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Electronic transmission (ePCT)

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European Patent Application WO2019IB57599
"Angular transmission device"

Pursuant to Article 19(1) PCT, please find enclosed amended pages 15-18 containing a complete set of claims in replacement of those originally filed. In the amendments:

- claim 1 replaces the claim of the same number as filed, and the feature "*a flexible blade*" has been replaced with "*a flexible blade or a flexible cable*" in lines 18 and 21. This amendment is based on paragraph [0026] of the original application that states that "*in an embodiment, the blade could be replaced by a flexible cable*";
- claims 2, 3, 5, 7, and 13 to 15 are unchanged;
- claim 4, 6 to 8, 10 to 12 replace the claims of the corresponding numbers as filed and are amended to be in conformity with amended claim 1, on the same basis. More precisely, the amendments are at:
    - claim 4, lines 3-4;
    - claim 6, line 2;
    - claim 7, lines 2-3;
    - claim 8, line 2;
    - claim 10, line 2;
    - claim 11, line 2;
    - claim 12, line 2.

Very truly yours,

P&TS Ltd.

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Claims

1. Angle transmission device (1,201) comprising :

- An input shaft (2,202) rotating around a first rotation axis and an output shaft (3,203) rotating around a second rotation axis,

- An assembly (4,204) arranged to couple the input shaft (2,202) with the output shaft (3,203) so that the output shaft (3,203) can be rotationally driven by the input shaft (2,202), said assembly (4,204) allowing for the transformation of the rotation of the input shaft (2,202) around said first rotation axis into the rotation of the output shaft (3,203) around the second rotation axis;

- the assembly (4,204) comprising a rotary actuator (5, 205) and a linear mobile (6,206), the rotary actuator (5,205) being coupled with the input shaft (2,202) and arranged for moving the linear mobile (6,206) in a translation motion relative to the actuator (5,205), the linear mobile (6,206) being coupled with the output shaft (3,203) so that the rotation of the input shaft (2,202) can drive the rotation of the output shaft (3,203);

the device (1,201) being characterized in that the assembly (4,204) further comprises a flexible blade (10,100,216) or a flexible cable fixed to said linear mobile (6,206) and looped around the output shaft (3,203), so that when the actuator (5,205) moves the linear mobile (6,206), the flexible blade (10,100,216) or the flexible cable drives the rotation of the output shaft (3,203).

2. Device (1,201) according to claim 1, wherein the rotary actuator (5,205) comprises a ball screw (7,207) and the mobile (6,206) comprises a ball nut (8,208), the device (1,201) comprising a plurality of balls circulating between the ball screw (7,207) and the ball nut (8,208) so that the balls

transmit the torque between the ball screw (7,207) to the ball nut (8,208) to move the ball nut (8,208) in a linear motion, and wherein the rotation of the input shaft (2,202) drives the ball screw (7,207) and generates the linear motion of the ball nut (8,208) that drives the rotation of the output shaft (3,203).

3. Device (1,201) according to claim 1, wherein the actuator (5,205) comprises a lead screw and the linear mobile (6,206) comprises at least a nut, the lead screw being coupled with said nut to move said nut in a linear motion relative to the lead screw, the rotation of the input shaft (2,202) drives the lead screw and generates the linear motion of the nut that drives the rotation of the output shaft (3,203).

4. Device (1,201) according to any one of claims 1 to 3, wherein the linear mobile (6,206) comprises at least a nut (8,208) and a housing (9,209) integral with said nut (8,208), the flexible blade (10,100,216) or the flexible cable being fixed on said housing (9,209).

5. The device (1,201) according to any one of claims 1 to 4, wherein the rotary actuator (5,205) comprises a rotary motor, preferably a brushless motor, a stepper motor, a piezo motor, a voice coil or a DC motor.

6. Device (1,201) according to any one of claims 1 to 5, wherein the flexible blade (10,100,216) or the flexible cable comprises two ends (105) and a loop (104), said loop (104) being between said two ends (105), said ends (105) being fixed to the linear mobile (6,206).

7. Device (1,201) according to any one of claims 1 to 6, wherein the device is arranged to be in contact or to have a gap between the flexible blade or the flexible cable (10,100,216) and the linear mobile (6,206).

8. Device (1,201) according to any one of claims 1 to 7, wherein the flexible blade (10,100,216) or the flexible cable is made of metal or polymer.

9. Device (1,201) according to any one of claims 1 to 8, wherein the input shaft (2,202) and/or the output shaft (3,203) is mounted on at least one ball bearing (215).

10. Device (1,201) according to any one of claims 1 to 9, wherein the flexible blade (10,100,216) or the flexible cable allows the angular rotation of the output shaft (2,202) between -1000° and 1000°, preferably between about -180° and +180°, more preferably between -30° and +30°.

11. Device (1,201) according to any one of claims 1 to 10, wherein the flexible blade (10,100,216) or the flexible cable allows for the control of the angular position of the output shaft (3,203) between a plurality of discreet indexed positions.

12. Device (1,201) according to any one of claims 1 to 11, wherein the flexible blade (10,100,216) or the flexible cable allows for the control of the angular position of the output shaft (3,203) on an operational range comprised between a first angular position and a second angular position.

13. Device (1,201) according to any one of claims 1 to 12, wherein the device is a reducer for reducing the torque and/or the speed between the input shaft (2,202) and the output shaft (3,203), preferably with a reduction ratio comprised between 1:1 and 1:20000, more preferably between about 1:1 and 1:2000, in particular between 1:1 and 1:200.

14. Device (1,201) according to any one of claims 1 to 13, wherein the first rotation axis is perpendicular to the second rotation axis.

15. Method for transforming a rotation around a first axis into a rotation into a second axis, the method using a device (1,201) according to any one of claims 1 to 14.