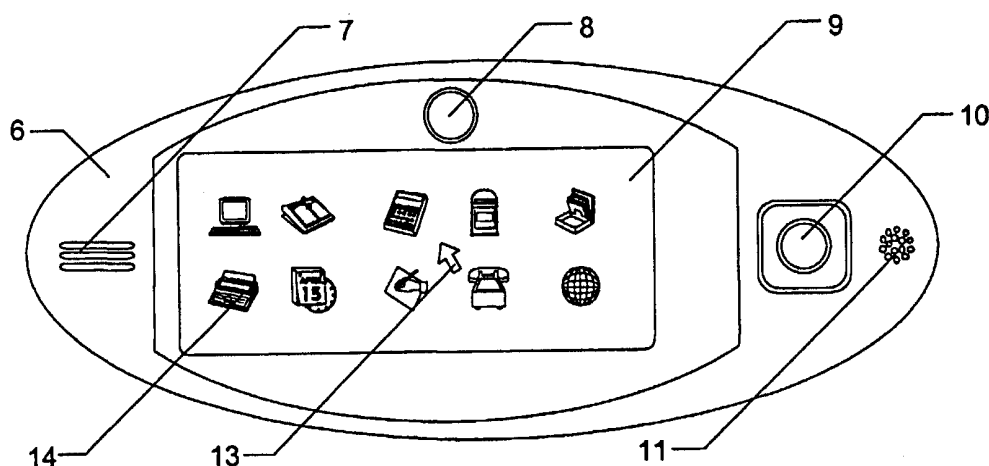




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : G06F 3/023	A1	(11) International Publication Number: WO 00/62149 (43) International Publication Date: 19 October 2000 (19.10.00)
(21) International Application Number: PCT/NO00/00117 (22) International Filing Date: 12 April 2000 (12.04.00) (30) Priority Data: 19991707 12 April 1999 (12.04.99) NO (71)(72) Applicant and Inventor: PEDERSEN, Steinar [NO/NO]; Elgtråkket 48, N-1383 Asker (NO).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: COMPUTATION AND COMMUNICATION DEVICE WITH SINGULAR CONTROL MODULE



(57) Abstract

The invention represents a hand-held computation and communication device (6) that employs a single or main control module (10) for positioning and control of a screen cursor (13), for activation of menu- and icon-based programs and functions, and for input of alphanumeric data and graphic information.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon		Republic of Korea	PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

Computation and communication device with singular control module

5 The invention represents a hand-held device for computation and communication that utilises a main control and input module for positioning of a cursor or object on a screen, for activation of menu- and icon-based programs and functions and for input of alpha-numeric data and graphic information.

10 The size of hand-held computers and PDAs (personal digital assistants) are continuously decreasing, with the result that associated keypads become small and difficult to operate. For this reason, the use of pressure-sensitive screens are increasing, whereby the user selects programs, enters data and controls functions by means of fingers or special writing tools. This concept is functioning very well, except for the process of releasing and positioning the writing tool in connection with each operation that is, relatively speaking, cumbersome and time-consuming. Although more readily available, the fingers lack precision when attempting to depress small screen symbols.

25 Telephones and remote control devices are equipped with a numeric (number based) or alphanumeric (number, letter or symbol based) keypad that allow input of telephone numbers, selection of TV or radio channels, or for control of functions that require selection between different numbered options.

30 Telephones with a memory function allow input and storage of names and numbers in the phone's internal memory or on SIMM-cards that may be switched between different units. Modern phones (e.g. GSM) may also be used to transmit simple text messages. For this purpose, a particular kind of alphanumeric keypad is used, where the primary number keys are also serving as letter keys. Because there are only ten number keys and a few

function keys on keypads used with telephones, selection of letters involves serial activation of single number keys, often in combination with function keys. This implies that input of names, text messages or other
5 numeric and alphanumeric information is cumbersome and time consuming.

Modern telephones use menus for selection of various options connected to the phone use. The user may select
10 between different menus by means of function keys, arrow keys and/or scrolling wheels. The menus are organised as hierarchical systems, and it takes time to reach the bottom of a particular menu, or to select options that are localised in different parts of the menu structure.

15 There is a clear tendency towards miniaturising in the phone market, and this is particularly true for mobile phones. A consequence is that the keys become gradually smaller and thus difficult to operate without making
20 erroneous keystrokes.

Some of the same trends, with associated weaknesses are seen with remote control devices. These are very often loaded with function keys, in addition to the numeric
25 keypad used for e.g. selection of TV-channels, pre-programmed radio stations, CD-tracks, etc. This has lead to production of over-sized control devices, or to smaller units with correspondingly small keys.

30 With the development of international standards for transmission and communication protocols for use with wireless data communication (e.g. WAP), this provides opportunities for introduction of multifunctional communication devices. It is envisaged that in the near
35 future, the same unit will be used both as mobile phone, "stationary" phone, input- and control device for

computers, remote control for TV/radio, device for control of various domestic functions, for the car, etc. There is also an increasing tendency to include the functionality of hand-held computers and PDAs in communication devices, or vice versa.

Some of the problems associated with crowded keypads are already solved, e.g. by use of hierarchical menus and graphic symbols (icons) that appear on the device's display or screen. Interactive use of programs and functions by means of menus and icons require a precise method of activation and control. With computers, this activation is generally performed with mice, trackballs, track-keys (e.g. IBM's TrackPointTM), touch pads or joysticks. Trackballs and track-keys (together with arrow keys) are to some extent used with remote control devices for computers, TV-sets and projectors. Mobile phones employ arrow keys, scrolling wheels and function keys with limited functionality.

Important weaknesses of these control utilities, in addition to their restricted functionality and lack of flexibility are their limited capability of being downsized and to some extent, their lack of precision. These are important prerequisites in conjunction with communication devices that are to be adapted for future, multifunctional communication and computation tasks.

This inventor has developed control devices that are described in e.g. Norwegian patent No. 300943 and in PCT/NO96/00077, where the main control module consists of a hand- or finger-grip (control button) that is mounted on a plate (guide plate). This stick-and-plate concept utilises different sensor systems for detecting

the module's position, movement or configuration in a plane or in space. One important asset of the stick-and-plate concept is the possibility of employing congruent motion control, i.e. that the movement pattern of cursor
5 or object are essentially congruent with the corresponding pattern of the control module or a member of the control module. This permits the user to e.g. "write" or "draw" numbers, letters or other symbols by seizing the module with two fingers, or by means of
10 putting a single finger on top of the control module.

The stick-and-plate concept has also been used as basis for devices utilising a vectorial control mode (joystick type), or for switching between congruent and vectorial
15 mode.

This inventor has surprisingly discovered that some of the principles that have been developed and used in connection with the stick-and-plate concept may also be
20 employed as basis for a multifunctional control module that can serve as the only control and input utility for hand-held computation and communication devices. Such a control module has the potential of eliminating weaknesses associated with pressure-sensitive screens,
25 alpha-numeric/numeric keypads and arrow keys when used in connection with hand-held computers, PDAs and communication devices. A major advantage is that it may substitute *all* other control and input utilities used with hand-held devices, and at the same time being fully
30 *incorporated* in the device and thus eliminating the need for accessory input and control utilities (writing tools, mice, etc.).

The present invention describes a hand-held device that
35 may be used for one or several purposes (data storage

and computation, word processing, calculations, time planning, graphic work, communications, data transfer, remote control, etc.), utilising a single control module for function control and for data input. The shape and
5 dimensions of the portable device may vary, but it is typically rectangular, square or trapezoid with rounded edges and corners, or oval. The size may vary between wide limits, but external dimensions are typically between 80x30x10 mm and 160x60x20 mm.

10

The device incorporates a single, or a main control module that is responsible for controlling movements and functions of a cursor or an object on the device's display, or a cursor or an object on the screen of a
15 separate unit (computer screen, TV-set, etc.), with which the device is communicating.

The control module is used for precise selection and activation of menu- or icon-based programs and functions
20 by use of the screen cursor. The control module may also be used for input of alphanumeric information, either by use of the cursor to select numbers, letters and other symbols that appear on the screen/display, or by using the module to "write" or "draw" numbers or letters. The
25 screen cursor will mimic these movements and corresponding symbols will appear on the screen/display. Suitable software and/or an integrated microprocessor will interpret the graphic information on the screen (or alternatively, the motion pattern of members of the
30 control module) and transform this information into digitised, alphanumeric information that is fed into the processor memory. The alphanumeric information may thereafter be used for its intended purposes, e.g. for dialling a phone number, selection of a TV-channel, etc.

When in use, the hand-held device is normally seized by one hand, with the thumb resting upon the main control module and the other fingers embracing the device body.
5 Alternatively, the device may be held by one hand while the index finger of the other hand is put on top of the control module.

The control module may e.g. be constructed according to
10 the stick-and-plate concept, or use concepts that are controlled in a similar way.

Embodiments that utilise the stick-and-plate concept comprise a control button that is mounted on a guide
15 plate. The guide plate is attached to the chassis in a way that allows it to be moved easily in all directions in a plane. The dimensions and shape of the control button may vary, but it is typically 5-20 mm in diameter and 2-5 mm tall. The guide plate is usually square with
20 a 10-40 mm edge, or it may have another shape (circular, rectangular, irregular, etc.) with similar dimensions. The control button is moveable in all directions within a delimited part of a plane (the mobility range). The mobility range is typically square with 10-25 mm edges.
25 The main button is equipped with switch functions that are activated when depressed. In a preferred embodiment the button is cup-shaped, with the switch localised inside the cup.

30 The control button is moved sideways by means of a finger (usually the thumb), which is placed on top of the button, touching the rim of the cup and the top of the switch "activator". The control button can thus be moved sideways without activating the switch, and the

switch may easily be activated by pushing the finger towards the bottom of the cup. The control button is normally localised in a recess of the device body. In preferred embodiments the guide plate is prevented from
5 rotating by being attached to the chassis by a pantographic arm. The guide plate may be spring-loaded, ensuring that the main button is brought back towards the centre of its mobility range when released.

10 It will be obvious to a person skilled in the art that other control modules that can be fully incorporated into hand-held computation and communication devices and which are utilising a congruent or a combined
15 congruent/vectorial control mode, where the module is suitable for controlling cursors and objects on a screen, for activation of menu- and icon-based programs and functions and for input of graphic and alpha-numeric information may also serve as the only, or the main control module for such devices.

20 Preferred embodiments will now be described by means of examples with reference to accompanying figures, where:

Fig. 1 illustrates a multifunctional, hand-held device
25 with a single control module used for computation, communication, word-processing, etc.

Fig. 2 is a side view of the device illustrated in Fig. 1.

30 Fig. 3 illustrates an alternative multifunctional, hand-held device used for computation, communication, word-processing, etc.

Fig. 4 illustrates a display with number "keys" that can be activated by the cursor.

Fig. 5 illustrates a display with dedicated input fields
5 where a letter is "written" in one of the fields by means of the control module.

Fig. 6 illustrates ten input fields containing "written" numbers.
10

Fig. 7 illustrates ten input fields containing "written" letters.

Fig. 8 illustrates a hand-held device serving as a
15 remote control.

Fig. 9 illustrates a hand-held device serving as a mobile phone.

Fig. 10 illustrates a communication device without display, communicating with a special eye screen (head monitor).
20

Fig. 11 illustrates a head monitor with a semi-transparent LCD screen showing a control menu.
25

Fig. 12 is a side view of a control button and a guide plate connected to a capacity based sensor.

Fig. 13 is a top view of a capacity based sensor as employed by the device illustrated in Fig. 14.
30

Fig. 14 is a side view of a control button and a guide plate attached to an opto-electronic sensor.

Fig. 15 is a top view of an opto-electronic sensor as employed by the device illustrated in Fig. 15.
35

Fig. 16 shows a communication device with a main control module and two auxiliary function keys.

- 5 Fig. 17 shows mechanical elements attached to the control module according to Fig 16, preventing rotation of the guide plate.

- 10 Fig. 18 illustrates the pantographic arm used to prevent rotation, with the button in an eccentric position.

Fig. 19 is a side view of a control button, with a cup-shaped body and a switch function.

- 15 Fig. 20 is a vertical section of a hand-held device, showing the control button, a pantographic arm and an extra button at the lower side of the body.

- 20 Fig. 21A is a top view of a control module comprising a control button, a guide plate and a spring mechanism that will come into action when the control module is entering the fringe zone.

- 25 Fig. 21B illustrates movement of the control module into the fringe zone.

Fig. 22 illustrates the position of the fringe zone relative to the control button and the guide plate.

- 30 A more detailed description of some embodiments of the invention and different parts thereof are presented below:

- 35 Fig. 1 and Fig. 2 show a hand-held computation and communication device. The device has a single control module 2 that are used to activate programs and functions by means of a cursor 5 and icons 4 that appear

on the display 3. The control module 2 is also used to enter alphanumeric information. By moving the button, the user can "write" numbers, letters and symbols. While in use, the thumb will typically rest on top of the button, while the other fingers are embracing the body. The device may thus be operated by means of one hand. The control module may alternatively be controlled by e.g. the index finger. The dimensions of the communication device are typically between 80x30x10 mm and 160x60x20 mm. The device has an on/off switch 12 that is localised on the right side of the device.

Fig. 3 illustrates a hand-held communication and computation device 6 with an alternative, oval shape. The device is equipped with a main control module 10, miniature speaker 7, camera 8, microphone 11, and a display 9 with icons 14 and a cursor 13.

Fig. 4 illustrates how a single control module, in conjunction with a menu system and the cursor may be used for input of alphanumeric information e.g. for calculations or for "dialling" a phone number. A graphic keyboard 16 appearing on the display is activated by moving the cursor 5 on top of individual keys. The resulting number will appear on the display (here, top left), and may thereafter be transmitted by means of the control module, a menu, or by using an auxiliary key (not shown). The number may easily be corrected by means of the control module, e.g. in combination with a menu-based editing function.

In Fig. 5 - Fig. 7 alphanumeric information is entered by means of a different principle. Here, the control module is used to enter graphic representations of various symbols. In Fig. 5 the letter "h" 17 is written by means of the control module with a switch function activated. The letter is entered within a field 17 that

is intended for letters, while another field 18 is intended for numbers. The device is equipped with an optical character recognition function (OCR software and/or microprocessor) that interprets the graphics (or the button's movement pattern), and transforms this into digitised, alphanumeric information. In this way, text may be entered using the operator's own "hand writing". One big advantage is that the method provides simple and rapid entrance of text, a process that is considerably more complicated with a numeric keypad. Fig. 6 and Fig. 7 show examples of "grafitti" versions of numbers 19 and letters 20, suitable for entering by the control module. A differentiation between numbers and letters are not necessary when a character set without similarities between numbers and letters are used.

Fig. 8 illustrates a device that may be used as a remote control. Icons 23 representing a TV-set and a car can be selected and activated by the control module 21, preparing the device for dedicated control functions.

In Fig. 9 the control module 21 is used to activate the device's function as a mobile phone. The display indicates that the device has established contact with a signal transmitter (indicated by the text symbol "TELECOM" on the display). When activated, a set of menus (and sub-menus) will appear on the screen. The content and functionality of such menus will depend upon the device's basic configuration as a mobile phone, remote control unit, computation device, etc.

To an increasing extent, head monitors and eye-screens will substitute present computer screens, providing possibilities for 3D representation of a "virtual reality". In Fig. 10 and Fig. 11 a communication device 27 with a control module 28 is used as a mobile phone, communicating with a head set 29 with a semitransparent

LCD-screen 30. The head set 29 has a built-in antenna in addition to an earphone 32 and a microphone 33. The electronics of the mobile phone may either be incorporated in the control unit 27 or be associated with the head set 29. The same principle may also be used with hand-held computers/PDAs, or with combined devices.

Fig. 12 and Fig. 13 show an example of a capacity based sensor 36, which may be used to determine the X-Y position of a control module. The sensor comprises four stationary condenser plates 35 that are located below another, horizontally movable plate 36. The top condenser plate is attached to the guide plate and the control button 34. The guide plate is kept in position in the X-Y plane by means of a support plate 37. When the upper condenser plate 36 is moved in the horizontal plane, the capacitance between this plate and each of the four lower condenser plates 35 will change. Based upon a continuous measurement of the capacitance, the X-Y position of the control module can be determined.

Fig. 14 and Fig. 15 show an opto-electronic sensor utilising a light source 40 (diode laser, LED, etc.) and a photosensor matrix 39 with addressable elements (CCD, etc.). The sensor matrix 39 is capable of continuously determining the exact position where a beam from the light source 40 hits the matrix. This position is used to determine very precisely the X-Y position of the control module.

Fig. 16 illustrates a hand-held device equipped with auxiliary keys 43, 44 that are used to activate particular functions, e.g. to establish or terminate a phone connection.

Fig. 17 illustrates an embodiment where a pantographic arm is used to prevent rotation of the control module. The main button 41 is mounted on a square guide plate 45, which again is attached to a connecting member 48 by means of two arms 46, 47. The connecting member 48 is further attached to the chassis by a second arm set 49 and 50. The components 45, 46, 47, 48, 49 and 50 together constitute the pantographic arm. Fig. 18 illustrates how the pantographic arm prevents rotation. In Fig. 18 the guide plate 45 and the connecting member 48 are made transparent in order to show how the arms 46, 47, 49 and 50 are attached to the plates.

Fig. 19 illustrates a control button 41 (with spring function removed), comprising an "activator" plate 51 and a micro-switch 54. All parts are contained in a cup-shaped enclosure 52. The switch function of the control button may e.g. be used in conjunction with movements to "write", activate functions or programs, transmit number signals, terminate a phone connection, etc. In Fig. 20 the device has an auxiliary button 57 that may be used to activate specific functions. This is useful e.g. for securing that the switch function associated with the control button is not activated unintentionally, e.g. when carried in the pocket. The device furthermore incorporates a pantographic arm 47, 48, 49, 50, a guide plate 45 and a sensor 56.

In Fig. 21A and Fig. 21B, the guide plate 59 is enclosed in a double frame with a spring system that becomes active when the control module is moved towards the border of its mobility range. The spring system consists of an inner, horizontally movable frame 61 and a set of plate springs 62 (Fig. 21B) that will position the inner frame concentrically relative to an outer, stationary frame 60. In Fig. 21A the guide plate 59 is pushed against the inner frame 61, representing the inner

border of the "fringe zone". The user will sense the contact between the guide plate and the frame, as a further, outward movement will yield increased resistance. In Fig. 21B, the guide plate is pushed as far as possible into the upper right corner, the outer frame preventing further outward movement. In Fig. 22, the area between 63 and 64 represents the area within which the guide plate is moving when the main button is operating in the fringe zone. Fringe zone movements can be used to instigate a vectorial control mode (joystick control).

It will be obvious to a person skilled in the art that the specific functions associated with hand-held computation and communication devices described above do not limit possible combinations of functions that may be associated with such devices, but are merely intended as relevant examples. It will furthermore be obvious that the described functions do not necessarily have to be combined in one single device, but may function alone or in other combinations in dedicated or multipurpose devices.

Patent claims

1. Hand-held device to be used for computation and communication, for storage of data, word processing, number processing, time planning, drawing, transfer of sound, data, control signals, pictures and other information, etc., where the device has a screen or display, or communicates with a head-set, eye-screen or another kind of external display that may show alphanumeric information, graphics and a system of menus or other symbols (icons) that are used to activate certain program functions; *characterised* in that the device incorporates a main control module for input of alphanumeric and graphic information and for activation of menu- or icon-based programs and functions; where the main control module furthermore controls a screen cursor and other graphic or virtual objects that may be moved on the display or screen.
2. Hand-held device according to claim 1; *characterised* in that alphanumeric information is entered into the device by means of movements of the main control module, where the movements mimic or describe a graphic representation of letters, numbers, symbols or mathematical operators.
3. Hand-held device according to claim 2; *characterised* in that the device incorporates a system for interpretation of letters, numbers and symbols that are entered into the device, transforming graphic information into digitised, alphanumeric information.
4. Hand-held device according to claims 1-3; *characterised* in that the main control module comprises

a button that is mounted on a guide plate that may be moved in all directions within a limited area of a plane.

5 5. Hand-held device according to claim 4; *characterised* in that the button and/or the guide plate is prevented from rotation by means of a pantographic arm.

6. Hand-held device according to claims 4-5;
10 *characterised* in that the main control module operates according to a congruent control mode when operated in the central part of its mobility range, and vectorial control mode in the fringe zone.

15 7. Hand-held device according to claims 1-6; *characterised* in that the main control module is associated with a sensor that at any instant can detect its position or movement.

20 8. Hand-held device according to claims 1-7; *characterised* in that the main control module is equipped with one or more switch functions.

Fig. 1

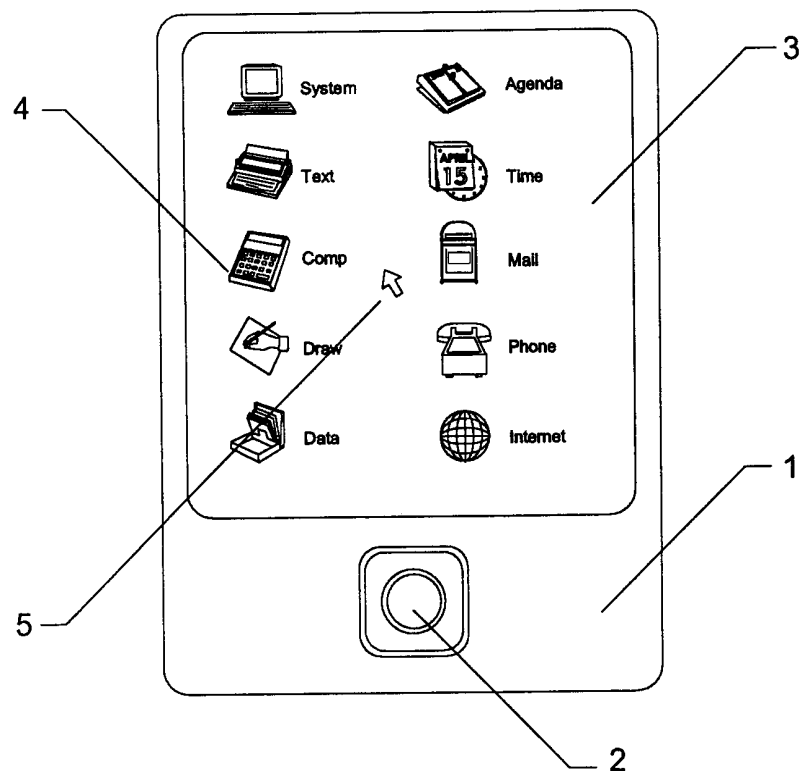


Fig. 2

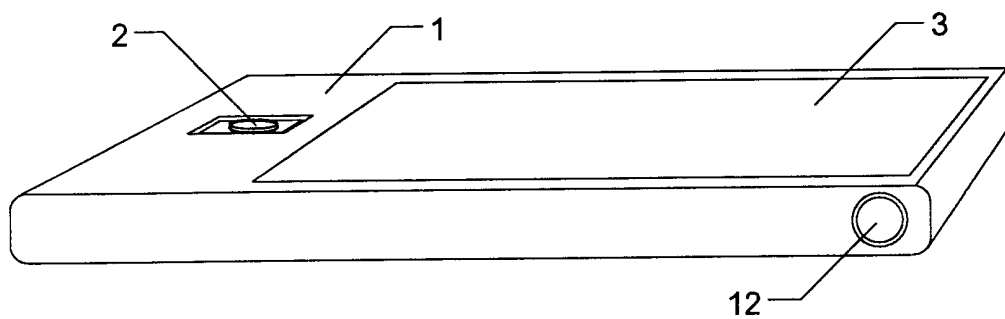


Fig. 3

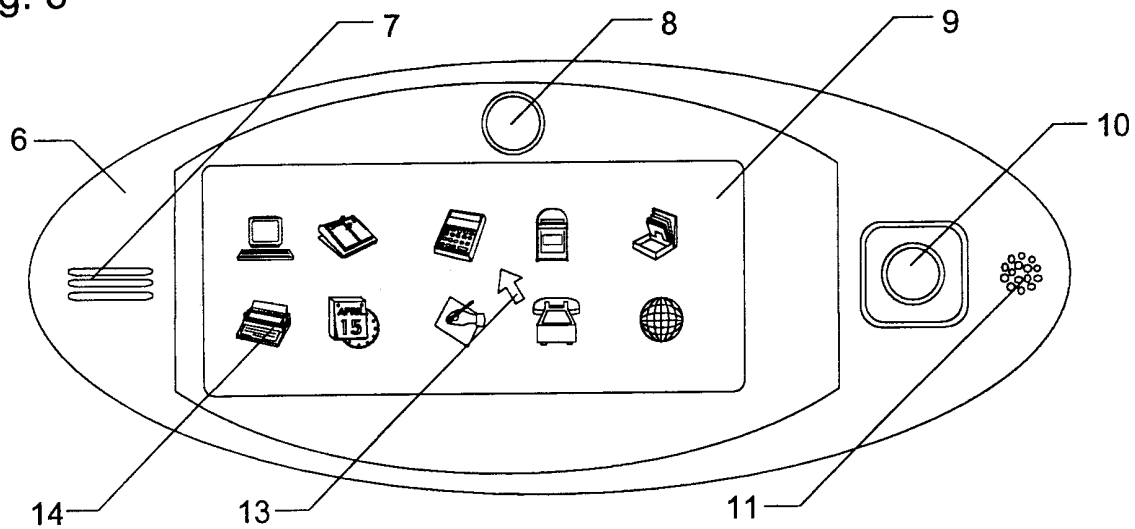


Fig. 4

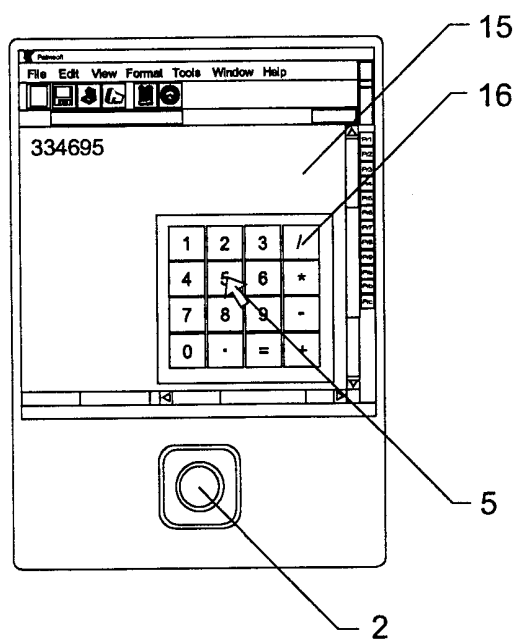


Fig. 5

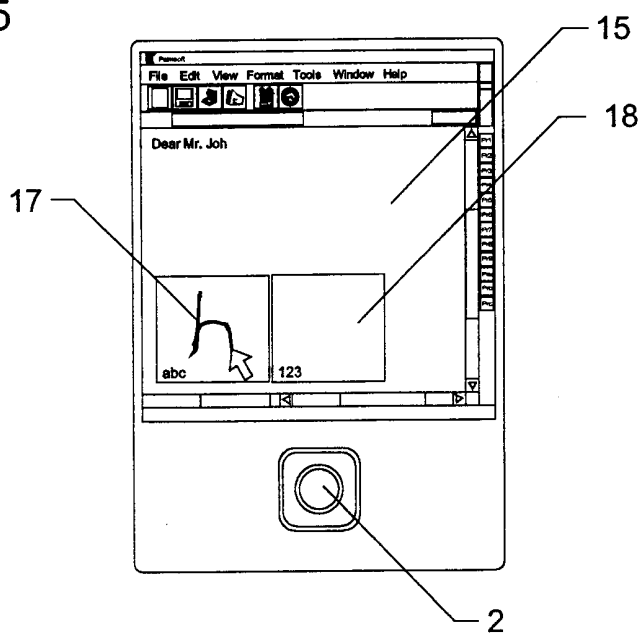


Fig. 6

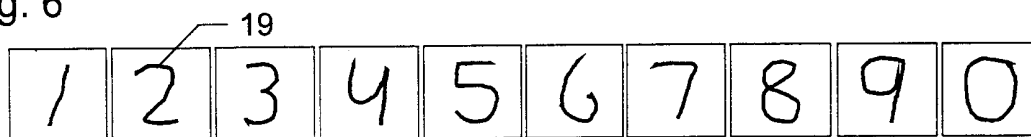


Fig. 7

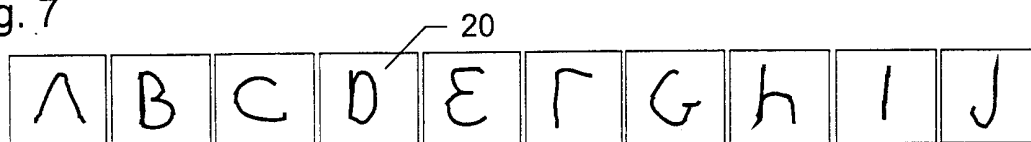


Fig. 8

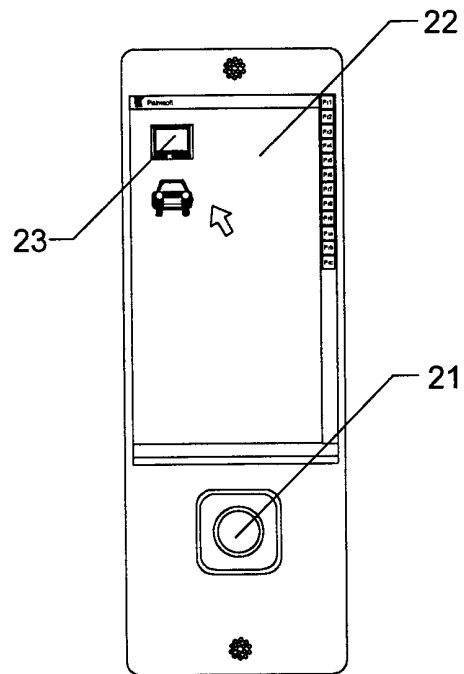


Fig. 9

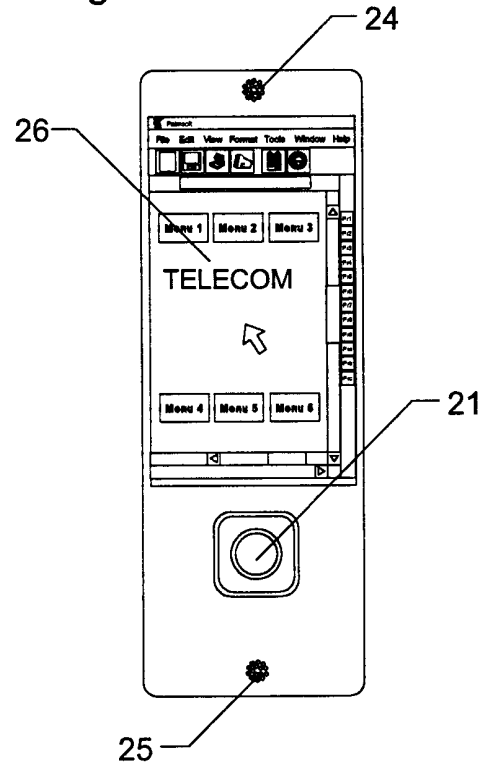


Fig. 10

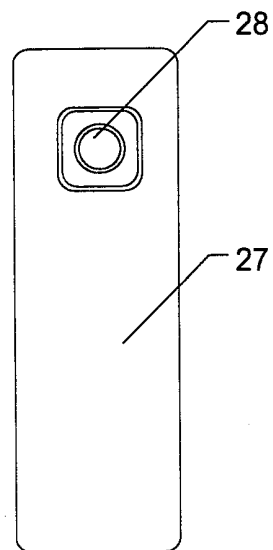


Fig. 11

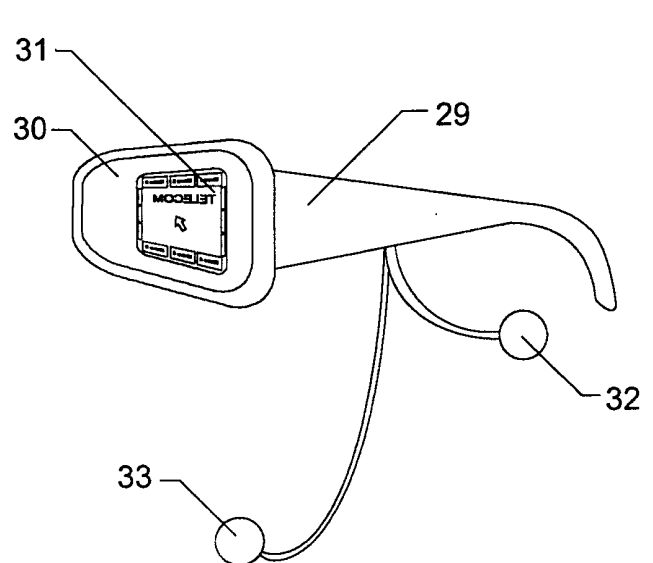


Fig. 12

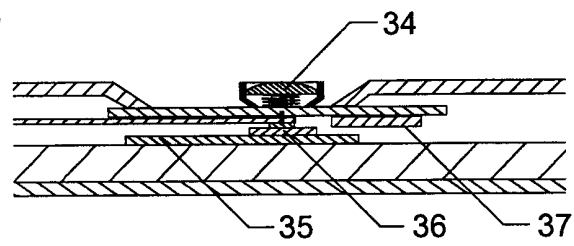


Fig. 13

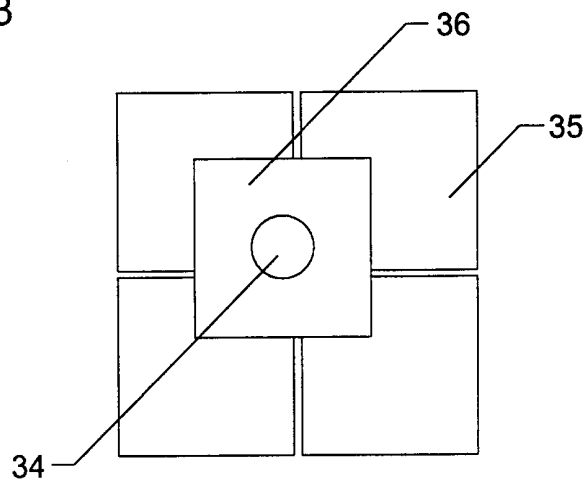


Fig. 14

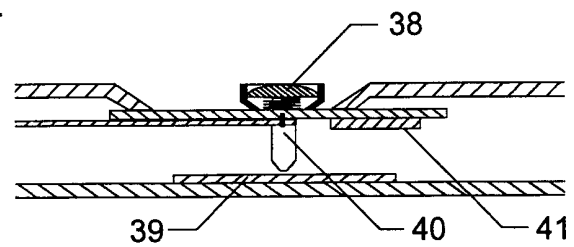


Fig. 15

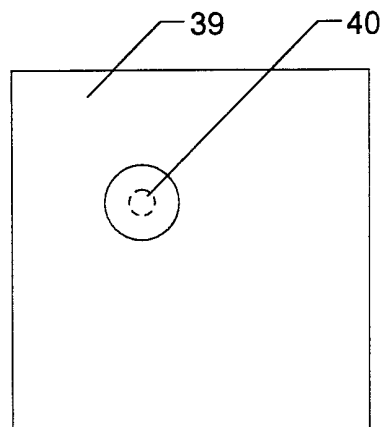


Fig. 16

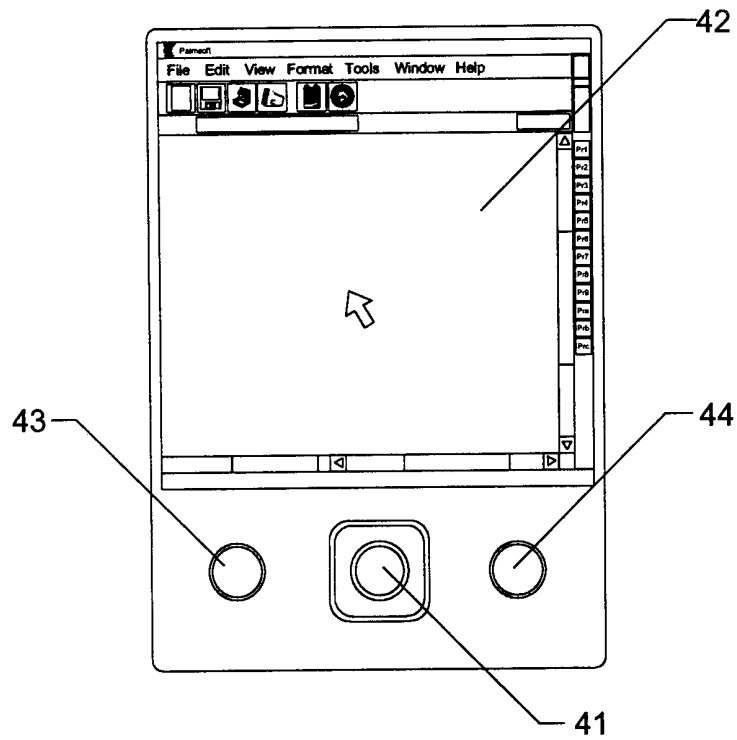


Fig. 17

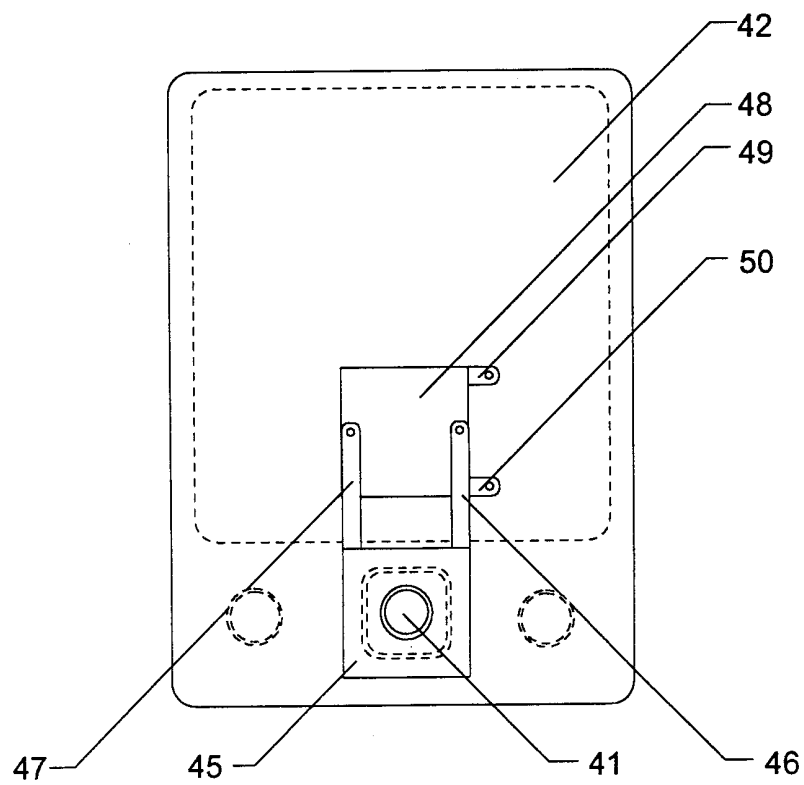


Fig. 18

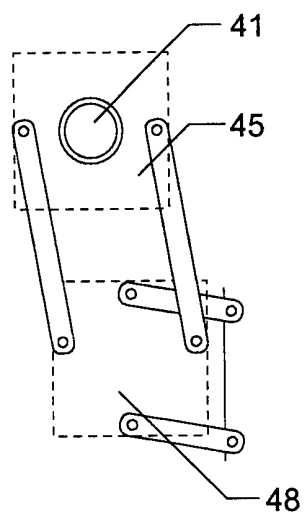


Fig. 19

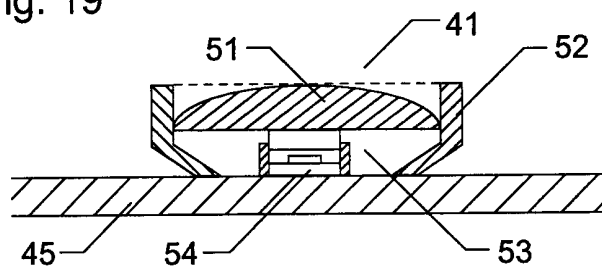


Fig. 20

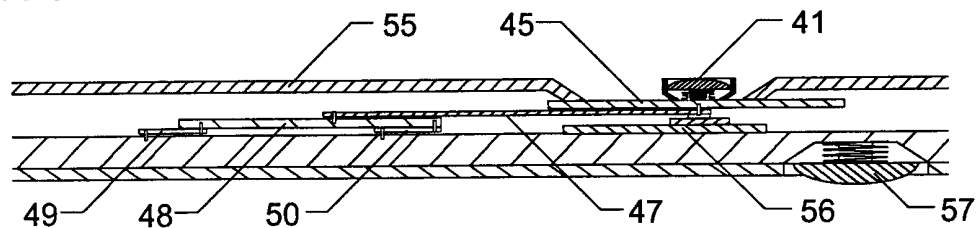


Fig. 21A

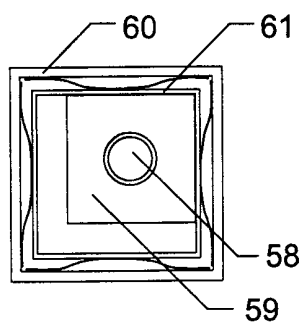


Fig. 21B

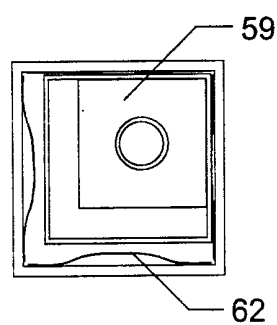
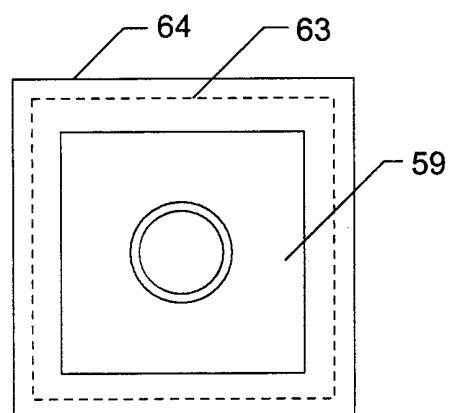


Fig. 22



INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 00/00117

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G06F 3/023

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)

IPC7: G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5543590 A (DAVID GILLESPIE ET AL), 6 August 1996 (06.08.96), column 4, line 55 - column 6, line 32; column 7, line 45 - column 8, line 62; column 13, line 46 - line 61, column 25, line 14 - column 29, line 23; column 31, line 7 - column 32, line 7; figures 1,4; claims 1-3, 5,7,11-13; abstract	1
Y	--	2-8
Y	EP 0379336 A2 (HITACHI, LTD.), 25 July 1990 (25.07.90), column 2, line 24 - line 41; column 3, line 26 - line 40; column 9, line 49 - column 11, line 1, column 19, line 31 - line 49; figures 1-2b, 8-10,46; abstract	2-8
	--	

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* 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 document 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

"I" 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

2 August 2000

Date of mailing of the international search report

15-08-2000

Name and mailing address of the ISA/

Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

JESPER BERGSTRAND/EE
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 00/00117

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	US 5912667 A (MING-CHIH CHANG), 15 June 1999 (15.06.99), see the whole document -- -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.

PCT/NO 00/00117

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5543590 A	06/08/96	AU 3544395 A	27/03/96
		CN 1166214 A	26/11/97
		EP 0777875 A	11/06/97
		JP 10505182 T	19/05/98
		US 5488204 A	30/01/96
		US 5889236 A	30/03/99
		WO 9607966 A	14/03/96
		AU 3544495 A	27/03/96
		EP 0777888 A	11/06/97
		JP 10505183 T	19/05/98
		US 5543591 A	06/08/96
		US 5861583 A	19/01/99
		US 5880411 A	09/03/99
		US 5914465 A	22/06/99
		US 5942733 A	24/08/99
		WO 9607981 A	14/03/96
		US 5374787 A	20/12/94
		US 5495077 A	27/02/96
		US 5543588 A	06/08/96
		DE 69324067 D,T	15/07/99
		EP 0574213 A,B	15/12/93
		US 5648642 A	15/07/97
		US 5841078 A	24/11/98
<hr/>			
EP 0379336 A2	25/07/90	DE 69014916 D,T	20/04/95
		JP 2188818 A	24/07/90
		KR 9403655 B	25/04/94
		US 5917475 A	29/06/99
<hr/>			
US 5912667 A	15/06/99	NONE	
<hr/>			