March 21, 1939. B. B. SMITH 2,151,395

METHOD AND APPARATUS FOR CARGO LOADING AND DISCHARGING IN FLIGHT

Filed Nov. 23, 1936 2 Sheets-Sheet 1

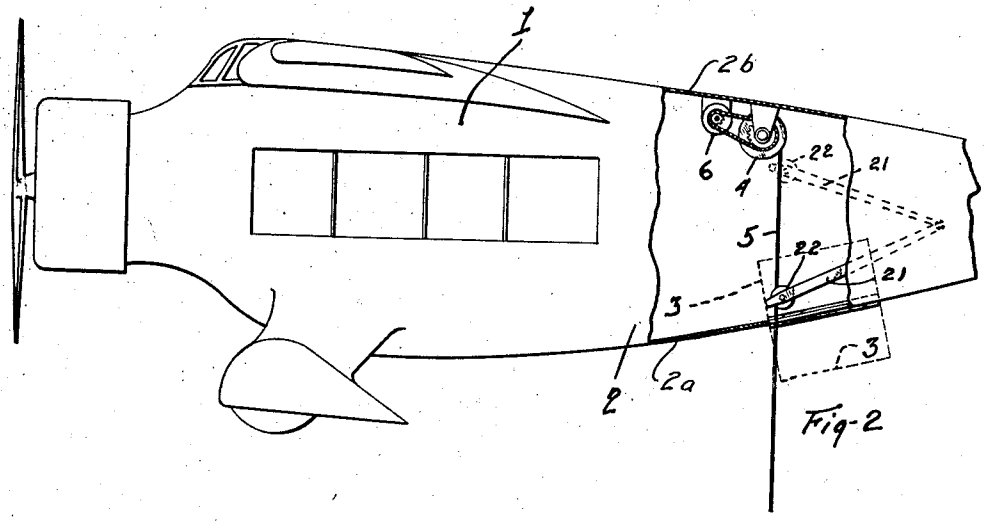


Fig-2

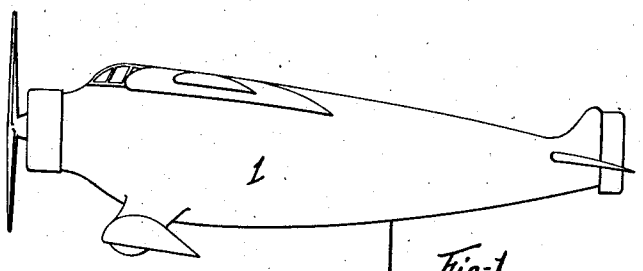


Fig-1

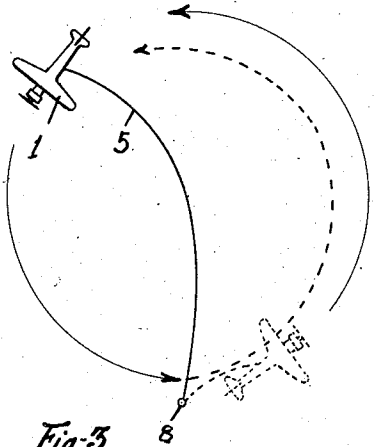


Fig-3

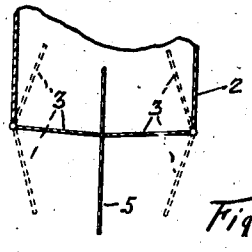
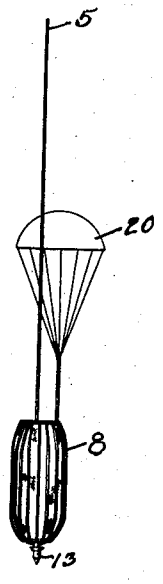
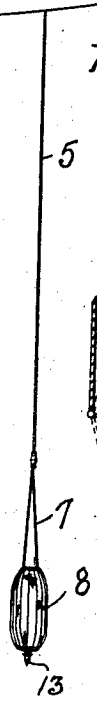


Fig-4





INVENTOR

Bamford B. Smith

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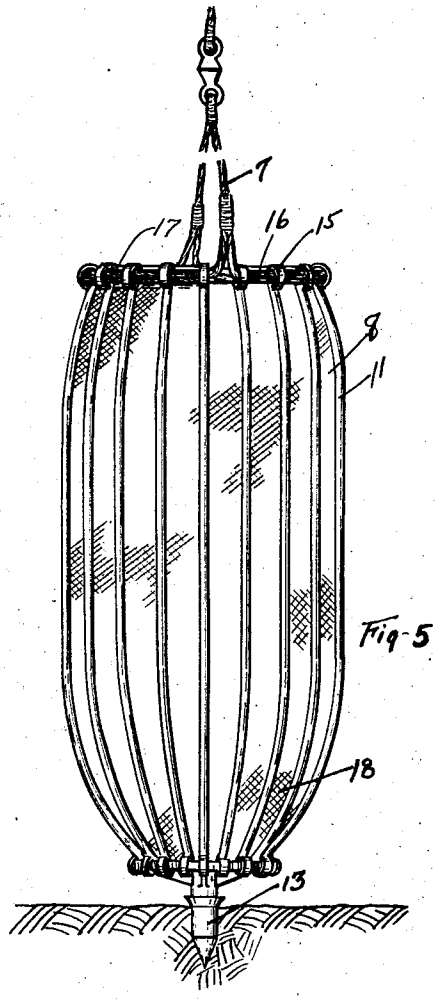


Fig-5

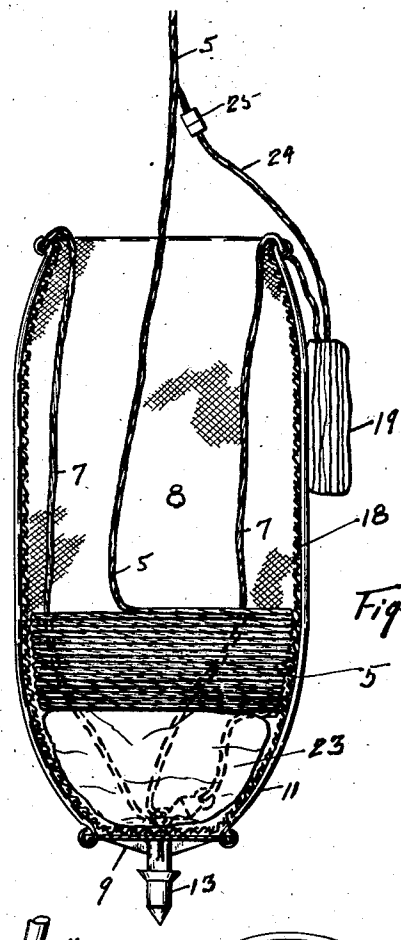


Fig-6

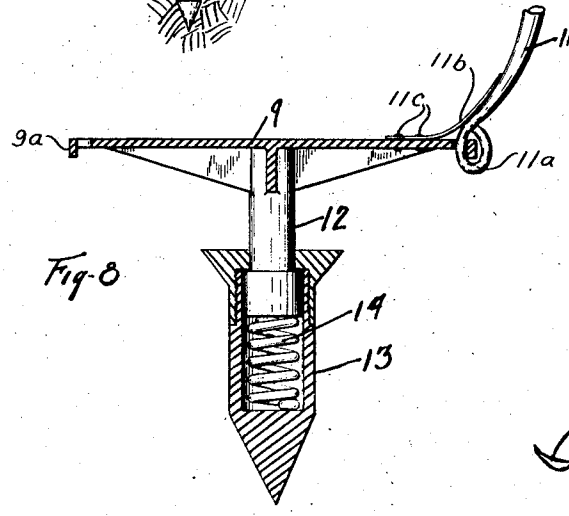


Fig-8

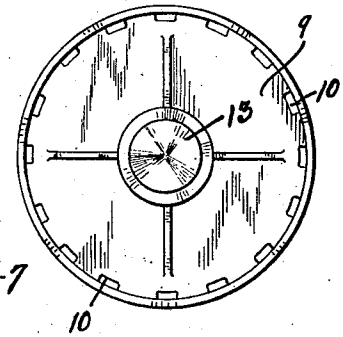


Fig-7

INVENTOR

Beauford B. Smith

Patented Mar. 21, 1939

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR CARGO LOADING AND DISCHARGING IN FLIGHT

Beauford B. Smith, Emigrant Gap, Calif., assignor to A. M. Hinman, Emigrant Gap, Calif.

Application November 23, 1936, Serial No. 112,392

7 Claims. (Cl. 244—137)

My invention relates to airplanes and has for its particular object the provision of means whereby an airplane in flight may lower a tethered hopper to the ground where it becomes fixed, forming the apex of an inverted cone about the base of which the plane continues. While on the ground the hopper may be loaded or unloaded as desired, after which the tether may be reeled in and the hopper taken aboard the plane.

My invention is intended to be of especial use in application to those conditions where physical connection with the ground is essential yet where the terrain is such that landing the plane is impractical or even impossible. It is also intended for use under conditions where contact with the ground is required for only a short interval, as in handling comparatively small amounts of air mail, in which case the contact can be effected in much less time than would be required to land the plane, transfer the material desired and take off again, with the accompanying delays due to taxiing into position for transfer and for taking off.

Another object of my invention is to provide means whereby such a hopper may be permitted to drop quickly from the plane.

Another object of my invention is to provide means whereby the tether may be suitably guided, and held within desired lateral limits with reference to the airplane.

A still further object of my invention is to provide means for maintaining the hopper in an upright position as its drops, and after it has landed.

And a still further object of my invention is the provision of means whereby the shock of landing of the hopper may be reduced.

These and other objects will appear as my invention is more fully hereinafter described in the following specification, illustrated in the accompanying drawings and finally pointed out in the appended claims.

Referring to the drawings:

Fig. 1 is a side elevation of a plane in flight showing the hopper of my device being drawn thereto.

Fig. 2 is a side elevation, partly in section, of a plane embodying my device, and showing the hopper being lowered therefrom.

Fig. 3 is a diagrammatic plan view, to a reduced scale, showing the relation between a plane, incorporating my device, in flight and with the hopper of my device grounded.

Fig. 4 is a fragmentary sectional view, through the floor of a plane, taken adjacent the tether cable of my device.

Fig. 5 is an elevation of the hopper of my device showing it grounded.

Fig. 6 is a sectional elevation of the hopper of my device, showing the disposition therein of the tether cable and the load.

Fig. 7 is an obverse view of the base of the hopper.

Fig. 8 is a fragmentary, sectional elevation of the base of the hopper.

Referring more particularly to the drawings in which like numerals refer to like parts throughout the several views.

I preferably provide a cabin plane 1 having spaced side walls 2, a floor 2A, and a ceiling 2B. A pair of transversely aligned hatch members 3 in the floor 2A are longitudinally hinged upon their remote longitudinal edges, and are adapted to open either inwardly or outwardly, as indicated in Fig. 4, providing an aperture through the floor 2A when thus opened.

A winding drum 4 is affixed to the ceiling 2B and in substantially vertical alignment with the aperture provided by the hatch members 3.

A cable 5, of a length sufficient to reach obliquely from the plane 1 to the ground under the most extreme conditions under which operation of my device is feasible, is fastened at one of its ends to the drum. It is desired that the diameter of the cable 5 be kept as small as possible to reduce the amount of air drag thereupon. Suitable actuating means 6 for rotating and/or braking the winding drum 4 is provided.

A bifurcated bridle 7 is suitably attached to the free end of the cable 5. A hopper 8 is suspended from the bridle 7 as hereinafter described.

I preferably form the hopper 8 with a circular metallic base 9 provided with an integral rim 9A. The base 9 is provided with a plurality of equally spaced apertures 10 adjacent the rim 9A. A plurality of substantially vertically disposed ribs 11, each terminating in a loop 11A, is disposed about the base 9, each of the loops 11A being engaged by an aperture 10. Each of the ribs 11 is outwardly pressed as by a reactance member 11B, which may be suitably secured to the base 9 as by rivets 11C.

The base member 9 is provided with a depending foot 12 affixed thereto. A pointed sleeve 13 is fitted to the foot 12 and is arranged to permit limited axial displacement therewith. A suitable reactance member, as coil spring 14 is provided to maintain the sleeve 13 in a normally extended position.

Each of the ribs 11 is provided, at its remote end, with a loop 15. Cords 16 and 17 extend each through half of these loops and connect with the bifurcations of the bridle 7, thus securing the hopper 8 thereto.

A suitable filler for the spaces between the ribs 11 may be provided as by a fabric lining 18.

In order to assure that the hopper 8 will maintain an upright position in its descent from the

plane, a suitable drag may be provided as by the attachment of a parachute pack 19, in which is packed a parachute 20.

To maintain a transversely centralized alignment of the cable 5, an arm 21, hingedly mounted to the plane at one of its ends and free to swing in a vertical plane between desired limits, is provided with a sheave 22 at its free end over which the cable 5 is trained. When the hopper is within the plane, the arm 21 with the sheave 22 occupies the position shown in dotted outline, and when the hopper is being dropped or retrieved the arm 21 with the sheave 22 occupies the position shown in solid outline.

In use, the hopper 8 is placed upright in the floor 2A of the plane, any load to be lowered is placed within the hopper 8 as at 23, the bridle 7 is dropped within the hopper and a sufficient length of cable 5 is unreeled from the drum 4 and coiled within the hopper as shown in Fig. 6. The length of cable thus disposed should be somewhat in excess of that required to reach from the grounded hopper obliquely to the circling plane above, as the force of the dropping hopper should be expended upon the ground rather than upon the cable 5. In case no load is to be dropped but one is to be retrieved from the ground, the hopper is prepared accordingly.

With the hopper thus prepared and with the parachute 20 arranged in the pack 19, and with a parachute release cord 24 suitably engaged with the cable 5 as through the medium of a friction coupling 25, the hopper is ready to be dropped. When the plane arrives over the area with which contact is to be established, it is put into as tight a circle as practicable, the hatch doors are released downwardly, and the hopper drops clear of the plane. Simultaneously, the arm 21 and the sheave 22 assume their lowered position, holding the cable 5 in proper trim. The hatches 3 may be immediately closed if desired. Upon falling clear of the plane, the hopper continues its descent, the cable 5 paying out from the coil there-within. After a predetermined distance has been travelled, the parachute 20 is pulled from the pack 19 through the medium of the release cord 24, after which the connection between the cord 24 and the cable 5 is severed through the parting of the friction coupling 25.

The hopper continues its descent, held upright by virtue of the drag of the parachute 20. Upon striking the ground, the force of the descent is broken in part by the penetration of the pointed sleeve 13 into the soil and partly through the buffer action of the spring 14.

It is to be noted that the weight of the hopper should be sufficient, when combined with the action of the pointed sleeve 13, to cause it to remain substantially stationary, resisting the tendency of the cable drag to shift it.

The plane continues to travel in a tight circle, while the ground crew removes the load 23 and places any load for the plane in place thereof.

When this has been accomplished, the drum actuating means 6 is energized, causing the drum 4 to rotate and retrieve the cable 5 and the attached hopper 8. As soon as the hopper is sufficiently clear of the ground and any surrounding obstacles as buildings, power lines and the like, the plane may resume its journey, the hopper being retrieved in the meantime. When the hopper contacts the closed doors 3 they can open inwardly. The bridle 7, upon contacting the sheave 22, can carry it upwardly, permitting the hopper to be received within the plane and allowing the hatches 3 to be closed. The hopper may now be again prepared for use as described above.

It will be apparent to and appreciated by those skilled in the art that various modifications and changes may be made in the apparatus disclosed without departing from the spirit or scope of the invention. It is desired therefore that only such limitations shall be placed on the invention as may be imposed by the prior art and the appended claims.

Having thus described my invention, that which I claim as new and wish to secure by Letters Patent is:

1. In a device of the class described, an aircraft, a tether hopper connected to the aircraft and adapted to be dropped therefrom, means attached to the plane for adjusting the length of the tether, means for maintaining the tether in transversely centralized alignment relative to the aircraft, an air drag in parachute form attached to the hopper to maintain it in desired posture during its period of dropping, and a spring pressed, conical foot terminating the hopper.

2. In combination with an aircraft a hopper adapted to drop therefrom, a tether connecting the aircraft with the hopper and mainly wound in said hopper, means attached to the aircraft for retrieving the hopper, and a spring and point buffer means terminating the hopper and adapted to cushion the contact thereof with the ground.

3. In combination with an aircraft, a hopper adapted to be dropped therefrom, a tether connecting the aircraft with the hopper and mainly wound in said hopper, means attached to the aircraft for retrieving the tether and hopper, and parachute means attached to the hopper to maintain it in desired posture during its descent.

4. In combination with an airplane, a hopper, a tether connecting the airplane and the hopper, parachute means attached to the hopper to maintain the hopper in upright position, and means attached to the airplane for recovering the tether and hopper.

5. The herein described method of effecting the transfer of material between an aircraft in flight and the ground consisting in first guiding the aircraft in a closed circuit, then dropping a tethered hopper toward the ground while unwinding the tether from the hopper, then checking the speed of said hopper before it reaches the ground.

6. The herein described method of effecting the transfer of material between an aircraft in flight and the ground consisting in dropping a tethered hopper toward the ground while unwinding the tether from the hopper, then checking the speed of said hopper before it reaches the ground, then guiding the aircraft in a closed circuit about an axis normal to the point of contact of the hopper with the ground.

7. The herein described method of effecting the transfer of material between an aircraft in flight and the ground consisting in dropping a tethered hopper toward the ground while unwinding the tether from the hopper, then checking the speed of said hopper before it reaches the ground, then guiding the aircraft in a closed circuit about an axis normal to the point of contact of the hopper with the ground, and then retrieving the hopper from the ground to the aircraft.

BEAUFORD B. SMITH.