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Morton

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(54) **SCANNING SYSTEMS**

(71) Applicant: **Rapiscan Systems, Inc.**, Torrance, CA (US)

(72) Inventor: **Edward James Morton**, Guildford (GB)

(73) Assignee: **Rapiscan Systems, Inc.**, Torrance, CA (US)

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(56) **References Cited**

U.S. PATENT DOCUMENTS

2,952,790	A	9/1960	Steen
3,146,349	A	8/1964	Jordan

(Continued)

FOREIGN PATENT DOCUMENTS

CN	101022649	A	8/2007
CN	101303317	A	11/2008

(Continued)

OTHER PUBLICATIONS

US 5,987,079 A, 11/1999, Scott (withdrawn)

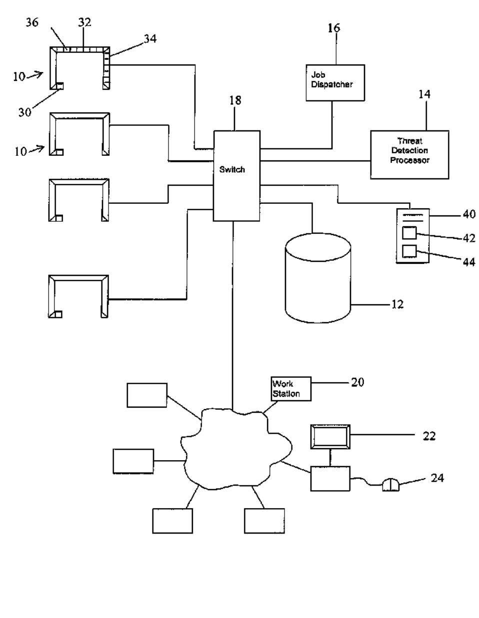
(Continued)

Primary Examiner — Christopher E. Everett
(74) *Attorney, Agent, or Firm* — Novel IP

(57) **ABSTRACT**

The present application is directed toward cargo scanning systems having scanners, each arranged to scan a respective object and generate a set of scan data, processors arranged to process each set of scan data to determine whether it meets a predetermined threat condition, workstations, and data management system arranged to direct data that meets the threat condition to one of the workstations for analysis.

28 Claims, 3 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

3,239,706	A	3/1966	Farrell
3,458,026	A	7/1969	Lauzon
3,485,339	A	12/1969	Miller
3,768,645	A	10/1973	Conway
3,955,678	A	5/1976	Moyer
3,980,889	A	9/1976	Haas
4,057,725	A	11/1977	Wagner
4,105,922	A	8/1978	Lambert
4,228,353	A	10/1980	Johnson
4,259,721	A	3/1981	Kuznia
4,266,425	A	5/1981	Allport
4,274,005	A	6/1981	Yamamura
4,340,816	A	7/1982	Schott
4,352,021	A	9/1982	Boyd
4,366,382	A	12/1982	Kotowski
4,468,802	A	8/1984	Friedel
4,626,688	A	12/1986	Barnes
4,672,649	A	6/1987	Rutt
4,675,890	A	6/1987	Plessis
4,709,382	A	11/1987	Sones
4,817,123	A	3/1989	Sones
RE32,961	E	6/1989	Wagner
4,866,439	A	9/1989	Kraus
4,866,745	A	9/1989	Akai
4,868,856	A	9/1989	Frith
4,872,188	A	10/1989	Lauro
4,887,604	A	12/1989	Shefer
4,979,137	A	12/1990	Gerstenfeld
4,987,584	A	1/1991	Doenges
4,991,708	A	2/1991	Francioni
5,033,106	A	7/1991	Kita
5,086,300	A	2/1992	Ash More
5,092,451	A	3/1992	Jones
5,097,939	A	3/1992	Shanklin
5,144,191	A	9/1992	Jones
5,182,764	A	1/1993	Peschmann
5,221,843	A	6/1993	Alvarez
5,243,693	A	9/1993	Maron
5,247,556	A	9/1993	Eckert
5,247,561	A	9/1993	Kotowski
5,259,014	A	11/1993	Brettschneider
5,272,627	A	12/1993	Maschhoff
5,313,511	A	5/1994	Annis
5,319,547	A	6/1994	Krug
5,341,916	A	8/1994	Doane
5,367,552	A	11/1994	Peschmann
5,410,156	A	4/1995	Miller
5,412,702	A	5/1995	Sata
5,467,377	A	11/1995	Dawson
5,490,196	A	2/1996	Rudich
5,490,218	A	2/1996	Krug
5,505,291	A	4/1996	Huang
5,511,104	A	4/1996	Mueller
5,548,123	A	8/1996	Perez-Mendez
5,557,108	A	9/1996	Tumer
5,590,057	A	12/1996	Fletcher
5,600,303	A	2/1997	Husseiny
5,600,700	A	2/1997	Krug
5,604,778	A	2/1997	Polacin
5,606,167	A	2/1997	Miller
5,633,907	A	5/1997	Gravelle
5,634,551	A	6/1997	Francioni
5,642,393	A	6/1997	Krug
5,660,549	A	8/1997	Witt
5,661,774	A	8/1997	Gordon
5,689,541	A	11/1997	Schardt
5,712,926	A	1/1998	Eberhard
5,738,202	A	4/1998	Ydoate
5,764,683	A	6/1998	Swift
5,796,802	A	8/1998	Gordon
5,818,897	A	10/1998	Gordon
5,838,758	A	11/1998	Krug
5,841,831	A	11/1998	Hell
5,859,891	A	1/1999	Hibbard
5,870,449	A	2/1999	Lee
5,881,122	A	3/1999	Crawford
5,882,206	A	3/1999	Gillio
5,887,047	A	3/1999	Bailey
5,901,198	A	5/1999	Crawford
5,903,623	A	5/1999	Swift
5,905,806	A	5/1999	Eberhard
5,909,477	A	6/1999	Crawford
5,910,973	A	6/1999	Grodzins
5,930,326	A	7/1999	Rothschild
5,949,842	A	9/1999	Schafer
5,963,211	A	10/1999	Oikawa
5,966,422	A	10/1999	Dafni
5,974,111	A	10/1999	Krug
5,982,843	A	11/1999	Bailey
5,987,097	A	11/1999	Salasoo
6,018,562	A	1/2000	Willson
6,021,174	A	2/2000	Campbell
6,026,143	A	2/2000	Simanovsky
6,026,171	A	2/2000	Hiraoglu
6,035,014	A	3/2000	Hiraoglu
6,037,597	A	3/2000	Karavolos
6,044,353	A	3/2000	Pugliese
6,067,366	A	5/2000	Simanovsky
6,073,751	A	6/2000	Worzischek
6,075,871	A	6/2000	Simanovsky
6,076,400	A	6/2000	Bechwati
6,078,642	A	6/2000	Simanovsky
6,088,423	A	7/2000	Krug
6,091,795	A	7/2000	Schafer
6,108,396	A	8/2000	Bechwati
6,111,974	A	8/2000	Hiraoglu
6,118,852	A	9/2000	Rogers
6,122,343	A	9/2000	Pidcock
6,128,365	A	10/2000	Bechwati
6,137,895	A	10/2000	Al-Sheikh
6,149,592	A	11/2000	Yanof
6,163,591	A	12/2000	Benjamin
6,181,765	B1	1/2001	Sribar
6,183,139	B1	2/2001	Solomon
6,185,272	B1	2/2001	Hiraoglu
6,188,745	B1	2/2001	Gordon
6,195,444	B1	2/2001	Simanovsky
6,216,540	B1	4/2001	Nelson
6,218,943	B1	4/2001	Ellenbogen
6,236,709	B1	5/2001	Perry
6,246,320	B1	6/2001	Monroe
6,252,929	B1	6/2001	Swift
6,256,404	B1	7/2001	Gordon
6,269,142	B1	7/2001	Smith
6,272,230	B1	8/2001	Hiraoglu
6,292,533	B1	9/2001	Swift
6,301,327	B1	10/2001	Martens
6,304,629	B1	10/2001	Conway
6,317,509	B1	11/2001	Simanovsky
6,324,243	B1	11/2001	Edic
6,324,249	B1	11/2001	Fazzio
6,345,113	B1	2/2002	Crawford
6,370,222	B1	4/2002	Cornick
6,418,189	B1	7/2002	Schafer
6,429,578	B1	8/2002	Danielsson
6,430,255	B2	8/2002	Fenkart
6,431,344	B1	8/2002	Emmermann
6,445,765	B1	9/2002	Frank
6,446,782	B1	9/2002	Patrick
6,459,755	B1	10/2002	Li
6,459,761	B1	10/2002	Grodzins
6,459,764	B1	10/2002	Chalmers
6,507,025	B1	1/2003	Verbinski
6,542,580	B1	4/2003	Carver
6,546,072	B1	4/2003	Chalmers
6,549,683	B1	4/2003	Bergeron
6,552,346	B2	4/2003	Verbinski
6,556,653	B2	4/2003	Hussein
6,563,906	B2	5/2003	Hussein
6,590,956	B2	7/2003	Fenkart
6,618,466	B1	9/2003	Ning
6,629,593	B2	10/2003	Zeitler
6,647,091	B2	11/2003	Fenkart
6,647,094	B2	11/2003	Harding

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,647,095	B2	11/2003	Hsieh
6,687,333	B2	2/2004	Carroll
6,690,766	B2	2/2004	Kresse
6,707,879	B2	3/2004	McClelland
6,715,533	B2	4/2004	Kresse
6,721,387	B1	4/2004	Naidu
6,721,391	B2	4/2004	McClelland
6,735,271	B1	5/2004	Rand
6,737,652	B2	5/2004	Lanza
6,748,043	B1	6/2004	Dobbs
6,754,298	B2	6/2004	Fessler
6,760,407	B2	7/2004	Price
6,770,884	B2	8/2004	Bryman
6,775,348	B2	8/2004	Hoffman
6,788,761	B2	9/2004	Bijjani
6,812,426	B1	11/2004	Kotowski
6,813,374	B1	11/2004	Karimi
6,816,571	B2	11/2004	Bijjani
6,827,265	B2	12/2004	Knowles
6,829,585	B1	12/2004	Grewal
6,830,185	B2	12/2004	Tsikos
6,837,432	B2	1/2005	Tsikos
6,856,667	B2	2/2005	Ellenbogen
6,859,514	B2	2/2005	Hoffman
6,899,540	B1	5/2005	Neiderman
6,901,135	B2	5/2005	Fox
6,901,346	B2	5/2005	Tracy
6,906,329	B2	6/2005	Bryman
6,907,101	B2	6/2005	Hoffman
6,922,455	B2	7/2005	Jurczyk
6,922,460	B2	7/2005	Skatter
6,922,461	B2	7/2005	Kang
6,928,141	B2	8/2005	Carver
6,933,504	B2	8/2005	Hoffman
6,934,354	B2	8/2005	Hoffman
6,940,071	B2	9/2005	Ramsden
6,944,264	B2	9/2005	Bijjani
6,947,517	B2	9/2005	Hoffman
6,950,492	B2	9/2005	Besson
6,950,493	B2	9/2005	Besson
6,952,163	B2	10/2005	Huey
6,953,935	B1	10/2005	Hoffman
6,957,913	B2	10/2005	Renkart
6,962,289	B2	11/2005	Vatan
6,968,030	B2	11/2005	Hoffman
6,968,034	B2	11/2005	Ellenbogen
6,971,577	B2	12/2005	Tsikos
6,973,158	B2	12/2005	Besson
6,975,698	B2	12/2005	Katcha
6,978,936	B2	12/2005	Tsikos
6,980,627	B2	12/2005	Qiu
6,990,171	B2	1/2006	Toth
6,990,172	B2	1/2006	Toth
6,991,371	B2	1/2006	Georgeson
6,993,115	B2	1/2006	McGuire
6,996,209	B2	2/2006	Marek
7,010,083	B2	3/2006	Hoffman
7,016,459	B2	3/2006	Ellenbogen
7,020,241	B2	3/2006	Beneke
7,020,242	B2	3/2006	Ellenbogen
7,023,956	B2	4/2006	Heaton
7,023,957	B2	4/2006	Bijjani
7,027,553	B2	4/2006	Dunham
7,027,554	B2	4/2006	Gaultier
7,031,430	B2	4/2006	Kaucic
7,031,434	B1	4/2006	Saunders
7,034,313	B2	4/2006	Hoffman
7,039,154	B1	5/2006	Ellenbogen
7,042,975	B2	5/2006	Heuscher
7,045,787	B1	5/2006	Verbinski
7,046,756	B2	5/2006	Hoffman
7,046,761	B2	5/2006	Ellenbogen
7,050,536	B1	5/2006	Fenkart
7,054,408	B2	5/2006	Jiang
7,062,009	B2	6/2006	Karimi
7,062,011	B1	6/2006	Tybinkowski
7,062,074	B1	6/2006	Beneke
7,064,334	B2	6/2006	Hoffman
7,065,175	B2	6/2006	Green
7,065,179	B2	6/2006	Block
7,068,749	B2	6/2006	Kollegal
7,068,750	B2	6/2006	Toth
7,068,751	B2	6/2006	Toth
7,072,434	B1	7/2006	Tybinkowski
7,076,029	B2	7/2006	Toth
7,078,699	B2	7/2006	Seppi
7,081,628	B2	7/2006	Granfors
7,084,404	B2	8/2006	Hoffman
7,087,902	B2	8/2006	Wang
7,088,799	B2	8/2006	Hoffman
7,090,133	B2	8/2006	Zhu
7,092,481	B2	8/2006	Hoffman
7,092,485	B2	8/2006	Kravis
7,103,137	B2	9/2006	Seppi
7,110,488	B2	9/2006	Katcha
7,112,797	B2	9/2006	Hoge
7,116,749	B2	10/2006	Besson
7,116,751	B2	10/2006	Ellenbogen
7,119,553	B2	10/2006	Yang
7,123,681	B2	10/2006	Ellenbogen
7,127,027	B2	10/2006	Hoffman
7,130,374	B1	10/2006	Jacobs
7,133,491	B2	11/2006	Bernardi
7,136,450	B2	11/2006	Ying
7,136,451	B2	11/2006	Naidu
7,139,367	B1	11/2006	Le
7,139,406	B2	11/2006	McClelland
7,142,629	B2	11/2006	Edic
7,149,278	B2	12/2006	Arenson
7,149,339	B2	12/2006	Veneruso
7,155,812	B1	1/2007	Peterson
7,158,611	B2	1/2007	Heismann
7,164,747	B2	1/2007	Ellenbogen
7,164,750	B2	1/2007	Nabors
7,166,458	B2	1/2007	Ballerstadt
7,166,844	B1	1/2007	Gormley
7,167,539	B1	1/2007	Hoffman
7,173,998	B2	2/2007	Hoffman
7,177,387	B2	2/2007	Yasunaga
7,177,391	B2	2/2007	Chapin
7,190,757	B2	3/2007	Ying
7,192,031	B2	3/2007	Dunham
7,197,113	B1	3/2007	Katcha
7,197,172	B1	3/2007	Naidu
7,203,629	B2	4/2007	Oezis
7,204,125	B2	4/2007	Fine
7,206,379	B2	4/2007	Lemaitre
7,212,113	B2	5/2007	Zanovitch
7,215,731	B1	5/2007	Basu
7,215,738	B2	5/2007	Muenchau
7,218,700	B2	5/2007	Huber
7,218,704	B1	5/2007	Adams
7,224,763	B2	5/2007	Naidu
7,224,765	B2	5/2007	Ellenbogen
7,224,766	B2	5/2007	Jiang
7,224,769	B2	5/2007	Turner
7,233,640	B2	6/2007	Ikhlef
7,236,564	B2	6/2007	Hopkins
7,238,945	B2	7/2007	Hoffman
7,247,856	B2	7/2007	Hoge
7,251,310	B2	7/2007	Smith
7,257,189	B2	8/2007	Modica
7,260,170	B2	8/2007	Arenson
7,260,171	B1	8/2007	Arenson
7,260,172	B2	8/2007	Arenson
7,260,173	B2	8/2007	Wakayama
7,260,174	B2	8/2007	Hoffman
7,260,182	B2	8/2007	Toth
7,263,160	B2	8/2007	Schlomka
7,266,180	B1	9/2007	Saunders
7,272,429	B2	9/2007	Walker
7,274,767	B2	9/2007	Clayton
7,277,577	B2	10/2007	Ying
7,279,120	B2	10/2007	Cheng

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,280,631 B2 10/2007 De
7,282,727 B2 10/2007 Retsky
7,283,604 B2 10/2007 De
7,283,609 B2 10/2007 Possin
7,295,019 B2 11/2007 Yang
7,295,651 B2 11/2007 Delgado
7,298,812 B2 11/2007 Tkaczyk
7,302,083 B2 11/2007 Larson
7,308,073 B2 12/2007 Tkaczyk
7,308,074 B2 12/2007 Jiang
7,308,077 B2 12/2007 Bijjani
7,317,195 B2 1/2008 Eikman
7,317,390 B2 1/2008 Huey
7,319,737 B2 1/2008 Singh
7,322,745 B2 1/2008 Agrawal
7,324,625 B2 1/2008 Eilbert
7,327,853 B2 2/2008 Ying
7,330,527 B2 2/2008 Hoffman
7,330,535 B2 2/2008 Arenson
7,333,587 B2 2/2008 De
7,333,588 B2 2/2008 Mistretta
7,333,589 B2 2/2008 Ellenbogen
7,335,887 B1 2/2008 Verbinski
7,336,769 B2 2/2008 Arenson
7,349,525 B2 3/2008 Morton
7,397,891 B2 7/2008 Johnson
7,430,479 B1 9/2008 Holslin
7,440,543 B2 10/2008 Morton
7,492,855 B2 2/2009 Hopkins
7,505,557 B2 3/2009 Modica
7,512,215 B2 3/2009 Morton
7,564,939 B2 7/2009 Morton
7,580,505 B2 8/2009 Kang
7,684,538 B2 3/2010 Morton
7,734,066 B2 6/2010 Delia
7,734,102 B2 6/2010 Bergeron
7,817,775 B2 10/2010 Kang
7,903,783 B2 3/2011 Modica
7,973,697 B2 7/2011 Reilly
8,173,970 B2 5/2012 Inbar
8,243,167 B2 8/2012 Liang
8,304,740 B1 11/2012 Frank
8,472,583 B2 6/2013 Star-Lack
9,111,331 B2 8/2015 Parikh
9,632,206 B2 4/2017 Parikh
2001/0016684 A1 8/2001 Shahidi
2001/0022346 A1 9/2001 Katagami
2001/0033635 A1 10/2001 Kuwabara
2002/0031202 A1 3/2002 Callerame
2002/0038753 A1 4/2002 Ursu
2002/0045152 A1 4/2002 Viscardi
2002/0094064 A1 7/2002 Zhou
2002/0172324 A1 11/2002 Ellengogen
2002/0176531 A1 11/2002 McClelland
2003/0021377 A1 1/2003 Turner
2003/0023592 A1 1/2003 Modica
2003/0031352 A1 2/2003 Nelson
2003/0085163 A1 5/2003 Chan
2003/0191557 A1 10/2003 Takehara
2004/0041724 A1 3/2004 Levitan
2004/0073808 A1 4/2004 Smith
2004/0080315 A1 4/2004 Beevor
2004/0086078 A1 5/2004 Adams
2004/0101098 A1 5/2004 Bijjani
2004/0120454 A1 6/2004 Ellenbogen
2004/0126015 A1 7/2004 Hadell
2004/0140924 A1 7/2004 Keller
2004/0202154 A1 10/2004 Aklepi
2004/0212492 A1 10/2004 Boesch
2004/0212499 A1 10/2004 Bohinc
2004/0213378 A1 10/2004 Zhou
2004/0213379 A1 10/2004 Bittl
2004/0232054 A1 11/2004 Brown
2004/0251415 A1 12/2004 Verbinski
2004/0252024 A1 12/2004 Huey
2004/0252807 A1 12/2004 Skatter
2004/0258198 A1 12/2004 Carver
2004/0258305 A1 12/2004 Burnham
2004/0263379 A1 12/2004 Keller
2005/0008119 A1 1/2005 McClelland
2005/0024199 A1 2/2005 Huey
2005/0031075 A1 2/2005 Hopkins
2005/0031076 A1 2/2005 McClelland
2005/0053189 A1 3/2005 Gohno
2005/0064922 A1 3/2005 Owens
2005/0105682 A1 5/2005 Heumann
2005/0110672 A1 5/2005 Cardiasmenos
2005/0111610 A1 5/2005 Deman
2005/0117700 A1 6/2005 Peschmann
2005/0156734 A1 7/2005 Zerwekh
2005/0157844 A1 7/2005 Bernardi
2005/0157925 A1 7/2005 Lorenz
2005/0169421 A1 8/2005 Muenchau
2005/0198226 A1 9/2005 Delia
2005/0226364 A1 10/2005 Bernard
2005/0249416 A1 11/2005 Leue
2005/0251397 A1 11/2005 Zanovitch
2005/0281390 A1 12/2005 Johnson
2006/0018428 A1 1/2006 Li
2006/0045323 A1 3/2006 Ateya
2006/0066469 A1 3/2006 Foote
2006/0086794 A1 4/2006 Knowles
2006/0113163 A1 6/2006 Hu
2006/0115044 A1 6/2006 Wu
2006/0115109 A1 6/2006 Whitson
2006/0138331 A1 6/2006 Guillebaud
2006/0220851 A1 10/2006 Wisherd
2006/0257005 A1 11/2006 Bergeron
2006/0273259 A1 12/2006 Li
2006/0274916 A1 12/2006 Chan
2007/0003003 A1 1/2007 Seppi
2007/0083414 A1 4/2007 Krohn
2007/0096030 A1 5/2007 Li
2007/0110215 A1 5/2007 Hu
2007/0133740 A1 6/2007 Kang
2007/0165777 A1 7/2007 Anwar
2007/0172024 A1 7/2007 Morton
2007/0183568 A1 8/2007 Kang
2007/0194909 A1 8/2007 Garfield
2007/0195994 A1 8/2007 McClelland
2007/0280416 A1 12/2007 Bendahan
2007/0280502 A1 12/2007 Paresi
2008/0023631 A1 1/2008 Majors
2008/0044801 A1 2/2008 Modica
2008/0056432 A1 3/2008 Pack
2008/0056435 A1 3/2008 Basu
2008/0075230 A1 3/2008 Oreper
2008/0111693 A1 5/2008 Johnson
2008/0143545 A1 6/2008 King
2008/0198967 A1 8/2008 Connelly
2008/0260097 A1 10/2008 Anwar
2009/0034790 A1 2/2009 Song
2009/0161816 A1 6/2009 Deman
2009/0174554 A1 7/2009 Bergeron
2009/0236531 A1 9/2009 Frank
2009/0283690 A1 11/2009 Bendahan
2009/0323894 A1 12/2009 Hu
2010/0030370 A1 2/2010 King
2010/0161504 A1 6/2010 Casey
2011/0060426 A1 3/2011 Morton
2011/0172972 A1 7/2011 Gudmundson
2011/0216881 A1 9/2011 Modica
2012/0093367 A1 4/2012 Gudmundson
2012/0105267 A1 5/2012 Delia
2012/0300902 A1 11/2012 Modica
2015/0325010 A1 11/2015 Bedford

FOREIGN PATENT DOCUMENTS

CN 101446910 A 6/2009
DE 2729353 A1 1/1979
DE 3214910 A1 5/1983
EP 0176314 4/1986
EP 0432568 6/1991

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

EP	0531993	A1	3/1993
EP	0584871	A1	3/1994
EP	0924742	A2	6/1999
EP	0930046	A2	7/1999
EP	0963925	A2	12/1999
EP	1277439	A1	1/2003
EP	1374776	A1	1/2004
EP	2270547		1/2011
FR	2328280	A	5/1977
GB	1497396	A	1/1978
GB	1526041	A	9/1978
GB	2015245	A	9/1979
GB	2089109	A	6/1982
GB	2212903	A	8/1989
GB	2337032	A	11/1999
GB	2404431		2/2005
GB	2437777	A	11/2007
JP	S57175247	A	10/1982
JP	S5916254	A	1/1984
JP	59075549		4/1984
JP	600015546		1/1985
JP	600021440		2/1985
JP	06038957		2/1994
JP	H10211196	A	8/1998
JP	H11230918	A	8/1999
JP	2001176408	A	6/2001
JP	2001233440	A	8/2001
JP	2003126075	A	5/2003
JP	2004000605	A	1/2004
JP	2004079128	A	3/2004
JP	2005013768	A	1/2005
JP	2005257400		9/2005
KR	1019920010403	A	6/1992
KR	100796878	B1	3/2006
KR	1020060078151	A	7/2006
WO	9528715	A2	10/1995
WO	9960387	A	11/1999
WO	2000049428		8/2000
WO	03051201	A2	6/2003
WO	03105159		12/2003
WO	2004037088		5/2004
WO	2004111625		12/2004
WO	2005091227		9/2005
WO	2005084351		11/2006
WO	2006119603		11/2006
WO	2006119605	A1	11/2006
WO	2006135586		12/2006
WO	2007051092	A2	5/2007
WO	2007055720	A2	5/2007
WO	2007103216	A2	9/2007
WO	2009106857		9/2009

OTHER PUBLICATIONS

International Search Report for PCT/GB2004/001747, Aug. 10, 2004, CXR Ltd.

Sun Olapiriyakul and Sanchoy Das, Design and analysis of a two-stage security screening and inspection system, Journal of Air Transport Management, vol. 13, Issue 2, Mar. 2007, pp. 67-74.

Kelly Leone and Rongfang (Rachel) Liu, The key design parameters of checked baggage security screening systems in airports, Journal of Air Transport Management, vol. 11, Issue 2, Mar. 2005, pp. 69-78.

Viggo Butler and Robert W. Poole, Jr., Rethinking Checked-Baggage Screening, Reason Public Policy Institute, Policy Study 297, Jul. 2002.

McLay, Laura A., Jacobson, Sheldon H., and Kobza, John E., A multilevel passenger screening problem for aviation security, Naval Research Logistics (NRL), vol. 53, issue 3, pp. 183-197, 2006.

ClearView Workstation, L3 Security & Detection Systems, Jun. 9, 2011.

Rapiscan Security Products, Inc., Users Guide for Level 3 Threat Image Projection (TIP) System Manual, Aug. 4, 1999, document in general.

International Search Report for PCT/US2006/11492, Oct. 11, 2007, United Technologies Corporation.

International Search Report for PCT/US2007/005444, Oct. 29, 2007, Telesecurity Sciences, Inc.

International Search Report for PCT/GB2009/000575, Apr. 7, 2010, Rapiscan Security Products Inc.

'Development and Validation of a Test of X-ray Screener Readiness' Eric C. Neiderman, Ph.D., et al. IEEE, 2000.

'Test and Evaluation Plan for Screener Proficiency Evaluation and Reporting System (SPEARS) Threat Image Projection' J.L.Fobes, Ph.D., et al. FAA, Dec. 1995.

'Revised Test and Evaluation Plan for Determining Screener Training Effectiveness' Brenda A. Klock, et al. FAA, Aug. 2000.

Rapiscan Security Products, Inc., Users Guide for Levels 1 and 2 Threat Image Protection (TIP) Users Manual, Jan. 12, 2001, document in general.

Horner et al., "Phase-Only Matched Filtering", Applied Optics, vol. 23, No. 6, Mar. 15, 1994, pp. 812-816.

Mahalanobis, et al. "Minimum Average Correlation Energy Filters", Applied Optics, vol. 26, No. 17, pp. 3633-3640, Sep. 1987.

Kumar et al. "Spatial frequency domain image processing for biometric recognition", Biometrics ICIP Conference 2002.

Caulfield, et al. "Improved Discrimination in Optical Character Recognition", Applied Optics, vol. 8, pp. 2354-2356, Nov. 1969.

Morin, et al. "Optical Character Recognition (OCR) in Uncontrolled Environments Using Optical Correlators", Proc. SPIE Int. Soc. Opt. Eng. 3715, 346; 1999.

International Search Report for PCT/US2012/054110, Dec. 24, 2012.

International Search Report for PCT/US2017/017642, Jun. 29, 2017.

Victor J. Orphan, Ernie Muenchau, Jerry Gormley, and Rex Richardson, "Advanced y ray technology for scanning cargo containers," Applied Radiation and Isotopes, vol. 63, Issues 5-6, 2005, pp. 723-732.

International Search Report for PCT/GB09/00575, Apr. 7, 2010.

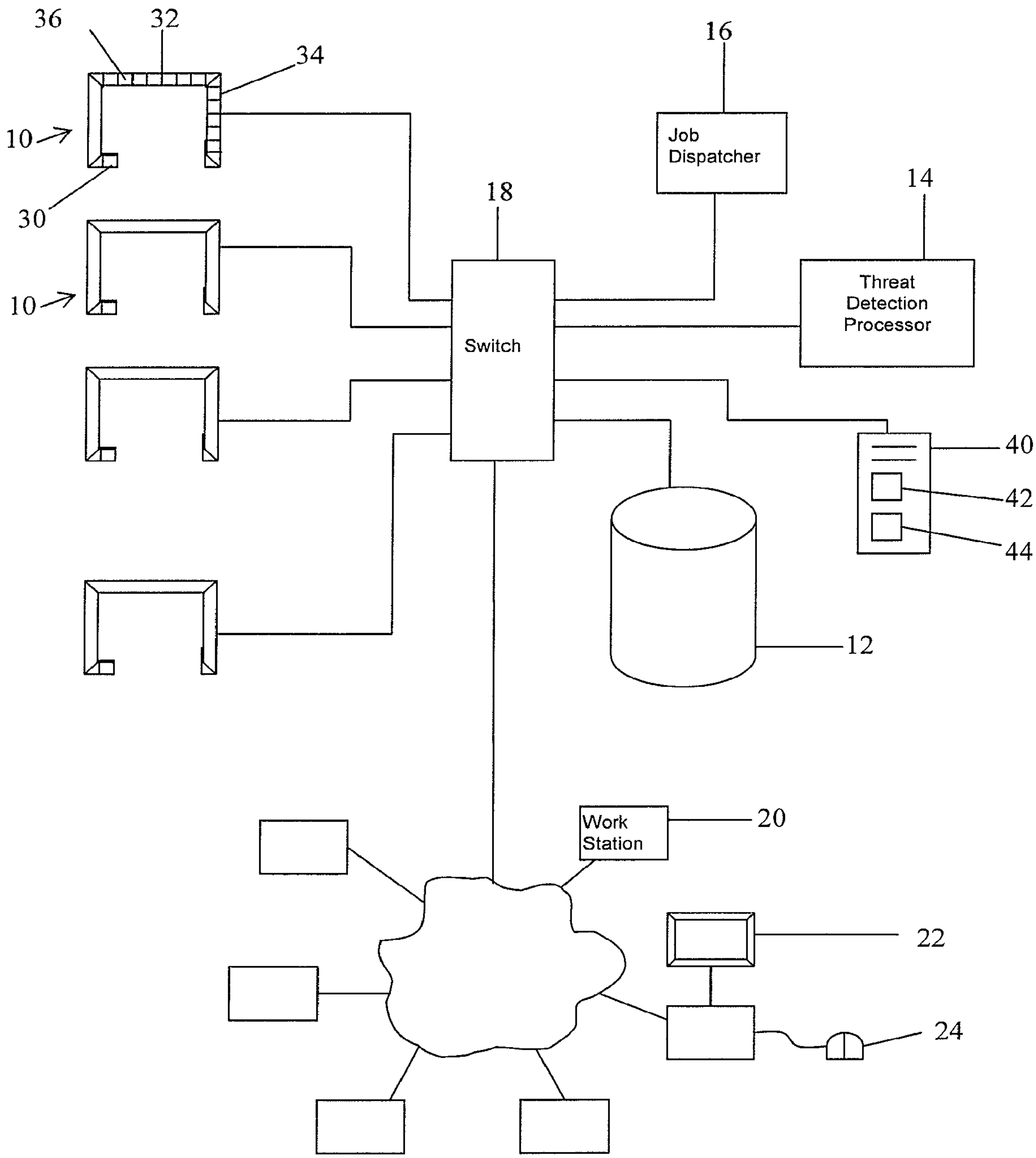

36
32
34
10
30
10
16
Job Dispatcher
18
14
Switch
Threat Detection Processor
40
42
44
12
Work Station
20
22
24

Fig. 1

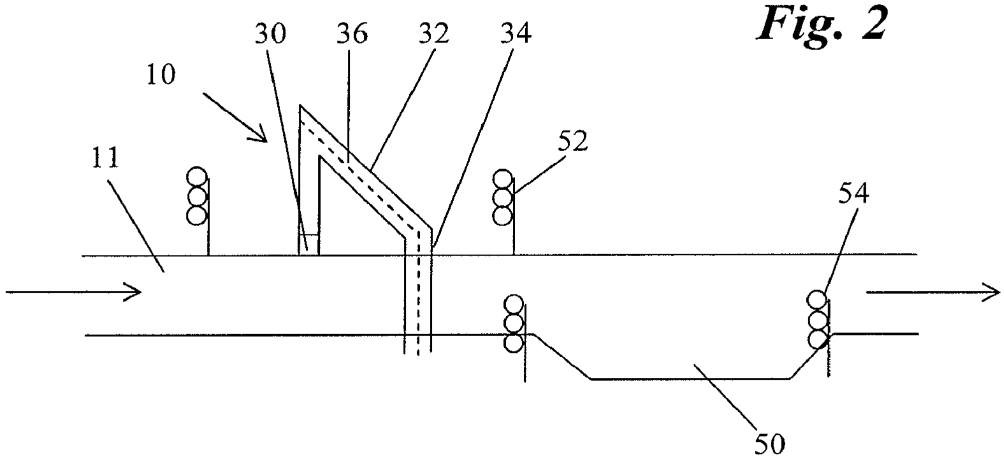


Fig. 2

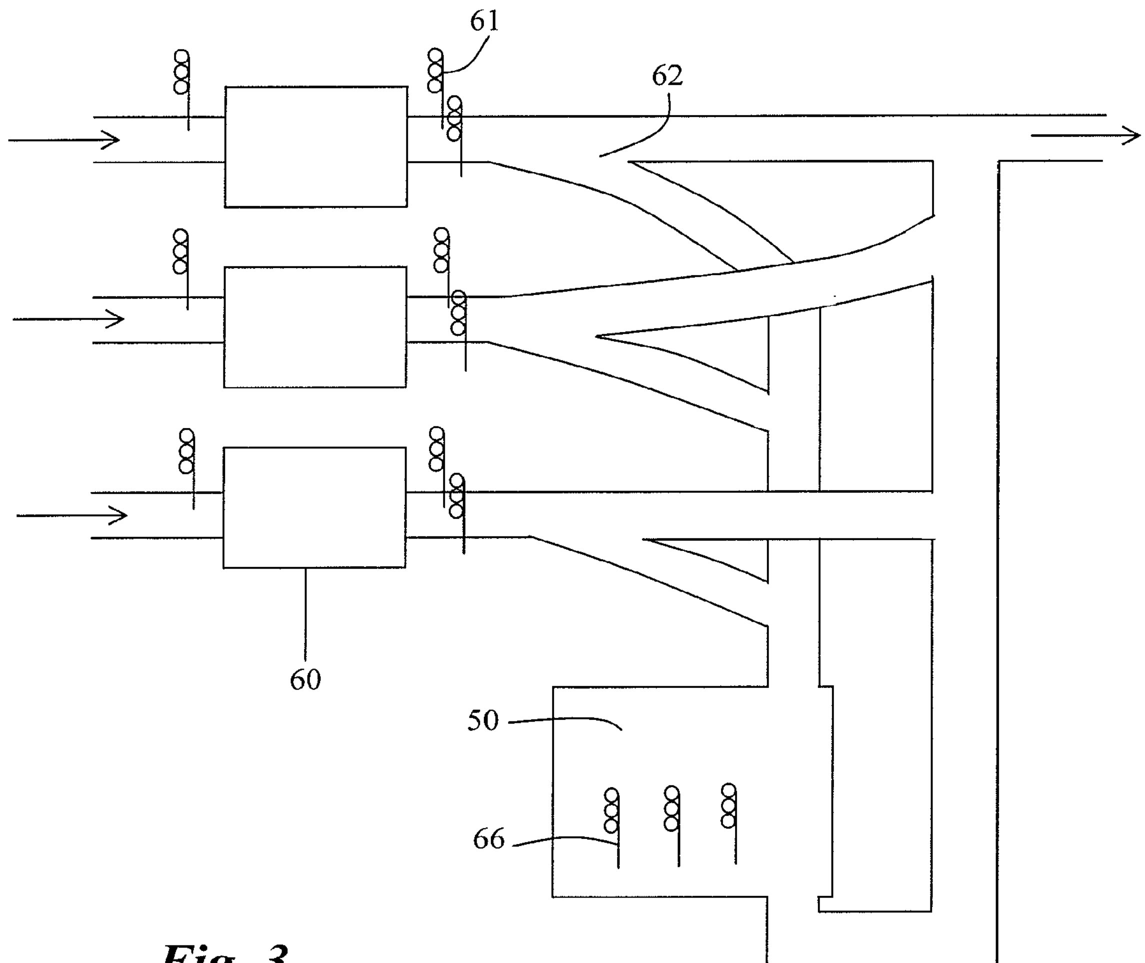


Fig. 3

Fig. 4

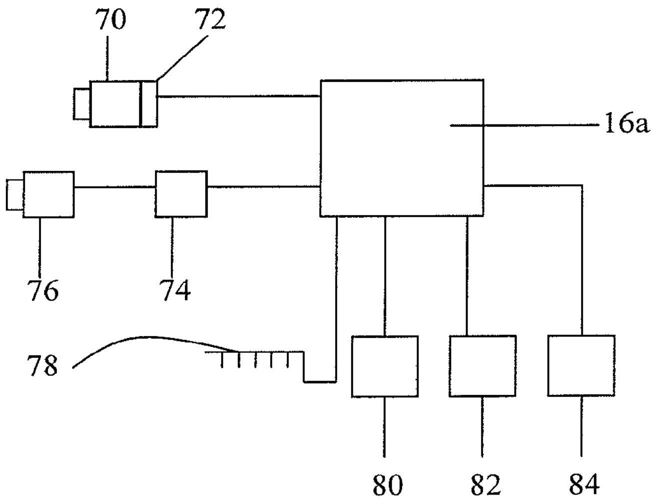
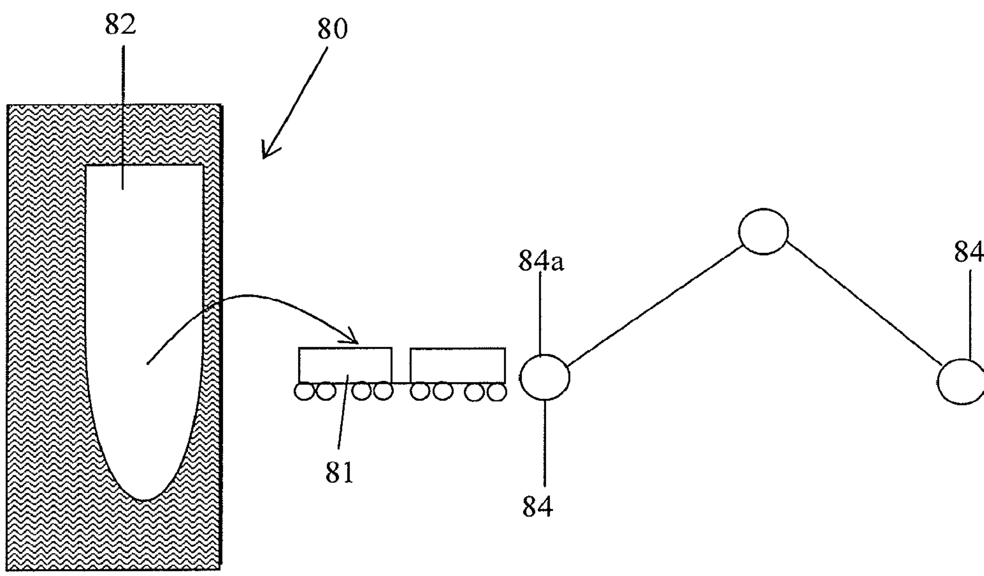


Fig. 5



SCANNING SYSTEMS

CROSS REFERENCE

The present application is a national stage application of PCT/GB2009/000575, filed on Feb. 27, 2009, which further relies on Great Britain Patent Application Number 0803644.4, filed on Feb. 28, 2008, for priority. The applications are incorporated herein by reference in their entirety.

FIELD OF THE INVENTION

The present invention relates to scanning systems. It has particular application in scanning systems for cargo.

BACKGROUND

There is a requirement to be able to screen cargo items for the presence of illicit materials and devices for the protection of the public.

Currently, such inspection may be undertaken using X-ray based screening apparatus. In these systems, an X-ray image of the object under inspection is taken and an operator reviews this image to resolve, in their experience, whether the cargo is clear for onwards travel or whether the cargo requires a further level of inspection. However greater volumes of cargo traffic and greater desire and need for security scanning have lead to an increasing need to increase the throughput of scanning systems.

SUMMARY OF THE INVENTION

The present invention provides a cargo scanning system comprising a plurality of scanners each arranged to scan a respective object and generate a set of scan data, processing means arranged to process each set of scan data to determine whether it meets a predetermined threat condition, and data management means arranged to direct data that meets the threat condition to a workstation, or one of a plurality of workstations, for analysis.

The present application is directed toward cargo scanning systems having scanners, each arranged to scan a respective object and generate a set of scan data, processors arranged to process each set of scan data to determine whether it meets a predetermined threat condition, workstations, and data management system arranged to direct data that meets the threat condition to one of the workstations for analysis.

The data management means may comprise a job dispatcher. The job dispatcher may be arranged to coordinate the tasks which are directed to each of the workstations. The data management means may further comprise a threat detection processor, which may be arranged to process image data to allocate the data to a threat category automatically, for example using one or more image processing algorithms. The data management means may also comprise a threat injector, which may be arranged to input test image data defining an image of a threat item. These different functions of the data management system can be provided as separate processors, or can be provided as different functions of a single processor.

The system may further comprise a cargo movement control means arranged to control movement of the objects through the scanners. Where the system is arranged to scan cargo carried on road-going vehicles the movement control means may include traffic lights and other signs and indicators for the driver of the vehicle. Where the system is arranged to scan rail cargo, the movement control means may include points on the railway. Where the system is arranged to scan cargo on a conveyor, the movement control means can include the conveyor.

The system may further comprise a holding bay and the movement control means may be arranged to hold one of the objects in the holding bay in response to the object meeting the threat condition. The movement control means may be arranged to cause the object to bypass the holding bay if it does not meet the threat condition.

According to some embodiments of the invention, a multi-level inspection process is provided which seeks to automate the scanning process to allow higher throughput and lower screening cost per cargo item.

The present invention further provides a method of scanning cargo comprising providing a plurality of scanners, scanning a respective object with each of the scanners to generate a respective set of scan data, processing each set of scan data to determine whether it meets a predetermined threat condition, and directing data that meets the threat condition to a workstation for analysis.

Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram of a scanning system according to an embodiment of the invention;

FIG. **2** is a schematic view of part of the scanning system of FIG. **1**;

FIG. **3** is a schematic plan view of a scanning system according to a further embodiment of the invention;

FIG. **4** is a schematic diagram of a threat detection system forming part of a scanning system according to a further embodiment of the invention; and;

FIG. **5** is a schematic diagram of a cargo security system according to a further embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1**, a scanning system according to one embodiment of the invention comprises a number of scanners **10**, which can be for example static, moving gantry or mobile scanners, each of which is arranged to scan a cargo container to generate image data. In this case the scanners **10** are arranged over a roadway **11** so that they can scan road-going cargo trucks. A storage array **12**, threat detection processor **14** and job dispatcher **16**, which generally includes a computer with a processor, are all connected to the scanners **10** and to each other by a data switch **18** or other suitable data transmission system. The data switch is also connected to a network of workstations **20**. Each of the workstations **20** includes a display **22** arranged to display the image data in the form of an image for viewing by an operator, and a user input **24**, in this case in the form of a mouse, which enables the operator to allocate one of a number of threat categories to each image.

The scanners **10** are able to operate independently and at high throughput. A typical scanner comprises an X-ray generator **30**, a set of X-ray detector arrays **32**, **34** each comprising a number of individual detectors **36** each arranged to generate an output signal. The scanner may be a drive-through scanner, or it may include means, such as a movable gantry, to scan the cargo item through an X-ray beam which fires from the X-ray generator **30** through the cargo item and onto the set of X-ray detectors **36**. A two-dimensional image data set is formed by the scanner from the detector output signals. That data set contains information about the cargo item under inspection. In some embodiments more than one X-ray beam is used. In this case the beams may be used to generate two-dimensional image data sets, or three dimensional image data sets. In either case the image data from a series of scans is typically in a form that can be used to build up a three-dimensional image of the cargo item. The scanners **10** pass the image information through the data switch **18** which is able to route the information directly from the scanners **10** to the other nodes **12**, **14**, **16**, **20**. Typically, a scan will generate data in the form of Ethernet packets and the data switch **18** is therefore simply an Ethernet switch.

In the embodiment described here, data from the scanners **10** is passed directly to the central storage array **12** and the job dispatcher node **16** which is therefore arranged to receive from the generating scanner **10** the new cargo image data.

The job dispatcher **16** is then arranged, on receipt of any new image data set, to allocate time on the threat detection processor **14** for automated analysis of the new image data. Advantageously, the image data produced by the scanner **10** will have multi-energy attributes such that a detailed materials discrimination algorithm can be executed first by the threat detection processor **14**, followed by an automated detection algorithm. Once the threat detection processor has analysed the image data produced by the scanner **10**, it is arranged to notify the job dispatcher **16** of its conclusions.

If a threat item (e.g. a material or device) has been detected by the threat detection processor **14**, the job dispatcher **16** is arranged to allocate an operator to review the image data produced by the scanner to resolve the severity of the threat item(s) that were detected by the threat detection processor **14**, and to transmit the image data to one of the workstations **20**, or simply make the data available for retrieval and analysis by the operator. The operator will utilise one of the networked operator workstations **20** that has the capability to manipulate the image data for optimal display.

Once the operator has made their decision, and input it as an operator decision input to the workstation using the input device **24**, the result (either that the cargo is in fact clear for onwards travel or that it does indeed contain threat materials or devices) is forwarded to the job dispatcher **16** by the operator workstation. This can be done by sending the image data back with the decision attached to it in the form of a threat categorization, or by sending the decision, again for example as a threat categorization, with an identifier which uniquely identifies the image data set. The job dispatcher **16** is then arranged to notify the scanner **10** of the result.

In the event that a cargo item is flagged or categorized by the operator at the workstation **20** as containing a threat material or device, the facility manager is also notified, and a traffic management system controlled as described in more detail below to direct the cargo items appropriately, such that the threat cargo item can be quarantined until such time as an operative is available for manual search of the cargo item.

Typically, the threat detection processor **14** can be optimised to deliver a low false alarm rate to minimise the congestion and process delays that are caused when a threat cargo item is detected. The corollary of this is that the true detection rate will also be low. In this situation, very few operators are required in order to inspect image data from large numbers of scanning devices. This ensures a low screening cost per cargo item.

In this low false alarm rate scenario, it is reasonable to send a fraction of all the scanned images to the network of operators using random scheduling of cargo items which were cleared by the threat detection processor **14**.

This ensures that good inspection coverage of all the cargo items that are passing through the facility is achieved.

In a further mode of operation of the system, the balance between false alarm rate and detection probability is adjusted such that a higher detection rate is achieved but with a consequent increase in false alarm rate. In this scenario, more operators will be required in order to confirm or reject the cargo items following automated threat detection processing. At this higher false alarm rate level, it is unlikely that additional random inspection of automatically cleared containers will be required. The use of more operators pushes up the cost of screening containers but this comes at the benefit of an enhanced detection probability.

The threat detection processor **14** can be set to any particular sensitivity to suit the environment in which the system is to be used. However in this embodiment the sensitivity of the threat detection processor **14** is adjustable so that the operation of the system can be adjusted to suit the prevailing conditions. This means that where the threat detection processor is arranged to allocate each item to one of a number of threat categories, corresponding to different levels of threat, the category to which any particular images will be allocated can be adjusted so as to adjust the proportion of items that will be allocated to each of the categories. The threat detection processor can be arranged to adjust this allocation on the basis of one or more inputs, for example inputs indicative of an overall threat level, the volume of traffic which needs to be scanned, or the number of operators available to review the images. In a modification to this arrangement, the threat detection processor **14** can be arranged to allocate the items in the same way at all times, and the job dispatcher **16** can be made adjustable so that it allocates jobs to the workstations, and controls the flow of traffic in a way which is variable and adjustable in response to the same variables.

In a further embodiment of this invention, a further network node is added in the form of a threat injector **40**. The threat injector node **40** comprises a computer **42** having a processor **44** and memory **46**, with a library, stored in the memory **46**, of images of threat items that have been collected under controlled conditions using scanners identical to those 10 in use in the installation. Using a scheduling algorithm that is controlled by the job dispatcher **16**, image data that has been cleared by the threat detection processor **14** is passed to the threat injector **40**. The threat injector **40** superimposes a threat object image from its library of stored images into the true cargo image in order to create a hybrid image that now contains a known threat in an otherwise clear image.

This hybrid image is then dispatched by the job dispatcher **16** to one of the workstations **20** for an operator review. The operator will be expected to find and mark the threat object. When the operator threat categorization decision is input at the workstation **20** and returned to the job dispatcher **16**, the job dispatcher will send a notification to the workstation **20** to notify the operator that a known threat had been inserted into the image and will confirm whether the operator located the threat correctly. This information is then stored in a database of records, as part of one of the records which is relevant to the particular operator, in order to build up a picture of the individual operator's performance standard.

In a practical realisation of this invention, each workstation **20** can be arranged to display to an operator approximately 10% hybrid threat images, and 90% pure scanned images, in order to keep them occupied and well trained. The nature and complexity of the threat images that are injected are arranged to be variable and dependent on the identity of the operator, so that the testing can be balanced against the performance ability of the observer. This allows targeted training programmes to be established by the facility managers to ensure optimal human operation of the screening system.

In a modification to this system, instead of a hybrid image being generated as described above, a test image representing a threat object is simply selected from a library of test images and sent to one of the work stations **20**, and the response of the operator monitored to see whether their categorization of the image is correct.

The job dispatcher **16** can be arranged to allocate jobs to individual workstations or workstation operators on the basis simply of the current workload of each operator, which the job dispatcher can determine from the tasks it has already allocated, and results it is waiting for from each operator, and the threat category to which the threat detection processor has allocated the item. However where the system has a record or profile associated with each operator, the allocation of tasks to operators can also be made on the basis of the profile. For example in some case the threat detection processor may allocate items to different categories not just on the basis of a level of threat that it associates with the item, but also on the basis of the type of threat, for example the type of threat object that has been detected or the category of threat material that has been detected. Where the operator profile includes types of threat that each operator is able to analyse, or a degree of proficiency of each operator at analysing each type of threat, the job dispatcher can allocate each task to an operator at least on the basis of this information to match each task to an operator suitable to perform it.

Each operator workstation **20** has the facility to annotate the displayed image, in response to inputs from the user input **24**, in order to mark up an image to indicate the presence and type of threat objects and materials that have been detected in the cargo item.

In a further modification to this embodiment of this invention, to facilitate the smooth operation of each scanning device **10**, the job dispatcher **16** is able to cause the scanning system to route the passage of cargo items at its exit depending on the results of the automated detection processor and of any subsequent human inspection of the image data. For example, as shown in FIG. **2**, each of the scanners **10** can have a holding bay **50** which a vehicle can enter after passing through the scanner, with a traffic control system, such as traffic lights **52**, arranged to direct vehicles that have passed through the scanner **10** into the holding bay, or past the holding bay **50**. If the automated threat detection processor **14** detected the presence of a threat item or material, of the traffic lights **52** adjacent to the scanner **10** will be controlled by the job dispatcher **16** to direct the load to the holding bay **50** until such time as the operator has input their response. When the operator response has been received by the job dispatcher **14** it is arranged to control further traffic controls, such as a further set of traffic lights **54**, to indicate that the cargo is free to leave the scanning site, or that it needs to move on to another area for example for manual searching.

To maximise throughput of the installation, the automated threat detection processor **14** is arranged to generate a decision relating to a cargo item in a time period which is short compared to the overall scanning time for the cargo item. The job dispatcher **16** is arranged to be capable of allowing a scanner **10** to continue scanning new cargo items even if a cargo item is located in the associated holding bay **50** awaiting an operator decision.

The embodiments of FIGS. **1** and **2** are arranged to scan and control cargo carried on road vehicles, and the traffic management systems therefore rely on traffic lights and other suitable indicators or signs to direct the driver of the vehicle where to drive. However in another embodiment the system is arranged to scan cargo transported by rail. In this case the traffic management systems comprise traffic lights and also points on the rail tracks, for example at the exits **62** from the scanners in FIG. **3**, that can be switched to determine the route which the cargo takes.

The job dispatcher **16** is also arranged to control queuing of multiple suspect cargo items in the holding bay in order to maximise throughput of the screening installation.

Referring to FIG. **3**, in a further embodiment, a security installation is similar to that of FIG. **2** but comprises a number of scanners **60**, each with an associated traffic control system **61**, and arranged to scan cargo items in parallel. The exits **62** from all of the scanners **60** lead to a shared quarantine area **64** that serves all of the scanning systems **60**. The traffic control systems **61** which comprise traffic lights or equivalent traffic management systems, are arranged to direct traffic either straight through scanners **60** to the exit of the scanning installation or, in the event of a threat being detected, to direct the load to the quarantine area **64** where further traffic management systems **66** are provided and arranged to route cargo loads to the exit of the installation following manual search as required.

Referring to FIG. **4**, in further embodiments of the invention, which can be otherwise similar to those of FIGS. **1** to **3**, the job dispatcher **16***a* is similar to that of FIG. **1**, but is also arranged to receive, use and manage one or more different forms of information in addition to X-ray image data. This could typically include video images of the cargo load, which the job dispatcher **16***a* is arranged to receive from one or more video cameras **70**. It can also include optical character recognition data related to container numbering, which can either be obtained by an image processor **72** arranged to process images from the video cameras, or a separate processor **74** arranged to receive and process images from an imaging device **76** specifically arranged to image a part of the container that carries the numbering. The information can also include scanned images of manifest information that may be provided with the cargo item. It may include data from secondary sensors such as weighbridge data from a weighbridge **78** indicative of the weight of the container, data from chemical detectors or 'sniffers' **80** indicative of the presence of one or more chemical compounds in the container, passive gamma ray data from a gamma ray detector **82** or neutron sensing data from a neutron sensor **84**. The secondary sensors are shown here is present at the scanner site and part of the installation, but any of them can equally be at a separate location, and arranged to store the data they provide on a data carrier so that it can be input to the job dispatcher, or to transmit the data to the job dispatcher with some form of identification of the container it relates to. Where this ancillary data is available, the job dispatcher **16***a* is typically arranged to pass the data to the automated threat detection processor which is arranged to use it as an input to the threat detection algorithm that it uses in order to assist it in making the best possible threat categorization decision.

Referring to FIG. **5**, in a further embodiment of the invention a cargo security system is similar to that of FIGS.

3 and 4, but the system is arranged to scan cargo carried by rail on a rail train 81. The parts of the system are distributed over larger distances so as to enable an efficient flow of cargo traffic. The system is arranged to scan and categorize cargo arriving at a port 80 on a vessel 82. The system includes a number of scanners, and all of the sources of secondary data described above with reference to FIG. 4, but these are distributed at a number of locations 84 along the rail route between the port 80 and a final quarantine or checking area. In particular the scanners 60 are at one location 84*a* close to the port 80 where they can be used to scan the cargo shortly after it has been loaded onto the rail vehicle 81, and the final checking area is provided at another location 84*b* further away from the port which may be at a destination of the cargo where it is removed from the rail vehicle 81 carrying it, and any individual cargo items or containers which are identified as a possible threat can be checked without delaying the progress of containers which are not identified as a threat. A traffic management system similar to that of FIG. 3 including rail points and traffic lights is used to control the route of each item of cargo, into or past the checking area 86, dependent on the analysis of the scan data and other secondary data by the threat detection processor. This arrangement means that the cargo items do not need to be delayed close to the port 80, and can be moving away from the port, and towards their final destination, while the threat detection analysis is being performed.

I claim:

1. A non-transient computer readable medium comprising a plurality of programmatic instructions that, when executed by at least one processor:

receive scan data, wherein the scan data are representative of contents positioned within one or more containers;

perform an automated detection process on the scan data;

receive descriptive information of the contents of the one or more containers;

assess the scan data based on the automated detection process;

for a first portion of the assessed scan data, acquire a threat object image from a library of images representative of known threats and combine the threat object image with the first portion of the assessed scan data to generate hybrid scan data; and

send the hybrid scan data and a second portion of the assessed scan data to an operator workstation, wherein the second portion of the assessed scan data does not have a threat object image from the library of images representative of known threats and wherein an amount of the second portion of the assessed scan data is greater than an amount of the hybrid scan data.

2. The non-transient computer readable medium of claim **1**, wherein, when executed by the at least one processor, the plurality of programmatic instructions automatically allocate the hybrid scan data and the second portion of the assessed scan data to at least one operator workstation for analysis.

3. The non-transient computer readable medium of claim **1**, wherein, when executed by the at least one processor, the plurality of programmatic instructions generate optical character recognition data indicative of characters associated with the one or more containers.

4. The non-transient computer readable medium of claim **1**, wherein, when executed by the at least one processor, the plurality of programmatic instructions execute a material discrimination process on the scan data.

5. The non-transient computer readable medium of claim **4**, wherein, when executed by the at least one processor, the plurality of programmatic instructions first executes the material discrimination process on the scan data and then subsequently executes the automated detection process on the scan data.

6. The non-transient computer readable medium of claim **5**, wherein, when executed by the at least one processor, the plurality of programmatic instructions is configured to display the hybrid scan data and the second portion of the assessed scan data on an operator workstation after the material discrimination process and the automated detection process is performed on the scan data.

7. The non-transient computer readable medium of claim **1**, wherein, when executed by the at least one processor, the plurality of programmatic instructions combines the threat object image with the first portion of the assessed scan data by superimposing the threat object image onto an image corresponding to the first portion of the assessed scan data.

8. The non-transient computer readable medium of claim **7**, wherein the first portion of the assessed scan data combined with the threat object image corresponds to an image of contents without a threat.

9. The non-transient computer readable medium of claim **1**, wherein, when executed by the at least one processor, the plurality of programmatic instructions determines a severity of a threat item based on the scan data.

10. The non-transient computer readable medium of claim **1**, wherein, when executed by the at least one processor, the plurality of programmatic instructions receives decision data from an operator workstation, wherein the decision data comprises a categorization of the threat item.

11. The non-transient computer readable medium of claim **1**, wherein, when executed by the at least one processor, the plurality of programmatic instructions generates and transmits a notification based on the decision data.

12. The non-transient computer readable medium of claim **1**, wherein, when executed by the at least one processor, the plurality of programmatic instructions allocates each threat item to one of a number of threat categories and wherein each of the threat categories corresponds to a different level of threat.

13. The non-transient computer readable medium of claim **1**, wherein, when executed by the at least one processor, the plurality of programmatic instructions allocates the hybrid scan data and the second portion of the assessed scan data to one or more operator workstations based on an overall threat level.

14. The non-transient computer readable medium of claim **1**, wherein, when executed by the at least one processor, the plurality of programmatic instructions allocates the hybrid scan data and the second portion of the assessed scan data to one or more operator workstations based on a volume of traffic.

15. A method implemented by at least one processor configured to execute a plurality of programmatic instructions in a non-transient computer readable medium, the method comprising:

receiving scan data, wherein the scan data are representative of contents positioned within one or more containers;

performing an automated detection process on the scan data;

receiving descriptive information of the contents of the one or more containers;

assessing the scan data based on the automated detection process;

for a first portion of the assessed scan data, acquiring a threat object image from a library of images representative of known threats and combining the threat object image with the first portion of the assessed scan data to generate hybrid scan data; and

sending the hybrid scan data and a second portion of the assessed scan data to an operator workstation, wherein the second portion of the assessed scan data does not have a threat object image from the library of images representative of known threats and wherein an amount of the second portion of the assessed scan data is greater than an amount of the hybrid scan data.

16. The method of claim **15**, comprising automatically allocating the hybrid scan data and the second portion of the assessed scan data to at least one operator workstation for analysis.

17. The method of claim **15**, comprising generating optical character recognition data indicative of characters associated with the one or more containers.

18. The method of claim **15**, comprising executing a material discrimination process on the scan data.

19. The method of claim **18**, comprising first executing the material discrimination process on the scan data and then subsequently executing the automated detection process on the scan data.

20. The method of claim **19**, comprising displaying the hybrid scan data and the second portion of the assessed scan data on an operator workstation after the material discrimination process and the automated detection process is performed on the scan data.

21. The method of claim **15**, comprising combining the threat object image with the first portion of the assessed scan data by superimposing the threat object image onto an image corresponding to the first portion of the assessed scan data.

22. The method of claim **21**, wherein the first portion of the assessed scan data combined with the threat object image corresponds to an image of contents without a threat.

23. The method of claim **15**, comprising determining a severity of a threat item based on the scan data.

24. The method of claim **15**, comprising receiving decision data from an operator workstation, wherein the decision data comprises a categorization of the threat item.

25. The method of claim **15**, comprising generating and transmitting a notification based on the decision data.

26. The method of claim **15**, comprising allocating each threat item to one of a number of threat categories and wherein each of the threat categories corresponds to a different level of threat.

27. The method of claim **15**, comprising allocating the hybrid scan data and the second portion of the assessed scan data to one or more operator workstations based on an overall threat level.

28. The method of claim **15**, comprising allocating the hybrid scan data and the second portion of the assessed scan data to one or more operator workstations based on a volume of traffic.

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