CLAIMS

WHAT IS CLAIMED

1. A directed jet impulse pig launching system comprising:

a pig trap fluid injector assembly, the pig trap fluid injector assembly comprising:

a longitudinally extending pipe (87) including an inlet end (99), an outlet end (101), and at least one bend (105) located in between said ends (99/101) at an oblique angle α relative to horizontal;

a flat-profile flange (89) located at the inlet end and including a leak path through the flat-profile flange and a plurality of bolt holes (103); and

a curved-profile flange (91) located at the outlet end (101) and including a leak path through the curved-profile flange and an opening (82);

a nozzle (81) connected to the longitudinally extending pipe and located at least partly in the opening (82);

a kicker line surrounding the longitudinally extending pipe between the inlet and outlet ends and forming an annular space about the longitudinally extending pipe, the annular space being in communication with the leak paths of the flat- and curved-profile flanges;

wherein when the pig trap fluid injector assembly is installed in a sidewall opening (24) of a pig trap, the nozzle (81) is oriented to deliver a jet of fluid in a downstream direction, the jet of fluid being at a velocity greater than that of a main pipeline flow velocity to create concentrated forces significantly higher

than the forces generated when pipeline product flows into the back of the launcher as is the case with a typical kicker line operation.

2. The directed jet impulse pig launching system of claim 1, further comprising:

a housing (121) containing the nozzle (81) and forming an annular space (113) between the housing (121) and an outside surface (115) of the nozzle (81).

3. The directed jet impulse pig launching system of claim 2, further comprising, the housing (121) including a restrictor plate (123) at one end.

4. The directed jet impulse pig launching system of claim 3, further comprising, the restrictor plate (123) including at least one port to provide a fluid leak path (111) through the restrictor plate (123).

5 The directed jet impulse pig launching system of claim 1, further comprising, the curved-profile flange (91) configured complementary to a curvature of a sidewall (12) of the pig trap.

6. The directed jet impulse pig launching system of claim 1, further comprising:

the nozzle (81) including a valve (83).

7. The directed jet impulse pig launching system of claim 6, further comprising:

a valve state indicator (85) in communication with the valve (83).

8. A pig trap comprising:

a barrel (11) including a sidewall opening (24); and

a directed jet impulse launching system including:

a kicker line connectable to the barrel;

a longitudinally extending pipe smaller in diameter than, and surrounded by, the kicker line, the longitudinally extending pipe including a flat-profile flange at an inlet end and a curved-profile flange at an outlet end to match a curvature of the sidewall opening, each of said flanges including a leak path through the flange;

at least one nozzle (81) connected to the longitudinally extending pipe and located at a non-normal angle α relative to horizontal and oriented to deliver a jet of fluid into the barrel through the sidewall opening in a direction opposite that of a closure door (22) of the pig trap (10).

9. A pig trap (10) according to claim 8, further comprising:

the at least one nozzle (81) including a valve (83); and

a valve state indicator (85) in communication with the valve (83).

10. A pig trap (10) according to claim 9, further comprising:

a computer including executable instructions in communication with the valve (83) and the valve state indicator (85).

11. A pig trap (10) according to claim 8, further comprising, the barrel (11) including at least one positioning pin (131) located along the barrel (11) and configured to indicate an axial location of a pig when in the barrel (11).

12. A pig trap according to claim 8, further comprising:

a curved fluid distribution grid (15) in communication with the at least one nozzle (81) and located in a lower half (73) of the barrel (11) above a floor of the barrel (11), the fluid distribution grid (15) including a perforated matrix containing a plurality of ports.

13. A method of launching a pig into a pipeline system, the method comprising:

diverting a portion of a main pipeline product flow into a nozzle (81) located within kicker line connected to a sidewall opening (24) of a barrel (11) of a pig trap (10), the nozzle (81) oriented at non-normal angle α relative to horizontal; and

discharging a part of the diverted portion through the nozzle (81) at a velocity at least 30 times that of the main pipeline product flow toward a back side (75) of a vertical element (71) of the pig, the discharged part impinging on the back side (75) of the vertical element (71);

wherein the nozzle is connected to a longitudinally extending pipe surrounded by the kicker line, an annular space being formed between the kicker line and the longitudinally extending pipe; and

wherein the longitudinally extending pipe includes an inlet end having a flange, an outlet end having a flange, and at least one bend located in between said ends, each flange including a leak path through the flange to the annular space.

14. A method according to claim 13, further comprising:

further accelerating the pig forward in the barrel by the discharged part impinging upon at least one other trailing vertical element (71) of the pig as the pig moves forward in the barrel (11).

15. A method according to claim 13, further comprising:

allowing a portion of main pipeline product flow to flow into the longitudinally extending pipe, and raising a pressure around the longitudinally extending pipe by allowing a portion of the main pipeline product to flow into the leak paths to fill the annular space (113).

16. A method according to claim 13, further comprising:

the nozzle delivering a fluid entry velocity in a range of 100 fps to 1200 fps.

17. A method according to claim 16, wherein the mainline product flow is at a velocity no greater than about 2 mph.

18. A method according to claim 13, further comprising:

the discharged part impinging on the back side of the vertical element producing an elevated stagnation pressure against the back side of the vertical element;

wherein the elevated stagnation pressure creates a launch force at least 10 times greater than that of a same sized kicker line not including the nozzle and discharging the portion of the diverted flow.

19. A method according to claim 18, wherein the launch force is in a range of 15 to 100 times greater.