CLAIMS

1. An actuator for a downhole tool, the actuator comprising:

an actuator housing;

an escapement sleeve axially moveable with respect to the actuator housing and having a plurality of axially-arranged escapement teeth;

a rocker secured within the actuator housing and having opposing first and second pallets; and

an operating sleeve reciprocable to rock the rocker back and forth to alternately move the opposing first and second pallets into engagement with the escapement sleeve as the escapement sleeve advances axially in an actuating direction.

2. The actuator of claim 1, further comprising a piston for driving the operating sleeve in a first axial direction in response to a pressure applied to the piston and an axial biasing member for biasing the operating sleeve in an opposing second axial direction, such that cycling the pressure to the piston drives reciprocation of the operating sleeve; AND

OPTIONALLY, further comprising a rocker spring for biasing the rocker in a first rotational direction, OPTIONALLY wherein the pressure applied to the piston is also applied to advance the escapement sleeve axially.

3. The actuator of claim 1, wherein the escapement sleeve comprises an array of annular rings that define the escapement teeth.

4. The actuator of claim 1, wherein the rocker comprises a first tapered surface and the operating sleeve comprises a first engagement member for engaging the first tapered surface when the operating sleeve is urged in a first axial direction to rotate the rocker in a first rotational direction;

OPTIONALLY, wherein the rocker comprises a second tapered surface opposite the first tapered surface and the operating sleeve comprises a second engagement member opposite the first engagement member for engaging the second tapered surface when the operating sleeve is urged in a second axial direction opposite the first direction to rotate the rocker in a second rotational direction opposite the first rotational direction; AND

OPTIONALLY, further comprising a rocker spring that biases the rocker in a second rotational direction opposite the first rotational direction.

5. The actuator of claim 1, wherein the pallets are arranged so that one of the pallets can only disengage from a respective one of the escapement teeth after the other pallet has engaged another one of the escapement teeth.

6. The actuator of claim 1, further comprising one or more additional rockers circumferentially spaced from the rocker within the actuator housing, each also having opposing first and second pallets, and wherein the operating sleeve rocks each of the one or more additional rockers back and forth to alternately move the opposing their respective first and second pallets into engagement with the escapement teeth as the escapement sleeve advances axially.

7. A well system, comprising:

a downhole tool; and

an actuator comprising an actuator housing, an escapement sleeve axially moveable with respect to the actuator housing and having a plurality of axially-arranged escapement teeth, a rocker secured within the actuator housing and having opposing first and second pallets, and an operating sleeve reciprocable to rock the rocker back and forth to alternately move the opposing first and second pallets into engagement with the escapement teeth as the escapement sleeve advances axially to actuate the downhole tool.

8. The well system of claim 7, wherein the downhole tool comprises a valve, and wherein the actuating the downhole tool comprises opening or closing the valve in response to axially advancing the escapement sleeve.

9. The well system of claim 7, further comprising a piston for driving the operating sleeve in a first axial direction in response to a pressure and an axial biasing member for biasing the operating sleeve in an opposing axial direction, such that cycling the pressure to the piston drives reciprocation of the operating sleeve; AND

OPTIONALLY, wherein the pressure applied to the piston is also applied to advance the escapement sleeve axially.

10. The well system of claim 7, wherein the escapement sleeve comprises an array of annular rings that define the escapement teeth.

11. The well system of claim 7, wherein the rocker comprises a first tapered surface and the operating sleeve comprises a first engagement member for engaging the first tapered surface when the operating sleeve is urged in a first axial direction to rotate the rocker in a first rotational direction;

OPTIONALLY, wherein the rocker comprises a second tapered surface and the operating sleeve comprises a second engagement member for engaging the second tapered surface when the operating sleeve is urged in a second axial direction opposite the first direction to rotate the rocker in a second rotational direction opposite the first rotational direction; AND

OPTIONALLY, further comprising a rocker spring that biases the rocker in a second rotational direction opposite the first rotational direction.

12. A method of actuating a downhole tool, the method comprising:

advancing an escapement sleeve axially with respect to an actuator housing; and

using an operating sleeve to rock a rocker back and forth to alternately move opposing first and second pallets on the rocker into engagement with a plurality of axially-arranged escapement teeth on the escapement sleeve to control the advancing of the escapement sleeve axially.

13. The method of claim 12, further comprising disengaging one of the pallets from a respective one of the escapement teeth only when the other pallet is in engagement with another one of the escapement teeth.