Feb. 26, 1929. 1,703,308

E. JOHNSON

AIRPLANE POWDER DUSTING APPARATUS

Filed Jan. 9, 1926 3 Sheets-Sheet 1

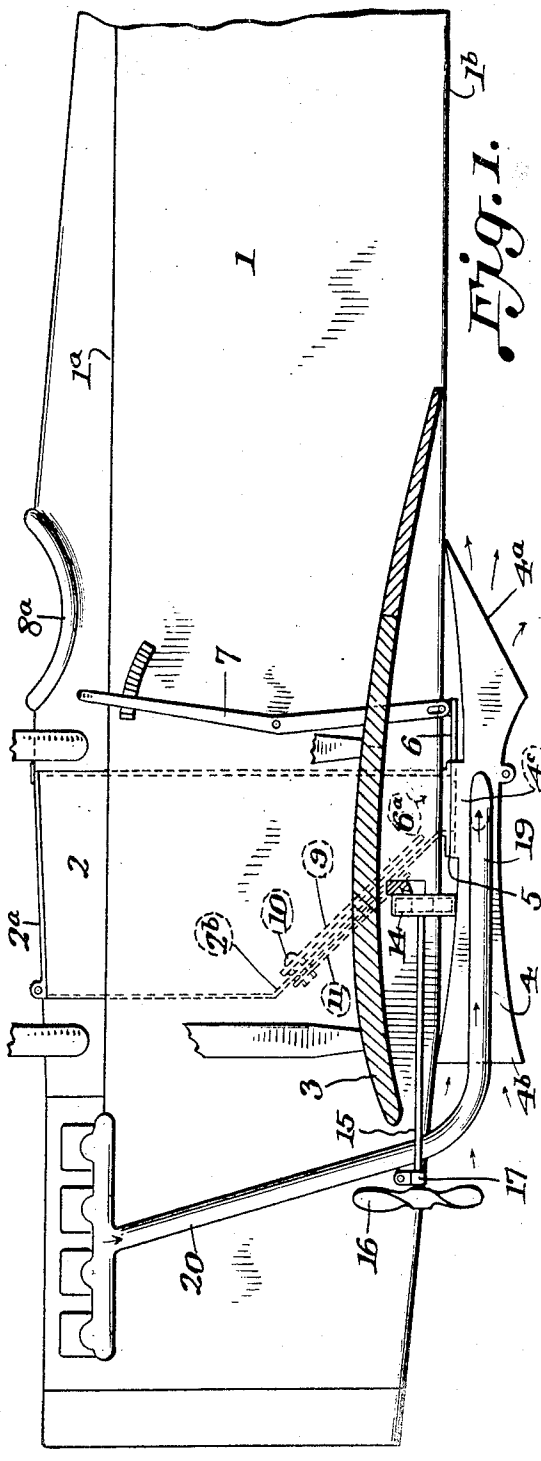


Fig. 1.

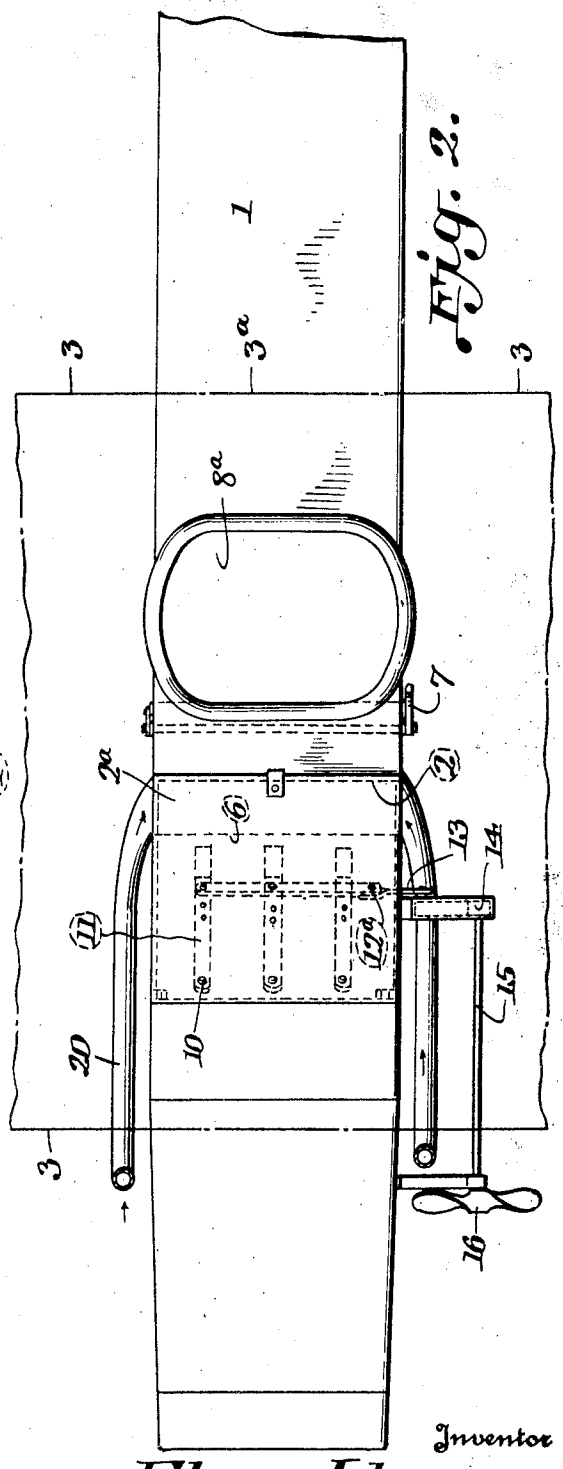


Fig. 2.

Inventor

Elmer Johnson

By R. W. Williams, C. W. Boyd, P. D. Cronin, and A. J. Baker

Attorneys

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E. JOHNSON

AIRPLANE POWDER DUSTING APPARATUS

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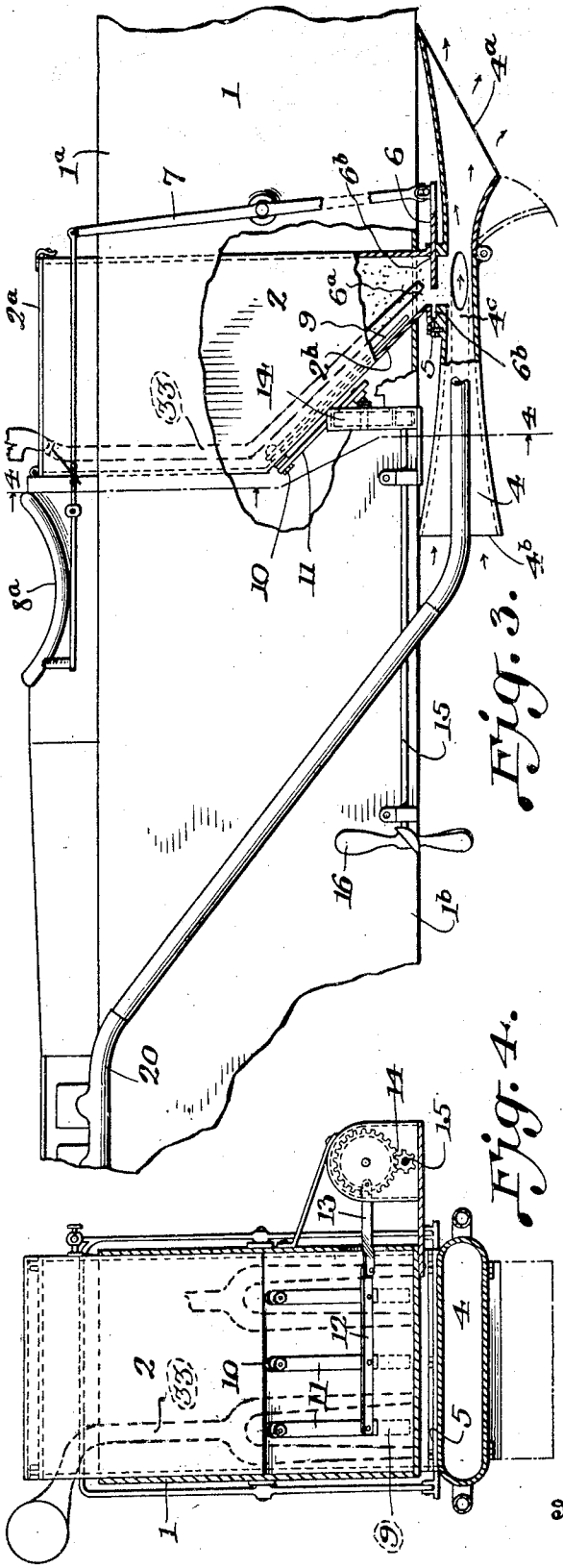


Fig. 3.

Fig. 4.

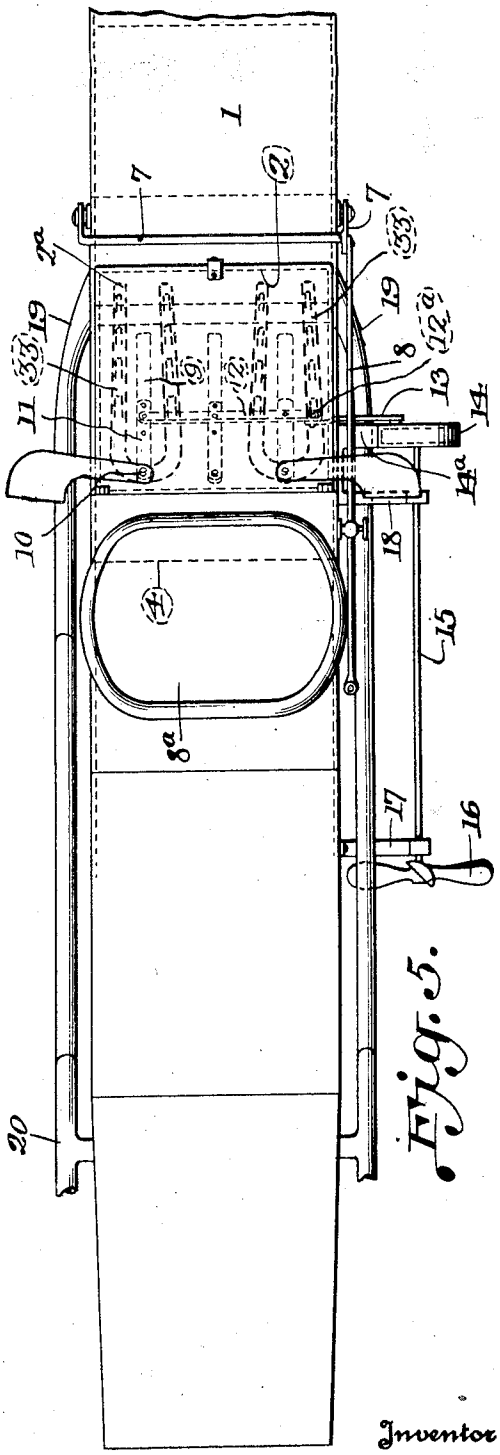


Fig. 5.

Inventor

Elmer Johnson

By R. W. Williams, C. W. Boyle, P. D. Cronin and R. J. Becker

Attorneys

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E. JOHNSON

AIRPLANE POWDER DUSTING APPARATUS

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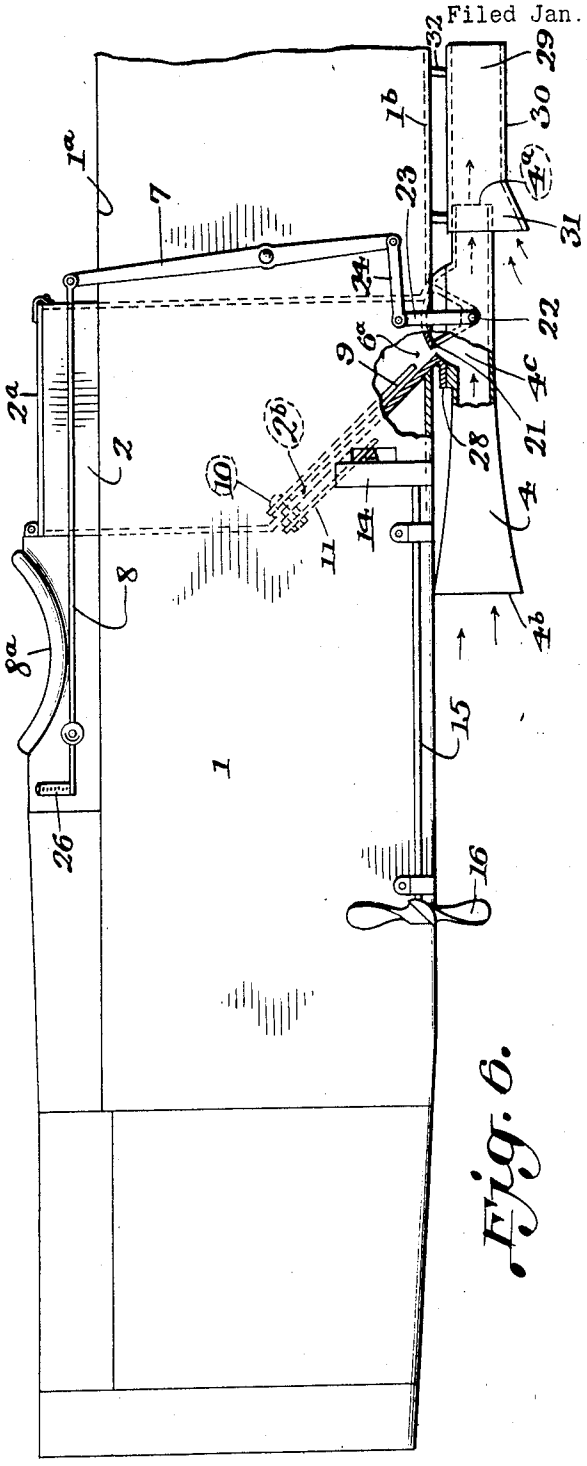


Fig. 6.

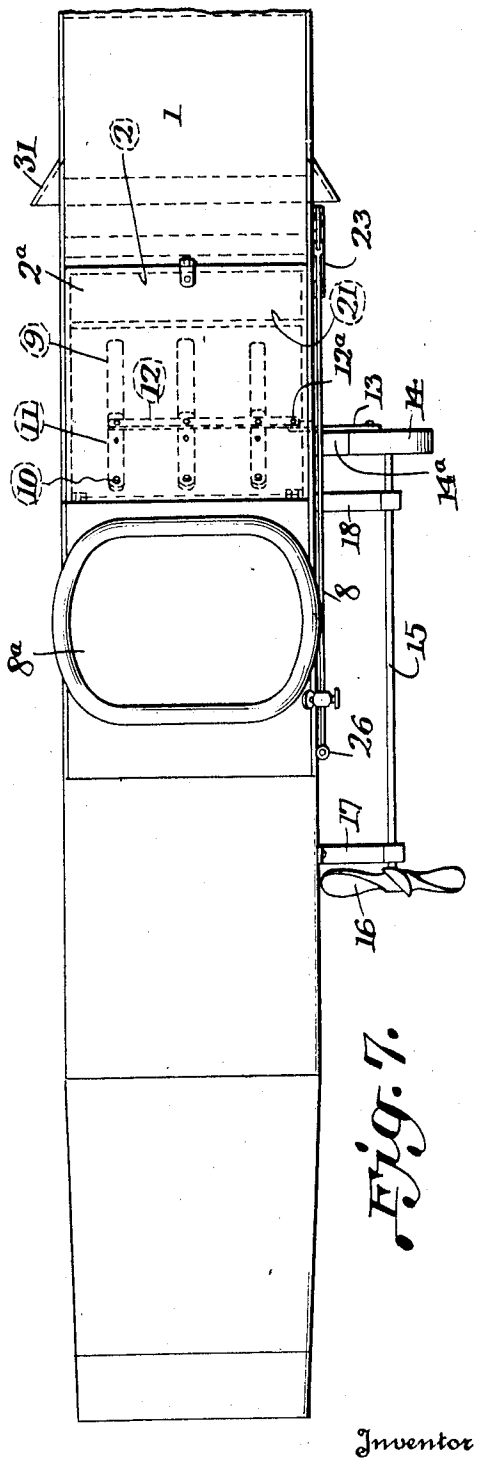


Fig. 7.

Inventor

Elmer Johnson

By R. W. Williams, C. W. Boyle, P. D. Cronin and J. Locke

Attorneys

Patented Feb. 26, 1929. 1,703,308

UNITED STATES PATENT OFFICE.

ELMER JOHNSON, OF WASHINGTON, DISTRICT OF COLUMBIA, DEDICATED, BY ASSIGNMENTS, TO THE GOVERNMENT AND THE PEOPLE OF THE UNITED STATES.

AIRPLANE POWDER-DUSTING APPARATUS.

Application filed January 9, 1926. Serial No. 80,337.

(GRANTED UNDER THE ACT OF MARCH 3, 1883, AS AMENDED APRIL 30, 1928; 370 O. G. 757.)

This application is made under the act of March 3, 1883, chapter 143 (22 Stat. 625) and the invention herein described and claimed may be used by the Government of the United States or any of its officers and employees in the prosecution of work for the Government or by any other person in the United States without payment to me of any royalty thereon.

The principal object of this invention is to provide pneumatically operated powder dusting equpiment for dusting by airplane uniformly and at any desired rate. Another object is to make use of the air current produced by the forward speed of the airplane and the airplane propeller to actuate means for agitating the powder in the hopper and to facilitate the discharge of powder from the hopper. A further object is to make use of the exhaust from the airplane engine so as to give impulse to and assist in the pneumatic ejection, breaking up of lumps and pellets of the powder and the scattering of powder from the hopper.

For the better understanding of this invention the accompanying drawings have been provided, in which—

Fig. 1 is a side elevation of a practical embodiment, a part of the airplane being shown;

Fig. 2 is a plan view of the apparatus illustrated in Fig. 1;

Fig. 3 is a side elevation of a modification of the invention with certain parts broken away;

Fig. 4 is a view taken along the line 4—4 of Fig. 3;

Fig. 5 is a plan view of the apparatus illustrated in Fig. 3;

Fig. 6 is a side elevation showing a modification of the hopper valve and the venturi or air scoop;

Fig. 7 is a plan view of the apparatus illustrated in Fig. 6.

Referring specifically to these figures, it is seen that the numeral 1 designates the fuselage of an airplane which supports the powder dusting apparatus comprising a powder container or dusting hopper 2 equipped with a cover 2^a and an exit opening in the bottom provided with valve 6, means for operating said valve, an air scoop or Venturi tube 4 agitating means in the dusting hopper, mechanism including a propeller for imparting motion thereto adapted to actuate said agitating means, and a pipe for carrying exhaust gases and heat from the airplane engine to the Venturi tube. The upper 1^a and lower longérons 1^b of the fuselage 1 support the hopper 2, which is secured to said longérons in any suitable manner, preferably by brackets, not shown. This hopper contains any dry powder or granular material that is desired to be spread or scattered by airplane. An air scoop or venturi 4 is suitably secured directly below and substantially parallel to the fuselage 1 and under the bottom longérons 1^b, adjacent to and connected with the hopper by means of detachable joint 5 which permits of the ready removal of either the hopper or the venturi or both. The venturi is provided with a wide mouth 4^b for the reception of a draft or current of air from the forward speed of the airplane and the airplane propeller, a throat 4^c connecting with and adapted to receive powder as it is discharged from the exit opening 6^a in the bottom of the hopper and a discharge opening 4^a which serves as a distributor for the powdered material as it is fed from the hopper. This discharge opening 4^a may be straight as shown in Fig. 6 or flared as shown in Figs. 1 and 3 and the flare is adjustable and capable of being widened or deepened at its lower end as shown in Fig. 3 to govern the direction of the flow of the cloud of dust as it issues from the venturi.

The air current that passes through the interior of the venturi has the function of providing suction adapted to facilitate the withdrawal of powder from the discharge opening in the bottom of the hopper, as well as to break up the powder. The hopper is provided with a valve 6 shown partly open, which operates in suitable guides 6^b and regulates the size of the opening in the bottom of the hopper. The position of this valve is regulated through rocking lever 7 at the top of which is affixed handle 8 for rocking said lever from the pilot's cockpit 8^a. The hopper may be either between the wing structures 3 and 3^a of the airplane or elsewhere and in front of or behind the

cockpit as best located to balance the load in the airplane and maintain the proper equilibrium.

A set of swinging levers 9 inside and operating close to the sloping wall 2^b of the hopper, which wall 2^b is inclined toward the exit opening of the hopper, are rigidly fastened to and hinged by pins 10 to a set of rocking levers 11, outside the wall 2^b, said levers 11 connected to reduction gears 14 by bar 12 to give each bar of the swinging levers 11 the same throw, bar 12 being adjustable upwardly and downwardly on levers 11 to control the length of throw of the tips of levers 9. A connecting rod 13 joined to bar 12 by ball joint 12^a is driven by reduction gears 14 through shaft 15 on which is propeller 16 located in a suitable place and manner to rotate when the airplane is in flight. This propeller is rotated by the current of air produced by the movement of the airplane propeller and the forward movement of the airplane. Brackets 17 and 18 carry suitable bearings (not shown) and act as supports for shafts 15. Reduction gearing 14 is supported by means of suitable brackets 14^a fastened to the fuselage 1.

Connected to and having an outlet into the mouth or sides of venturi 4 are tubes 19, an extension of the manifold 20 of the airplane motor. These tubes carry exhaust gases and heat from the exhaust manifold of the airplane engine to the interior of the venturi and serve not only to increase the velocity of the air passing through the venturi but also convey heat to the powder that is withdrawn from the hopper, thereby aiding in the breaking up of pellets or lumps of the powder and resulting in the distribution of a more uniform finely divided mass or cloud of powder. A rocking valve 21, as shown in Figure 6, may be used in the place of slide valve 6 shown in Figures 1 and 3. This rocking valve is shown partly open and is hinged to the venturi 4 by means of shaft 22 allowing the valve to swing through the desired arc. The position of valve 21 is regulated by lever 23 which is rigidly secured at the lower end by bolt 22 connecting bar 24 and rocking lever 7 at the top of which is affixed handle 26 for rocking lever 7. As will be noted the handle of the valve control levers is located adjacent to the pilot's cockpit in the fuselage.

The venturi 4 may be secured to the hopper by any suitable means preferably by a detachable joint 28. Immediately behind the air scoop or venturi, as shown in Figures 6 and 7, which is shortened by having its flared distributing end 4^a removed and overlapping the rear end of said air scoop, is an additional enlarged extension 29 of the venturi flared on its sides 31 and bottom 30 at the front end of the extension where it connects with the venturi. This extension serves to provide an additional current of air to the stream of powder as it passes along the venturi and also discharges the powder toward the rear of the fuselage in such a manner as to prevent the cloud of powder that is formed as it is discharged from the venturi from enveloping the fuselage and interfering with or inconveniencing the pilot and to prevent interference with the proper functioning of the operating parts of the airplane and the dusting apparatus. This extension is suitably secured to the lower longérons of the airplane preferably by means of clamps 32.

While several modifications of the invention have been described above and shown in the drawings, it is to be understood that the embodiments given are merely illustrative of the invention and that within the broad scope of the invention and as defined in the appended claims are included other specific embodiments of the apparatus. It is to be further understood that the relative location in the airplane of the several parts of the dusting apparatus may be changed in any desired particular so long as the proper stability and equilibrum of the airplane are not interfered with.

Furthermore, I do not limit myself to the specific means described and shown of agitating the powder in the hopper, or the valve control means for the hopper, or the utilization of the exhaust from the airplane engine, which exhaust may be discharged directly into the mouth or elsewhere of the air scoop or venturi instead of the side as shown in the drawings and described above.

Furthermore, an alternative method of agitating the powder in the hopper and of pneumatically ejecting the powder from the bottom of the hopper, in addition to or in combination with the pneumatic means afforded for this purpose by the air current passing through the venturi, may be accomplished by air scoops 33 located above the longérons on each side of and connecting with the interior of the hopper. Apparatus of this nature is described in Patent No. 1,459,955 issued to me June 26, 1923.

Furthermore, the valve control means of the hopper may be positioned inside the pilot's cockpit and the fuselage instead of outside as shown and described above. It is obvious that in either position of the valve control means, the valve of the hopper may be opened and closed at will while the airplane is in flight.

I claim:

1. In an airplane, a dusting hopper, means to pneumatically eject and scatter material from the hopper, means to agitate the material in the hopper and a propeller adapted to actuate said agitating means.

2. In an airplane, a dusting hopper hav-

ing an exit opening therein, means to pneumatically scatter material after it passes from said hopper through said exit opening, and means operated by a propeller for causing the agitation of said material in the hopper.

3. In an airplane, a dusting hopper having an exit opening therein, means to pneumatically scatter material after it passes from said hopper through said exit opening, and means operated by a propeller located outside of the hopper for causing the agitation of said material in the hopper.

4. In an airplane, a dusting hopper having an exit opening therein, means for opening and closing said exit while the airplane is in flight, a propeller for driving said airplane and for scattering material passing from said exit, and a second propeller for operating means to cause the agitation of the material in the hopper.

5. In an airplane, a propeller therefor, a dusting hopper having an exit opening therein and having one of its walls inclined, a valve for opening and closing said exit and operable while the airplane is in flight, means under said hopper for conveying a blast of air to scatter the material passing from said hopper, said means being in line with the propeller, and means for causing the agitation of the material in the hopper.

6. In an airplane dusting apparatus, a dusting hopper, means to pneumatically eject and scatter material from said hopper, means to facilitate the removal of the material from said hopper and a propeller adapted to actuate said facilitating means.

7. In a means for distributing substances into the atmosphere, the combination with an aircraft, a receptacle carried thereby and means for removing a substance in said container by suction and discharging it into the atmosphere, said means comprising a Venturi tube with the receptacle opening into the throat of said tube.

8. A distributor for distributing substances from an aircraft, comprising in combination with the aircraft, a hopper mounted thereon, a distributor carried by said aircraft adjacent said hopper to receive the substances from the hopper and distribute them to the atmosphere, an air driven fan on said aircraft, and means operated therefrom for agitating the substances contained in said hopper to loosen the same.

9. In a dusting apparatus, a fuselage, a hopper in front of the pilot, extending from the top of the fuselage to the bottom and adapted to permit the ejection of the contents of the hopper at the bottom thereof in front of the pilot and means to withdraw material from the hopper pneumatically.

10. In combination in an airplane, of a wing structure, a fuselage, a hopper located adjacent the wing structures, means of scattering the material the width of the fuselage and hopper consisting of passageways to convey air adjacent the hopper opening, and means to control the hopper opening from a point adjacent the pilot's cockpit in the fuselage, and a pilot's cockpit, said pilot's cockpit being located so that the pilot is back of the wing structure, but can see beneath the wing structure and over the fuselage.

11. In an airplane to be used for dusting purposes, consisting of a fuselage, upper and lower wing surfaces, an engine forward of said surfaces, a hopper in the fuselage between the surfaces and a pilot's cockpit to the rear of said surfaces, an entrance opening to the hopper to the rear of the wing surfaces at the top of the fuselage and an exit opening in the hopper adjacent the rear of the wing surfaces and below the fuselage.

12. In an airplane, a dusting hopper in front of the pilot and extending from near the top of the fuselage to near the bottom thereof, and means for pneumatically scattering material passing from said hopper.

13. In an airplane, a dusting hopper located in front of the pilot, and a Venturi tube for said hopper from which the material passing from said hopper is pneumatically scattered, said Venturi tube being parallel and adjacent to the bottom of the fuselage.

14. In an airplane, a dusting hopper located in front of the pilot, and a Venturi tube therefor provided with a wide mouth to receive air for scattering the material passing into the Venturi tube from the hopper.

15. In an airplane, a dusting hopper located in front of the pilot and adjacent the center of gravity of the airplane so that the scattering of material from said hopper will not affect the equilibrium of the airplane, and means for scattering the material after it passes from said hopper.

16. In an airplane, a dusting hopper located in front of the pilot and extending to a point near the bottom of the fuselage, and a Venturi tube below the hopper and adapted to receive material from said hopper, said Venturi tube having an opening at one end thereof in front of the pilot for the reception of air and having another opening in the other end thereof from which the material passing from the hopper into the Venturi tube is ejected and scattered by the air passing therethrough.

17. In an airplane dusting apparatus, a dusting hopper, means to pneumatically eject and scatter material from the hopper, means within the hopper to agitate said material and a propeller adapted to actuate said agitating means.

ELMER JOHNSON.