Claims

What is claimed is:

1. A safety valve comprising:

an outer housing comprising a central bore extending axially through the outer housing;

a flow tube comprising:

a translating sleeve; and

a flow tube main body disposed within the translating sleeve, wherein the flow tube main body has an upper end and a lower end;

a piston operable to transmit a force to the translating sleeve;

a flapper valve disposed on a distal end of the outer housing; and

an electromagnet assembly operable to maintain the safety valve in an open state, the electromagnet assembly comprising a tubular housing coaxially aligned with the outer housing, and at least one coil attached to the tubular housing, the electromagnet assembly operable to move within the safety valve, the at least one coil operable to generate a magnetic force to fix the electromagnet assembly in place to hold the translating sleeve in place.

2. The safety valve of claim 1 wherein the piston is coupled to the electromagnet assembly.

~~2. The safety valve of claim 1 wherein the translating sleeve and the flow tube main body are operable to move within the outer housing.~~

3. The safety valve of claim 2, wherein the piston and the electromagnet assembly are operable to move due to fluid pressure.

~~3. The safety valve of claim 2,~~

~~wherein the translating sleeve further comprises a translating sleeve shoulder,~~

~~wherein the flow tube main body comprises a flow tube shoulder, and~~

~~wherein the flow tube shoulder is operable to engage with the translating sleeve shoulder to prevent the flow tube to move beyond the translating sleeve.~~

4. The safety valve of claim 3 further comprising a power spring disposed between ~~the~~ a translating sleeve shoulder and a lower valve assembly, wherein the power spring is operable to provide a positive spring force against the translating sleeve shoulder.

5. The safety valve of claim 3 further comprising a nose spring disposed between ~~the~~ a flow tube shoulder and a translating sleeve assembly, wherein the translating sleeve and the translating sleeve assembly are fixedly attached.

6. The safety valve of claim 5 wherein the piston is fixedly attached to the translating sleeve assembly.

7. The safety valve of claim 5 wherein the electromagnet assembly is fixedly attached to the translating sleeve assembly by a second piston.

8. A method of actuating a safety valve comprising:

moving a translating sleeve using well pressure from a first translating sleeve position to a second translating sleeve position, the translating sleeve being disposed within an outer housing comprising a central bore extending axially through the outer housing;

locking in place the translating sleeve in the second translating sleeve position by providing a force from an electromagnet assembly; and

moving a flow tube main body from a first flow tube main body position to a second flow tube main body position, the flow tube main body being disposed within

the translating sleeve, wherein moving the flow tube main body from the first flow tube main body position to the second flow tube main body position displaces a flapper valve from a closed position to an open position,

wherein the step of moving the flow tube main body from the first flow tube main body position to the second flow tube main body position comprises increasing a pressure in the flow tube main body and causing a nose spring to push the flow tube main body into the flapper valve thereby opening the flapper valve.

9. The method of claim 8 wherein the step of moving the translating sleeve using well pressure comprises decreasing a pressure within the flow tube main body, allowing the well pressure to transmit a force to the translating sleeve, and moving the translating sleeve to the second translating sleeve position.

10. The method of claim 9 wherein decreasing pressure in the flow tube main body comprises pumping fluid out of the flow tube main body or swelling a conduit above the flow tube main body.

11. The method of claim 9 wherein the well pressure transmits the force through a piston, the piston being operable to move the translating sleeve.

12. The method of claim 8 wherein the step of locking in place the translating sleeve in the second translating sleeve position comprises providing power to the electromagnet assembly and using a magnetic force provided by the electromagnet assembly to prevent movement of a second piston, the second piston being operable to prevent movement of the translating sleeve from the second translating sleeve position.

13. The method of claim 8 wherein the providing the force from the electromagnet assem-

bly comprises applying the force in an axial direction, the electromagnet assembly comprising a tubular housing coaxially aligned with the outer housing, and at least one coil attached to the tubular housing ~~the step of moving the flow tube main body from the first flow tube main body position to the second flow tube main body position comprises increasing a pressure in the flow tube main body and causing a nose spring to push the flow tube main body into the flapper valve thereby opening the flapper valve.~~

14. The method of claim ~~13~~ 8, wherein the translating sleeve further comprises a translating

sleeve shoulder and the flow tube main body comprises a flow tube shoulder, wherein the flow tube shoulder and the translating sleeve shoulder are in contact when the flow tube main body is in the second flow tube main body position.

15. The method of claim 8 wherein the step of moving the flow tube from the first flow tube main body position to the second flow tube main body position comprises

increasing a pressure in the flow tube main body such that the pressure in the flow tube main body and a positive spring force acting on a flow tube shoulder provided by a nose spring overcome a differential pressure across the flapper valve, thereby

moving the flow tube to the second flow tube position.

16. A system comprising:

a safety valve disposed in a wellbore, wherein the safety valve comprises a translating sleeve, the translating sleeve being operable to move by well pressure;

an electromagnet assembly operable to prevent the translating sleeve from moving, the electromagnet assembly comprising a tubular housing coaxially aligned with the outer housing, and at least one coil attached to the tubular housing, the electromagnet assembly operable to move within the safety valve, the at least one coil operable to generate a magnetic force to fix the electromagnet assembly in place to hold the translating sleeve in place; and

a process control system operable to actuate the safety valve from a closed position to an open position, the process system comprising:

a pump; and

an electrical connection to the safety valve operable to provide electrical power to the safety valve.

17. The system of claim 16 wherein the safety valve further comprises:

an outer housing comprising a central bore extending axially through the outer housing, wherein the translating sleeve is disposed in the central bore;

a flow tube is disposed within the translating sleeve;

a piston operable to transmit a force to the translating sleeve; and

a flapper valve disposed on a distal end of the outer housing~~; and~~

~~an electromagnet assembly operable to prevent the translating sleeve from moving~~.

18. The system of claim 17 wherein the ~~electromagnet assembly comprises~~ at least one coil extends axially.

19. The system of claim 16 wherein the process system further comprises a pressure transducer, a flowmeter, or a combination thereof.

20. The system of claim 16 wherein the process system is operable to detect a process upset and cut power to the safety valve.