June 12, 1928. 1,673,087

A. L. MORSE

DUSTING APPARATUS FOR AIRCRAFT

Filed Sept. 14, 1926 2 Sheets-Sheet 1

Fig. 1.

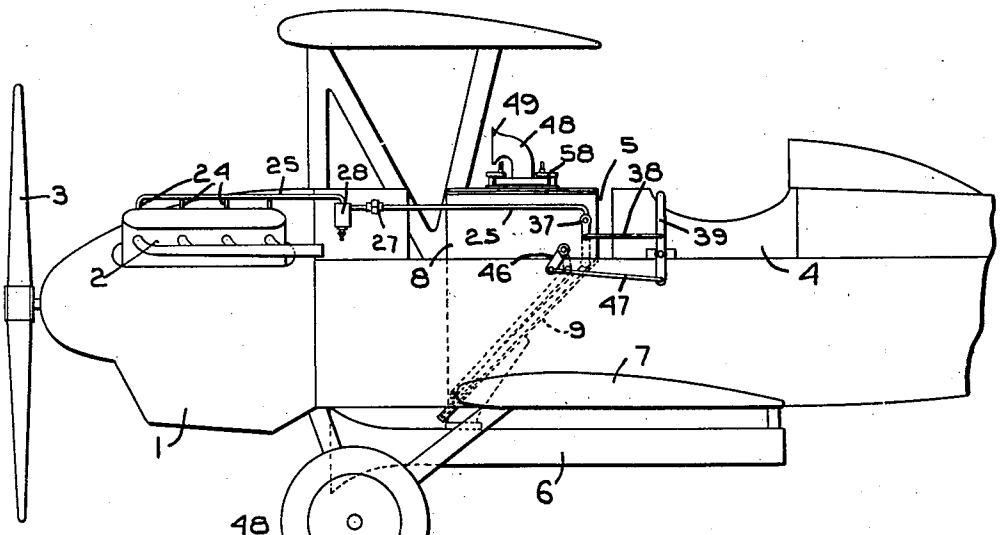


Fig. 2.

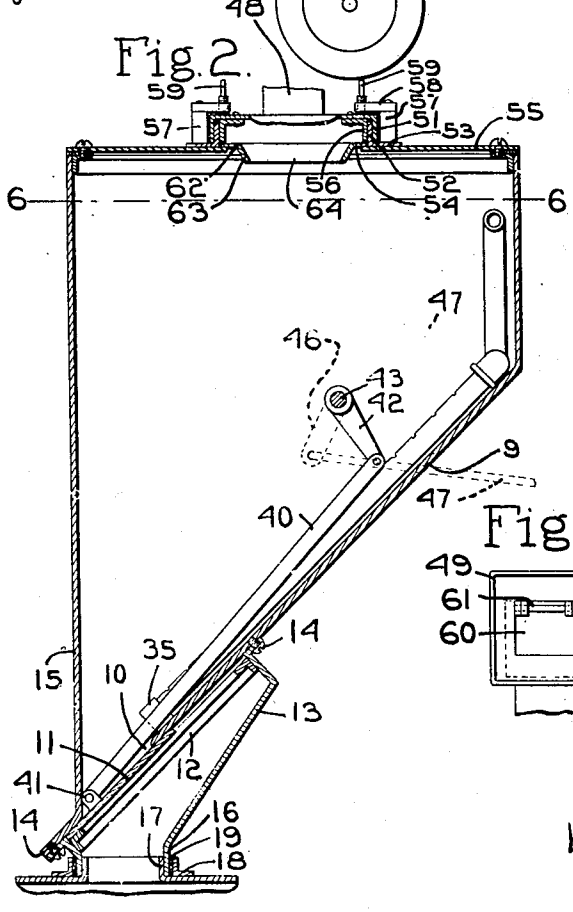


Fig. 3.

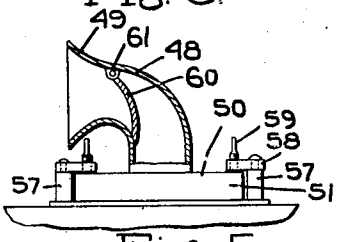


Fig. 5.

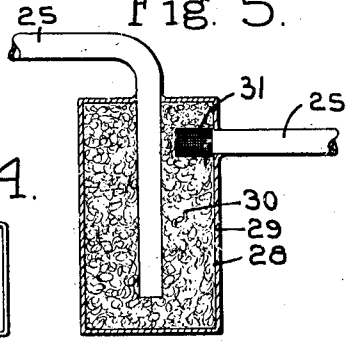


Fig. 4.

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Fig 6.

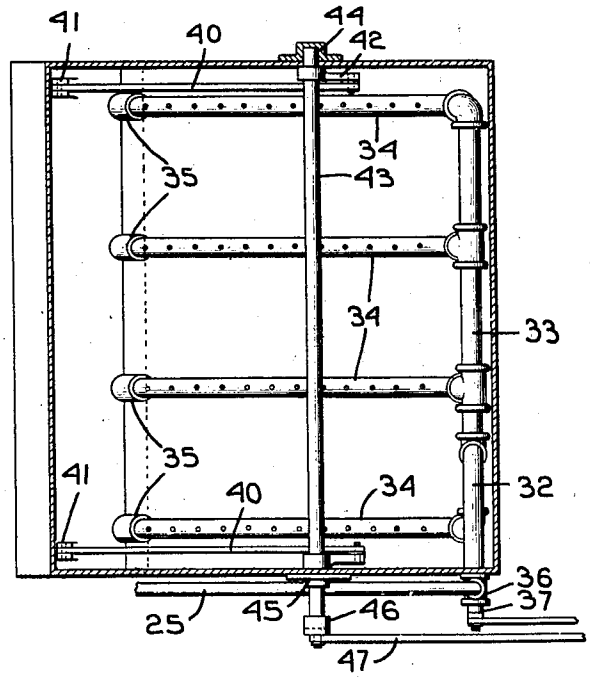


Fig. 7.

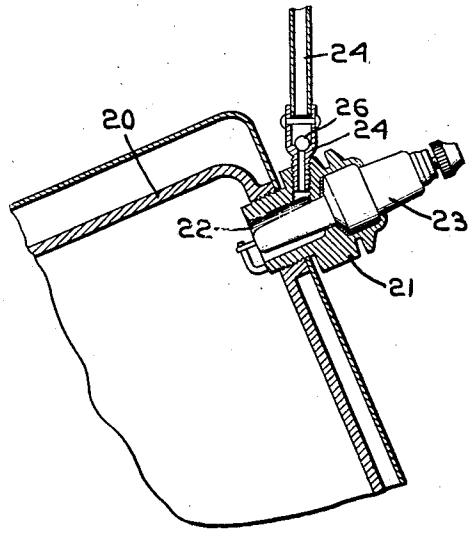


Fig. 8.

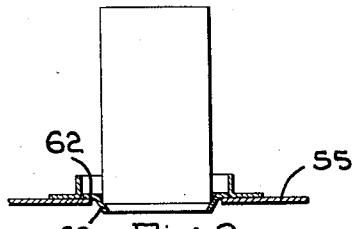
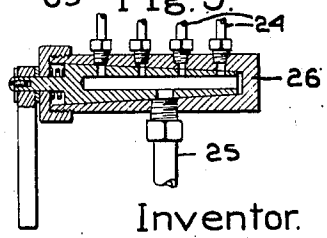


Fig. 9.



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UNITED STATES PATENT OFFICE.

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DUSTING APPARATUS FOR AIRCRAFT.

Application filed September 14, 1926. Serial No. 135,300.

This invention relates to improvements in dusting apparatus for air craft and the principal object thereof is to provide novel means for agitating the material in the dust-containing hopper by gases under pressure delivered from the motor.

A further object of the invention is to provide means for filtering the gases which are delivered from the motor to the hopper.

A further object of the invention is to provide means for introducing air under pressure into the hopper upon the material contained therein to aid in the discharge of the material from the hopper which heretofore has been mainly produced by the suction of the current of air passing through the distributor with which the outlet of the hopper communicates.

A further object of the invention is to provide novel mechanism for facilitating the filling of the hopper from usual dust-containing cartons or cans.

A further object of the invention is to provide a novel construction by means of which the hopper can be readily installed within, and removed from, the usual front cockpit of an aeroplane.

Other objects and features of the invention will more fully appear from the following description and the accompanying drawings and will be particularly pointed out in the claims.

A preferred embodiment of the invention is illustrated herein as applied to an aeroplane of the usual type having front and rear cockpits, but it will be understood that the invention in its broad sense may be employed in any form of air craft having dust-scattering mechanism to which it may be adapted.

The invention as illustrated herein comprises certain improvements upon the dusting mechanism disclosed in my prior application No. 25,721 filed April 24, 1925 for powder distributing apparatus, and is adapted to be used either in conjunction with the distributing mechanism therein disclosed, or usual types of distributing mechanism in which the material is scattered by a suitably directed stream of air beneath the fuselage, body or wings of the air craft.

In the drawings:

Fig. 1 is a diagrammatic view of an aeroplane with the dusting apparatus embodying the present invention installed therein;

Fig. 2 is a central vertical section of a preferred form of hopper construction embodying the invention;

Fig. 3 is a detail view, partly in vertical section, of funnel mechanism for introducing air under pressure into the hopper;

Fig. 4 is a front elevation of the funnel shown in Fig. 3;

Fig. 5 is a view, mainly in vertical section, of a device for purifying the gases delivered from the motor into the material in the hopper;

Fig. 6 is a sectional view of the hopper on line 6—6 Fig. 2, viewed from the top;

Fig. 7 is a detail sectional view of a portion of one of the motor cylinders showing a chambered spark plug with a portion of the conduit leading therefrom to the hopper.

Fig. 8 is a detail sectional view showing the filling device for the hopper.

Fig. 9 is a longitudinal sectional view of a shut-off cock adapted to be interposed intermediate of the pipes leading from the engine cylinders and a conduit to the hopper operable to establish or shut off communication therebetween.

The preferred embodiment of the invention is illustrated herein as applied to an aeroplane of the usual type having a body or fuselage 1, and provided with a motor of the conventional V type, the left hand bank 2 of the cylinders of which is illustrated. The propeller 3, which is driven by the motor, is located at the front end of the body. The fuselage has the usual cockpit 4 for the pilot and also is provided with a front cockpit 5 in which the hopper of the dusting apparatus is located. A suitable distributor 6, preferably is detachably secured below the fuselage 1 and lower wing 7 and may be provided with a restricted throat portion and a rearwardly elongated discharge exit so constructed as to provide a venturi action as disclosed in my prior application aforesaid.

The hopper 8 is of general rectangular form in horizontal cross section and of such dimensions as properly to fit within the front cockpit of the aeroplane. It preferably is provided with a downwardly sloping bottom 9 having at its lower end an outlet 10 provided with a suitable valve for controlling the discharge of the dusting material. In the preferred embodiment of the invention illustrated, (see Fig. 2), the valve is in the form of a flat plate 11 which is slidably mounted upon suitable guides 12

of angle iron which are secured to a sheet metal valve casing 13 which is detachably connected by screws or bolts 14 to the bottom of the hopper. In the construction shown the lower end of the front wall 15 is bent forwardly into the plane of the bottom of the hopper and certain of the screws or bolts 14 connect the valve casing to this bent portion of the wall 15.

The outlet of the sheet metal valve casing is provided with a downwardly extending wall of rectangular form extending the full width of the hopper which fits within a surrounding wall 18 of angle iron which is secured to the distributor. A suitable packing 19 of felt or other material serves to form a tight joint. By reason of this construction an easily separable union is produced which will permit the removal of the hopper, but will prevent the escape of dust in its passage from the hopper to the distributor.

In the device disclosed in my prior application above mentioned, means are provided for agitating the material in the hopper comprising a mechanical agitator and a compressor both of which are actuated by a fan motor, the air from the compressor being introduced into the material at the bottom of the hopper through a series of pipes.

One of the principal features of the present invention relates to a simplified mechanism for agitating the material in the hopper. This is accomplished in the present invention by introducing gases under pressure from the motor into the material in the hopper. Any suitable means may be provided for accomplishing this purpose. In the preferred embodiment of the invention illustrated herein one or more, but preferably each, of the cylinders 20 of the motor is provided with a spark plug 21 having a chamber 22 communicating with the cylinder. This chamber is formed between the metallic spark plug casing and the inner end portion of the porcelain member 23 of the spark plug. A nipple having a screw-threaded connection with the wall of the metallic casing of the spark plug communicates with the chamber 22 thereof and with a pipe 24 which leads to a conduit 25. The conduit 25 extends to the distributing hopper where it communicates with a header for a series of delivery pipes which are located in the bottom of the hopper so that the hot gases from the engine project upwardly through the material in the hopper and serve both to agitate the material and to fluff it up. A check valve which, as shown, is in the form of a ball check in the nipple permits the gases from the cylinder to pass into the pipe 24, but prevents the return of gases or air into the cylinder during the suction stroke of the piston. The conduit 25 may communicate with pipes 24 connected to the spark plug casings of any or all of the cylinders of one or both banks of the motor. The conduit 25 desirably is formed in sections which are connected together by a detachable coupling 27 adapted to be easily released when it is desired to remove the hopper from the aeroplane. Desirably a shut-off cock 26 such as that illustrated in Fig. 9 is interposed between the pipes 24 and the conduit 25. This shut-off cock 26 is of the plug valve type, pipes 24 being connected by nipples with ports in one side of the casing, while the conduit 25 communicates with a single larger port in the opposite side of the casing. The plug valve is hollow and is of conical form and provided with ports arranged to communicate with the ports of the pipes 24 and also with the port of the conduit 25. The plug valve is held firmly in place by a spring interposed between the shoulder end of the plug and a cap on the end of the casing. The plug has a stem which passes through the cap and is engaged by a suitable operating handle. The ports in the plug valve may be of different length in the direction of the circumference of the valve so that the valve may be rotated different distances to cut into operation any desired number of cylinders, and the valve, if rotated sufficiently, may be caused to cut off communication of all the cylinders with the conduit.

In the simpler construction illustrated in Fig. 1, all of the pipes 24 communicate with the conduit 25. Desirably means are provided for purifying the gases which pass from the engine cylinder into the material of the hopper to prevent the transmission of dust, oil, or other foreign matter into the materail in the hopper. A preferred form of air purifying device, which is illustrated herein, comprises a filter 28 having a closed casing 29 containing a suitable filtering material 30, preferably of a fibrous nature, such as steel wool, or cotton waste. The section of the conduit 25, which leads from the cylinder, extends through the top of the filter casing, preferably nearly to the bottom of the filtering material. The section of the conduit 25, leading from the filter, projects into the casing near the upper end thereof, and desirably is provided with a wire screen 31 to prevent the filtering material from blowing through. The conduit 25 communicates with a pipe 32 leading to a header 33 having branches 34 which, as shown herein, extend longitudinally of and in close proximity to the inclined bottom of the hopper. These branch pipes 34 are provided with suitable perforations to permit the gases delivered from the engine cylinders to blow through the material in the hopper and keep the same in thoroughly agitated and fluffy condition. Desirably each of the branch pipes 34 is provided with a removable cap 35 which when removed will permit the pipes

34 to be blown out if any material should accumulate therein.

The conduit 25, or the coupling thereof leading to the pipe 33 of the header, is provided with a suitable valve 36 having an arm 37 detachably connected to a link 38 which in turn is connected to a lever 39 which controls the valve 11 for the outlet of the hopper so that the valve in the conduit 25 will be opened and closed simultaneously with the opening and closing of the outlet valve of the hopper. By reason of this construction the gases will be introduced into the hopper for the purpose of agitating the material only when the material is being discharged from the hopper.

While the particular embodiment of the invention disclosed herein relates primarily to the utilization of gases delivered under pressure from the motor into the hopper of a dusting apparatus for the purpose of agitating the material in the hopper and fluffing it up, it will be obvious that these gases may be used for other purposes, such, for example, as to propel a suitable motor or for any other suitable uses which may employ gases under pressure.

The mechanism for controlling the outlet valve of the hopper comprises a link, or as illustrated herein two links 40, which are pivotally connected at their lower ends to lugs 41 extending upwardly from the outlet valve 11 and which are pivotally connected at their upper ends to arms 42 of a rock shaft 43 which is journalled in suitable bearings 44 and 45 in the side walls of the hopper. One end of the rock shaft 43 is provided with an arm 46 which is detachably connected to a link 47, the other end of which is detachably connected to the lever 39. The shaft 43 of the hopper desirably is located above the wall of the front cockpit when the hopper is in position so that the hopper may be readily removed when the links 38 and 47 are detached from the operating lever 39 and the coupling 27 of the conduit 25 released.

Any suitable means may, of course, be employed detachably to secure the hopper in the cockpit. By virtue, however, of the construction above described there are no permanent connections between the hopper and the fuselage which render the hopper difficult of removal.

A further feature of the invention consists in providing means for introducing air under pressure into the hopper on top of the powder to aid in discharging the material therefrom. This is accomplished in the present invention by providing the hopper with a closed top having an air funnel extending therefrom presenting a bell-shaped mouth toward the front so that the pressure of the air entering the hopper through the funnel when the air craft is in flight, will act upon the material in the hopper. In the preferred construction illustrated in the accompanying drawings, an air funnel 48, preferably of rectangular cross section as illustrated in Fig. 4 and having a bell mouth 49, is mounted upon a cover plate 50 having a downwardly extending flange 51 which closely surrounds a flange 52 of an angle iron member 53 which extends peripherally about an aperture 54 in the hopper cover 55. The cover plate 50 may also be provided with an angle iron member 56 adapted to seat within the inner face of the flange 52 with a suitable felt packing to provide a tight joint construction, but one which may be readily disengaged.

Any suitable means may be provided for detachably securing the cover plate to the top of the hopper. A convenient construction which is illustrated herein comprises two or more posts 57 mounted upon the angle iron member which surrounds the aperture 54 at the top, with pivotally mounted arms 58 extending therefrom over the cover plate, with set screws 59 in the ends of said arms adapted to engage said plate. The air funnel desirably is provided with a check valve which, as shown herein, is in the form of a flap valve 60 supported by a hinge 61 at its top, the purpose of this valve being to permit the entry of air into the hopper through the air funnel, but to prevent air and dust from passing from the hopper through the funnel.

A further feature of the invention consists in providing a novel mechanism through which the dusting material may be introduced into the hopper without substantial loss of the dusting material.

The usual dusting material is packed in cartons or cans and considerable of the dust is carried away by air current when the cartons or cans are emptied into the hopper. The means for substantially preventing such loss illustrated herein comprises a filling plate 62 which is supported upon the top wall of the hopper which defines the wall of the aperture therethrough and which extends a short distance within the surrounding angle iron wall 51. The filling plate 62 is provided with a central downwardly extending funnel 63, the aperture 64 of which is of less diameter and smaller area than that of the carton or can in which the dusting material is packaged so that when the end of the carton or can is opened the can may be quickly inverted and permitted to rest in inverted position upon the inclined wall 63 of the funnel, while the material drops into the hopper. The engagement of the open end of the carton or can with the funnel wall will form a seal which will substntially prevent the dust from being scattered by air currents.

The filling plate 62 may be so constructed

as to be removable, or may be permitted to remain permanently in position. When the hopper is to be filled the cover plate with its funnel is first removed, after which the cartons or cans can be inverted and dumped into the hopper in the manner above described.

It will be understood that the particular embodiment of the invention disclosed herein is of an illustrative character and not restrictive and that the invention is adapted to be applied to other forms of air craft than that particularly illustrated herein. It is also understood that various changes in form, construction and arrangement of parts may be made within the spirit and scope of the following claims.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. Dusting apparatus for air craft provided with a driving motor having a cylinder and a piston reciprocable therein, comprising a hopper for the dusting material provided with an outlet, means for scattering the material delivered from said outlet, means for delivering gases under pressure from said cylinder into the material in said hopper to agitate said material, means for opening and closing the outlet of said hopper and means operably connected therewith for admitting and preventing the delivery of gases from said cylinder to said hopper.

2. Dusting apparatus for air craft provided with a driving motor having a cylinder, a piston reciprocable therein and inlet and exhaust conduits, comprising a hopper for the dusting material provided with an outlet, means for scattering the material delivered from said outlet, a separate conduit communicating with said cylinder operable to deliver gases under pressure from said cylinder into the material in said hopper to agitate said material.

3. Dusting apparatus for air craft having a driving motor, comprising a hopper for the dusting material having an outlet, means for scattering the material delivered from said outlet, means for delivering gases under pressure from said motor into the material in said hopper including distributing pipes for said gases located within said hopper.

4. Dusting apparatus for air craft provided with an internal combustion engine, comprising a hopper for the dusting material provided with an outlet, means for scattering the material delivered from said outlet, a conduit leading from the cylinders of said motor to said hopper and a plurality of distributing pipes located within said hopper communicating with said conduit.

5. Dusting apparatus for air craft provided with an internal combustion engine comprising a hopper for the dusting material provided with an outlet, means for scattering the material delivered from said outlet, a conduit leading from the cylinders of said motor to said hopper, a plurality of distributing pipes located within said hopper communicating with said conduit, means for detachably connecting said conduit to said motor and means for detachably securing said hopper to said air craft whereby the hopper can be readily removed.

6. Dusting apparatus for air craft provided with an internal combustion engine comprising a hopper for the dusting material provided with an outlet, means for scattering the material delivered from said outlet, a conduit leading from the cylinders of said motor to said hopper, a plurality of distributing pipes located within said hopper communicating with said conduit and means for purifying the gases delivered from said cylinder to said hopper including a filter containing a fibrous material interposed between sections of said conduit.

7. Dusting apparatus for air craft provided with an internal combustion engine comprising a hopper for the dusting material provided with an outlet, means for scattering the material delivered from said outlet, a conduit leading from the cylinders of said motor to said hopper, a plurality of distributing pipes located within said hopper communicating with said conduit and means for purifying the gases delivered from said cylinder to said hopper including a filter containing a fibrous material interposed between sections of said conduit, the section of the conduit leading from the filter to the hopper having a screen extending into the upper portion of the filter and the section leading from the motor to the filter extending into the material of the filter in proximity to the bottom thereof.

8. Dusting apparatus for air craft comprising an internal combustion engine having a chambered spark plug communicating with the cylinder of the engine, comprising a hopper for the dusting material, means for scattering the material delivered from said hopper, a conduit communicating with the chamber of the spark plug leading to said hopper to deliver gases from said cylinder into the material in said hopper and a check valve in said conduit acting to prevent the return of gases from the conduit into the cylinder.

9. Dusting apparatus for air craft comprising a hopper having an outlet provided with a valve and a top having a filling opening, a downwardly extending funnel within said filling opening having an aperture of smaller area than the area of the open end of a dust-containing carton, whereby an open carton may be quickly inverted and placed upon the inclined wall

of said funnel and loss of dust by air currents substantially prevented.

10. Dusting apparatus for air craft comprising a hopper having an outlet provided with a valve and a top having a filling opening provided with a surrounding wall, a downwardly extending funnel within said filling opening having an aperture of smaller area than the open end of a dust-containing carton, whereby an open carton may be quickly inverted and placed on the inclined wall of said funnel and loss of the dust by air currents substantially prevented. a cover fitting upon said surrounding wall and means for detachably clamping said cover thereupon.

11. Dusting apparatus for air craft comprising a hopper having an outlet provided with a valve and a top having a filling opening provided with a surrounding wall, a downwardly extending funnel within said filling opening having an aperture of smaller area than the open end of a dust-containing carton, whereby an open carton may be quickly inverted and placed on the inclined wall of said funnel and loss of the dust by air currents substantially prevented, a cover fitting upon said surrounding wall provided with an air funnel presenting a forwardly extending bell-mouth and means for clamping said cover upon said wall.

12. Dusting apparatus for aeroplanes having dust-distributing means provided with an upwardly extending peripheral wall comprising a hopper having an outlet, an outlet casing detachably secured to the bottom of said hopper and presenting a wall closely fitting the peripheral wall of said distributing means, a valve for said hopper outlet slidably mounted upon said outlet casing, a link within said hopper connected to said valve, a rock shaft mounted in the walls of said hopper having an arm connected to said link and an external arm and means for detachably connecting the external arm of said rock shaft to an actuating lever.

13. Dusting apparatus for aeroplanes having dust-distributing means provided with an upwardly extending peripheral wall comprising a hopper having an outlet, an outlet casing detachably secured to the bottom of said hopper and presenting a wall closely fitting the peripheral wall of said distributing means, a valve for said hopper outlet slidably mounted upon said outlet casing, a link within said hopper connected to said valve, a rock shaft mounted in the walls of said hopper having an arm conected to said link and an external arm, means for detachably connecting the external arm of said rock shaft to an actuating lever, a conduit leading from the cylinders of the aeroplane engine into the material in the hopper, a valve in said conduit, and means detachably connecting said valve to said lever operable to open and close the valve in the conduit concurrently with the opening and closing of the hopper valve.

14. Dusting apparatus for aeroplanes having dust-distributing means provided with an upwardly extending peripheral wall comprising a hopper having an outlet, an outlet casing detachably secured to the bottom of said hopper and presenting a wall closely fitting the peripheral wall of said distributing means, a valve for said hopper outlet slidably mounted upon said outlet casing, a link within said hopper connected to said valve, a rock shaft mounted in the walls of said hopper having an arm connected to said link and an external arm, means for detachably connecting the external arm of said rock shaft to an actuating lever, a conduit leading from the cylinders of the aeroplane engine into the material in the hopper, a valve in said conduit, means detachably connecting said valve to said lever operable to open and close the valve in the conduit concurrently with the opening and closing of the hopper valve and a detachable union in said conduit whereby the hopper may be readily removed from the cockpit by detaching said union and by detaching the connections leading from the conduit and hopper valves to the actuating lever.

15. A dusting apparatus for air craft comprising an internal combustion engine having a plurality of cylinders, a hopper for the dusting material and means for scattering the material delivered from said hopper, pipes communicating respectively with the combustion chambers of said cylinders, a conduit leading from said pipes into said hopper to deliver gases from said cylinder into said hopper to agitate and fluff up the material therein, and a multiple inlet and single outlet shut-off cock intermediate of said pipes and said conduit.

16. In a machine as described an internal combustion engine comprising a cylinder, a piston reciprocable therein, and inlet and exhaust conduits, a separate conduit communicating with the explosion chamber of the engine adapted to receive a portion of the gases delivered by pressure produced within the cylinder and means connected with said separate conduit for utilizing the power of said gases under presure.

17. In a machine as described, an internal combustion engine comprising a cylinder, a piston reciprocable therein, and inlet and exhaust conduits, a separate conduit communicating with the explosion chamber of the engine adapted to receive a portion of the gases delivered by pressure produced within said cylinder, a hopper for dusting material, and means for utilizing the power of said gases under pressure to agitate the dusting material in said hopper.

18. In a machine as described, comprising

an internal combustion engine having a plurality of cylinders, and inlet and exhaust manifolds, separate pipes communicating respectively with the combustion chambers of said cylinders, a conduit communicating with said pipes, and a multiple inlet and single outlet shut-off cock intermediate of said pipes and conduit having means selectively operable to establish communication between one or more of said pipes and said conduit.

19. In a machine as described, comprising an internal combustion engine having a plurality of cylinders, and inlet and exhaust manifolds, separate pipes communicating respectively with the combustion chambers of said cylinders, a conduit communicating with said pipes, and a multiple inlet and single outlet shut-off cock intermediate of said pipes and conduit having means selectively operable to establish communication between one or more of said pipes and said conduit, a hopper for dusting material, and means for utilizing the power of said gases under pressure to agitate the dusting material in said hopper.

In testimony whereof, I have signed my name to this specification.

ALAN L. MORSE.