

**(12) United States Patent
Philipp**

**(10) Patent No.: US 6,466,036 B1
(45) Date of Patent: Oct. 15, 2002**

- (54) **CHARGE TRANSFER CAPACITANCE MEASUREMENT CIRCUIT**
- (76) Inventor: **Harald Philipp**, 7 Cirrus Gardens, Hamble Hampshire SO31 4RH (GB)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

| | | | | |
|--------------|---|--------|-------------------------|---------|
| 5,705,807 A | * | 1/1998 | Throngnumchai et al. .. | 250/214 |
| | | | | P |
| 5,726,581 A | * | 3/1998 | Vranish | 324/688 |
| 5,730,165 A | * | 3/1998 | Philipp | 137/1 |
| 6,188,228 B1 | * | 2/2001 | Philipp | 324/658 |
| 6,242,927 B1 | * | 6/2001 | Adams et al. | 324/664 |
| 6,278,283 B1 | * | 8/2001 | Tsugai | 324/678 |

- (21) Appl. No.: **09/390,869**
- (22) Filed: **Sep. 7, 1999**

Related U.S. Application Data

- (60) Provisional application No. 60/109,889, filed on Nov. 25, 1998.
- (51) Int. Cl.⁷ **G01R 27/26**
- (52) U.S. Cl. **324/678; 324/658**
- (58) Field of Search **324/678, 658, 324/661, 663, 665, 676, 679**

(56) References Cited

U.S. PATENT DOCUMENTS

| | | | | |
|-------------|---|---------|------------------------|----------|
| 3,886,447 A | * | 5/1975 | Tanaka | 324/678 |
| 4,054,833 A | * | 10/1977 | Briefer | 324/679 |
| 4,806,846 A | * | 2/1989 | Kerber | 324/678 |
| 4,977,480 A | * | 12/1990 | Nishihara | 73/724 X |
| 5,329,239 A | * | 7/1994 | Kindermann et al. | 324/678 |
| 5,343,157 A | * | 8/1994 | Deschamps | 324/678 |
| 5,537,054 A | * | 7/1996 | Suzuki et al. | 324/770 |

OTHER PUBLICATIONS

"Capacitive Sensors and Sensing Theory," Product Catalog, Gordon Products, Inc., Brookfield, CT, USA, Oct. 1997.*

* cited by examiner

Primary Examiner—N. Le

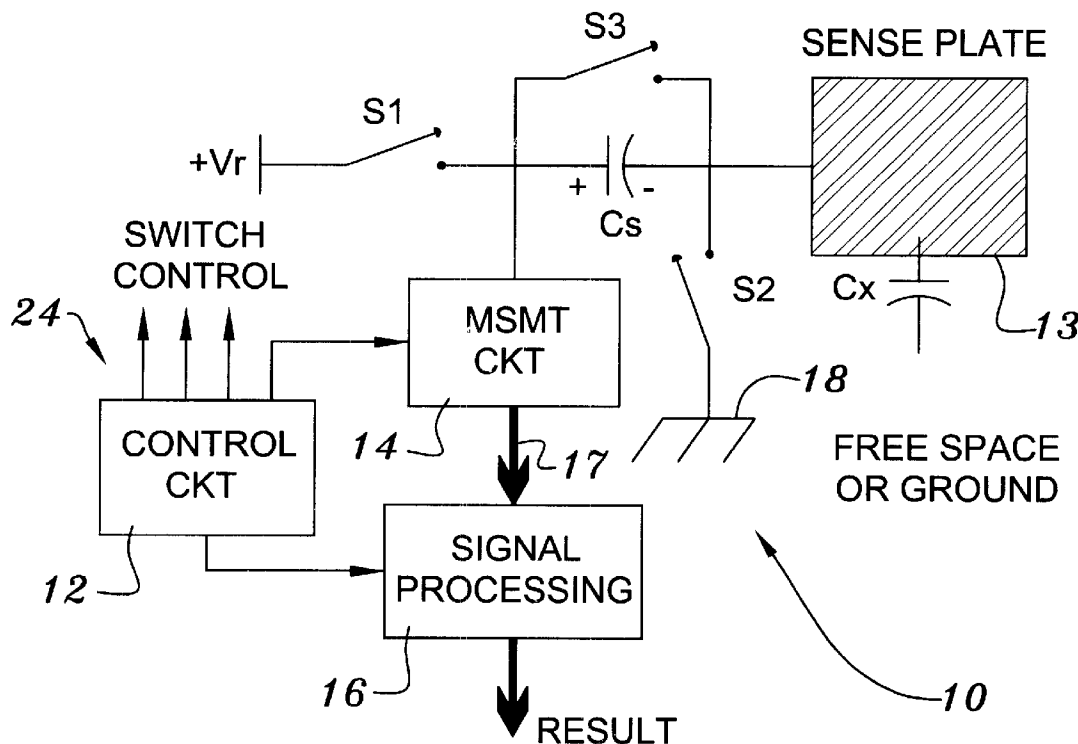
Assistant Examiner—T. R. Sundaram

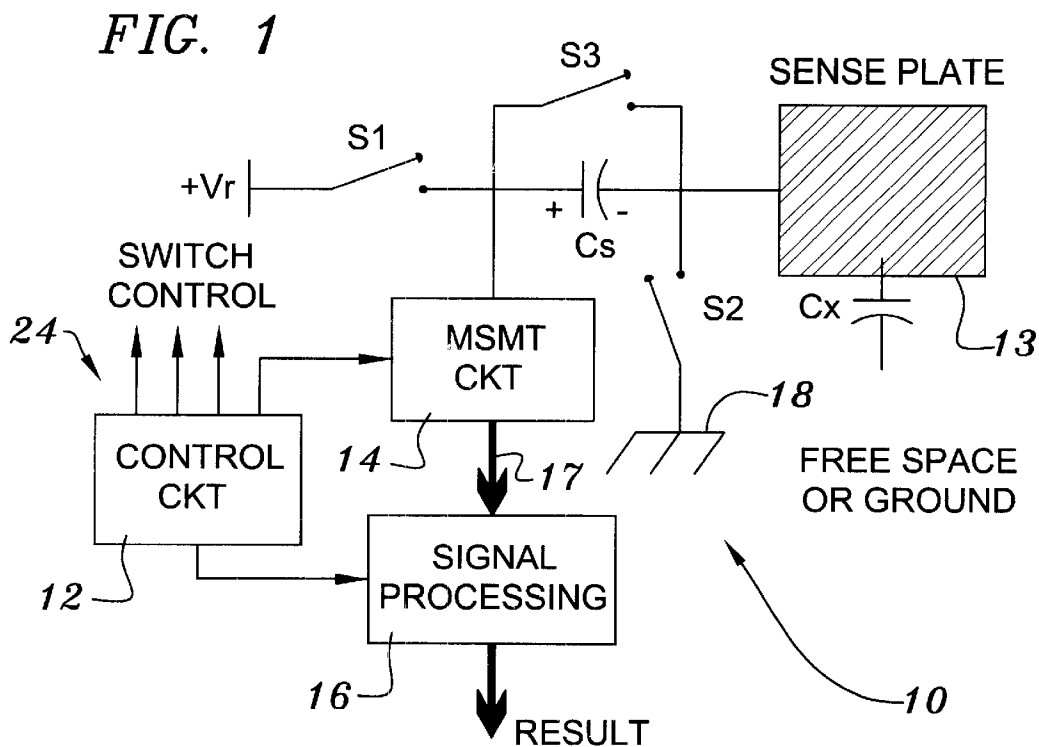
(74) Attorney, Agent, or Firm—David Kiewit

(57) ABSTRACT

Pulse circuits for measuring the capacitance to ground of a plate may be used in control equipment to provide an indication of the proximity of a person or object to be sensed. Pulse circuits are disclosed that are made from sets of three or more electrical switching elements arranged so that each of the switching elements has one side electrically connected to either a supply voltage or to an electrical ground. These arrangements are compatible with existing integrated circuit fabrication technology. In addition, the circuitry can be configured as a proximity sensing switch that requires only a two wire connection to a host apparatus.

39 Claims, 14 Drawing Sheets





| | STEP | S1 | S2 | S3 | FUNCTION |
|------|------|----|----|----|-----------------|
| LOOP | A | - | X | X | RESET ALL |
| | B | - | - | - | DEADTIME |
| | C | X | - | - | CHARGE-TRANSFER |
| | D | - | - | - | DEADTIME |
| | E | - | X | - | HOLD |
| | F | - | X | - | MEASURE |

FIG. 2

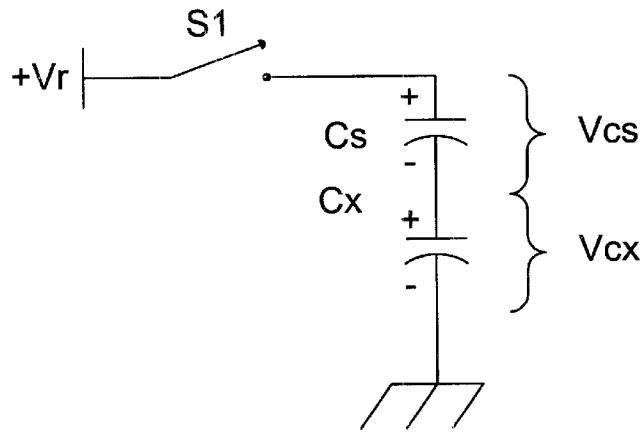


FIG. 3

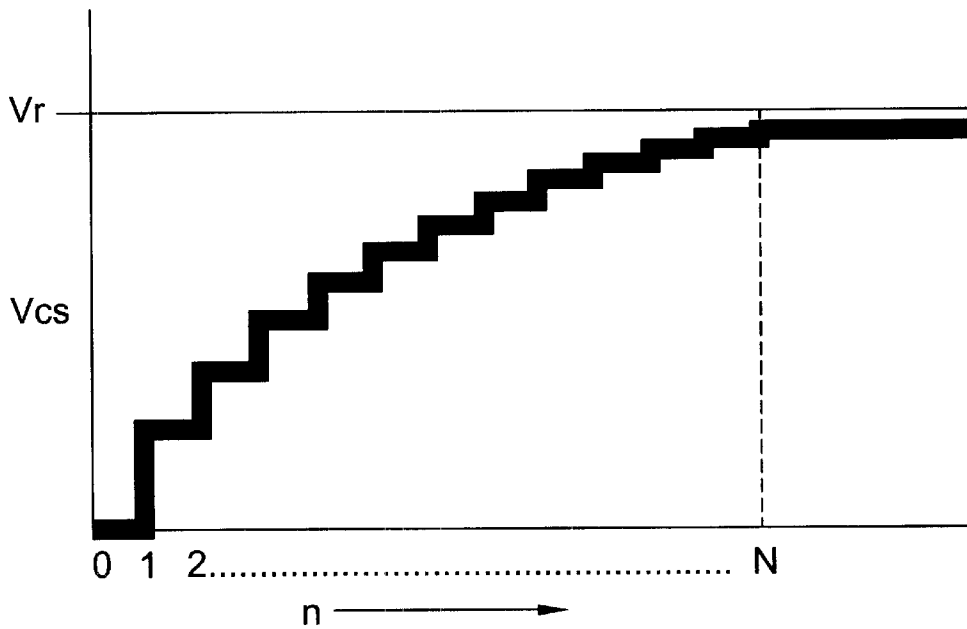
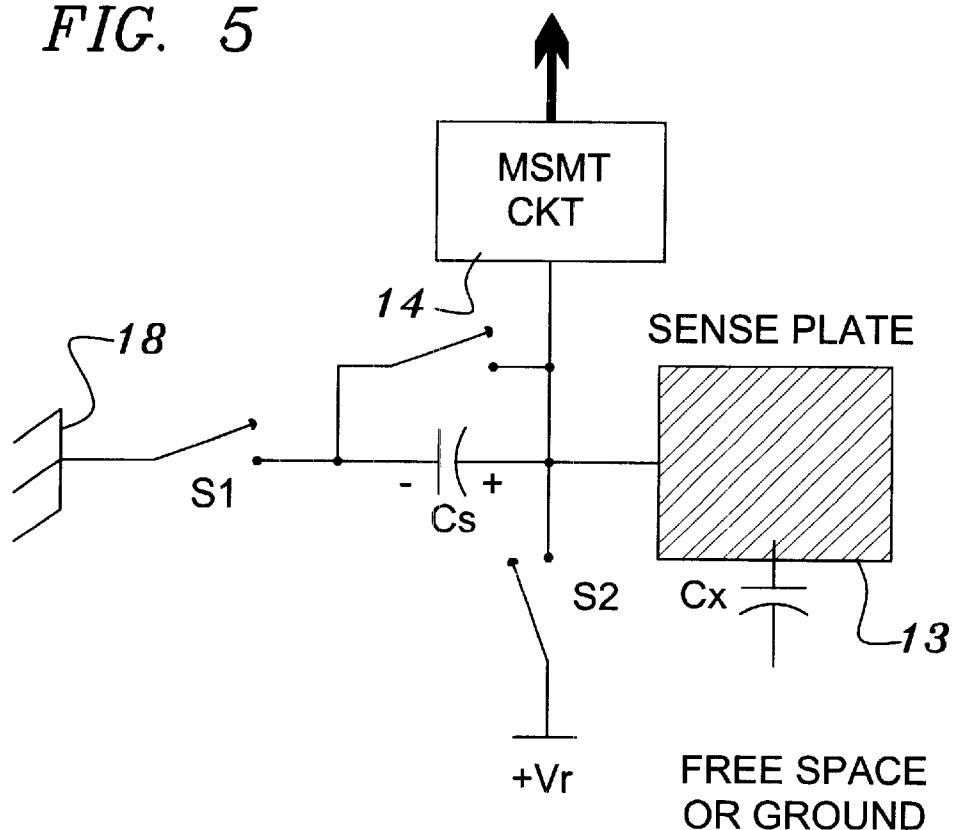


FIG. 4

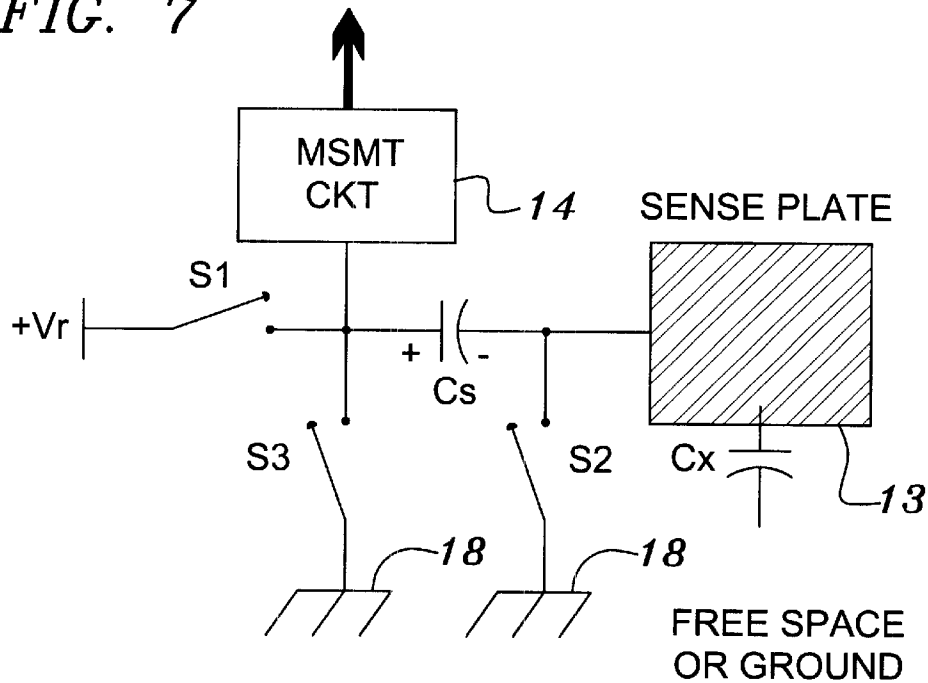
FIG. 5



| | STEP | S1 | S2 | S3 | FUNCTION |
|------|------|----|----|----|-----------|
| | A | X | - | X | RESET ALL |
| LOOP | B | - | - | - | DEADTIME |
| | C | - | X | - | CHARGE |
| | D | - | - | - | DEADTIME |
| | E | X | - | - | TRANSFER |
| | F | X | - | - | MEASURE |

FIG. 6

FIG. 7



| | STEP | S1 | S2 | S3 | FUNCTION |
|------|------|----|----|----|-----------------|
| LOOP | A | - | X | X | RESET ALL |
| | B | - | - | - | DEADTIME |
| | C | X | - | - | CHARGE-TRANSFER |
| | D | - | - | - | DEADTIME |
| | E | - | X | - | HOLD |
| | F | - | X | - | MEASURE (HOLD) |

FIG. 8

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.