United States Patent [19]

Sconce

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[54] **INFLATABLE SPLINT**

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[52] **U.S. Cl.**..... **128/89 R**; 128/402; 128/DIG. 20

[51] **Int. Cl.** **A61f 5/04**

[58] **Field of Search** 178/89, 87, 402, 399, 400, 178/DIG. 20

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[57] **ABSTRACT**

An inflatable splint includes overlying flexible inner and outer sheets sealed around their peripheral edges to form a fluid impervious, air inflatable bladder. A plurality of spaced apart pockets on the inner sheet of the bladder may contain therapeutic substances, such as hot or cold compresses, chemical cold packs, ice packs, or the like which are removably placed in selected ones of the pockets for treating an injured extremity of a user. The bladder is placed around the injured area of the user's extremity so that the therapeutic substances contained in the pockets overlie the injured area. The bladder can be attached to the user in a variety of configurations by releasable fasteners such as tabs containing one type of Velcro material spaced around one half of the bladder outer edge, and spaced apart sections of a cooperating type of Velcro material located along the other half of the bladder outer edge. The bladder is inflated to immobilize the injured extremity and to force the therapeutic substances into pressure contact with the injured area. A pair of fluid inlets on opposite sides of the bladder outer sheet enable the user to apply the splint to either arm and still be in position to inflate the splint.

7 Claims, 3 Drawing Figures

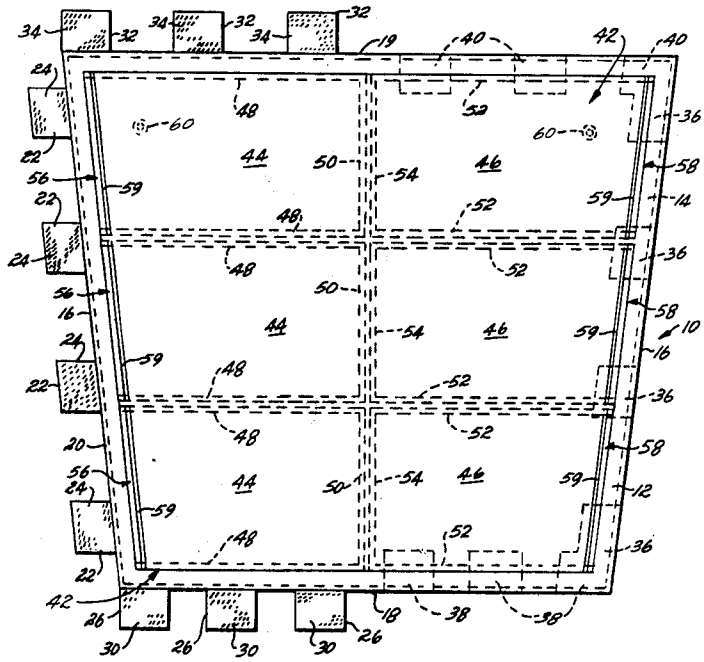


Fig. 1

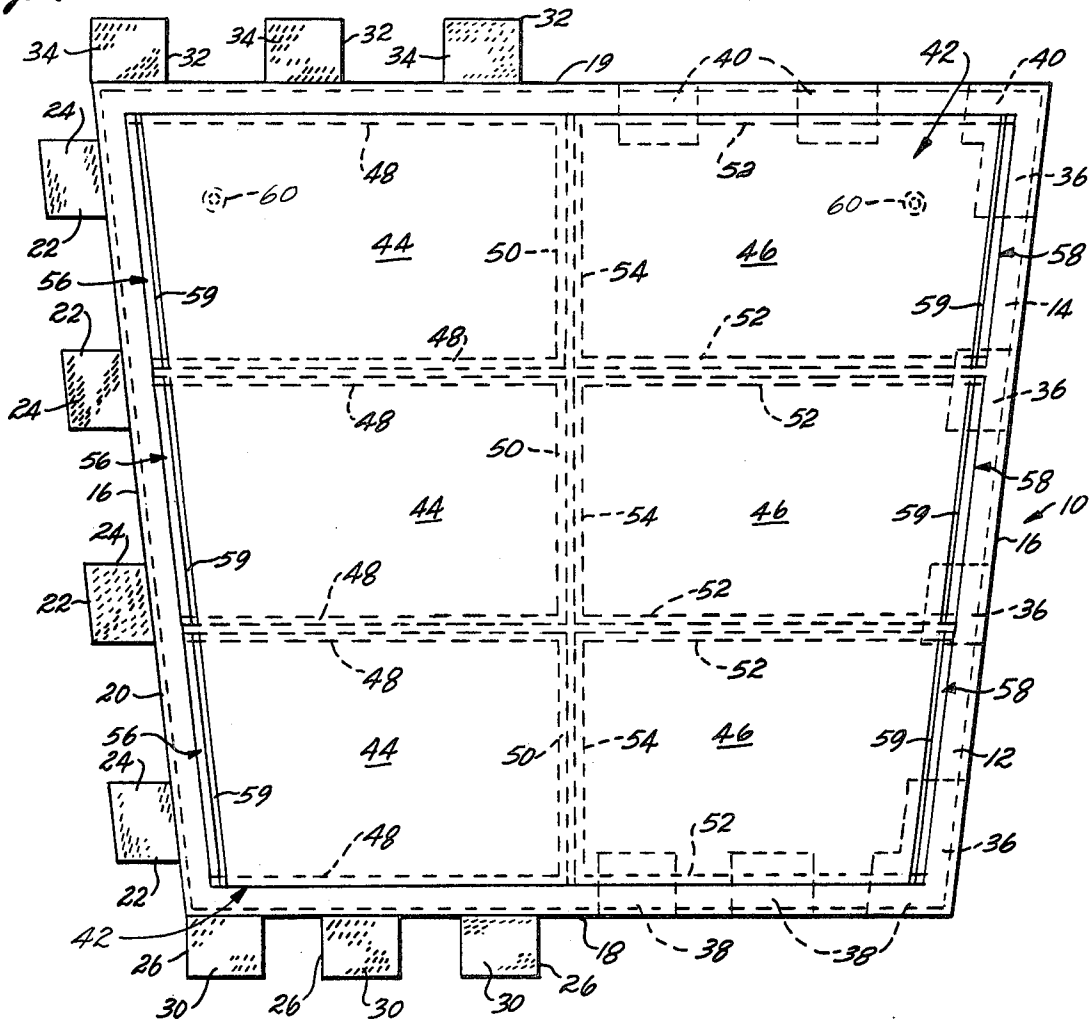
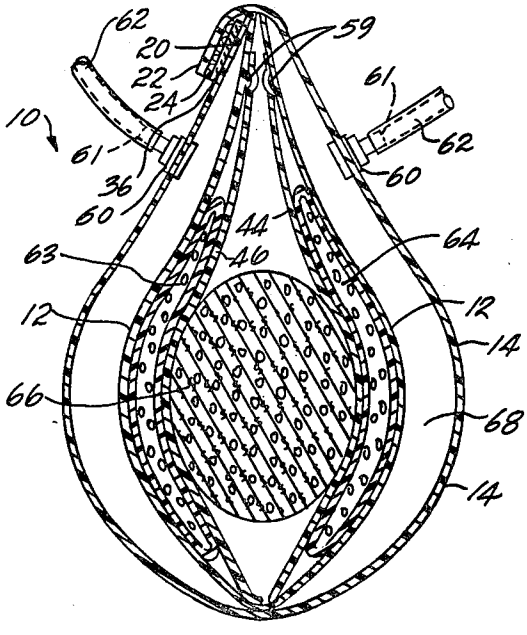

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Fig. 3


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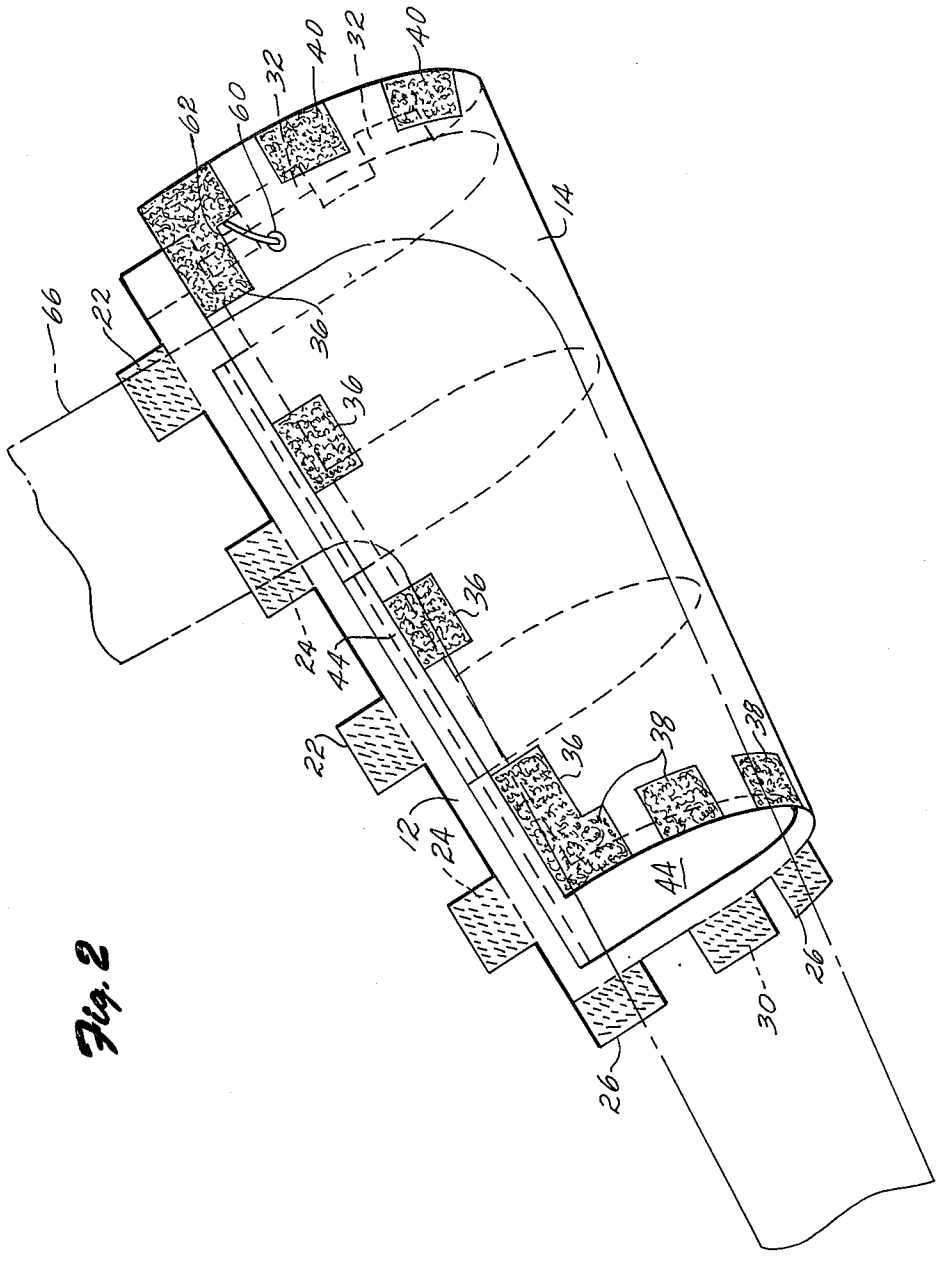


Fig. 2

INFLATABLE SPLINT

BACKGROUND

This invention relates to inflatable splints, and more particularly to a splint for immobilizing an injured extremity and concurrently applying thermal pressure to an injured area of the immobilized extremity.

Inflatable splints generally include a bladder which is releasably secured around an injured arm or leg and then inflated to stiffen it so it will support the injured extremity. An inflatable splint also can act as a tourniquet by restricting the flow of blood to the injured area in accordance with the amount of pressure it exerts.

Recently, some inflatable splints have been combined with a second bladder which contains crushed ice or the like to be held around the injured arm or leg when the adjoining air-filled bladder of the splint is inflated. Such thermal pressure applying inflatable splints are described, for example, in U.S. Pat. No. 3,548,819 to Davis et al. and U.S. Pat. No. 3,561,435 to Nicholson. Generally speaking, the cooling medium in such splints is used to reduce swelling or pain while the injured extremity is being temporarily immobilized. However, the splints disclosed in these patents are of limited anatomical use, and they also limit the type of cooling or heating media which can be used as well as the manner in which the cooling or heating medium is applied to the injured area.

SUMMARY

This invention provides an inflatable splint capable of applying thermal pressure to an injured area of a patient's body. The splint can be applied in a large number of configurations throughout the body, such as at the shoulders, elbows, knees, neck, and ankles, as well as the arms and legs of the patient. The splint also can be used to apply a variety of cooling or heating media as well as being able to easily vary the area of contact between the cooling or heating medium and the patient's body depending upon the location and extent of the injury. Thus, the inflatable splint provided by this invention is an improvement over the pneumatic splint disclosed in my U.S. Pat. No. 3,338,237.

Briefly, the splint of this invention in its preferred embodiment includes an inflatable bladder having inner and outer walls made of a fluid impervious, flexible material and sealed around its peripheral edges to form a hollow interior for use in holding a supply of fluid in the bladder. A plurality of spaced apart pockets cover a major portion of the bladder inner wall. The pockets have respective openings in them for permitting separate thermal swelling retardant substances such as cold compresses or chemical cold packs, or any other therapeutic treatment medium to be removably inserted in selected ones of the pockets.

Fastening means secured to the peripheral edges of the bladder releasably attach opposite portions of the bladder to hold the bladder around the injured area of an extremity of a patient so that one or more pockets which contain the thermal treatment medium can be placed against the injured area. Fluid inlet means opening through the outer wall of the bladder admit a supply of fluid under pressure to the interior of the bladder to inflate it so as to substantially immobilize the injured extremity and also to force the thermal treatment media contained in the pockets into pressure contact with the injured area.

In a preferred form of the invention, a pair of fluid inlets on opposite sides of the bladder outer wall enable the patient to apply the splint to either arm and still be in position to inflate the splint. Moreover, the bladder can be attached to the patient in a variety of configurations by releasable fastening means which preferably include a series of spaced apart tabs containing a first type of Velcro material spaced around substantially one-half of the bladder outer edge, and spaced apart sections of a cooperating type of Velcro material located around the other half of the bladder. The fasteners are spaced around the entire outer periphery of the bladder and are located so as to leave gaps around the outer edge of the folded bladder when they are fastened. This enables various portions of a patient's different extremities to pass through the gaps, thereby accommodating the various extremities of the patient's body in various angular configurations so the area of pressure contact between the thermal treatment medium and the patient's body can be easily varied in accordance with the location and extent of the patient's injury.

DRAWINGS

These and other aspects of the invention will be more fully understood by referring to the following detailed description and the accompanying drawings, in which:

FIG. 1 is a plan view showing the pneumatic splint of this invention in flat form;

FIG. 2 is a perspective view showing the splint of FIG. 1 in the process of being attached to an injured extremity of a patient; and

FIG. 3 is a cross-sectional elevation view showing the splint in its inflated condition applying a thermal-type therapeutic medium to the extremity of the patient.

DESCRIPTION

Referring to FIG. 1, an inflatable splint **10** comprises an inflatable bladder made from overlying inner and outer sheets **12** and **14**, respectively, of a flexible, fluid-impervious material such as crystal clear polyvinyl or polyethylene sheeting. In a preferred form of the invention, the overall shape of the bladder in its flat form is tapered toward one end and preferably is trapezoidal in shape as shown in FIG. 1. The bladder thus defines a pair of nonparallel spaced apart longitudinal edges **16** which are intersected by a pair of spaced apart and parallel short and long lateral edges **18** and **19**, respectively. The peripheral edges of the bladder are sealed by a heat seal seam **20** which is continuous around the trapezoidal outer periphery of the bladder to form a fluid-tight hollow interior of the bladder.

Fasteners formed along the longitudinal and lateral edges of the bladder provide means for releasably securing the bladder in a variety of folded configurations so that the bladder can surround various areas of any extremity of a patient which may become injured, such as a patient's shoulders, elbows, knees, neck, ankles, as well as his arm and leg. The fasteners include a series of longitudinally spaced apart, flexible tabs **22** preferably formed from the polyvinyl or polyethylene sheeting, along one longitudinal edge of the bladder. A separate section of Velcro hook material **24** is secured to each tab **22**. A series of similarly shaped flexible spaced apart tabs **26** project outwardly along the left half of the short lateral edge **18** of the bladder, and a separate section of Velcro hook material **30** is secured to each

tab **26.** Similarly, a series of spaced apart tabs **32** are formed opposite tabs **26** along the left half of the long lateral edge **19** of the bladder, and respective sections **34** of Velcro hook material are secured to tabs **32.** Velcro hook material sections **24, 30** and **34** are secured to their corresponding tabs in an upwardly facing direction when the inner sheet **12** of the bladder faces upwardly as in FIG. **1.**

A series of longitudinally spaced apart sections **36** of Velcro pile material are secured along the longitudinal edge **16** opposite the edge where tabs **22** are formed. Each Velcro section **36** is aligned opposite a corresponding tab **22** and is secured to the outer sheet **14** of the bladder (facing away from the view in FIG. **1**) so that tabs **22** can be folded over the longitudinal edge on the opposite side of the bladder to releasably engage their corresponding Velcro pile sections.

A series of spaced apart sections **38** of Velcro pile material are fastened along the right half of lateral edge **18,** the spacing between Velcro sections being identical to that for Velcro tabs **26.** Similarly, a second series of spaced apart sections **40** of Velcro pile material are secured along the remaining half of the lateral edge **19,** the spacing between Velcro sections **40** being identical to that between tabs **32.** Velcro sections **38** and **40** are secured to the outer sheet **14** of the bladder, so they can be releasably attached to their corresponding Velcro sections **30** and **34** when the bladder is folded along its centerline into a position in which the bladder can be wrapped around an injured extremity, as shown in FIG. **2.**

A third sheet **42** of flexible fluid-impervious material such as crystal clear polyvinyl or polyethylene sheeting overlies inner face **12** of the bladder. Sheet **42** is bonded to the inner sheet of the bladder so as to form a plurality of spaced apart pockets covering a major portion of the inner sheet **12** of the bladder. Preferably, a row of three pockets **44** is formed along the half of the bladder where the Velcro fastener tabs are located, and a second row of three pockets **46** is located on the other half of the bladder. Sheet **42** preferably is bonded to inner sheet **12** by parallel heat seals **48** which form the sides of the three pockets, and by heat seals **50** along the centerline of the bladder for forming the bottoms of the three pockets. Similarly, pockets **46** are formed by parallel heat seals **52** which form the sides of the three pockets, and by heat seals **54** along the centerline adjacent heat seals **50** for forming the bottoms of pockets **46.** Pockets **44** have corresponding openings **56** located adjacent one longitudinal edge of the bladder, and pockets **46** have corresponding openings **58** located along the other longitudinal edge **16** of the bladder. Preferably, the open tops of pockets **44** and **46** are releasably closed by corresponding molded plastic zippers **59** (see FIG. **3**), although other means can be used to provide a releasable, substantially fluid-tight closure for the tops of the pockets.

A pair of filler valves **60** open through opposite halves of the outer sheet **14** of the bladder. Each valve preferably includes a screw cap fitting **61** (shown in FIG. **3**) which can be turned manually to either open or close the fluid inlet port through the valve so as to admit gas under pressure to the interior of the bladder. Separate elongated hose extensions **62** are connected to the threaded fittings **61** of the filler valves.

FIGS. **2** and **3** illustrate the use of inflatable splint **10.** Pockets **44** and **46** provide means for applying either hot or cold treatment to an injured area of the patient's body. For example, separate chemical cold packs **63, 64** can be removably placed in the pockets on opposite sides of the splint to counteract swelling and/or restrict blood flow from the injured area. Alternatively, cold or hot compresses, ice packs, or the like, can be inserted in selected ones of the pockets. The molded plastic zippers **59** at the open tops of the pockets provide a substantially fluid-tight releasable closure when crushed ice or other fluids are disposed in the pockets. The separate openable and closable pockets also allow cold or hot treatment to be applied in a variety of forms, and they also provide means for quickly and easily controlling the configuration and area of coverage in which the hot or cold treatment is applied in accordance with the location and extent of the patient's injury.

Once the appropriate hot or cold treatment medium is placed in the pockets of the bladder, the bladder is then folded so it can be wrapped around the injured extremity, such as a patient's arm **66** illustrated in FIGS. **2** and **3.** The bladder is folded so that the tabs on the left half of the bladder can be folded over the opposite outer edges along the right half of the bladder to releasably attach certain of the Velcro fasteners to each other depending upon the portion of the patient's body to which the splint is being applied. The fasteners are spaced apart so that gaps can be provided at certain locations along the three outer edges of the bladder remote from the folded portion thereof for allowing passage of the injured extremity. For example, in the application illustrated in FIG. **2,** gaps can be left to accommodate the upper arm and front forearm of the patient. Since the fasteners are spaced along each of the three overlapping edge portions of the folded bladder, the edge portions which remain between the gaps can be releasably sealed to hold the splint snugly in place on the patient's arm and to reduce as much as possible any loss of thermal energy to the exterior of the closed splint.

After the splint is in place on the patient's arm, the bladder is inflated by admitting air through either or both of the filler ports to stiffen the bladder so as to temporarily immobilize the injured extremity. After the desired amount of gas pressure is admitted to the bladder, the appropriate filler valve is closed to retain the desired amount of pressure. The air not only immobilizes the injured extremity, but the air pressure in the bladder also can be varied to regulate blood flow, which then allows the splint to act as a tourniquet.

Thus, the inflatable splint of this invention combines the restrictive properties of the conventional inflatable splint with the capability of applying a variety of different thermal treatment media in a large number of configurations to an injured area of any of the patient's extremities which are subject to injury.

I claim:

1. An inflatable therapeutic splint comprising

an inflatable bladder having inner and outer walls made of a fluid-impervious, flexible, foldable material and sealed around the peripheral edges thereof to form a hollow interior for receiving and holding therein a supply of inflation fluid under pressure, the bladder having a pair of opposed longitudinal edges extending along the length of the bladder, the bladder being foldable on itself centrally of the longitudinal edges for substantial registration of the longitudinal edges, the bladder when so folded

being elongated in a direction along the longitudinal edges,

a plurality of pockets secured to the inner wall of the bladder, the pockets having respective openings thereinto for permitting separate thermal treatment media such as cold or hot compresses, ice packs, or the like to be removably inserted in selected ones of the pockets, the pockets being arranged on the bladder in at least three rows spaced apart along the elongate extent of the bladder with each row extending transversely of the elongate extent of the bladder,

cooperating fastening means secured to the opposite longitudinal edges of the bladder and extending along the length thereof for releasably attaching the opposite longitudinal edges of the bladder when folded to each other to hold the bladder around an extremity of a user with the elongate extent of the bladder aligned with the length of the extremity so that the three rows of pockets are disposed in series along the length of the extremity, and

fluid inlet means opening through the outer wall of the bladder for admitting inflation fluid under pressure to the interior of the bladder to inflate it when folded around a user's extremity to substantially immobilize the extremity and to force the three rows of pockets into thermal pressure contact with the extremity.

2. Apparatus according to claim **1** including means for releasably closing the opening in each pocket.

3. Apparatus according to claim **1** in which the peripheral edges of the bladder include a pair of opposite lateral edges intersecting the longitudinal edges thereof to form a bladder which, in flat form, is divided into right and left halves, and including a first type of fastening means extending around the peripheral edge of the right half of the bladder, and a second type of fastening means for releasably attaching itself to the first fastening means and extending around the peripheral edge of the left half of the bladder.

4. Apparatus according to claim **3** in which the first fastening means are spaced apart along one longitudinal edge and substantially half of each lateral edge on a right half of the bladder and are arranged for cooperation with corresponding spaced apart second fastening means on a left half of the bladder so that releasable engagement of the corresponding first and second fastening means will maintain the right and left halves of the bladder in an overlying relation for fitting around the extremity.

5. Apparatus according to claim **1** in which each pocket has a closure for providing a releasable fluid-tight seal.

6. Apparatus according to claim **1** including a pair of side-by-side pockets in each row of pockets on the bladder.

7. Apparatus according to claim **1** wherein each row of pockets extends substantially entirely transversely of the elongate extent of the bladder.

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