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(54) **ROTARY ROOF VENT**

(57) The proposed utility model relates to radial-flow devices for smoke extraction and exhaust air ventilation, and more particularly to radial-flow (centrifugal) ventilators for smoke extraction and ventilation which can be installed on the roofs of buildings and provide for the extraction by natural draft of smoke, gases and air from the premises of a building in the event of a fire or of gas contamination. A rotary roof vent comprises a base, an impeller, a shaft on which a ring with blades rotates, and a cover; the impeller is configured as a single piece and is comprised of a ring provided with stiffening ribs and having blades arranged along its edges, and disposed in the central part is a hollow sleeve for mounting on the

shaft, wherein the blades are scooped, at the end of each blade is a protuberance at an acute angle, and on the inner side of the blade, closer to the centre, is a protuberance at an obtuse angle to the blade, wherein the blades project into the interior of the impeller by 20% relative to the diameter of the base, the stiffening ribs of the impeller are arc-shaped and replicate the contour of the blades, the cover is outwardly convex, and a sleeve for fastening on the shaft is disposed in the centre thereof. The technical result is that of providing improved technical and performance characteristics, and also expanding the existing range of technical means.

EP 4 253 852 A1

Description

[0001] The proposed utility model relates to devices for smoke removal and exhaust ventilation with a radial flow, namely, radial (centrifugal) smoke removal and ventilation fans installed on the roofs of buildings and ensuring the removal of smoke, gases and air from the premises of the building in the event of a fire or gas contamination due to natural traction. 5

[0002] The rotary deflector is used for ventilation of residential and office premises, swimming pools, hangars, granaries, livestock complexes, structural elements of the roof (rafters, insulation, lathing or solid roofing), removal of gas and vapors from the shafts of multi-storey buildings and ensuring properly organized ventilation. 10

[0003] The prior art roof radial fan for smoke removal and ventilation with an impeller (RU 2618416, publ. 15

[0004] 03.05.2017 Bull.

[0005] N° 13), which is made of curved blades in the form of a hollow spherical belt, with a vertical axis on which the impeller rotates, on the upper base of which there are blades - cups made of aluminum housing, and fluoroplastic bushings are also used. 20

[0006] The disadvantages of the above design of the turbo deflector are: 25

1. Moisture and snow easily get inside the deflector due to the open design.

All condensate descends inward along the axis, and enters the bushings where the bearings and moving metal parts of the deflector are located and quickly disable them due to oxidation. 30

The moisture that gets into the bearing and on the rotating elements in winter freezes, and the deflector stops spinning until the thaw. 35

2. In duralumin and metal, oxide occurs from contact even without exposure to an aggressive environment. 40

3. Snow accumulates on the upper platform of the metal deflectors, which later turns into heavy ice, since this platform is too flat and the snow cannot fall off it freely. 45
Because of this, imbalance occurs, the seat is broken, which renders the entire deflector unusable.

4. Metal devices are heavy, which creates an additional load on the bearings and leads to a decrease in their service life. Secondly, the extra weight requires a stronger wind to spin, which greatly reduces the overall useful life of the deflector. 50

5. Poor aerodynamic properties due to the simple design of the blades of metal models. The disadvantage of these devices is that in light wind the impeller rotates slowly and does not provide sufficient fan per- 55

formance or cannot move at all due to the large inertia of the impeller, which the starting torque created by light wind cannot overcome. In addition, due to the imbalance and the friction of the parts against each other created because of this, these deflectors are hard to unwind (a stronger wind is needed) and spin less in time. Over time, the imbalance only increases and the operating time decreases even more.

6. Unreliable fastening of the spherical part to the base as a whole. Under the force of a strong wind, the fasteners are deformed due to weak rivets and thin metal at the junctions of the head with the base. The deflector can generally come off the landing basin.

7. In metal deflectors, due to the design features, many parts are unbalanced and asymmetrical, since this is a manual production, there is not a single completely factory one today. The accuracy of the blanks suffers greatly. Therefore, all metal deflectors in the assembly are also unbalanced and asymmetrical. A metal one always has an imbalance during assembly, so in the end it does not spin smoothly. Over time, the imbalance increases, and because of this, the seat begins to break and, as a result, the deflector breaks. The deflector in relation to the axis is completely unbalanced if you turn the seat separately, holding the deflector by the main body.

All cracks and gaps are uneven, the fastenings of the deflector parts are asymmetrical, they often do not fit tightly. The rivets are uneven in the mounting holes and are made of too soft material, so they break very quickly due to vibration and are not able to keep the structure in its original form for a long time.

8. Due to the shortcomings mentioned, metal deflectors require frequent maintenance in the form of lubrication of bearings and moving parts, and given that they are located on roofs and access to them is often very problematic.

9. The production time is too long and complicated due to the many stages at the production stage and a large part of the manual labor in the overall cycle. Also, due to manual labor and the use of metal in production, an expensive cost is obtained, which is aggravated by the fact that approximately 30% of finished parts are rejected in the production of metal deflectors, which also greatly affects the cost and production speed.

10. Due to the imbalance of the structure and further deterioration of the balance, metal deflectors begin to make a loud noise due to the friction of metal parts against each other.

11. The performance of this model is lower than that of other commonly used natural ventilation systems such as deflectors

[0007] TsAGI in metal and plastic, open ventilation ducts in different variations. The closest technical solution is a rotary deflector (RU 194486, publ. 12.12.2019 Bull.

[0008] N° 35), containing a base, rims, blades, an axle, bearings, while both rims are made monolithic with bushings and are installed by bushings into each other by means of protrusions, thus forming the upper and lower rims in which the blades are installed, the cover is made in the form hemispheres, while the base, rims with bushings, cover and blades are made of one-piece molded plastic. The disadvantage of this design is the structure of the rims, which, when the head rotates, create an air damper that prevents the passage of air flow from the room to the outside. The second disadvantage is the absence of internal air capture by the petals, which does not create additional air turbulence in the pipe and does not create additional draft for air to escape from the room. These two disadvantages reduce the potential performance of the deflector. Another disadvantage of this design is the prefabricated structure, which takes a long time to assemble the baffle, which limits production. The technical problem to be solved by the utility model is to manufacture a plastic turbo deflector with a design that takes into account the shortcomings of the previous deflectors.

[0009] This problem is solved due to the fact that the rotary deflector contains a base, an impeller, an axis on which the rim with blades rotates, and a cover, the impeller is made in one piece and is a rim with stiffeners, along the edges of which there are blades, and in the central part there is a hollow bushing for installation on the axle, while the blades are made of a recessed shape, at the end of each blade at an acute angle there is a process, and on the inner side of the blade closer to the center there is a process at an obtuse angle with respect to the blade, the blades go inside the impeller by 20% with respect to the diameter of the base, the stiffening ribs of the impeller are made arcuate and repeat the contour of the blades, the cover is made convex outwards, in the center there is a bushing for fixing on the axis. The base, impeller and cover are made of plastic.

[0010] The technical result provided by the given combination of features is the improvement of technical and operational characteristics, as well as the expansion of the arsenal of technical means.

[0011] A rotary or active deflector (turbo deflector) is installed at the outlet of natural ventilation pipes and is powered by wind energy.

[0012] It does not consume electricity, and, therefore, this installation is cost-effective.

[0013] The device is designed to extract the exhaust air from the room to the outside.

[0014] The operation of a rotational deflector made of ABS plastic is more efficient than that of other natural

exhaust systems, thereby increasing the efficiency of the entire ventilation system.

[0015] The rotary deflector protects the ventilation duct from atmospheric precipitation and foreign objects, protects the roof from condensation by lowering the air temperature in the attic, prevents overheating of the interior, reduces fat deposits and dustiness of the ventilation ducts, and provides a decorative design for the duct exit.

[0016] The essence of the utility model is illustrated by drawings, which show: figure 1 - General view of the device; figure 2 is a side sectional view of the device; in fig.

[0017] Z - enlarged view of the axis; figure 4 - impeller top view; figure 5 - impeller side view; figure 6 - base top view; figure 7 - base side view; figure 8 - General view of the blade (profile); Where:

- 1 - base,
- 2 - impeller,
- 3 - lid,
- 4 - blades,
- 5 - axis,
- 6 - washer,
- 7 - bearing,
- 8 - ring,
- 9 - ribs,
- 10 - base bushing
- 11 - impeller bushing.

[0018] Rotary deflector (turbo deflector) consists of base 1, impeller 2, which always rotates in one direction, regardless of wind direction, and cover 3.

[0019] The base 1 is completely rigid, with six ribs 9, additionally fastened in the middle with a common seat.

[0020] As a result, the base is completely rigid and not deformable.

[0021] The base is made monolithic.

[0022] Thanks to the casting of the part, the base is perfectly even and symmetrical.

[0023] Thanks to the six stiffening ribs, the base is very durable.

[0024] Due to the fact that the ribs and edges are made thin, the throughput of the air flow increases and, consequently, increases deflector performance.

[0025] The seat uses a 10 mm deep bushing-shaped recess, thanks to which the axle sits tightly and is perfectly centered vertically.

[0026] In the center of the base there is a sleeve 10, into which the hollow sleeve 11 of the impeller 2 is inserted

[0027] An axle 5 is inserted into the base sleeve, on which the sleeve 11 of the impeller 2 sits with bearings 7 and cover 3.

[0028] The impeller 2 is made in one piece, which makes it possible to increase the production of the number of pieces per unit of time, since there is no assembly stage of petals and rims.

[0029] The impeller is a rim with stiffeners, in the central

part there is a hollow sleeve for mounting on the axle, blades 4 are installed along the edges.

[0030] Blades 4 are recessed to create windage.

[0031] At the end of the blade at an acute angle, there is a process against which the air flow rests and prevents the trapped air from aerodynamically escaping further, increasing the efficiency of the blade when capturing the wind.

[0032] On the inner side of the blade 4 closer to the center there is a process at an obtuse angle with respect to the blade to capture the air flow coming out of the pipe.

[0033] The blades go inside by 20% in relation to the diameter of the base.

[0034] Together, this creates a rarefaction of the air inside the pipe, increasing the extraction of air from the room.

[0035] The stiffening ribs are arcuate and repeat the contour of the blades 4, setting the direction of movement of the air flow, and are located in the upper part of the impeller in such a way that they form a space for the passage of the air flow, while the flow leaves through the side openings unhindered.

[0036] This increases the overall performance of the product.

[0037] Bearings 7 provide balance and uniform torsional load.

[0038] Cover 3 is made convex outwards, which prevents snow and ice from accumulating on it and leading to unbalance of the structure.

[0039] Due to the manufacture of the cover is monolithic, it is perfectly flat, symmetrical, and very durable.

[0040] On the inside there are six stiffeners, which gives additional strength to the structure.

[0041] In the center there is a sleeve into which the axle is inserted, the axle is bolted from above and below, the bolt is closed from above with a level.

[0042] The cover is fastened in such a way that its torsion is not performed, due to this the weight of the rotating part is lighter and the speed of breaking off increases due to this, which increases the useful work time and reduces the chances of the deflector freezing in winter.

[0043] The main elements of the rotary deflector are mainly made of plastic or polypropylene.

[0044] The aerodynamic cover improves the aerodynamic properties of the device, protects against precipitation, which prevents the bearing from freezing in winter due to moisture ingress.

[0045] Thanks to the above-described design of the deflector, the following is provided: increased service life, noiselessness, increased product productivity, automated production, increased temperature conditions of use, maintainability, and increased production speed.

[0046] The device works as follows.

[0047] The wind, getting into the blades, makes the head of the device move, thereby discharging air in the system and improving traction.

[0048] For the operation of the turbo deflector, wind at a speed of 0.5 meters per second is sufficient, since all

parts are made of lightweight materials.

[0049] Accordingly, the stronger the wind, the higher the power of the device.

[0050] The turbo deflector device provides autonomous operation and eliminates back draft.

[0051] Thus, the claimed rotary deflector has the following qualities (advantages):

1. The plastic deflector is completely molded and manufactured in production using molds and production lines, which virtually eliminates manual labor and guarantees perfect accuracy, symmetry and balance, which ensures uniform rotation.

It also ensures the speed and ease of production, the absence of defects, the uniformity of any color by adding a dye to the raw material, and, as a result, low production costs.

2. The design of all parts is thought out in such a way that the entire deflector is rigid, tightly assembled, does not loosen over time and is durable.

3. The design is designed in such a way that in torsion the deflector outperforms all existing models on the market.

This is ensured by the well-thought-out aerodynamics of the blades and cover, precise balancing of the structure and light weight. All this allows the proposed model to start spinning with a weaker wind and spin longer at a higher speed, which ultimately provides a greater total total useful time of the deflector, and, accordingly, a much more efficient operation of the ventilation system as a whole.

4. The design is thought out in such a way that all iron structural elements (bearings, axle, bolts) are securely covered with plastic from aggressive environments. This ensures the durability of the metal elements and, as a result, a longer deflector life, since the plastic itself practically does not change its characteristics over time. In addition, the protection of metal parts ensures uninterrupted operation of the deflector throughout the winter, unlike metal samples, in which moisture that has entered in winter freezes, and the deflector stops spinning until the thaw. It also prevents frequent maintenance of the deflector, expressed in the lubrication of bearings, which can be quite difficult to do on the roof. The replacement of metal parts in the presented model is very easy and the service life of the deflector can thus be increased several times.

Claims

1. Rotary deflector containing a base, an impeller, an axis on which the rim with blades rotates, and a cover, **characterized in that** the impeller is made in one

piece and is a rim with stiffeners, along the edges of which there are blades, and in the central part there is a hollow sleeve for installation on the axis, while the blades are made of a recessed shape, at the end of each blade at an acute angle there is a process, 5 and on the inner side of the blade closer to the center there is a process at an obtuse angle with respect to the blade, the blades go inside the impeller by 20% with respect to the diameter of the base, the stiffening ribs of the impeller are arcuate and repeat 10 the contour of the blades, the cover is made convex outwards, in the center there is a bushing for fixing on the axis.

2. Rotary deflector according to claim 1, **characterized** 15
in that the base, impeller and cover are made of plastic.

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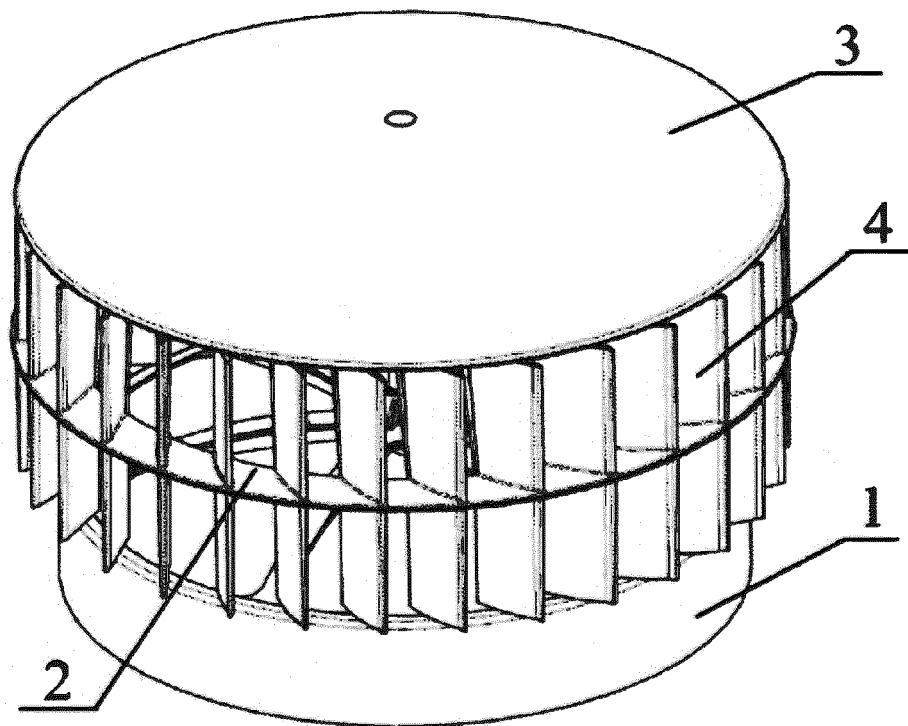


Fig. 1

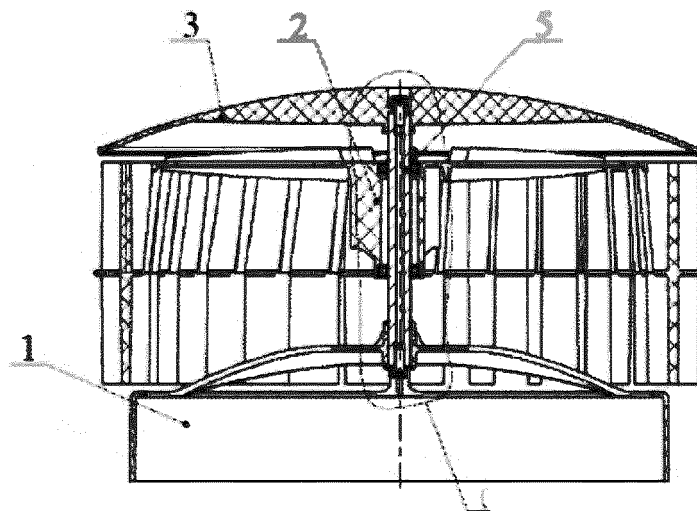


Fig. 2

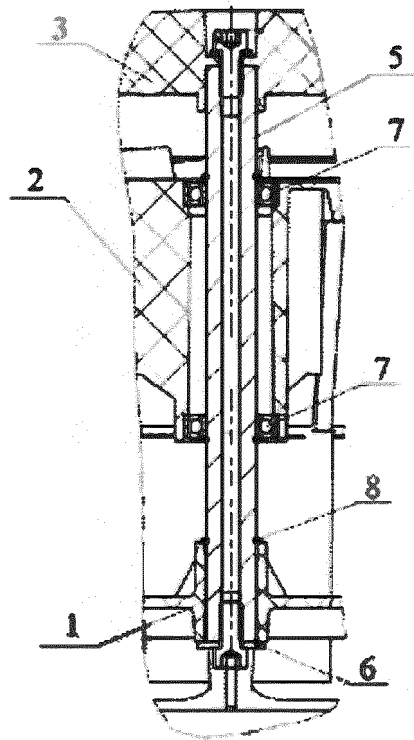


Fig. 3

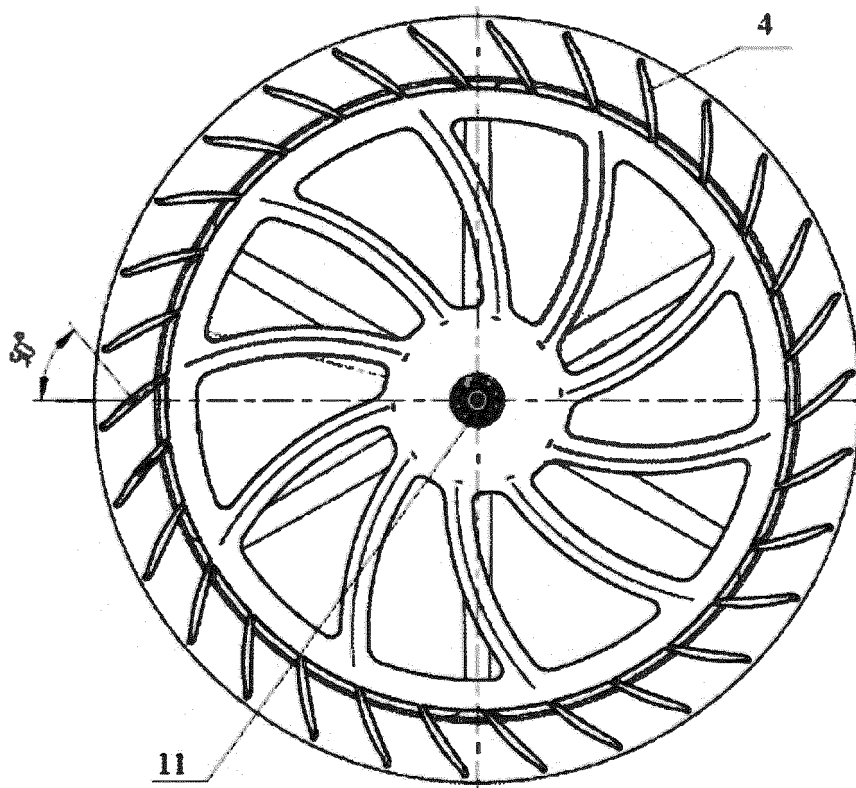


Fig. 4

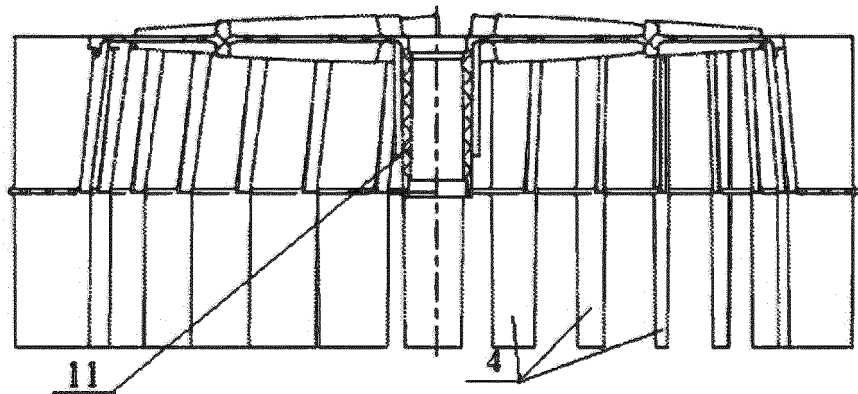


Fig. 5

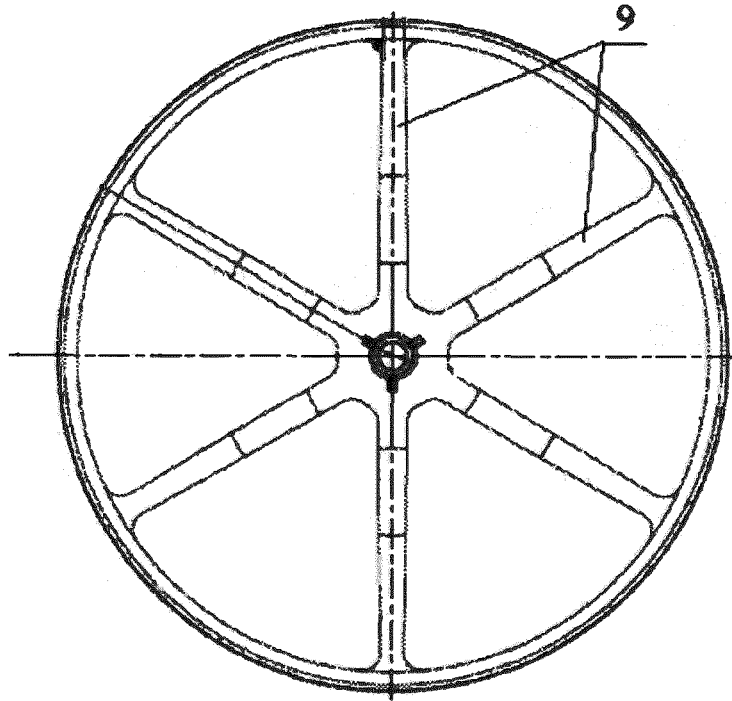


Fig. 6

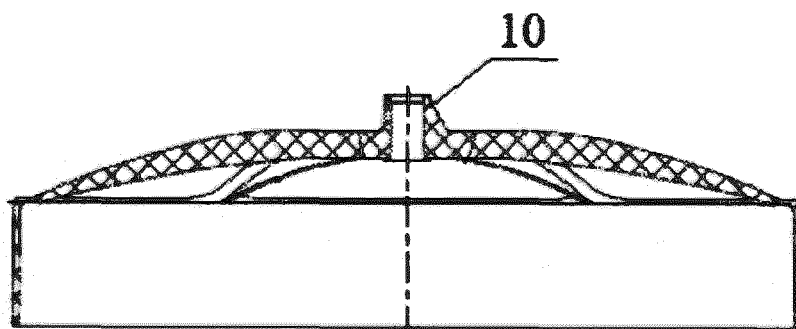


Fig. 7

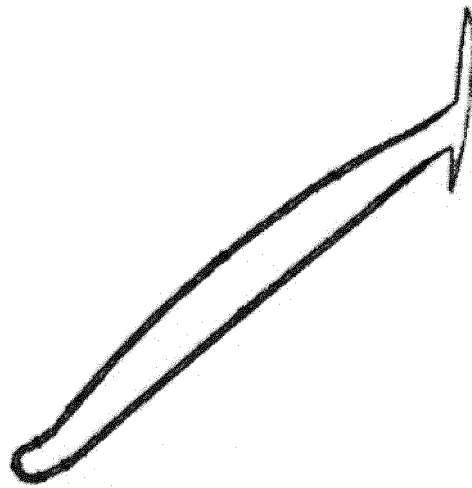


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/RU 2021/050382

A. CLASSIFICATION OF SUBJECT MATTER

F24F 7/00, 7/06

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)

F24F 7/00, 7/06

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

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

PatSearch (RUPTO internal), USPTO, PAJ, Esp@cenet, DWPI, EAPATIS, PATENTSCOPE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A, D	RU 194486 U1 (IVANOV DMITRY STANISLAVICH) 12.12.2019	1-2
A	US 6302778 B1 (ANDREWS GABRIEL) 16.10.2001	1-2
A	WO 2000/068619 A1 (ANDREWS GABRIEL) 16.11.2000	1-2

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

* Special categories of cited documents:

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"&" document member of the same patent family

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09 February 2022 (09.02.2022)

Date of mailing of the international search report

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