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DEVICE FOR HOLDING AND RELEASING A REMOTELY-CONTROLLED MACHINE

The invention relates to the technical field of devices making it possible to hold a remotely-controlled machine on a vehicle and to release it.

A remotely-controlled machine comprises both flying machines (or drones) and land-based machines (or robots).

Today, these machines are implemented on an operating theater from vehicles. The machines must be able to be released easily and recovered equally easily.

It is known to secure the flying machines to a platform carried by the vehicle using a cable. It is then easy to recover the machine by winding the cable. Patents WO2007141795 and US2004167682 A1 describe such a device for holding and releasing a flying machine. Known from EP 2,218,642 is a device for launching and recovering a flying machine. Known from US 4,834,321 is a device for keeping a helicopter on a platform.

However, today, it is desired to implement machines that do not remain physically connected to their platform, therefore to the vehicle, during their mission. The problem then arises of holding the machine on the platform carried by the vehicle outside usage phases, as well as that of releasing it from the platform, therefore from the vehicle, simply and quickly from inside a vehicle.

Thus, the invention aims to propose a simple and rustic device making it possible to hold a machine on a vehicle and to release it.

The device according to the invention also makes it possible to facilitate the recovery of the machine at the end of the mission while assisting with its positioning relative to the platform carried by the vehicle.

Indeed, today, in particular for remotely-controlled flying machines, the solutions making it possible to recover the machine implement capture nets or cables that are caught by the flying machine upon approaching its platform.

Patent US 8,453,967 thus describes a device implementing a net for recovering a flying machine. These solutions are complex and bulky.

It is not possible to recover an autonomous and small flying machine on a platform that is also small without implementing a guiding device. Yet the current satellite guiding devices have a positioning error that is not less than 100 millimeters, which is too large.

The invention makes it possible to facilitate the positioning of the machine relative to a platform carried by the vehicle, and therefore also facilitates its recovery from the inside of a vehicle without direct manual intervention by an operator on the machine.

Thus, the invention relates to a device for holding and releasing a remotely-controlled machine on a vehicle, the device comprising a platform able to be carried by the vehicle, the device being characterised in that it comprises at least two blades attached on the platform by one of their ends, the blades delimiting therebetween an accommodating space in which the machine is intended to be entirely positioned, the accommodating space being such that, when using the device with the machine, the whole machine is housed within the accommodating space, each blade being connected to a manipulating means allowing to move the free ends of the blades away from each other or closer to each other in order to hold the machine within the accommodating space or to release it.

According to one embodiment, the manipulating means moves the free ends of the blades away from each other in order to release the machine.

The blades can thus be flexible blades that will, at rest, be moved closer to each other so as to hold the machine, the manipulating means moving the blades away from each other in order to release the machine.

The platform can include a fixed part on which the blades are attached and a movable part which is intended to receive the machine and can move with respect to the fixed part, the manipulating means including the movable part of the platform an outer edge of which causes, during a movement thereof, the blades to be resiliently moved away from each other.

According to another embodiment, the blades can be flexible blades and the manipulating means can comprise at least one pulling means connected to each blade at the vicinity of its free end, the pulling means causing, when operated, the transition from a first position, in which the blade is not deformed, to a second position in which the blade is deformed by bending and then includes a domed part which is inserted into the accommodating space so as to be able to abut against the machine.

The pulling means can include at least one cable integral with each blade, wherein one end of the cable will be connected to a driving means.

The driving means can include at least one reeling drum.

The one or more reeling drums may advantageously be coaxial and arranged at equal distances from the plurality of blades.

According to one variant, the driving means can include a slide to which the cables are attached and which can translate along a direction perpendicular to the platform.

Advantageously, the device can include from four to eight blades that are evenly angularly distributed.

The blades can be conductive or covered with a conductive material at their part which is intended to contact an additional conductive deposit carried by the machine.

The upper face of the platform can also include at least one conductive coating intended to cooperate with a contact carried by the machine.

Other advantages will appear upon reading the following description of specific embodiments, the description being done in reference to the appended drawings, in which:

- Figures 1a and 1b are two views of a flying machine able to be held and released by a device according to the invention;
- Figure 2 is a diagram showing the approach by a flying machine to a platform of a device according to the invention;
- Figures 3a and 3b are two schematic side views of a first embodiment of the device according to the invention, figure 3a showing the machine approaching the platform and figure 3b showing the machine held on the platform;
- Figure 4 shows an example of a manipulating means suitable for this first embodiment;
- Figures 5a, 5b and 5c are three schematic side views of a second embodiment of a device according to the invention, figure 5a showing the machine approaching the platform, figure 5b showing the machine held on the platform and figure 5c showing the release of the machine by the platform;
- Figures 6a and 6b are two schematic side views of a third embodiment of the device according to the invention,

figure 6a showing the machine positioned on the platform in a released position and figure 6b showing the machine held on the platform;

- Figures 7a and 7b are two schematic side views of a variant of this third embodiment of a device according to the invention, figure 7a showing the machine positioned on the platform in a released position and figure 7b showing the machine held on the platform;
- Figure 8 is a top view of one embodiment of a device according to the invention;
- Figures 9a and 9b are two schematic views of a fourth embodiment of a device according to the invention, suitable for a machine of the wheeled robot type, figure 9a showing the machine positioned on the platform in a released position and figure 9b showing the machine held on the platform.

Figures 1a and 1b show a remotely-controlled flying machine 1 of the quadcopter type. This machine includes a cell 2 that carries four small electric motors 3 each driving a propeller 4. Each propeller 4 is surrounded by a protective fairing 5 and a skirt 6 surrounds the fairings 5 and bears landing feet 6a.

This example is drawn here very schematically. It is not part of the invention and is intended solely to describe the cooperation of the machine with the holding and release device according to the invention.

The cell 2 contains means (not shown) making it possible to provide the remote control of the machine 1: a radio transceiver allowing the dialogue with a remote control console, a satellite location means (GPS), electric batteries. It also carries a

steerable camera 7 as well as orientation gear motors of the latter. These various means are not described in detail.

Figure 2 schematically shows the control mode of a machine 1 from a vehicle 8 on which a platform 9 of the device according to the invention is positioned. The platform 9 is of course attached to the vehicle by appropriate connecting means.

The vehicle 8 is not shown in detail. It could be an armored vehicle or a land-based vehicle intended for security forces or a civilian land-based vehicle. The vehicle may also be a civilian or military ship.

A cone 10 represents the observation field of an approach control camera 11 that is secured to the platform. This field 10 is chosen to be relatively wide (half-cone 10 angle of about 45°).

An ellipsoid 12 depicts a so-called transitional volume that corresponds to the volume in which it is possible to position a flying machine automatically using satellite positioning means known at this time. The uncertainty regarding the positioning of the machine 1 is about a hundred millimeters in all three spatial directions. It is therefore possible to bring the machine automatically into the transitional volume 12 and the machine 1 is then visible by the camera 11.

Once the machine 1 is visible by the camera 11, a human operator housed in the vehicle 8 handles the controlled lowering of the machine 1 toward the platform 9.

The end of the lowering of the machine 1 will be controlled and secured by the holding device according to the invention.

Figures 3a and 3b schematically show a first embodiment of a holding and release device 13 according to the invention.

The device 13 comprises at least two blades 14 that are attached on the platform 9 by one of their ends.

Here, the blades 14 are connected to the platform 9 by hinges 15. The blades 14 delimit an accommodating space 16 between them inside which the machine 1 is intended to be positioned. It will be noted that the entire machine 1 is housed inside the accommodating space 16.

Each blade 14 is also connected to a manipulating means (not visible in figures 3a and 3b) that makes it possible to move the free ends of the blades 14 away from each other or closer to each other.

According to this embodiment, one can see in figure 3a that, when the ends of the blades 14 are moved apart, the entrance of the accommodating space 16 is open wide and the machine 1 can descend to rest on the platform 9.

Conversely, figure 3b shows that, when the ends of the blades 14 are close to each other, they hold the machine 1 in the accommodating space 16. Indeed, the whole machine 1 is housed inside the accommodating space 16.

More specifically, according to this embodiment, the blades 14 are relatively stiff and, when they are brought closer to one another, they bear against the outer surface of the skirt 6 of the fairing.

Figure 4 shows an exemplary embodiment of a manipulating means 17 of the blades 14. The manipulating means 17 here comprises two small linear jacks 17 that are attached by one end to a base 9a of the platform 9 and by the other end to the blade 14 in question.

The amplitude of the pivoting movement of the blades 14 from one position to the other is relatively small: about 20°. The actuators therefore also have a small travel.

In figures 3a and 3b, only two blades 14 are shown. In light of the globally cylindrical shape of the outer profile of the

machine 1, it will be advantageous to provide a larger number of blades 14 evenly angularly distributed around an axis 18 of the platform 9, which here is the observation axis of the approach control camera 11 (axis 18 of the observation cone 10). Figure 8 thus shows, in top view, a machine 1 that is held by eight blades 14 evenly angularly distributed around the axis 18. The number of blades and their distribution on the platform 9 will depend on the shape of the machine 1 that the platform 9 equipped with the blades 14 seeks to hold and release.

As a variant, it would be possible to provide blades 14 made from a resilient material, blades attached to the platform rigidly (without articulation).

In this case, the natural position of the blades at rest will be that of figure 3a: blades 14 with their free ends separated to free the machine. The manipulating means will then for example be made up of translatable walls, perpendicular to the platform 9, and which slide along the blades 14 in the vicinity of their fixed lower edge. These walls, by moving upward, will return the blades 14 perpendicular to the platform 9 and therefore bring their free ends closer together.

It will then be possible to provide a nose on each blade that will be positioned above the machine 1 and will prevent its removal when the blades 14 are in their final position, all perpendicular to the platform 9.

When the device comprises several blades 14 regularly angularly distributed (as shown in figure 8), the movable walls will be able to be made up of a simple cylindrical bushing that will move relative to the platform 9 and that will simultaneously move all of the blades 14.

Figures 5a to 5c show a second embodiment of a holding device according to the invention.

According to this embodiment, the blades 14 are flexible blades (for example made from spring steel) that are in the resting state (shown in figure 5a) close to one another, which will make it possible to keep the machine 1 in the accommodating space 16 (figure 5b), through the resilient deformation of the blades.

As shown in figure 5a, the blades 14 are in this close position when the machine 1 is in a downward movement D. During this downward movement, the skirt 6 of the machine will come into contact with the blades 14, which, through resilience, will separate to allow the descent of the machine 1 to the platform 9.

The blades 14 thus serve as a shock absorber during the descent of the machine 1.

The profile of the blades 14 is defined such that, once the machine 1 has come into contact with the platform 9 (figure 5b), the blades 14 will return to a position with their ends close together and will bear against the outer surface of the skirt 6 of the machine 1. The stiffness of the blades is chosen so as then to ensure reliable holding of the machine on the platform 9, inside the accommodating space 16.

To release the machine 1 in order to allow it to take off, it is necessary to separate the blades 14.

To that end, the platform 9 is formed by two parts: a fixed part 9a on which the blades 14 are attached and a movable part 9b that receives the machine 1 and that can move relative to the fixed part 9a.

The manipulating means 17 then comprises the movable part 9b of the platform 9 that will be able to come closer to the fixed part 9a (arrow R figure 5c) during a movement releasing the machine.

During this movement R, the cylindrical outer edge 19 of the movable part 9b of the platform 9 bears against an undulation 20 of each blade 14. This bearing causes the resilient separation of the blades 14 and the release of the machine. The blades 14 will return to their initial position (figure 5a) when the movable part 9b has returned to its position separated from the fixed part.

In order to completely define the manipulating means 17, it is therefore simply necessary to define a means making it possible to bring the two parts 9a and 9b of the platform 9 closer together.

In the figures, a mechanical means making it possible to bring the two parts of the platform 9 closer together is shown schematically and as a simple illustrative example. This means comprises a threaded rod 21 secured to the movable part 9b of the platform. This threaded rod 21 is also prohibited from rotating for example by a fixed pin circulating in a slot parallel to the axis 18 of the platform (and of the rod 21), the slot not being shown.

The threaded rod 21 cooperates with a nut 22 that is immobilised in translation by a housing 23 secured to the fixed part 9a of the platform 9. The nut 22 can rotate in its housing 23, its rotation is commanded by an electric motor 24 that causes the nut to pivot owing to a pinion 25 that meshes on a peripheral toothing of the nut 22.

The nut 22 not being able to translate, the rotation of the nut 22 will drive the rotation of the threaded rod 21, therefore of the movable part 9b of the platform 9.

Of course, this exemplary embodiment is in no way limiting. It would for example be possible to secure the threaded rod 21 to

the rod of a linear jack that will then command the translation of the movable part 9b of the platform 9.

Figures 5a to 5c show the approach control camera 11 oriented like in the preceding embodiments along the axis 18 of the platform. This camera will for example be mounted fixed relative to the threaded rod 21.

Figures 6a and 6b schematically show a third embodiment of the invention.

According to this embodiment, the blades 14 are flexible blades and the manipulating means 17 comprises at least one pulling means 26 that is a cable attached to each blade 14 at a point P adjacent to its free end.

Here, there is a cable 26 attached to each blade 14. The device includes, like the previous ones, a number of blades 14 greater than or equal to two and which is advantageously between four and eight. Figure 8 shows, in top view, a device with eight blades.

The cables 26 are all connected to a shared driving means 27 that is shown schematically here by a slide 27. Pulleys 28 see to the return of each cable 26 to orient it toward its blade 14.

The slide 27 can be moved in translation parallel to the axis 18 of the platform (arrows F in figure 6b). The movement can for example be commanded by a linear jack (not shown) to which the slide 27 will be attached.

As shown in figure 6b, when the slide 27 is moved downward (along arrow F), the pulling means 26 deform the blades 14, the free end of which moves away toward the outside (arrows E).

The blades 14 thus go from a first position (shown in figure 6a) in which the blades are not deformed to a second position (shown in figure 6b) in which the blades 14 are resiliently deformed by bending.

Each blade 14 then includes a domed part 14a that is inserted into the accommodating space 16 and bears against the machine 1, thus seeing to its immobilisation relative to the platform 9.

Thus, unlike in the previous embodiments, according to this embodiment, when the free ends of the blades 14 are moved away from one another (figure 6b), the whole machine 1 is held in the accommodating space 16.

Conversely, when the free ends of the blades 14 are brought closer together (figure 6a), the machine is released and can leave the accommodating space.

Of course, as shown in figure 6a, the initial resting position, in which the blades are brought closer to one another and are therefore not bent, is a position in which the blades 14 are, however, all oriented toward the outside of the space 16, here with an angle of about 15° relative to the vertical.

The blades 14 therefore absolutely do not hinder the downward movement of the machine 1 in the space 16. The flexibility of the blades 14 also provides an absorption of the impacts communicated by the machine 1.

It will be noted in the figures that each blade 14 includes a deposit 29 of a conductive material at their part that is intended to contact the machine 1. This deposit 29 cooperates with a complementary conductive deposit 30 that is carried by the skirt 6 of the machine 1.

The conductive deposits 29, 30 are in contact when the slide 27 has been moved downward, therefore in the holding position of the machine 1 in the accommodating space 16 (figure 6b).

It will also be noted that the upper face of the platform 9 includes at least one conductive coating 31 intended to cooperate with a contact 32 carried by the machine 1.

The conductive deposits 29 of the blades 14 as well as the conductive coating 31 of the platform 9 are connected to an electric generator.

At the machine 1, the conductive deposits 30 and the contacts 32 are connected to the batteries of the machine 1.

Thus, when the machine is positioned and immobilised on the platform 9, the recharging of the batteries of the machine 1 can be done.

As a variant, it is possible to implement blades 14 that are made completely from a conductive material, for example a spring steel or a carbon fiber-based composite.

It is clear that conductive deposits on the blades 14 can also be provided in the preceding embodiments (figures 3a to 5c), as well as a conductive coating on the platform 9.

Figures 7a and 7b show an embodiment variant of this third embodiment, this variant differing from the previous one only by the nature of the driving means 27, which here is made in the form of a reeling drum. The drum 27 can be driven in rotation R around the axis 18 of the platform 9 by a motor means, not shown.

All of the cables 26 are attached to the drum 27, which will for example include notches associated with each cable. The rotation R of the drum 27 will simultaneously wind all of the cables 26 on the latter, thus causing the pulling of the ends of the blades 14 and the deformation of the latter (figure 7b).

Here, we have shown only a single drum 27 receiving all of the cables 26. It is possible to provide one reeling drum per cable. The different reeling drums can be coaxial around the axis 18, therefore arranged at equal distances from the several blades.

It is also possible to position each reeling drum on the plate 9, for example in place of the pulleys 28. However, such a solution is more complex and costly.

The invention has been described as applied to the holding and release of a flying machine from a vehicle. It could also be implemented for the holding and release of a land-based rolling machine from a vehicle.

As an example, figures 9a and 9b show a machine 1 that is a robot including wheels 33. The blades 14 are positioned on either side of the platform 9 that is in turn connected to the vehicle by means, not shown, and they are connected to the platform 9 by hinges 15. A manipulating means, not shown (for example of the type of the jacks shown in figure 4) makes it possible to command the pivoting of the blades 14.

The blades 14 define an accommodating space 16 that receives the entire machine 1. The platform 9 here is rectangular and it has two blades 14, each of them being positioned along an edge of the platform 9.

As shown in figure 9b, when the blades 14 are pivoted, they bear against the machine 1 to hold it. To that end, the blades 14 carry, near their end, fingers 34 that press on an upper surface 35 of the machine 1.

The fingers 34 can advantageously carry electric contacts that will make it possible to connect batteries of the machine to an electrical source allowing them to recharge.

Of course, the platform 9 will be positioned near the ground to allow the machine to climb on it. It will be possible to that end to secure the platform 9 to an articulated arm carried by the vehicle and allowing it to come closer to the ground. Patent EP 1,837,234 describes examples of means making it possible to bring a platform carrying a machine close to the ground.

As a variant, here again it is possible to provide more than two blades 14, for example four blades: two on each side of an edge of the platform 9.

Krav

1. Indretning (13) til at holde på og frigøre en fjernstyret maskine (1) fra et køretøj (8), indretningen omfatter en platform (9), der kan bæres af køretøjet, idet indretningen er **kendetegnet ved at** den omfatter mindst to blade (14), der er fastgjort på platformen ved en af deres ender, imellem sig afgrænser bladene et optagerum (16), hvori maskinen (1) er beregnet til at være placeret i sin helhed, optagerummet (16) er sådant, at ved brug af indretningen med maskinen, er hele maskinen (1) indeholdt i optagerummet (16), idet hvert blad er forbundet til et betjeningsmiddel (17), der tillader at sprede bladenes (14) frie ender væk fra hinanden eller bringe dem tættere på hinanden for at holde maskinen inden i optagerummet (16) eller for at frigøre den.

2. Indretning til at holde på og frigøre en fjernstyret maskine ifølge krav 1, **kendetegnet ved at** betjeningsmidlet (17) spreder bladenes (14) frie ender væk fra hinanden for at frigøre maskinen (1).

3. Indretning til at holde på og frigøre en fjernstyret maskine ifølge krav 2, **kendetegnet ved at** bladene (14) er fleksible blade, som i hvile bringes tættere på hinanden for at holde maskinen (1), betjeningsmidlet (17) bevæger knivene (14) væk fra hinanden for at frigøre maskine.

4. Indretning til at holde på og frigøre en fjernstyret maskine ifølge krav 3, **kendetegnet ved at** platformen (9) indbefatter en fast del, hvorpå bladene er fastgjort, og en bevægelig del, der er beregnet til at modtage maskinen og kan bevæge sig i forhold til den faste del, hvor betjeningsmidlet indbefatter platformens bevægelige del, hvis yderkant under en bevægelse deraf forårsager, at bladene elastisk bringes væk fra hinanden.

5. Indretning til at holde på og frigøre en fjernstyret maskine ifølge krav 1, **kendetegnet ved at** bladene (14) er fleksible blade, og betjeningsmidlet (17) indbefatter mindst et trækmiddel (26), der er forbundet til hvert blad (14) i nærheden af dets frie ende, trækmidlet (26) forårsager, når det betjenes,

overgangen fra en første position, i hvilken bladet (14) ikke er deformeret, til en anden position, i hvilken bladet (14) er deformeret ved bøjning, og indbefatter derefter en udbuet del (14a), der lader sig indsætte i optagerummet (16) på en måde, så det kan støde mod maskinen (1).

6. Indretning til at holde på og frigøre en fjernstyret maskine ifølge krav 5, **kendetegnet ved at** trækmidlet (26) indbefatter mindst et kabel, der er fast forbundet med hvert blad (14), den ene ende af kablet er forbundet med et drivmiddel (27).

7. Indretning til at holde på og frigøre en fjernstyret maskine ifølge krav 6, **kendetegnet ved at** drivmidlet (27) indbefatter mindst en opviklingstromle.

8. Indretning til at holde på og frigøre en fjernstyret maskine ifølge krav 7, **kendetegnet ved at** opviklingstromlen eller opviklingstromlerne (27) er koaksiale og arrangeret i lige stor afstand fra de forskellige blade (14).

9. Indretning til at holde på og frigøre en fjernstyret maskine ifølge krav 6, **kendetegnet ved at** drivmidlet (27) indbefatter en ledeskinne, hvortil kablerne (26) er fastgjort, og som kan flytte sig i en retning vinkelret på platformen (9).

10. Indretning til at holde på og frigøre en fjernstyret maskine ifølge et af kravene 1 til 9, **kendetegnet ved at** det inkluderer fra fire til otte blade (14), der er jævnt vinkelfordelt.

11. Indretning til at holde på og frigøre en fjernstyret maskine ifølge et af kravene 1 til 10, **kendetegnet ved at** bladene (14) er ledende, eller er dækket med et ledende materiale (29) med hensyn til deres del, som er beregnet til at komme i kontakt med en supplerende tilslutningsflade (30), der bæres af maskinen (1).

12. Indretning til at holde på og frigøre en fjernstyret maskine ifølge krav 11, **kendetegnet ved at** platformens (9) øverste flade indbefatter mindst en ledende belægning (31), der er beregnet til at samvirke med en kontakt (32), der er båret af maskinen (1).

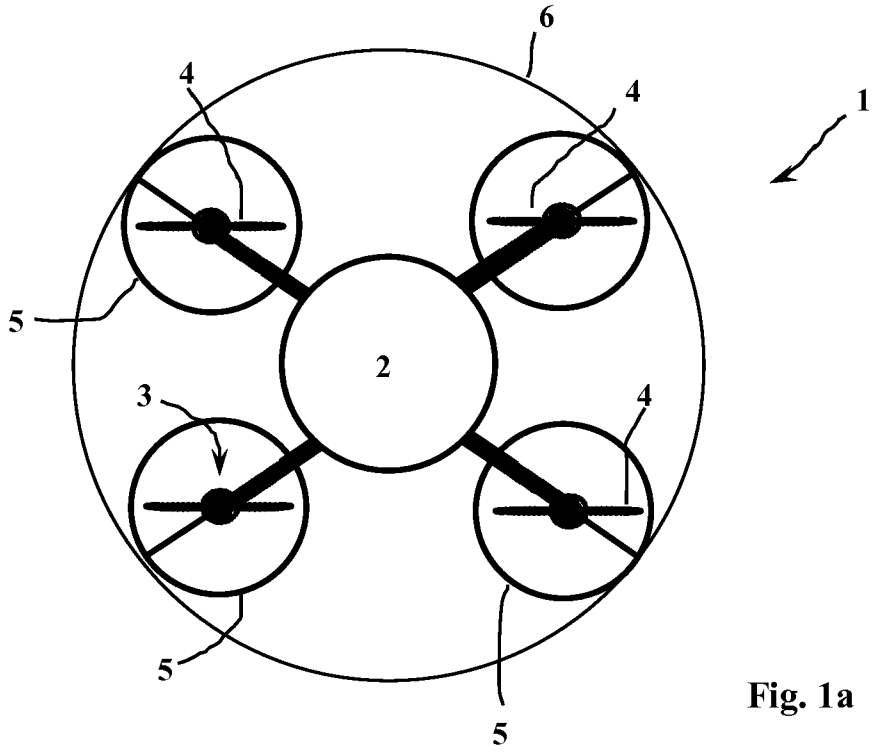


Fig. 1a

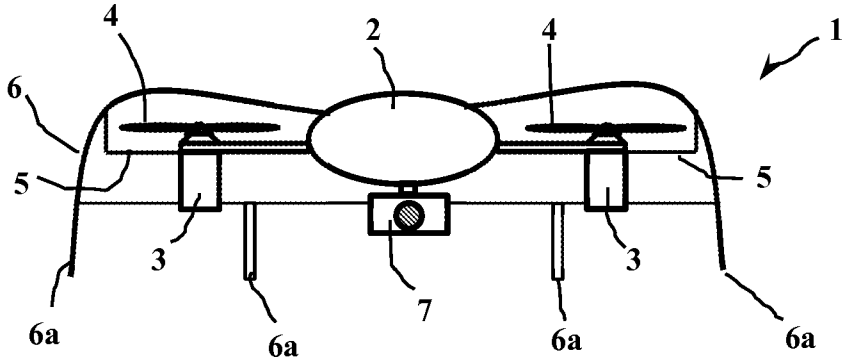


Fig. 1b

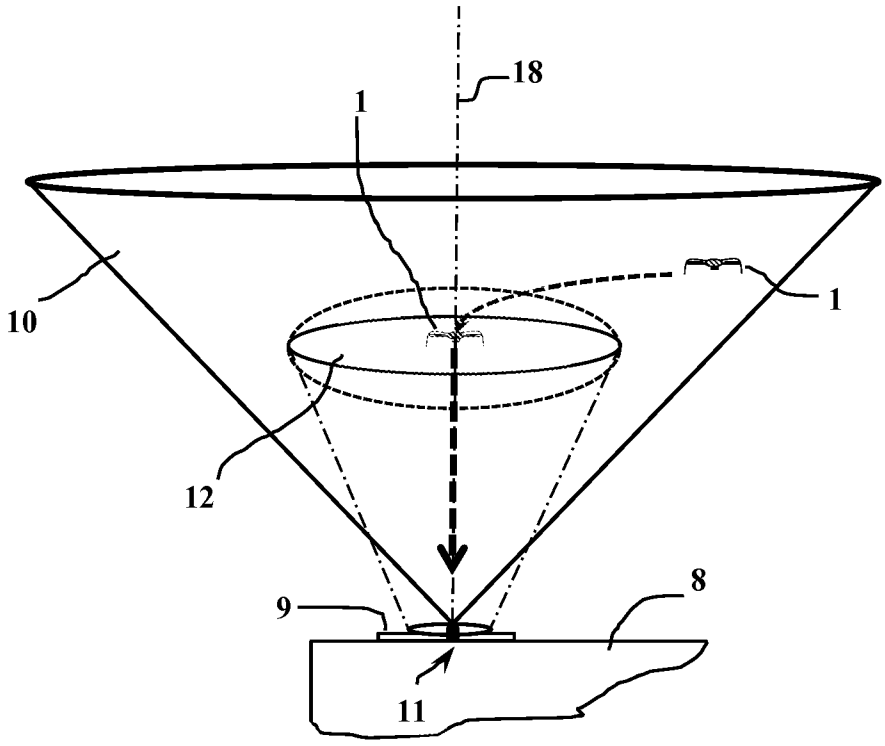


Fig. 2

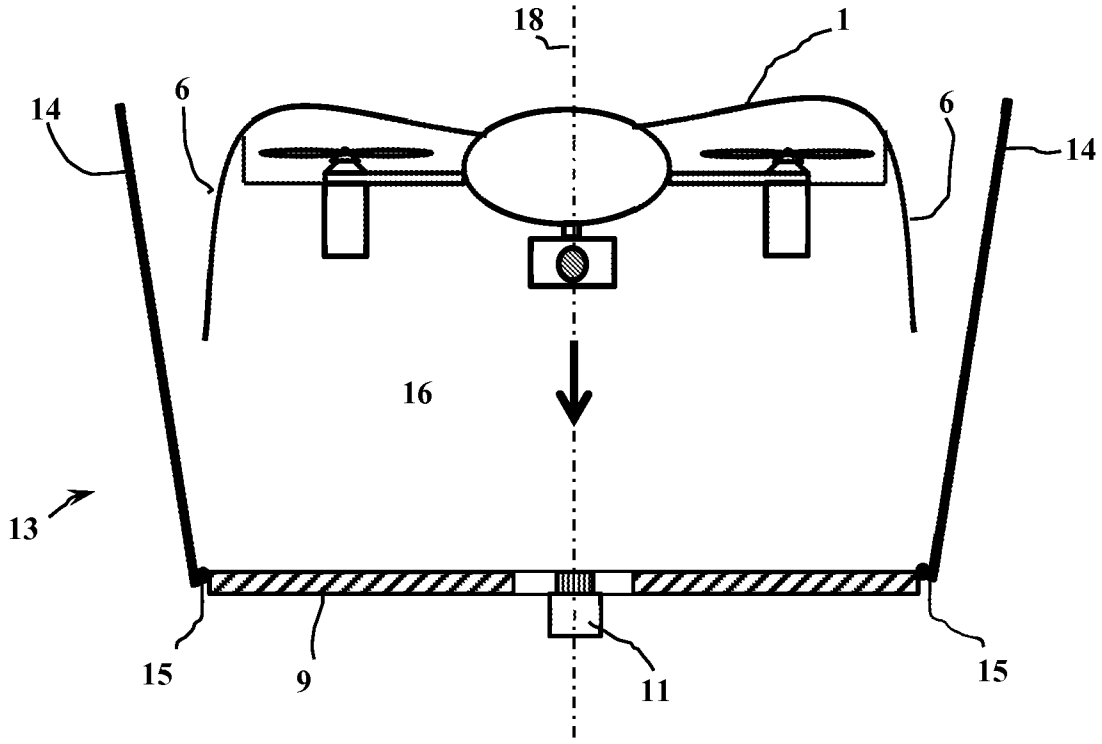


Fig. 3a

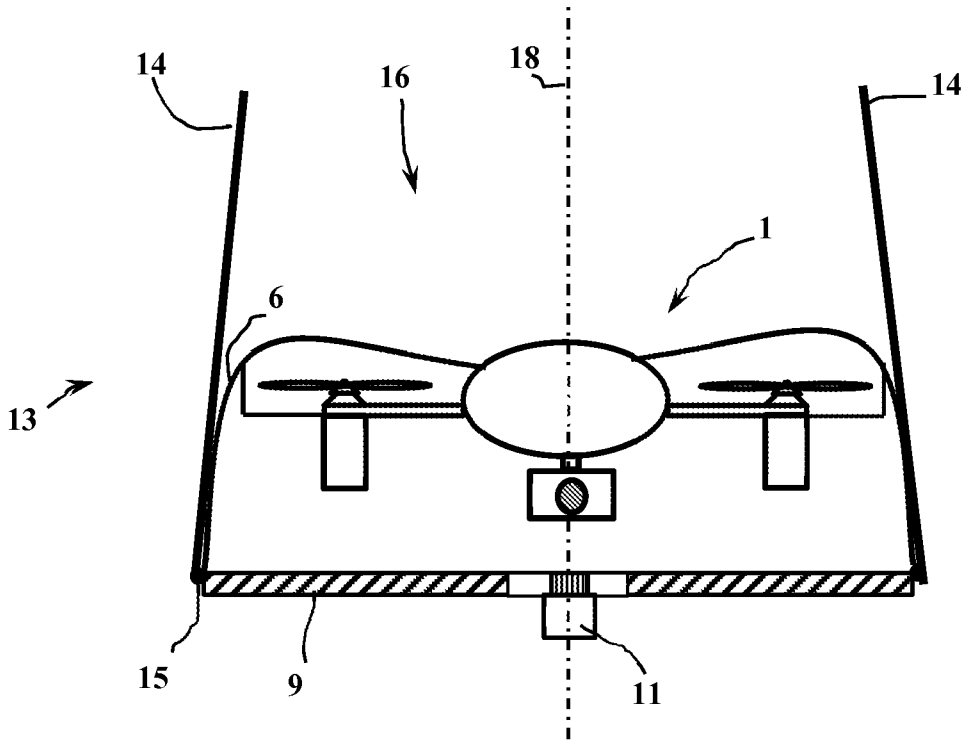


Fig. 3b

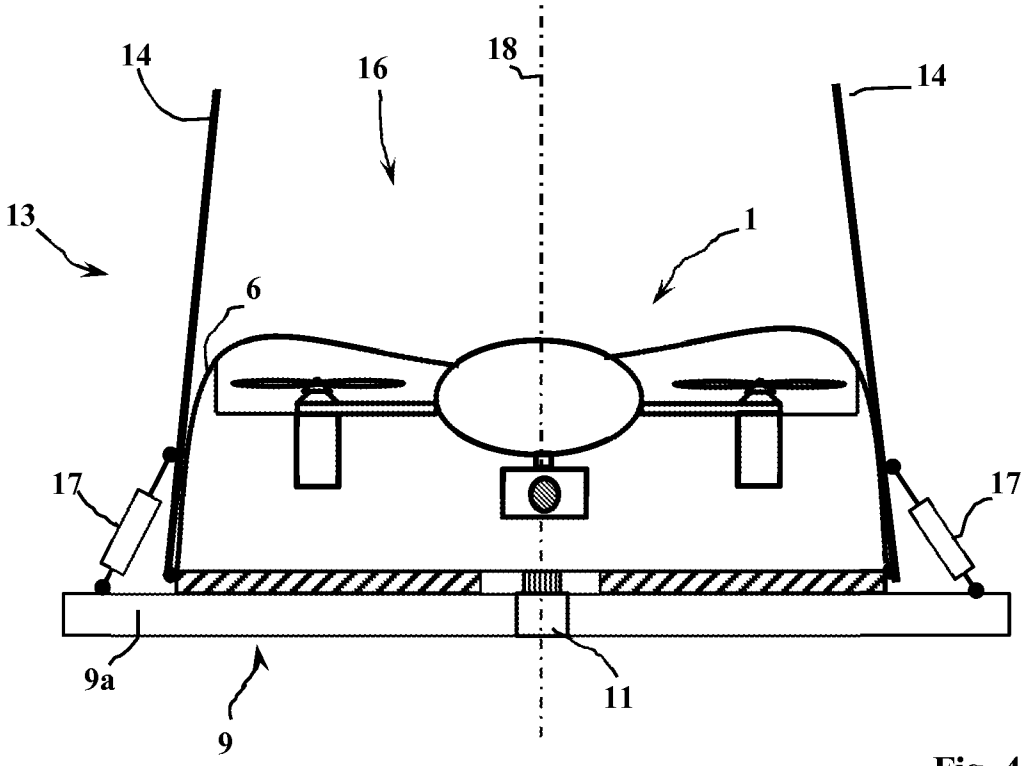


Fig. 4

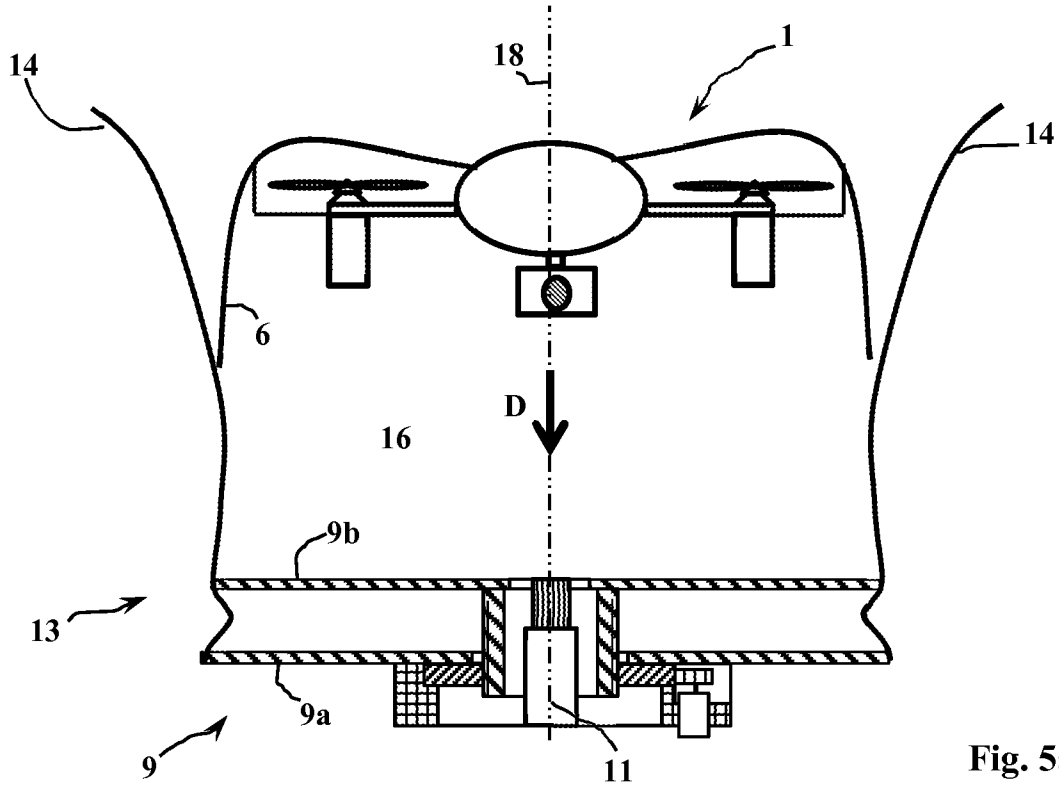


Fig. 5a

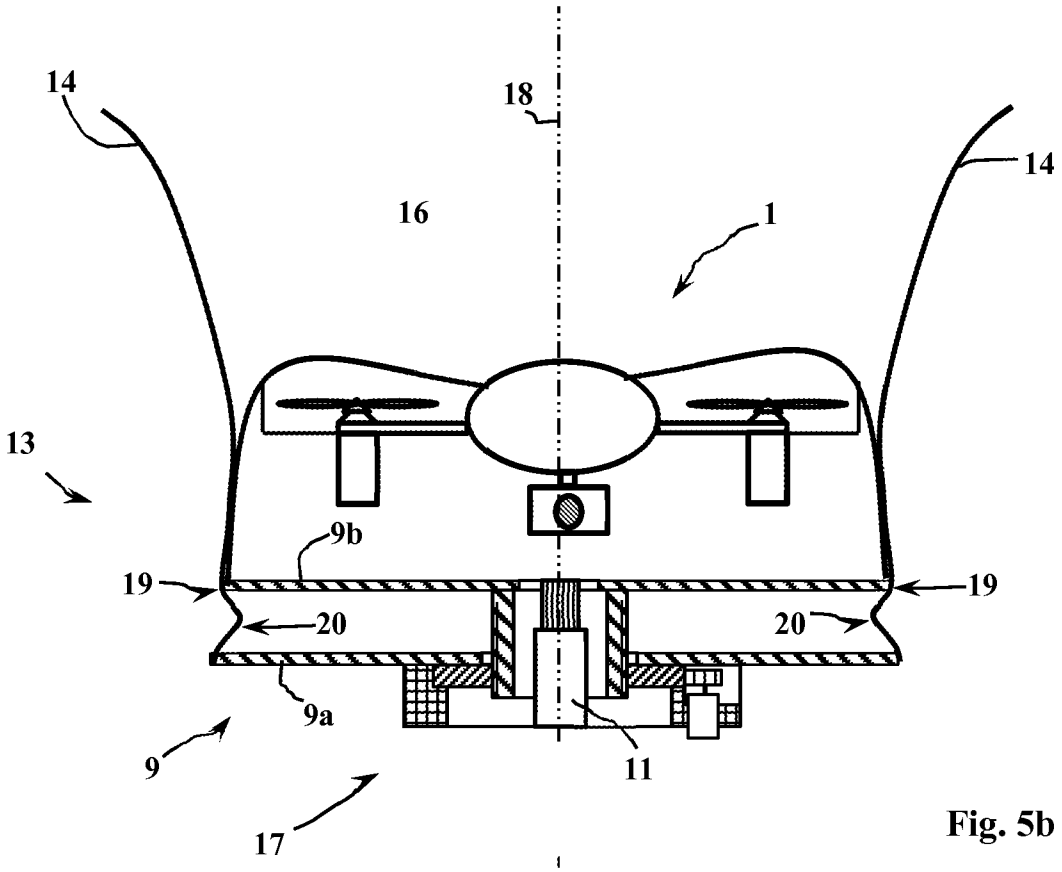
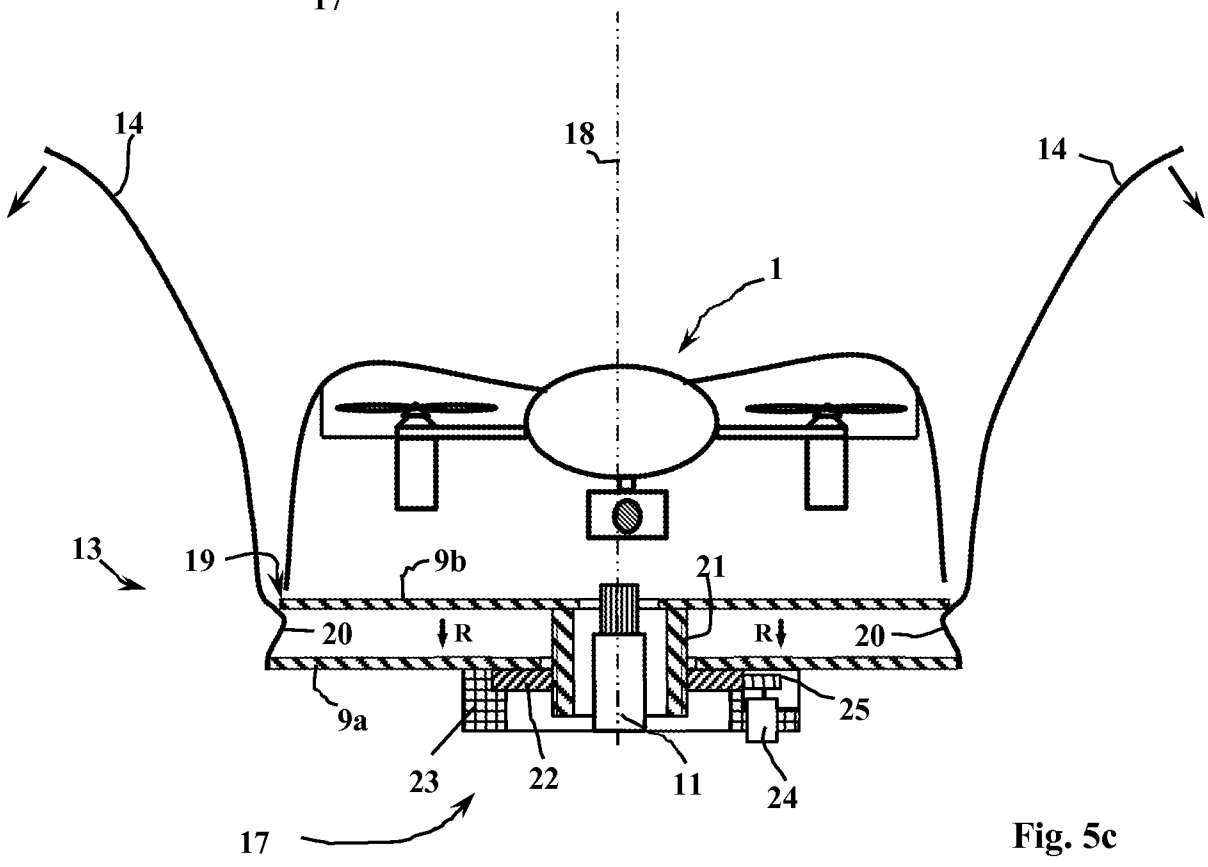

14
18
14
16
1
13
9b
19
19
20
20
9a
9
11
17

Fig. 5b


14
18
14
1
13
19
9b
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R
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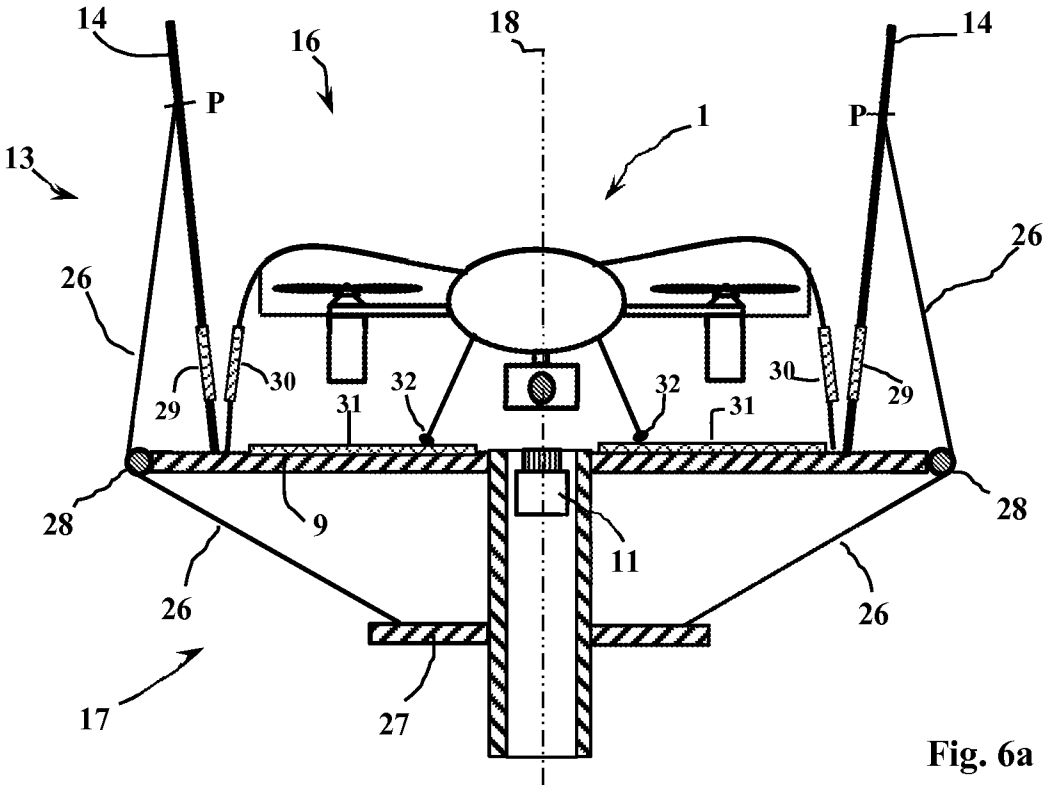
9a
25
23
22
11
24
17

Fig. 5c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P
1
P
13
26
26
29
30
31
32
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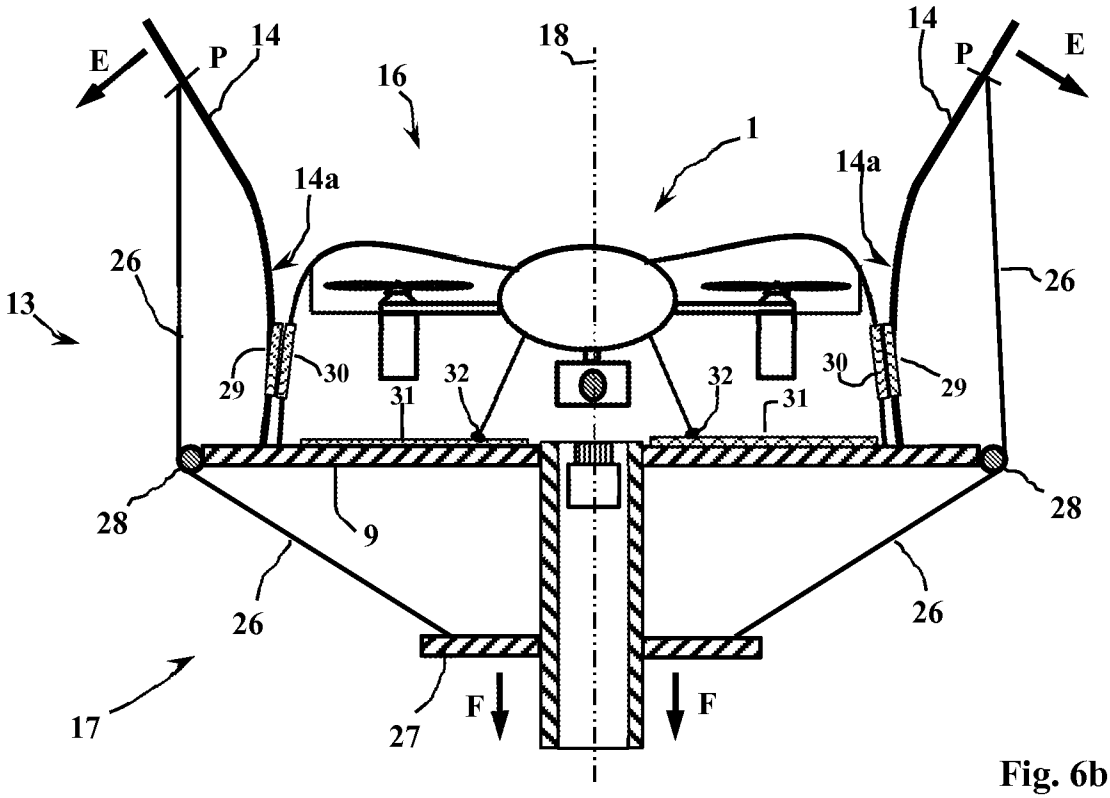
30
29
28
9
11
28
26
26
17
27

Fig. 6a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P
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18
16
14
P
E
1
14a
14a
26
26
13
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9
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26
26
17
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F
F

Fig. 6b

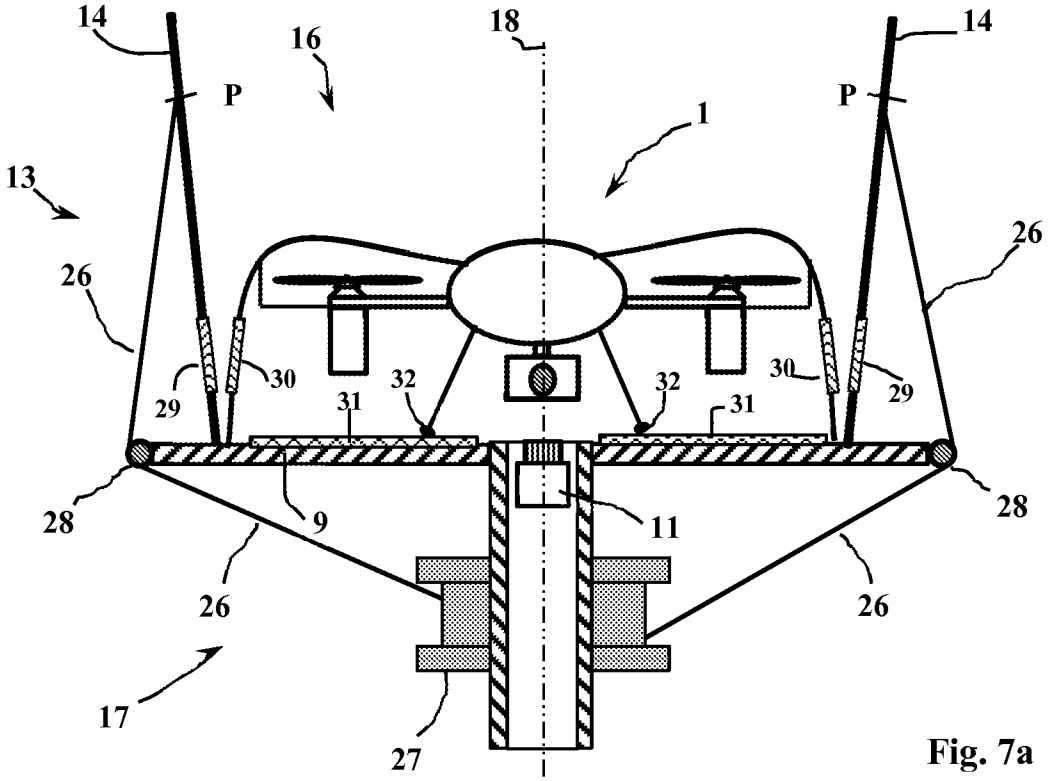
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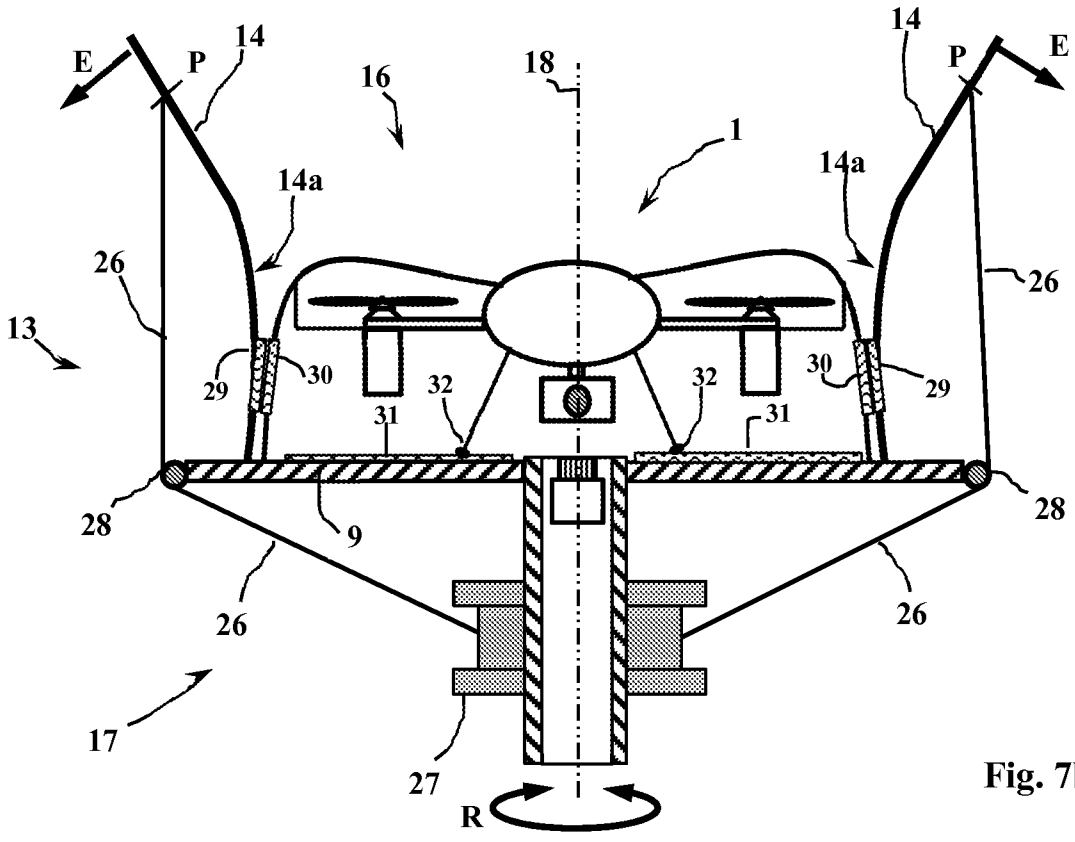
Fig. 7a


E
P
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16
18
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P
E
1
14a
14a
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R

Fig. 7b

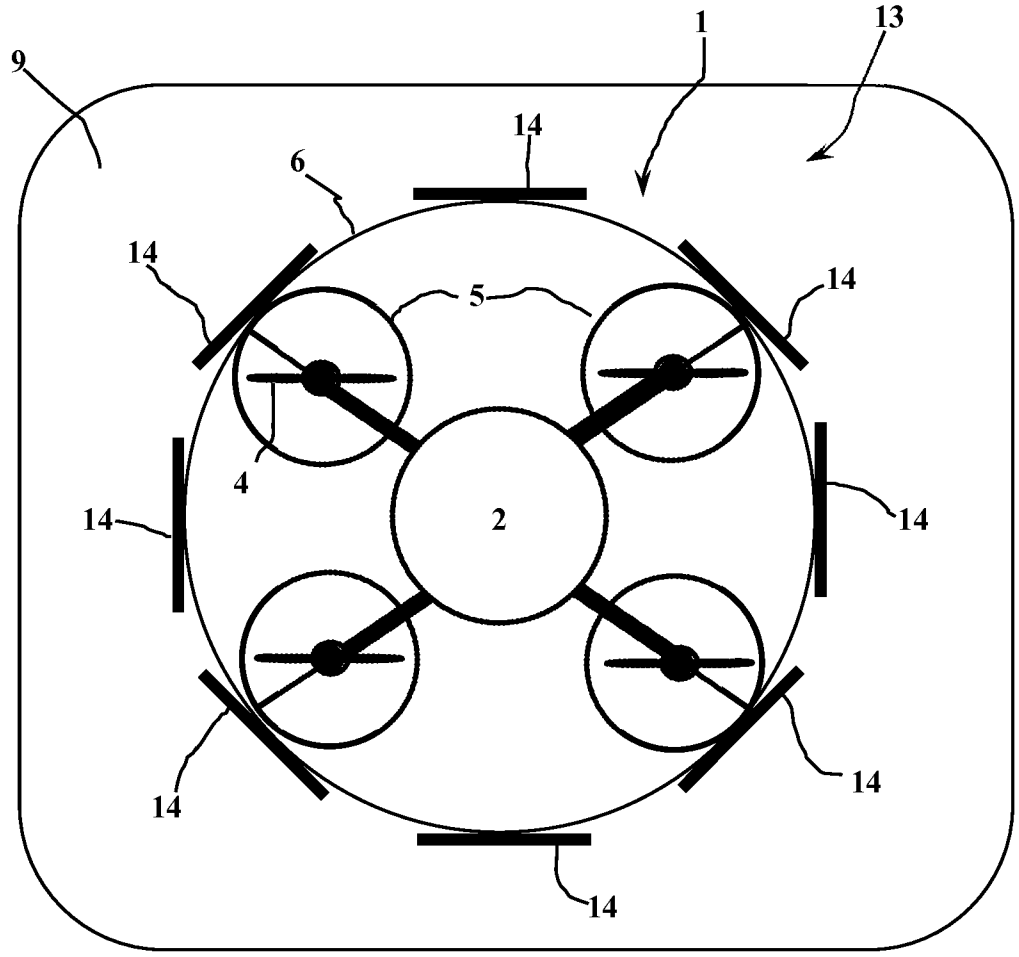

Fig. 8

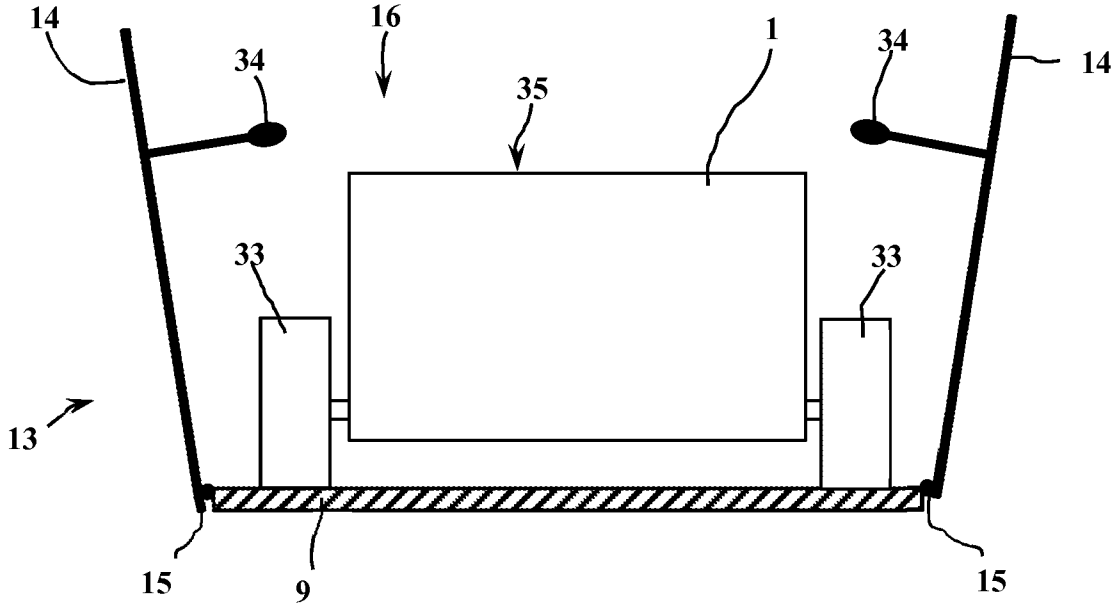

Fig. 9a

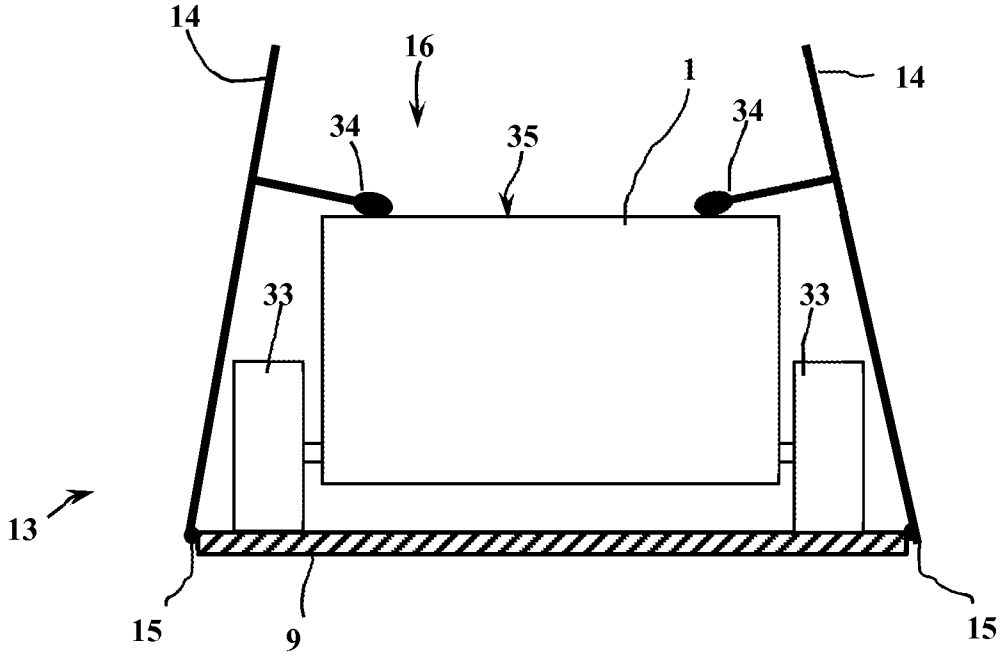

Fig. 9b