Claims

What is claimed is:

1. A subsea system for producing hydrocarbons comprising:

a subsea production member in fluid communication with a wellbore;

an element in the production member linearly moveable between at least a first position and a second position;

a selectively removable actuation module having,

an electrically powered rotary drive member having a rotatable output, and

a motion translator having a rotatable end linked with the drive member rotatable output and a linearly moveable opposite end connected with the element in the production member; and

a fail safe system in a first configuration coupled to the element in its first position and a second configuration coupled to the element in its second position.

2. The system of claim 1, the actuation module comprising, a motor, a rotatable drive shaft extending from the motor and a coupling system attached on one end to the drive shaft and on the other end to the member, so that energizing the motor selectively moves the element between the first and second position.

3. The system of claim 1, the fail safe system further comprising a spring connected to the element that is compressible with element movement into the second position and uncompressible to move the element into a fail safe position.

4. The system of claim 1, wherein the element is selected from the list consisting of a valve member, a choke, and a piston.

5. The system of claim 1, further comprising a detent in selective anchoring engagement with the drive member.

6. The system of claim 1, further comprising a fastener on the actuation module selectively attachable and detachable with a fastening element on the production member.

7. The system of claim 1, wherein the actuation module comprises a motor and a drive shaft selectively coupled with the motor.

8. The system of claim 7, further comprising a detachable configuration where the motor is detached from the production member.

9. The system of claim 7, further comprising a detachable configuration where the motor and drive shaft are detached from the production member.

10. The system of claim 7, further comprising a detachable configuration where the motor, drive shaft, and motion translator are detached from the production member.

11. The system of claim 1, wherein the production member is selected from the list consisting of a production tree and a manifold.

12. A subsea wellhead assembly for producing hydrocarbons from a subsea wellbore comprising:

a wellhead housing in fluid communication with the wellbore;

a production tree affixed to the wellhead housing;

a valve linearly moveable in the production tree; and

an actuator having,

a housing,

an electric motor having a rotatable shaft and a frame selectively attachable with the housing;

a linkage with an end rotatingly coupled with the rotatable shaft from the electric motor and a linearly moveable end connected to the valve;

a reaction plate connected to the linearly moveable end, and

a compressible member in contact with the reaction plate having a compressed configuration when the valve is in an open position and an expanded configuration when the valve is in a closed position.

13. The assembly of claim 12 wherein the linkage comprises a ball screw.

14. A method of operating a subsea production member having a selectively moveable element therein, the method comprising:

providing a selectively removable actuating device in mechanical cooperation with the moveable element;

energizing the actuating device to rotate a shaft;

converting the shaft rotary motion to linear motion;

linearly moving the moveable element with the converted linear motion;

removing the actuating device; and

selectively moving the moveable element into a fail safe position.

15. The method of claim 14, further comprising selectively moving the moveable element into a fail safe position in response to an event.

16. The method of claim 15, wherein the event is selected from the list consisting of a loss of power to the production member and a command signal.

17. The method of claim 14, wherein the moveable element is selected from the list consisting of a valve, a choke, and a piston.

18. The method of claim 14, further comprising selectively moving the moveable element into a position using the actuation device and anchoring the moveable element in the position.

19. The method of claim 14, wherein the actuation device comprises a motor, the method further comprising detaching the motor from the production member.

20. The method of claim 14, wherein the actuation device comprises a motor coupled with a drive shaft, the method further comprising detaching the motor and drive shaft from the production member.

21. The method of claim 14, wherein the actuation device comprises a motor connect to a drive shaft and a motion translation device connected to the drive shaft, the method further comprising detaching the motor, the drive shaft, and the motion translation device from the production member.

What is claimed is:

1. A subsea system for producing hydrocarbons comprising: a subsea production member in fluid communication with a wellbore; an element in the production member linearly moveable between at least a first position and a second position; a cylindrical actuation housing having an inner end mounted to and extending from the production member and an open outer end: a stem coupled to the element for linear movement therewith and protruding concentrically into the actuation housing; an electrically powered motor having a motor housing assembly and a rotatable drive member extending therefrom; a motion translator located within the actuation housing, having a rotatable end linked with the rotatable drive member and a linearly moveable opposite end connected with the stem; a fastening assembly connected between the motor housing assembly and the actuation housing to secure the motor housing assembly to the actuation housing with the rotary drive member inserted into the actuation housing, the fastening assembly having cooperative elements on the motor housing and on the actuation housing adjacent the open end of the actuation housing; and wherein releasing the fastener assembly enables the motor housing assembly to be retrieved while the actuation housing remains subsea.

2. The system of claim 1, wherein the fastener assembly comprises an external flange on an end of the motor housing assembly, an external flange on the outer end of the actuation housing, and a clamp that engages the external flanges.

3. The system of claim 1, wherein the fastener assembly comprises a plurality of J-slots formed in the actuation housing and a plurality of mating pins on the motor housing assembly.

4. The system of claim 1, wherein the element is selected from the list consisting of a valve member, a choke, and a piston.

5. The system of claim 1, further comprising a fail safe system comprising: a coil spring mounted within the actuation housing and coupled to the stem to urge the element from the first position toward the second position, wherein the movement toward the second position causes back spinning of the drive member; and a detent in selective anchoring engagement with the drive member to prevent the drive member from back spinning unless electrical power to

the motor has ceased.

6. The system of claim 1, wherein the motor housing assembly comprises: a motor housing: a tubular adapter secured to and protruding from the motor housing, wherein the fastener assembly comprises: abutting external flanges located on the tubular adapter and on the actuation housing assembly: a clamp selectively engaging the external flanges; and wherein the motion translator stabs into engagement with the stern such that releasing the clamp causes the motion translator to be retrieved along with the motor.

7. The system of claim 1, wherein the motor housing assembly comprises: a motor housing: a first tubular adapter secured to and protruding from the motor housing: a second tubular adapter in selective abutment with a forward end of the first tubular adapter: a first clamp securing the first tubular adapter to the motor housing: a second clamp securing the second tubular adapter to the first tubular adapter; wherein the motion translator stabs into engagement with the drive member and the stem such that releasing the second clamp and maintaining the first clamp closed causes the motion translator to be retrieved along with the motor; and releasing the first clamp while maintaining the second clamp closed causes the motion translator to remain in the actuation housing while the motor is retrieved.

8. The system of claim 1, wherein the fastener assembly comprises: a plurality of J-slots formed in an interior of the actuation housing adjacent the open end; a plurality of pins on an exterior portion of the motor housing assembly; and wherein the exterior portion of the motor housing assembly stabs into the interior of the actuation housing.

9. The system of claim 1, wherein the production member is selected from the list consisting of a production tree and a manifold.

10. A subsea wellhead assembly for producing hydrocarbons from a subsea wellbore comprising: a subsea valve having a valve element linearly moveable between first and second positions, and a valve stem extending therefrom; a cylindrical actuation housing mounted to the valve and having an open end opposite the valve, the stem extending concentrically within the actuation housing; an electric motor having a rotatable shaft and a motor housing having a portion that inserts into the open end of the actuation housing; a pin and slot arrangement on

an exterior portion of the motor housing and an interior portion of the actuation housing for releasably latching the motor housing to the actuation housing, enabling the motor to be retrieved while the actuation housing remains subsea; a motion translator linkage with a rotatable end selectively coupled with the rotatable shaft from the electric motor and a linearly moveable end connected to the valve stem; a reaction plate connected to the linearly moveable end of the linkage and movable in unison therewith: and a coil spring coaxially disposed in the actuation housing and having an outer end in contact with the reaction plate for urging the reaction plate and the valve stern toward the open end of the actuation housing.

11. A method of operating a subsea production member having a linearly moveable element therein and a stem extending from the moveable element, the method comprising: mounting a cylindrical actuation housing to the production member with the stem extending concentrically inside the actuation housing; connecting a linear movably end of a motion transfer linkage to the stem such that the linkage is enclosed by the actuation housing; providing an electrical motor with a motor housing assembly, lowering the motor subsea, inserting a rotary drive member of the motor into engagement with a rotatable end of the linkage; releasably securing the motor housing assembly to the actuation housing; energizing the motor to drive the linkage; linearly moving the moveable element with the linkage; and releasing the motor housing assembly from the actuation housing, and retrieving the motor housing assembly.

12. The method of claim 11, wherein releasably securing the motor housing assembly to the actuation housing comprises latching the motor housing assembly to the actuation housing employing a pin and slot arrangement.

13. The method of claim, 11 wherein releasably securing the motor housing assembly to the actuation housing comprises clamping the motor housing assembly to the actuation housing.

14. The method of claim 11, wherein the moveable element is selected from the list consisting of a valve, a choke, and a piston.

15. The method of claim 11, wherein the linear movably end of the linkage remains connected to the stem after the motor is retrieved.

16. The method of claim 11, wherein releasably securing the motor housing assembly to the actuation housing comprises engaging pins on the motor housing assembly with J-slots provided in the actuation housing, and rotating the motor housing assembly relative to the actuation housing an increment.

17. The method of claim 11, wherein retrieving the motor housing assembly further comprises releasing the linkage from engagement with the stem and retrieving the linkage along with the motor housing assembly.