WO2017120992, CN103949017A, KR101796969B1 and CN203852759U all describe head-worn purifiers that provide an alternative to both face masks and neck-worn purifiers. Each of WO2017120992, CN103949017A and KR101796969B1 describe a headset having a pair of earphones on opposite sides of a headband and a microphone provided on the end of an arm that extends from one of the earphones.

In WO2017120992 a separate air filtering unit (5) is connected by a pipe (6) to an air outlet (1) provided on the arm that supports the microphone (2). Filtered air is generated by the air filtering unit (5) and pumped through the pipe (6) to be discharged from the air outlet (1). This head-worn purifier takes the form of a conventional head-set, and does not completely cover the user's mouth and nose, and is therefore likely to be more socially acceptable then a face mask. In addition, by providing the air delivery outlet on the end of a conventional microphone arm, this head-worn purifier should be capable of providing more accurate delivery of purified air to the user's nose and/or mouth than a neck-worn purifier. However, this head-worn purifier will still allow a not insignificant amount of unfiltered air to reach the user's mouth and nose. Furthermore, the requirement for a separate air filtering unit makes the purifier more complex and more cumbersome for the user.

In CN103949017A a fan (6) is incorporated into one of the earphones (8), with this fan (6) being used to pump air through a duct (7) to an air purifying device (5) provided on the end of the arm that supports the microphone (3). Whilst this head-worn purifier has incorporated the air purification functionality into the headset, the air purification and delivery performance will be limited due to the small space available for both filtering pollutants from the air supplied by the fan and for delivering filtered air to the user. In particular, the small space available will significantly limit both the maximum flow rate and the filtering efficiency due to the small filter area available. Furthermore, as with the head-worn purifier described in WO2017120992, this head-worn purifier will still allow a significant amount of unfiltered air to reach the user's mouth and nose.

SUMMARY

It is an object of the present disclosure to provide a wearable air purifier that provides improved air purification and air delivery performance when compared with prior wearable air purifiers.

According to a first example there is provided an air treatment apparatus comprising a head wearable air purifier. The head wearable air purifier comprises a first speaker assembly arranged to be worn over a first ear of a user and a second speaker assembly arranged to be worn over a second ear of the user. The first speaker assembly comprises a speaker, a filter

assembly, an air flow generator for creating an airflow through the filter assembly, and an air outlet downstream from the filter assembly for emitting the filtered airflow from the first speaker assembly. The head wearable air purifier further comprises a nozzle comprising an air inlet arranged to receive a filtered airflow from the air outlet of the first speaker assembly and an air outlet arranged to emit the received filtered airflow from the head wearable air purifier, wherein the nozzle is detachably coupled to the first speaker assembly by a magnetic attachment or coupling between a nozzle-to-speaker connector provided on the nozzle and a speaker-to-nozzle connector provided on the first speaker assembly. The air inlet of the nozzle is then aligned with the air outlet of the first speaker assembly when the nozzle is coupled to the first speaker assembly. The air flow generator may comprise a motor-driven impeller.

In one aspect, the present disclosure refers to an air treatment apparatus comprising a head wearable air purifier, the head wearable air purifier comprising:

a first speaker assembly arranged to be worn over a first ear of a user and a second speaker assembly arranged to be worn over a second ear of the user;

wherein the first speaker assembly comprises a speaker, a filter assembly, an air flow generator for creating an airflow through the filter assembly, and an air outlet downstream from the filter assembly for emitting a filtered airflow from the first speaker assembly; and

a nozzle comprising an air inlet arranged to receive the filtered airflow from the air outlet of the first speaker assembly and an air outlet arranged to emit the received filtered airflow from the head wearable air purifier;

wherein the nozzle is detachably coupled to the first speaker assembly by a separable connection; and

wherein the separable connection comprises a nozzle-to-speaker connector provided on the nozzle and a speaker-to-nozzle connector provided on the first speaker assembly; and wherein the separable connection is provided by a magnetic attachment between the nozzle-to-speaker connector and the speaker-to-nozzle connector.

The nozzle may be detachably coupled to the first speaker assembly by a separable connection (i.e. the nozzle has a separable connection to the first speaker assembly). The separable connection may comprise the nozzle-to-speaker connector provided on the nozzle and the speaker-to-nozzle connector provided on the first speaker assembly. The nozzle-to-speaker connector may then be arranged to be detachably coupled to the speaker-to-nozzle connector. The air inlet of the nozzle may then be provided by the nozzle-to-speaker connector and the air outlet of the first speaker assembly provided by the speaker-to-nozzle connector.

One of the nozzle-to-speaker connector and the speaker-to-nozzle connector may comprise a male connector element and the other of the nozzle-to-speaker connector and the speaker-to-nozzle connector comprise a female connector element that is arranged to receive the male connector element. The male connector element may be arranged to be able to rotate when disposed within the female connector element. Both the male connector element and the female connector element may be annular. The nozzle-to-speaker connector may comprise the male connector element that extends around and defines the air inlet of the nozzle and the speaker-to-nozzle may comprise the female connector element that extends around and defines the air outlet of the first speaker assembly. Both the air inlet of the nozzle and the air outlet of the first speaker assembly may have a circular cross-section.

The magnetic attachment or coupling may be provided by cooperation between at least one magnet and a magnetic material, the magnet being provided on one of the nozzle-to-speaker connector and the speaker-to-nozzle connector and the magnetic material being provided on the other of the nozzle-to-speaker connector and the speaker-to-nozzle connector.

The speaker-to-nozzle connector may comprise a ring of the magnetic material and the nozzle-to-speaker connector may comprise the at least one magnet. The nozzle-to-speaker connector

further nozzle-to-speaker connector and the air outlet of the second speaker assembly may be provided by the further speaker-to-nozzle connector.

One of the further nozzle-to-speaker connector and the further speaker-to-nozzle connector may comprise a male connector element and the other of the further nozzle-to-speaker connector and the further speaker-to-nozzle connector may comprise a female connector element that is arranged to receive the male connector element.

The first speaker assembly may be mounted on a first end of a headband and the second speaker assembly mounted on an opposite, second end of the headband, the headband being arranged to be worn on the head of a user.

According to a second example there is provided an air treatment apparatus comprising a head wearable air purifier. The head wearable air purifier comprises a first speaker assembly arranged to be worn over a first ear of a user and a second speaker assembly arranged to be worn over a second ear of the user. The first speaker assembly and the second speaker assembly each comprise a speaker, a filter assembly, an air flow generator for creating an airflow through the filter assembly, and an air outlet downstream from the filter assembly for emitting the filtered airflow. The head wearable air purifier further comprises a nozzle comprising a first air inlet provided at a first end of the nozzle that is arranged to receive a filtered airflow from the air outlet of the first speaker assembly, a second air inlet provided at an opposing second end of the nozzle that is arranged to receive a filtered airflow from the air outlet of the second speaker assembly, and an air outlet arranged to emit the received filtered airflows from the head wearable air purifier. The first end of the nozzle is detachably coupled to the first speaker assembly by a magnetic attachment between a nozzle-to-speaker connector provided on the nozzle and a speaker-to-nozzle connector provided on the first speaker assembly, and the second end of the nozzle is detachably coupled to the second speaker assembly by a magnetic attachment between a further nozzle-to-speaker connector provided on the nozzle and a further speaker-to-nozzle connector provided on the second speaker assembly. The air flow generator may comprise a motor-driven impeller.

In another aspect, the present disclosure refers to an air treatment apparatus comprising a head wearable air purifier, the head wearable air purifier comprising:

a first speaker assembly arranged to be worn over a first ear of a user and a second speaker assembly arranged to be worn over a second ear of the user;

wherein the first speaker assembly and the second speaker assembly each comprise a speaker, a filter assembly, an air flow generator for creating an airflow through the filter assembly, and an air outlet downstream from the filter assembly for emitting the filtered airflow; and

a nozzle comprising a first air inlet provided at a first end of the nozzle that is arranged to receive a filtered airflow from the air outlet of the first speaker assembly, a second air inlet provided at an opposing second end of the nozzle that is arranged to receive a filtered airflow from the air outlet of the second speaker assembly, and an air outlet arranged to emit the received filtered airflows from the head wearable air purifier;

wherein the first end of the nozzle is detachably coupled to the first speaker assembly and the second end of the nozzle is detachably coupled to the second speaker assembly, wherein the nozzle is detachably coupled to the first speaker assembly by a first separable connection and is detachably coupled to the second speaker assembly by a second separable connection, wherein the first separable connection and the second separable connection each comprise a nozzle-to-speaker connector provided on the nozzle and a speaker-to-nozzle connector provided on the corresponding speaker assembly, and

wherein the first separable connection and the second separable connection are each provided by a magnetic attachment between the respective nozzle-to-speaker connectors and the speaker-to-nozzle connectors.

The first air inlet of the nozzle may be aligned with the air outlet of the first speaker assembly when the first end of the nozzle is coupled to the first speaker assembly, and the second air inlet of the nozzle may be aligned with the air outlet of the second speaker assembly when the second end of the nozzle is coupled to the second speaker assembly.

The nozzle may be detachably coupled to the first speaker assembly by a first separable connection (i.e. the first end of the nozzle has a separable connection to the first speaker assembly) and may be detachably coupled to the second speaker assembly by a second separable connection (i.e. the second end of the nozzle has a separable connection to the first speaker assembly). The first separable connection and the second separable connection may each comprise the nozzle-to-speaker connector provided on the nozzle and the speaker-to-nozzle connector provided on the corresponding speaker assembly. The nozzle-to-speaker connector may be arranged to be detachably coupled to the speaker-to-nozzle connector. The nozzle-to-speaker connector may provide the corresponding air inlet of the nozzle and the speaker-to-nozzle connector may provide the air outlet of the corresponding speaker assembly.

According to a third example there is provided a nozzle for an air treatment apparatus comprising a head wearable air purifier, wherein the head wearable air purifier comprises a first speaker assembly arranged to be worn over a first ear of a user and a second speaker assembly arranged to be worn over a second ear of the user. The nozzle comprises a first air inlet provided at a first end of the nozzle that is arranged to receive a first filtered airflow from the first speaker assembly, a second air inlet provided at an opposing second end of the nozzle that is arranged to receive a second filtered airflow from the second speaker assembly. The nozzle further comprises an air outlet arranged to emit the received filtered airflows from the nozzle. The first end of the nozzle is arranged to be detachably coupled to the first speaker assembly by a magnetic attachment between a nozzle-to-speaker connector provided on the nozzle and the first speaker assembly, and the second end of the nozzle is arranged to be detachably coupled to the second speaker assembly by a magnetic attachment between a further nozzle-to-speaker connector provided on the nozzle and the second speaker assembly.

In another aspect, the present disclosure refers to a nozzle for an air treatment apparatus comprising a head wearable air purifier, wherein the head wearable air purifier comprises a first speaker assembly arranged to be worn over a first ear of a user and a second speaker assembly arranged to be worn over a second ear of the user, the nozzle comprising:

a first air inlet provided at a first end of the nozzle that is arranged to receive a first filtered airflow from the first speaker assembly;

a second air inlet provided at an opposing second end of the nozzle that is arranged to receive a second filtered airflow from the second speaker assembly; and

an air outlet arranged to emit the received filtered airflows from the nozzle; wherein the first end of the nozzle is arranged to detachably coupled to the first speaker assembly and the second end of the nozzle is detachably coupled to the second speaker assembly, wherein the nozzle is detachably coupled to the first speaker assembly by a first separable connection and is detachably coupled to the second speaker assembly by a second separable connection, wherein the first separable connection and the second separable connection each comprise a nozzle-to-speaker connector provided on the nozzle, and

wherein each said nozzle-to-speaker connector is provided by a magnetic attachment.

CLAIMS

1. An air treatment apparatus comprising a head wearable air purifier, the head wearable air purifier comprising:

a first speaker assembly arranged to be worn over a first ear of a user and a second speaker assembly arranged to be worn over a second ear of the user;

wherein the first speaker assembly comprises a speaker, a filter assembly, an air flow generator for creating an airflow through the filter assembly, and an air outlet downstream from the filter assembly for emitting a filtered airflow from the first speaker assembly; and

a nozzle comprising an air inlet arranged to receive the filtered airflow from the air outlet of the first speaker assembly and an air outlet arranged to emit the received filtered airflow from the head wearable air purifier;

wherein the nozzle is detachably coupled to the first speaker assembly by a separable connection; and

wherein the separable connection comprises a nozzle-to-speaker connector provided on the nozzle and a speaker-to-nozzle connector provided on the first speaker assembly; and

wherein the separable connection is provided by a magnetic attachment between the nozzle-to-speaker connector and the speaker-to-nozzle connector.

2. The air treatment apparatus according to claim 1, wherein the air inlet of the nozzle is provided by the nozzle-to-speaker connector and the air outlet of the first speaker assembly is provided by the speaker-to-nozzle connector.

3. The air treatment apparatus according to claim 2, wherein one of the nozzle-to-speaker connector and the speaker-to-nozzle connector comprises a male connector element and the other of the nozzle-to-speaker connector and the speaker-to-nozzle connector comprises a female connector element that is arranged to receive the male connector element.

4. The air treatment apparatus according to claim 3, wherein the male connector element is arranged to be able to rotate when disposed within the female connector element.

5. The air treatment apparatus according to any of claims 3 or 4, wherein the nozzle-to-speaker connector comprises the male connector element that extends around the air inlet of the nozzle and the speaker-to-nozzle comprises the female connector element that extends around the air outlet of the first speaker assembly.

6. The air treatment apparatus according to claim 1, wherein the magnetic attachment is provided by at least one magnet and a magnetic material, the magnet being provided on one of the nozzle-to-speaker connector and the speaker-to-nozzle connector and the magnetic material being provided on the other of the nozzle-to-speaker connector and the speaker-to-nozzle connector.

7. The air treatment apparatus according to any of claims 1 or 6, wherein the speaker-to-nozzle connector comprises a ring of the magnetic material and the nozzle-to-speaker connector comprises the at least one magnet.

8. The air treatment apparatus according to claim 7, wherein the nozzle-to-speaker connector comprises a plurality of magnets radially spaced about the nozzle-to-speaker connector.

9. The air treatment apparatus according to any of claims 7 or 8, wherein the nozzle-to-speaker connector comprises an annular magnet.

10. The air treatment apparatus according to claim 8 when dependent upon claim 5, wherein the speaker-to-nozzle connector comprises a female connector element and the female connector element comprises the ring of the magnetic material, and the nozzle-to-speaker connector further comprises a plurality of magnets radially spaced about periphery of the male connector element.

11. The air treatment apparatus according to any preceding claim, wherein the second speaker assembly comprises a speaker, a filter assembly, an impeller for creating an airflow through the filter assembly, a motor arranged to drive the impeller, and an air outlet downstream from the filter assembly for emitting a filtered airflow from the second speaker assembly.

12. The air treatment apparatus according to claim 11, wherein the nozzle comprises a further air inlet arranged to receive the filtered airflow from the air outlet of the second speaker assembly, and the nozzle is detachably coupled to the second speaker assembly.

13. The air treatment apparatus according to claim 12, wherein the air inlet is provided by a first end of the nozzle and the further air inlet is provided by an opposing second end of the nozzle.

14. The air treatment apparatus according to any of claims 12 or 13, wherein the nozzle is detachably coupled to the second speaker assembly by a further separable connection.

15. The air treatment apparatus according to claim 14, wherein the further separable connection comprises a further nozzle-to-speaker connector provided on the nozzle and a further speaker-to-nozzle connector provided on the second speaker assembly.

16. The air treatment apparatus according to claim 15, wherein the further air inlet of the nozzle is provided by the further nozzle-to-speaker connector and the air outlet of the second speaker assembly is provided by the further speaker-to-nozzle connector.

17. The air treatment apparatus according to claim 16, wherein one of the further nozzle-to-speaker connector and the further speaker-to-nozzle connector comprises a male connector element and the other of the further nozzle-to-speaker connector and the further speaker-to-nozzle connector comprises a female connector element that is arranged to receive the male connector element.

18. The air treatment apparatus according to any preceding claim, wherein the first speaker assembly is mounted on a first end of a headband and the second speaker assembly mounted on an opposite, second end of the headband, the headband being arranged to be worn on the head of a user.

19. An air treatment apparatus comprising a head wearable air purifier, the head wearable air purifier comprising:

a first speaker assembly arranged to be worn over a first ear of a user and a second speaker assembly arranged to be worn over a second ear of the user;

wherein the first speaker assembly and the second speaker assembly each comprise a speaker, a filter assembly, an air flow generator for creating an airflow through the filter assembly, and an air outlet downstream from the filter assembly for emitting the filtered airflow; and

a nozzle comprising a first air inlet provided at a first end of the nozzle that is arranged to receive a filtered airflow from the air outlet of the first speaker assembly, a second air inlet provided at an opposing second end of the nozzle that is arranged to receive a filtered airflow from the air outlet of the second speaker assembly, and an air outlet arranged to emit the received filtered airflows from the head wearable air purifier;

wherein the first end of the nozzle is detachably coupled to the first speaker assembly and the second end of the nozzle is detachably coupled to the second speaker assembly,

wherein the nozzle is detachably coupled to the first speaker assembly by a first separable connection and is detachably coupled to the second speaker assembly by a second separable connection, wherein the first separable connection and the second separable connection each comprise a nozzle-to-speaker connector provided on the nozzle and a speaker-to-nozzle connector provided on the corresponding speaker assembly, and

wherein the first separable connection and the second separable connection are each provided by a magnetic attachment between the respective nozzle-to-speaker connectors and the speaker-to-nozzle connectors.

20. The air treatment apparatus according to claim 19, wherein the nozzle-to-speaker connector provides the corresponding air inlet of the nozzle and the speaker-to-nozzle connector provides the air outlet of the corresponding speaker assembly.

21. A nozzle for an air treatment apparatus comprising a head wearable air purifier, wherein the head wearable air purifier comprises a first speaker assembly arranged to be worn over a first ear of a user and a second speaker assembly arranged to be worn over a second ear of the user, the nozzle comprising:

a first air inlet provided at a first end of the nozzle that is arranged to receive a first filtered airflow from the first speaker assembly;

a second air inlet provided at an opposing second end of the nozzle that is arranged to receive a second filtered airflow from the second speaker assembly; and

an air outlet arranged to emit the received filtered airflows from the nozzle; wherein the first end of the nozzle is arranged to detachably coupled to the first speaker assembly and the second end of the nozzle is detachably coupled to the second speaker assembly, wherein the nozzle is detachably coupled to the first speaker assembly by a first separable connection and is detachably coupled to the second speaker assembly by a second separable connection, wherein the first separable connection and the second separable connection each comprise a nozzle-to-speaker connector provided on the nozzle, and

wherein each said nozzle-to-speaker connector is provided by a magnetic attachment.