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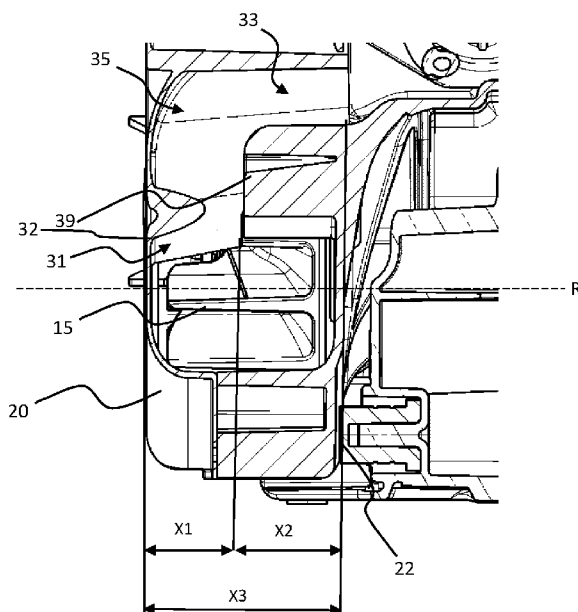


FIG. 2

(57) Abstract: A system (10) for centrifugal purification of combustion air, said system (10) comprising a fan wheel (15) rotatable about a rotation axis (R), a helical fan housing (20) surrounding said fan wheel (15) and an air nozzle (30) disposed within said helical fan housing (20) proximal to said fan wheel (15), said air nozzle (30) forming an air passage (35) for combustion air, wherein the air nozzle (30) comprises: an inlet (31) comprising a leading edge (32) as seen in a direction of flow of combustion air, said leading edge (32) being adapted to conduct air to said inlet (31), the inlet (31) extending at least partially tangentially to a periphery of the fan wheel (15), and an outlet (33) extending at least partially parallel to the rotation axis (RA) and in an inward direction relative to said rotation axis (RA).



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SYSTEM FOR CENTRIFUGAL PURIFICATION OF COMBUSTION AIR
AND A HAND-HELD MOTOR-DRIVEN TOOL COMPRISING SUCH A SYSTEM

5 **Technical field**

The present disclosure relates to a system for centrifugal purification of combustion air and a hand-held motor-driven tool comprising such a system.

Background

10 Hand-held motor-driven tools are often provided with internal combustion engines for driving the tool. This is particularly common in the field of chainsaws. Motor-driven chainsaws are often provided with crankcase scavenged two-stroke one-cylinder engines.

15 To clean dust and particles harmful to the engine from the combustion air, the combustion air inlet of the engine is usually provided with an air filter. When working in dusty environments, as is often the case with chain saws, the air filter will gradually be clogged by impurities. The air filter must, therefore, be cleaned or replaced periodically. In order to reduce the need for maintenance of the filter, it is desirable to clean the combustion air upstream of the filter.

20 Cleaning of the combustion air can be achieved by centrifugal cleaning. To this end, it is known in the art to utilize a fan wheel as a centrifuge for separating particles from the combustion air. Accordingly, tools such as chainsaws may have devices for centrifugal purification of combustion air.

25 The start functionality of a tool, such as a chainsaw, driven by an internal combustion engine is dependent on the temperature of the air entering the carburetor. In warm and hot conditions, the carburetor temperature is increased. This may result in making it harder for a user to start up the chainsaw and a higher number of pulls of the starting handle or similar may be required.

30 The present inventors have realized that high ambient temperatures such as temperatures over about 30 degrees Celsius causes issues starting the chainsaw due to the delivery of the correct air/fuel mixture being sensitive to higher temperatures in the

carburetor. When the carburetor temperature rises over about 30 degrees Celsius some of the fuel will start to boil and vaporize, resulting in gas vapor in the carburetor.

The present inventors have further realized that after stopping of the combustion engine, the heat of the combustion engine is distributed in the tool which heats up the carburetor, making it more difficult to start.

The combination of high ambient temperatures and frequent starting and stopping of the tool may be particularly challenging in terms of keeping the carburetor temperature at an acceptable level.

The present inventors have realized that lowering of the temperature of the air entering the carburetor via the centrifugal purification is of importance.

Summary

According to an aspect, a system for centrifugal purification of combustion air is provided. The system comprises a fan wheel rotatable about a rotation axis, a helical fan housing surrounding said fan wheel and an air nozzle disposed within said helical fan housing proximal to said fan wheel. The air nozzle forms an air passage for combustion air,

The air nozzle comprises an inlet comprising a leading edge as seen in a direction of flow of combustion air. The leading edge is adapted to conduct air to the inlet. The inlet extends at least partially tangentially to a periphery of the fan wheel.

The air nozzle further comprises an outlet extending at least partially parallel to the rotation axis and in an inward direction relative to the rotation axis.

The inlet comprises an inner wall. The inner wall axially delimits the inlet relative to the rotation axis such that there is a distance extending inwardly in a direction parallel to the rotation axis between said inner wall and an inner radially extending wall of the helical fan housing. The inner radially extending wall extends at least partially orthogonally to the rotation axis thereby axially delimiting the fan housing.

The ratio between the distance and a total axial extension of the helical fan housing in a direction extending along the rotation axis is at least 0,35.

The ratio allows for the combustion air to move along a route extending at a distance from the combustion engine. Thereby, the temperature of the combustion air passing through the air nozzle on the way to the carburetor may be lowered compared to a conventional centrifugal purification system. This is associated with a number of advantages. For example, in warm and hot ambient conditions, the combustion engine will be easier to start and the drivability will be improved. In addition or alternatively, the ratio may allow for counteracting of additional heating of the carburetor in cases where the temperature of the carburetor has increased due to heat transfer from the combustion engine.

The leading edge may be located close to the periphery of said fan wheel. Thereby, air flow into the air nozzle may be improved.

The outlet may extend along an axial section of the total axial extension of the helical fan housing along the rotation axis corresponding to the distance. The extension of the outlet allows for the combustion air to travel further away from the combustion engine for longer, thereby enabling additional lowering of the temperature of the combustion air. The extension of the outlet further allows for the hot air to not mix with the preferably cooler air flowing into the air nozzle.

The ratio between the distance and the total axial extension of the helical fan housing may be smaller than 0.65. The ratio enables the combustion air to travel at a sufficient distance from the combustion engine for a longer time, thereby causing the temperature of the combustion air to be lower.

The inlet may be arranged adjacent and at least partially parallel to an outer radially extending wall of the helical fan housing. The outer radially extending wall may be arranged opposite to the inner radially extending wall. This ensures that the air travels at a desired distance from the combustion engine for a longer time.

The inlet may have a cross-section width as seen in a direction of flow of combustion air. The width may extend parallel to the rotation axis and the ratio between the inlet width and the total axial extension of the helical fan housing may be between 0.35 and 0.65.

The system may comprise a mounting interface adapted to receive a starter assembly. The mounting interface may accommodate mounting of a starter assembly at

an outer radially extending wall of the helical fan housing. Accordingly, the air passage is routed more proximal to the starter assembly than the combustion engine, reducing the risk for the combustion engine heating the combustion air to undesirable temperature levels.

5 The total axial extension of the helical fan housing may be between 30 and 60 mm.

 The air passage from the inlet may extend generally tangentially to the periphery of the fan wheel and then bend perpendicularly such that the outlet is directed generally parallel to the rotation axis. The bending of the air passage allows for an air nozzle that
10 is more cost-efficient to manufacture.

 The leading edge may have a semi-elliptical shape as seen in a direction of air flow. The semi-elliptical shape has shown to enable the desired guiding of a portion of the air flow into the air nozzle without substantial negative impact on the flow.

 The leading edge may be integrally connected to a straight wall portion of the air
15 nozzle. The inlet may have a generally rectangular cross-section and a height of said inlet may be defined by a radial distance between said straight wall portion and an outer edge of said air nozzle. The straight wall portion enables sufficient air flow and prevents particles from travelling into the combustion engine.

 The system may be configured to provide centrifugal purification of combustion
20 air for a combustion engine.

 In one embodiment, the combustion engine is a crankcase scavenged two-stroke engine.

 In one embodiment, the combustion engine is a one-cylinder engine.

 According to one aspect a hand-held motor-driven tool is provided. The hand-
25 held motor-driven tool may comprise an internal combustion engine and a system according to any of the embodiments described herein.

 The hand-held motor-driven tool may further comprise a starter assembly mounted to a mounting interface of the system.

 Embodiments of the invention are defined by the appended dependent claims
30 and are further explained in the detailed description section as well as in the drawings.

It should be emphasized that the term “comprises/comprising” when used in this specification is taken to specify the presence of stated features, integers, steps, or components, but does not preclude the presence or addition of one or more other features, integers, steps, components, or groups thereof. All terms used in the claims are
5 to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the [element, device, component, means, step, etc.]" are to be interpreted openly as referring to at least one instance of the element, device, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the
10 exact order disclosed, unless explicitly stated.

Brief description of drawings

Embodiments of the invention will be described in the following; reference being made appended drawings which illustrate non-limiting examples of how the
15 inventive concept can be reduced into practice.

Figure 1a depicts a back cross-section view of a hand-held motor-driven tool comprising a system for centrifugal purification according to one embodiment.

Figure 1b depicts a perspective explosion view of the hand-held motor-driven tool of Figure 1a.

20 Figure 2 depicts a back cross-section view of the system for centrifugal purification of Figure 1a-b.

Figure 3 depicts a perspective view of a hand-held motor-driven tool comprising a system for centrifugal purification according to one embodiment.

25 Figure 4 depicts a side view of a hand-held motor-driven tool comprising a system for centrifugal purification according to one embodiment.

Figure 5 depicts a detailed perspective view of a system for centrifugal purification according to one embodiment.

Figure 6 depicts a detailed perspective view of the air nozzle of the system depicted in Figure 5.

30 Figure 7 depicts an explosion view of a hand-held motor-driven tool comprising a system for centrifugal purification according to one embodiment.

Figure 8a-b depicts graphs showing the effect on the temperature of the combustion air with the system according to one example.

Detailed description

5 The device shown in the drawings is in the form of a motor-driven hand-held tool. In the depicted embodiment, the motor-driven hand-held tool is a chainsaw. It may however be envisioned that the system is implemented in other hand-held tools such as blowers, clearing saws, hedge clippers. It may also be envisioned that the system is implemented in other applications such as boat engines.

10 The device comprises a combustion engine and a carburetor.

High carburetor temperature results in issues with engine performance and drivability as well as poor startability. The reason for this is incorrect delivery of air/fuel mixture going into the engine.

Notably, modern carburetors of various design, particularly within the field of chainsaws, are more sensitive to higher temperatures in the carburetor compared to conventional needle carburetors. Further, modern chainsaws are often provided with electronic devices such as control units in the proximity of the carburetor which also results in raising of the temperature of the combustion air inside the carburetor.

Fuel (gasoline and alkylate) has different boiling ranges. When the carburetor temperature rises over about 30 degrees some of the fuel will start boil/vaporizing and will resulting in gas vapor in the carburetor. The occurrence of the formed gas bubbles increases with higher carburetor temperature. Further, the carburetor requires the gasoline to be in liquid form in order to deliver correct air/fuel mixture into the combustion engine, so the engine can work properly. Incorrect air/fuel mixture can give misfires and bad or incomplete combustion.

Figures 1-7 depicts a system for centrifugal cleaning of combustion air aiming to lower the air temperature in the device at the position where the carburetor is positioned. The system may be configured to provide centrifugal cleaning of combustion air for a combustion engine 70.

30 Advantageously, the combustion engine 70 is a crankcase scavenged two-stroke engine. As the skilled person is well aware of, a crankcase scavenged two-stroke engine

is a type of internal combustion engine commonly used in small, lightweight applications like motorcycles, chainsaws, and outboard boat motors. The scavenging process occurs during every two strokes of the piston, resulting in a power stroke and an exhaust stroke within one revolution of the crankshaft.

5 Advantageously, the combustion engine 70 is a one-cylinder engine. The combustion engine hence only comprises a single cylinder 78. This makes the combustion engine 70 particularly suitable for lightweight applications.

 The lowering of the air temperature is provided by means of an air injection system which will be described in further detail. The air injection system may lower the
10 temperature of the air entering into the carburetor and may improve startability in warm ambient conditions. Furthermore, the air injection system may counteract the carburetor having a high temperature as a result of heat transfer from the combustion engine after the combustion engine has been shut down after operation and cooling measures such as fans etc. driven by the engine are no longer running.

15 Referencing Figure 1a-b, the system 10 comprises a fan wheel 15 rotatable about a rotation axis R, a helical fan housing 20 surrounding said fan wheel 15 and an air nozzle 30 disposed within said helical fan housing 20 proximal to said fan wheel 15. The air nozzle 30 forming an air passage 35 for combustion air.

 During operation, the fan wheel 15 sucks in air. In the depicted example, the air
20 is sucked through the starter assembly of the hand-held motor-driven tool. The air enters into the helical fan housing 20 and is guided to the carburetor 75 and to other parts of the combustion engine 70. The flow of air, e.g. the combustion air, may be divided such that a portion of the air is passed into the air nozzle 30 and the remaining air cools the cylinder 78 and other parts of the combustion engine 70. Notably, combustion air herein
25 refers to the air sucked into the air nozzle 30 by means of the fan wheel 15.

 The air passed into the air nozzle 30 is passed into the carburetor 75 of the combustion engine 70. Accordingly, the air nozzle 30 may be configured to be connected to the carburetor 75 of the combustion engine 70. The air nozzle 30 may be configured to be fluidly connected to the carburetor 75.

30 The air nozzle 30 comprises an inlet 31. The inlet 31 comprises a leading edge 32. The leading edge 32 may be considered a leading edge as seen in a direction of flow

of combustion air. The leading edge 32 is adapted to conduct air to the inlet 31. The inlet 31 extends at least partially tangentially to a periphery of the fan wheel 15. The inlet 31 may form an upstream portion of the air nozzle 30.

5 The air nozzle 30 further comprises an outlet 33. The outlet 33 extends at least partially parallel to the rotation axis RA. The outlet 33 extends in an inward direction relative to said rotation axis RA. The outlet 33 may form a downstream portion of the air nozzle 30.

10 The inlet 31 may be fluidly connected to the space inside the helical fan housing 20. The inlet 31 may form an aperture in said helical fan housing 20. The aperture may be adapted to guide air from the helical fan housing 20 into the air nozzle 30.

The outlet 33 may be fluidly connected to the carburetor 75. The outlet 33 may be adapted to guide the combustion air out of the air nozzle 30 and into carburetor 75. The outlet 33 may be adapted to mitigate the hot air in the tool and/or system for centrifugal cleaning to mix with the preferably cooler air flowing into the air nozzle 30.

15 The outlet 33 is thus adapted to separate the hotter air from the air flowing into the air nozzle 30.

The air nozzle 30 is preferably made of a polymeric material such as plastic. The air nozzle 30 may define the air passage 35. The inlet 31 is provided upstream of the outlet 33 as seen in the direction of flow of the combustion air.

20 The air passage 35 may be formed by the inlet 31 and the outlet 33. In one embodiment, the air nozzle 30 may further comprise an intermediate portion interconnecting the inlet 31 and the outlet 33. The air passage 35 may thus be formed by the inlet 31, the outlet 33 and the intermediate portion. As will be discussed in further detail, the intermediate portion may comprise a bend.

25 The leading edge 32 is provided at an upstream portion of the inlet 31 as seen in the direction of flow of the combustion air. The leading edge 32 may be provided as a screen or baffle wall. The leading edge 32 is configured to guide air into the inlet 31 and into the air nozzle 30. Preferably, the leading edge 32 is located close to the periphery of said fan wheel 15.

30 The helical fan housing 20 may be considered a spiral or volute fan housing. As can be seen in Figures 1-7, the air nozzle 30 is preferably disposed in the helical fan

housing 20 adjacent to the fan wheel 15. The air nozzle 30 may be located in the helical fan housing 20 at a position in which the fan housing has a great radial width which provides for proper air cleaning. A majority of the impurities pass outside the air nozzle 30 in the peripheral portion of the fan housing.

5 The inlet 31 comprises an inner wall 39 axially delimiting the inlet 31 relative to the rotation axis RA such that there is a distance X2 extending inwardly in a direction parallel to the rotation axis RA between said inner wall 39 and an inner radially extending wall 22 of the helical fan housing 20. The inner radially extending wall 22 extends at least partially orthogonally to the rotation axis RA. The inner radially
10 extending wall 22 axially delimits the helical fan housing 20.

 The distance X2 may be considered an inlet distance X2, as it is defined as a distance between the wall of the inlet 31 and the wall of the helical fan housing 20.

 Axially delimit may herein refer to the aforementioned walls extending at least partially along a plane orthogonal to the rotation axis RA. The inner wall 39, i.e. the
15 inlet inner wall 39, and the inner radially extending wall 22 of the helical fan housing 20, i.e. the inner radially extending fan housing wall 20, thus blocks of the flow of combustion air in a flow direction extending along the rotation axis RA. Instead, the aforementioned walls may guide the air to move in a peripheral direction relative to the rotation axis RA in a plane substantially orthogonal to the rotation axis RA.

20 Referencing Figure 1b, the tool may comprise an air inlet system 71 configured to distribute air to the combustion engine 70. The air inlet system 71 may comprise the carburetor 75. The air inlet system 71 may further comprise other components such as filters for filtering the combustion air passed through the carburetor 75.

 In one example, the air inlet system 71 may comprise two air inlets configured to
25 distribute air to the combustion engine 70. The first air inlet may be configured to guide the air from the carburetor 70 to the combustion engine 70. The second inlet (not depicted) may be configured to distribute clean air directly to the combustion engine 70, for example by means of a throttle.

 The positioning and dimensions of the air nozzle 30 is most clearly depicted in
30 Figure 2.

Referencing Figure 2, the ratio between the distance X2 and a total axial extension X3 of the helical fan housing 20 in a direction extending along the rotation axis RA is at least 0.35.

Preferably, the ratio between the distance X2 and the total axial extension X3 of the helical fan housing 20 is smaller than 0,65. Accordingly, the ratio may be between 0.35 and 0.65.

The total axial extension X3 of the helical fan housing may be considered the distance between the inner radially extending wall 22 and an outer radially extending wall 21 of the helical fan housing 20. The distance extends along the rotation axis RA. In the depicted embodiment, the inner and outer radially extending walls are orthogonal to the rotation axis RA. But it may be envisioned that the inner and outer radially extending walls are inclined relative to a direction orthogonal to the rotation axis RA.

The inlet 31 may be arranged adjacent and at least partially parallel to the outer radially extending wall 21 of the helical fan housing 20. The outer radially extending wall 21 may be arranged opposite to the inner radially extending wall 22.

The inlet 31 may have a cross-section width X1 as seen in a direction of flow of combustion air. The width X1 may extend parallel to the rotation axis RA. The ratio between the inlet width X1 and the total axial extension X3 of the helical fan housing 20 may be between 0.35 and 0.65.

The width X1 may thus be considered an axial width relative to the rotation axis RA.

The outlet 33 may extend along an axial section of the total axial extension X3 of the helical fan housing 20. The outlet 33 may extend along the rotation axis RA corresponding to the distance X2.

The outlet 33 may extend along an inner axial section of the total axial extension X3 of the helical fan housing 20.

Advantageously, the axial section and the inlet width X1 may correspond to the total axial extension X3 of the helical fan housing 20. Accordingly, the total distance of the axial section and the inlet width X1 may be equal to the total axial extension X3 of the helical fan housing 20.

The total axial extension X3 may be between 30 and 60 mm. Hence, the distance X2 may be between 10.5 and 39 mm. Correspondingly, the inlet width X1 may be between 10.5 and 39 mm

Figure 3-4 depicts the system from the side. As seen in said Figure 3-4, the leading edge 32 may be integrally connected to a straight wall portion 38 of the air nozzle 30. The straight wall portion 38 may hence be arranged downstream of the leading edge 32 as seen in the direction of flow of combustion air.

The straight wall portion 38 may extend at an angle relative to a tangential direction of the fan wheel 15. However, the straight wall portion 38 preferably extends mainly in said tangential direction.

The inlet 31 may have a generally rectangular cross-section. Preferably, a height of the inlet 31 may be defined by a radial distance between said straight wall portion and an outer edge 37 of said air nozzle 30. The radial distance hence extends in a radial direction relative to the rotation axis RA. It may however be envisioned that the inlet may have a differently shaped cross-section.

In the depicted embodiment, the outer edge 37 extends substantially parallel to the straight wall portion 38. Hence, a substantially straight channel may be formed between the straight wall portion 38 and the outer edge 37.

Figure 5-6 depicts the air nozzle 30 in further detail. Referencing said Figure 5-6, the air passage 35 from the inlet 31, e.g. in a direction extending downstream from the inlet 31, extends generally tangentially to the periphery of the fan wheel 15. The air passage 35 then bends perpendicularly such that the outlet 33 is directed generally parallel to the rotation axis RA.

Worded differently, the air passage 35 extends from the inlet 31, through the air nozzle 30 generally tangentially to the periphery of the fan wheel 15 and subsequently curves about 90 degrees. Thereby, the outlet 33 is directed generally parallel to rotation axis RA. The curve may be formed by a bend of the intermediate portion of the air nozzle 30.

To obtain the best possible flow characteristics, the leading edge 32 may have a semi-elliptical shape or a partially elliptical shape as seen in a direction of air flow. The partially or semi-elliptical shape of the wall 14 provides a uniform air flow through the

nozzle 30 without shedding of vortices or disturbing turbulence, which is essential for obtaining a proper air purification as well as a sufficient flow of combustion air to the engine.

The leading edge 32 may be arranged upstream from the straight wall portion 38. Thus, the leading edge 32 may be transition into the straight wall portion 38. The radially outward extension of the inlet 12 is defined by the outer edge 37 of the air nozzle 30.

The position of the outer edge 37 of the air nozzle to a great extent determines the air flow through the air nozzle 30. The smaller the height of the inlet 31 in the radial direction, the better the purifying performance because impurities, to a greater extent, will pass by the outside the outer edge 37 of the air nozzle 30.

Preferably, the inlet 31 has a width to height ratio of about 3.5:1 which, for an engine of a size commonly used in chain saws and having a fan wheel diameter of 95 millimeters, has been suitable for obtaining a proper centrifugal air cleaning as well as a sufficiently large flow of air through the air nozzle 30. The ratio of inlet width to height may vary according to the size of the engine, but should preferably be within the range of between about 3:1 and 4:1. It is also important that the disturbance of the cooling air flow to the engine caused by the air nozzle 30 be as small as possible, which is also obtained by the nozzle depicted herein.

Figure 7 depicts an exploded view of the device and the system. As depicted, the system may further comprise a mounting interface 25. The mounting interface 25 may be adapted to receive a starter assembly 50. The mounting interface 25 may be adapted to accommodate mounting of the starter assembly 50. The mounting interface 25 may be adapted to accommodate mounting of the starter assembly 50 at an outer radially extending wall 21 of the helical fan housing 20.

The mounting interface 25 may comprise one or more apertures adapted to receive fastening element(s) to mount the starter assembly 50 to the mounting interface 25.

In the depicted embodiment, the mounting interface 25 is provided on the outer radially extending wall 21 of the helical fan housing 20. In the depicted embodiment, the radially extending wall 21 is provided as an annular member adapted to be mounted

to the axially extending wall of the helical fan housing 20. The axially extending wall may thus be an axially extending wall relative to the rotation axis RA of the fan wheel.

As depicted in Figure 1-7, a hand-held motor-driven tool comprising an internal combustion engine 70 and a system 10 may be provided. As aforementioned, the
5 internal combustion engine 70 may be a two-stroke engine and/or a crank-case scavenged engine and/or a one-cylinder engine.

The hand-held motor-driven tool may comprise starter assembly 50 mounted to the mounting interface 25 of the system 10.

The hand-held motor-driven tool may be for example a chainsaw, clearing saw,
10 blower or a hedge clipper.

In one example, an engine such as a boat engine comprising the system 10 may be provided.

Figure 8a-b depicts graphs showing the temperature for the system when used in a chainsaw and a comparison with a chainsaw with a conventional system for
15 centrifugal purification. In Figure 8a-b, the chainsaw with the conventional system for centrifugal purification is referenced as C1 and chainsaw provided with the system described herein is referenced as C2.

Figure 8a shows the graphs for the air temperature test cell ATeC and the cylinder top temperature CyTO. As can be seen in the graph, the effect on the air
20 temperature for the test cell ATeC is neglectable. However, the cylinder top temperature CyTO is significantly lower for the chainsaw C2 compared to the conventional chainsaw C1.

Figure 8b shows the graphs for the temperature in the air nozzle CCAi and the temperature in the carburetor body CaBo. As can be seen in the graph, the temperature
25 in the carburetor and in the air nozzle is significantly lower for the chainsaw C2 compared to the conventional chainsaw C1. Accordingly, the system described herein is associated with advantages relating to the lowering of the temperature of the combustion air.

It should be appreciated that even though numerous characteristics and
30 advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the description is

only illustrative and changes may be made in detail, especially in matters of shape, size and arrangement of parts within the scope of the invention to the full extent indicated by the appended claims.

CLAIMS

1. A system (10) for centrifugal purification of combustion air, said system (10) comprising a fan wheel (15) rotatable about a rotation axis (R), a helical fan housing (20) surrounding said fan wheel (15) and an air nozzle (30) disposed within said helical fan housing (20) proximal to said fan wheel (15), said air nozzle (30) forming an air passage (35) for combustion air,
wherein the air nozzle (30) comprises:
an inlet (31) comprising a leading edge (32) as seen in a direction of flow of combustion air, said leading edge (32) being adapted to conduct air to said inlet (31), the inlet (31) extending at least partially tangentially to a periphery of the fan wheel (15), and
an outlet (33) extending at least partially parallel to the rotation axis (RA) and in an inward direction relative to said rotation axis (RA),
wherein the inlet (31) comprises an inner wall (39) axially delimiting the inlet (31) relative to the rotation axis (RA) such that there is a distance (X2) extending inwardly in a direction parallel to the rotation axis (RA) between said inner wall (39) and an inner radially extending wall (22) of the helical fan housing (20), the inner radially extending wall (22) extending at least partially orthogonally to the rotation axis (RA) thereby axially delimiting the fan housing (20),
whereby the ratio between said distance (X2) and a total axial extension (X3) of the helical fan housing (20) in a direction extending along the rotation axis (RA) is at least 0.35.

2. The system (10) according to claim 1, wherein the leading edge (32) is located close to the periphery of said fan wheel (15).

3. The system (10) according to claim 1 or 2, wherein the outlet (33) extends along an axial section of the total axial extension (X3) of the helical fan housing (20) along the rotation axis (RA) corresponding to the distance (X2).

4. The system (10) according to any one of the preceding claims, wherein the ratio between the distance (X2) and the total axial extension (X3) of the helical fan housing (20) is smaller than 0.65.

5

5. The system (10) according to any one of the preceding claims, wherein the inlet (31) is arranged adjacent and at least partially parallel to an outer radially extending wall (21) of the helical fan housing (20) opposite to the inner radially extending wall (22).

10

6. The system (10) according to claim 5, wherein the inlet (31) has a cross-section width (X1) as seen in a direction of flow of combustion air, the width extending parallel to the rotation axis (RA) and wherein the ratio between the inlet width (X1) and the total axial extension (X3) of the helical fan housing (20) is between 0,35 and 0,65.

15

7. The system (10) according to any one of the preceding claims, further comprising a mounting interface (25) adapted to receive a starter assembly (50) and accommodating mounting of a starter assembly (50) at an outer radially extending wall (21) of the helical fan housing (20).

20

8. The system (10) according to any one of the preceding claims, wherein the total axial extension (X3) is between 30 and 60 mm.

9. The system (10) according to any one of the preceding claims, wherein the air passage (35) from the inlet (31) extends generally tangentially to the periphery of the fan wheel (15) and then bends perpendicularly such that the outlet (33) is directed generally parallel to the rotation axis (RA).

10. The system (10) according to any of the preceding claims, wherein the leading edge (32) has a semi-elliptical shape as seen in a direction of air flow.

30

11. The system (10) according to any one of the preceding claims, wherein the leading edge (32) is integrally connected to a straight wall portion (38) of the air nozzle (30) and wherein the inlet (31) has a generally rectangular cross-section and a height of said inlet (31) is defined by a radial distance between said straight wall portion (38) and
5 an outer edge (37) of said air nozzle (30).

12. The system (10) according to any one of the preceding claims, the system (10) being configured to provide centrifugal purification of combustion air for a combustion engine (70).

10

13. The system (10) according to claim 12, wherein the combustion engine (70) is a crankcase scavenged two-stroke engine.

14. The system (10) according to claim 12 or 13, wherein the combustion engine
15 (70) is a one-cylinder engine.

15. A hand-held motor-driven tool comprising an internal combustion engine (70) and a system (10) according to any one of claims 1 to 14.

20 16. The hand-held motor-driven tool according to claim 15, further comprising a starter assembly (50) mounted to a mounting interface (25) of the system (10).

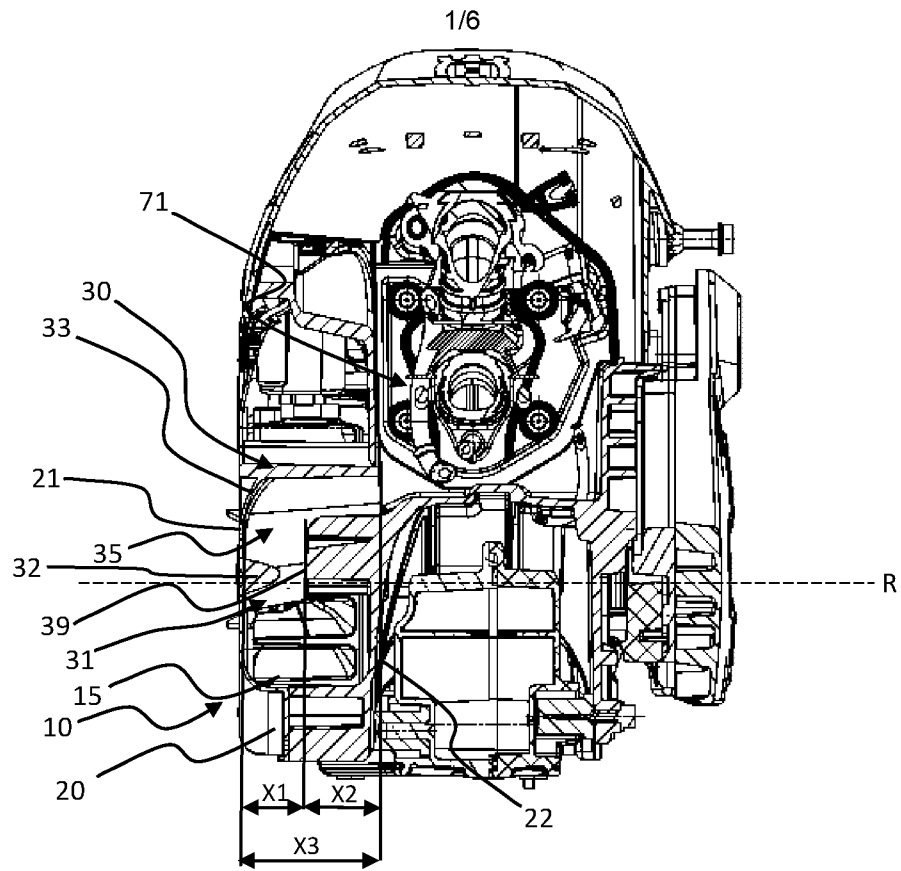


FIG. 1a

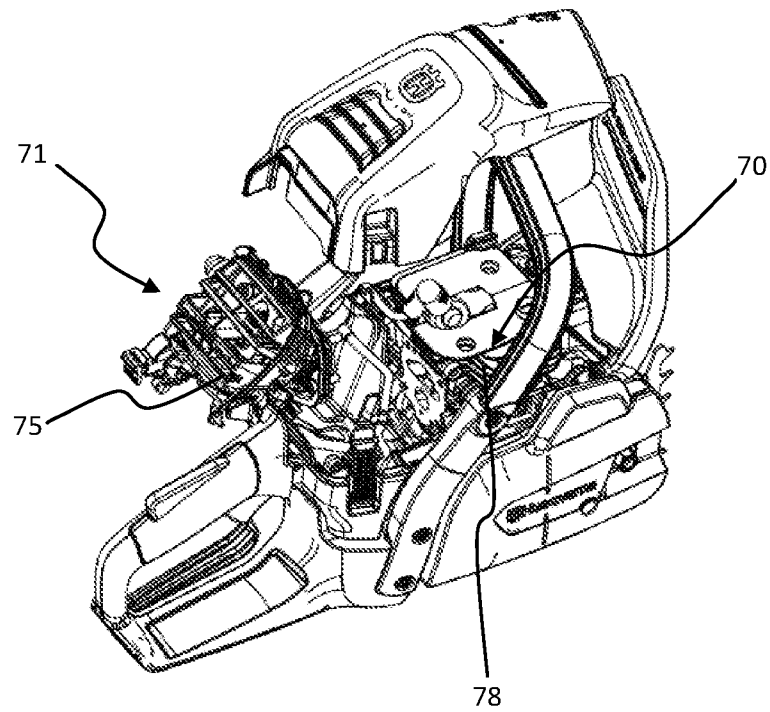


FIG. 1b

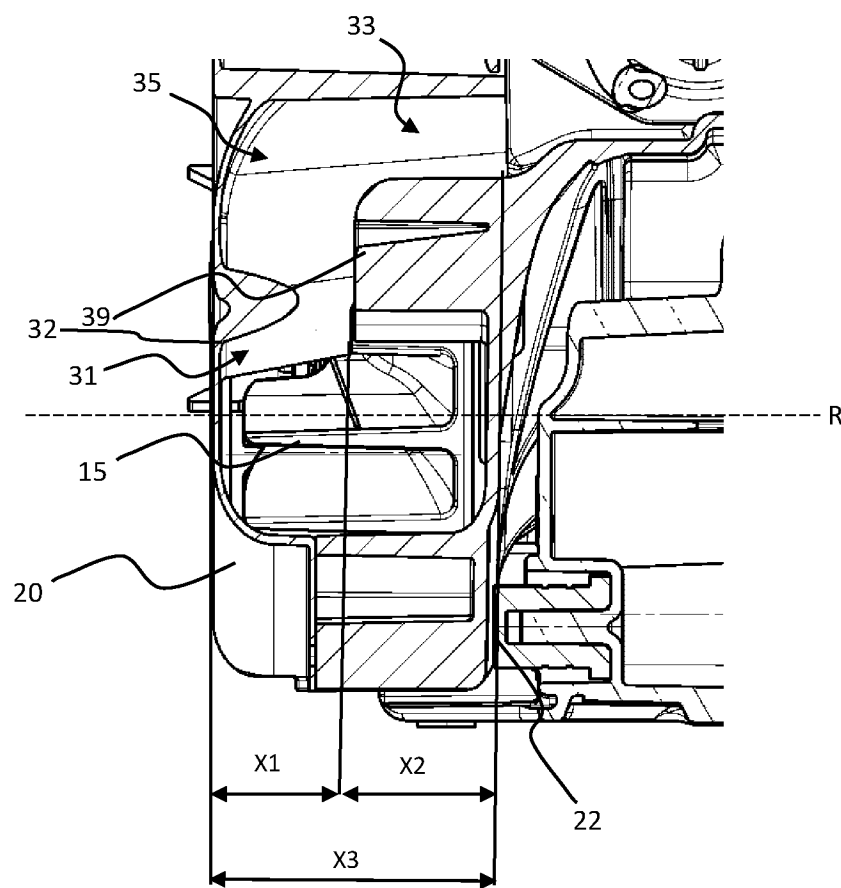


FIG. 2

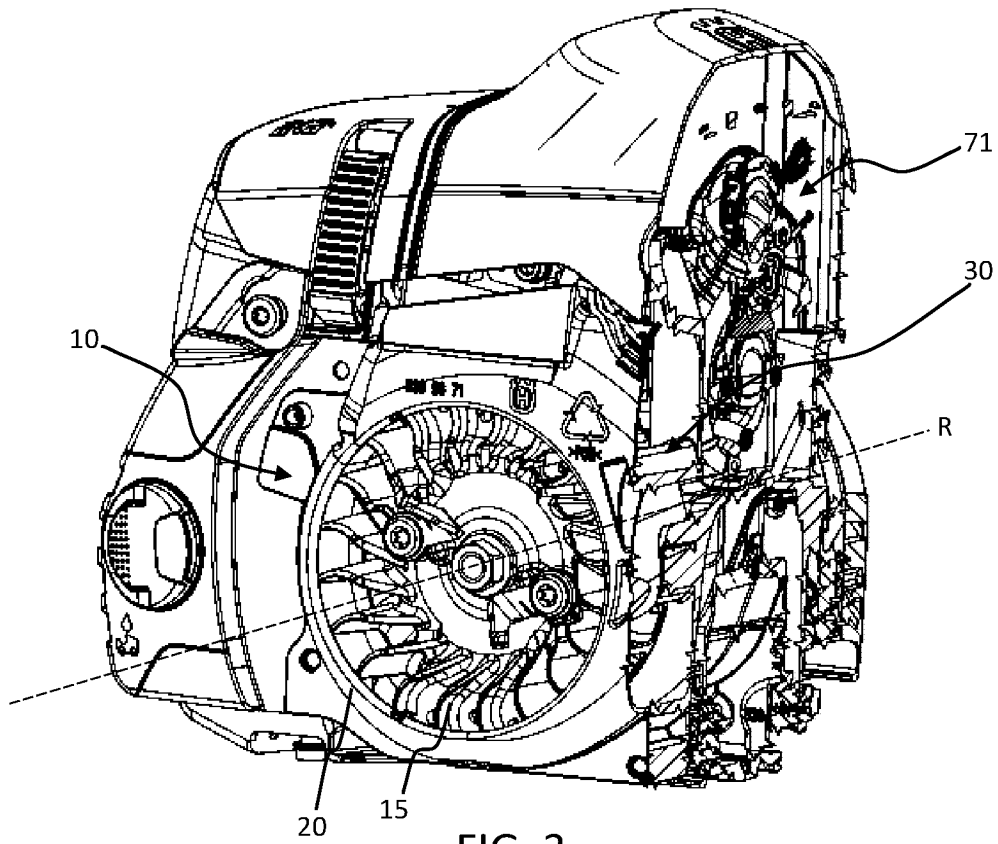


FIG. 3

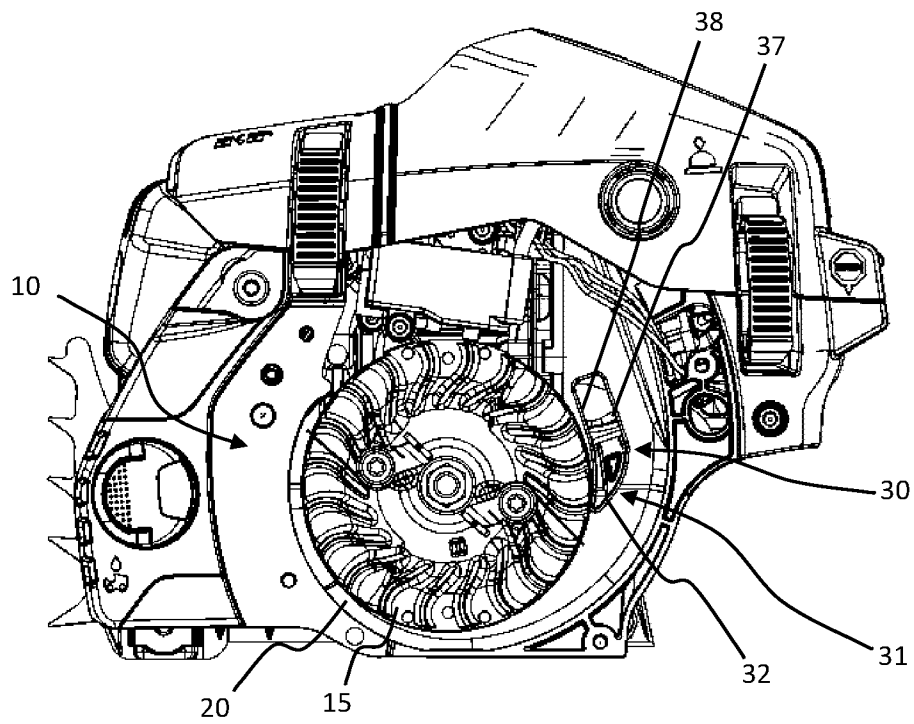


FIG. 4

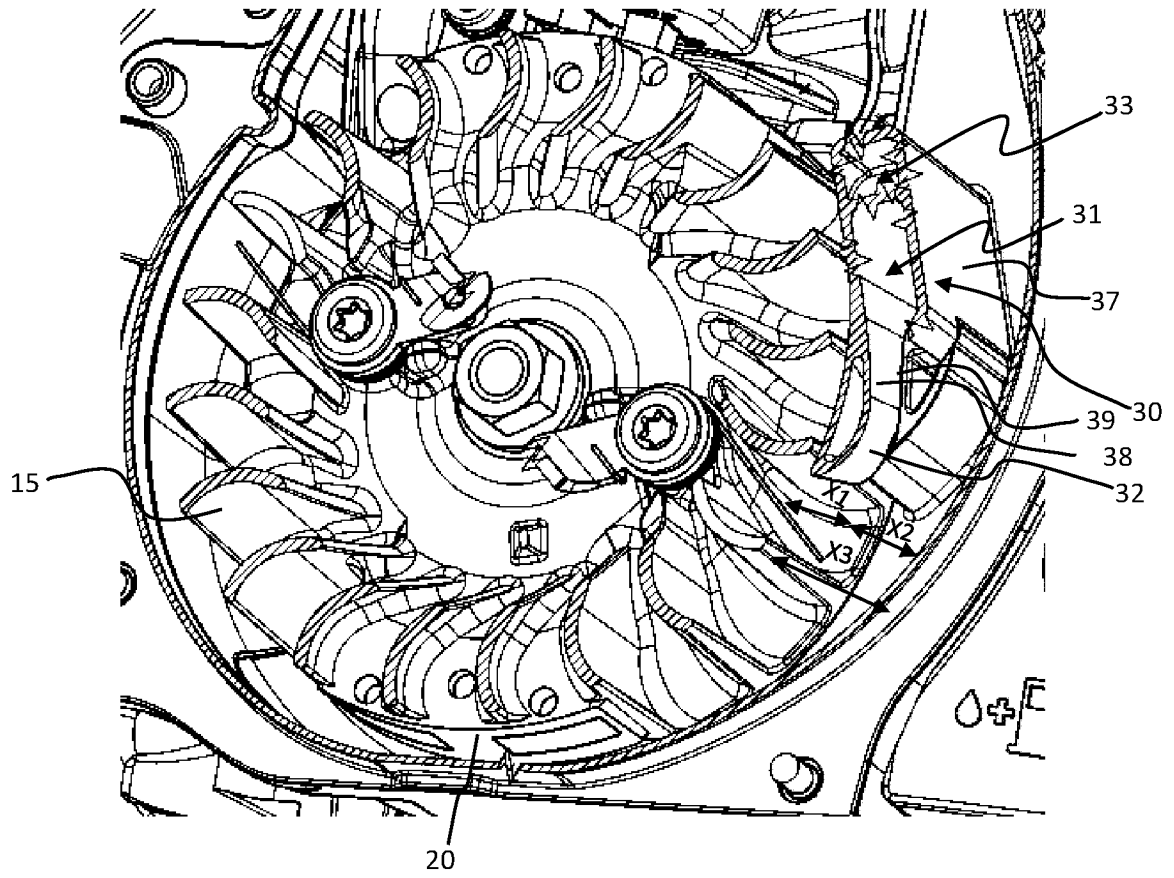


FIG. 5

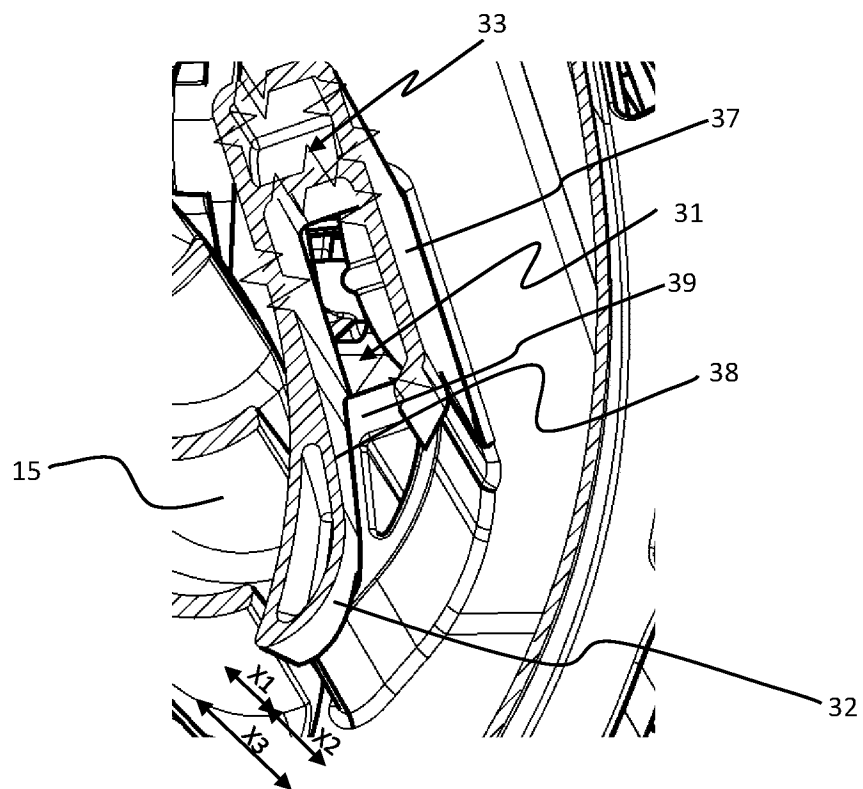


FIG. 6

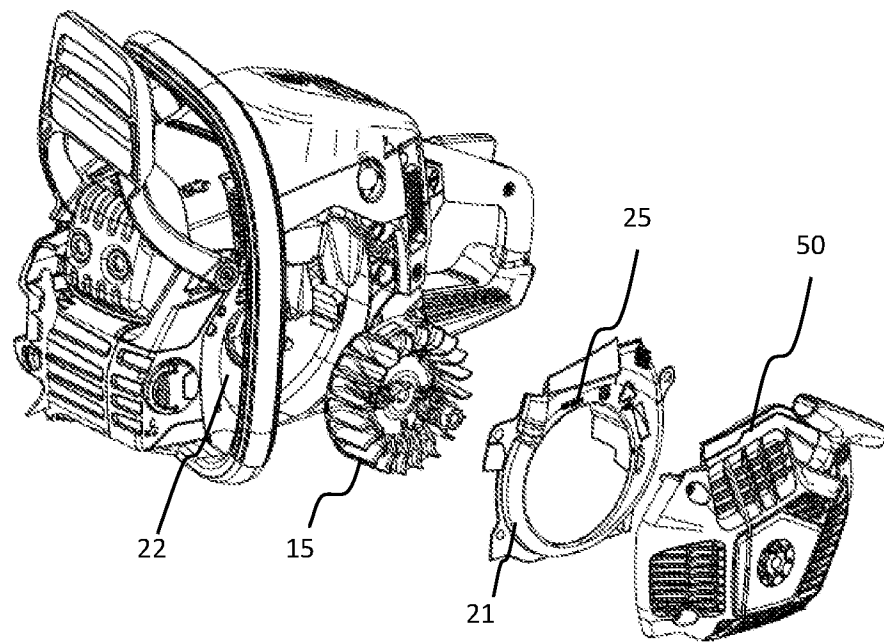


FIG. 7

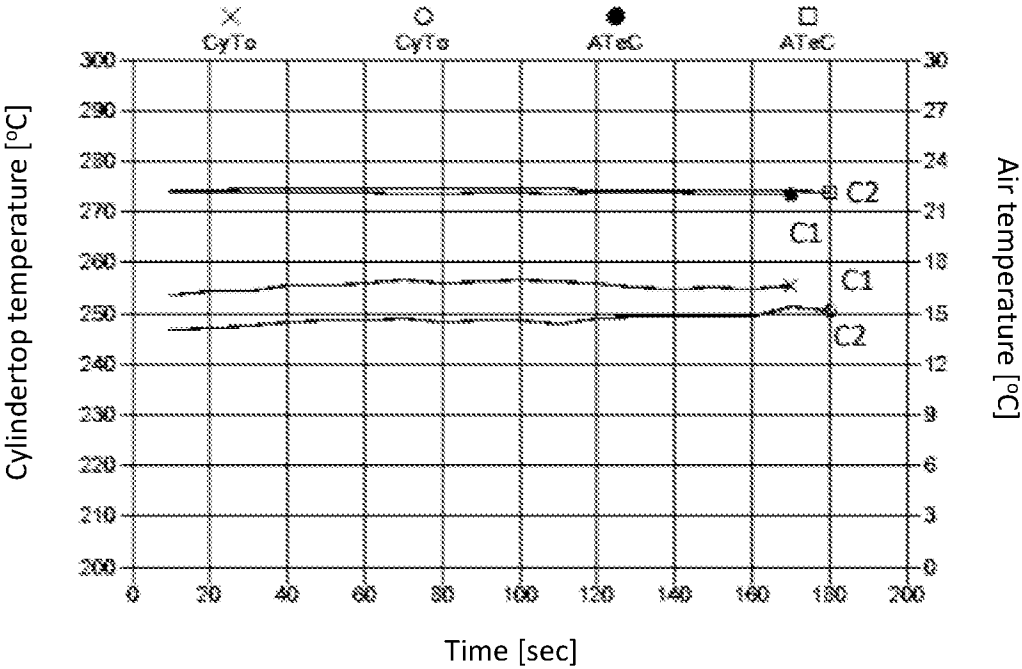


FIG. 8a

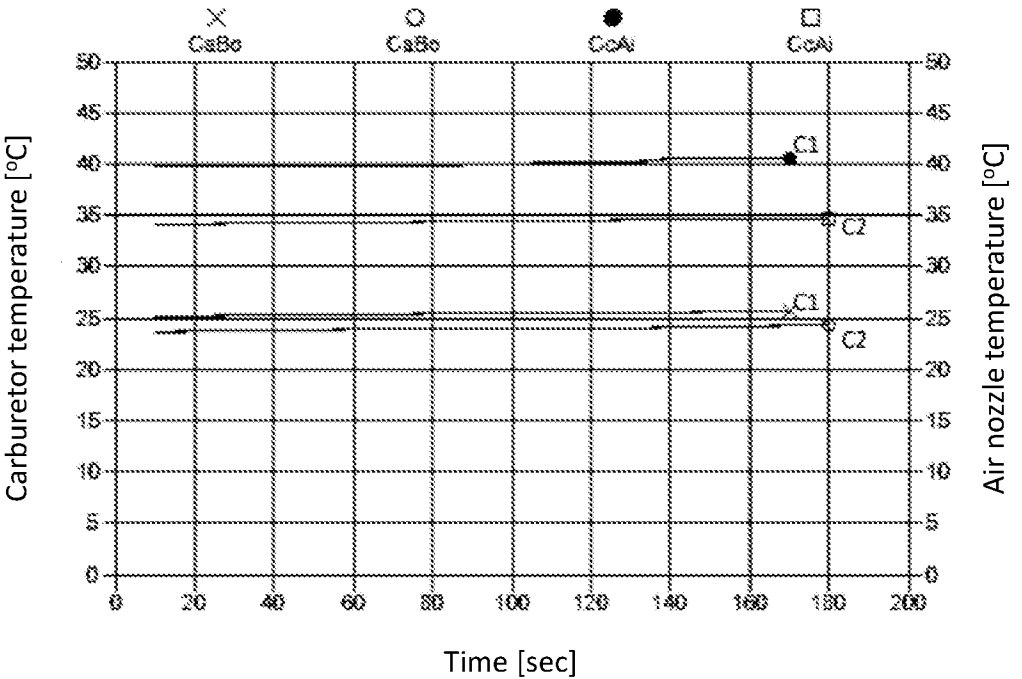


FIG. 8b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2024/050768

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: F01P, F02B, F02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

KIME

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 8413616 B2 (BERGQUIST OSKAR), 9 April 2013 (2013-04-09); column 3, line 49 - column 4, line 2; all figures --	1-16
A	US 5720243 A (STEGEMYR ERIK ET AL), 24 February 1998 (1998-02-24); whole document --	1-16
A	US 8490585 B2 (KIENZLE WOLFGANG ET AL), 23 July 2013 (2013-07-23); abstract; all figures --	1-16
A	FR 2845122 A1 (STIHL AG & CO KG ANDREAS), 2 April 2004 (2004-04-02); abstract; all figures -- -----	1-16

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"D" document cited by the applicant in the international application	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
10-10-2024

Date of mailing of the international search report
11-10-2024

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Continuation of: second sheet

International Patent Classification (IPC)

F02M 35/06 (2006.01)

F01P 11/12 (2006.01)

F02B 63/02 (2006.01)

F01P 5/06 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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