Jan. 8, 1963 R. E. DOYLE 3,072,371

AIRCRAFT WITH FLUENT MASS RETAINING AND DISPENSING MEANS

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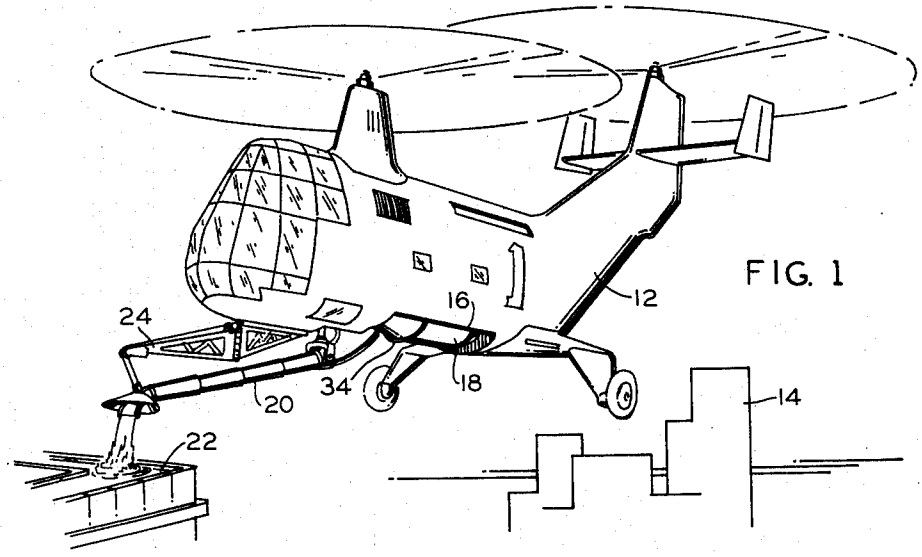


FIG. 1

FIG. 2

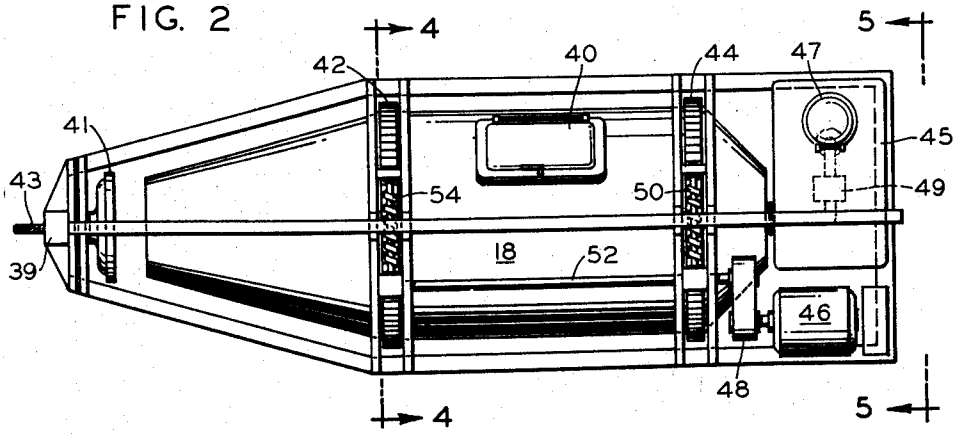
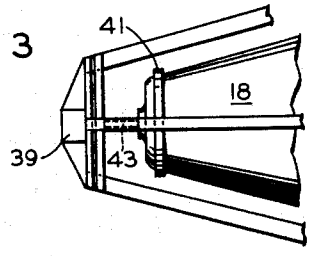


FIG. 3



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FIG. 4

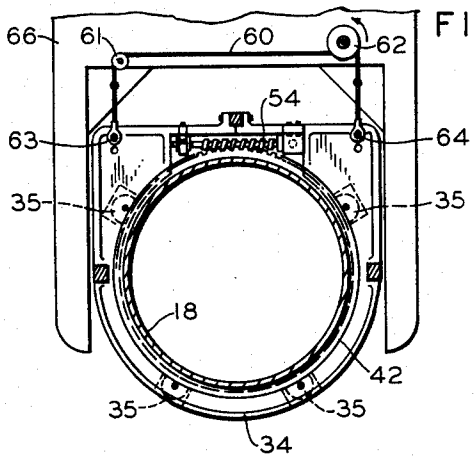


FIG. 5

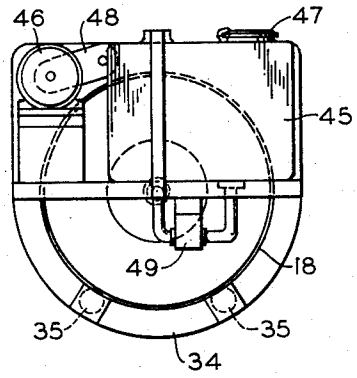


FIG. 6

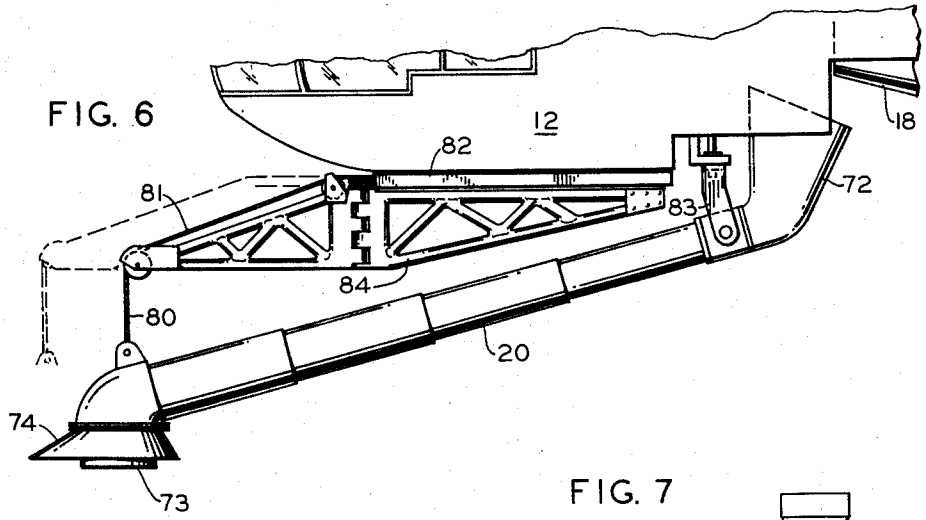
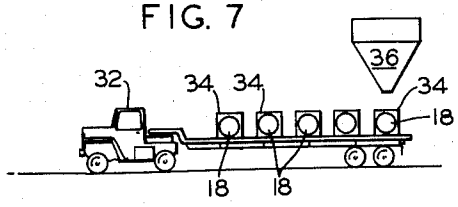


FIG. 7



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3,072,371 AIRCRAFT WITH FLUENT MASS RETAINING AND DISPENSING MEANS

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6 Claims. (Cl. 244—137)

This invention concerns the transportation and pouring of a fluent mass and more particularly refers to airborne means for transporting such material and discharging it at the desired site without intermediate handling.

The transportation of fluent building materials, such as cement or concrete in a ready mixed form, to construction sites presents unique problems, particularly when such sites are located in relatively inaccessible locations. Typical of such conditions are high buildings in crowded downtown areas, construction sites in remote or mountainous regions, as for instance irrigation dams or hydroelectric power plants.

In the typical example of multi-story downtown buildings, present construction techniques require ready-mixed concrete to be transported on trucks to the site, unloaded from the truck, conveyed to an upper floor, and finally poured into previously set up forms. It is apparent that such trucks encounter numerous traffic obstacles in their travel to and from the construction site and that moreover, the loading and unloading of the material and lifting it to the exact pouring location presents additional problems. The various delays encountered are extremely costly when measured in terms of time and quantity of vehicles required to provide on a continuing basis an average supply of building materials. Additionally, when trucking ready-mixed concrete to a site, the mix usually is not completely ready for pouring but a certain amount of water must be added at a predetermined time prior to pouring. Delays beyond this final point cannot be tolerated as the mix will harden. Many instances are known where ready-mixed concrete in condition for pouring had to be dumped from a truck because the vehicle either did not reach the pouring site in time or the pouring site was not ready and any delay would have caused the concrete to set up and harden within the mixing container.

The instant invention overcomes these prior disadvantages by providing an aircraft which is adapted to assume a relatively steady attitude relative to a fixed object, such as a helicopter, and fitting this aircraft with means to receive a removable container which is adapted to contain a fluent mass, particularly cement or concrete. This container when filled with the proper amount of the fluent mass is lifted aboard the aircraft and flown to the pouring site in a direct manner, free from obstructions, traffic delays, narrow streets, inaccessible passageways, and so forth. The aircraft is provided with a discharge chute for pouring the fluent mass, thus obviating the need for unloading equipment, crane and other lifting means usually necessary for bringing the material to the proper elevation. An aircraft fitted with the equipment described hereafter can therefore, make many round trips and perform the work of an entire fleet of trucks and other land-bound vehicles. Although the operating cost per hour of an aircraft is several times that of a truck, the amount of material per unit of time transported in this manner is so much greater that a sizable saving in construction cost is achieved aside from the greater convenience and ease of scheduling.

One of the principal objects of this invention is the provision of a new and novel means for transporting and pouring a fluent mass, which means overcomes many of the limitations and disadvantages of prior art arrangements.

Another one of the principal objects of this invention is the provision of an airborne arrangement for bringing a fluent mass to a site and dispensing the fluent mass.

Another object of this invention is the provision of an aircraft which is provided with means for retaining and dispensing a fluent mass while the aircraft is airborne.

Another object of this invention is the provision of a helicopter type aircraft which is provided with means for receiving a removable container adapted to contain a fluent mass and means for agitating the mass while the container is in the aircraft and in flight.

A further object of this invention is the provision of an aircraft fitted with means to hoist a removable container aboard, the container being adapted to hold and dispense a fluent mass, and means disposed on the aircraft for guiding the mass from the container to a location disposed underneath the aircraft while the aircraft is airborne.

Further and still other objects of this invention will be apparent from the following description when taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a perspective representation of the aircraft dispensing a fluent mass, such as concrete, to a building site;

FIGURE 2 is a longitudinal view of the inside of the aircraft showing the fluent mass container and equipment associated therewith;

FIGURE 3 is a portion of FIGURE 2 with the container cover in closed position;

FIGURE 4 is a sectional view along lines **4**—**4** in FIGURE 2;

FIGURE 5 is a view along lines **5**—**5** in FIGURE 2;

FIGURE 6 is a close-up view at the chute and its supporting mechanism for providing the transfer of the fluent mass from the container to the construction site, and

FIGURE 7 is a schematic view showing an arrangement for loading the containers prior to their being hoisted aboard the aircraft.

Referring now to the figures, and FIGURE 1 in particular, there is shown an aircraft, reference numeral **12**, which is adapted to assume a relatively steady attitude relative to stationary buildings **14**. A helicopter type aircraft is well suited for the present purpose. Visible from the underside of the aircraft there is an aperture **16** through which a container **18** having a fluent mass has been lifted aboard. As shown in the illustration, material such as concrete is being discharged from container **18** via an extendable inclined chute **20** into a form **22**. In a typical example form **22** might be the tenth or twentieth floor of a building. Support means **24** extend from the aircraft and support chute **20** in the proper pouring position. When the pouring operation has been completed, chute **20** is retracted from the depicted extended position and support means **24** also assume an attitude where this means does not interfere with the further flight operations of the aircraft. The aircraft then returns to its base.

In FIGURE 7 there is shown a typical flat bed truck **32** which is loaded with a plurality of alike containers **18**, each being adapted to contain a fluent mass. Each container is disposed in a frame **34** which serves for lifting each respective container aboard the aircraft as will be shown more clearly in FIGURES 2 through 5. The truck **32** is disposed underneath a hopper **36** which contains the mix and fills the respective containers.

Referring now to FIGURES 2 through 5, the fluent mass container **18**, in the typical example, is a concrete mixing drum or barrel which is equipped with a charging aperture and lid **40** and a set of peripheral ring gears **42** and **44**. A motor **46** via a reduction set **48** drives a worm **50** in engagement with ring gear **44** and via shaft

52 a worm 54 which engages ring gear 42. Therefore, when motor 46 is energized, the drum is rotated to keep the fluent mass agitated as is required for instance in the case of ready-mixed concrete. It will be understood that if motor 46 is an electric motor, means are provided in the aircraft for energizing the motor. The drum 18 may be provided on the inside with a longitudinal screw as is conventional in many types of existing concrete mixing containers. A removable circular cover 41 supported on a threaded shaft 43 and operated by motor 39 is adapted to close an opening for discharging the mass from container 18. FIGURE 3 shows the cover 41 in position for closing the discharge opening of the container.

Since it is conventional practice to require for final mixing the addition of a certain amount of water shortly before pouring the concrete, there is provided also a water tank 45 which is fitted with a filler opening 47. Pump 49 when operating transfers water from the tank into the drum shortly before pouring and in most instances, while the aircraft is airborne and approaching the pouring site. Additionally, water from this storage tank can be used to clean and flush the inside of the container while the aircraft is returning to the pickup site where the empty container is discharged and a new one hoisted aboard.

As shown more clearly in FIGURES 4 and 5, each container is surrounded by a frame 34 which is provided with a plurality of rollers 35 circumferentially spaced about the outer diameter of the drum for rotatably supporting the drum. Each drum and surrounding frame is lifted in and out of opening 16 of the aircraft by means of a hoisting arrangement which includes cable 60 traveling about a set of pulleys 61 and 62 and being adapted to engage a set of bolts 63 and 64 which are rigidly protruding from the frame 34. The hoisting arrangement is fastened to an inverted U-shaped structure 66 which is disposed inside the aircraft. It will be apparent therefore that upon rotating of pulleys 61 and 62 a respective container with its surrounding frame is lifted out from or lifted into the helicopter body.

The details of discharge chute 20 are shown more clearly in FIGURE 6 and as illustrated the chute comprises several telescoping portions for causing the chute to be extended or retracted. The chute has an upper end 72 which receives the fluent mass when cover 41 is lifted from the end of the container. The lower end 73 is provided with a shield 74 or air deflector which prevents spattering of particles. As is well known, aircraft of the helicopter type by virtue of the rotating blade create a downdraft in an area immediately below the aircraft and for this reason, the lower end of the chute must extend down far enough where the downdraft does not substantially affect the discharge of the fluent mass. Deflector 74 additionally provides protection and shields the discharging mass from the eddies produced as the result of the rotating blades creating a lifting force for the aircraft. Chute 20 is made of tubular material to enclose the fluent mass along its travel through the area immediately below the aircraft for isolating the mass from the effects of turbulent air prevailing in this region. The lower end of the chute is supported by a hoisting arrangement which includes a cable 80 and a bracket 81 adapted to pivot relative to a fixed bracket 84. Both brackets are adapted to travel in longitudinal direction along a fixed rail 82 as shown by the dashed lines in FIGURE 6. The upper end of the chute is supported by a linkage mechanism 83. In this way, the chute can be extended forwardly, assume various angles in azimuth, and can be lowered or elevated as the particular case requires.

Operation of the foregoing arrangement may be visualized as follows: A plurality of containers is charged with fluent mass as shown in FIGURE 7. Each container with its surrounding frame then can be hoisted aboard an aircraft and the mix is made ready for pouring while the aircraft is in flight. When reaching the site, the fluent mass is directly discharged from the container aboard the aircraft through the chute which protects the fluent mass from the air currents. When the pouring operation has been completed, the aircraft returns to its base and by means of the hoisting means and support means provided in the aircraft, the empty container is released and a new one taken aboard. If the aircraft returns to its base over isolated areas or over open water, the container and chute may be rinsed with water from the supply while the aircraft is in flight.

It will be apparent that the arrangement and procedure described above provided utmost convenience and are characterized by extreme simplicity and a minimum number of operations necessary for transferring material.

While there has been described and illustrated a certain embodiment of the present invention, it will be apparent to those skilled in the art that various changes and modifications may be made therein without deviating from the principle and intent of the present invention which shall be limited only by the scope of the appended claims.

What is claimed is:

1. In an aircraft of the type which is adapted to assume a relatively steady attitude relative to a fixed object in response to force exerted by its lifting means, the combination of: retaining means disposed on said aircraft for supporting a container adapted to contain a fluent mass; hoisting means on said aircraft for lifting said container into the aircraft; means for imparting motion to said container for agitating said mass when said container is supported by said retaining means in said aircraft; an extendable inclined chute provided on said aircraft; adjustable support means extending from said aircraft for supporting the chute when extended from the aircraft; the upper end of said chute disposed to receive fluent mass discharged from said container when the container is supported by said retaining means; the lower end of said chute adapted to extend from said aircraft for directing the fluent mass to a fixed object while said aircraft is hovering thereabove, and said lower end adapted to extend beyond the aircraft area which is affected by the downdraft of the aircraft lifting means.

2. In an aircraft as set forth in claim 1 wherein a supply of liquid is provided in the aircraft for adding liquid to said container when the latter is supported in the retaining means.

3. In an aircraft of the type which is adapted to assume a relatively steady attitude relative to a fixed object in response to force exerted by its lifting means, the combination of: retaining means disposed on said aircraft for supporting a container adapted to contain a fluent mass; said aircraft having an opening for receiving said container; hoisting means on said aircraft for lifting said container through the opening into the aircraft; a frame supporting the container when the container is disposed in said aircraft; drive means adapted to move the container relative to said frame and aircraft for agitating said mass when the container is aboard the aircraft; means for causing the container to discharge said mass; a retractable chute adapted to extend from the underside of the aicraft; means disposed on said aircraft for supporting the chute in an inclined position; the upper end of the chute disposed to receive the fluent mass from the container and the lower end extending beyond the area below the underside of the aircraft which is affected by the downdraft of the lifting means for discharging the mass to a fixed object, and means aboard the aircraft for forcing liquid into the container.

4. In an aircraft as set forth in claim 3 wherein said chute is substantially enclosing said mass during passage thereof from one end to the other.

5. In an aircraft as set forth in claim 3 wherein the

lower end of said chute is provided with a shield for minimizing the downdraft effect of the lifting means.

6. In an aircraft of the type which is adapted to assume a relatively steady attitude relative to a fixed object in response to force exerted by its lifting means, the combination of: retaining means disposed on said aircraft for supporting a drum shaped container which is adapted to contain a fluent mass; hoisting means on said aircraft for lifting the container into said aircraft; means for imparting rotary motion to the container for agitating the mass when the container is supported by said retaining means in said aircraft; an extendable inclined chute provided on said aircraft; adjustable support means extending from said aircraft for supporting said chute when extended from said aircraft; the upper end of said chute disposed to receive fluent mass discharged from said container when the container is supported by said retaining means; the lower end of said chute adapted to extend from said aircraft for directing the fluent mass to a fixed object while said aircraft is hovering thereabove, and said lower end adapted to extend beyond the aircraft area which is affected by the downdraft of the aircraft lifting means.

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