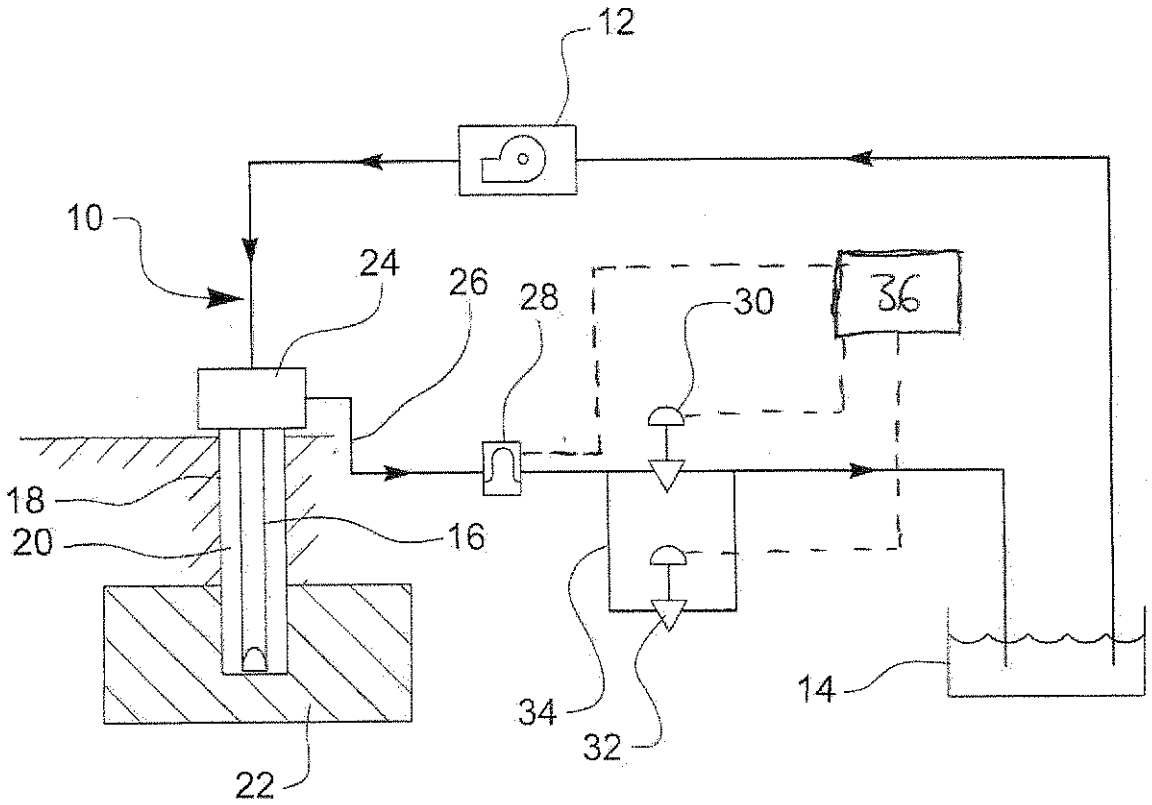

FIG 1

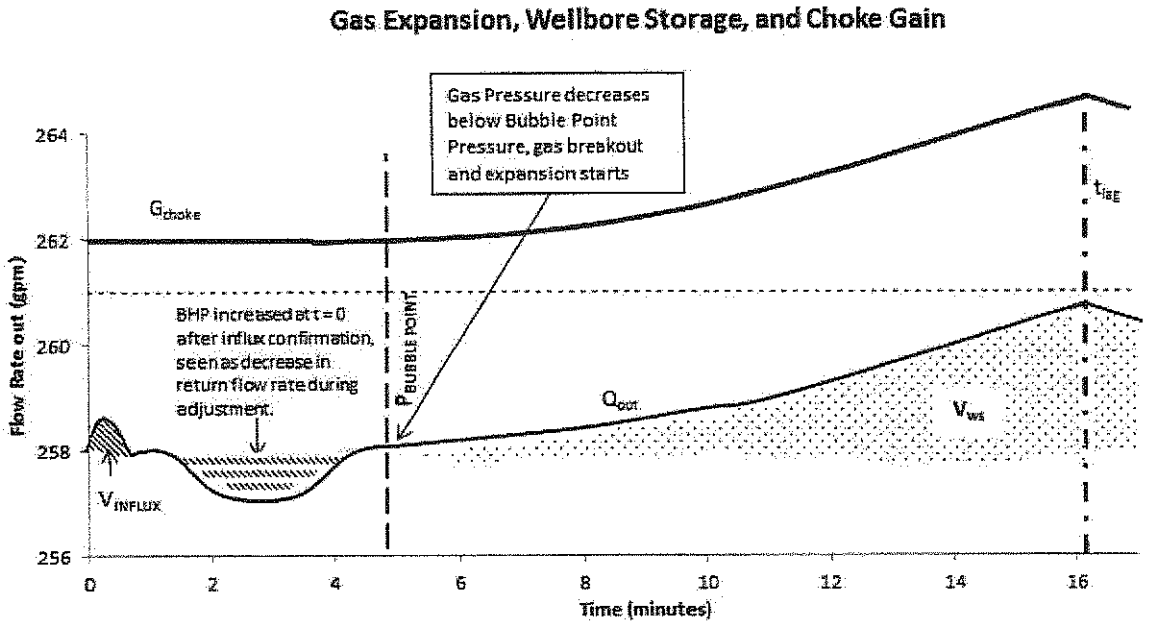

Figure 2

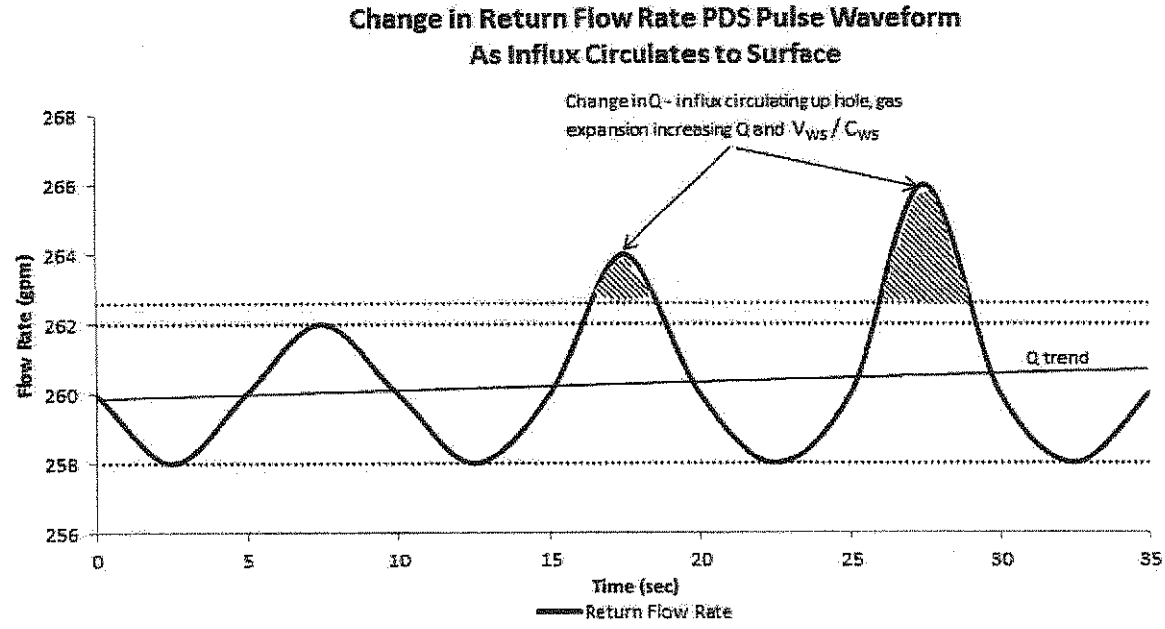

Figure 3

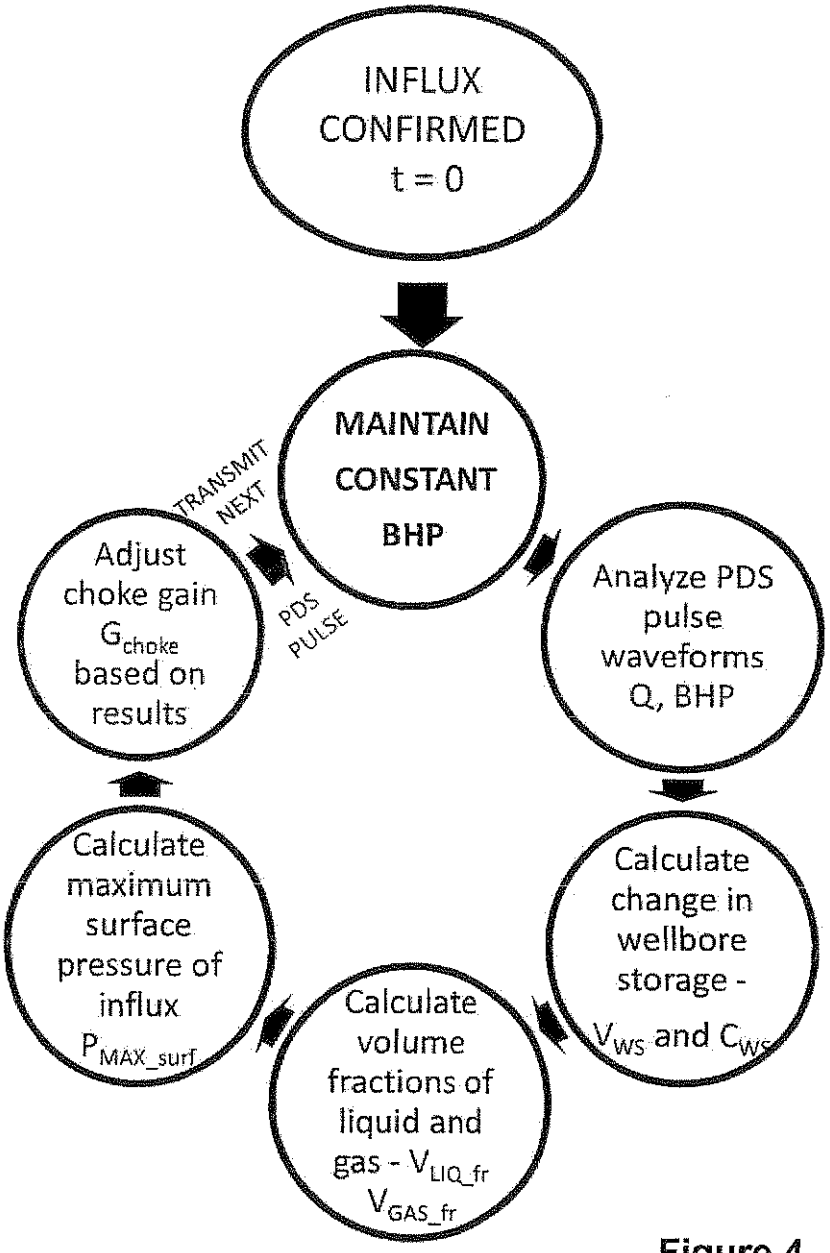
INFLUX CONFIRMED t = 0
MAINTAIN CONSTANT BHP
TRANSMIT NEXT
PDS PULSE
Adjust choke gain G_{choke} based on results
Analyze PDS pulse waveforms Q, BHP
Calculate maximum surface pressure of influx P_{MAX_surf}
Calculate change in wellbore storage - V_{WS} and C_{WS}
Calculate volume fractions of liquid and gas - V_{LIQ_fr} V_{GAS_fr}

Figure 4

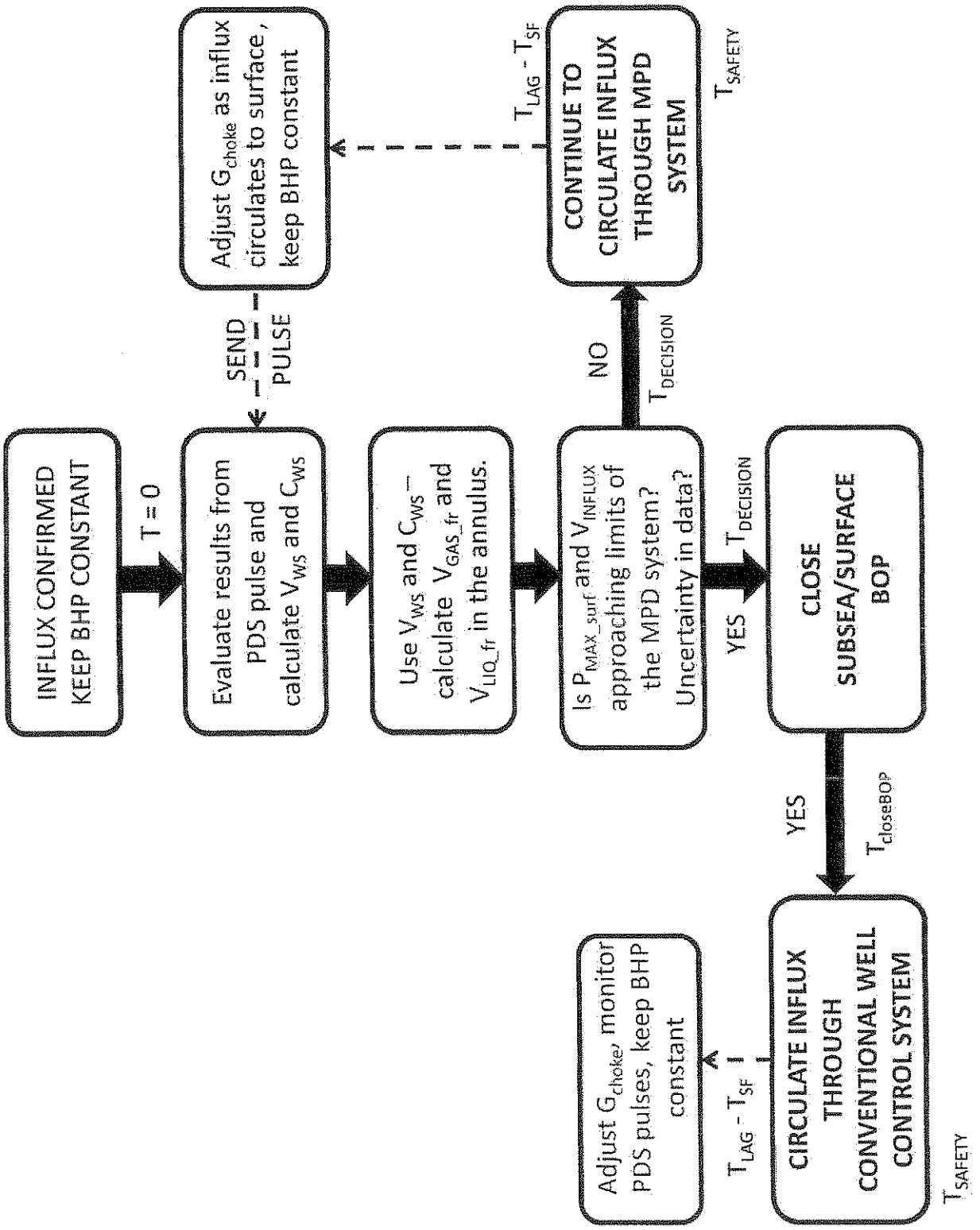
INFLUX CONFIRMED KEEP BHP CONSTANT
T = 0
Evaluate results from PDS pulse and calculate V_{WS} and C_{WS}
SEND PULSE
Use V_{WS} and C_{WS} – calculate V_{GAS_fr} and V_{LIQ_fr} in the annulus.
Is P_{MAX_surf} and V_{INFLUX} approaching limits of the MPD system? Uncertainty in data?
NO
$T_{DECISION}$
YES
$T_{DECISION}$
Adjust G_{choke} as influx circulates to surface, keep BHP constant
T_{LAG} - T_{SF}
CONTINUE TO CIRCULATE INFLUX THROUGH MPD SYSTEM
T_{SAFETY}
CLOSE SUBSEA/SURFACE BOP
YES
$T_{closeBOP}$
Adjust G_{choke}, monitor PDS pulses, keep BHP constant
T_{LAG} - T_{SF}
CIRCULATE INFLUX THROUGH CONVENTIONAL WELL CONTROL SYSTEM
T_{SAFETY}

Figure 5