

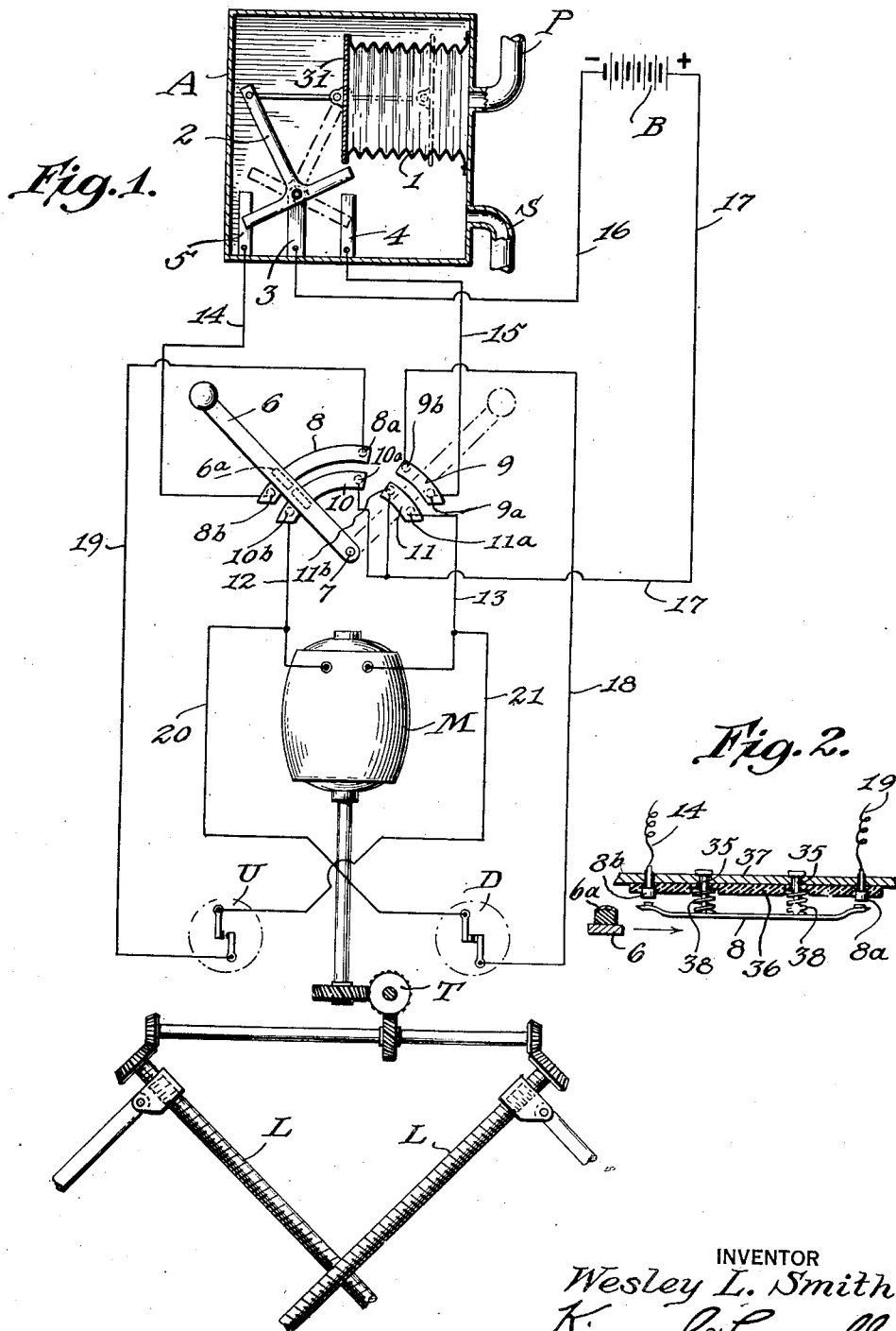
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GEAR DEVICE

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## GEAR DEVICE

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5 Claims. (Cl. 244—102)

This invention relates to an operating mechanism for the landing-gear of flying machines.

It is the object of my invention to provide an automatically operating mechanism for extending the landing-gear of flying machines and all types of aircraft of analogous nature preparatory to the landing of such machines and for retracting the landing-gear upon the initiation of flight.

It is the further object of my invention to provide a mechanism for the landing-gear of flying machines, the operation of which is automatically responsive to predetermined conditions in the state of flight of the machine. This mechanism may be rendered operative in response to the air-speed or buoyancy of the flying machine proportioned with respect to the tractive power which is available for the propulsion thereof.

It is the further object of my invention to provide an electric circuit containing a source of electric energy, an electric motor energized thereby and a plurality of switches interposed therein which may be conditioned preparatory to the landing of the flying machine or the initiation of flight thereby to effect the automatic operation of the motor to actuate the landing-gear in its extending or retracting direction. My arrangement also provides switches which automatically interrupt the operation of the motor upon the conclusion of the extending or retracting movement of the landing-gear.

Other objects and purposes of my invention will appear from the more detailed description of the invention following hereinafter taken in conjunction with the accompanying drawing wherein:

Fig. 1 is a schematic diagram of the arrangement in accordance with my invention with certain parts shown in elevation and others in section, and

Fig. 2 is a longitudinal sectional view along the arc line 2—2 shown in Fig. 1.

In the drawing is shown a portion of an actuating mechanism for a landing-gear L designed to be attached to a flying machine of any type which is in retracted position while the machine is in flight and which is extended preparatory to the landing of the machine. Such landing-gear and mechanical actuating mechanism therefor is fully illustrated and described in the United States patent to Loening No. 1,563,384, December 1, 1925. Since the present invention is not concerned with the details of construction of such landing-gear it is merely illustrated schematically in the accompanying drawing.

In the illustrated embodiment of the invention

the landing-gear is operated by a reversible electric motor M through the intermediary of suitable transmission means T.

The mode of energizing of the motor M constitutes the essence of the present invention and will now be described in detail. In the preferred embodiment of my invention an airtight casing A is suitably positioned upon any part of the flying machine. A syphon 1 is mounted on the inside of casing A. The tube P leading to the interior of the syphon may be connected to the pressure side of a Pitot-static airspeed indicator head. The inside of casing A is connected to the static tube S, and the differentials in pressure thus arising upon the interior and exterior of the syphon 1 cause it to extend and collapse between the limiting positions of the end plate 31 shown in full and dotted lines in Fig. 1. The movement of this end plate in turn causes the rocking of a switch 2 pivoted upon terminal 3 into selective contact with the terminals 5 and 4. This switch forms part of an electric circuit which includes a source of electric energy such as a direct current battery B, the electric motor M, limit switches U and D, and throttle switches 8—11 described in detail hereinafter.

The control member for operating the propulsion of the flying machine, which may be represented by the throttle lever 6 pivoted at 7, controls a portion of the electric circuit to condition the operation of the electric motor in the proper direction for the actuation of the landing-gear. The throttle lever 6 shown in the full line position represents the "power on" position in which case the throttle is open and the machine is in normal flight. In the position shown in dotted lines on the right, the lever is in the "power off" position, in which case the throttle is closed and the machine is prepared for landing. As shown more clearly in Fig. 2, the throttle lever 6 has projections 6a upon the rear face thereof which cooperate with conductive segments 8—10, and 9—11, which normally are displaced from respective cooperating electrical contacts 8a—8b, 10a—10b, 9a—9b and 11a—11b, and which are adapted to be bridged by such segments. The arrangement of the several contacts resemble those shown in detail for contact segment 8 in Fig. 2 wherein the segment 8 is shown normally extending from the backing plate 37, having a layer of insulating material 36 thereupon, by means of springs 38 surrounding pins 35 which guide the to and fro movement of the segment 8 into and out of con-

tact with terminals 8a and 8b, suitably mounted in insulated relationship in the backing plate 37 and from which extend the conductors 19 and 10 respectively, forming part of the electric circuit shown in its composite form in Fig. 1.

The limit switches U and D forming part of the electric circuit and switches which are normally closed and which are opened to interrupt the circuit of the electric motor upon the travel of the motor in a predetermined direction for a predetermined extent in order to interrupt such circuit upon the complete extension or retraction of the landing-gear. A transmission mechanism for operating such switches in the manner described is fully described in the above patent to Loening. Switch D is operated so that it is open when the landing-gear is fully extended; at all other times it is closed. The switch U is opened when the landing-gear is fully retracted and is closed at all other times.

The operation of my novel circuit with conductors 12-21 extending between the several elements, as shown in the accompanying drawing, may be explained as follows:

When the flying machine is on the ground at rest the throttle member 6 is in its position to the right or in the "power off" position, thereby contact segments 9-11 bridge their respective contacts 9a-9b and 11a-11b. Also the syphon 1 in the airtight casing is in its collapsed condition whereupon switch 2 is in its dotted line position and closes the circuit at contact 4. The switch D is in its open position as a consequence of the extension of the landing-gear at the time of the previous landing of the machine. Thereupon if a circuit should be traced from the positive side of the battery to conductor 17, switch 11, motor M and conductor 20, it is found that the circuit is broken at the switch D and the motor cannot be energized until the switching arrangement is modified. This is executed upon the start of a flight, whereupon the throttle lever 6 is thrown towards its position to the left or "power on" position. Thereby switches 9 and 11 are opened and switches 8 and 10 are closed. Although the circuit from the battery to the motor may now be traced through elements 17-10-12-M-21, switches U 8 and 5, it is apparent that the motor cannot operate on account of the open circuit at 3 and 5 before a return to the negative side of the battery may be had. However when the flying machine attains a sufficient flying speed, thereby developing a predetermined pressure in the syphon 1, the switch 2, in the position shown in Fig. 1 will complete the circuit for the motor to effect a retraction of the landing-gear. When the gear is fully retracted, switch U opens to break the circuit and to deenergize the motor. This condition prevails with the switch D closed and switch U open until the machine must be prepared for landing.

At the end of the flight the throttle lever 6 is thrown to the "power off" position which closes the switches 11 and 9 and opens switches 8 and 10. In tracing the circuit in the present condition it is found that although switch D is closed, the circuit is interrupted between the contacts 3 and 4 and the operation of the motor cannot take place. However as the air speed decreases and approaches the landing speed the syphon 1 collapses and thereby bridges the contacts 3 and 4 by means of the switch 2. This movement completes the motor circuit from the plus side of the battery through conductor 17,

contact 11, conductor 13, motor M, conductor 20, switch D, conductor 18, switch 9, conductor 15, switches 4 and 3, and conductor 16 to the negative side of the battery. The motor operates in a direction reverse from the previous operation to effect the extension of the landing-gear. When the landing-gear is fully extended switch D opens and interrupts the motor circuit.

In the above description one specific arrangement has been described to attain a system which is responsive to the airspeed or the buoyancy of the airplane and to the percentage of the power therein for its propulsion in order to control the operation of the landing-gear. However any other arrangements may be availed to obtain the same results. Thus, the power effect may be derived from the intake manifold pressure responsive device, centrifugal governor connected to the engine or the like. The airspeed response may be obtained from a Venturi tube, floating air paddle and analogous device. The landing-gear may be operated by a mechanism employing fluid pressure such as gas or liquid. For multi-motored flying machines the power responsive means can be adjusted so that the device will respond to any percentage of the total power which is desired for any possible combination of engines. It is understood that various modifications will suggest themselves to those skilled in the art without departing from the spirit of the invention as set forth above, the scope of which is specified in the annexed claims.

What I claim is:—

1. In a flying machine having a fluid pressure producing device responsive to the speed of the flying machine, a retractable landing gear and a reversible electric motor and its circuits for moving said landing gear between operative and inoperative positions; a speed responsive switch device for closing circuits in one direction and the other through said motor, said device including an electric switch, a syphon, conduit means to connect the syphon with the fluid pressure producing device, and an operative connection between said switch and said syphon.

2. In a flying machine having a fluid pressure producing device responsive to the speed of the flying machine, a retractable landing gear and a reversible electric motor and its circuits for moving said landing gear between operative and inoperative positions; a speed responsive switch device for closing circuits in one direction and the other through said motor, said device including a closed casing, a syphon mounted in said casing, a conduit communicating with the interior of said syphon, a second conduit communicating with the interior of the casing externally of the syphon, said conduits affording communication with high and low pressure points of the speed responsive fluid pressure producing device, an electric switch mounted within said casing and adapted for circuit connection to the motor circuit, and an operative connection between said switch and said syphon.

3. In a flying machine having a fluid pressure producing device responsive to the speed of the flying machine, a retractable landing gear and a reversible electric motor and its reversing circuits for moving said landing gear between operative and inoperative positions; a speed responsive switch device for closing circuits in one direction and the other through said motor, said device including a closed casing, a syphon mounted in said casing, a conduit communicating with the interior of said syphon, said con-

duits affording communication with high and low pressure points of the speed responsive fluid pressure producing device, a conductive support mounted in said casing, a pair of fixed contacts spaced from said support on opposite sides thereof, said support being adapted for connection to a power source and the fixed contacts being adapted for connection to the reversing circuits of the motor, a movable contact pivoted intermediate its ends to said support and tiltable to engage the respective fixed contacts, an arm projecting from the movable contact and fixedly attached thereto, and a link connecting said sylphon and the free end of said arm.

4. In a flying machine of the type having a retractable landing gear and an operating device for extending said landing gear into its extended position preparatory to landing and for withdrawing said gear into its retracted position after the starting of flight; mechanism to auto-

matically control said operating device comprising means responsive to the airspeed of the machine, means the position of which corresponds to the power being developed by the power plant of said machine, and means governed by said first and second means to effect the operation of said mechanism.

5. In a flying machine of the type having a retractable landing gear and an operating device for extending said landing gear into its extended position preparatory to landing and for withdrawing said gear into its retracted position after the starting of flight, mechanism to automatically control said operating device comprising means responsive to the airspeed of the machine, means comprising the throttle control for the power plant of said machine, and means governed by said first and second means to effect the operation of said mechanism.

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