

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
26 January 2006 (26.01.2006)

PCT

(10) International Publication Number
WO 2006/008465 A1

(51) International Patent Classification⁷: **A61M 5/142**,
E05D 7/10, A61M 5/14, H05K 5/02, A47B 91/04

(21) International Application Number:
PCT/GB2005/002747

(22) International Filing Date: 13 July 2005 (13.07.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0416006.5 16 July 2004 (16.07.2004) GB

(71) Applicant (for all designated States except US): **ALARIS MEDICAL U.K. LIMITED** [GB/GB]; The Crescent, Jays Close, Basingstoke, Hampshire RG22 4BS (GB).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HAYLOR, Nicholas, Bryant** [GB/GB]; 32 Nightingale Crescent,

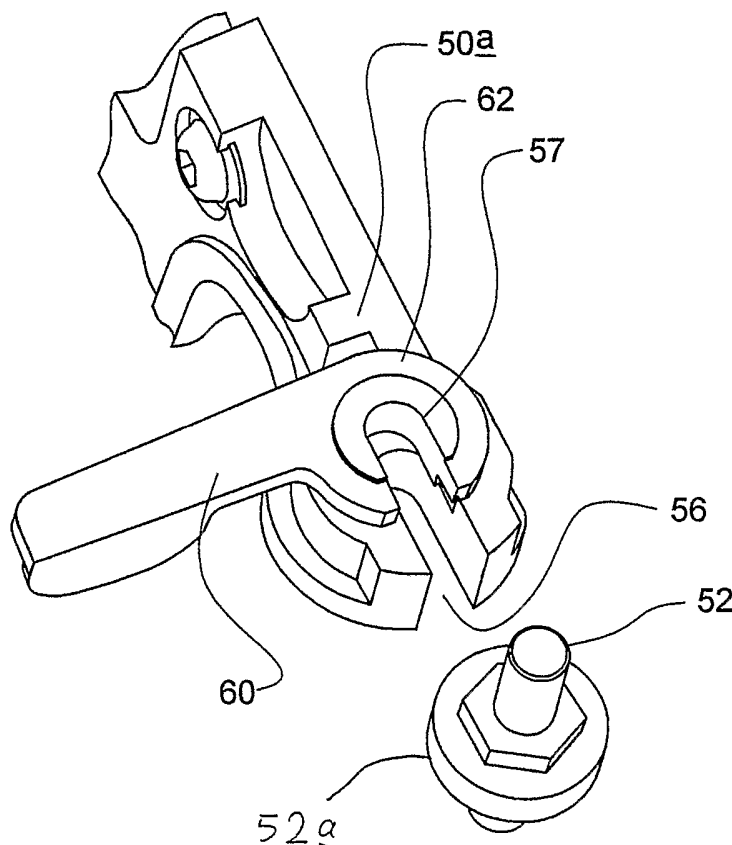
Bracknell, Berkshire RG12 9PU (GB). **EVELEIGH, Simon, Francis** [GB/GB]; Pastones Barnham Road, Eastergate, Chichester, West Sussex PO20 6RP (GB). **RUEDI, Rene, Werner** [GB/GB]; 29 Beta Road, Farnborough, Hampshire GU14 8PQ (GB). **LLOYD, Alexander** [GB/GB]; 11 Pond Close, Marchwood, Southampton SO40 4YU (GB). **SHEARN, James, Gower, Johnson** [GB/GB]; 28 Cowdery Heights, Old Basing, Basingstoke, Hampshire RG24 7AN (GB).

(74) Agent: **CARSTAIRS, J., C.**; Forrester Ketley & Co, Forrester House, 52 Bounds Green Road, London N11 2EY (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL,

[Continued on next page]

(54) Title: INFUSION APPARATUS



(57) Abstract: In a peristaltic medical infusion pump unit, comprising a peristaltic assembly and a counter surface or anvil facing said peristaltic assembly and provided by the inner surface of a door (30) pivotally mounted on a housing (12) of the unit, the door (30) is readily non-destructively removable and replaceable. In use of the peristaltic pump unit, a flexible resilient tube (36) forming part of a medical fluid delivery line is extended between the peristaltic assembly and the counter surface or anvil provided by the door. The medical fluid delivery line has first and second colour coded fittings (38, 40) spaced therealong upstream and downstream of the peristaltic assembly (26) and the region of the housing of the pump unit across which the infusion line is extended is provided, correspondingly spaced above and below the peristaltic assembly (26) with correspondingly colour coded support means (22, 24) for these fittings.

WO 2006/008465 A1



SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

- (84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

“Infusion Apparatus”

5

THIS INVENTION relates to infusion apparatus for parenteral infusion of medical fluids to patients.

More particularly, the invention relates to infusion pump units for such
10 infusion apparatus which units comprise a peristaltic pumping mechanism comprising a peristaltic pump in which a flexible resilient tube, forming part of a fluid delivery line for delivering a medical fluid to a patient is located between, on the one hand, a peristaltic assembly, for example, an array of displaceable fingers, and, on the other hand, a counter surface or anvil, said
15 tube, in use of the apparatus, being repeatedly pressed against the anvil or counter surface, by said peristaltic assembly, at different positions along the flexible resilient tube in a predetermined sequence, to provide a peristaltic pumping action in a manner well known per se. In one known type of such apparatus, for practical reasons, a mechanism for driving a plurality of
20 displaceable fingers to achieve the desired pumping action, and, typically, monitoring or sensing devices of one kind or another, are incorporated in a housing of the pump unit and said anvil or counter surface is provided by a door or cover hingedly connected with said housing, the arrangement being such that in an open position of the door, said anvil or counter surface is spaced
25 from the pressure elements so that the way is clear for the introduction of a medical fluid line, incorporating such a flexible resilient tube, across said housing so that said flexible resilient tube forming part of said line is extended across the peristaltic assembly and so that the door can thereafter be swung into a closed position in which said flexible resilient tube is located between the

peristaltic assembly and the anvil or counter surface, with the parts of the medical infusion line above and below said flexible resilient tubing extending freely from the pump unit, from between said housing and said door, at opposite ends of said door, the door being releasably securable in said closed position to retain said flexible resilient tube in place.

An infusion apparatus of the above kind and a pump unit of the above kind are herein referred to as being "of the kind specified".

10 In an infusion apparatus of the kind specified, it is generally desirable that the door should be capable of being occasionally non-destructively detached from and re-fitted to the housing, for example to allow thorough cleaning of the housing and/or the door. It is one object of the present invention to provide an arrangement allowing for the detachment and replacement of such a door from and to such a housing in a straightforward manner.

According to one aspect of the invention there is provided an infusion apparatus of the kind specified wherein said door is readily non-destructively removable, e.g. for cleaning purposes, and replaceable and wherein the housing carries at least one journal and the door carries a complementary bearing arrangement, said bearing arrangement including a first part having an open-ended transverse slot terminating in a bearing surface for said journal and a second part moveable with respect to said first part and which in a first position discloses said transverse slot to allow said journal to pass transversely through said slot into co-operation with said bearing surface, said second part being moveable into a second position in which it obstructs such transverse slot and provides a further bearing surface co-operating with said journal. Preferably said first part and said second part each have an open-ended transverse slot

terminating in the respective bearing surface the second part being rotatable between a position in which the transverse slots are in alignment to allow transverse passage of said journal into co-operation with said bearing surfaces and a second position in which said second part obstructs movement of the
5 journal out of said first part.

In infusion apparatus of the kind specified, a further problem encountered is that hard-pressed nursing staff sometime attempt to arrange the infusion line in the pumping unit in the opposite direction from that intended,
10 i.e. in such a way that operation of the peristaltic pump would tend to pump fluid from the patient towards the medical fluid source rather than in the intended direction. Various measures have been proposed in the past to minimise the likelihood of nursing staff making this mistake but these measures have not been entirely successful. It is an object of another aspect of the
15 invention to provide improved means of safeguarding against such a mistake.

According to this aspect of the invention, there is provided infusion apparatus of the kind specified in which the infusion line has first and second colour coded fittings spaced therealong upstream and downstream of said
20 flexible resilient flexible tube and wherein the region of said housing of the pumping unit across which the infusion line is to be extended is provided, correspondingly spaced above and below the peristaltic assembly, with correspondingly colour coded support means for said fittings.

25 A further problem may be encountered in relation to the operation of infusion apparatus of the kind specified, as follows. There are occasions, in medical treatment, for example in intensive care facilities, where it may be necessary to infuse a patient simultaneously with several different medical fluids, at respective different rates and so on. Furthermore, in, for example,

intensive care facilities, there may be several patients in one room or ward in a similar condition. Typically, each such patient may have a respective infusion apparatus of the kind specified for each medical fluid being administered. State-of-the-art infusion apparatus of the kind specified generally incorporates
5 sensors for sensing when something goes wrong with the infusion process and for activating an alarm when this occurs. Typically, the alarm will include an audible alarm and, for example, an alarm light on the housing of the pump unit concerned, which will flash to identify the pump unit associated with the alarm condition. Usually the pump unit will also trigger a nurse call, (i.e. send a
10 signal along an appropriate communication channel to alert a nurse) when such an alarm conditions occurs.

According to another aspect of the invention there is provided a docking station for supporting a plurality of infusion pumps of infusion apparatus of the
15 kind specified, said infusion pumps having respective output signal connectors, and wherein said docking station includes electronic processing means for receiving signals from said output signal connectors and further includes visual alarm signal means and information display means such that where a plurality of such infusion pumps are mounted on such docking station and connected
20 with said processing means, and one of said infusion pumps produces an alarm signal, a corresponding output signal is provided to said processing means, causing the latter to activate said alarm means and to present, on said display means, an indication as to which of the pump units mounted on the docking station is generating the alarm.

25

According to a yet further aspect of the invention there is provided a pump unit of the kind specified in which at least one sensor, and a bracket arrangement for supporting a respective part of an infusion line, are incorporated in a module designed for ready fitting to the remainder of the

apparatus. With this arrangement, it is possible for a manufacturer of infusion apparatus of various sizes and types, for example, to design these various apparatus in such a way as to receive the standard module, thereby facilitating manufacture and repair of the apparatus.

5

An embodiment of the invention is described below by way of example and with reference to the accompanying drawings in which:-

Figure 1 is a perspective view showing an infusion pump unit
10 embodying the invention, with a removable door removed;

Figure 2 is a corresponding perspective view showing the unit of Figure 1 with the removable door in place and in an open position and further showing part of an infusion line in place;

15

Figure 3 is a perspective view of a pump unit of Figure 2, complete with door, but with the door in a closed position in which the infusion line is held in the unit;

20

Figure 4 is a fragmentary perspective view to an enlarged scale as compared with Figures 1 to 3 showing part of a hinge arrangement which allows ready removal of the door of the pump unit of Figures 1 to 3 when required;

25

Figure 4a is a view in section of a detail of the hinge arrangement;

Figures 5, 6 and 7 are respective fragmentary perspective views of part of the door, illustrating the hinge arrangement;

Figures 8 and 9 are perspective views of feet of the pump unit;

Figure 10 is a fragmentary perspective view of part of the interior of the
5 pump unit showing a Smart Media card mounted on a circuit board of the pump
unit;

Figure 11 is a perspective view of a docking station supporting several
10 pump units;

Figure 11a is a schematic diagram of circuitry of a processing unit of the
docking station;

Figure 12 is an elevation view of the rear of the pump unit showing an
15 RS232 connector provided thereon;

Figure 13 is an underneath plan view of the pump unit; and

Figure 14 is a fragmentary view in vertical section along the line
20 XIV -XIV of Figure 13.

Referring to the drawings, and firstly to Figures 1 to 3, an infusion
system for parenteral infusion of a medical fluid to a patient comprises a pump
unit 10, a major part of which comprises a housing 12 which accommodates, in
25 manner known per se, a cam mechanism controlling a plurality of fingers of a
peristaltic pumping mechanism, an electric motor and associated gearing,
driving said cam mechanism, and further accommodates electronic control and
processing circuitry for controlling such motor and processing signals from
pressure sensors etc. provided on the unit. The pump unit, as shown, may also

comprise an electronically operated display 14, an alarm light 16, an input keyboard 18 or other manually operated controls, all in manner known per se. On its rear side (see Figure 12) the housing 12 is provided with a channel 17 to receive a mounting rail or column, for example a mounting rail or column 124 (Figure 11) of a docking station 126 whereby the pump unit may be readily fitted to or detached from such docking station. As illustrated in Figure 12, the pump unit is also provided at its rear with a swing-down bracket 156 having a clamping screw 158 whereby the unit may be clamped to such vertical rail or column. The unit is also provided on its rear side with a horizontal channel 150 to fit over a horizontal supporting rail (e.g. of a docking station) and has a rotatable securing member 152 to secure such a horizontal rail in the channel 150. The rear of the unit 10 may likewise be provided with various connectors including connectors for receiving complementary power supply connectors, electronic communications interfacing connectors for providing data and alarm output signals and for receiving input signals, etc.

As shown in Figures 1 and 2, on the front of the housing there is provided a face or deck 20 on which is exposed an upper mounting or bracket 22 for a complementary fitting 38 forming part of an infusion line; a lower mounting or bracket 24 for a complementary fitting 40 forming part of such infusion line and a peristaltic assembly 26 which is, effectively, the operative end of the peristaltic pumping mechanism and may, in principle, be the free ends of respective fingers moveable, by the cam mechanism referred to, inwards and outwards from the face or deck 20. In order to make it easier to maintain sterile conditions, these fingers may be covered by a thin flexible membrane, (not shown), sealed at its edges with respect to the deck 20. As shown in Figures 2 and 3, a door 30 is normally fitted to the housing 12 and can be swung between an open position illustrated in Figure 2 and a closed position illustrated in Figure 3, about a pivotal axis A. A medical fluid infusion line, for

use with the pump unit, comprises upper and lower sections 32 and 34 respectively of transparent plastics tubing, an intermediate section 36 of resiliently compressible tubing, for example of silicone rubber, and upper and lower fittings 38 and 40 via which the tubing section 36 is connected respectively with the upper line 32 and with the lower line 34. In use, the upper line 32 extends upwardly to a source of the medical fluid to be administered whilst the lower line 34 extends from the infusion pump to an infusion needle or the like inserted into the patient. In use, the infusion line is extended across the face or deck 20 of the pump unit so that the fittings 30 and 40 are received in the brackets 22 and 24 respectively and so that the tubing section 36 extends over the peristaltic assembly 26 as illustrated in Figure 2. The infusion line is fitted in place in this fashion whilst the door 30 is in the open position shown in Figure 2. After the infusion line has been so fitted, the door 30 is moved to the closed position shown in Figure 3 and is secured by a catch 37 which comprises a lever mounted on the outer edge of the door 30 (i.e. the edge which lies at the side of the pump unit when the door is in its closed position), for pivoting about an axis 37a generally perpendicular to that outer edge of the door and parallel with the front face of the door. The catch 37 has a handle portion 37b which extends downwardly and partly across the front of the door and has a cam portion 37c adapted to fit within a complementary recess 39 at the front of the pump housing at the adjacent side of the pump, the cam portion 37c having a cam surface 37d, (see Figure 7), configured to engage under a boss 41 (which projects laterally from the pump housing into recess 39) when, with the pump door 30 closed, the handle portion 37b is swung downwardly and rearwardly from a position in which it projects forwards and outwards from the door to a position (shown in Figure 3) in which the handle portion 37b lies against the front of the door.

The pump housing may have a carrying handle, (not shown), pivotally mounted on top.

5 The terms "upper" and "lower" are used herein for convenience and should not be understood to mean that the apparatus must be used in the orientation shown in Figures 1 to 3. The unit will, of course, pump fluid perfectly well in any orientation.

10 In operation of the pump, in known manner, the fingers of the peristaltic assembly 26 periodically press the flexible resilient tubing against a counter surface or anvil to propel fluid within the infusion line along the latter. In the pump shown, the peristaltic assembly comprises an upper finger 26a and a lower finger 26b which are of a relatively limited extent in the longitudinal direction of the infusion line, and an intermediate finger or pad 26c, between
15 the upper and lower fingers and which finger 26c is extended or elongated in the longitudinal direction of the infusion line. In operation, assuming the fluid is to be propelled downwards, as viewed in Figures 1 to 3, along the infusion line, the peristaltic assembly performs a repeating cycle in which, with the intermediate pad 26c spaced from the counter surface, the upper finger presses
20 the flexible tube against the counter surface or anvil to close the tube at the location of the upper finger 26a, the lower finger is then withdrawn from the counter surface to open the tube at the location of the lower finger 26b, then the intermediate pad or finger 26c is moved towards the counter surface to drive the fluid in the tube adjacent the intermediate pad 26c downward along the
25 tube, then the tube is pinched closed again between the lower finger 26b and the counter surface, then the upper finger 26a is withdrawn from the counter surface and the intermediate finger 26c withdrawn from the counter surface to draw fresh fluid into the part of the tube adjacent the intermediate finger 26c.

In order for example, to allow for ready cleaning of the housing 12 or the door 30, or to allow ready replacement of the door 30 should the latter become damaged, means is provided in accordance with the present invention whereby the door 30 can be readily removed when required. As illustrated in Figures 4 to 7, the door has at its upper and lower ends laterally extending arms 50 which carry at their ends respective bearing arrangements for hinge pins or journals 52, fixed in the casing adjacent the upper and lower ends of the housing. The door comprises an inner part (shown partially in Figures 5 to 7), which provides the counter surface or anvil referred to, and an outer shell, (omitted in Figures 5 to 7 for clarity but visible in Figures 2, 3, 4 and 4a), secured to the outer side of the inner part. The portions of the inner part of the door which are incorporated in the arms 50 are referenced 50a in Figures 5, 6 and 7, and are referred to below as arms 50a. Figure 4 is a fragmentary perspective view showing the upper part of the door 30, from the inside of the door, without the housing 12 but showing, in position in relation to the door, a unit 52a which is in practice fixed in the housing 12 and which provides the upper hinge pin or journal 52. (A corresponding unit fixed in the housing 12 likewise provides the lower hinge pin or journal 52).

20

As best shown in Figure 5, each said arm 50a (only one is shown, the other being a mirror image) has at one end a slot 56 extending to the end of the respective arm, the inner end of the slot being of semi-cylindrical form of a curvature corresponding to that of the bearing surface of hinge pin or journal 52. Rotatably mounted on the end portion of the arm 50a, for rotation about the axis of the semi-cylindrical end surface of the slot 56 is a respective retaining lever 60, a hub portion 62 of which is likewise provided with a slot 57 opening onto the periphery of the hub portion, the inner end of this slot likewise being a

25

semi-cylindrical surface coaxial with that of the semi-cylindrical surface of the slot 56 and of the same curvature. In the arrangement shown, the lever 60 on the upper arm 50a lies on top of the latter as viewed in Figures 1 to 3 (and conversely the corresponding lever 60 for the lower arm 50a (not shown) lies below the lower arm 50a). Each lever 60 is retained between the respective arm 50a and the opposing side wall 51 of part of the outer shell which lies in the respective arm 50 of the door, the hub 62 of the lever 60 having, on its side facing the arm 50a, a part-cylindrical boss which is received in a corresponding part-cylindrical recess on the adjoining side of the arm 50a, such boss and recess being again coaxial with the half-cylindrical surfaces at the inner end of the slot 56 and of the slot 57 in the lever 60, whereby the lever 60 is rotatably mounted on the arm 50a. The lever 60 is kept in place, when the door is removed, as described below, between the arm 50a and said side wall 51. In the position of the lever 60, (relative to the door and arm 50a) shown in Figure 5, the transverse slots 56, 57 in the arm 50a and the lever hub 62 are aligned, defining a single open slot which, when the door is applied to the casing, can receive the respective hinge pin or journal 52. The lever 60 may then be swung through 90° to the position shown in Figure 6 in which the slot 57 in the hub 62 is displaced through approximately 90° with respect to the slot 56 so that whilst the respective half-cylindrical ends of these slots co-operate with respective portions of the cylindrical part of the hinge pin 52, one side wall of the slot in the hub 62 obstructs the slot 56 and provides a bearing surface for engagement with the hinge pin 52 and likewise one side wall 56 of the slot 56 obstructs the slot 57 in the hub 62 so that the combination of the arm 50a and lever 60 retains the hinge pin 52 securely but is nonetheless rotatable around the hinge pin 52. In this, the closed position of the lever 60, the latter lies snugly against the arm 50a as shown in Figure 6. More particularly, the lever arm of lever 60 may, as shown, comprise a major part 63 in the form of a wall or strip lying in the plane of movement of the lever arm and may further comprise a tab portion 65

extending at right angles to said part 63 and which, in said closed position of the lever, lies within a corresponding recess in the respective arm 50a of the inner part of the door. In this closed position of the lever, the part 63 lies snugly against the arm 50a between the arm 50a and the wall 51 of the outer shell. When the door is to be removed, both levers 60 are pivoted in the door to the position shown in Figure 5 and the door is then pulled away from the pump housing and hinge pins. Door replacement is by the reverse of this procedure, the levers 60 finally being pivoted to the position shown in Figure 6 to retain the door on the hinge pins 52.

Figure 4a is a fragmentary sectional view showing the part of the door with the upper arm 50a, and also showing the unit 52a providing hinge pin 52 and indicating the part of housing 12 in which it is fixed. The section in Figure 4a is taken in a plane through the axis A of the hinge pins 52 and which is generally parallel with the major surfaces of the door, and is taken with the lever 60 in the position shown in Figures 4 and 6 in which the respective hinge pin 52 is held captive in the arm 50a. Thus, the plane of section in Figure 4a runs along the slot 56 in the arm 50a and through the open end of slot 56 and runs across the slot 57 in the lever 60.

In order to prevent inadvertent or unnecessary removal of the door by nursing staff or others, whilst still allowing ready removal and replacement of the door by servicing personnel, the levers 60 may be held in their closed positions by screws 70 screwed into the door inner part and the heads of which screws 70 overlies the tab portions 65 in their recesses and which screws must be undone to allow the levers 60 to be swung into their open positions. To facilitate mounting of the door and as a "backup" should a screw 70 become lost, the levers 60 and arms 50a may be provided with integral complementary retaining means, e.g. in the form of detents and co-operating recesses, or (less

preferably) the levers 60 may have detents or recesses on the sides of parts 63 facing the respective walls 51 and co-operating with complementary recesses or detents on the walls 51 facing the parts 63.

5 Referring to Figure 1 and 2, the brackets 22 and 24 project forward somewhat from the face 20 and provide, or incorporate, respective resilient clips which define respective recesses to receive the respective fittings 38 and 40 of the infusion line, and these recesses are so shaped as to ensure, as far as possible, that the fitting 40 will not fit in the recess in bracket 22, nor will the
10 fitting 38 fit in the recess in bracket 24. Likewise, the fittings 38, 40 and the brackets 22, 24 are so shaped as to ensure that neither fits in its respective bracket in an inverted position. Nevertheless, it has been found that, despite such measures, nursing personnel often take a significant time, if unfamiliar with a particular pump unit, to determine on a trial and error basis, the correct
15 orientation and position of the infusion line in a peristaltic pump unit. Time may, of course, be very precious in a medical emergency situation. In accordance with the present invention therefore, to assist nursing personnel in quickly determining the correct orientation and position of the infusion line in the pump unit, colour coding is used. Thus the bracket 22 and fitting 38 are
20 made of the same, visually striking, colour, distinct from the remainder of the pump unit and infusion line, and the bracket 24 and fitting 40 are made of the same visually striking colour as each other, but contrasting with that of the bracket 22 and fitting 38 and again distinct from the remainder of the pump unit or infusion line. For example, bracket 22 and fitting 38 might be blue and the
25 bracket 24 and fitting 40 might be orange.

Referring to Figures 1 and 2 once more, the bracket 24, besides serving to co-operate with and hold the fitting 40 of the infusion line, also incorporates various sensors, such as a pressure sensor (not shown) of a type known per se,

for measuring the pressure at which the medical fluid is supplied to the patient and a bubble detector, also known per se. A bracket performing the above-noted function and incorporating such sensors is likely to be required in any of a range of different infusion pumps of the character concerned. In the preferred embodiment of the invention, the bracket 24, the sensors referred to and possibly other facilities such as a mechanism for pinching off the infusion line when the door 30 is opened, are all incorporated in a module which can be easily fitted to the pump during manufacture, e.g. which can be simply "plugged in". Where the manufacturer produces a range of different models of pump unit, the different models are preferably designed to receive the same design of module, thereby rationalising manufacture to some extent, minimising manufacturing costs and stock-holding requirements for spares.

The pump unit housing is provided with feet 100, 102, for example of elastomeric material, for use when the unit is to be supported on a flat surface rather than, for example, clamped to a rail. In prior infusion pump units, where the feet have simply been attached by adhesive to the bottom of the pump housing, these feet have had a tendency to become dislodged. Attachment of such feet to the bottom of the housing by screws has also proved unsatisfactory in that such screws are sometimes over-tightened during assembly causing the housing to crack. In the preferred embodiment of the invention, the feet used are unitary elastomeric items such as illustrated in Figure 8 or Figure 9 and which are inserted through holes in the bottom of the housing. Thus, each foot shown has a lower part 104, intended to be extended from the pump casing, a circumferential groove or rebate 106, intended to receive the edge of the hole in wall of the pump casing through which the foot is extended, and an enlarged retaining portion 108 (for foot 100) or 110 (for foot 102) above the groove 106 which engages the inside of the pump housing, to retain the foot against displacement from the hole. In the preferred embodiment of the invention, the

pump unit has two rear feet 100 fitted in holes in downwardly projecting parts 113 of the pump housing, (see Figures 13 and 14) these feet each having an upper inner part 108 with a tapering wall to assist in pushing through the respective hole in the bottom of the pump housing. The pump housing, in the preferred embodiment, is formed in two parts, one providing a front panel of the housing and forward parts of the top, bottom and side walls, and the other part providing a back, and rearward parts of the side walls, top wall and bottom wall. The holes in which the front feet 102 are fitted are intersected by the junction between the front and rear housing parts so that the rear part of the housing has, in the forward edge thereof, at the bottom, two notches, corresponding to the rear parts of the respective holes for feet 102, into which the narrower parts, (defined by grooves 106), of feet 102 can be fitted before the front housing part having corresponding notches in its rear edge, at the bottom, is applied to the rear housing part, whereby the edge portions of the last-mentioned notches engage in the grooves 106 and holes encompassing the feet 102 are thus completed. In this way, the front feet 102, like the rear feet 100, are firmly and reliably held in place.

As noted above, the pump unit includes electronic processing means controlling operation of the motor driving the peristaltic assembly 26; receiving signals from the pressure and other sensors; receiving input from the keypad on the front of the pump unit; controlling the alarm means and the display; and so on. The electronic processing means comprises, in manner known per se, a CPU (central processing unit), running a program stored in electric memory within the pump unit. In preferred embodiments of the invention, this memory, or a part thereof, is carried in a commercially available, readily replaceable, non-volatile memory card, such as a "Smart Media" card, a "Compact Flash" card, an "SDM" card or the like, received in a complementary socket within the pump unit, whereby the operating program of the CPU, or some aspect thereof,

or pre-set data utilised by such program, may readily be changed, for example to provide for different medication administration regimes or improved control algorithms, simply by opening the pump unit housing, and exchanging cards. Figure 10 illustrates such a "Smart Media" card 112 in a socket 114 mounted on a circuit board 116 within the pump unit 10.

At the rear of the casing, as shown in Figure 12, are provided various electrical connectors, including a power supply connector 118 and data connectors. In the preferred embodiment, one of these data connectors may be a multi-pin connector, such as an RS232 connector 120 in which pins unused for data communication have been set aside for a nurse call function. As usual, a pump alarm will trigger the nurse call.

Referring to Figure 11 a plurality of pump units 10 may be mounted on a docking station 126 which may be located at the bed side of a patient being infused with respective medical fluids via the respective pumps 10 mounted on the docking station. The docking station includes electronic processing means 127 (Figure 11a) housed in a unit 128 of the docking station which carries visual alarm signal means such as a lamp or beacon 130 and information display means 132 controlled by the electronic processing means in the unit 128. Respective output signal connectors of the pump units are connected with respective inputs 134a, 134b, 134c of unit 128. In operation, if one of the infusion pumps on the docking station produces an alarm signal, a corresponding output signal is provided via the respective input 134 to the processing means 127, causing the latter to activate the alarm means 130 and to present, on display means 132, an indication as to which of the pump units mounted on the docking station is generating the alarm. A nurse alerted by the alarm can thus readily and quickly determine which docking station 126 has the pump unit 10 associated with the alarm condition.

When used in this specification and claims, the terms "comprises" and "comprising" and variations thereof mean that the specified features, steps or integers are included. The terms are not to be interpreted to exclude the
5 presence of other features, steps or components.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process
10 for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms
thereof.

Claims

1. A peristaltic pump unit for medical infusion, comprising a peristaltic assembly, a counter surface or anvil facing said peristaltic assembly, a support for supporting, between said peristaltic assembly and said counter surface or anvil, a flexible resilient tube forming part of a medical fluid delivery line and a driving mechanism operable to drive said peristaltic assembly to pinch such flexible tube against said anvil or counter surface at different positions along the flexible resilient tube, and wherein said peristaltic assembly and said mechanism are incorporated in a housing and wherein said anvil or counter surface is provided by a door or cover hingedly connected with said housing so that in an open position of said door or cover, said anvil or counter surface is spaced from the peristaltic assembly to allow the introduction of such flexible resilient tube across the peristaltic assembly, or to allow the removal of such flexible resilient tube from the unit, and so that in a closed position of said door or cover, such flexible resilient tube extended across the peristaltic assembly will be positioned between the peristaltic assembly and said anvil or counter surface, characterised in that said door is readily non-destructively removable, e.g. for cleaning purposes, and replaceable and wherein the housing carries at least one journal or hinge pin and the door carries a complementary bearing arrangement, (or the door carries at least one journal or hinge pin and the housing carries a complementary bearing arrangement), said bearing arrangement including a first part having an open-ended transverse slot terminating in a bearing surface for said journal and a second part moveable with respect to said first part and which in a first position discloses said transverse slot to allow said journal to pass transversely through said slot into co-operation with said bearing surface, said second part being moveable into a second position in which it obstructs such transverse slot and provides a further bearing surface co-operating with said journal.

2. A pump unit according to Claim 1 wherein said first part and said second part each have an open-ended transverse slot terminating in the respective bearing surface the second part being rotatable between a position in which the transverse slots are in alignment to allow transverse passage of said journal into co-operation with said bearing surfaces and a second position in which said second part obstructs movement of the journal out of said first part.

3. A pump unit according to Claim 2 wherein said first part is fixed with respect to the door and said bearing surface of said first part is arcuate about an axis fixed with respect to the door, and wherein said second part is rotatable with respect to the door about said axis and wherein said journal or hinge pin is carried by said housing and is coaxial with said bearing surfaces when the door is in position on the housing.

4. A pump unit according to Claim 2 wherein said first part is fixed with respect to the housing and said bearing surface of said first part is arcuate about an axis fixed with respect to the housing, and wherein said second part is rotatable with respect to the housing about said axis and wherein said journal or hinge pin is carried by said door and is coaxial with said bearing surfaces when the door is in position on the housing.

5. A pump unit according to Claim 3 or Claim 4 wherein said second part has a boss which is cylindrical about said axis, apart from the interruption due to said slot in the second part, said boss being journaled in a recess provided in a face of said first part, which recess, apart from the interruption due to said slot in the first part, is also cylindrical about said axis.

6. A pump unit according to Claim 5 wherein said first part comprises a base structure of said door and said face providing said cylindrical recess is at an edge of said base structure and wherein a cover plate or trim secured to said base structure has a wall or flange which extends at least partly over said second part, on the side of the second part remote from said cylindrical recess, whereby said second part is held captive between said base structure and said wall or flange.

7. A pump unit according to any of Claims 1 to 6 wherein said second part has an operating lever for moving the second part between said first and said second positions and wherein a fastener releasably secured to said first part normally acts on said lever to maintain said lever in the position in which said second part is in said second position with respect to said first part.

8. A peristaltic pump unit for medical infusion, comprising a peristaltic assembly, a counter surface or anvil facing said peristaltic assembly, a support for supporting, between said peristaltic assembly and said counter surface or anvil, a flexible resilient tube forming part of a medical fluid delivery line and a driving mechanism operable to drive said peristaltic assembly to pinch such flexible tube against said anvil or counter surface at different positions along the flexible resilient tube, and wherein said peristaltic assembly and said mechanism are incorporated in a housing of said unit and in which the medical fluid delivery line has first and second colour coded fittings spaced therealong upstream and downstream of said flexible resilient flexible tube and wherein the region of said housing of the pump unit across which the infusion line is to be extended is provided, correspondingly spaced above and below the peristaltic assembly, with correspondingly colour coded support means for said fittings.

9. A pump unit according to Claim 8 wherein said first colour-coded fitting has a first approximately cylindrical form configured for engagement in a groove or recess of complementary form in the correspondingly colour-coded support means provided on said housing, and wherein said second colour-coded fitting has a second approximately cylindrical form configured for engagement in a groove or recess of complementary form in the correspondingly colour-coded support means provided on said housing, said colour-coded support means being in the form of resilient clips configured to embrace their respective colour-coded fittings and wherein the forms of said colour-coded fittings and said grooves in the support means are selected to resist the first colour-coded fitting being fitted in the groove in the second support means and to resist the second colour-coded fitting being fitted in the groove in the first support means.

10. A pump unit according to any of claims 1 to 9 in which at least one sensor, and a bracket arrangement for supporting a respective part of an infusion line, are incorporated in a module designed for ready fitting to the remainder of the apparatus.

11. A peristaltic pump unit for medical infusion, comprising a peristaltic assembly, a counter surface or anvil facing said peristaltic assembly, a support for supporting, between said peristaltic assembly and said counter surface or anvil, a flexible resilient tube forming part of a medical fluid delivery line, a driving mechanism operable to drive said peristaltic assembly to pinch such flexible tube against said anvil or counter surface at different positions along the flexible resilient tube, and wherein said peristaltic assembly and said mechanism are incorporated in a housing of said unit and wherein said housing carries, spaced from said peristaltic assembly, but in line therewith, a support bracket for supporting a complementary part of a said flexible tube extended

across the peristaltic assembly, and wherein said bracket is in the form of a replaceable module which incorporates one or more of a pressure sensor for sensing the pressure of fluid in such flexible tube and a bubble detector, for detecting bubbles in such flexible tube.

5

12. An infusion pump for infusion of a medical fluid to a patient, the pump including an external casing in the form of a shell of predetermined thickness provided, in a base portion thereof, with a plurality of apertures receiving respective feet, each said foot comprising a body having a circumferential groove or a rebate receiving an edge portion of the respective
10 said aperture, a lower part below said circumferential groove or rebate, extending from said casing and an upper part, above said circumferential groove or rebate, within said casing, said upper and lower parts being larger than the respective said aperture, whereby the foot is retained against
15 displacement from the casing.

13. An infusion pump according to Claim 12 wherein said casing includes a first part and a second part having respective edges which meet in the assembled condition of the pump and wherein at least one of said apertures
20 receiving a said foot is defined jointly by co-operating notches in respective said edges of said first and second parts of said casing.

14. An infusion pump according to Claim 12 or Claim 13 wherein said feet are of elastomeric material.

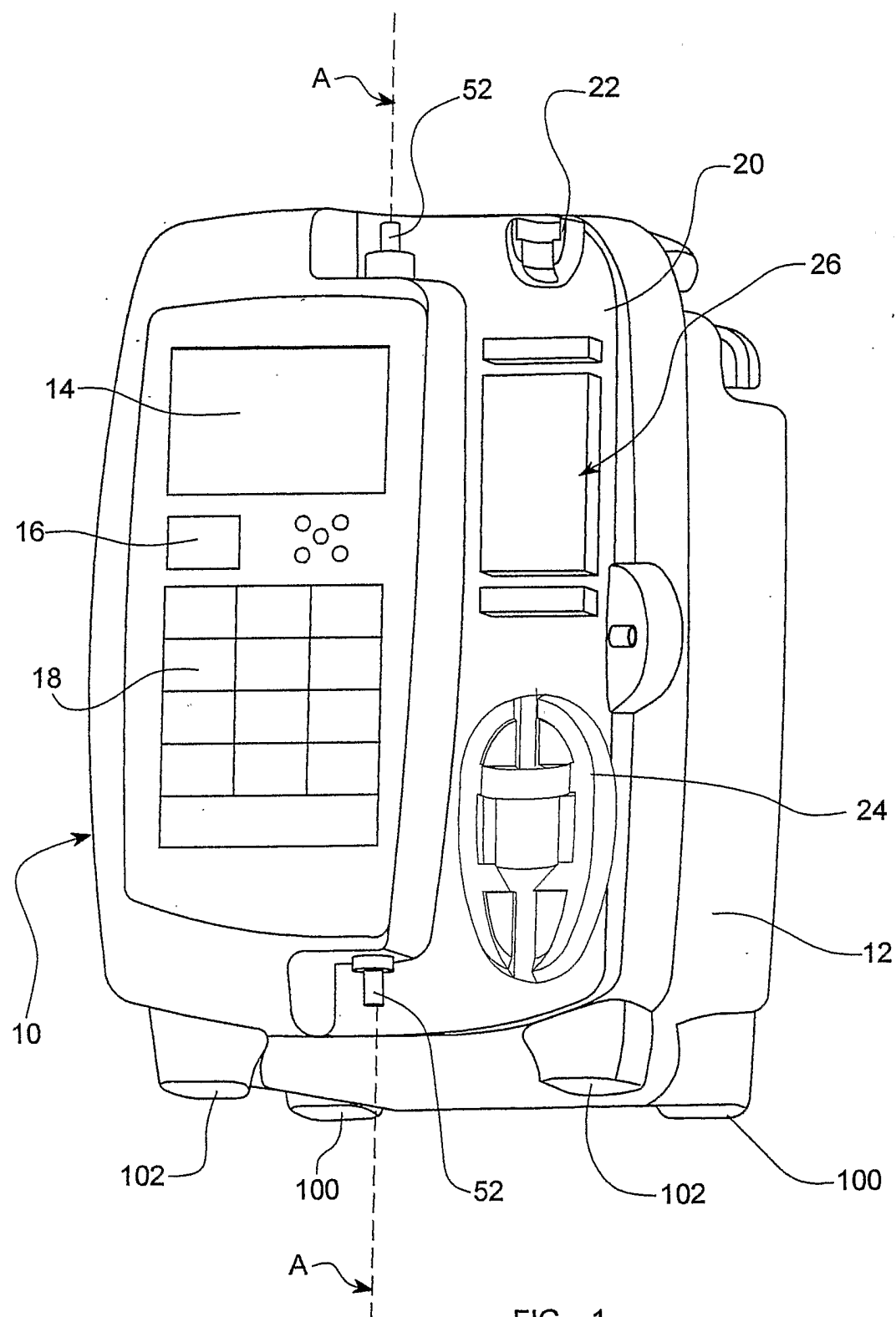
25

15. A docking station for supporting a plurality of medical infusion having respective output signal connectors, and wherein said docking station includes electronic processing means for receiving signals from said output signal connectors and further includes visual alarm signal means and

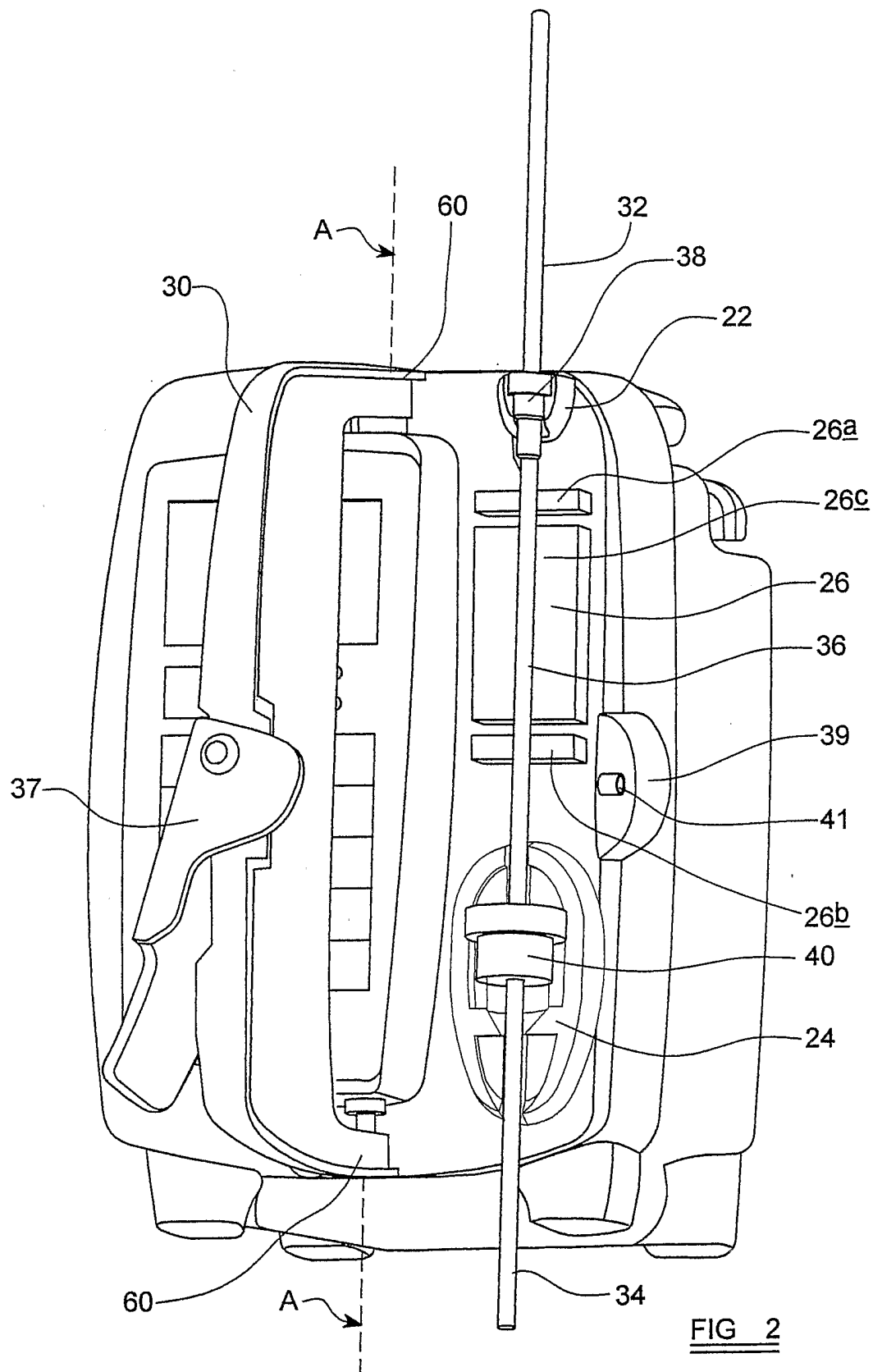
information display means such that where a plurality of such infusion pump units are mounted on such docking station and connected with said processing means, and one of said infusion pump units produces an alarm signal, a corresponding output signal is provided to said processing means, causing the latter to activate said alarm means and to present, on said display means, an indication as to which of the pump units mounted on the docking station is generating the alarm.

16. A peristaltic pump unit for medical infusion, comprising a peristaltic assembly, a counter surface or anvil facing said peristaltic assembly, a support for supporting, between said peristaltic assembly and said counter surface or anvil, a flexible resilient tube forming part of a medical fluid delivery line, a driving mechanism operable to drive said peristaltic assembly to pinch such flexible tube against said anvil or counter surface at different positions along the flexible resilient tube, and wherein said peristaltic assembly and said mechanism are incorporated in a housing of said unit and wherein said housing houses an electric motor driving the peristaltic assembly and carries at least a pressure sensor for sensing the pressure in the fluid being delivered along said fluid delivery line, and an input device for setting the pump unit. the pump unit including electronic processing means controlling operation of the motor driving the peristaltic assembly, and receiving signals from said pressure sensor, the electronic processing means comprising a central processing unit running a program stored in electric memory within the pump unit, and wherein at least part of said memory is carried in a readily replaceable, non-volatile memory card, received in a complementary socket within the pump unit, whereby the operating program of the central processing unit may readily be changed, for example to provide for different medication administration regimes or improved control algorithms, by exchanging said memory card for another.

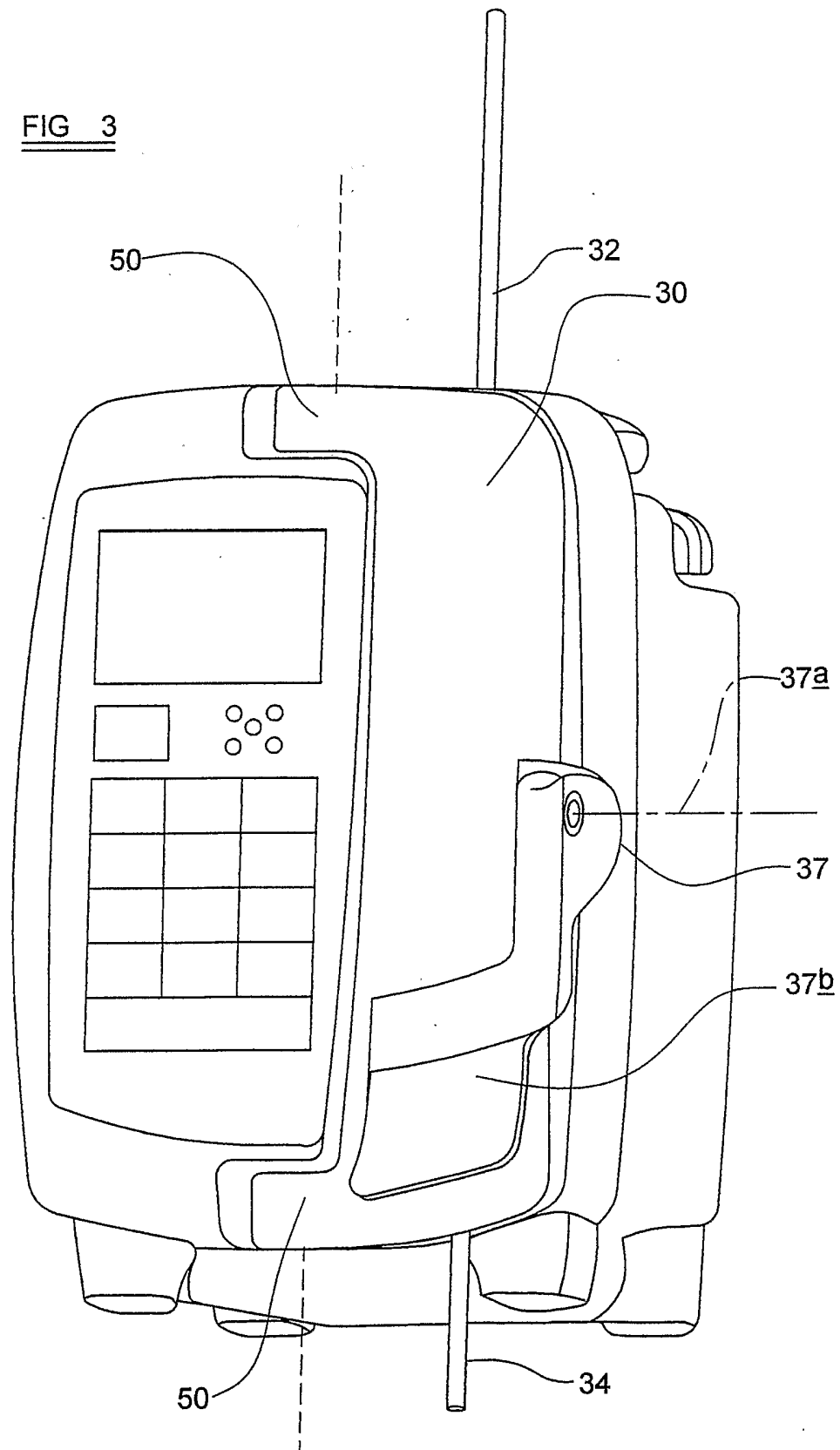
1 / 11



2 / 11

FIG 2

3 / 11

FIG 3

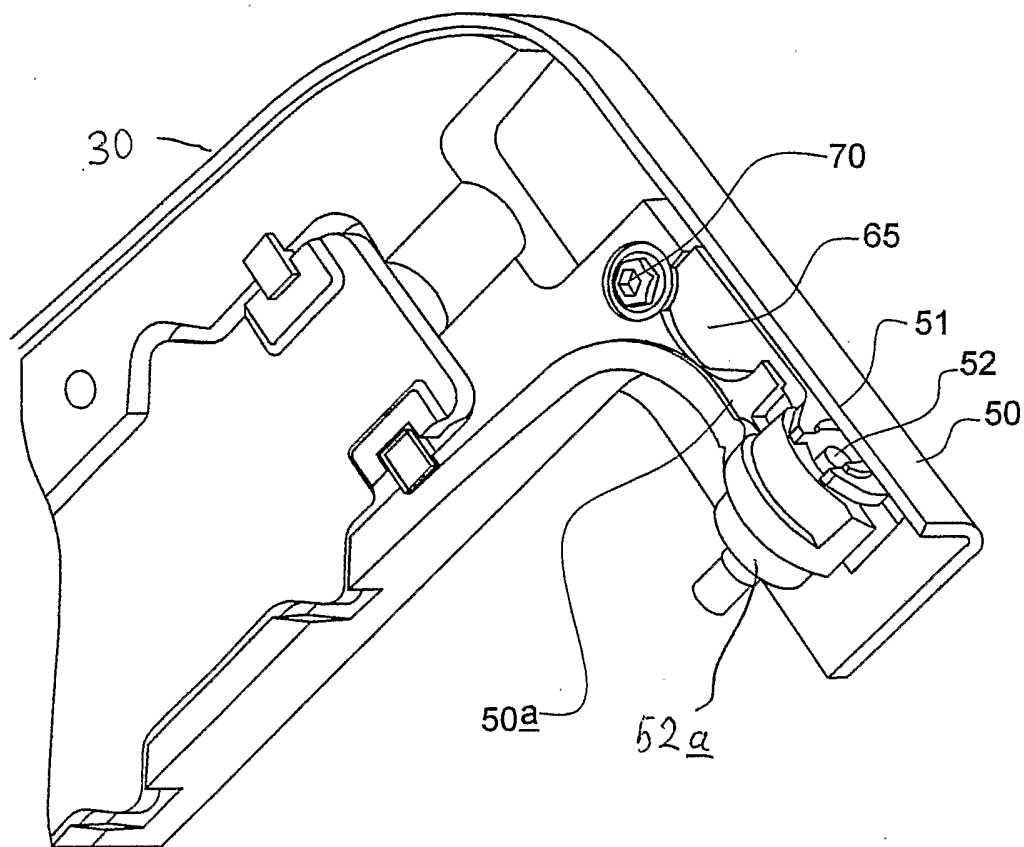
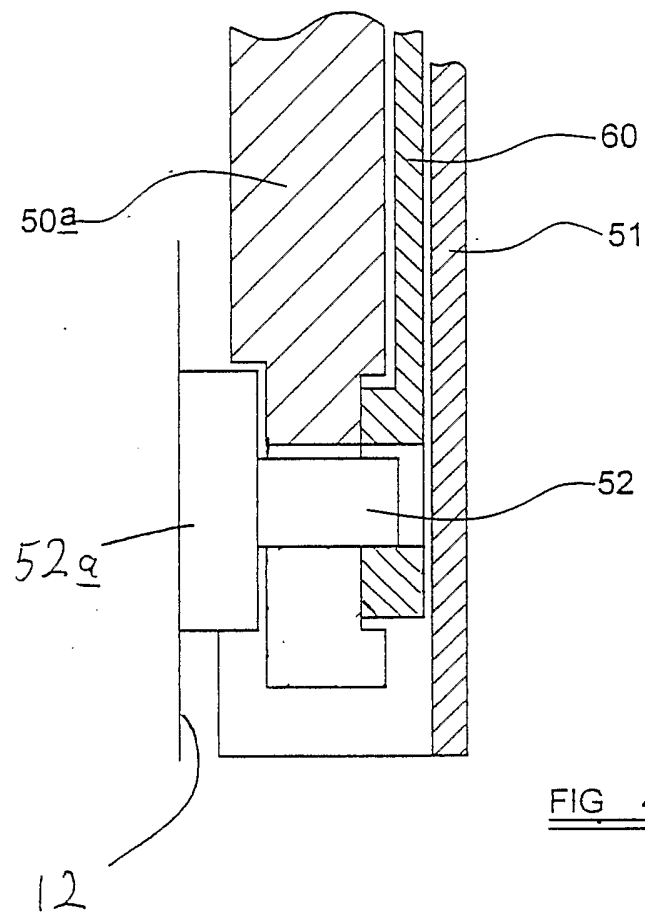


FIG 4



6 / 11

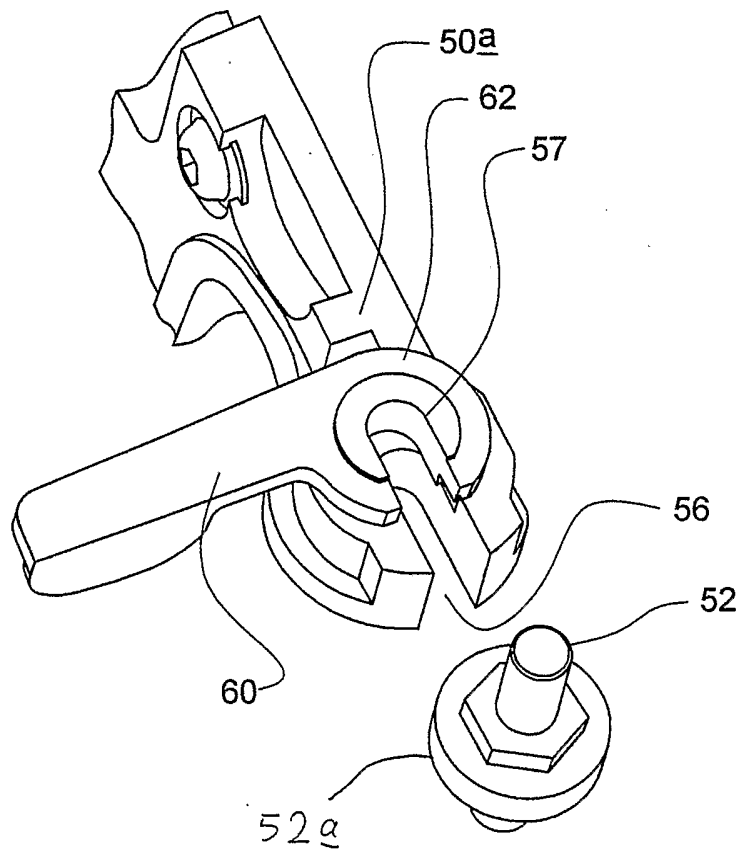
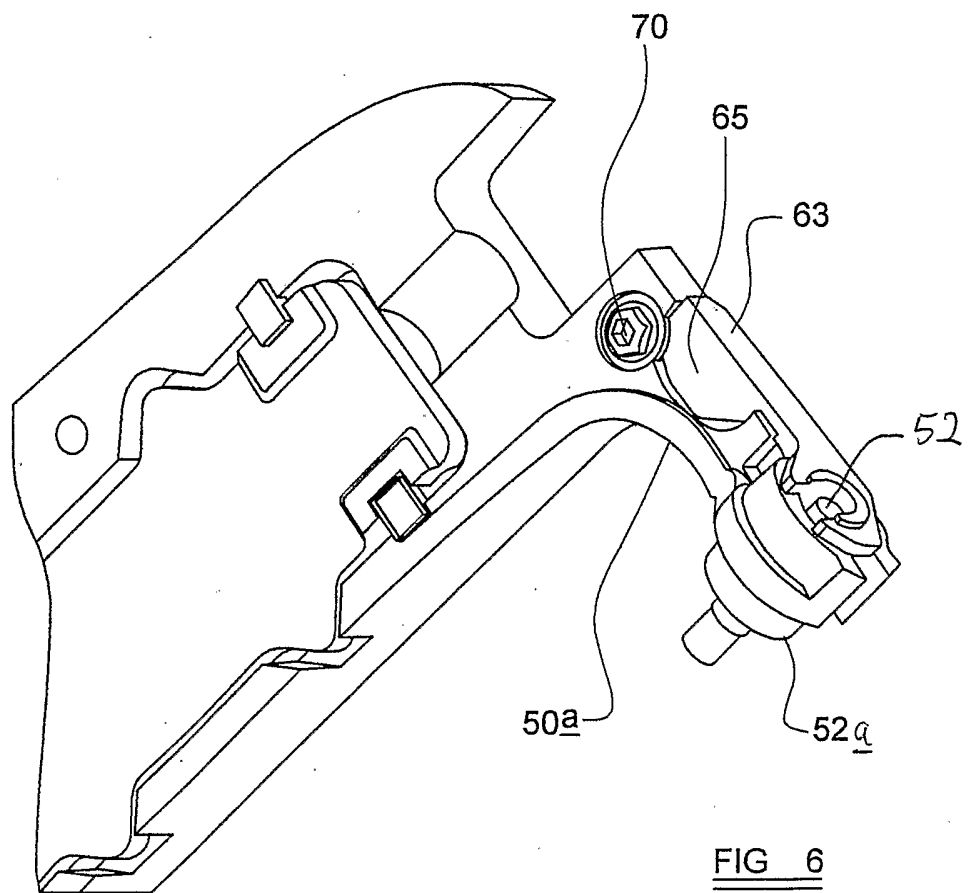


FIG 5



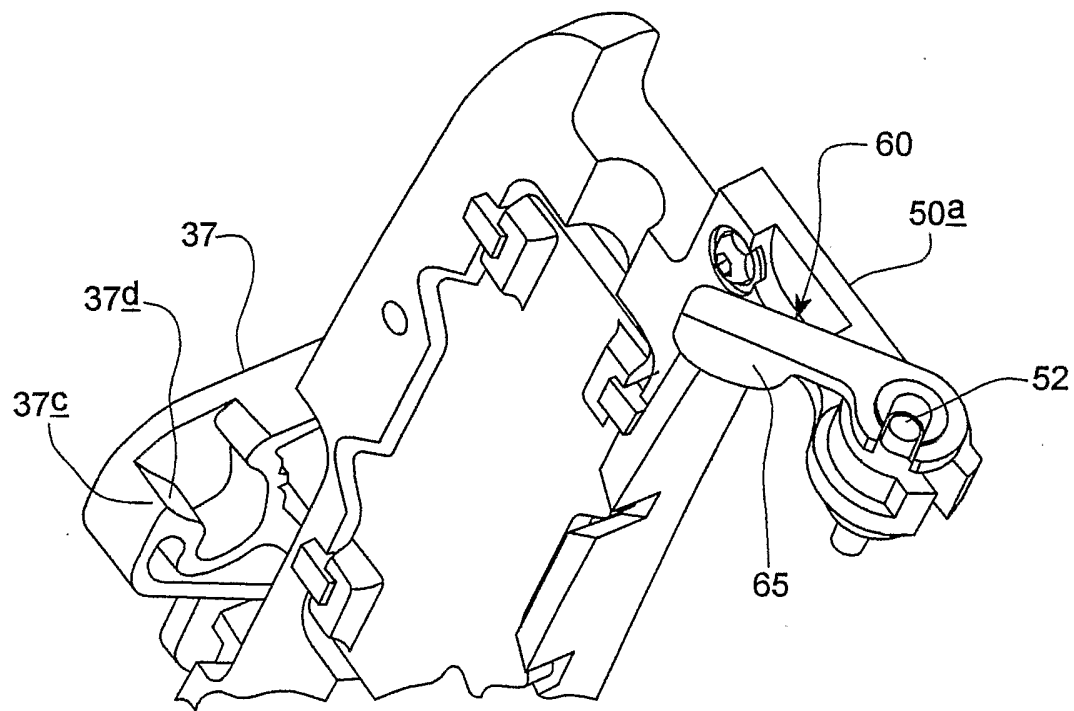


FIG 7

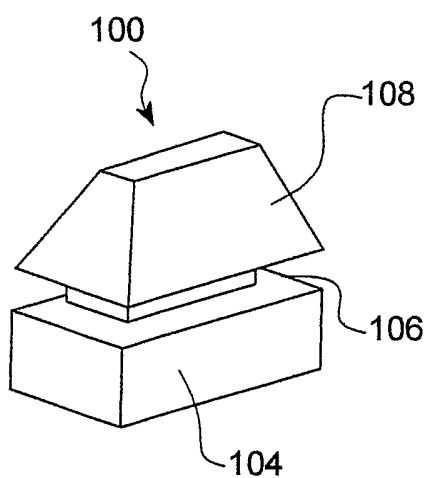


FIG 8

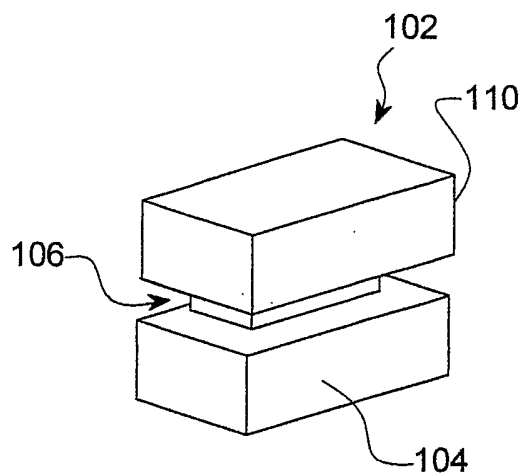


FIG 9

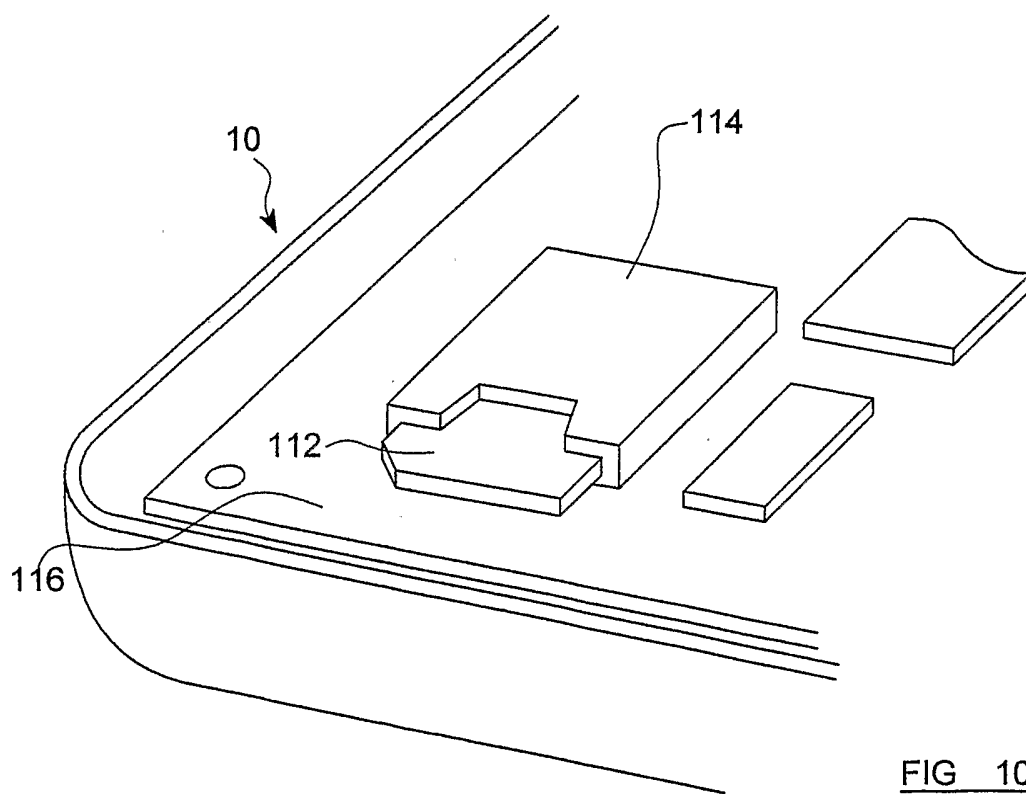
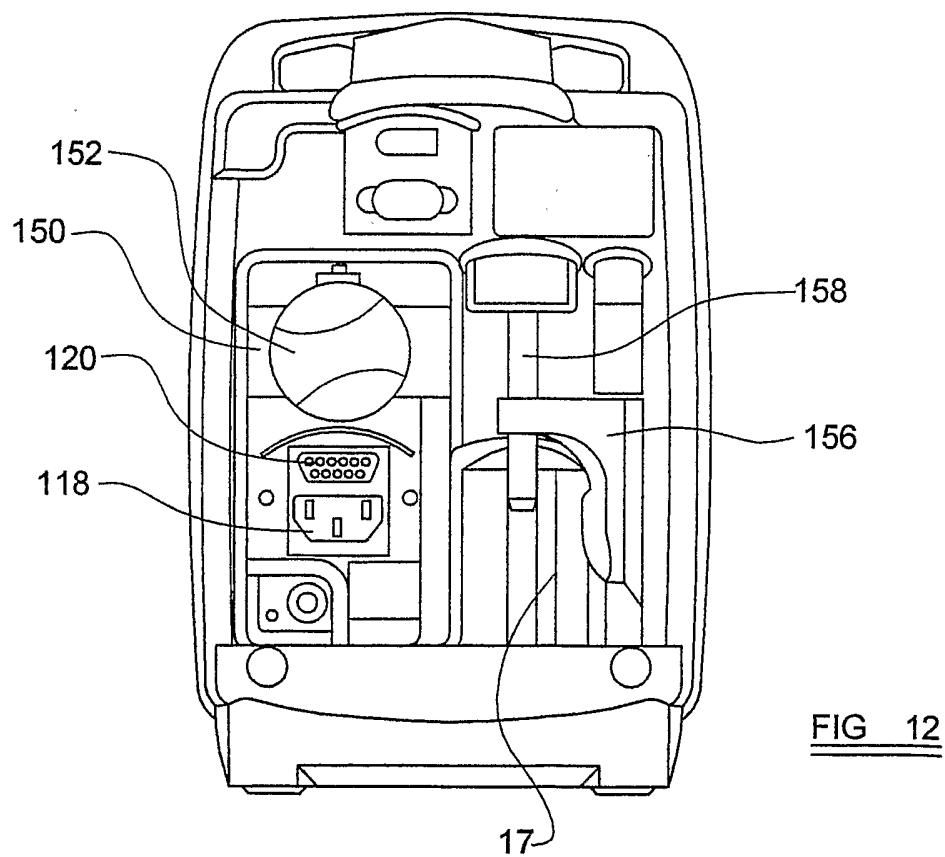
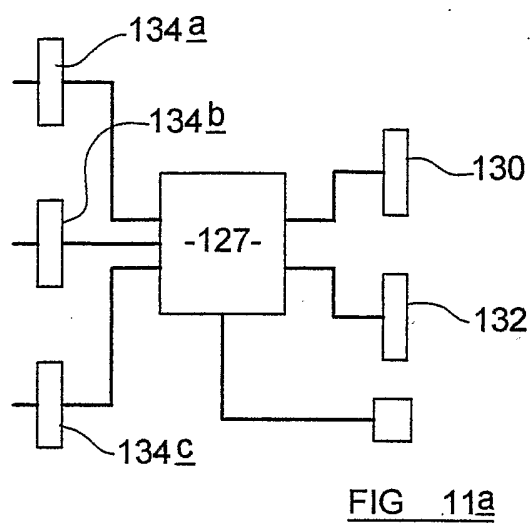
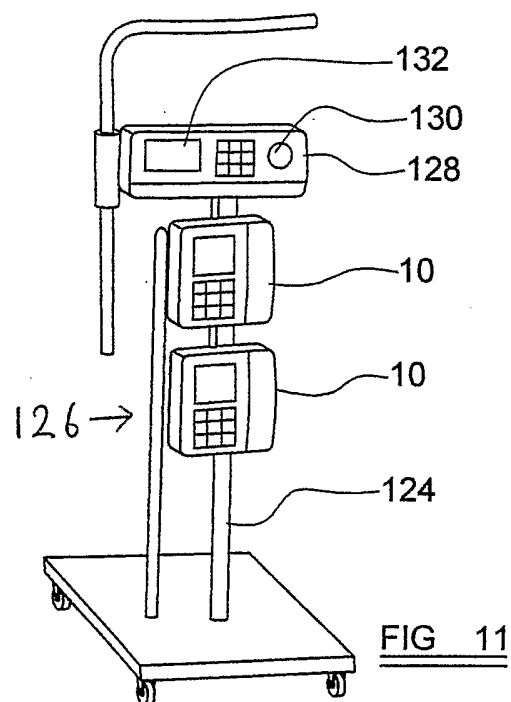
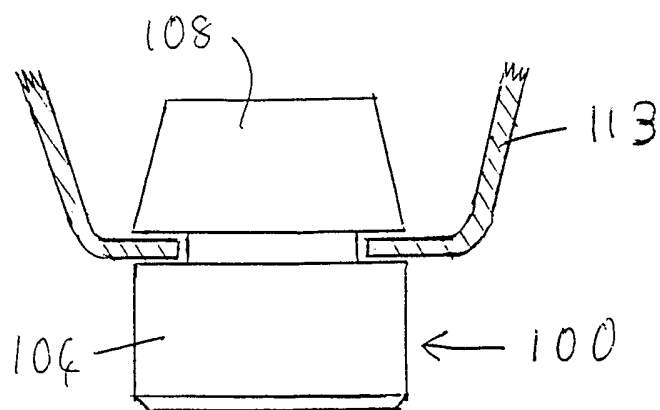
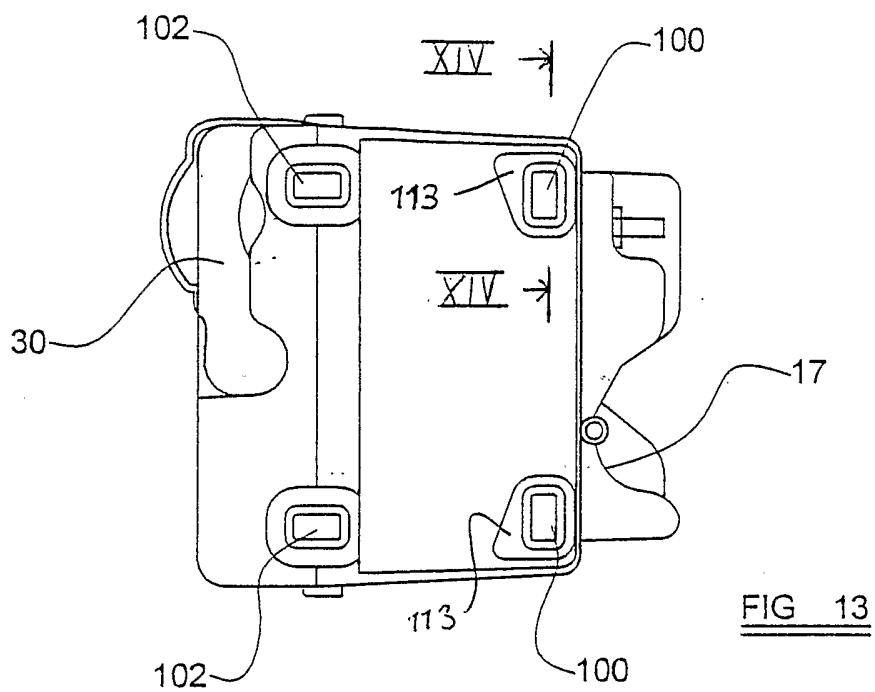


FIG 10

10 / 11



11 / 11



INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB2005/002747

A. CLASSIFICATION OF SUBJECT MATTER

A61M5/142 E05D7/10 A61M5/14 H05K5/02 A47B91/04

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)

A61M E05D H05K H04B A47B

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 364 364 A (KASVIKIS ET AL) 15 November 1994 (1994-11-15) abstract; figures 1,2,7	1
A	US 6 261 262 B1 (BRIGGS KENNETH D ET AL) 17 July 2001 (2001-07-17) abstract; figures 2,3,7	1
A	US 2003/181866 A1 (ABRAHAMSON KENT ET AL) 25 September 2003 (2003-09-25) abstract; figures 1,2,2A	1,11
A	US 2002/165503 A1 (MORRIS MATTHEW G ET AL) 7 November 2002 (2002-11-07) abstract; figures 3,10,11	1
Y	paragraph '0041!; figures 1-3	16
	----- -/--	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in 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

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 November 2005

Date of mailing of the international search report

16.12.2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Nielsen, M

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB2005/002747

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 493 706 A (BORSANYI ET AL) 15 January 1985 (1985-01-15) abstract; figure 11 -----	1
A	DE 93 06 248 U1 (KODAK AG, 7000 STUTTGART, DE) 8 July 1993 (1993-07-08) figures 1-3 -----	1
A	FR 2 590 618 A (PAUMELLERIE ELECTRIQUE) 29 May 1987 (1987-05-29) abstract; figures 1-3 -----	1
Y	US 4 689 043 A (BISHA ET AL) 25 August 1987 (1987-08-25)	8-10
A	column 3, lines 19-52; figure 2 -----	1,11
Y	US 6 508 809 B1 (BACHER FRANK) 21 January 2003 (2003-01-21) column 1, line 57 - column 2, line 21 -----	8-10
A	US 2002/177799 A1 (RIVERA JOHN ET AL) 28 November 2002 (2002-11-28)	8-10
Y	paragraphs '0022! - '0024!; figures 1,2 -----	12-14
A	US 4 150 672 A (MARTIN, JOHN K ET AL) 24 April 1979 (1979-04-24) abstract column 6, lines 25-27 -----	8-10
A	US 4 150 673 A (WATT, WILLIAM E R) 24 April 1979 (1979-04-24) abstract -----	8-10
A	US 4 299 237 A (FOTI ET AL) 10 November 1981 (1981-11-10) column 4, lines 30-37 -----	8-10
A	US 4 856 339 A (WILLIAMS ET AL) 15 August 1989 (1989-08-15) abstract column 2, line 61 - column 3, line 20 column 4, lines 51-61 column 7, lines 1-15 column 7, lines 56-68 column 10, lines 7-32 figures 1,9,10,11A,11B,17 -----	11
A	US 5 567 120 A (HUNGERFORD ET AL) 22 October 1996 (1996-10-22) column 2, lines 15-19 column 2, lines 27-58 column 4, lines 32-55; figures 1-3 column 5, line 36 - column 6, line 8 column 8, lines 56-63 -----	11
	----- -/--	

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB2005/002747

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 551 088 A (BAXTER INTERNATIONAL INC) 14 July 1993 (1993-07-14) abstract -----	11
Y	US 6 041 462 A (MARQUES ET AL) 28 March 2000 (2000-03-28) column 2, lines 35-40; figure 1 -----	12-14
A	US 4 141 100 A (DOMROE ET AL) 27 February 1979 (1979-02-27) column 7, lines 58-65; figures 2-4 -----	12-14
A	GB 366 609 A (AUTOMATIC TELEPHONE MANUFACTURING COMPANY LIMITED; SIDNEY REYNELL SMIT) 11 February 1932 (1932-02-11) page 4, line 94; figure 2 -----	12-14
A	GB 640 970 A (FRANCIS GRAHAM WALKER; DAVID JOHN TATE; KENNETH WILLIAM HALE; THOMAS E) 2 August 1950 (1950-08-02) page 5, lines 40-48; figure 3 -----	12-14
A	US 5 007 607 A (KIM ET AL) 16 April 1991 (1991-04-16) abstract column 2, lines 31-39; figures 1-3 -----	12-14
A	US 4 405 043 A (BURGHART ET AL) 20 September 1983 (1983-09-20) column 4, lines 32-37; figures 4,5 -----	12-14
A	WO 2004/023043 A (CAVICCHIOLI, LINO) 18 March 2004 (2004-03-18) abstract page 8, lines 9-13; figures 25-37 -----	12-14
X	EP 1 157 711 A (TERUMO KABUSHIKI KAISHA) 28 November 2001 (2001-11-28) abstract paragraphs '0004!, '0005! paragraph '0015! paragraphs '0018!, '0019! paragraphs '0022!, '0023! figures 1-3,5 -----	15
X	US 4 756 706 A (KERNS ET AL) 12 July 1988 (1988-07-12) abstract column 2, lines 45-59 column 3, lines 34-41 column 4, lines 7-50 column 5, lines 32-55 figures 1,2a,3 -----	15
	----- -/--	

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB2005/002747

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 814 015 A (GARGANO ET AL) 29 September 1998 (1998-09-29) abstract; figures 1,62 -----	15
X	DE 36 03 728 A1 (LANG,VOLKER,PROF.DR) 13 August 1987 (1987-08-13) abstract column 3, lines 11-16; figures 1-4 -----	15
A	US 2002/038392 A1 (DE LA HUERGA CARLOS) 28 March 2002 (2002-03-28) abstract -----	15
Y	WO 94/07186 A (GRASEBY MEDICAL LIMITED) 31 March 1994 (1994-03-31) abstract page 1, lines 26-31 page 4, lines 11-15 -----	16
A	EP 0 575 256 A (GEMPLUS CARD INTERNATIONAL; GEMPLUS) 22 December 1993 (1993-12-22) abstract; figure 1 -----	16
A	US 2002/183616 A1 (TOEWS GLENN ET AL) 5 December 2002 (2002-12-05) paragraph '0036! paragraph '0127! -----	16
A	US 2003/065294 A1 (PICKUP RAY L ET AL) 3 April 2003 (2003-04-03) paragraph '0049!; figure 2 -----	16
A	WO 01/32069 A (RESPIRONICS, INC) 10 May 2001 (2001-05-10) abstract -----	16
A	WO 96/11723 A (AUSTRALASIAN MEDICAL TECHNOLOGY LIMITED; EDWARDS, JEFFREY, D; GILMOUR,) 25 April 1996 (1996-04-25) abstract -----	16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2005/002747

Box 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 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 additional sheet

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 an additional fee, this Authority did not invite payment of any additional fee.
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.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB2005 /002747

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-7,10(partly)

Peristaltic pump unit for medical infusion having a housing with a removably mounted door.

2. claims: 8,9,10(partly)

Peristaltic pump unit for medical infusion having colour coded support means to match colour coded fittings on a flexible resilient tube.

3. claim: 11

Peristaltic pump unit for medical infusion having a support bracket in the form of a replaceable module incorporating a pressure sensor and/or a bubble detector.

4. claims: 12-14

Infusion pump for medical infusion having an external casing with apertures receiving feet with a groove resulting in the feet being retained against displacement from the casing.

5. claim: 15

Docking station for supporting a plurality of medical infusion pump units, the docking station including electronic processing means, visual alarm signal means and information display means, the processing means causing alarm and display indicating which of the pump units mounted on the docking station is generating an alarm.

6. claim: 16

Peristaltic pump unit for medical infusion having at least part of a memory carried in a readily replaceable, non-volatile memory card, received in a complementary socket within the pump unit.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB2005/002747

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5364364	A	15-11-1994	NONE	
US 6261262	B1	17-07-2001	AT 281870 T AU 737662 B2 AU 8063198 A CA 2292602 A1 DE 69827491 D1 DE 69827491 T2 EP 0984814 A1 ES 2232952 T3 JP 2002508685 T WO 9856453 A1	15-11-2004 30-08-2001 30-12-1998 17-12-1998 16-12-2004 27-10-2005 15-03-2000 01-06-2005 19-03-2002 17-12-1998
US 2003181866	A1	25-09-2003	AU 2003213795 A1 CA 2479127 A1 EP 1485149 A1 WO 03080158 A1	08-10-2003 02-10-2003 15-12-2004 02-10-2003
US 2002165503	A1	07-11-2002	CA 2444403 A1 CN 1507359 A CZ 20033292 A3 EP 1383559 A1 HU 0400062 A2 JP 2004528117 T NO 20034904 A NZ 528962 A PL 363987 A1 WO 02089876 A1	14-11-2002 23-06-2004 16-06-2004 28-01-2004 28-04-2004 16-09-2004 30-12-2003 29-07-2005 29-11-2004 14-11-2002
US 4493706	A	15-01-1985	CA 1221271 A1 DE 3382011 D1 EP 0116596 A1 JP 1026304 B JP 59501395 T WO 8400691 A1	05-05-1987 03-01-1991 29-08-1984 23-05-1989 09-08-1984 01-03-1984
DE 9306248	U1	08-07-1993	NONE	
FR 2590618	A	29-05-1987	NONE	
US 4689043	A	25-08-1987	AU 604477 B2 AU 6952487 A CA 1238832 A1 DE 3774598 D1 EP 0238227 A2 JP 1730395 C JP 4018867 B JP 62221365 A	20-12-1990 24-09-1987 05-07-1988 02-01-1992 23-09-1987 29-01-1993 27-03-1992 29-09-1987
US 6508809	B1	21-01-2003	DE 20018424 U1	01-03-2001
US 2002177799	A1	28-11-2002	NONE	
US 4150672	A	24-04-1979	NONE	
US 4150673	A	24-04-1979	NONE	
US 4299237	A	10-11-1981	NONE	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB2005/002747

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4856339	A	15-08-1989	NONE	
US 5567120	A	22-10-1996	CA 2177630 A1 DE 19630815 A1	30-11-1997 07-05-1998
EP 0551088	A	14-07-1993	AU 655342 B2 AU 3047292 A CA 2086457 A1 DE 69310217 D1 DE 69310217 T2 JP 5176996 A US 5312334 A	15-12-1994 08-07-1993 07-07-1993 05-06-1997 18-09-1997 20-07-1993 17-05-1994
US 6041462	A	28-03-2000	AU 2947697 A WO 9747439 A1 EP 0907467 A1	07-01-1998 18-12-1997 14-04-1999
US 4141100	A	27-02-1979	AU 2888877 A BE 859065 A1 DE 2743685 A1 DE 7730081 U1 JP 58005296 A JP 1176559 C JP 53067533 A JP 58008359 B	22-03-1979 16-01-1978 30-03-1978 28-10-1982 12-01-1983 14-11-1983 16-06-1978 15-02-1983
GB 366609	A	11-02-1932	BE 384073 A FR 726120 A	23-05-1932
GB 640970	A	02-08-1950	NONE	
US 5007607	A	16-04-1991	CA 2000415 A1	30-06-1990
US 4405043	A	20-09-1983	NONE	
WO 2004023043	A	18-03-2004	AU 2003263406 A1	29-03-2004
EP 1157711	A	28-11-2001	US 2002013551 A1	31-01-2002
US 4756706	A	12-07-1988	NONE	
US 5814015	A	29-09-1998	AU 708108 B2 AU 4982096 A EP 0813428 A1 JP 11500643 T WO 9625963 A1	29-07-1999 11-09-1996 29-12-1997 19-01-1999 29-08-1996
DE 3603728	A1	13-08-1987	NONE	
US 2002038392	A1	28-03-2002	NONE	
WO 9407186	A	31-03-1994	AU 4825793 A	12-04-1994
EP 0575256	A	22-12-1993	DE 69331080 D1 DE 69331080 T2 FR 2692689 A1	13-12-2001 14-08-2002 24-12-1993
US 2002183616	A1	05-12-2002	EP 1401519 A1	31-03-2004

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB2005/002747

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002183616 A1		JP 2004538052 T	24-12-2004
		WO 02096487 A1	05-12-2002
US 2003065294 A1	03-04-2003	CN 1561242 A	05-01-2005
		EP 1429835 A1	23-06-2004
		JP 2005503899 T	10-02-2005
		WO 03028797 A1	10-04-2003
		US 2004087916 A1	06-05-2004
		US 2004181196 A1	16-09-2004
WO 0132069 A	10-05-2001	AU 783265 B2	06-10-2005
		AU 1354001 A	14-05-2001
		BR 0015191 A	22-10-2002
		CA 2389624 A1	10-05-2001
		EP 1231965 A2	21-08-2002
		JP 2003527160 T	16-09-2003
WO 9611723 A	25-04-1996	NONE	