Nov. 29, 1932. C. ROSATELLI 1,889,295

DIFFERENTIAL AND SIMULTANEOUS CONTROL FOR THE ENGINES OF MULTIPLE ENGINE MACHINES

Filed Dec. 11, 1930 2 Sheets-Sheet 1

Fig. 1

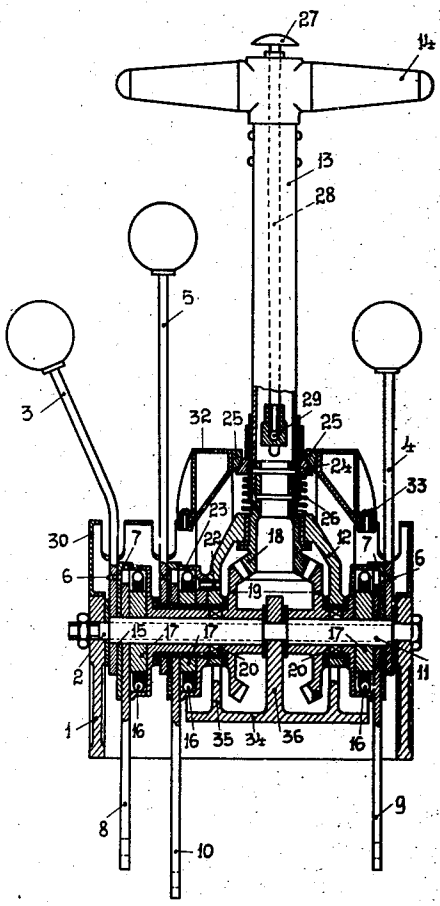

Fig. 2

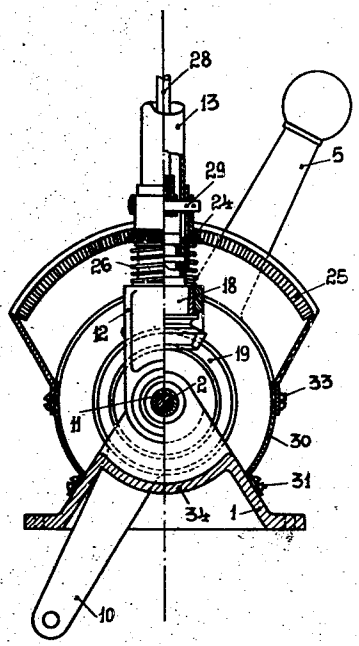

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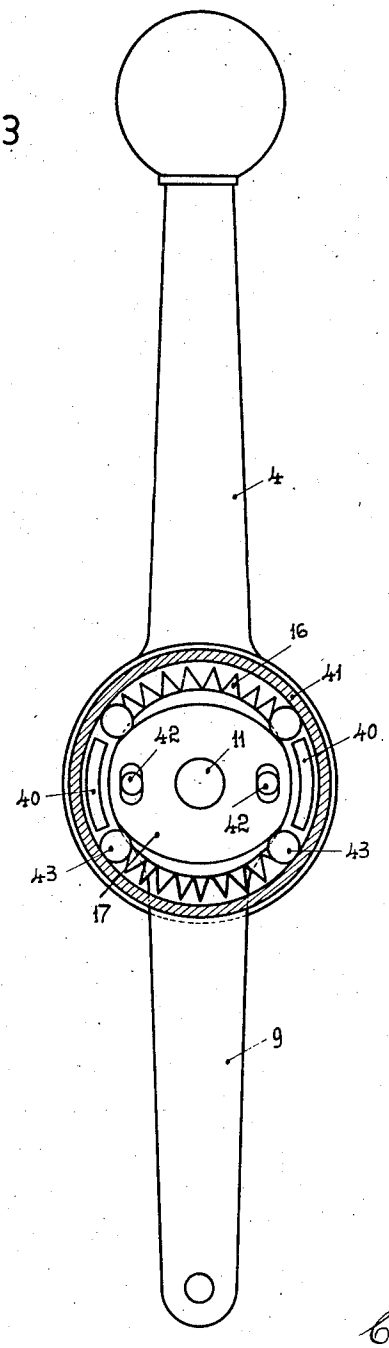
Fig. 3



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UNITED STATES PATENT OFFICE

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DIFFERENTIAL AND SIMULTANEOUS CONTROL FOR THE ENGINES OF MULTIPLE ENGINE MACHINES

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In modern multiple-engine machines (especially for air-craft purposes) the engine control is effected through the operation of separate handles; this arrangement, besides being complicated in operation, does not allow of a rapid simultaneous control of the engines. One multiple operating device should therefore be adopted which enables the operator to increase or decrease the number of turns of the engines by operating one handle only, without varying the adjustment of each engine, said adjustment being always effected through separate operating devices.

In most cases two engines are arranged parallel to the longitudinal axis of the machine, so that it is often necessary to dispose of an operating device by which it is possible to increase the speed of one engine and to decrease the speed of the other engine by the same extent, which considerably simplifies and facilitates the control of the machine on the ground and in flight.

The single multiple operating device, if it is to be practically useful, should be capable of moving the two or three lateral handles operating the respective engines, without varying their mutual position. This permits the simultaneous increase or decrease of the number of turns of all the engines by the same extent.

The apparatus according to this invention meets all the above requirements. It is based essentially on the combination of the two known principles of the differential gear and of the control device of the friction lock or other similar type.

The accompanying drawings show by way of example a constructional form of the device according to this invention in connection with a three engine control, one of the engines being placed in the middle and the other two laterally of the former.

Figure 1 is a longitudinal section through the device.

Figure 2 is a cross section thereof.

Fig. 3 is a cross-section of the lock device.

Referring to the drawings, 1 denotes a frame, on which a pivot pin 2 is mounted and supports the mechanism for controlling the various engines (three in the example shown). This mechanism comprises handles 3 and 4 serving for governing (e. g. for the carburetor and magneto control) the lateral engines and handle 5 serving for governing the central engine. The handles 3 and 4 are riveted at 6 to a disk-shaped member 7 of friction actuating devices 21 while the handle 5 is fixed to a disk-shaped member of a friction operating device 23 similar to the former.

The friction actuating devices 21 are loosely mounted on sleeves 11 and 15 respectively slipped on the pivot pin 2, while the friction operated device 23 is loosely mounted on a tubular extension of the adjacent device 21.

Each friction actuating device includes a drum, in which an oval cam 17 is arranged, which is connected by means of a pin and slot connection 42 with the adjacent disk-shaped member 7 and rigidly fixed to the hub of a lever 8, or 9, or 10; said levers are connected at their other end with the carburetor or magneto rods of the respective engine.

Springs 16 are arranged in the space between the drum and the parts having a larger radius of curvature of the cam 17, said springs being compressed between pairs of balls 43, which, having a diameter greater than the space between the drum and the parts of the cam 17 having a smaller radius of curvature, are forced by said springs between the drum and the cam for locking the two parts together.

A pair of projections 40 diametrically opposed fixed to the disk 7 is situated between pairs of adjacent balls 43, so that when the corresponding control handle 3, or 4, or 5 is displaced in one direction, said projections displace first a pair of diametrically opposed balls to disengage the cam 17 from the drum whereupon the pins 42 engage one end of the respective slot to effect the displacement of the corresponding lever 8, or 9, or 10. When the control handle is displaced in the opposite direction, the other pair of diametrically opposed balls is actuated and when the pins 42 reach the other

end of the slots, the corresponding lever is displaced in the opposite direction.

When the handle 3, or 4, or 5 is released, the springs 16 lock the cam 17 with the drum and therefore the lever in the new corresponding position.

The connection between the main handle 13 ending in a grip 14 and the two levers 8 and 9 controlling the lateral engines is effected by means of the fork 12. Said fork encloses a differential gear comprising a bevel pinion 18 fast with the lever 13 and two bevel wheels 19 connected by teeth couplings 20 with the drums of the friction actuating devices 21 of the lateral levers 8 and 9. The drum of the friction device 23 of the central lever 10 is secured by means of screws 22 to the fork 12.

In order to lock the main lever 13 it is provided with a grooved cone 24, which is brought by means of a spring 26 into engagement with the double conical sector 25 which is correspondingly grooved. To release the handle 13 a knob 27 is pressed by the hand and moves downwards through the rod 28 and the pin 29, the cone 24 which becomes thus disengaged from the sector 25.

The unit is protected by a cylindrical sheet metal box 30 secured by screws 31 to the casing 1. A sheet metal box 32 is secured by screws 33 on the casing 30 and the two conical grooved sectors 25 are riveted or welded to a central opening of said box.

The casing comprises a cylindrical bottom 34 with two lateral ridges 35 enclosing the oil for lubricating the gearings of the differential mechanism; the central bearing 36 supporting the pin 2 and keeping the two bevel wheels 19 in spaced relation.

By this arrangement when the main lever 13 is at rest and consequently locked by the grooved cone 24, the drums of the friction devices associated therewith are also locked and each of the levers 8, 9, and 10 may be actuated by the respective handles 3, 4 and 5 as above described. In order to effect the common engine control through the main handle 13, the knob 27 is depressed thus releasing the grooved cone 24 from the sectors 25 and the handle is inclined in one or the other direction, as required, so that by displacing the drums of the friction devices 21 and 23, these latter carry along the three levers 8, 9 and 10.

When one of the handles 3, 4 or 5 reaches the end of its stroke before the others, it strikes against the end of the slot in the box enclosing the unit and stops; its extensions 40 are thus locked and acting on the balls 43 release the handles 3, or 4 or 5 and corresponding levers 8, 9 or 10 of the drum of the corresponding friction device, which continues to rotate idle. The other handles (together with the parts associated therewith) are permitted to move further until all the levers are in the fully on or off position, this being possible also through the greater force of the handle 13 which is capable of performing an angular displacement almost twice as great as that of each handle 3, 4 or 5.

For the differential control of each engine the handle 13 is rotated about its axis by means of the grip 14. The pinion 18 is thus rotated and being in mesh with the two bevel wheels 19 solidly connected with the drums of the operating friction devices of the levers 8 and 9 controlling the lateral engines, it displaces said levers in opposite directions.

What I claim is:

1. Engine control for multiple engine aeroplanes comprising levers for adjusting each engine, handles for operating said levers, a friction lock device inserted between each of said levers and their respective handles, a main lever connected with one member of said lock devices for simultaneously actuating said adjusting levers.

2. Engine control for multiple engine aeroplanes comprising levers for adjusting each engine, handles for operating said levers, a friction lock device inserted between each of said levers and their respective handles, a main control lever, a pinion on said lever and bevel gears on one member of each of said lock devices, said gears meshing with said pinion in order to simultaneously actuate said adjusting levers.

3. Engine control for multiple engine aeroplanes comprising a casing, a pivot mounted on said casing, levers for adjusting each of the engines mounted on said pivot, handles for actuating said levers mounted on said pivot, a friction lock device interposed between each of said levers and their respective handles, said device being mounted on said pivot and a main control lever mounted on said pivot and connected to one member of said lock devices for simultaneously actuating said levers.

4. An engine control for multiple engine aeroplanes, comprising a main lever for simultaneously adjusting said engines, levers for controlling the individual engines, handles for operating said levers, a friction lock device for each of said levers and its respective handle, consisting of a drum connected with said main lever, an oval cam arranged on said drum, balls in the space between said cam and said drum, springs for forcing said balls between said drum and said cam for locking together said parts, a pin and slot connection between said cam and its respective lever and projections carried by the respective handle for removing said balls from the locked position and a box with guide slots for said handles, so that when one of said handles reaches the end of its respective guide slot, it carries said balls of the lock device into the released position for disconnecting the respective lever and permitting the further motion of the others.

5. An engine control for multiple engine aeroplanes comprising a main lever for simultaneously adjusting said engines, levers for controlling the individual engines, handles for actuating said levers, a friction lock device between each of said levers and its respective handle consisting of a drum connected with said main lever, an oval cam arranged on said drum, balls in the space between said cam and said drum, springs for forcing said balls between said drum and said cam for locking together said parts, a pin and slot connection between said cam and its respective lever and projections carried by the respective handle for removing said balls from the locked position, a pinion on the main lever, bevel gears on the drum of said friction lock device, said gears being in mesh with said pinion for simultaneously actuating said control levers and a box with guide slots for said handles, so that when one of said handles reaches the end of its respective guide slot, it carries said balls of the lock device into the released position for disconnecting the respective lever and permitting the latter motion of the others.

6. An engine control for multiple engine aeroplanes as defined by claim 5 in which means are provided for locking said main lever in its adjusted position.

7. An engine control for multiple engine aeroplanes as defined by claim 5 provided with a grooved cone slidable on said main lever, a pair of grooved sectors fixed to said box for co-operating with said cone and a pressure member for releasing at will said cone from said sectors.

8. An engine control for multiple engine aeroplanes comprising levers for adjusting each engine, handles for operating said levers, a friction lock device inserted between each of said levers and their respective handles, a main lever connected with one member of said lock devices for simultaneously actuating said adjusting levers and a box having a guide slot for said handles and means for disconnecting said levers from the main lever upon its contact with one end of the guide slot.

9. An engine control for multiple engine aeroplanes comprising levers for adjusting each engine, handles for operating said levers, a friction lock device inserted between each of said levers and their respective handles, a main control lever, a pinion on said lever and bevel gears on one member of each of said lock devices, said gears meshing with said pinion in order to simultaneously actuate said adjusting levers and a box with a guide slot for said handles, and means for disconnecting said levers from the main lever upon its contacting one end of its guide slot.

In testimony that I claim the foregoing as my invention, I have signed my name.

CELESTINO ROSATELLI.