CLAIMS

1. A machine (100) equipped with a powertrain that comprises:

- a thermal powertrain comprising a thermal engine (1) and a shaft (A1), termed the output shaft of the thermal engine, drivable in rotation by the thermal engine;

- an electric powertrain comprising an electric motor (2);

- an electric power supply system (4) comprising a battery (40) for supplying power to the electric motor (2);

- a propeller propulsion system comprising a propeller (3) and a shaft (A3), termed the propeller shaft, to which the propeller (3) is coupled;

the powertrain also comprising a system of clutches (E123, E14, E23, E324) configured, selectively:

- to drive the propeller (3) by means of the thermal engine (1) without transmission of the rotation of the electric motor (2) to the propeller (3);
- to drive the propeller (3) by means of the electric motor (2) without transmission of the rotation of the thermal engine (1) to the propeller (3);
- to drive the propeller (3) by combined transmission of the rotation movement of the thermal engine (1) to the propeller (3) and of the rotation movement of the electric motor (2) to the propeller (3);

the powertrain comprising a shaft (A2), termed the intermediate shaft, rigidly connected to or able to be coupled in rotation to the propeller shaft (A3),

and the clutch system comprising:

- a first clutch (E123) configured, in the engaged state, to transmit the rotation of the thermal engine (1) to the intermediate shaft (A2), and
- a second clutch (E23) configured, in the engaged state, to transmit the rotation from the intermediate shaft (A2) to the propeller shaft (A3) and/or a third clutch (E324) configured, in the engaged state, to transmit the rotation of the electric motor (2) to the propeller shaft (A3);

the electric motor (2) comprising a stator (201) and a rotor (202), the rotor being mounted to rotate about the intermediate shaft (A2) inside the stator (201), the rotor (202) and the intermediate shaft (A2) being coaxial;

in which the powertrain also comprises an epicyclic gear train type mechanical

transmission system (S2, S23, C223) that comprises:

- an interior shaft (S2), termed the sun gear, corresponding to a part of the intermediate shaft (2) and a ring gear (C223) carried by the interior of the hollow body of the rotor;
- a planet gear (S23) disposed between the sun gear (S2) and the ring gear (C223) and a planet carrier the end of which opposite the planet gear (S23) is constrained to rotate with a part of the second clutch (E23), the second clutch (E23) comprising another part constrained to rotate with the propeller shaft (A3).

2. The machine (100) as claimed in claim 1, in which each shaft (A1, A2) that forms part of the system for transmission of movement to the propeller (3) is coaxial with the propeller shaft (A3).

3. The machine (100) as claimed in claim 1 or 2, in which the stator (201) takes the form of a hollow body provided with a winding (21), and the rotor (202) is provided with magnets (22).

4. The machine (100) as claimed in any one of claims 1 to 3, in which the clutch system comprises a fourth clutch (E14) configured, in the engaged state, to transmit the rotation of the thermal engine (1) to the electric motor (2) to cause it to function as a generator.

5. The machine (100) as claimed in claim 4, in which the fourth clutch (E14) comprises a part that, in the engaged state of the first clutch (E123), is constrained to rotate with the output shaft (A1) of the thermal engine (1) and another part that is mounted on and constrained to rotate with the rotor (202) of the electric motor (2).

6. The machine (100) as claimed in any one of claims 1 to 5, in which the third clutch (E324) comprises a part constrained to rotate with the rotor (202) of the electric motor (2) via a mechanical transmission system (S3, S223, C213) and a part constrained to rotate with the propeller (3).

7. The machine (100) as claimed in any one of claims 1 to 5, in which the electric power supply system (4) also includes an electric management system (41, 42) that comprises:

- a high-tension unit (41) for opening or closing the power supply circuit between the battery (40) and the electric motor (2);
- a controller (42) for treating the current supply by the battery (40) or produced by the electric motor (2) when functioning as a generator.

8. A method for controlling a machine (100) as claimed in any one of claims 1 to 7, in which for electric propulsion of the machine during a take-off and/or climbing phase,

the clutches are brought to the following configuration:

- the first clutch (E123) is disengaged to release the thermal engine (1) from the propeller (3);
- the second clutch (E23) is disengaged;
- the third clutch (E324) is engaged to transmit the movement of the electric motor (2) to the propeller (3).

9. A method for controlling a machine (100) as claimed in any one of claims 1 to 7, in which, for thermal propulsion with no use of the electric powertrain,

the clutches are brought to the following configuration:

- the first clutch (E123) is engaged;
- the second clutch (E23) is engaged to transmit the movement of the thermal engine (1) to the propeller (3).

10. A method for controlling a machine (100) as claimed in any one of claims 1 to 7, in which, for propulsion by combined use of the thermal engine (1) and the electric motor (2),

the clutches are brought to the following configuration:

- the first clutch (E123) is engaged;
- the second clutch (E23) is engaged to transmit the movement of the

thermal engine (1) to the propeller (3);

- the third clutch (E324) is engaged to transmit the movement of the electric motor (2) to the propeller (3).

11. A method for controlling a machine (100) as claimed in 4,
in which, to charge the battery (40) using the thermal engine (1) whilst maintaining driving in rotation of the propeller (3), the clutches are brought to the following configuration:
the first clutch (E123), the fourth clutch (E14) and the second clutch (E23) are engaged, so that the thermal engine (1) drives the intermediate shaft (A2) to cause the rotor (202) to turn relative to the stator (201) in order to generate a current, whilst driving the propeller shaft (A3);
and in that the electric management system (41, 42) controls the current produced by the electric motor (2) functioning as a generator to charge the battery (40).

12. A method for controlling a machine (100) as claimed in claim 4,
in which, for recovery of energy by wind driven or water driven effect,
the clutches are brought to the following configuration:

- the first clutch (E123) and/or the second clutch (E14) is or are disengaged to uncouple the propeller (3) from the thermal engine (1) or to uncouple the rotor (202) from the thermal engine (1);
- the second clutch (E23) is disengaged;
- the third clutch (E324) is engaged to transmit the movement of the propeller (3) to the rotor (202) of the electric motor (2).

13. A method for controlling a machine (100) according to claim 4,
in which, to charge the battery (40) using the thermal engine (1) without driving the propeller (3), the clutches are brought to the following configuration:

- disengaging the third clutch (E324) and the second clutch (E23),
- closing the first clutch (E123) and the fourth clutch (E14) so that the thermal engine (1) drives the intermediate shaft (A2) to cause the rotor (202) to turn in

order to generate a current,

and in that the electric management system (41, 42) controls the current produced by the electric motor (2) functioning as a generator to charge the battery (40).

14. A method of controlling a machine (100) as claimed in any one of claims 1 to 7, in which, the machine comprising wheels provided with an electric powertrain connected to the power supply battery (40) of the machine via an electric management system (41, 42), the method comprises supply of power to the electric powertrain of the wheels by the electric battery (40).