

Nov. 18, 1958

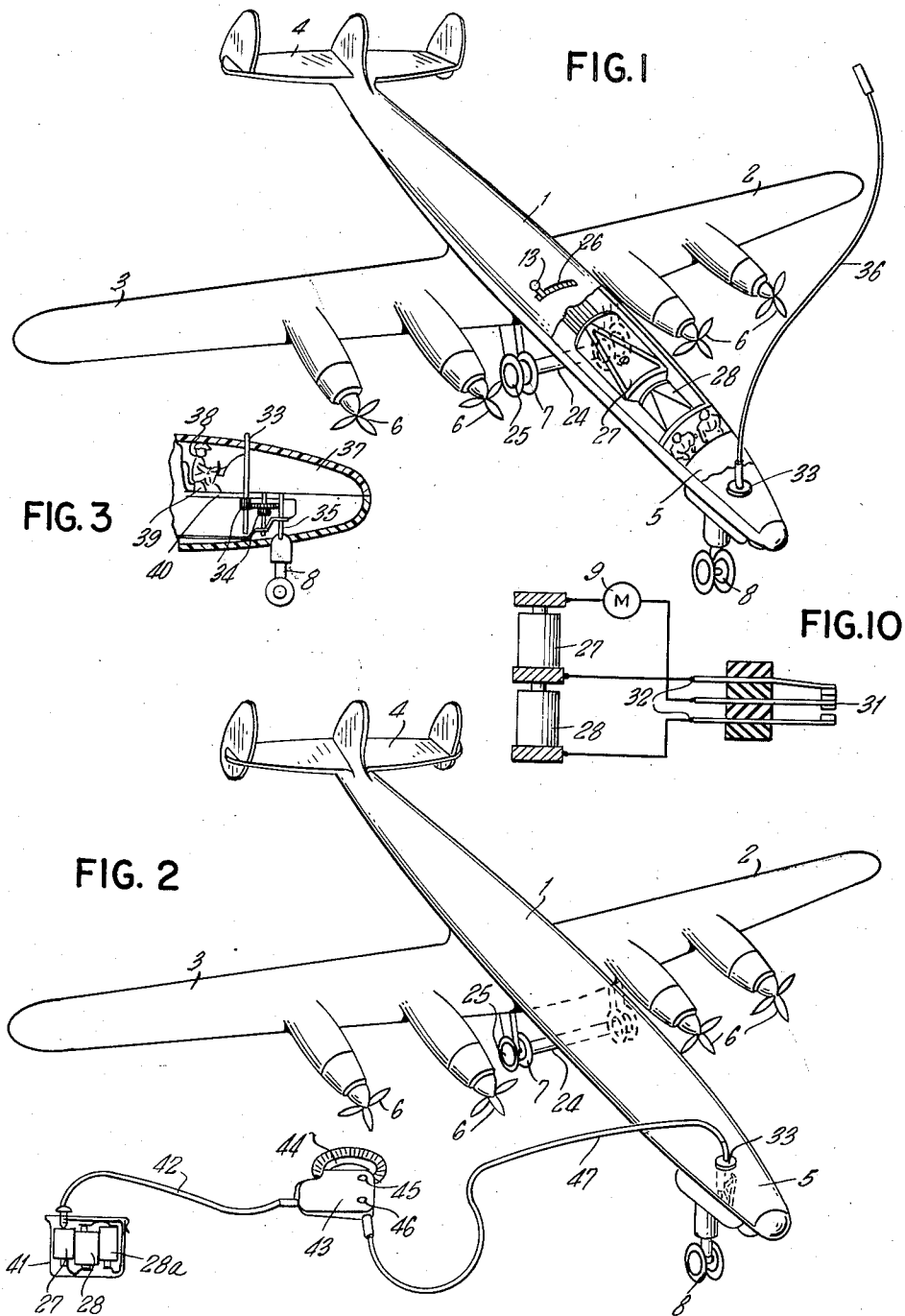
H. MÜLLER ET AL

2,860,447

TOY AIRCRAFT

Filed July 10, 1957

3 Sheets-Sheet 1



Nov. 18, 1958

H. MÜLLER ET AL

2,860,447

TOY AIRCRAFT

Filed July 10, 1957

3 Sheets-Sheet 2

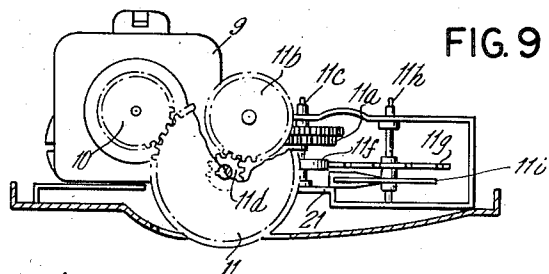


FIG. 9

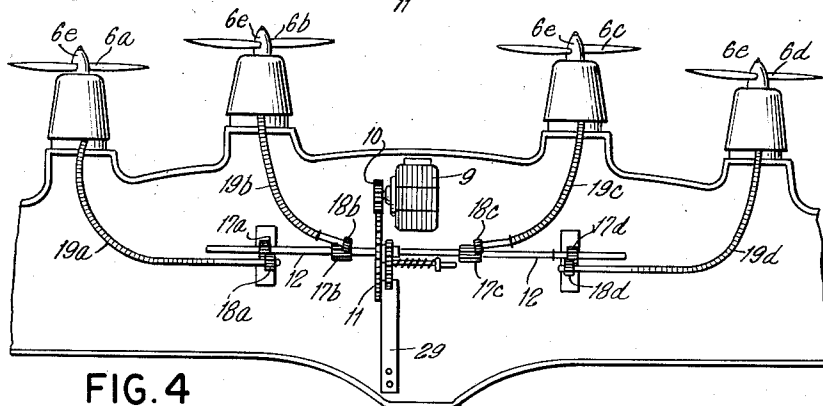


FIG. 4

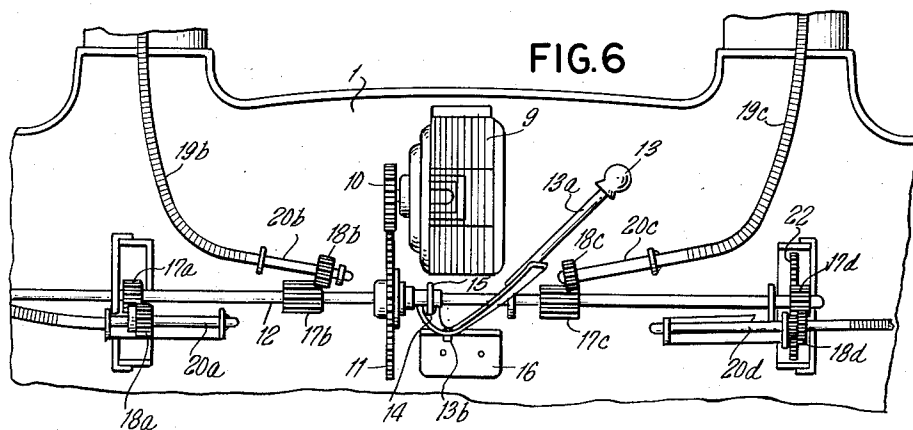


FIG. 6

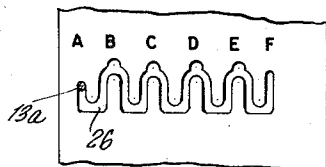


FIG. 7

Nov. 18, 1958

H. MÜLLER ET AL

2,860,447

TOY AIRCRAFT

Filed July 10, 1957

3 Sheets-Sheet 3

FIG. 8

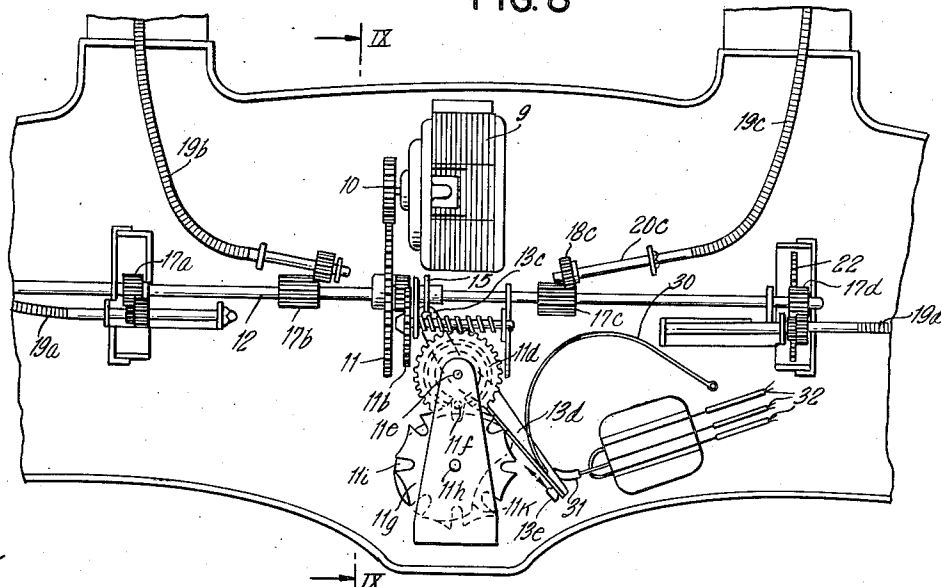
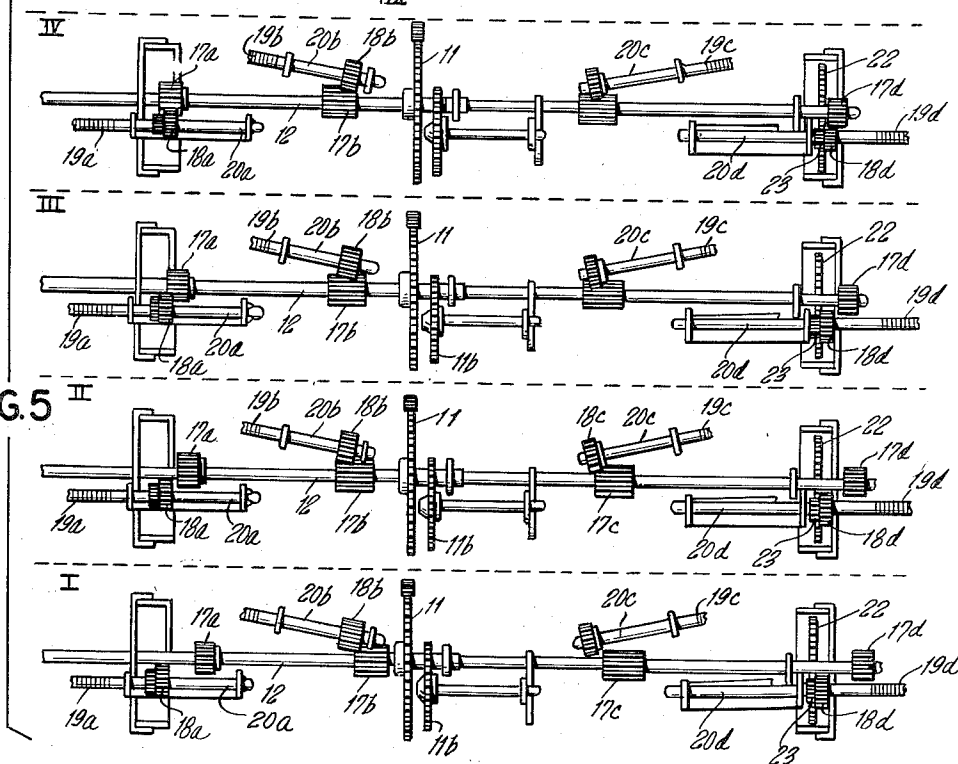


FIG. 5



1

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TOY AIRCRAFT

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Claims priority, application Germany July 27, 1956

9 Claims. (Cl. 46—243)

Our invention relates to multi-propeller toy airplanes and has for its general object to provide a toy that permits simulating the ground maneuvering of actual aircraft prior to take-off and subsequent to landing.

There are known toy airplanes in which four propellers are simultaneously driven or in which a handle located at the fuselage or at the wings permits selectively starting and stopping the right or left propeller in order to simulate the steering of the airplane when taxi-ing with only one propeller in operation. Such toy airplanes are driven by a spring mechanism or by a fly-wheel drive. The drive for the landing-gear wheels in these known toys is derived from the propeller drive. Such toys have also been provided with a steering wheel in order to make the plane travel any desired route while the propellers are in rotation. The propellers are driven from the centrally located spring mechanism by means of flexible shafts.

Relating to such toy aircraft designed for traveling on ground, it is a more specific object of the invention to more faithfully simulate the starting operation of actual, large aircraft in such a manner that the propellers, like in the actual aircraft, start running in time-spaced relation to one another and that the drive for the landing-gear wheels is operated only after all propellers have commenced running. According to a further object of the invention, the drive is to be so designed that the toy aircraft can move forward in any desired traveling direction as is the case with real airplanes in an airport, so that the playing child can perform all movements of aircraft when starting, landing, fueling, taxi-ing, overtaking and parking as actually observed in airports.

According to a feature of our invention, therefore, we provide the multi-propeller toy aircraft with step-down transmissions which connect the drive proper with the propellers, and we also provide means for controlling the driving connection to the respective propellers so that they are started in the desired time sequence. According to a more specific feature, the control means preferably comprise a longitudinally displaceable control shaft provided with pinions which, due to longitudinal shaft displacement, enter successively into meshing engagement with spur gears that are connected with the respective propellers preferably through flexible shafts.

The initiation of the control movements just mentioned may be effected by means of a manually actuable control lever, or by an automatic control device put in operation by the drive or prime mover of the toy aircraft.

According to another feature of the invention it is of particular advantage to provide an electric motor for driving the propellers and the running gear of the aircraft, this motor being built into the fuselage. A fly-wheel motor would not suffice to deliver sufficient power for successively starting the individual propellers in the proper time relation, to subsequently start the running gear and to also perform taxi-ing and parking operations. Spring mechanisms for driving the propellers and running gear would only permit a relatively limited range of action.

2

A toy aircraft according to the invention may also be provided with a nose wheel which can be steered, for instance by means of a remote-control shaft, in order to permit ground travel of the aircraft toward the left or right as may be desired, and in order to have the aircraft return to the original starting location after passing through a desired travel path.

The above-mentioned electric drive motor of the toy aircraft may be energized through a flexible cord from a step-down transformer connected to a current supply line. However, the motor may also be operated from a battery. The attraction of the toy is greatly increased if a second battery is provided which, after starting of all propellers or, if desired, also of the running wheel in the landing gear, is switched on and then causes the propellers to increase their speed of rotation while also increasing the traveling speed of the airplane on ground.

According to another feature of the invention a noise mechanism is built into the toy. When providing, as mentioned, for increased speed of revolution of the drive motor after all propellers have started rotating, the noise produced by the noisemaker is increased as the toy commences to travel on ground, thus further improving the realism of the simulated operations.

The above-mentioned and more specific objects, advantages and features of the invention, these features being set forth with particularity in the claims annexed hereto, will be apparent from, and will be mentioned in, the following description of the embodiments illustrated by way of example on the drawing in which:

Figs. 1 and 2 show two toy airplanes of somewhat different design in perspective illustration.

Fig. 3 is a lateral view of the nose and cockpit of the airplane according to Fig. 1.

Fig. 4 is a schematic and part-sectional top view of the propeller drive used in each of the two toys.

Fig. 5 shows four illustrations, denoted by I, II, III and IV, of the propeller control shaft in four different operating positions respectively.

Fig. 6 is a partial top view similar to Fig. 4 but showing a manual control device for displacing the control shaft.

Fig. 7 shows a detail of Fig. 6 in front view, namely a guiding groove for the manual control lever.

Fig. 8 is a part-sectional top view similar to Fig. 4 and shows an automatically operating device for controlling the drive of the propellers and the running gear.

Fig. 9 is a cross section along the line IX—IX in Fig. 8, and

Fig. 10 is a circuit diagram relating to Fig. 8.

The toy airplane according to Fig. 1 or Fig. 2 is essentially a replica of a modern large four-propeller airplane as far as external appearance is concerned. The toy comprises a fuselage 1, wings 2 and 3, an elevator and rudder portion 4, a nose and cockpit portion 5, the propellers 6, and a landing gear comprising main running wheels 7 and a nose wheel 8. Mounted in the fuselage is an electric motor 9 (Figs. 4, 6) whose shaft carries a pinion 10 meshing with a spur gear 11 on a control shaft 12. The control shaft 12 is longitudinally displaceable. In the embodiment according to Figs. 1, 6 and 7 the displacement is controlled by means of a control lever 13 which has a forked end 14 (Fig. 6) straddling a disc 15 firmly attached to the control shaft 12. When turning the control lever 13 about its pivot 13b (Fig. 6) on a bearing member 16, the control shaft 12 is displaced longitudinally toward the left or toward the right.

The airplanes according to the illustrated embodiments are provided with four propellers which in Fig. 4 are denoted by 6a, 6b, 6c and 6d. For driving these four propellers, the control shaft 12 is provided with respec-

tive pinions 17a, 17b, 17c, 17d. These pinions can be placed into meshing engagement with respective pinions 18a to 18d (Figs. 4, 5) which are connected with the shafts of propellers 6a to 6d through flexible shafts 19a to 19d. The pinions 18a to 18d are firmly joined with respective rigid stub shafts 20a to 20d which enter into the hollow flexible shafts 19a to 19d respectively and are securely joined therewith. The pinion shafts 20a to 20d are journaled on a sheet metal support 21 (Fig. 9). The spacing between the pinions 17a to 17d on the longitudinally displaceable control shaft 12, and the respective lengths of pinions 17a to 17d are such that, when the control lever 13 is being actuated, the individual pairs of pinions enter into operation in the desired time sequence.

The just-mentioned sequential starting operation of the propellers will be explained with reference to Fig. 5 in which the individual illustrations denoted by I, II, III, IV correspond to four sequential control positions of the control lever 13. When the lever is displaced into first position according to part I of Fig. 5, the pinions 17b and 18b are in meshing engagement with each other so that the propeller 6b is driven from motor 9. When the control shaft 12 advances to second position according to part II of Fig. 5, the pinion 17c enters into meshing engagement with the pinion 18c so that the propeller 6c is set in motion. Consequently upon completion of this control operation the two inner propellers 6b and 6c are both running.

When now the control lever is displaced into third position corresponding to part III of Fig. 5, the pinions 17a and 18a engage so that the left outer propeller 6a is started. During the next following control operation according to part IV of Fig. 5, the last propeller 6d is started by meshing engagement of pinions 17d and 18d.

According to Fig. 5, another spur gear 22 is mounted near the right-hand end of the control shaft 12. The spur gear 22 is continuously in mesh with a pinion 23 firmly mounted on the stub shaft 20d of the above-mentioned pinion 18d. Consequently, when in the fourth position IV of Fig. 5 the control-shaft pinion 17d enters into mesh with the pinion 18a for driving the propeller 6a, the pinion 23 also commences to drive the spur gear 22. Spur gear 22 is connected by means of a chain sprocket or rope sheave with the shaft 24 of the main running wheels 25. Consequently, the landing gear of the toy airplane receive driving power from motor 9 only after the fourth propeller is set in motion.

The body of the fuselage 1 has a guiding slot 26 (Figs. 1, 7) for the control lever 13 whose cross section is denoted by 13a in Fig. 7. It will be recognized that the playing child can move the control lever 13 along the guiding slot 26 only by shifting the lever consecutively from point A to point B, thence to points C, D, E to point F in such a manner that the lever must be moved laterally back and forth along a meander-shaped path. As a result, the interval of time elapsing between two sequential control positions of the lever is constrainedly prolonged, thus securing a still more faithful simulation of the starting sequence as it actually occurs when starting the propellers of real aircraft. In Fig. 1 the guiding slot 26 and the manual control lever 13 are shown mounted on the upper side of the fuselage 1 between the wings 2 and 3.

In the embodiment according to Fig. 1, the motor 9 is energized from two dry cells 27 and 28. These two cells are located one behind the other within the fuselage between the main running wheel 7 and the nose wheel 8. This improves the weight balance in such a manner that the toy airplane when traveling on ground is always reliably supported at three points, namely at the main wheels 7 and the nose wheel 8, so that the plane does not have the tendency of dragging its control-surface portion 4 on the ground.

When starting the propellers 6a to 6d as described

above, the motor 9 receives current exclusively from the dry cell 27. Only when the fourth propeller 6d is switched on and the spur gear 22 has started driving the running wheels 7 so that the airplane commences to travel on ground, is the second dry cell 28 added into the energizing circuit of the motor thus imparting a higher revolving speed to the propellers. This will be more fully described below with reference to Figs. 8 and 10. The addition of the second dry cell 28 may also be somewhat delayed so that it takes place only after the fourth propeller 6d is already in rotation.

The increased speed of the propellers is accompanied by increased noise. This noise can be augmented by a noise-making device. For instance as shown, a strip of cardboard or plastic material 29 (Fig. 4) has one end attached to the fuselage structure while the other end rests against one of the spur gears or pinions, for instance against the pinion 11d (see Fig. 9). As soon as the motor 9 assumes an increased speed of rotation due to the addition of the second dry cell 28, the spur gear 11d also increases its speed of rotation so that the strip 29 (Fig. 4) also produces noise of increased intensity.

The charm and attraction of the toy are augmented if the starting of the individual propellers and of the running gear, upon starting of the electric motor, take place automatically. A device capable of such automatic operation is illustrated in Figs. 8 and 9. The motor 9 according to this modification drives a worm 11c through a spur gear transmission comprising gears 10, 11, 11a and 11b. Worm 11c meshes with a worm gear 11d. The shaft 11e of worm gear 11d carries a driver 11f for a Geneva gear 11g. The shaft 11h of Geneva gear 11g carries a control cam 11i. A control lever 13d rests against the control cam 11i and has a forked portion 13c straddling the above-mentioned disc 15 of the control shaft 12. During operation, the motor 9 is effective to operate the driver 11f through transmission gears 10, 11 and 11a to 11d. After each full revolution of driver 11f it shifts the Geneva gear 11g one tooth division. This stepping travel of the Geneva gear 11g corresponds to one of the above-mentioned switching operations. That is, the control cam 11i is so shaped that the control lever 13 is deflected a corresponding angle about its pivot. When the control lever 13d enters into a recess 11k of cam disc 11i, the control lever 13d is displaced toward the left under the action of a biasing spring 30, whereby the control shaft 12 is shifted in the reverse direction back to its starting position.

All propellers 6a to 6d are started when the control lever 13d reaches the outermost right-hand position illustrated in Fig. 8. Then the control lever 13d enters into contact with an electric contact piece 31 which effects the addition of the second dry cell 28 to electric leads 32 as is separately illustrated in Fig. 10.

The king pin 35 (Fig. 3) of the nose wheel 8 is connected by a spur gear transmission 34 with a steering shaft 33 which protrudes upwardly out of the nose portion of the fuselage. As shown in Fig. 1, the flexible cable 36 is stuck onto the steering shaft 33. The control shaft 36 carries at its other end a steering wheel (not illustrated in Fig. 1 but similar to wheel 44 in Fig. 2) to be operated by the playing child.

After the motor is switched on and the individual propellers 6a to 6d are sequentially started whereafter the running gear is automatically placed in operation, the steering of the nose wheel 8 by means of the control cable 36 permits a very accurate control of the toy airplane during ground travel so that the playing child can imitate the starting movements of actual aircraft on the runway in an airport.

The cockpit 37 (Fig. 3) may consist of transparent material so that the figure 38 of the pilot is visible from the outside. This figure 38 is mounted on a supporting plate 40 by means of an intermediate small spring 39.

When starting the electric motor and particularly after

the speed of the motor and the traveling motion of the toy are increased, the figure is placed into slight oscillations, which further adds to the charm of the toy.

In the modified toy airplane according to Fig. 2, which in all other essentials is similar to the airplane described above, the batteries 27, 28, 28a for energizing the electric motor are located in a separate box 41 outside of the toy proper. The box 41 with the dry-cell batteries is carried by the playing child in a pocket or special carrying case. An electric cord 42 connects the battery box with a switching device 43 which is also provided with the steering wheel 44 and control push buttons 45 and 46. The control device 43 is carried in the hand of the playing child and is connected with the toy airplane by a cable 47 which comprises not only the remote-control cable 36 (according to Fig. 1) leading to the steering shaft 33 but which also contains in its interior the current supply leads for the electric motor 9. Such remote-control devices are known as such from U. S. Patent No. 2,723,492, and for that reason are not further described in this specification.

In the illustrated embodiments, the blades of each individual propeller have a hub portion 6e (Fig. 4) in common, as is the case in actual airplanes of large size. The propeller blades and the hub portion are preferably formed of a relatively soft or flexible synthetic plastic. The propeller blades may also have rectangular shape at their free ends and may be given a color well visible during rotation, for instance silver color.

In a toy airplane with automatic control of the propeller and running-gear drive as described above with reference to Figs. 8 and 9, an arresting device or latch may be used in order to lock the control lever 13d in a desired position so that the automatic control operations will repeat themselves until the latch is released. In Fig. 8, such a latch lever is denoted by 13e. The latch lever can be displaced in the direction of the indicated double-headed arrow. In the illustrated position, the latch lever 13e enters into the path of control lever 13d and thus arrests the control lever 13d. As a result, the running-gear drive remains switched on, and the cycle of the preceding control operations cannot automatically repeat itself. Consequently, the playing child, by thus arresting the control lever 13d, can perform traveling maneuvers on ground; and the above-described sequential control operations will be automatically performed only after latch lever 13e is shifted out of the illustrated active position.

It will be obvious to those skilled in the art, upon a study of this disclosure, that toy aircraft according to our invention may be given various designs, components or accessories other than those particularly illustrated and described herein, without departing from the essential features of our invention and within the scope of the claims annexed hereto.

We claim:

1. Toy aircraft, comprising a fuselage and a plurality of propellers and ground-travel gear, a drive for said propellers and travel gear, said drive being mounted in said fuselage, transmission shaft means with which said drive is drivingly connected, said shaft means having a plurality of pinions and being axially displaceable, spur gears connected with said respective propellers for driving them, said pinions being sequentially engageable with said spur gears by axial displacement of said shaft means, and control means operatively connected with said transmission shaft means for displacing it, the tooth face length and mutual longitudinal spacing of respective ones of said pinions and spur gears being arranged so that on axial displacement of said shaft means respective ones of said pinions and spur gears will mesh in time sequence to thereby start said propellers in time sequence and for maintaining each of said propellers in rotation once it has started and during the starting and continued rotation of subsequent ones of said propellers.

2. Toy aircraft, comprising a fuselage and a plurality of propellers and ground-travel gear, a drive for said propellers and travel gear, said drive being mounted in said fuselage, a transmission shaft with which said drive is drivingly connected, said shaft having a plurality of pinions and being axially displaceable, spur gears connected with said respective propellers for driving them, said pinions being sequentially engageable with said spur gears by axial displacement of said shaft, and control means operatively connected with said transmission shaft displacing it to thereby start said propellers in time sequence and for maintaining each of said propellers in rotation once it has started and during the starting and continued rotation of subsequent ones of said propellers, and including a worm and worm gear meshing with each other, a step-down gearing connecting said drive with said worm to impart revolution of reduced speed to said worm gear, a Geneva driver coaxially joined with said worm gear, a Geneva stepping gear engageable by said driver to rotate in steps, a cam joined with said Geneva gear to be incrementally driven thereby, a switching lever forming part of said control means for displacing said transmission shaft, and spring means biasing said control lever against said cam, whereby said control lever and transmission shaft are incrementally switched by said cam.

3. In toy aircraft according to claim 2, said drive comprising an electric motor, current supply means having selective low and high voltages, a selector switch connecting one of said low and high voltages at a time to said motor for operating it at low and high speeds respectively, said control lever being controllably engageable with said selector switch when said lever is switched to a position in which all said propellers have started running, whereby said switch is actuated to increase the speed of said drive.

4. Toy aircraft, comprising a fuselage and a plurality of propellers and ground-travel gear, a drive for said propellers and travel gear, said drive being mounted in said fuselage, transmission shaft means with which said drive is drivingly connected, said shaft means having a plurality of pinions and being axially displaceable, spur gears connected with said respective propellers for driving them, said pinions being sequentially engageable with said spur gears by axial displacement of said shaft means, and control means operatively connected with said transmission shaft means for displacing it, the tooth face length and mutual longitudinal spacing of respective ones of said pinions and spur gears being arranged so that on axial displacement of said shaft means respective ones of said pinions and spur gears will mesh in time sequence to thereby start said propellers in time sequence and for maintaining each of said propellers in rotation once it has started and during the starting and continued rotation of subsequent ones of said propellers, said drive comprising an electric motor, current supply means having selective low and high voltages, a selector switch connecting one of said low and high voltages at a time to said motor for operating it at low and high speeds respectively, said control means including a control lever controllably engageable with said selector switch when said control means is switched to a position in which all said propellers have started running, whereby said switch is actuated to increase the speed of said drive.

5. Toy aircraft for ground travel, comprising a fuselage and a plurality of propellers, a drive fixedly mounted within said fuselage, controllable transmission means having mating pairs of gears inter-connecting said drive with each of said plurality of propellers, and a sequencing device connected with said respective transmission means for successively controlling respective ones of said pairs of gears for starting said propellers in time sequence and for maintaining each of said propellers in rotation once it has started and during the starting and continued rotation of subsequent ones of said propellers, said sequencing

7

means comprising a lever pivoted for movement through a plurality of incremental positions, and operably connected to axially move said transmission means to engage and disengage subsequent ones of said pairs of gears in steps corresponding to said incremental positions, the tooth face length and mutual longitudinal spacing of the respective gears of said gear pairs being arranged so that in a first incremental position of said lever only a first one of said pairs of gears will be in mesh to connect only one of said propellers to said drive, and in a second incremental position of said lever a first one and a second one of said pairs of gears will be in respective mesh to connect two of said propellers to said drive.

6. Toy aircraft for ground travel according to claim 5, and having ground travel wheels, said controllable transmission means including an additional mating pair of gears axially movable into mutual mesh for connecting said drive with said ground travel wheels, each of the gears of said additional pair of mating gears being longitudinally spaced from the respective gears of said first mentioned gear pairs so as to remain out of mesh during at least said first incremental position of said lever.

7. In toy aircraft according to claim 5, said lever consisting of a manually operable lever pivoted in said fuselage and protruding upwardly out of said fuselage to cause axial displacement of said transmission shaft when said lever is shifted about its pivot.

8. In toy aircraft according to claim 5, said lever consisting of a manually operable lever pivoted in said fuselage and protruding upwardly out of said fuselage, said fuselage having a slot traversed by said lever and of stepped shape to define switching steps for said lever, said pinions having positions on said transmission shaft which are correlated to said steps, whereby passage of said lever from one to the next step position causes another propeller to be started.

8

9. Toy aircraft, comprising a fuselage and a plurality of propellers, a drive mounted within said fuselage, respective transmissions interconnecting said drive with each of said plurality of propellers, each of said respective transmissions having an individually controllable gear pair engageable for driving the respective appertaining propeller, and sequencing means comprising a lever pivoted for movement through a plurality of incremental positions and operably connected to axially move a gear of each of said gear pairs to mutually engage and disengage subsequent ones of said gear pairs in steps corresponding to said incremental positions of said lever, the tooth face length and mutual longitudinal spacing of the respective gears of said gear pairs being arranged so that in a first incremental position of said lever only one of said pairs of gears will be engaged to connect only one of said propellers to said drive, and in a second incremental position of said lever a first one and a second one of said pairs of gears will be in respective engagement to connect two of said propellers to said drive.

References Cited in the file of this patent

UNITED STATES PATENTS

2,146,665	Wood	Feb. 7, 1939
2,346,850	Lines	Apr. 18, 1944
2,427,952	Evans	Sept. 23, 1947
2,439,054	Mosthof	Apr. 6, 1948
2,632,284	McDonald	Mar. 24, 1953
2,723,492	Muller	Nov. 15, 1955
2,778,158	Ernst	Jan. 22, 1957
2,795,897	Ernst	June 18, 1957

FOREIGN PATENTS

506,802	Great Britain	June 2, 1939
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