

Sept. 15, 1959

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2,904,040

CERVICAL BRACE

Filed Aug. 11, 1958

Fig. 1

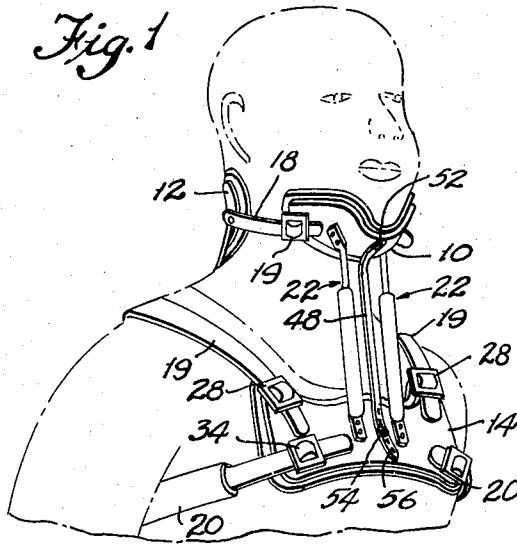


Fig. 4

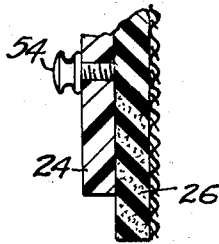
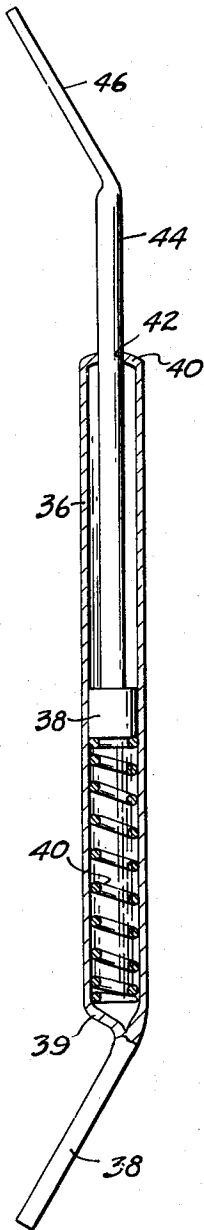


Fig. 3

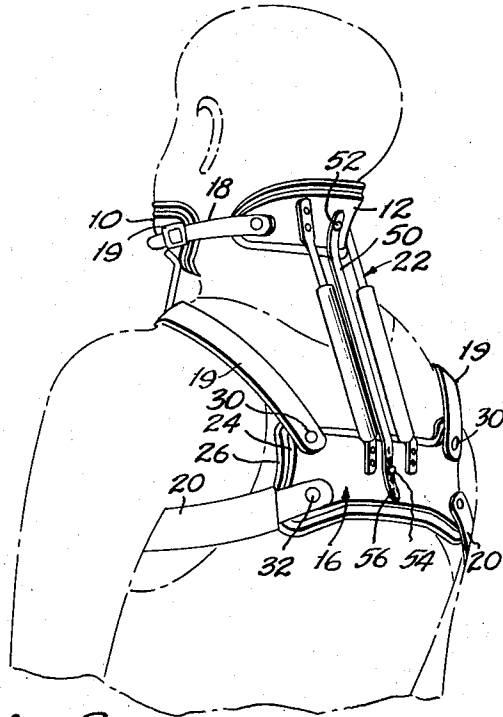


Fig. 2

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2,904,040

CERVICAL BRACE

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Application August 11, 1958, Serial No. 754,326

5 Claims. (Cl. 128—87)

This invention relates to orthopedic appliances generally and in particular to a cervical brace for supporting the head and neck of a patient so as to immobilize the cervical spine during healing of a fracture or correction of a deformity.

The conventional cervical brace provides a truss structure including chest and back pads, suitably strapped to the body of the patient at approximately shoulder level to provide support, a chin cup and a neck (occipital) yoke for applying the support to the patient's head in the areas of the chin and the back of the neck, said chin cup and neck yoke being strapped to one another for snug retention in contact with the chin and neck; and two pairs of struts, commonly referred to as tension rods, for transmitting the support from the chest pad to the chin cup and from the back pad to the occipital yoke respectively. In the past it has been considered necessary that the supporting struts be rigid and unyielding in the transmission of support, although it is common to provide means for adjusting the effective length of the struts, and in some cervical braces, means is provided for adjusting the chin cup and occipital yoke to selected angles of tilt with respect to the supporting struts. In all such cases, however, the support provided by the struts is a relatively rigid, unyielding support and it has been assumed that such is necessary in order to properly immobilize the cervical spine.

The general object of the present invention is to provide a cervical brace which, though embodying the general elements of construction referred to above, is adapted to apply a spring-loaded support of limited yieldability to the chin cup and neck yoke, the spring load being of a sufficiently high value to effect adequate immobilization of the occipital spine and the yieldability, on the other hand, being such as to provide just sufficient freedom of limited movement of the head, particularly in a forward-rearward path, to provide for a limited exercising effect which, although it does not permit of any delaying or injurious effect upon the spinal area being treated, actually improves and speeds up the treatment through the stimulation of circulation and other beneficial effect of limited exercise upon the muscles of the neck and even the muscles in the chin and the back of the head in actual contact with the support applying pads.

A further object is to provide for such spring loaded support in combination with substantially immovable positioning of the axis of the neck and head.

A further object is to provide an improved cervical brace that does not require the conventional length adjustment in the support transmitting struts, and which eliminates the possibility of incorrect adjustment as the result of error in judgment or lack of adequate skill on the part of a medical attendant. In this connection, I find that the conventional cervical brace has the inherent defect, not heretofore recognized, of being substantially incapable of adjustment to provide and maintain exactly the right amount of pressure at each point of pressure application in order to attain maximum therapeutic ef-

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fect, and in this respect an important object of this invention is to provide a brace which will automatically provide the right amount of pressure at each point with minimum dependence upon the skill of the attendant in adjusting the brace.

Other objects and advantages will become apparent in the ensuing specification and appended drawing in which:

Figure 1 is a right front perspective view of my improved cervical brace as worn by a patient;

Figure 2 is a left rear perspective view of the same;

Figure 3 is a fragmentary enlarged sectional view of the laminate construction embodied in the chin cup and neck yoke; and

Figure 4 is an enlarged axial sectional view of one of the support transmitting struts.

Referring now to the drawing in detail, my improved cervical brace comprises, in general, a chin cup 10 to receive and apply support to the chin of a patient (indicated in broken lines); an occipital yoke 12 to embrace and apply support to the back of the patient's neck immediately below the rearwardly protruding rear area of the skull; a chest pad 14 adapted to rest upon and derive support from the chest slightly below the shoulder level; a back pad 16 adapted to rest against and derive support from the patient's back at approximately arm pit level; tie straps 18 connecting the chin cup 10 and occipital yoke 12 to one another on each side of the neck to maintain snug supporting engagement with the chin and neck areas respectively; shoulder straps 19 and arm pit straps 20 for strapping the pads 14 and 16 to the patient's body; and two pairs of my improved struts 22 for transmitting support from the pads 14 and 16 to the chin cup 10 and the occipital yoke 12.

The pads 14 and 16 (Fig. 3) each comprise a stiff face plate 24 for secure attachment of the struts 22, and a cushioning liner sheet 26 of soft, compressible, resilient material for accommodating the respective pad to the surface contours of the patient's body with a cushioning effect. The face plate 24 may be a relatively thick sheet of stiff, synthetic resin plastic material (e.g. relatively unplasticized acrylic thermoplastic resin) while the pad 26 may likewise be a thermoplastic synthetic resin but of the plasticized, foamed structure providing a spongy construction, or of sponge rubber.

The shoulder straps 19 function primarily to support the pads 14 and 16 at a selected height on the patient's body, which height may be adjusted by means of adjustable fasteners (e.g. buckles 28) connecting the forward ends of the straps to the upper corners of the chest pad 14. The rear ends of the straps are detachably attached to the pads 16 by suitable releasable fasteners 30 which may be conventional snap-socket fasteners.

Similarly, the underarm straps 20 are detachably attached to the back pad 16 by snap-fasteners 32, and are adjustably attached to the lower corners of chest pad 14 by adjustable fasteners 34.

Referring now to Fig. 4, each of the struts 22 comprises a cylinder 36 having one end flattened to provide an integral tab 38 which is perforated for riveting the same to the base plate 24 and having its opposite end spun inwardly to provide an annular closure flange 40 defining a cylindrical bearing opening 42. A plunger rod 44 is slidably extended through bearing opening 42 and has a plunger head 38 secured to its inner end and slidably bearing against the inner wall of cylinder 36. A coil spring 40 is engaged under compression between the plunger head 38 and the closed end portion 39 joining the cylinder 36 to the tab 38. The opposite end of rod 44 is flattened to provide a tab 46 which is apertured and riveted to the chin cup 10 (or the neck yoke 12) as the case may be.

The space between plunger head 38 and the closed end

39 of the cylinder is largely filled with grease or other heavy lubricant which lubricates the spring 40 as well as the plunger head 38 to avoid friction between the plunger and the cylinder. The spring 40 is selected to provide (upon slight compression thereof) a spring load which, in the aggregate of all four struts, will automatically provide exactly the right amount of supporting pressure as applied to the chin cup and occipital yoke respectively.

The range of possible movement between the head pieces 10, 12 and the chest and back pads 14 and 16 may be restricted by front and rear regulator straps 48 and 50 each having one end anchored by a rivet 52 to a respective head piece 10 or 12, and each having an adjustable connection to a respective pad 14 or 16 consisting in a button 54 anchored in a respective face plate 24 and a series of button holes 56 in the other end of the respective strap, to selectively receive the button 54 to provide varying effective lengths of strap.

In the installation of the brace, the operator or attendant, after initially installing the brace on the patient's body with the chin cup and occipital yoke in engagement with the chin and neck respectively, will adjust the height of the pads 14 and 16 (by adjusting the buckles 28) until the springs 40 are placed under compression. The operator will adjust the loading of the springs to meet the requirements of the case. A variation in the amount of spring deflection may be tolerated within a small range without unfavorably varying the value of the spring load. This is in contrast to the requirement for adjustment of the rigid struts of the conventional brace to exactly the right length in order to apply the proper amount of pressure. Furthermore, after the brace has been installed, with the proper amount of spring loading, the brace will accommodate a small range of relative movement between the chin cup and occipital yoke on the one hand and the chest and back pads on the other hand, the springs either compressing further or elongating to accommodate such limited movements, and yet the head will continue to be supported with the neck axis substantially fixed (against lateral or fore-aft tilting) with respect to the shoulder axis and main body axis of the patient. At the same time, the limited amount of movement which is permitted is such as to provide for almost automatic exercising of the neck muscles so as to stimulate circulation in the area being treated, and will thereby hasten, as well as facilitate the treatment and healing processes.

I claim:

1. In a cervical brace, in combination: chest and back pads for engagement with a patient's chest and back respectively; shoulder and under-arm straps connecting said pads and oriented for arching over the patient's shoulders and extending around the sides of the patient's chest beneath the arms respectively; a chin cup and an occipital yoke adapted to engage respectively the chin and the back of the patient's neck; a pair of struts attached at respective ends to the chest pad and chin cup respectively; and a pair of struts attached at respective ends to the back pad and occipital yoke respectively; each of said struts comprising a cylinder having a closed end provided with attaching means, a piston slidable in said cylinder, a piston rod attached at one end to said piston and slidably extending through the other end, and a coil spring in said cylinder, engaged under compression between said closed end thereof and said piston and providing yielding spring-loaded support for the patient's chin and occipital area respectively.

2. In a cervical brace, in combination: chest and back pads for engagement with a patient's chest and back respectively; shoulder and under-arm straps connecting said pads and oriented for arching over the patient's shoulders and extending around the sides of the patient's chest beneath the arms respectively; a chin cup and an occipital yoke adapted to engage respectively the chin and the back of the patient's neck; tie means extending between and joining the chin cup and occipital yoke at the respective

sides of the patient's neck; a pair of struts attached at respective ends to the chest pad and chin cup respectively; and a pair of struts attached at respective ends to the back pad and occipital yoke respectively; each of said struts comprising a cylinder having a closed end provided with attaching means, a piston slidable in said cylinder, a piston rod attached at one end to said piston and slidably extending through the other end of the cylinder, said piston rod having attaching means at its other end, and a coil spring in said cylinder, engaged under compression between said closed end thereof and said piston and providing yielding spring-loaded support for the patient's chin and occipital area respectively.

3. In a cervical brace, in combination: chest and back pads for engagement with a patient's chest and back respectively; shoulder and under-arm straps connecting said pads and oriented for arching over the patient's shoulders and extending around the sides of the patient's chest beneath the arms respectively; a chin cup and an occipital yoke adapted to engage respectively the chin and the back of the patient's neck; a pair of struts attached at respective ends to the chest pad and chin cup respectively; and a pair of struts attached at respective ends to the back pad and occipital yoke respectively; regulator straps anchored at one end to the chin cup and occipital yoke respectively; means for adjustably attaching the other ends of said straps to the chest and back pads respectively for varying the effective lengths of said regulator straps so as to provide regulated limits of spring-actuated extension of said struts; each of said struts comprising a cylinder having a closed end provided with attaching means, a piston slidable in said cylinder, a piston rod attached at one end to said piston and slidably extending through the other end of the cylinder, said piston rod having attaching means at its other end, and a coil spring in said cylinder, engaged under compression between said closed end thereof and said piston and providing yielding spring-loaded support for the patient's chin and occipital area respectively.

4. In a cervical brace, in combination: chest and back pads for engagement with a patient's chest and back respectively; shoulder and under-arm straps connecting said pads and oriented for arching over the patient's shoulders and extending around the sides of the patient's chest beneath the arms respectively, said shoulder straps embodying adjustable buckle means for varying their effective lengths so as to vary the vertical spacing between said pads and said chin cup and occipital yoke, thereby to vary the spring loading in said struts; a chin cup and an occipital yoke adapted to engage respectively the chin and the back of the patient's neck; tie means extending between and joining the chin cup and occipital yoke at the respective sides of the patient's neck; a pair of struts attached at respective ends to the chest pad and chin cup respectively; and a pair of struts attached at respective ends to the back pad and occipital yoke respectively; means for adjustably attaching the other ends of said straps to the chest and back pads respectively for varying the effective lengths of said regulator straps so as to provide regulated limits of spring-actuated extension of said struts; each of said struts comprising a cylinder having a closed end provided with attaching means, a piston slidable in said cylinder, a piston rod attached at one end to said piston and slidably extending through the other end of the cylinder, said piston rod having attaching means at its other end, and a coil spring in said cylinder, engaged under compression between said closed end thereof and said piston and providing yielding spring-loaded support for the patient's chin and occipital area respectively.

5. In a cervical brace, in combination: chest and back pads for engagement with a patient's chest and back respectively; shoulder and under-arm straps connecting said pads and oriented for arching over the patient's shoulders and extending around the sides of the patient's

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chest beneath the arms respectively; a pair of head pieces consisting in a chin cup and an occipital yoke respectively adapted to engage respectively the chin and the back of the patient's neck; tie means extending between and joining the chin cup and occipital yoke at the respective sides of the patient's neck; a pair of struts attached at respective ends to the chest pad and chin cup respectively; and a pair of struts attached at respective ends to the back pad and occipital yoke respectively; regulator straps anchored at one end to the chin cup and occipital yoke respectively; means for adjustably attaching the other ends of said straps to the chest and back pads respectively for varying the effective lengths of said regulator straps so as to provide regulated limits of spring-actuated extension of said struts; each of said struts comprising a

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cylinder having a closed end provided with means attaching the same to a respective pad, a piston slidable in said cylinder, a piston rod attached at one end to said piston and slidably extending through the other end of the cylinder, said piston rod having means at its other end attaching it to a respective head piece, and a coil spring in said cylinder, engaged under compression between said closed end thereof and said piston and providing yielding spring-loaded support for the patient's chin and occipital area respectively.

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