July 15, 1924. 1,501,818

A. A. SOULEK ET AL

AERIAL ADVERTISER

Filed March 20, 1924

Fig. 1

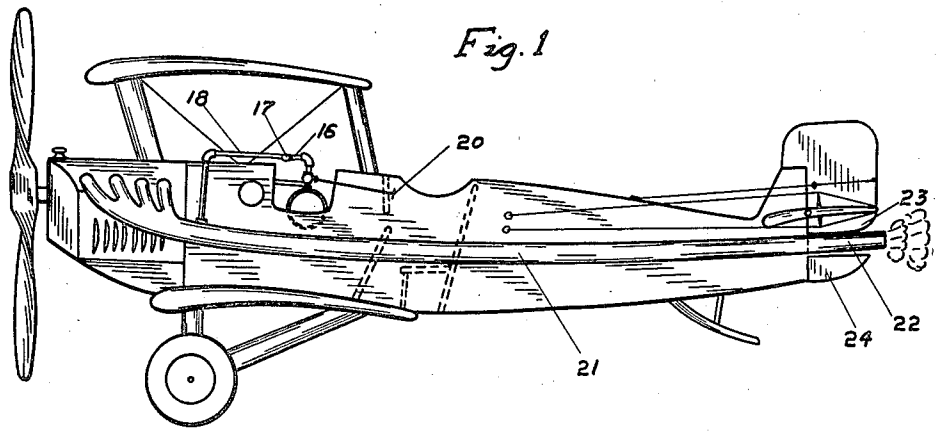


Fig. 2.

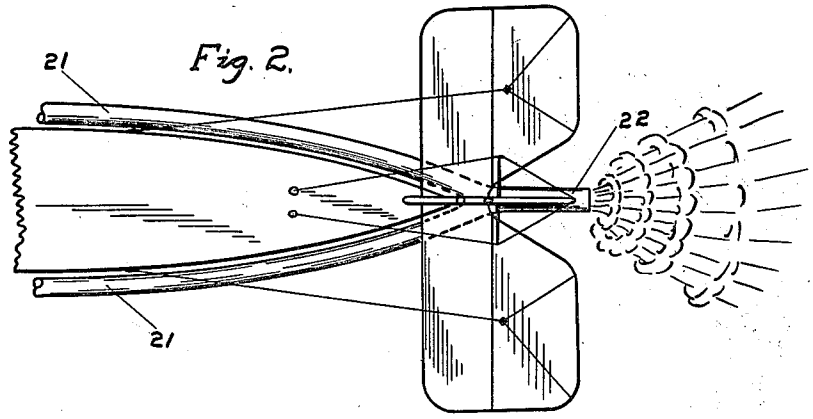
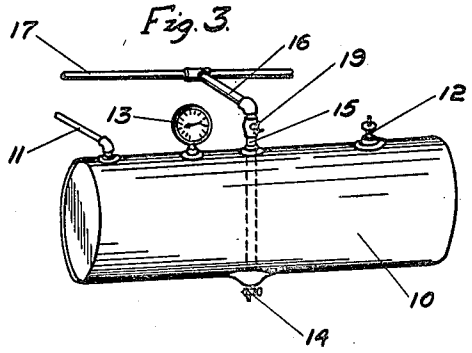


Fig. 3.



A. A. SOULEK
K. A. HOBLIT
INVENTORS

BY Emil F. Lange

ATTORNEY.

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UNITED STATES PATENT OFFICE.

ANDREW A. SOULEK AND KARL A. HOBLIT, OF LINCOLN, NEBRASKA.

AERIAL ADVERTISER.

Application filed March 20, 1924. Serial No. 700,573.

To all whom it may concern:

Be it known that we, ANDREW A. SOULEK and KARL A. HOBLIT, citizens of the United States, residing at Lincoln, in the county of Lancaster and State of Nebraska, have invented certain new and useful Improvements in Aerial Advertisers, of which the following is a specification.

Our invention relates to a method of and means for producing a smoke or vapor of distinct visibility and for depositing the smoke or vapor at a considerable altitude in the air and in the form of signs, symbols, letters or characters which can be easily interpreted by observers on the surface of the earth. More specifically, it is our purpose to utilize aircraft in flight for advertising purposes by leaving visible trails of smoke and by maneuvering the aircraft in paths which correspond in form to the form of the signs, symbols, letters or characters which it is desired to make.

We are aware that aircraft have been employed during war time for signalling to observers on the ground by means of trails of smoke, the trails of smoke having a prearranged form which could be readily understood by the observer. We are also aware that somewhat similar devices have been used commercially for advertising purposes. All of the prior devices of which we are aware are however open to serious objections. In most of them the smoke producing device is heavy and complicated and requires considerable attention from the pilot or other operator, and the trail of smoke is neither as distinct nor as persistent as it should be for advertising purposes.

The object of our invention in brief is the provision of a device which can be installed easily on the aircraft, which is light in weight and which occupies the minimum of space, which can be operated with the minimum of effort on the part of the pilot, and which utilizes the air currents about the aircraft to conserve the smoke and to make the trail more distinct. It is also our object to provide a novel method of making the smoke or vapor, our method being simpler and more effective than those heretofore employed.

Having in view these objects and others which will be pointed out in the following description, we will now refer to our drawings, in which—

Figure 1 is a side elevation of an airplane which is equipped with our smoke generator and conductor.

Figure 2 is a plan view of the rear portion of an airplane and showing the discharge end of the smoke conductor.

Figure 3 is a view in perspective of the container of the smoke producing materials.

In carrying out our invention we provide a single container 10 having only one chamber. We thus reduce the cost of the device and also its weight, the container at the same time being simpler in construction than those of multiple construction or those having a plurality of compartments. In practice we prefer to employ a container having a capacity of about five gallons, but the container may be made in larger or smaller sizes when so desired.

The container is kept partly filled with the smoke producing material hereinafter described, the upper portion of the container being filled with compressed air which is conducted through a pipe 11 from an air pump (not shown) to the interior of the container 10. The atmospheric relief valve 12 is so adjusted that a fixed pressure of about one pound above the pressure in the exhaust pipe is maintained in the container 10. If desired the relief valve 12 may be secured in a closing plug whereby the combined valve and plug may be removed in order to refill the container with smoke producing material. The pressure gauge 13 is provided for the purpose of indicating to the pilot at all times whether or not the relief valve 12 and the air pump are properly functioning. At the bottom of the container 10 is a cock 14 through which to drain or blow out any sediment which might be formed in the smoke producing materials.

For conveying the smoke producing material from the container into the exhaust pipes of the engine, we provide a system of pipes having their intake at or near the bottom of the interior of the container and having their outlets in the exhaust pipes. In the construction shown in our drawings, the vertical pipe 15 extends to within about an inch of the bottom of the container and preferably immediately over the drain or

blow out cock 14. The pipe 16 is connected to the pipe 15 at its upper extremity, and the transverse pipe 17 is connected to the pipe 16 at its forward extremity. The pipe 17 has connected thereto at each of its extremities a forwardly extending pipe 18, each of the pipes 18 being connected with an exhaust pipe. For shutting off and for regulating the emission of the smoke producing material from the container 10, we provide a valve 19 with lever or other control 20. The valve 19 may be placed anywhere in the system of pipes 15, 16, 17 or 18, but we prefer to position it in proximity to the container 10, the pipe 15 being usually the most convenient. The control 20 should be positioned in the pilot's cock pit and within convenient reach of the pilot.

As shown in Figures 1 and 2, the exhaust pipes 21 are positioned on opposite sides of the fuselage. They converge, their junction being immediately to the rear of the rudder pivot. At their junction they merge into a single pipe 22 which projects rearwardly to an appreciable distance beyond the rear edge of the rudder. In order to avoid and prevent interference of the pipe 22 with the rudder, we construct the rudder of two parts 23 and 24 both mounted on the same vertical pivot, and having sufficient space therebetween for the exhaust pipe 22.

In prior methods of leaving smoke trails in the wake of aircraft, it has been necessary to carry two or more separate smoke making materials and to cause the separate materials to unite gradually and in the proper proportions during flight. Such a method necessitates the use of two or more containers or of a container having a plurality of compartments and means for controlling and regulating the flow of the materials therefrom. This adds not only to the weight of the equipment, but to the pilot's duties is added the burden of properly governing the admixture of the separate materials. We provide a single material and in a single container for producing a smoke which is superior in visibility and persistence to the smokes produced by the prior methods.

For a smoke producing material, we employ any material which when injected into the exhaust pipe, will be burned to form a vapor having substantially the density of the air at a given altitude, and which will be clearly visible to observers on the ground. In our experiments we have found that an oil emulsion gives admirable results. We emulsify the oil preferably by the continental method which consists in adding to four parts of vegetable oil and two parts of water, one part of an emulsifying agent (preferably finely powdered acacia or the like). By thoroughly mixing the vegetable oil and the emulsifying agent and then adding the water all at one time, we obtain a primary emulsion in the form of a homogeneous mixture of oil in the form of microscopic globules suspended in an aqueous medium. This primary emulsion when injected into the exhaust pipe of an internal combustion engine will produce a dense vapor consisting of smoke and steam. The finely divided particles of oil are ignited by the exhaust gases and the water in the emulsion is completely vaporized, the smoke and steam being thoroughly mixed at the time of their formation. The vapor thus produced becomes diffused in the exhaust gases, all of which are discharged through the outlet end 22 of the exhaust pipe.

The primary emulsion after being formed in the manner above described, may be stuffed with a hydrocarbon oil or with any other suitable oil. The purpose of this is twofold. It materially reduces the cost of producing the smoke generating material and it affords a convenient method whereby the character of the smoke may be readily adapted for any of the various conditions of the air. In order to be persistent the vapor should be of substantially the density of the air at the altitude where the vapor is released, and the density of our vapor can be altered by simply altering the materials or the proportions when stuffing the primary emulsion.

Vapors produced by smoke and steam alone, while clearly visible in the day time, are either not visible at night or at most are very indistinct. In order to adapt our smoke producing material for night use, we employ a phosphorescent material which illuminates the trail of vapor to thus give the vapor a striking and pleasing appearance at night. Yellow phosphorus is admirably adapted for the purpose. By dissolving the phosphorus in carbon bisulphide, the solution can be easily introduced into the vegetable oil either before or after emulsifying the oil. The steam in the trail of vapor will furnish the necessary moisture required for making the phosphorus luminous. Similar results may be obtained by use of a sulphide of barium, strontium, or calcium. Striking color effects can be obtained in either the day time or the night time by using the materials which are used in pyrotechnics for producing colored effects. For example barium nitrate in finely divided form may be mixed intimately in the emulsion and when the charge is fired by the exhaust gases the vapor will have a brilliant green appearance. Similarly other striking colors may be produced by the selection of the suitable materials.

By using a homogeneous mixture which can be carried in a single compartment, we are enabled to materially reduce the weight

of the smoke making equipment and at the same time to provide such an equipment which is simpler in construction and easier to operate than the devices heretofore employed for the purpose. The single control 20 is in the most convenient position in the pilot's cock pit and the gauge 13 is so placed that the pilot can tell at a glance if the air pump and the relief valve are functioning properly. The relief valve 12 requires no attention on the part of the pilot unless the pressure becomes too high as indicated on the scale of the gauge 13, but normally the valve 12 will release the excessive pressure.

The construction of the exhaust pipe and the position of the exhaust pipe with respect to the fuselage and the rudder possess marked advantages over the prior devices which have been designed for similar purposes. The "suck" of the air in the rear of the rudder creates a partial vacuum which facilitates the discharge of the exhaust gases from the exhaust pipe, while the air currents at the sides of the fuselage tend to converge in the rear of the rudder and to then spread. The resulting smoke trail is somewhat elliptical in cross section, but it has a ribbon like appearance to observers on the ground. The rudder ordinarily has no distinct effect on the character of the smoke trail, but when the aircraft is steered along curved paths, as in turning, the rudder is inclined with respect to the exhaust, the result being that the smoke trail follows the path of the aircraft more readily than it does in the prior devices heretofore used for this purpose.

Having thus described our invention in terms which will be readily understood by others skilled in the art to which it pertains, what we believe to be new and desire to secure by Letters Patent of the United States is:—

1. In combination with an aircraft, means for leaving a trail of visible and relatively persistent smoke and vapor in the wake of the moving aircraft, said means including a container of a single chamber in which the smoke producing material is carried, exhaust pipes on both sides of the fuselage of the aircraft, said exhaust pipes converging rearwardly and having a single outlet in the rear of the rudder of the aircraft, and means under the control of the pilot for conducting the smoke producing material from the container into the exhaust pipes at both sides of the fuselage, whereby when the smoke producing material is burned and discharged with the exhaust gases a dense and persistent smoke like trail will be left in the path of the aircraft.

2. In combination, an aircraft, exhaust pipes extending rearwardly along both sides of the fuselage of the aircraft, a rudder having a vertical pivot in the rear of the aircraft, said exhaust pipes being rearwardly converging and meeting immediately in the rear of the vertical pivot of the rudder, a single outlet pipe communicating with both of said exhaust pipes at their junction, said single exhaust pipe being centrally positioned with respect to the fore and aft axis of the aircraft and extending to a point in the rear of the rudder, said rudder being cut away on a longitudinal line and into upper and lower parts which may be actuated simultaneously without interference from the single outlet pipe, and means under the control of the pilot for discharging smoke producing materials into both of said exhaust pipes.

3. In combination with an aircraft, means for leaving a trail of visible and relatively persistent smoke and vapor behind the aircraft in its path, said means including a single container in which a vegetable oil emulsion is carried, means under the control of the pilot for discharging said emulsion into the exhaust pipes whereby the exhaust gases will ignite the oil particles and vaporize the water in the emulsion, whereby a mixture of smoke, exhaust gases, and steam is discharged from the exhaust pipe.

4. A smoke and vapor producing material for use in combination with the exhaust of an aircraft, said material consisting of an emulsion of vegetable oil in water.

5. A smoke and vapor producing material for use in combination with the exhaust of an aircraft to leave a dense and relatively persistent trail, said material consisting of a vegetable oil emulsion in water and stuffed with hydrocarbon oils.

6. A smoke and vapor producing material for use with an aircraft, said material comprising a vegetable oil emulsion, a hydrocarbon oil, and a phosphorescent material, whereby when said mixture is led out through the exhaust pipes the oils in the mixture will be ignited by the exhaust gases and the water in the emulsion will be vaporized to form a dense and relatively persistent trail which is made luminous by the phosphorescent material in the mixture.

In testimony whereof we affix our signatures.

KARL A. HOBLIT.
ANDREW A. SOULEK.