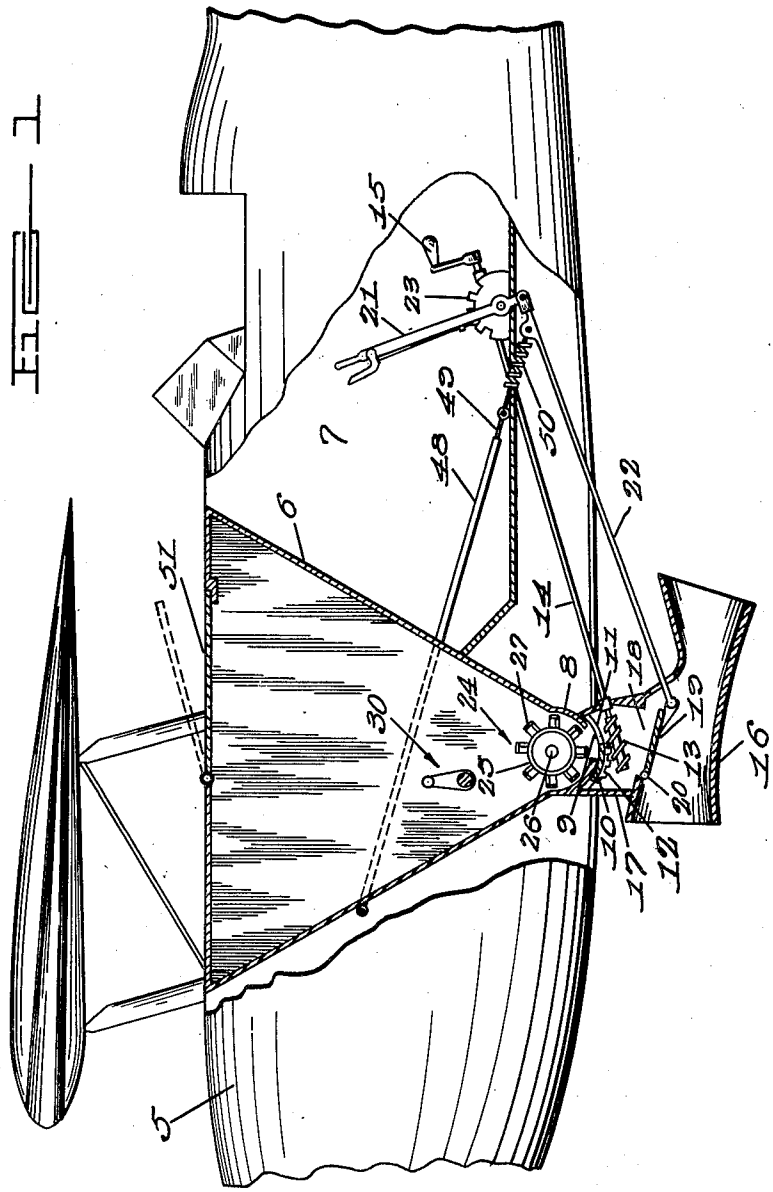
Jan. 15, 1952 M. CARBERRY 2,582,678

MATERIAL DISSEMINATING APPARATUS FOR AIRPLANES

Filed March 13, 1946 3 Sheets-Sheet 1

FIG. 1



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Filed March 13, 1946 3 Sheets-Sheet 2

FIG. 2

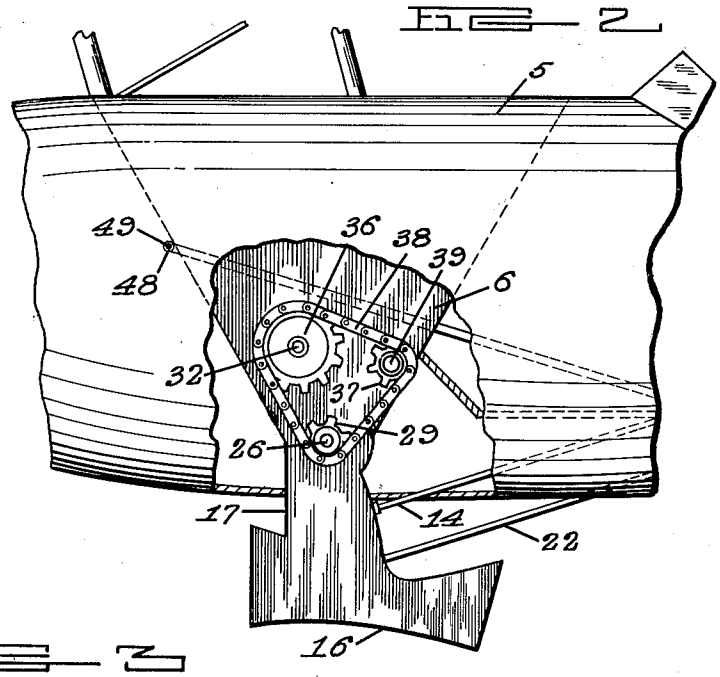
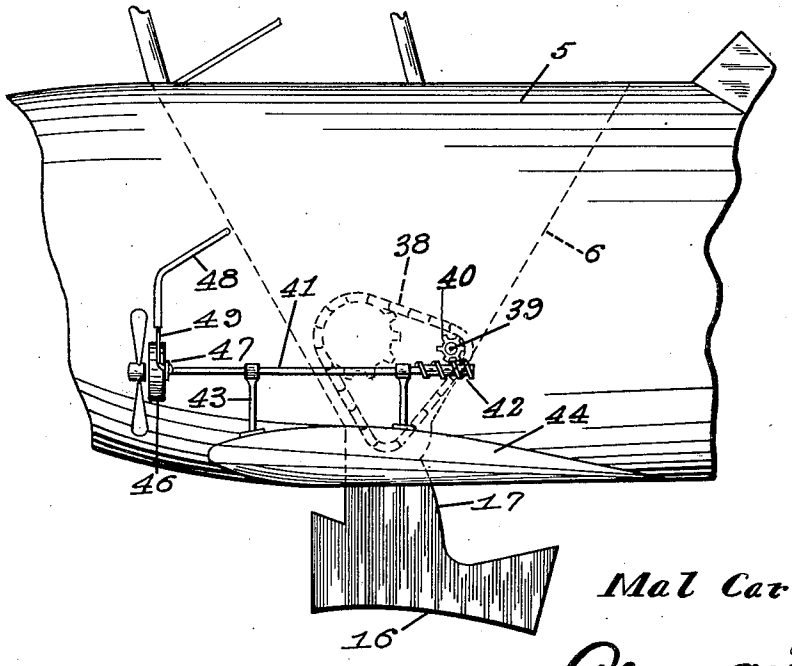


FIG. 3



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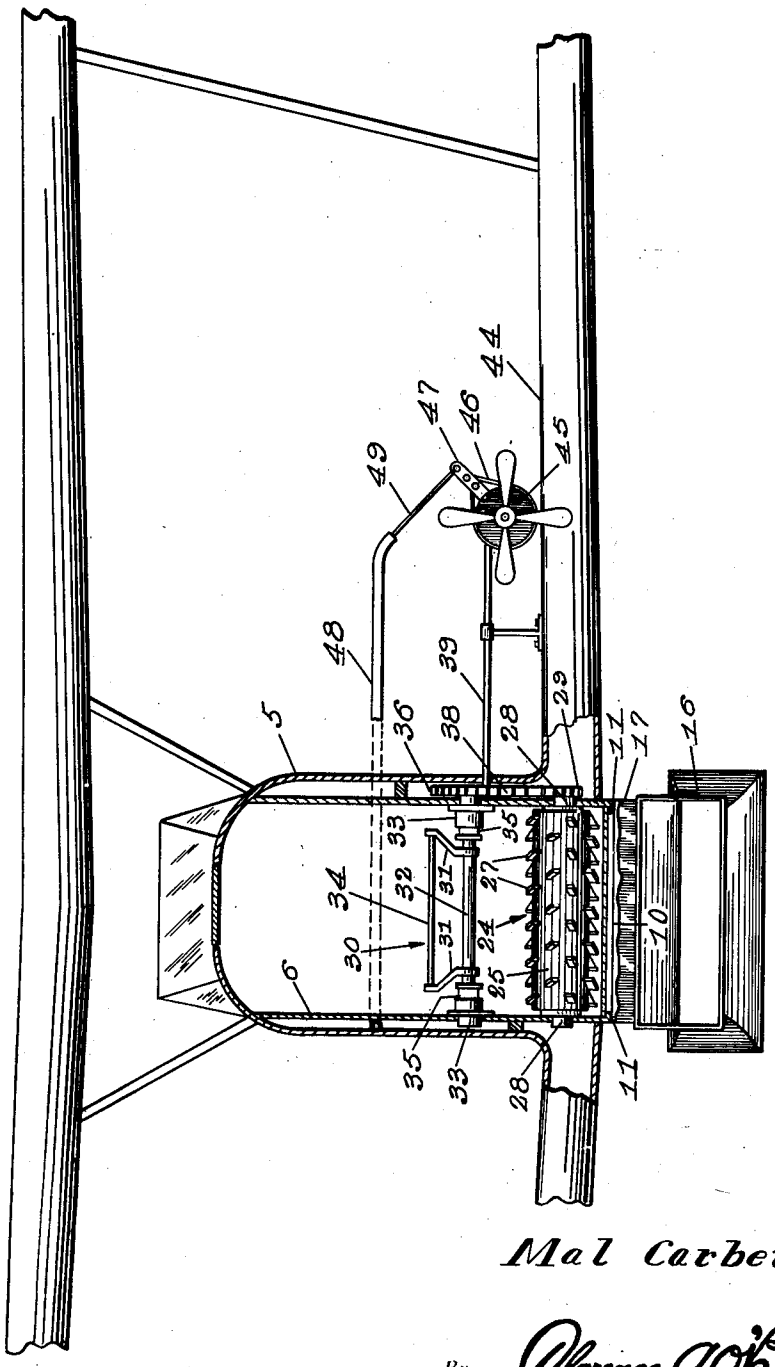
Filed March 13, 1946 3 Sheets-Sheet 3

Fig. 4



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MATERIAL DISSEMINATING APPARATUS FOR AIRPLANES

Mal Carberry, Fresno, Calif.

Application March 13, 1946, Serial No. 654,163

3 Claims. (Cl. 244—136)

1

This invention relates to apparatus for disseminating finely divided or powdered material from airplanes, such as is commonly known and practiced in the art of dusting crops.

An object of the invention is to provide an improved means for agitating the material so as to prevent clogging of the same in the apparatus and to thereby insure a free flow of the material from the apparatus.

A further object of the invention is to provide improved means including a volumetric measuring discharge device, for effecting variable rates of delivery of the material from the apparatus and by means of which the actual rate of delivery of the material may be regulated so that the quantity of material disseminated per unit area is maintained substantially constant.

The invention has further reference to an apparatus of the above kind wherein the agitating means and discharge device are driven by an impeller located in and driven by the slip stream of the airplane propeller, and wherein a manually adjustable valve is provided for regulating the quantity of material delivered to a Venturi tube, a brake being provided for controlling the operation of the mentioned impeller so that the agitating means and discharge device are only driven when the valve is open. The present invention contemplates improved means for interconnecting and manually operating the brake and the valve so that the former is applied when the latter is closed, and vice versa.

More specific objects and features of the invention will become apparent from the following description when considered in connection with the accompanying drawings, in which:

Figure 1 is a fragmentary view, partly in side elevation and partly broken away and in section, of an airplane body provided with an apparatus constructed in accordance with the present invention.

Figure 2 is a view somewhat similar to Figure 1, but with additional parts in elevation.

Figure 3 is a side elevational view looking toward the left of Figure 4.

Figure 4 is a view of the construction shown in Figure 1, partly in front elevation and partly in vertical transverse section.

Referring in detail to the drawings, 5 indicates the body or fuselage of an airplane, and 6 indicates a hopper provided in the fuselage 5 in front of the cockpit 7 and adapted to receive the material to be disseminated. At the bottom, the hopper 6 is provided with a concaved bottom wall 8 of substantially semi-cylindrical form in cross

2

section and preferably extended the full width of the hopper. The bottom wall 8 of the hopper is provided in its rear lower portion with an outlet opening 9 in the form of an elongated slot extending substantially from end to end of said wall 8. The opening 9 is controlled by an arcuate sliding gate 10 disposed against the underside of the wall 8 and mounted in suitable arcuate guides at 11. By adjusting the gate 10, the quantity of material discharged from the hopper may be regulated, and manually operable means is provided for adjusting said gate. This means preferably consists of a rack 12 provided on the underside of the gate 10 and engaged by a worm 13 secured on the forward end of a forwardly inclined shaft 14 that extends rearwardly and upwardly into the cockpit 7 where it is equipped with a suitable crank or handle 15 for actuation by the operator seated in the cockpit.

A Venturi tube 16 is longitudinally arranged directly beneath the fuselage 5 within the slip stream of the airplane propeller. Immediately in front of the throat of the Venturi tube, the latter is provided with an inlet neck 17 connected to the bottom of the hopper 6 so that the material is discharged into the same through the opening 9 of the hopper. At the juncture of the neck 17 with the Venturi tube 16, the latter is provided with an inlet opening 18 through which the material passes from the neck 17 into the Venturi tube. The passage of material through the opening 18 is controlled by a valve 19 which is hinged at 20 at its forward edge for vertical swinging movement. A hand lever 21 is pivotally mounted in the cockpit 7 and is operatively connected to the rear portion of valve 19 by a connecting rod 22, conventional means including a rack segment 23 being provided for latching the lever 21 in adjusted positions. Thus, lever 21 may be actuated for closing the valve 19 or for adjusting it to fully or different partially opened positions. This provides a secondary and desirable control of the material supplied to the Venturi tube, as well as a control of the volume of the stream of air passing through the latter. It is thus possible to effectively regulate the discharge and dissemination of the material according to the exact nature of the material and so as to insure most efficient operation under varying conditions of use.

For the purpose of feeding the material from the hopper 6, a volumetric measuring discharge device 24 is provided in the bottom of the hopper 6. This discharge device is of the cylindrical drum type including a cylinder 25 secured upon

a shaft 26 located at the axis of the concaved bottom wall 8 of the hopper, and a plurality of short vanes 27 rigid with and radiating from the cylinder 25 so that their outer edges operate in close proximity to the surface of the wall 8. As shown more clearly in Figure 4, the vanes 27 are disposed obliquely of the cylinder 25 and are arranged in longitudinal rows with those of each row circumferentially staggered with respect to those of the next adjacent rows. It will be apparent that the relative diameter of cylinder 25 and the length of vanes 27 will govern the rate of discharge of the material through the opening 9 by the device 24, and the cylinder 25 is preferably made in sections removable from shaft 26 to permit the substitution of different types of drums according to the type of material to be disseminated. It will further be seen that the upper portion of the drum passes through the material above the concave wall 8 so as to have an agitating action upon the material prior to feeding it downwardly and rearwardly through the opening 9. Shaft 26 is mounted in bearings 28 and extends through one of the latter where its projecting end is equipped with a sprocket wheel 29 as shown in Figure 2.

Disposed above the drum or device 24 is a transverse upper agitator 30 of the crank type. As shown, the agitator 30 includes a pair of spaced crank arms 31 secured on a shaft 32 journaled in bearings 33 mounted in opposite sides of the hopper 6, and a bar 34 connecting the outer ends of said crank arms 31. The bearings 33 are of special form, being provided at their inner ends with packing glands 35 to prevent entrance of the material into the bearings from the hopper. The bearings 28 for the shaft of device 24 are also preferably of this type. Shaft 32 also extends outwardly through one of the bearings 33 where its projecting end is equipped with a sprocket wheel 36 as is also best shown in Figure 2. The sprocket wheels 29 and 36 are located between a side of hopper 6 and the adjacent side wall of fuselage 5, and another sprocket wheel 37 is also journaled in this space rearwardly of shafts 26 and 32. An endless sprocket chain 38 passes around the sprocket wheels 29, 36 and 37 so that rotation of sprocket wheel 37 is transmitted to the shafts 26 and 32. Specifically, the sprocket wheel 37 is secured on the inner end of a transverse horizontal shaft 39 that extends laterally from one side of the fuselage 5 and is equipped on its outer end with a small worm wheel or gear 40. Disposed longitudinally of and beside the fuselage 5 is a further horizontal shaft 41 which is provided at its rear end with a worm 42 meshing with the gear 40. The shaft 41 may be journaled in bearing brackets 43 mounted upon the lower wing 44 of the airplane at this side of the fuselage. At its forward end, the shaft 41 is equipped with an impeller which is arranged in the slip stream of the airplane propeller so as to be driven thereby. Thus, as the airplane travels ahead, impeller drives shaft 41 and motion is transmitted from this shaft to the agitator 30 and device 24 by the operating connections described. Just behind the impeller and on shaft 41 there is a brake drum 45. While the brake may be of any type, it is shown as including a brake band 46 extending around the drum 45 and having its ends connected to a lever arm 47. A Bowden wire operating device is employed to provide an operating connection between the lever arm 47 and the connecting rod 22 which operating device includes the usual rigid guide tube 48 extended from the cockpit 7 around the hopper 6 and laterally through one side of the fuselage 5 to a point adjacent the lever arm 47. The device further includes the usual flexible actuating wire 49 that is extended through the guide tube 48 and is attached at one end to the lever arm 47 and is connected at its other end by a tension spring 50 to the rod 22. The arrangement is such that when lever 21 is operated to close the valve 19, a pull is exerted on wire 49 so as to tighten the band 46 on the drum 45 and thereby restrain the shaft 41 against rotation by the impeller. On the other hand, the arrangement is also such that when the lever 21 is operated to open the valve 19, tension on spring 50 is relieved and band 46 is released from drum 45 so as to permit the propeller to drive the shaft 41. Thus, when valve 19 is closed, agitation and discharge of material automatically stops, and when valve 19 is opened, such agitation and discharge of material is permitted. The hopper 6 has a suitable lid 51 which may be opened to facilitate introduction of material to be disseminated within the hopper 6.

In use, the operator actuates lever 21 so as to open valve 19 to the desired degree and to release the brake band 46, thereby permitting the propeller to drive the agitator 30 and discharge device 24. Agitator 30 keeps the material loose so that it will effectively flow downwardly to the discharge device 24 and will not be tunneled by the latter. The discharge device 24 provides further agitation for the same purpose and also insures feeding of the material uniformly downwardly and rearwardly to the opening 9. Shaft 14 is operated to adjust the gate 10 and thereby regulate the rate of discharge of the material from the hopper. The opening of valve 19 adjustably restricts the passage through the Venturi tube 16 so as to obtain the desired dissemination of the material delivered to the Venturi tube. Whenever it is desired to discontinue dissemination of the material, lever 21 is actuated to close valve 19 and to apply brake band 46 so as to prevent driving of shaft 41 by the impeller. This of course, should be done after closing the gate 9 so that material delivered to the neck 17 will be discharged before closing the valve 19. The use of the vaned cylinder 25 operating concentrically of and within the concave bottom wall 8 has been found very efficient for the intended purpose, and the manner of interconnecting the valve 19 and brake band 46 with the lever 21 provides a simple and efficient means for accomplishing the stated result. Minor changes in details of construction illustrated and described are contemplated, such as fairly fall within the scope of the invention as claimed.

What I claim is:

1. In combination with an airplane having an elongated fuselage providing a cockpit, an apparatus for dispensing finely divided material from the airplane comprising a hopper having downwardly convergent walls extended transversely of the fuselage, said walls having lower edges interconnected by a downwardly concave semicylindrical wall having a longitudinal axis transversely of the fuselage, the semicylindrical wall having an elongated slot formed longitudinally therein, an arcuate gate of segmental cylindrical form mounted concentrically against the wall rotatable to open and closed positions across the slot, means located in the cockpit connected to the gate for manually rotating the gate to selected positions, a cylinder of smaller diam-

eter than the inner diameter of the semicylindrical wall mounted concentrically of the wall and having a plurality of spaced vanes extending radially therefrom in close proximity to the wall, means for rotating said cylinder, and an elongated Venturi tube having a constricted portion supported below the hopper longitudinally of the fuselage having the constricted portion thereof in communication with the slot in the semicylindrical wall, the tube being formed with a forwardly disposed air intake opening and a rearwardly disposed discharge opening.

2. In combination with an airplane, an apparatus for dispensing finely divided material from the airplane comprising a hopper having a downwardly concave semicylindrical bottom wall having a longitudinal axis transversely of the airplane and having an elongated slot formed longitudinally therethrough, a cylinder rotatably mounted in the hopper coaxially of the bottom wall having a plurality of spaced vanes extending radially therefrom into close proximity to the inner surface of the wall, means for rotating the cylinder, a gate of segmental cylindrical form mounted on the hopper coaxially of the wall in intimate contact with the wall movable to open and closed positions relative to the slot, means for manually adjusting the gate to selected positions, a Venturi tube supported below the hopper longitudinally of the airplane with a communicating neck portion between the wall and the interior of the Venturi tube, and a manually operable valve movable to open and closed positions between the neck and Venturi tube.

3. An apparatus for disseminating finely divided material from an airplane comprising a hopper having downwardly converging sides terminating at their lower edges in a downwardly concave semicylindrical wall having a longitudinal axis parallel to the sides of the hopper and having a slot formed longitudinally in the semicylindrical wall, a cylinder rotatably mounted in the hopper coaxially of the semicylindrical wall having a plurality of vanes extending radially therefrom in proximity to the concave surface of the wall, adjacent vanes being oppositely angularly displaced from alignment with the cylinder, an arcuate gate comprising a segment of a cylinder mounted on the hopper coaxially of the wall for rotative movement to open and to closed positions relative to the slot in the wall, means for manually regulating the gate to selected positions, and a Venturi tube mounted below the hopper having an air intake opening, an outlet opening, and an intermediate constricted portion in communication with the slot in the semicylindrical wall of the hopper.

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