



US008689868B2

(12) **United States Patent**  
**Lerche et al.**

(10) **Patent No.:** **US 8,689,868 B2**  
(45) **Date of Patent:** **Apr. 8, 2014**

(54) **TRACTOR COMMUNICATION/CONTROL AND SELECT FIRE PERFORATING SWITCH SIMULATIONS**

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(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 613 days.

(21) Appl. No.: **12/451,913**

(22) PCT Filed: **Jan. 7, 2008**

(86) PCT No.: **PCT/US2008/000200**

§ 371 (c)(1),  
(2), (4) Date: **May 3, 2010**

(87) PCT Pub. No.: **WO2008/100362**

PCT Pub. Date: **Aug. 21, 2008**

(65) **Prior Publication Data**

US 2010/0286800 A1 Nov. 11, 2010

**Related U.S. Application Data**

(60) Provisional application No. 60/879,169, filed on Jan. 6, 2007.

(51) **Int. Cl.**  
**E21B 47/09** (2012.01)  
**E21B 47/024** (2006.01)  
**E21B 44/00** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **E21B 47/024** (2013.01); **E21B 44/00** (2013.01)  
USPC ..... **166/255.1**; 166/255.2; 166/66; 175/24; 175/45

(58) **Field of Classification Search**  
USPC ..... 166/255.1, 255.2, 251.1, 66; 175/4.51, 175/24, 45; 340/853.3, 853.2, 854.9  
See application file for complete search history.

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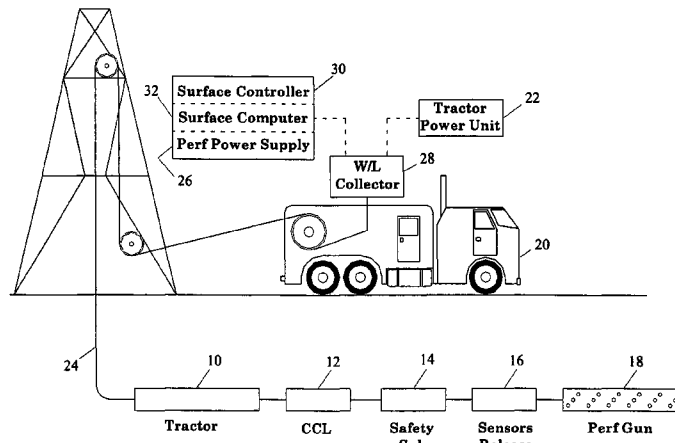
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(57) **ABSTRACT**

Apparatus and methods for controlling and communicating with one or more tools in a downhole tool string including a tractor, an auxiliary tractor tool, a logging tool, a safety sub, a release mechanism, a unit containing sensors for monitoring downhole conditions, a setting tool, and a perforating gun. Control and communication are accomplished by sending signals from the surface to control switches in the control units on the tool, with redundant switches for safety, to state machines in the respective control units, each state machine returning a signal verifying switch status to the surface. The state machine need not return a signal including a unique identifier.

**24 Claims, 18 Drawing Sheets**



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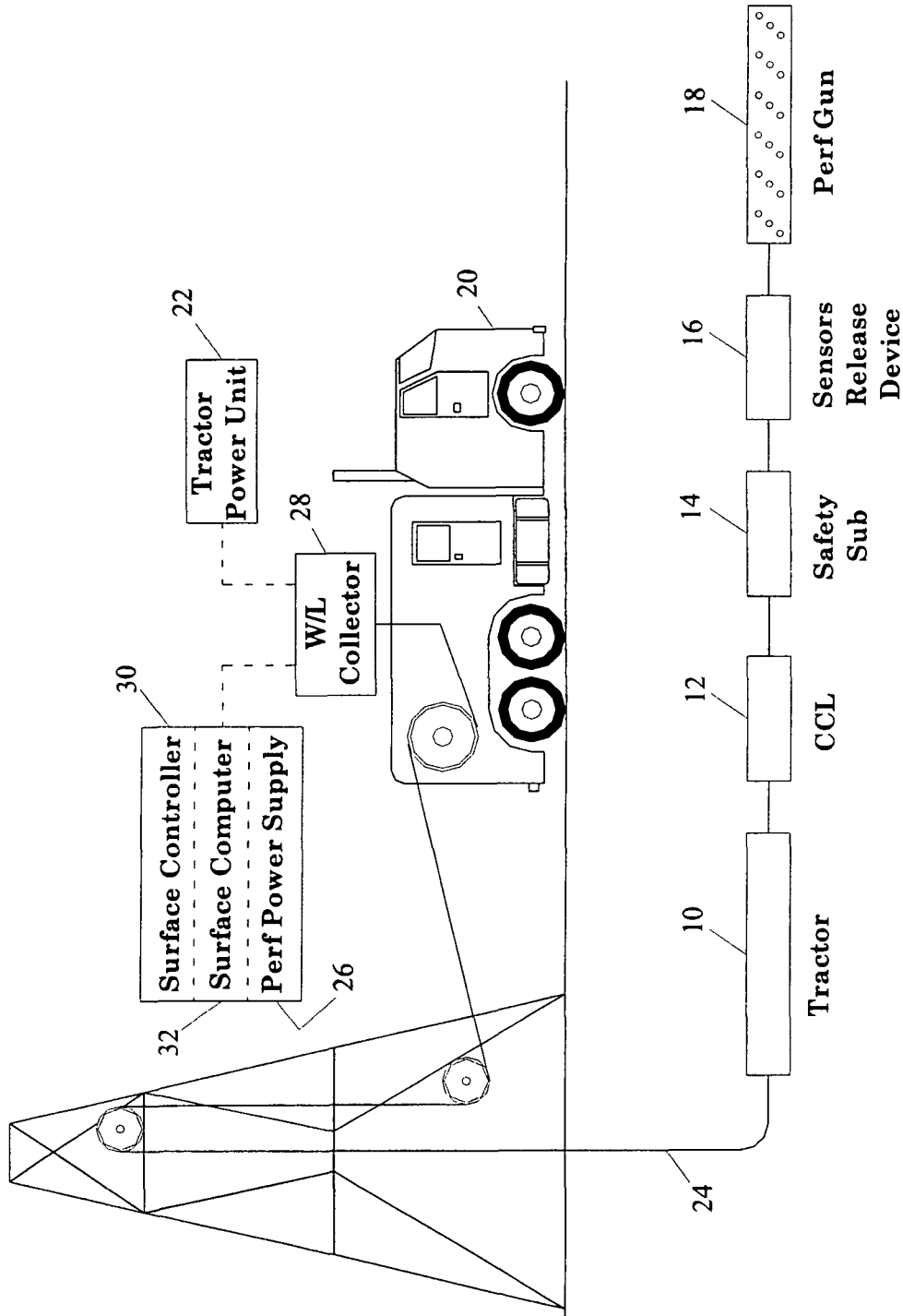


Figure 1

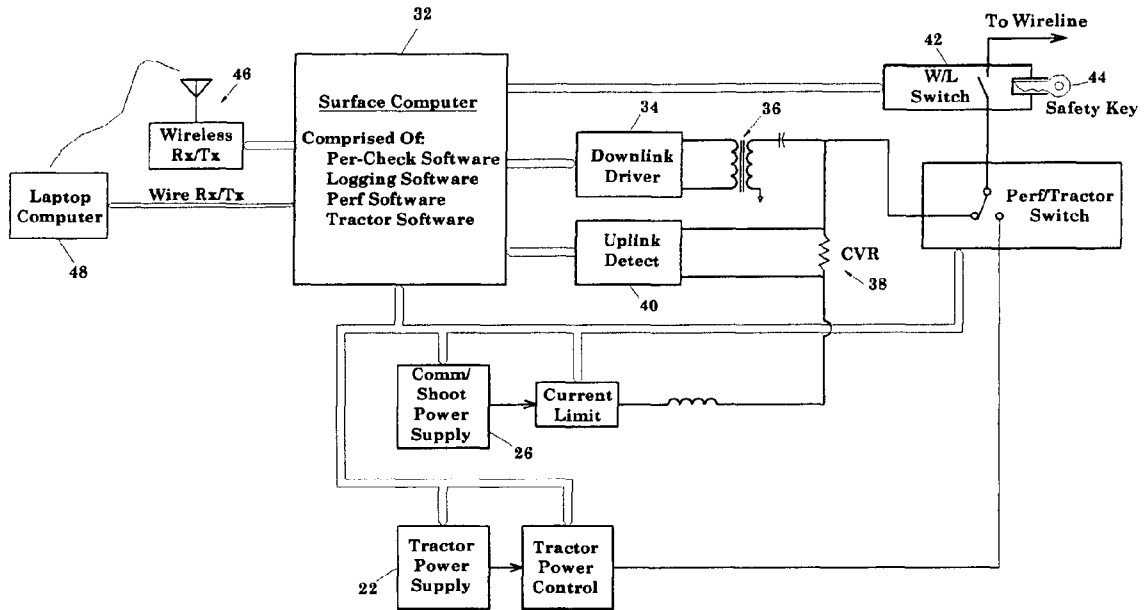


Figure 2

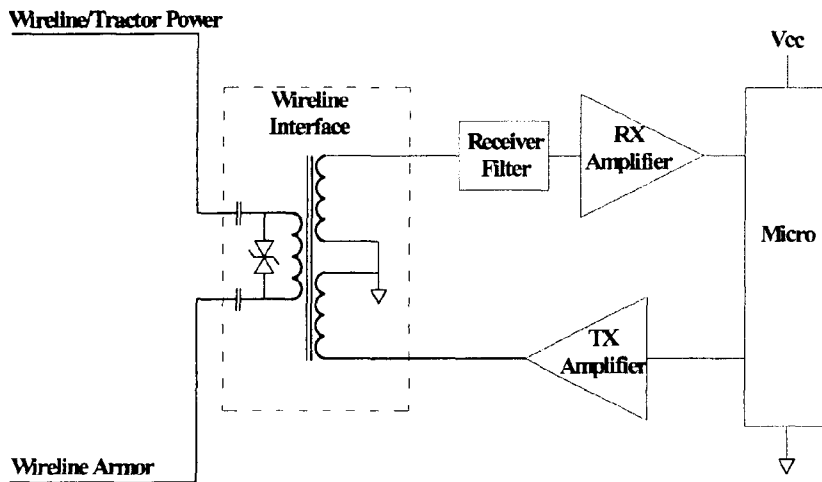


Figure 12

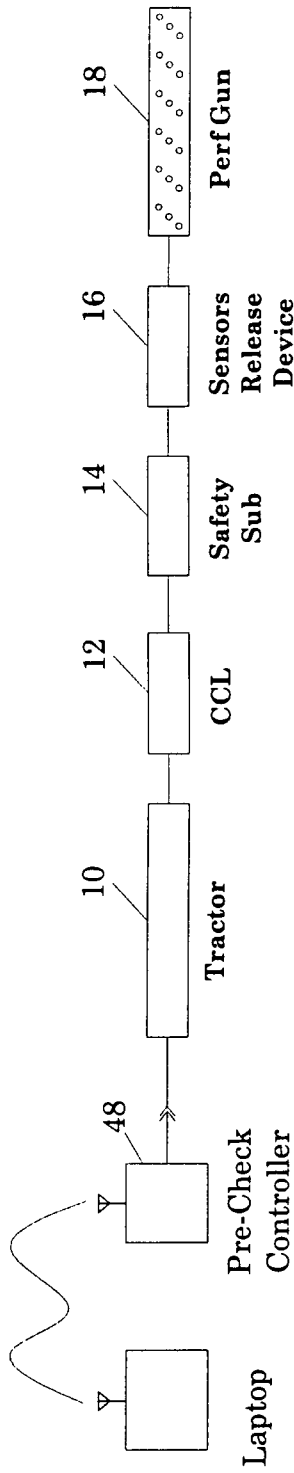


Figure 3A

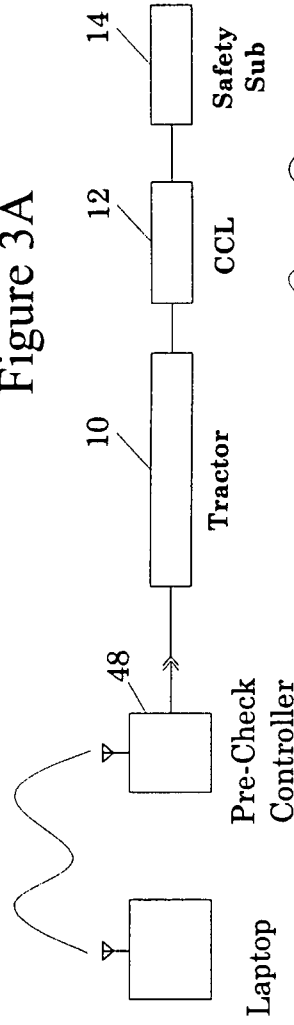


Figure 3B

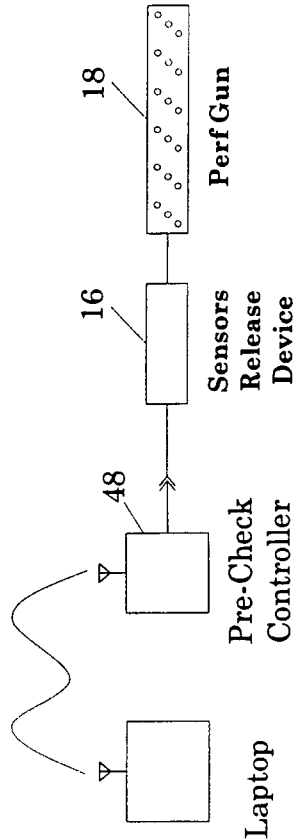


Figure 3C

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