~~(13)~~ is forward swept at an angle ~~(20)~~ of 25° as measured from a radius of rotation of such blade.

23. The combination of any of claims 1 to 4, wherein the fan ~~(2)~~ has a diameter ~~(11)~~ of at least 5 feet (1.52 meters).

24. The combination of any of the preceding claims, wherein the forward spar is forward swept.

25. The combination of any of the preceding claims, wherein the metallic outer surface comprises a first surface portion extending between said spars opposite as a second surface portion extending between said spars, wherein the first surface portion is concave and the second surface portion is convex.

26. The combination of any of the preceding claims, wherein the trailing edge is linear.