BED AIRFLOW AND TEMPERATURE CONTROL

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application Serial No. 62/957,103, filed January 03, 2020. The disclosure of the prior application is considered part of (and is incorporated by reference in) the disclosure of this application.

TECHNICAL FIELD

[0002] This document relates to bed systems, and more particularly to devices, systems, and methods for controlling air flow and temperature of a bed.

BACKGROUND

[0003] In general, a bed is a piece of furniture used as a location to sleep or relax. Many modern beds include a soft mattress on a bed frame. The mattress may include springs, foam material, and/or an air chamber to support the weight of one or more occupants. Various features and systems have been used in conjunction with beds, including heating and cooling systems for heating and cooling a user of a bed.

SUMMARY

[0003a] According to a first aspect of the present invention, there is provided a mattress system comprising:

a mattress cover;

a first layer having a top surface and an opposite bottom surface, the top surface covered by the mattress cover, the first layer configured to permit a first airflow rate;

a heating unit arranged above the top surface of the first layer and under the mattress cover, the heating unit being electrically controlled to increase temperature;

an airflow insert pad arranged under the bottom surface of the first layer, and configured to permit a second airflow rate being higher than the first airflow;

an air controller configured to move air through the airflow insert pad and through the first layer to decrease a temperature at the top surface of the first layer;

an inflatable chamber positioned below the first layer; and

a foam rail structure including top, bottom, and opposite side foam rails extending between the top and bottom foam rails, and configured to surround the inflatable chamber.

[0003b] According to a second aspect of the present invention, there is provided a mattress system comprising:

a mattress cover;

a first foam layer having a top surface and an opposite bottom surface, the top surface covered by the mattress cover, the first foam layer configured to permit a first airflow rate;

a foot warming envelop enclosing a heating unit and arranged under the mattress cover, the heating unit being electrically controlled;

an airflow insert pad arranged under the bottom surface of the first foam layer, and configured to permit a second airflow rate being higher than the first airflow;

an air controller configured to draw air from the airflow insert pad to increase distribution of air through the first foam layer and decrease a temperature at the top surface of the first foam layer;

an inflatable chamber positioned below the first foam layer; and

a foam rail structure including top, bottom, and opposite side foam rails extending between the top and bottom foam rails, and configured to surround the inflatable chamber.

[0004] Some embodiments described herein include a bed system with microclimate control capabilities for providing quality sleep experience. The bed system can include a microclimate control subsystem configured to supply conditioned air (e.g., heated or cooled air) to a mattress to achieve a desired temperature at the top of the mattress. In some implementations, conditioned air can be supplied to one or more airflow pads arranged under the mattress top, so that the conditioned air is distributed to the mattress top through the airflow pads. Alternatively, the microclimate control subsystem can draw ambient air from the mattress, thereby conditioning the temperature at the top of the mattress. For example, air is forced to be drawn from the airflow pads so that air at the mattress top is suctioned into the mattress and permits for the air to be circulated and refreshed at the mattress top. Utilizing supply of conditioned air to provide air at desired temperature to the mattress system, or utilizing air suction to drain heat away from the mattress system, can provide precise microclimate control at the mattress, thereby permitting conformable sleep.

WHAT IS CLAIMED IS:

1. A mattress system comprising:

a mattress cover;

a first layer having a top surface and an opposite bottom surface, the top surface covered by the mattress cover, the first layer configured to permit a first airflow rate;

a heating unit arranged above the top surface of the first layer and under the mattress cover, the heating unit being electrically controlled to increase temperature;

an airflow insert pad arranged under the bottom surface of the first layer, and configured to permit a second airflow rate being higher than the first airflow;

an air controller configured to move air through the airflow insert pad and through the first layer to decrease a temperature at the top surface of the first layer;

an inflatable chamber positioned below the first layer; and

a foam rail structure including top, bottom, and opposite side foam rails extending between the top and bottom foam rails, and configured to surround the inflatable chamber.

2. The mattress system of claim 1, wherein the heating unit includes a foot warming envelop positioned at a foot of the mattress system, and the airflow insert pad is positioned closer to a head of the mattress system than the foot warming envelop.

3. The mattress system of claim 1 or 2, wherein the first layer is configured as a foam layer.

4. The mattress system of any of claims 1-3, wherein the air controller is configured to draw air from the airflow insert pad.

5. The mattress system of any of claims 1-4, wherein the air controller is configured to supply conditioned air to the air insert pad.

6. The mattress system of claim 5, wherein the conditioned air is heated air or cooled air.

7. The mattress system of any of claims 1-6, wherein the airflow insert pad includes a pad cover and an airflow material enclosed in the pad cover, the pad cover including a vent, and

wherein the airflow insert pad is arranged for the vent to face the bottom surface of the first layer.

8. The mattress system of claim 7, wherein the pad cover is made of an air restrictive material, and the vent is covered by a meshed material.

9. The mattress system of claim 7 or 8, the vent includes a window provided in the pad cover.

10. The mattress system of any of claims 7-9, the vent has edges spaced inward of a perimeter of the airflow insert pad to form a border around the vent.

11. The mattress system of any of claims 7-10, further comprising:

an air duct fluidly connected to the airflow insert pad, the air duct including an opening that is connected to a portion of the airflow insert pad that corresponds to the border around the vent.

12. The mattress system of any of claims 8-11, wherein the airflow insert pad is free of holes.

13. The mattress system of any of claims 1-12, wherein the airflow insert pad is made of one of a spacer monofilament material and a reticulated foam.

14. The mattress system of any one of the preceding claims, wherein the rails are attached to the periphery of the first layer on the bottom surface.

15. The mattress system of any one of the preceding claims, further comprising:

a second foam layer (i.e., support foam layer) attached to the bottom surface and including a cutout section configured to receive the airflow insert pad, the airflow insert pad

being enclosed in the cutout section and surrounded by the second foam layer such that the airflow insert pad is not laterally exposed.

16. The mattress system of claim 15, wherein the airflow insert pad is attached to the bottom surface of the first layer through the cutout section of the second foam layer.

17. The mattress system of claim 15 or 16, wherein the foam rail structure is attached to the second form layer.

18. The mattress system of claim 17, further comprising:
an air duct extending between the airflow insert pad and the air controller.

19. The mattress system of claim 18, wherein at least one of the rails has a notch configured to at least partially receive the air duct.

20. The mattress system of any one of the preceding claims, further comprising:
one or more reinforcement straps attached to the side rails and extending between the side rails.

21. The mattress system of any one of the preceding claims, further comprising:
an air chamber at least partially surrounded by the rails; and
an air hose extending from the air chamber, the air hose extending at least partially along the duct.

22. The mattress system of any of claims 18-21, further comprising:
a foundation including a duct opening configured to mate with an end of the air duct.

23. The mattress system of any of claims 18-22, further comprising:
a sleeve at least partially disposed around the air duct.

24. The mattress system of any one of the preceding claims, wherein the heating unit comprises a layer positioned at a foot of the mattress system above the first layer and under the mattress cover that is configured to generate heat in response to an electric current, wherein the air controller comprise:

an air controller housing defining a housing inlet and a housing outlet;

a fan positioned in the air controller housing;

an air passage connecting at least one of the housing inlet and the housing outlet of the air controller housing to the airflow insert pad.

25. The mattress system of claim 24, wherein the air controller further comprises a heater positioned in the air controller housing between the housing inlet and the housing outlet.

26. The mattress system of claim 24 or 25, wherein the air passage connects the housing inlet to the airflow insert pad and wherein the air controller is configured to draw air from the airflow insert pad into the air controller housing.

27. A method of operating the mattress system of any of claims 1-26, the method comprising:

heating via the heating unit; and

cooling via the air controller.

28. The method of claim 27, and further comprising:

heating a foot portion of the mattress system via the heating unit while cooling a second portion of the mattress system via the air controller.

29. The method of claim 27 or 28, and further comprising:

heating a foot portion of the mattress system via the heating unit before a user enters the mattress system;

stopping heating the foot portion of the mattress system via the heating unit either before or when a user is sensed entering the mattress system; and

cooling a second portion of the mattress system via the air controller after a user is sensed entering the mattress system.

30. A mattress system comprising:

a mattress cover;

a first foam layer having a top surface and an opposite bottom surface, the top surface covered by the mattress cover, the first foam layer configured to permit a first airflow rate;

a foot warming envelop enclosing a heating unit and arranged under the mattress cover, the heating unit being electrically controlled;

an airflow insert pad arranged under the bottom surface of the first foam layer, and configured to permit a second airflow rate being higher than the first airflow;

an air controller configured to draw air from the airflow insert pad to increase distribution of air through the first foam layer and decrease a temperature at the top surface of the first foam layer;

an inflatable chamber positioned below the first foam layer; and

a foam rail structure including top, bottom, and opposite side foam rails extending between the top and bottom foam rails, and configured to surround the inflatable chamber.