(12) UK Patent Application (19) GB (11) 2 328 866 (13) A

(43) Date of A Publication 10.03.1999

(21) Application No 9818318.9

(22) Date of Filing 21.08.1998

(30) Priority Data
(31) 9717818 (32) 21.08.1997 (33) GB

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(51) INT CL[6]
A47G 9/00 , A61G 7/07

(52) UK CL (Edition Q)
A4M M1B1 M1B2 M1B3 M1B4 M1B5 M1B7

(56) Documents Cited
GB 2320892 A GB 2319721 A GB 2307402 A
GB 2290706 A GB 1398544 A US 5197461 A
US 4175297 A

(58) Field of Search
UK CL (Edition P) A4M
INT CL[6] A47G 9/00 , A61G 7/057 7/07 7/075
Online: WPI

(54) Abstract Title
Inflatable/deflatable pillow for the relief of neck or back pain

(57) Medical apparatus for the relief, treatment and/or prevention of neck or back pain comprises an inflatable support pillow (2) and an inflation device connected to the pillow. The support pillow is adapted for interpositioning between a patient's occiput and a head rest and supports the neck and sides of the head. The inflation device includes a pump and control means, such as a timer, for controlling the inflation and deflation of the pillow through a repetitive cycle which causes the patient's head to be moved with a nodding and/or side-to-side motion. Such movement gently massages the patient's neck to alleviate or prevent pain. The device can be adapted for back treatment.

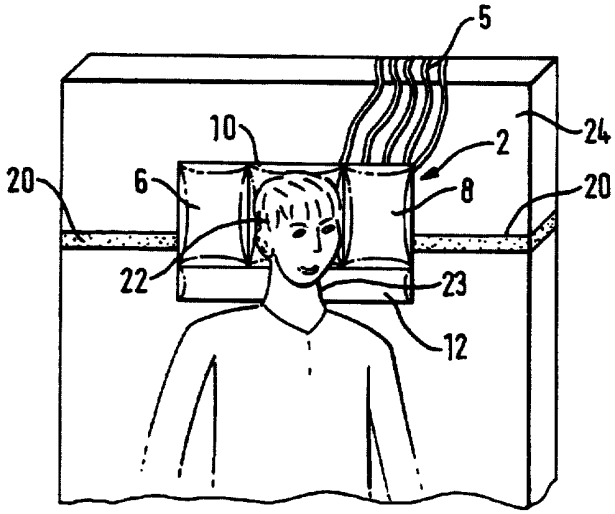


FIG.1b

GB 2 328 866 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

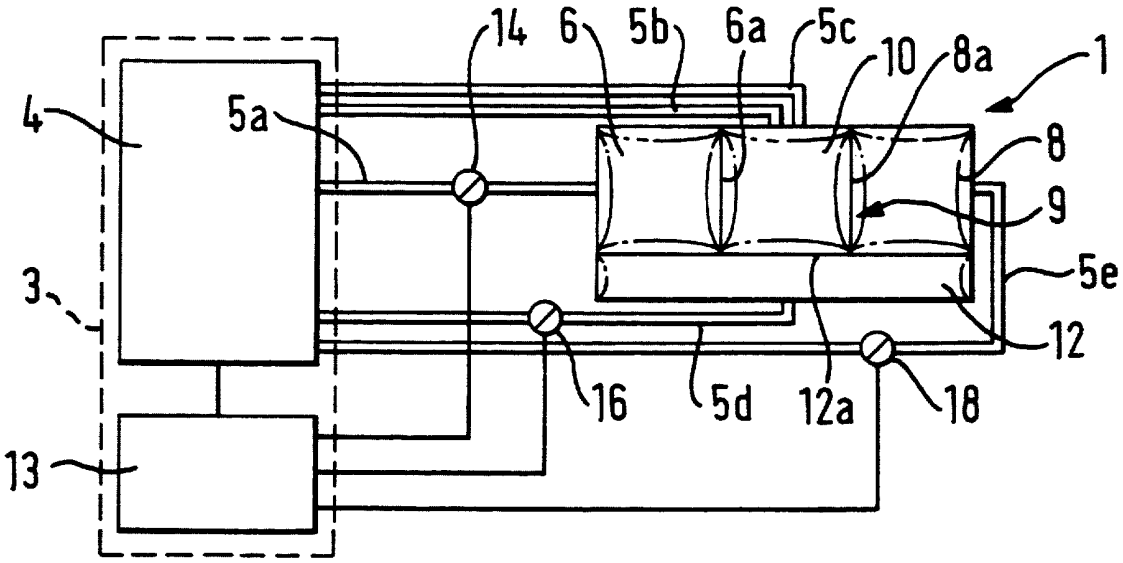

14
6
5b
6a
5c
10
8a
1
4
5a
8
9
3
5e
12
16
5d
12a
18
13

FIG. 1a

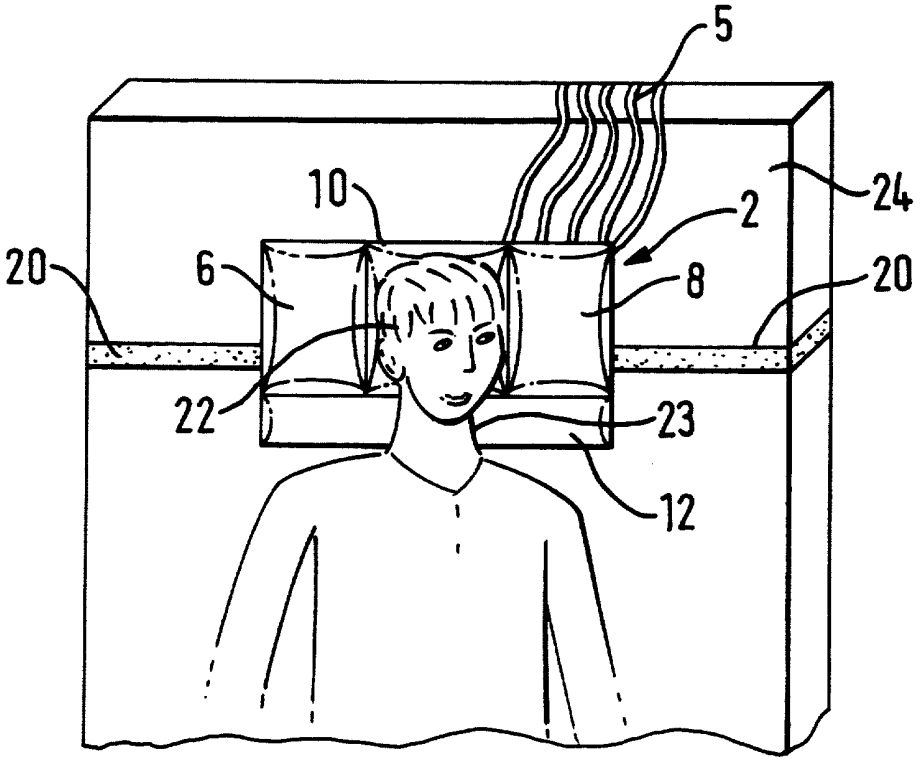

5
10
2
24
20
6
8
20
22
23
12

FIG. 1b

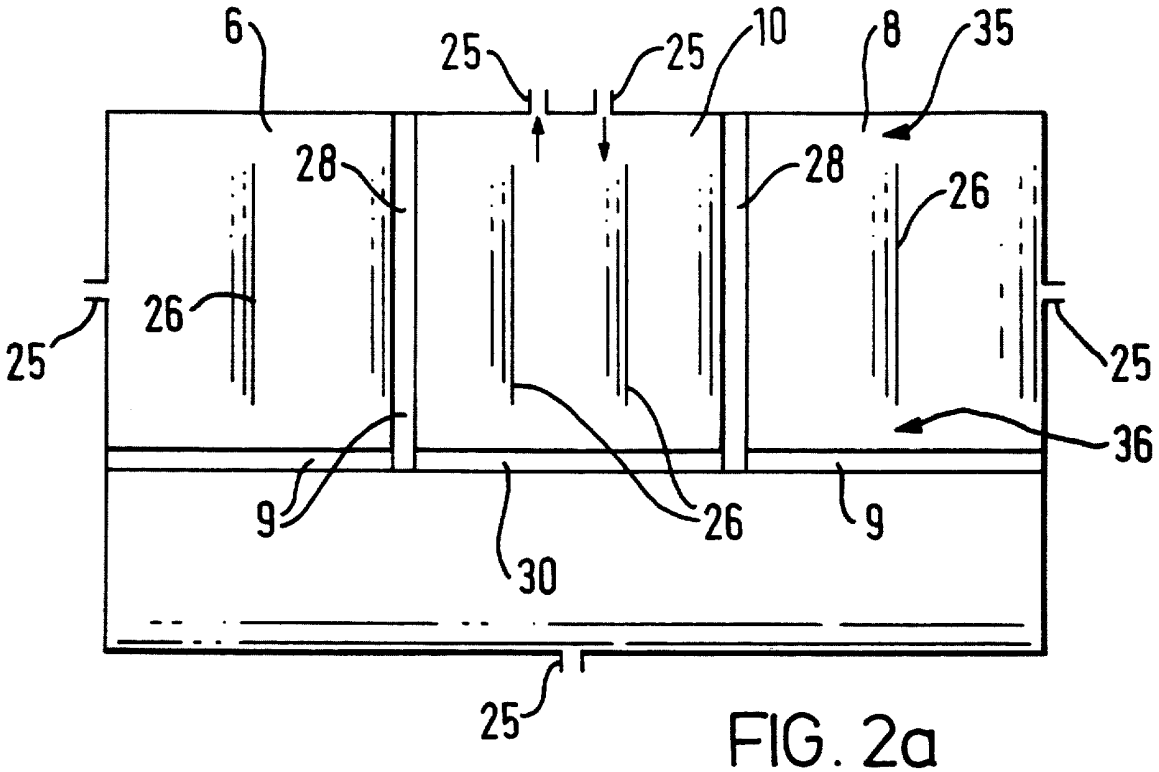

6
25
25
10
8
35
28
28
26
26
25
25
36
9
26
9
30
25

FIG. 2a

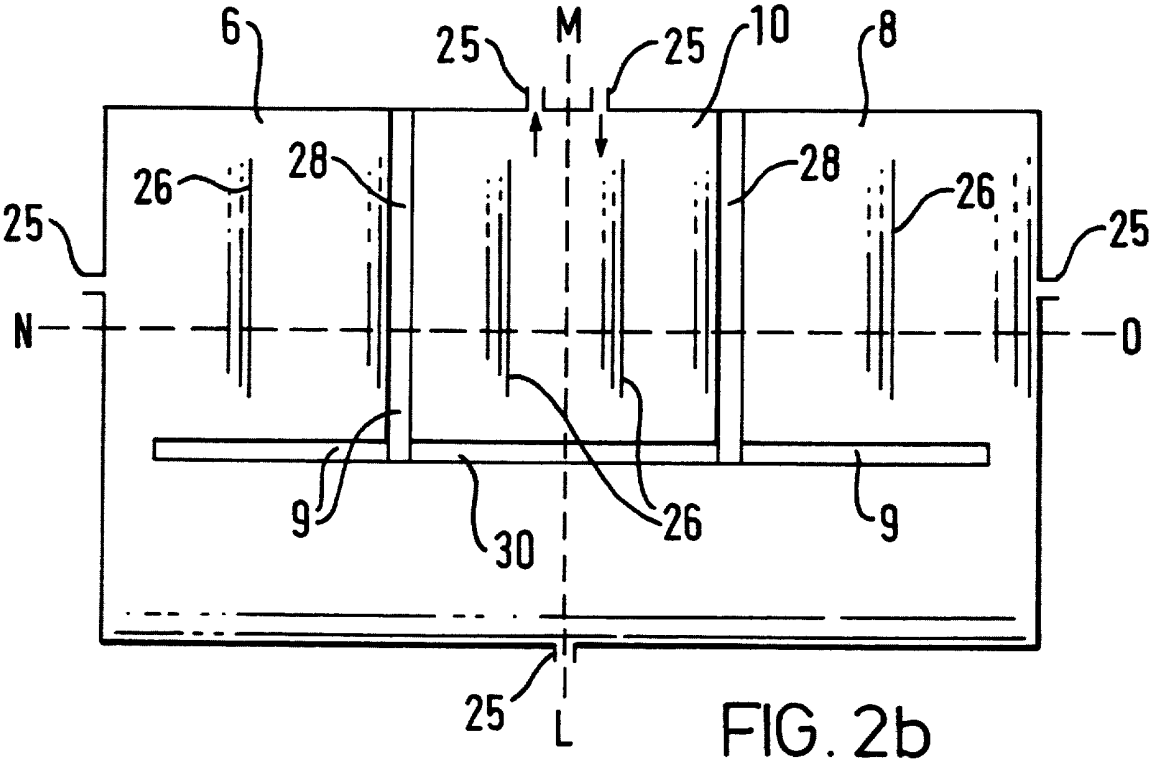

6
25
M
25
10
8
26
28
28
26
25
25
N
O
9
26
9
30
25
L

FIG. 2b

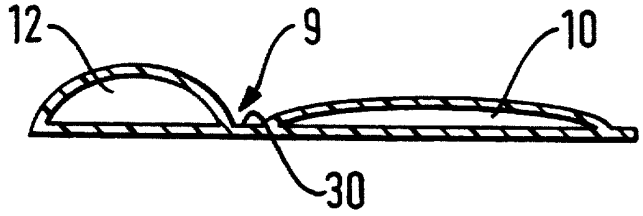


FIG. 3a

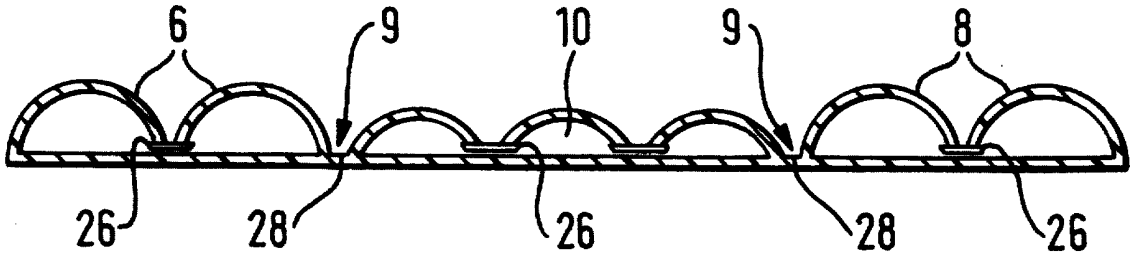


FIG. 3b

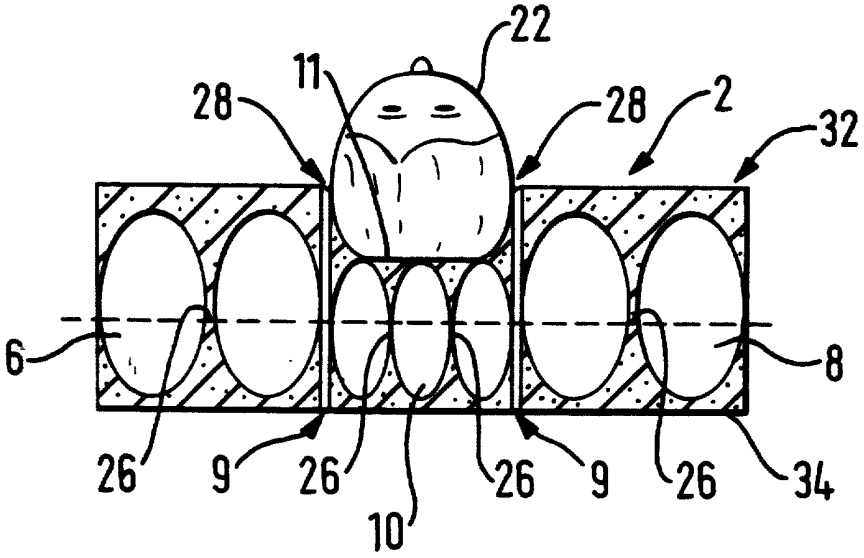


FIG. 4

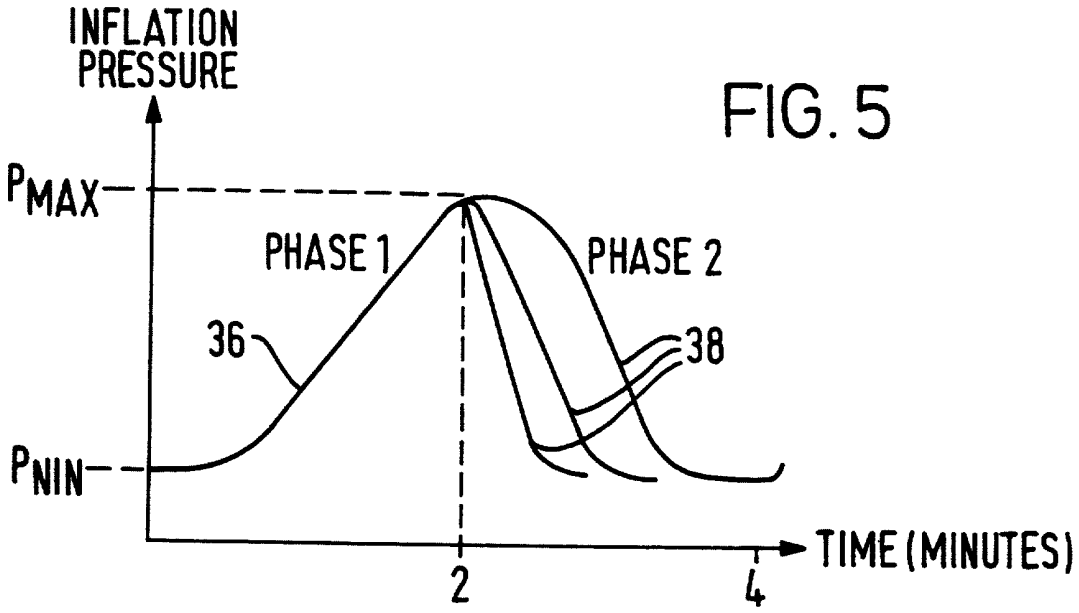

INFLATION PRESSURE
PMAX
PNIN
PHASE 1
PHASE 2
36
38
TIME (MINUTES)
2
4

FIG. 5

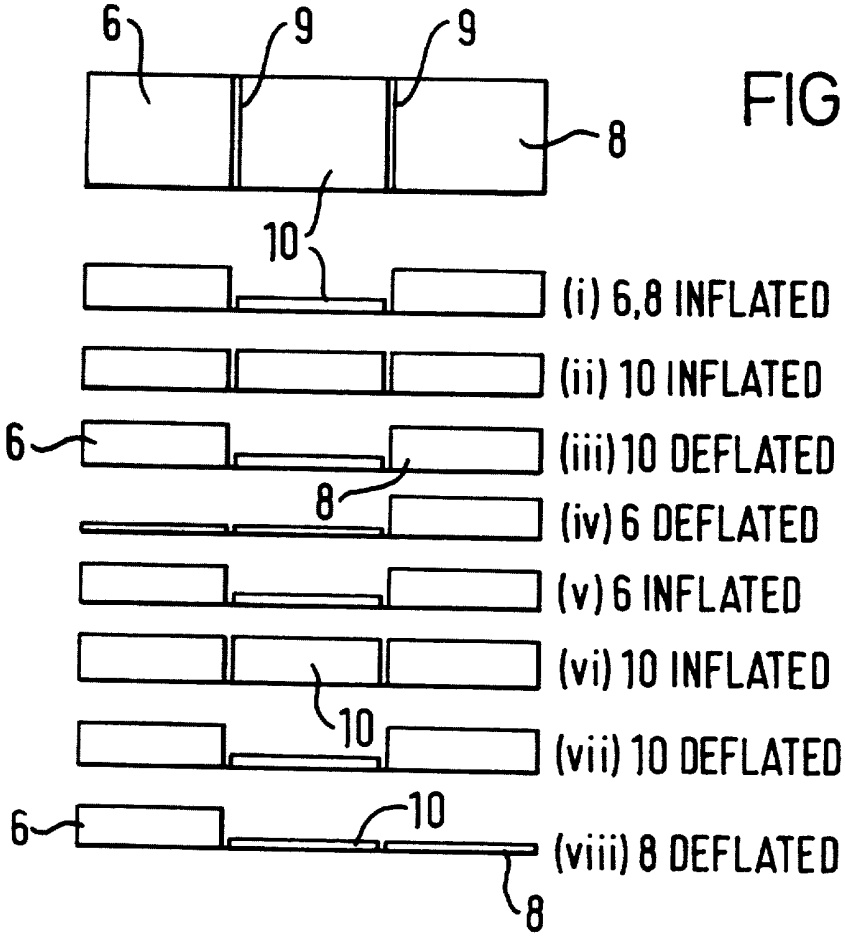
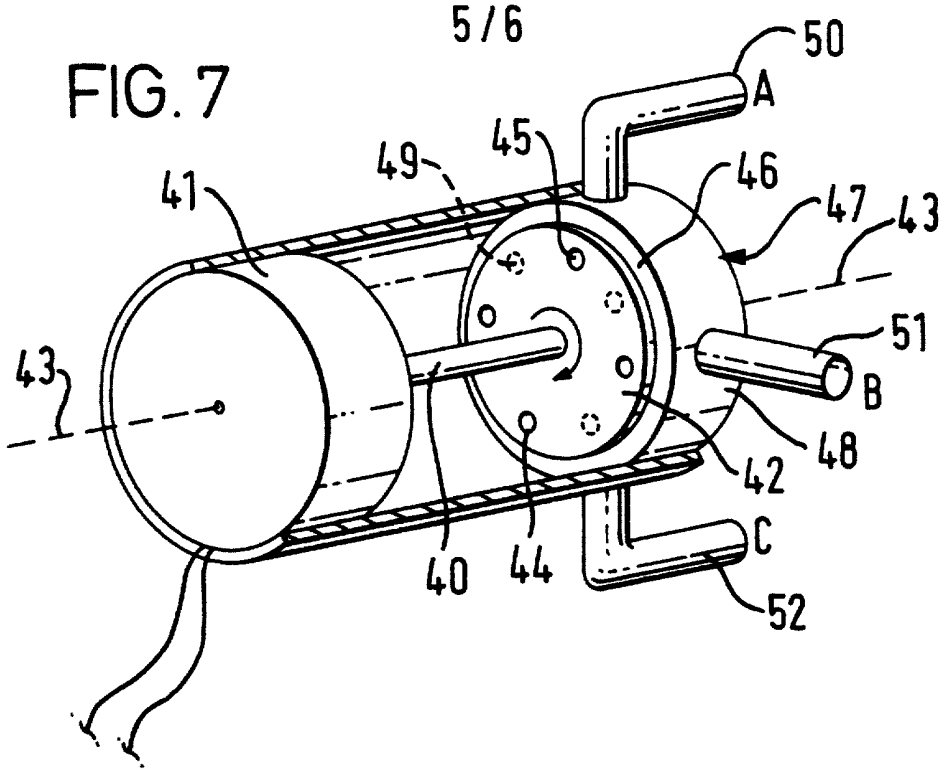

6
9
9
8
10
(i) 6,8 INFLATED
(ii) 10 INFLATED
6
(iii) 10 DEFLATED
8
(iv) 6 DEFLATED
(v) 6 INFLATED
(vi) 10 INFLATED
10
(vii) 10 DEFLATED
6
10
(viii) 8 DEFLATED
8

FIG. 6

FIG. 7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A
45
49
46
47
43
41
51
43
B
48
42
C
40
44
52

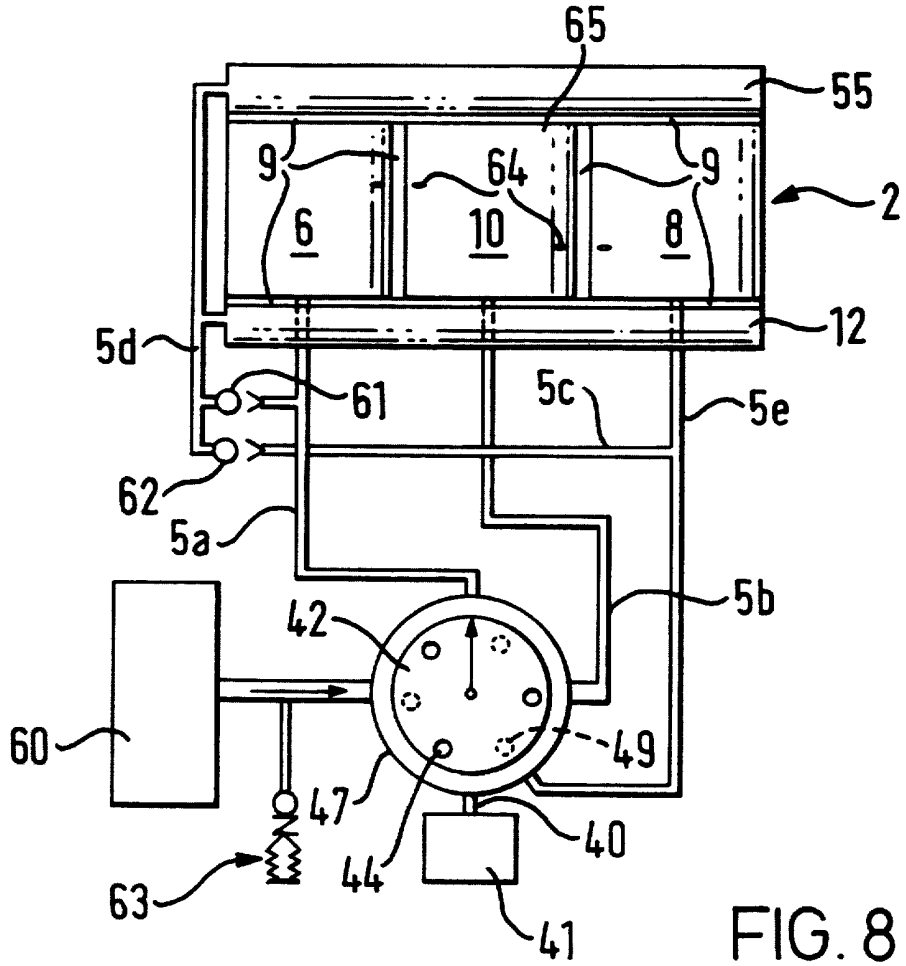

65
55
9
64
9
2
6
10
8
12
5d
61
5c
5e
62
5a
5b
42
60
49
47
40
44
63
41

FIG. 8

FIG. 9

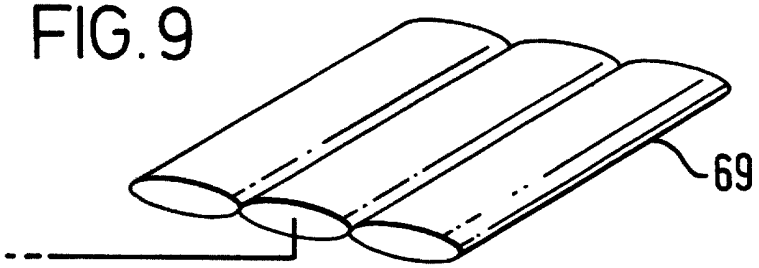


FIG. 10

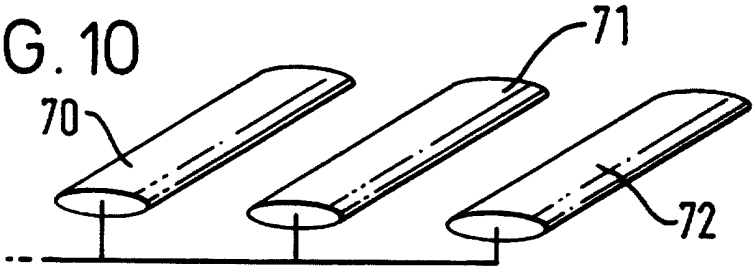


FIG. 11

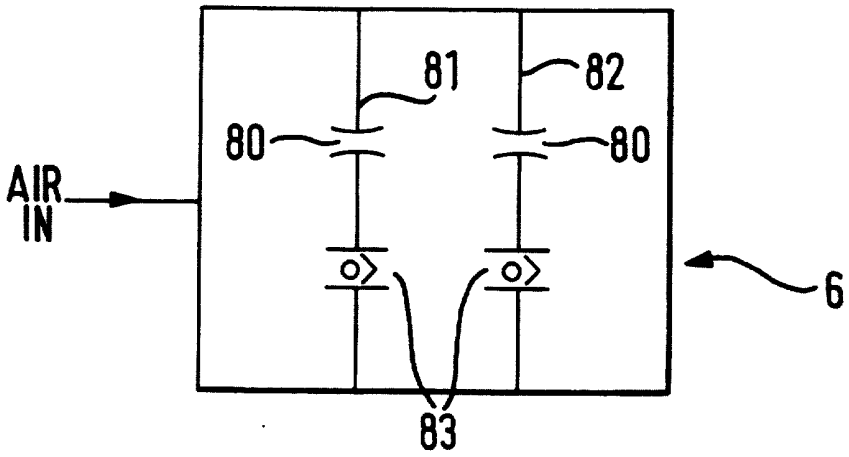


FIG. 12a

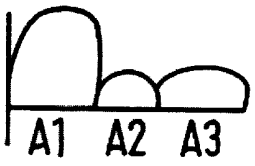


FIG. 12b

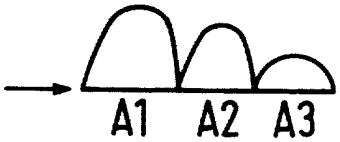
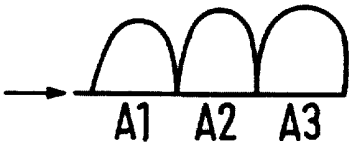


FIG. 12c



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MEDICAL APPARATUS FOR RELIEF OF PAIN

Field of the Invention

This invention relates to a medical apparatus for the relief of pain and more particularly, though not exclusively, relates to a dynamically inflatable neck support pillow for the relief, treatment and prevention of neck pain. The teachings of the invention could however be applied to the relief of back pain.

Background of the Invention

Neck pain is a common ailment afflicting many people. Neck-related pain may be caused or be exacerbated by poor posture as well as by the overstretching of surrounding ligaments in the neck region.

Various supports and pillows for the head, neck and lumbar region are known in the prior art. Canadian Patent No. 2099545 describes an adjustable cervical support pillow with an inflatable bolster portion along one edge to fit the contour of the neck. US Patent No. 4,285,081 describes a portable device for recumbency of the head and neck so as to provide support to the user during travelling. British Patent No. 2198341 describes an inflatable neck support pillow of generally U-shaped configuration having rear and side portions for providing rear and lateral support to the head of the user. Other configurations of pillows and head rests are known, for example, from US Patent No. 4,528,705, US Patent No. 4,501,034, US Patent No. 5,271,114 and US Patent No. 4,829,614.

The prior art supports and pillows such as those described in the abovementioned documents have provided some relief from neck pain and are an improvement over conventional pillows. However, none of these prior art supports or pillows is designed to effect any treatment for prevention of neck-related pain.

Summary of the Invention:

The present invention thus aims to provide a medical apparatus which not only relieves neck pain but also treats and/or prevents neck pain.

In its broadest aspect, the present invention resides in the application of a periodic inflation and deflation cycle to an inflatable/deflatable support for the head and neck of a patient to allow nodding and/or side-to-side movement of the patient's head.

According to another, more particular, aspect of the present invention there is provided medical apparatus for the relief of neck pain, the apparatus comprising:

a fluid inflatable support pillow adapted for interpositioning between a patient's occiput and a head rest; and

a source of inflation fluid connected to the pillow, characterised in the source including control means for controlling the inflation and the deflation of the pillow in accordance with a periodic cycle so as to move the patient's head cyclically, in a nodding and/or a side-to-side manner.

The support pillow, in an embodiment of the present invention, is advantageously formed with a plurality of different chambers one or more of which is shaped to provide lateral support to the head of a user and to underlie his neck, and another of which supports the back of the head, and the plural chambers may be variably and selectively inflated and deflated for cyclically raising and lowering the supported head.

Not only does the abovementioned embodiment of the present invention provide comfort to the user during treatment, as made possible by the lateral support provided to the user's head and the support provided to the nape of his neck, but also the iterative inflation and deflation of the pillow portion supporting the occiput of the user applies a gentle pressure to massage the neck. This massaging action provides relief of neck pain and also provides treatment of muscular, skeletal and various other conditions which may be giving rise to the neck pain.

According to a further aspect of the present invention there is provided a method of operating a medical apparatus providing support for a patient's head, the method comprising providing a fluid inflatable support pillow adapted for interpositioning between a patient's occiput and a head rest therefor; providing a source of inflation fluid connected to the pillow, and controlling the inflation and deflation of the pillow in accordance with a periodic cycle determined by control means connected with the said source of inflation fluid so that when the control means is operative the patient's head is moved cyclically in a nodding and/or side-to-side manner.

According to yet another aspect of the present invention, there is provided medical apparatus for the relief, treatment and/or prevention of neck pain, the apparatus comprising: an envelope for interpositioning between a patient's occiput and a head rest, and a fluid source for periodically supplying fluid to and extracting fluid out of a central concavity in the envelope, the fluid being also supplied to and then retained in one or more peripheral inflatable volumes of the envelope outward of the central concavity.

According to one alternative aspect of the present invention, there is provided a method of supporting a patient's head, the method comprising: providing a fluid inflatable support pillow such that when the pillow is interposed between a head rest and the patient's occiput, the patient's occiput rests against a central inflatable volume of the pillow supported by peripheral parts of the pillow and the patient's neck rests on another peripheral part of the pillow; and subjecting the patient's occiput, as positioned against the central inflatable volume of the pillow, to repeated cycles of movement resulting from periodic inflation and deflation of said central inflatable volume.

Yet a further aspect of the present invention resides in the abovementioned aspects but applied to treatment of the back, particularly the lumber region, rather than the neck.

The above-described and further features of the present invention are set forth in the appended claims and will be readily understood by consideration of the detailed description hereinafter given with reference to the accompanying drawings.

Description of the Drawings:

Figure 1a is a schematic view of a medical apparatus embodying the present invention including an inflatable neck support pillow;

Figure 1b is a perspective view of the inflatable neck support pillow of Figure 1a strapped to a head rest;

Figure 2a is a detailed schematic view of the inflatable neck support pillow of Figure 1;

Figure 2b is a detailed schematic view of another inflatable neck support pillow embodying the present invention;

Figure 3a is a cross-sectional view of the pillow of Figure 2b in inflated condition, the cross-section being on the line ML shown in Figure 2b;

Figure 3b is a cross-sectional view of the support pillow of Figure 2b in inflated condition, the cross-section being on the line NO shown in Figure 2b;

Figure 4 is a cross-sectional view of a support pillow similar to that of Figure 2b in an inflated condition provided within a padded pillow case, and supporting the patient's occipital load;

Figure 5 is an illustrative graph of fluid inflation pressure versus time typical for a central, occiput-supportive portion of a pillow according to the present invention, the graph illustrating a first phase of inflation of about two minutes duration, followed by a second more rapid phase of deflation;

Figure 6 is a sequence table showing an exemplary inflation and deflation sequence for three in-line compartments within a pillow according to the present invention;

Figure 7 is a schematic perspective view of one embodiment of an electric motor driven rotor/stator arrangement for use in controlling the

distribution of air from a source of compressed air to different compartments of a support pillow according to the present invention;

Figure 8 is a schematic diagram of a medical apparatus in accordance with the present invention utilising the rotor/stator arrangement of Figure 7;

Figure 9 is a schematic perspective view of a separate three segment top volume for location over side and central volumes of an inflatable/deflatable pillow;

Figure 10 is a schematic perspective view similar to Figure 9 but in which the segments are separated one from the other and are inflatable from a single source;

Figure 11 is a schematic plan view of one outer portion of the pillow of Figure 1a; and

Figures 12a-12c are schematic illustrations of an inflation/deflation portion of an inflatable support pillow according to the present invention.

Detailed Description of the Embodiments:

Throughout the description of the various embodiments described herein and in the claims features referred to by number will retain that number throughout and like parts will carry the same reference numerals.

Referring specifically to Figure 1a, there is shown a medical apparatus 1 embodying the present invention. The apparatus 1 comprises an inflatable neck support pillow 2 of generally rectangular form and a fluid inflation device 3. The inflation device 3 comprises a distributor 4 having a plurality of outputs each coupled by a tubular connection pipe 5a, 5b, 5c, 5d and 5e, respectively, with a plurality of input/outputs 25 of the pillow. The distributor comprises a pump the operation of which is controlled by a microprocessor 13 having a periodic cyclic switching program therein.

The pillow 2 is formed of overlapping plastics sheets, such as sheets of polyvinylchloride or polyurethane, which are interconnected along welded portions 9 positioned so as to divide the pillow 2 into a plurality of

independently inflatable/deflatable rectangular compartments referred to throughout this specification as volumes. In Figure 1a the pillow 2 comprises an inflatable central volume 10, two inflatable side volumes 6, 8 and an inflatable base volume 12. The inflatable base and side volumes 6, 8 and 12 together form a U-shape surrounding three outer edges 6a, 8a and 12a of the central volume 10.

The tubular connection lines 5a, 5b, 5c, 5d and 5e couple the fluid inflation device 3 to respective ones of the inflatable central base, and side volumes 6, 8, 10 and 12. The fluid inflation device 3 comprises an adjustable flow compressed air pump 4 and an electrical controller coupled for controlling the ON/OFF operation of the pump 4. Flow restrictors 14, 16, 18, such as electronic solenoid control valves, are located in the tubular connection lines 5a, 5d and 5e intermediate the side and base volumes 6, 8, 12, respectively, and the air pump 4, for controlling the supply and venting of air into and out of the individual central, base and side volumes of the pillow.

The restrictors 14, 16, 18 are solenoid valves which are selectively responsive to electrical control signals to allow the flow of a fluid therethrough, to stop the flow and allow venting of the connected volume or to hold an inflated condition. Therefore, once inflated the volumes 6, 8 and 12 can be controlled to remain inflated or can be deflated by switching the respective solenoid valves to a vent position.

The pump 4 is accordingly capable of periodically supplying air to and extracting air out of the central volume 10 and at the same time each of the solenoids 14, 16, 18 is operable to enable the state of inflation of the side and base volumes 6, 8, 12 to be determined.

The timer 13 is an electronically operated microprocessor programmed to switch the solenoids 14, 16, 18 to allow the individual volumes of the pillow to be inflated/deflated in accordance with a predetermined periodic switching cycle programmed in the microprocessor.

For example, in operation of the pillow of Figure 1a the switching program may be arranged t so that the two inflatable side volumes 6, 8 and the inflatable base volume 12 are inflated through valves 14 and 18 and valve 16 respectively and then the valves are instructed from the microprocessor to operate as non-return valves so that compressed air is retained within the respective side and base volumes 6, 8 and 12. With the side and base volumes thus constantly inflated, so that a patient's head is supports, the microprocessor instructs the air pump 4 to pump air into the central volume 10 through tubular connection 5c which has the effect in use of causing a patient's head to be raised or pushed forward and, after a predetermined dwell period, then disables the pump so that compressed air vents from central volumes 10 so that the head of the patient is lowered or moves backwards to a non-inflated rest position. By cyclical operation of the pump, the movement of the head achieves a nodding motion with an amplitude that can be controlled as a function of the timing of the pump operations.

additionally or alternatively, the solenoids can be operated to control the alternate inflation and deflation of the side volumes 6 and 8, possibly with the base volume 12 constantly inflated, so that the patient's head is subjected to a side-to-side rocking motion. Such controlled inflations and deflations enable the head of a patient to be moved with a side-to-side movement interspersed with nodding movement as the central volume 10 is inflated-deflated after each cycle of side-to-side movement with the head held securely between inflated side volumes 6, 8.

The compressed air pump 4 can be replaced by any suitable supply of fluid (gas or liquid) for inflating the pillow 2. Any such alternative fluid supply would, however, require the additional provision of a reservoir for storing the fluid. Advantageously, no such reservoir is required with the compressed air pump 4 used in the present embodiment.

In Figure 1b, the pillow 2 of Figure 1a is shown to be adjustably securable to a head rest 24, for example a bed mattress, by means of a strap 20. The patient's occiput rests on the central volume 10 of the pillow 2 with the nape of the patient's neck 23 resting on and supported by the base volume 12 of the pillow 2 and with the side volumes 6, 8 on opposite sides of the patient's head.

Figure 2a is a more detailed schematic view of one exemplary form of the pillow 2 of Figure 1a which is operable in a similar manner as described for the pillow of Figure 1a. However, the pillow in this embodiment is provided with side and central volumes which each have, in addition to welded portions 9 along two or more of their edges, linear or multiple spot welds 26 located centrally of each side volume to divide the side volume 6. 8 into two internally interconnected compartments which can both be filled with air through a single inlet 25. There is a sufficient gap 35, 36 at opposed ends of each linear weld 26 to allow the passage of air between the two compartments. The central volume 10 is divided similarly into three small internally interconnected chambers all of which are inflatable together from the same air source. As previously described with reference to Figure 1a, air is supplied to the pillow 2 through a plurality of inlets 25 so as to inflate each compartment of each of the central, side and base volumes 6, 8, 10, 12. The linear or spot welds 26 which are provided between respective opposed faces of the volumes limit the extent of inflation of the central and side volumes 6, 8, 10. Inflation of the central volume 10 is suppressed to a greater extent than inflation of the side and base volumes 6, 8, 12 on account of a greater number of welds 26 being provided in the central volume 10 than are provided in the side and base volumes 6, 8, 12. In Figure 2a, it can be seen that the welded portions 9 of the pillow 2 provide lateral 28 and longitudinal 30 alignments extending across and along the pillow 2. These alignments 16, 18 are simply provided by linear welding of the opposed faces of the pillow 2. The lateral alignments 28 are positioned at equal inward offsets

from opposed edges of the pillow 2. The lateral and longitudinal alignments 26, 28 serve to separate the central occipital volume 10 from the side and base volumes 6, 8, 12 as mentioned previously.

Figure 2b is a more detailed schematic view of another exemplary form of the pillow 2 of Figure 1a, which is very similar to the embodiment of Figure 2a. However, the pillow 2 of Figure 2b differs from the pillow 2 of Figure 1a principally in that the welded portion 30 does not extend to the side edges of the planar rectangular form structure. In this embodiment, the side and base volumes 6, 8, 12 are fluidly interconnected and define a continuous generally U-shaped volume 7 outward of the central volume 10. This embodiment has the advantage that only a single inflation inlet 25 is required for the inflation of the side and base volumes 6, 8, 12. However, whilst this embodiment can effect nodding movement of a patient's head, it cannot effect side-to-side movement.

Regardless of the precise form of the pillow 2, its construction is arranged such that, under normal inflation conditions, the central volume 10 is inflated to a lesser extent than the side and base adjacent volumes 6, 8 and 12. This situation is shown in the cross-sectional views of Figures 3a and 3b where it is shown that the central volume 10 presents a lower support surface than do any of the peripheral volumes 6, 8, 12 outward of the central inflatable volume 10. By virtue of this arrangement, the patient's occiput 11 can be rested upon the portion 10 of the pillow 2 with the sides of the head supported between the side portions 6, 8 and 4 and the nape of the patient's neck 23 can be supported on the base portion 12 as required by each of the embodiments described herein.

In Figure 4 there is shown a cross-sectional view of a pillow 2 of the present embodiment, the pillow 2 being shown to be inflated with the patient's occipital load 11 resting in the central concavity of inflated volume 10 with sideways support from the inflated side volumes 6, 8. The pillow 2 is further shown to be located within a padded enclosure or pillow case 32 filled with some form of padding 34 of soft material, for example foam or any other

suitable natural or synthetic fibre, so as to give the same comfortable feel as a conventional pillow.

In use of the thus described pillow 2 for the relief of neck pain, the central occipital volume 10 may be subjected to a periodic inflation and deflation process as determined by the periodic cyclic operation within the microprocessor, whilst the volumes 6, 8, 12 are maintained at a constant inflation level. Each phase of inflation of the central volume 10 may advantageously be followed by a prompt release of air from the pillow 2 so as to produce a deflation rate more rapid than the preceding inflation rate. That is to say, the central occipital volume 10 of the pillow 2 may undergo a cyclical first phase inflation followed by a second more rapid phase of deflation, with the side and base volumes 6, 8, 12 maintained at a constant inflation level throughout the process. The inflation/deflation cycle of the central occipital volume 10 typically raises and then lowers the patient's occiput 11, the range of movement being approximately two to three centimetres. The inflated side and base volumes 6, 8, 12 serve to laterally support and maintain proper support and location of the patient's head and the nape of his neck 23 throughout the inflation/deflation cycle.

Figure 5 graphically illustrates how the inflation pressure of the central occipital volume 10 may be varied through one inflation/deflation cycle. As illustrated by the graph, there is a steady increase 36 in inflation pressure from a minimum pressure P_{MIN} to a maximum pressure P_{MAX} over a duration time of approximately two minutes, followed by a more rapid decrease 38 of inflation pressure thereafter. A range of different deflation pressure rates may be used during treatment, and three possible deflation rate paths 38 are illustrated in Figure 5 by way of example. It is to be noted that repetition of the inflation/deflation cycle may commence approximately four minutes after the time at which the previous inflation started.

In this way, the movement of the central occipital volume 10 caused by the inflation/deflation cycle serves to gently massage the neck 23 of a patient whose occiput 11 is resting on the pillow 2. The precise temporal movement of the occiput 11, and hence the particular massage treatment being applied, is determined by controlling the operation of the compressed air pump 4 and the solenoid valves 14, 16 and 18. Therefore, different types of neck pain requiring different types of massage can be treated by simply adjusting the inflation/deflation cycle of the apparatus 1.

The rectangular planar form of the pillow 2 is suitable but not critical for working the invention. It would be possible for the invention to be applied to a circular or other shaped pillow so long as the pillow was appropriately sectioned. The pillow 2 may, as previously described, be made from polyvinylchloride or polyurethane. However, various other types of plastics material or even rubber could be used instead.

Furthermore, it is to be noted that the invention may be used for treatment of patients in a lying or seated position. For example, the pillow 2 of the above described embodiments may be used with a bed mattress or the back of a seat, for example a vehicle seat.

As previously mentioned, whilst the inflation and deflation of the pillow may be designed to move the patient's head only in a nodding fashion, it is readily possible, by appropriate modification of the inflation and deflation arrangement, additionally or alternatively to provide a side-to-side movement of the patient's head. The provision of such a side-to-side rocking movement is beneficial for treating whiplash injuries, for example. The side-to-side rocking movement can be achieved by repeated cyclic operation according to a preset sequence of inflation and deflation steps applied, for example, to the embodiment of Figures 1a, 1b or 2a where the volumes 6, 8 and 10 are inflated/deflated intermittently in accordance with a periodic cyclic sequence of steps programmed into microprocessor 13 while holding the base volume 12 in

a constantly inflated condition to continuously support the patient's neck. Figure 6 shows one such sequence.

Referring to Figure 6, the sequence begins at (i) with side volumes 6 and 8 inflated and central volume 10 deflated so that the patient's head is supported on both sides with the head lying backwards. Volume 10 is then inflated at (ii) and the patient's head 22 moves forward supported against sideways movement by inflated side volumes 6, 8. Volume 10 is then deflated at (iii) and the patient's head 22 is allowed to tilt backwards while remaining in contact with exterior surface 40 of volume 10. With the head tilted backwards as just outlined, volume 6 is deflated at (iv) causing the head to move to the patient's right hand side. Volume 6 is then inflated at (v) and the head 22 is returned to face centrally with the head tilted backwards and supported by volumes 6, 8 to prevent sideways movement. The central volume 10 is then inflated at (vi) and deflated at (vii) to effect a forward nodding movement of the head and a return to the backwards rest position of the head when volume 10 is deflated.

When this latter step is completed, side volume 8 is deflated at (viii) and the head pivots sideways to the patient's left hand side. Side volume 8 is then inflated as at (i) returning the patient's head to a centrally facing position. The nodding/side-to-side movement cycle of the patient's head achieved by the cycle of steps just described is repeated periodically under the control of the microprocessor 13 of the control means.

It is to be noted that the showing of the volumes 6, 8 and 10 in Figure 6 as rectangular is schematic only and illustrative only of their states of inflation and deflation. The actual shapes of the volumes will in all probability be different, particularly when inflated.

The control means is preferably a standard electronic timer control circuitry for controlling the switching of the valves 14, 16, 18 in the manner described herein so as to provide a continuous massaging movement of a patient's neck and head. The order of the cyclic steps can be varied although the

specific order of the individual steps just described is preferred to give the most efficient massage of the patient's neck.

The control timer referred to herein is a standard electronic microprocessor timer switching circuit of the kind which is well known to a skilled engineer working in this art and therefore is not described in detail other than to say the switching circuit is capable of operating the switching of the inflation/deflation sources in the periodic cyclic timing sequence described herein with reference to Figure 6 in particular although other timing sequences can be utilised.

As an alternative to the control of solenoid restrictors from a programmed microprocessor as described hereinabove, the inflatable volumes may alternatively be controlled by a rotor/stator arrangement which has a plurality of fluid ports therein which are angularly positioned about the rotor and stator of the pump, so that upon rotation of the rotor the ports moving with the rotor align selectively with fluid ports on the stator which are in turn connected with the volumes to either maintain the volume inflated or to variably inflate/deflate a chosen volume.

In one such rotor/stator arrangement shown in Figure 7, rotor 40 is rotated by a synchronous drive motor 41 and has, for example, a circular disc 42 mounted on the rotor 40 to extend outwardly in a radial plane relative to a rotational axis 43 of the rotor. The circular disc 42 is provided with a plurality of ports 44 therethrough and upon rotation of the rotor 40 the ports 44 align selectively with similar ports 45 in a planar circular surface 46 of a fixed stator 47. The surface 46 lies parallel with the rotatable disc 42 and, in very close proximity thereto, so that when any one of ports 44 aligns with a port 45 in surface 46 fluid is allowed to pass through the aligned ports into the stator 47.

The stator 47 is a hollow cylindrical housing 48 having in this embodiment three outlets 50, 51, 52 coupled with individual ones or

alternatively a plurality of ones of volumes 6, 8, 10, 12 of the pillow in the embodiment as described with reference to Figure 1a.

Figure 8 illustrates schematically one alternative embodiment in which the rotor/stator control arrangement of Figure 7 is operatable in practice. In this particular embodiment an additional top volume or a separate pillow 55 is shown and this pillow is inflated at all times and lies over the pillow arrangement described with reference to Figure 1a for example. This additional top volume 55 is an entirely optional feature although its presence in either event assists in providing a more comfortable pillow arrangement for a patient but does not detract from the operation of the pillow described with reference to Figure 1a for example. Although the additional top volume 55 is shown as an integral part of the pillow 2, top volume 55 can be a separate pillow 56, as outlined in Figure 9, which completely overlies all the volumes of the previously described pillow 2 but operates in a permanently inflated state whether used with the arrangement utilising a central electronic control microprocessor, or the arrangement to be further described in which the control of the inflation/deflation of the pillow volumes is by the above described rotor/stator arrangement.

Referring more specifically to Figure 8 there is illustrated schematically a variably inflatable/deflatable rotor/stator arrangement for inflating/deflating individual components 6, 8, 10, 12 (hereinafter referred to as volumes) of a pillow 2. In relation to those specific volumes which correspond with similar volumes described with reference to Figure 1a, there is provided a top volume 55 which can be attached as shown in Figure 8 along uppermost edge 57 of the volumes 6, 8, 10 by a plastics weld 9 for separate inflation from the rotor/stator arrangement described above with reference to Figure 7.

The pillow 2 of the embodiment shown in Figure 8 comprises top and base volumes 55, 12, respectively, between which are sandwiched in side-by-

side manner control volumes 6, 10 and 8, volume 10 constituting a central volume upon which a patient's head is arranged to rest in use.

When being operated to provide a therapeutic aid to relieve or prevent neck pain the rotor/stator arrangement operates by initiating electrical connection to switch on a synchronous motor 41. The rotor 40 and disc 42 then begin to rotate and simultaneously an air compressor 60 feeds air under pressure to the stator 47. The radial disc 42 of the rotor 40 rotates with the rotor and when one of the ports 45 in the disc aligns with a port 49 on the stator 47 compressed air from a compressor 60 is fed into the stator and on to a respective pillow volume, say volume 6, through tubular pipe connections 5a, 5b, 5c, 5d and 5e as appropriate.

In the embodiment shown in Figure 8 side volume 6 of pillow 2 is coupled with the pipe 5a for example to feed compressed air through pipe 5a to inflate side volume 6. Pipe 5b is arranged to feed central volume 10, and pipe 5e feeds side volume 8. Base and top volumes 12 and 55 are inflated together continuously from pipes 5a, 5e and 5d via non-return valves 61, 62 which allow the top and base volumes 55, 12 to be inflated permanently. To avoid undue air pressure building up within the system a pressure relieve valve 63 is provided. The volumes 12 and 55 are provided, as with any of the volumes of the pillow 2, with small apertures 64 in the surface 65 thereof to vent the volumes and allow them to deflate when the source of air is removed. However, non-return valves 61, 62 hold the volumes 12, 55 permanently inflated.

Therefore, the rotor disc 42 is effective to cause inflation of volumes 12 and 55 while intermediate volumes 6, 8 and 10 are also inflated at least temporarily together or independently in accordance with the particular positioning of ports on both the rotor and stator, to align or misalign as appropriate to inflate or vent to atmosphere the volumes 6, 8, 10 and 12 to obtain thereby a sequence of operation as is described herein with reference to

Figure 6. No further discussion of the operation of Figure 8 is necessary since it corresponds with the description of Figure 6.

To reiterate, the top volume 55 does not necessarily have to be permanently attached to volumes 6, 8, 10 but may itself take the form of an independent pillow 69 (Figure 9) with say three or more elongate compartments stitched to provide a ribbed effect lengthwise of the pillow, which may overlie the volumes 6, 8, 10 to provide the patient with much more comfort than with the pillow having just volumes 6, 8, 10 and 12. Such an arrangement as just described does not detract from the order of the operation of the apparatus as disclosed with reference to Figure 6 for example. Alternatively, Figure 10 illustrates an arrangement in which the overlying support of Figure 9 is divided into three separate elements 70, 71, 72 which otherwise operate in the same manner as the pillow of Figure 9. Another possibility is to divide the top volume 55 into a number of adjacent sections which could be controlledly inflated and deflated, for example in synchronisation with the side volumes 6 and 8.

The venting of the volumes through small apertures in the pillow can be such that when the various volumes are inflated/deflated they do so only partially and/or at different rates in dependence upon the size of the venting aperture located in the respective volumes. Therefore, for example, whereas side volume 6 in the Figure 6 arrangement is disclosed as being a unitary volume which is inflated/deflated at the appropriate time, side volume 6 may be subdivided into different sub-volumes having different inflation/deflation characteristics. For example, two parallel elongate rows of stitching could sub-divide the volume into three portions A1, A2, A3 as shown in Figures 11 and 12 and small vent holes could be provided in the surface of each portion, preferably, but not necessarily along a row of stitching.

Referring to Figure 11, vent holes 80 are schematically represented along stitch lines 81, 82 and non return valves between the individual portions

are represented at 83 and enable the portions to be inflated through a single inlet as shown. The apertures 80 are chosen to be of different aperture sizes so that when volume 6 is inflated each portion is inflated at a different rate and similarly, when air is no longer supplied, the different portions deflate at different rates. As shown in Figure 12, the different size venting apertures 80 enable, for example, portion A1 to deflate at a lesser rate than say portions A2 and A3 which in turn deflate at different but greater rates so that portion A2 deflates fastest leaving opposite side portion A3 deflated relatively by about 50% of portion A1, while portion A2, the central portion deflates at the greater rate but still remains partially inflated ensuring a patient's head remains supported at all times. Such operation provides greater control of the movement of a patient's head.

When compressed air from the compressor is used to inflate volume 6 portion A1 will inflate first followed by portion A2 and then portion A3 providing the maximum amount of support for the patient's head moves quickly from the external portion A1 through to an inflated portion A2 and then inflated portion A3. Figure 12b illustrates an intermediate inflation position leading to the position shown in Figure 12c where portion A3 fully supports the patient's head while volume 10 is inflated/deflated, with portions A1 and A2 beginning to deflate first through the vents 80.

The advantages for such a volume structure in a neck support pillow is that it enables all the portions A1-A3 to be inflated/deflated together but at different rates thereby controlling movement of the head more accurately than as shown specifically in the Figure 6 arrangement. Of course this finer control construction can be applied to the Figure 6 embodiment or to any of the preceding embodiments.

The embodiments of the invention hereinbefore described are in all respects exemplary only and modifications and variations thereto could be effected without departure from the spirit and scope of the invention as set forth

in the appended claims. Thus, for example, considering the embodiment shown in Figures 1a and 1b which comprises a pillow 2 having three inflatable volumes in line, namely a central volume 10 flanked by side volumes 6 and 8, and an elongate fourth volume 12 extending alongside the three volumes 6, 8, 10, the arrangement could be such that the side volumes 6 and 8 were each divided by a membrane into upper and lower half-volumes or part-volumes, that the upper part volumes were arranged to be inflated via a flow restriction from the central volume 10, and that the lower part volumes and the central volume 10 had their own inflation/deflation inputs as in the Figures 1a and 1b embodiment. With such a modified arrangement, the cycle of operation could be such that the central volume 10 was periodically inflated and deflated, that the upper part volumes of the side volumes 6 and 8 remained permanently inflated by virtue of their flow restrictor connections to the central volume 10 and that the lower part volumes of the side volumes 6 and 8 were alternately inflated and deflated during successive deflations of the central volume 10. This modification would have the effect of maintaining sideways support to the head of a patient during side-to-side rocking and back-and-forward nodding movement.

The base volume 12 throughout the description herein has in all embodiments been permanently inflated and this is because it is important to support firmly the nape of the neck. Accordingly, this permanently inflated portion could be replaced by a foam roll for example.

There has thus been disclosed a number of different embodiments all with the common concept of controlling various volumes of a pillow or support cushion to obtain nodding and/or side-to-side movement so that the head can be therapeutically manipulated to receive or prevent pain therein. Whilst the invention has been described by reference to embodiments for the relief of neck pain, the invention is applicable also to the relief of back pain and the same

embodiments, possibly, with dimensional changes, could be adapted to this function.

CLAIMS:

1. A medical apparatus (1) comprising an inflatable/deflatable support (2) for supporting a head (22) of a patient, characterised in means connected with the support for controlling periodic cyclic movement of the head with a nodding and/or side-to-side motion.

2. An apparatus as claimed in claim 1, wherein the periodic cycle comprises:

a first phase of inflation of the support (2), followed by

a second more rapid phase of deflation of the support.

3. An apparatus as claimed in claim 1 or 2, wherein the support comprises upper and lower panels which are sealed (9) to each other.

4. An apparatus as claimed in claim 3, wherein the upper and lower panels of the support (2) are secured to each other so as to define plural inflatable volumes (6,8,10,12).

5. An apparatus as claimed in any preceding claim, wherein the support (2) comprises a first, generally central, inflatable volume (10) and one or more other volumes (6,8,12) adjoining the central volume on three sides thereof.

6. An apparatus as claimed in claim 5, wherein the one or more other volumes (6,8,12) define a generally U-shape about the generally central volume (10).

7. An apparatus as claimed in claim 5 or 6, wherein the central inflatable volume (10) is connected to the source of inflation fluid for enabling the central volume (10) to inflate and deflate intermittently.

8. An apparatus as claimed in claim 5, 6 or 7, wherein the one or more other volumes (6,8,12) adjoining the central volume are adapted to be inflated to a substantially constant level.

9. An apparatus as claimed in claim 5, 6 or 7, wherein the one or more other volumes (6,8,12) adjoining the central volume (10) are adapted to be alternately inflated and deflated either instead of or in addition to cyclical inflation and deflation of the central volume, so that the patient's head can undergo a side-to-side rocking movement and/or a nodding movement when the apparatus is in use.

10. An apparatus as claimed in any of claims 5 to 8, wherein the one or more other volumes (6,8,12) are fluidly interconnected whereby the same can be inflated via a single orifice (25).

11. An apparatus as claimed in any of the preceding claims, wherein the source (3) of inflation fluid comprises a pump (4).

12. An apparatus as claimed in any of the preceding claims wherein the control means (3) comprises an electronic timer.

13. Medical apparatus (1) for the relief of neck pain, the apparatus comprising:

a fluid inflatable support pillow (2) adapted for interpositioning between a patient's occiput (11) and a head rest; and

a source (3) of inflation fluid connected to the pillow, characterised in the source including control means (4) for controlling the inflation and the deflation of the pillow through a periodic cycle so as to move the patient's head (22) cyclically, in a nodding and/or a side-to-side manner.

14. An apparatus as claimed in any of claims 1 to 13, wherein the inflatable/deflatable support is a pillow.

15. An apparatus as claimed in any of claims 1 to 11, wherein the control means comprises a rotor/stator arrangement.

16. An apparatus as claimed in claim 15, wherein the rotor/stator arrangement cyclically interconnects a source of compressed air with side, control, top or base volumes of a pillow.

17. An apparatus as claimed in any of claims 1 to 14, wherein the control means for controlling the inflation/deflation of the pillow comprises an electronic microprocessor programmed to periodically cyclically control the inflation/deflation.

18. A method of inflating/deflating a support (2) for supporting a head (22) of a patient, characterised in operating means for controlling periodic cyclic movement to the head so that the head moves with a nodding/side-to-side motion.

19. A method as claimed in claim 18, comprising providing a fluid inflatable support (2) having independently operable peripheral volumes (6,8,12) on three sides of a central independently inflatable volume (10),

inflating all volumes, and maintaining constantly inflated one volume (12) arranged to be located behind a patient's neck.

20. A method as claimed in claim 18 or 19, comprising providing an inflated peripheral volume (6,8) on either side, respectively of the patient's head (22) and a deflated central volume (10) to support the patient's head in a backwards rest position against the central volume.

21. A method as claimed in claim 20, comprising inflating the central volume (10) so that the patient's head (22) projects forward and maintaining inflated the peripheral volumes (6) and (8) on either side of the patient's head respectively.

22. A method as claimed in claim 21, comprising inflating the central volume (10) until the patient's head (22) lies backwards and then deflating the peripheral volume (6) on the right hand side of the patient's head so that the patient's head pivots sideways to face to the right.

23. A method as claimed in claim 22, comprising inflating the right hand side peripheral volume (6) to pivot the head to face centrally with the head (22) tilted backwards, inflating and then deflating the central volume (10) to provide a forward nodding and backwards movement of the patient's head.

24. A method as claimed in claim 23, comprising deflating the left hand side peripheral volume (8) to pivot the head to face the left hand side, and then inflating the left hand side peripheral volume (8) to pivot the patient's head (22) to the central facing position with the head lying backwards.

25. A method as claimed in any one of claims 21 to 24 comprising repeating the individual inflation/deflation steps therein in a periodic cyclical manner via operation of the control means (4).

26. A method of supporting a patient's head, the method comprising:

providing a fluid inflatable support pillow (2) such that when the pillow is interposed between a head rest and the patient's occiput, the patient's occiput rests against a central inflatable volume of the pillow (2) supported by peripheral ports of the pillow (6,8) and the patient's neck rests on another peripheral port (12) of the pillow; and

subjecting the patient's occiput, as positioned against the central inflatable volume (10) of the pillow, to periodic cycles of movement resulting from cyclical inflation and deflation of said central inflatable volume.

27. A method as claimed in claim 26, wherein said inflation/deflation cycle comprises a first phase of inflation of the support (2) during which there is a steady increase in fluid pressure from a minimum pressure to a maximum pressure over a predetermined time period (for example approximately two minutes) and a second more rapid phase of deflation of the support (2) during which there is a decrease in fluid pressure from the maximum pressure to the minimum pressure over a time period of less than said predetermined time period.

28. A method as claimed in claim 26 or 27, the method further comprising subjecting the patient's occiput (11) as positioned against the central inflatable volume (10) of the support, to a side-to-side rocking movement resulting from alternate inflation and deflation of said peripheral ports of the support either instead of or in addition to said cyclical inflation/deflation of said central inflatable volume (10).

29. Medical apparatus (1) for the relief, treatment and or prevention of neck pain, the apparatus comprising:

an envelope (10) for interpositioning between a patient's occiput (11) and a head rest, and

a fluid source (3) for periodically supplying fluid to and extracting fluid out of a central concavity (10) in the envelope, the fluid being also supplied to and then retained in one or more peripheral inflatable volumes (6,8,12) of the envelope outward of the central concavity (10).

30. A method of supporting a patient's head, the method comprising providing a fluid inflatable support pillow (2) adapted for interpositioning between a patient's occiput (11) and a head rest therefore; providing a source (3) of inflation fluid when the source is connected to the pillow, characterised in controlling the inflation and deflation of the pillow through a periodic cycle determined by control means (4) connected with the said source of inflation fluid so that when the control means (4) is operative the patient's head (22) is moved cyclically in a nodding and/or side-to-side manner.

31. A method as claimed in any of claims 18 to 30, comprising inflating/deflating a pillow constituting the support for the patient's head.

32. A method as claimed in any of claims 18 to 30, including controlling the inflation/deflation cycle by operating a rotor/stator arrangement.

33. A method as claimed in any of claims 18 to 31, comprising operating an electronic microprocessor to control the periodic cyclic inflation/deflation of an inflatable pillow.

34. An apparatus or method according to any of the preceding claims except adapted for treatment of a patient's back.

The Patent Office

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Application No: GB 9818318.9 **Examiner:** Neil Franklin
Claims searched: All **Date of search:** 30 December 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): A4M

Int Cl (Ed.6): A47G 9/00 A61G 7/057, 7/07, 7/075

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
E,X	GB 2 320 892A	(HUNTLEIGH TECHNOLOGY) See alternating pad of Figure 1	1,13 at least
E,X	GB 2 319 721A	(HUNTLEIGH TECHNOLOGY) See alternating pressure pad 3 in Figure 1 & p1 lines 9-19	1,13 at least
X	GB 2 307 402A	(KCI MEDICAL) See alternating pad of Figure 1	1,13 at least
X	GB 2 290 706A	(GARDENER) See pillow of Figures 5&6	1,13,18, 29,30,34 at least
X	GB 1 398 544	(AUTOROLL) See p2 lines 98-109	1,13,18 at least
X	US 5 197 461	(PETAJAN) See pillow of Figures & lines 6-10 col 1	1,13,18, 29,30 at least
X	US 4 175 297	(ROBBINS) See alternating pad of Figure 1	1,13 at least

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