



- (51) International Patent Classification: *G05G 9/047* (2006.01)
- (21) International Application Number: PCT/US2014/013961
- (22) International Filing Date: 30 January 2014 (30.01.2014)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 61/758,489 30 January 2013 (30.01.2013) US
- (72) Inventors; and
- (71) Applicants : SMITH, David Paul [US/US]; 30823 Slalom Lane, Wilmington, Illinois 60481 (US). XIA, Chung Feng [CN/CN]; Shanghai (CN). OSIKOWICZ, Lukasz Grzegorz [US/US]; 120 Lakeview Drive, #301, Bloomington, Illinois 60108 (US).
- (74) Agent: BARICH, Joseph M.; Barich IP Law Group, 564 W. Randolph St.; Second Floor, Chicago, Illinois 60661 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,

[Continued on next page]

(54) Title: OPERATOR CONTROLLED ELECTRICAL OUTPUT SIGNAL DEVICE WITH VARIABLE FEEL AND HOLD FEEDBACK AND AUTOMATED CALIBRATION AND LEARNABLE PERFORMANCE OPTIMIZATION

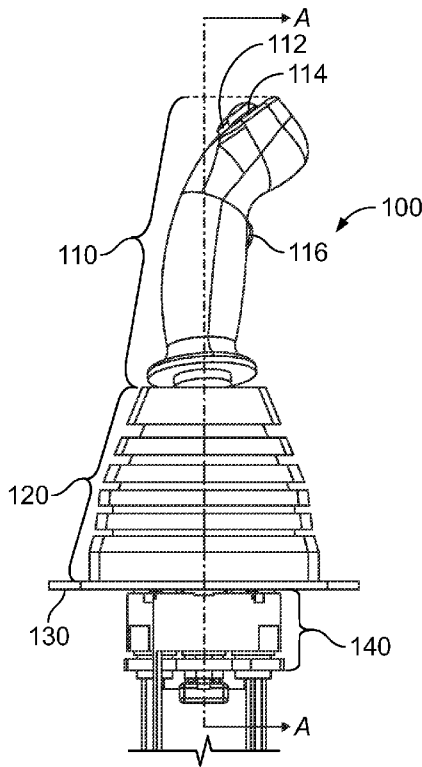
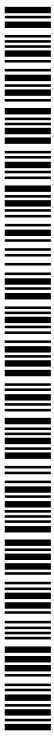


FIG. 1

(57) Abstract: An output signal device and method that provides the operator force feedback similar to a pilot control joystick. These force feedback regions include free play, deadband start of modulation, modulation, fore-warning bumper and hold near max angle. This output signal device may also vary the fore-warning feel and hold positions to be at any angle. This output signal device uses force sensing as the signal and has force slope changes used as auto-calibration of the output signal. This improves signal accuracy and provides a service prognostic signal. The prognostic signal may be used to activate redundant sensor. The variable force feedback may improve operation on rough terrain. The force feedback, may allow more productive operating positions to be learned. This enables productivity and other important job site criteria such as fuel usage to be optimized by interactive communication with this output signal device.





EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

— before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))

Published:

— with international search report (Art. 21(3))

(88) Date of publication of the international search report:
9 October 2014

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2014/013961

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - G05G 9/047 (2014.01) USPC - 180/332 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC(8) - G05G 9/047; G06F 3/033 (2014.01) USPC - 180/332, 333, 334; 345/161 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched CPC - E02F 9/2004; G05G 2009/047 (2014.02) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatBase, Google Patents, Google Scholar,		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2011/0155861 A1 (ANTRAYGUE) 30 June 2011 (30.06.2011) entire document	1-9
Y	US 5,828,363 A (YANIGER et al.) 27 October 1998 (27.10.1998) entire document	1-9
Y	US 2012/0205165 A1 (STRITTMATTER et al.) 16 August 2012 (16.08.2012) entire document	2, 7
Y	US 2006/0191775 A1 (EDMUNDS) 31 August 2006 (31.08.2006) entire document	3-6
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/>		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 25 June 2014		Date of mailing of the international search report 28 JUL 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2014/013961

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See last page.

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-9

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2014/013961

Continuation of Box No. III:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-9, drawn to a Joystick Electronic System (JSE) comprising an electromagnetic force feedback system wherein said electromagnetic force feedback system receives an indication of the torque exerted on said plug and uses said torque to control the amount of torque required to angularly displace said handle system.

Group II, claims 10-19, drawn to providing free play, dead band, modulation and jump regions at various angular displacements of a handle assembly wherein each region provides a different tactile feel.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: a Joystick Electronic System (JSE) including: a force sensing cartridge including a plug and a force sensing resistor, wherein said handle assembly is rotated around said pivot point to bring said pivot assembly into contact with said plug, wherein continued rotation of said handle assembly causes said pivot assembly to exert a torque on said plug, wherein said force sensing resistor determines the torque exerted on said plug; and an electromagnetic force feedback system wherein said electromagnetic force feedback system receives an indication of the torque exerted on said plug and uses said torque to control the amount of torque required to angularly displace said handle system as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: providing a free play region at a first angular displacement; said free play region provides a tactile feel wherein a force is required by the user to angularly displace said handle assembly that is greater than that required in said dead band region and said modulation region; providing a dead band region at a second angular displacement; said dead band region provides a tactile feel wherein the least amount of force of any region is required to angularly displace said handle assembly; providing a modulation region at a third angular displacement, wherein said modulation region provides a tactile feel wherein the force applied by the user is substantially linear in relationship to the angular displacement of said handle assembly and great than that required in said free play region; and providing a jump up region at a fourth angular displacement, wherein said jump up region provides a tactile feel wherein a significantly greater force is required to produce an angular displacement of said handle assembly than in said modulation region as claimed therein is not present in the invention of Groups I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of a handle assembly attached to a pivot assembly and rotating about a pivot point for providing multiple tactile feel regions to a user depending on an angular displacement of said handle assembly, this technical feature is not a special technical feature as it does not make a contribution over the prior art. Specifically, US 2006/0191775 A1 (EDMUNDS) 31 August 2006 (31.08.2006) teaches a handle assembly attached to a pivot assembly and rotating about a pivot point (joystick controller 10, [0035]; fig.1) for providing multiple tactile feel regions to a user depending on an angular displacement of said handle assembly (when pivotal movement of the lever about the second axis B-B is close to its maximum displacement in either direction, there is an increase in the biasing action of the bush 44 against the slider member 34 which provides a useful tactile feedback to the operator, to indicate that the joystick lever is nearing its limit of displacement, [0043]).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.