

Sept. 25, 1956

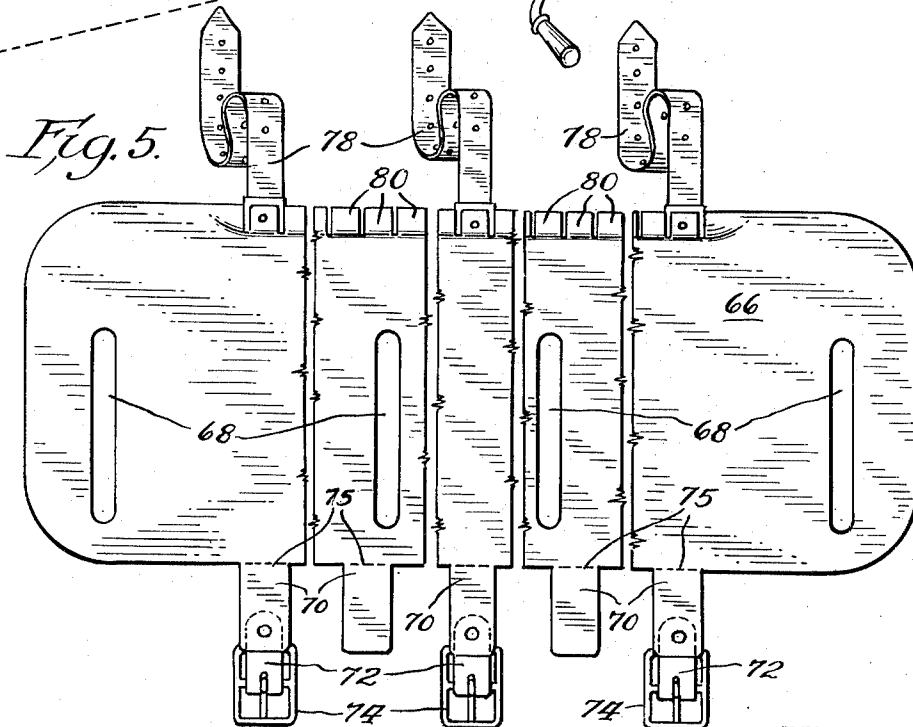
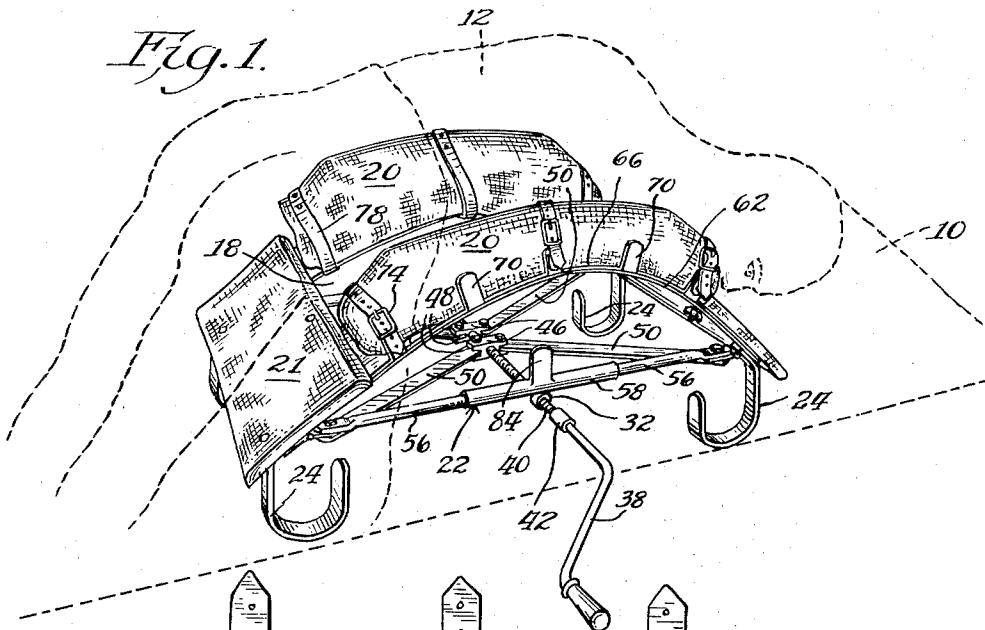
J. J. ETTINGER ET AL

2,764,150

CONVEX SPINAL FRAME

Filed June 11, 1954

3 Sheets-Sheet 1



INVENTORS
Joe J. Ettinger
and *Robert E. Delp*
By *Mann, Brown and Hansmann*
ATTORNEYS

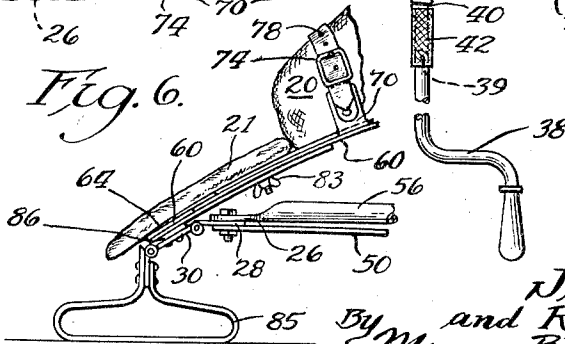
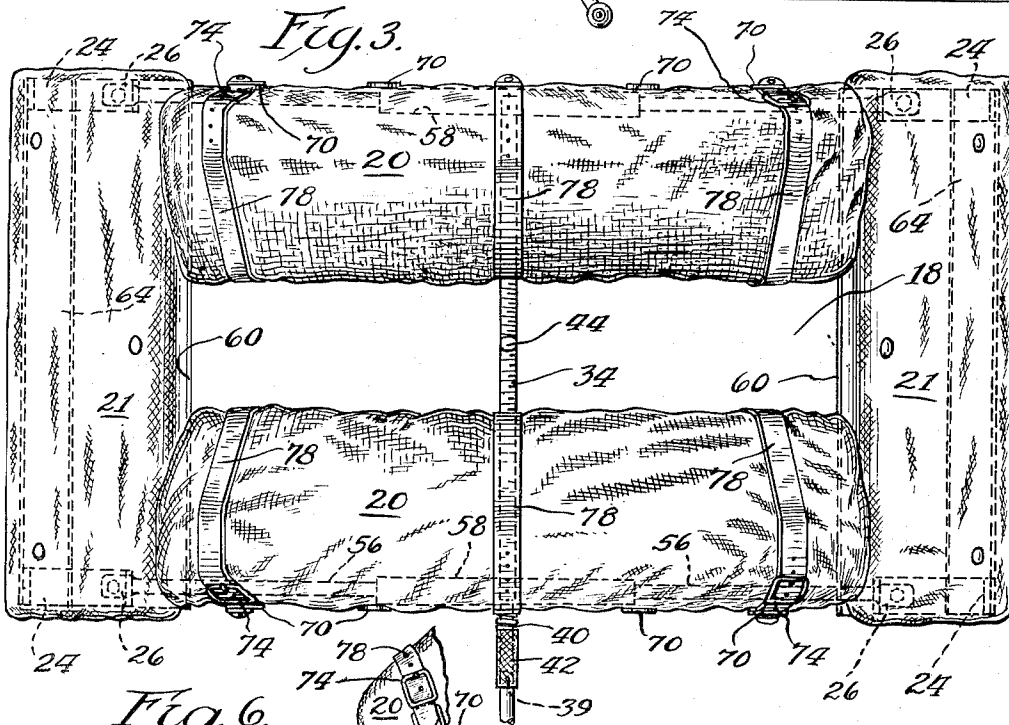
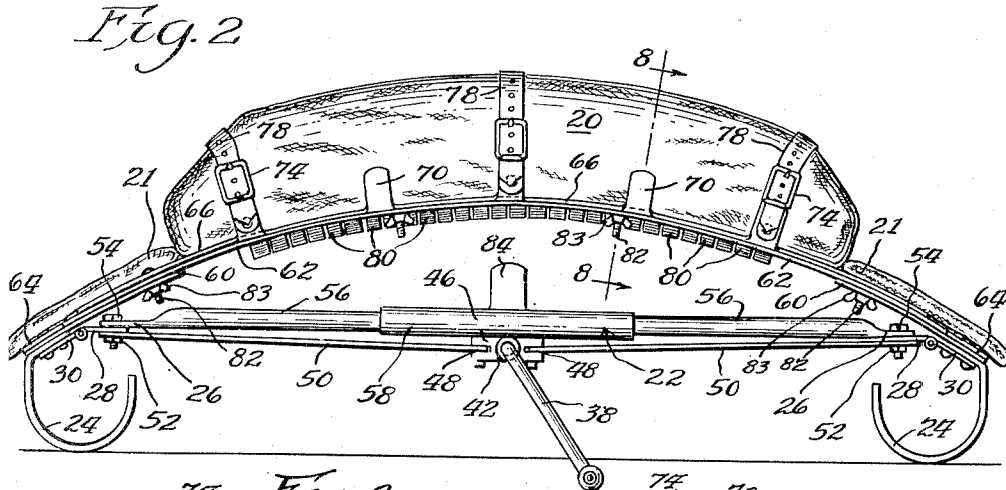
Sept. 25, 1956

J. J. ETTINGER ET AL
CONVEX SPINAL FRAME

2,764,150

Filed June 11, 1954

3 Sheets-Sheet 2



INVENTORS
Joe J. Ettinger
and Robert E. Delp.
By *Mann, Brown and Hanemann.*

ATTORNEYS

Sept. 25, 1956

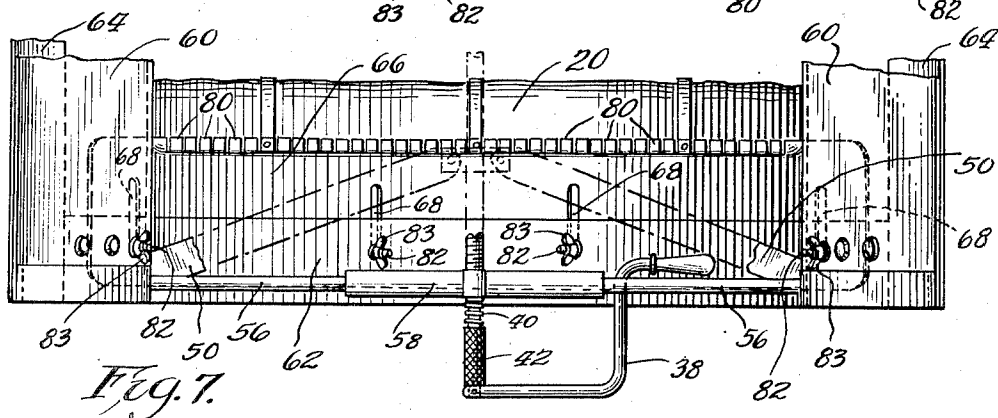
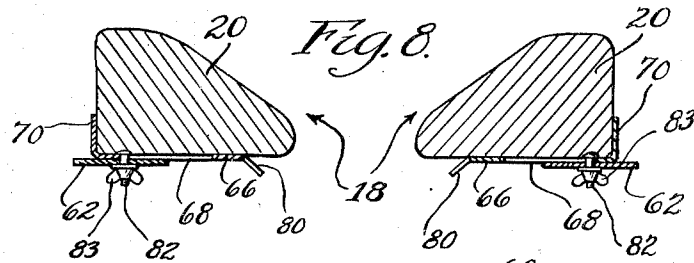
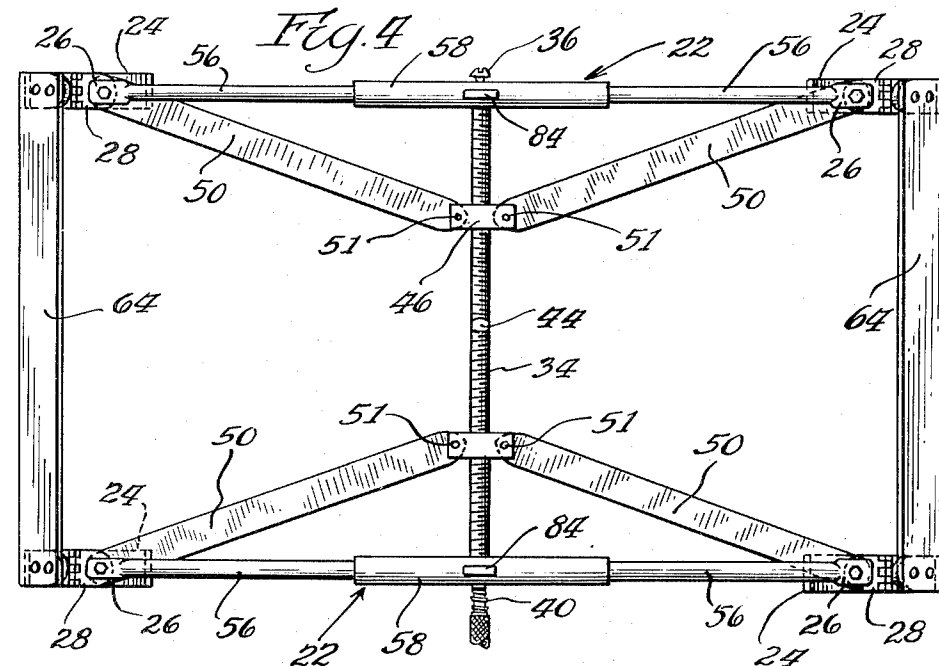
J. J. ETTINGER ET AL

2,764,150

CONVEX SPINAL FRAME

Filed June 11, 1954

3 Sheets-Sheet 3



INVENTORS
*Joe J. Ettinger
and Robert E. Delp.*
By *Mann, Brown and Hansmann*
ATTORNEYS

1

2,764,150

CONVEX SPINAL FRAME

Joe J. Ettinger and Robert E. Delp, Warsaw, Ind., assignors to Zimmer Manufacturing Company, Warsaw, Ind., a corporation of Indiana

Application June 11, 1954, Serial No. 436,213

9 Claims. (Cl. 128—84)

This invention relates to improvements in spinal frames and is particularly concerned with a novel convex spinal frame that reduces bleeding of the patient and that is readily adjustable to the needs of the operation and the physique of the patient.

With the spine frames presently employed in spine surgery, the greatest difficulty encountered is control of bleeding, particularly is this so in the case of the intervertebral disc operation. The patient is positioned on a spine frame with his abdomen pressing against the frame so that breathing must be done against his body weight. This necessarily greatly increases venous back pressure and accelerates venous oozing. The increased venous back pressure is largely due to the fact that the vena cava inferior is at least partially contracted as the abdomen and adjacent organs exert pressure thereon.

Many solutions for this problem have been suggested and tried with but little improvement in the control of bleeding. Spine operations have even been conducted with the patient lying on his side but this makes it extremely difficult to obtain proper lighting, a very dangerous condition for serious operations of this nature.

Accordingly, it is the principal object of the present invention to provide a spine frame that facilitates breathing and eliminates the dangerous increases in venous back pressure, thereby assisting in the control of bleeding.

An object of the present invention is to provide a spine frame that will properly flex the spine to provide most efficient access to the intervertebral disc.

Another object is to provide for adjusting the flexion of the spine frame.

Another object is to provide for manually adjusting the flexion of the spine frame when the patient is positioned thereon.

Another object is to provide for a lateral adjustment of the spine frame in accordance with the physique of the patient.

A further and additional object is to provide an extensible spine frame that easily glides over its supporting surface to permit flexion adjustments.

Other objects and advantages of the present invention will be apparent during the course of the following description.

In the accompanying drawings, forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same:

Fig. 1 is a perspective view of the convex spinal frame of the present invention with a patient positioned thereon and with the frame fully flexed;

Fig. 2 is a side view of the convex spinal frame with the frame only partially flexed;

Fig. 3 is a plan view of the convex spinal frame of Fig. 2;

Fig. 4 is a view of the extensible supporting structure only with the flexible frame removed;

Fig. 5 is a plan view of the pad supporting panel of the frame of the present invention;

Fig. 6 is a fragmentary side view of one end of the con-

2

vex spinal frame illustrating a modified form of support leg;

Fig. 7 is an underneath view of one-half of the convex spinal frame illustrating the arrangement of the pad supporting panel on the flexible frame; and

Fig. 8 is a sectional view taken along line 8—8 of Fig. 3.

It should be understood that the description of the preferred form of the invention is for the purpose of complying with section 112, Title 35, of the United States Code, and that the appended claims should be construed as broadly as the prior art will permit.

Referring to Figs. 1 and 2, the preferred form of the present invention is shown mounted on an operating table 10 with a patient 12 positioned thereon. Broadly the device consists of an extensible supporting structure and a flexible frame secured to the supporting structure at each end thereof and bridging the same. The arrangement is such that the curvature of the flexible frame may be adjusted as desired by extending or retracting the supporting structure. Fig. 1 illustrates the fully flexed position of the frame and Fig. 2 illustrates an intermediate position.

As is best seen in Figs. 1, 3 and 8, the convex spinal frame of the present invention is provided with a central opening 18 bounded by a pair of generally wedge-shaped pads 20. The pads 20 are positioned on the frame so that they face each other, that is, each pad tapers inwardly toward the opening 18. These pads support the anterior iliac spines of the patient so that the abdomen is located over the central opening 18. This arrangement facilitates breathing and eliminates the dangerously high venous back pressures usually associated with spine operations, thus permitting a more effective control of bleeding. This improved control of bleeding obtains because the abdomen overhangs the opening 18 and is free of the body weight and there is no pressure tending to contract the vena cava inferior and thereby increase the venous back pressure.

It is frequently necessary to vary the flexion of the frame during an operation in order to afford better access to the spine. Accordingly, the extensible supporting structure is manually adjustable while the patient is positioned on the frame. This structure, as shown in Figs. 1, 2, and 4, consists of a pair of parallel, lengthwise extending tube assemblies 22 supported at each end by arcuate feed 24. The tube assemblies 22 are flattened at each end to provide mounting pads 26 that are adapted to be attached to the inside pad 28 of a hinge, the outer pad 30 of which is adapted to be secured to the upper portions of the feed 24.

A transversely directed cylindrical sleeve 32 depends from the center of each of the tube assemblies to provide bearings for the journal portions of a threaded bar 34 that is mounted therein. A round-headed screw 36 is received in one end of the bar 34 and forms a retaining shoulder that cooperates with the sleeve bearing 32. At the other end of the bar, the smooth journal portion extends outboard of the supporting structure to provide a substantial operating clearance for a conventional crank handle 38 that is pivotally mounted thereon by a pin 39 (see Fig. 3). A helical spring 40 and locking sleeve 42 are telescoped over the outboard portion of the bar 34 in shouldered engagement with the spring urging the locking sleeve 42 outwardly. The locking sleeve 42 straddles the pivotal connection and maintains the crank handle 38 and outboard portion of the bar in operative alignment. When the frame is not in use, the locking sleeve 42 may be pushed inwardly against the action of the helical spring 40 until it clears the pivoted connection, and the handle may then be pivoted to an out-of-the-way position underneath the frame, as shown in Fig. 7.

Centrally of the tube assemblies 22, the threaded bar 34 is formed with a smooth spacing portion 44 which limits the inward travel of a pair of threaded blocks 46 mounted on the bar 34 on each side of the smooth portion. On one side of the smooth portion 44 the bar 34 is provided with right-hand threads and on the other side with left-hand threads so that as the bar 34 is rotated, the blocks 46 are simultaneously driven either towards each other or away from each other as determined by the direction of rotation of the threaded bar.

As best shown in Figs. 1 and 4, the blocks 46 are bifurcated at each end to provide a mounting notch 48 for a link 50 which is pivotally secured therein by a lock-pin 51. At their free ends, the links 50 are pivotally secured to the inner pads 28 of the hinge and the flattened mounting pads 26 of the tube assemblies by a nut and bolt, 52 and 54 respectively. See Fig. 2.

The tube assemblies 22, previously referred to, consist of a pair of end tubes 56 that are slidably received within a larger central tube 58. Substantially zero clearance is provided between the end tubes and the encompassing tube and the cooperating surfaces are very smooth to facilitate relative sliding movement.

The various parts of the supporting structure are preferably made of stainless steel, though other metals such as aluminum may also be used; the particular material employed being but a matter of choice.

The flexible frame proper consists of a pair of end panels 60 and a pair of side panels 62 defining a generally rectangular frame surrounding the relatively large central opening 18. See Fig. 7. The side panels overlap the end panels and are riveted thereto to form a unitary structure. At each end of the supporting structure, the end panels 60 of the flexible frame are sandwiched between an end strap 64, the outer hinge pad 30, and the feet 24 and secured therebetween, as by riveting. As is best shown in Fig. 2, the arrangement is such that both the end portions of the side panels 62 and the end straps 64 overlie the end panels 60 and are disposed in substantially the same plane in abutting relationship. The panels 60, 62 of the frame are formed preferably of spring steel to provide the desired amount of flexion and the end straps 64 are formed preferably of relatively rigid stainless steel.

A pair of pad support panels 66 preferably of flexible spring steel are adapted to be secured to the flexible frame along each side thereof to receive the pair of wedge-shaped pads 20 referred to hereinbefore. One of the pad support panels 66 is shown in detail in Fig. 5 and is formed with a series of spaced parallel mounting slots 68. Along one side a plurality of guide tongues 70 are provided to some of which are secured a plurality of buckle mounting straps 72 and their associated buckles 74. The guide tongues 70 are adapted to be bent upwardly along the dotted line 75 to a position wherein they serve to retain the wedge-shaped pad 20 in proper position on the support panel. Along the opposite side, the panel 66 is castellated to allow this side to be inclined downwardly.

Because the support panel is flexed when mounted on the frame, the castellations are necessary in order to avoid resulting tensile and compressive strains on the bent-over portion due to changes in the degree of curvature of the frame. Finally, a plurality of buckle tongue straps 78 are secured to the castellated segments 80 and cooperate with the buckles 74 to fasten the wedge pads 20 in place on the support panels 66.

As is best shown in Figs. 7 and 8, the support panel 66 is adjustably secured to the side panels 62 of the flexible frame at spaced points by means of a screw 82 and wing nut 83 which engage the slots 68. As shown in Fig. 1, the wedge-shaped pads 20 are then buckled in place and a pair of relatively flat end pads 21 are riveted to the end panels 60.

It should be noted that the support panels 66 overhang the side panels 62 and extend into the opening 18. Simi-

larly, the wedge-shaped pads 20 overhang the support panels 66 and extend further into the opening 18.

By reason of the slots 68, the support panel and the wedge-shaped pads 20 may be adjusted laterally with respect to the side panels of the frame. As previously mentioned, the wedge-shaped pads 20 are adapted to support the anterior iliac spines of the patient and must be properly spaced in accordance with the size of the particular patient. Each of the pads is tapered in the direction of the opening 18 to provide sufficient spacing for the patient's abdomen and relieve venous pressures. To this end the castellated segments 80 of the support panels are also inclined downwardly, as may be seen in Figs. 2 and 8.

In using the convex spinal frame of the present invention the procedure is as follows.

The patient is anesthetized and a tracheal catheter inserted. The spinal frame is placed on a standard operating table 10, and the patient placed face down on the frame with the support panels 66 so adjusted that the anterior iliac spines are well padded.

If it is desired to vary the curvature of the spine, the amount of flexion may be varied, even with the patient positioned on the frame, by means of the crank handle 38. Assuming it is desired to flatten out the frame, the handle 38 is rotated counterclockwise, as viewed in Fig. 1, thereby causing each of the threaded blocks 46 to move outwardly. The outwardly moving threaded blocks expand the associated links 50 causing them to extend the tube assemblies 22. The links 50 are attached to the end tubes 56 of the assemblies and, as the links expand, the end tubes 56 slide outwardly relative to the large central tube 58 in which they are mounted. It is this controlled movement of the extensible supporting structure which varies the flexion of the frame proper. The arcuate feet 24 are formed from a wide and smooth bar and glide over the surface of the operating table as the frame is extended.

In addition, the point of support between the table and the feet 24 varies somewhat since the feet also rotate to some extent. As the flexion is decreased, the end panels 60 become more nearly horizontal. This rotation of the feet 24 and change in inclination of the end panels is a result of the outer hinge pad 30 pivoting relative to the fixed inner hinge pad 28. The pivoting movement of the outer hinge pad 30 is important since it permits the end portions of the frame, which are secured thereto and serve as a fulcrum, to assume a more nearly co-planar relationship with the adjacent areas of the frame and, therefore, eliminates excessive strains that would otherwise be set up in the flexible frame portion when the flexion is adjusted.

If the handle 38 is cranked until the frame becomes substantially flat, the frame will contact and be spaced from the supporting structure by a spacing arm 84 welded to each of the central tubes 58 and extending upwardly therefrom into engagement with the side panels 62. Thus, even in this lowermost position of the frame, the patient's body will be spaced from the supporting structure to prevent contact therewith.

After the flexion of the frame has been properly adjusted, the usual prep is done and the operation is carried out in the usual manner. Experience has shown that the blood removed by a suction tip averages about three ounces when the spinal frame of the present invention is used. The patient's breathing is unimpaired and free. Glucose in saline solution is given but a blood transfusion is considered unnecessary. In addition, the operating time is easily reduced to less than half an hour.

In Fig. 6 is shown a modified form of foot which may also be employed with the spinal frame of the present invention. The modified foot 85 is formed into a loop and is preferably made from a relatively wide and smooth bar of stainless steel to permit it to glide freely along a table.

5

This modified foot is attached to the frame by means of a pivoted mounting pad 86 and is sandwiched between the outer hinge pad 30 and the end panel 60 of the flexible frame. The necessary pivotal motion is thereby provided to accommodate the desired changes in flexion.

Thus, it may be seen that the objectives of the present invention have been accomplished in that the spine frame of the present invention is provided with a substantial central opening to control bleeding by permitting relatively unimpaired breathing and to eliminate dangerous increases in venous back pressure. In addition, pad support panels are provided which are laterally adjustable to suit the physique of the particular patient. Finally, the extensible supporting structure may be adjusted manually to vary the flexion of the frame.

While we have illustrated and described only a single embodiment of our invention, it is to be understood that our invention may assume other forms and that our invention includes all variations, modifications, and equivalents coming within the scope of the appended claims.

We claim:

1. In a device of the class described a supporting structure, a convex arcuate frame mounted on said supporting structure at opposite ends thereof and bridging the same, said arcuate frame having a relatively large central opening bounded by opposed side panels and end panels, a pad support panel secured to each of said side panels at spaced points and laterally adjustable thereon, and wedge-shaped pads mounted on said pad support panels adjacent said central opening, said pads being positioned on said support panel in facing relationship.

2. In a device of the class described an extensible supporting structure, a convex arcuate flexible frame mounted on said supporting structure at opposite ends thereof and bridging the same whereby said supporting structure may be extended to vary the curvature of said arcuate frame, said arcuate frame having a relatively large central opening bounded by opposed side panels and end panels, a pad support panel secured to each of said side panels at spaced points and laterally adjustable thereon, and wedge-shaped pads mounted on said pad support panels adjacent said central opening, said pads being positioned on said support panels in facing relationship and being individually secured to said panels by a plurality of fastening means carried by each of said pad support panels.

3. In a device of the class described, an extensible supporting structure and a convex arcuate flexible frame mounted on said supporting structure at opposite ends thereof and bridging the same, said supporting structure comprising a pair of spaced, parallel extensible bar assemblies, supporting means secured at each end of said assemblies, a rotatable crossbar journaled in bearings formed on each of said assemblies, and an expanding linkage mechanism mounted on said crossbar and secured to each end of said assemblies, said linkage mechanism being operatively engaged by said rotatable crossbar whereby upon rotation of the crossbar the linkage assembly varies the lengths of the extensible assemblies to change the curvature of said arcuate frame.

4. In a device of the class described, an extensible

6

structure having hinge pads at the ends thereof, supports for said structure secured to said hinge pads, and a convex arcuate flexible frame secured to said hinge pads and said supports and bridging said extensible structure whereby when said structure is extended said hinge pads and said supports pivot relative to said structure to vary the curvature of said flexible frame.

5. In a device of the class described, an extensible supporting structure, a convex arcuate flexible frame bridging said structure and mounted thereon at opposite ends thereof, an expanding linkage mechanism secured to the opposite ends of said structure, and an operating mechanism connected to said linkage mechanism for expanding and contracting the same to vary the length of said extensible structure and therefore to change the curvature of said arcuate frame.

6. The invention as set forth in claim 5 and wherein said flexible frame is formed with a relatively large central opening which is flanked by padding extending lengthwise along the frame such that the frame in supporting the front of a reclining patient provides a padded support for the anterior iliac spines of the patient with the abdomen located over the central opening.

7. The invention as set forth in claim 4 and wherein said flexible frame is formed with a relatively large central opening which is flanked by padding extending lengthwise along the frame such that the frame in supporting the front of a reclining patient provides a padded support for the anterior iliac spines of the patient with the abdomen located over the central opening.

8. In a device of the class described an extensible supporting structure, a convex arcuate flexible frame bridging said structure and mounted thereon at opposite ends thereof, and adjustable means connected to said extensible structure for extending and contracting said structure to vary the curvature of said flexible frame, said flexible frame being provided with a relatively large central opening flanked by padding extending lengthwise along the frame such that the frame in supporting the front of a reclining patient provides a padded support for the anterior iliac spines of the patient with the abdomen located over the central opening.

9. The invention as set forth in claim 8 and wherein said flexible frame includes laterally adjustable panels that define said central opening and permit the width of said opening to be varied.

References Cited in the file of this patent

UNITED STATES PATENTS

1,814,482	Miller	July 14, 1931
2,152,734	Ford	Apr. 4, 1939

OTHER REFERENCES

The Journal of Bone and Joint Surgery, for July 1953, advertising page 16.

Surgery, for February 1950, pp. 276-279. (Copies of these publications in Scientific Library.)

1947 Catalog of Zimmer Mfg. Co., Warsaw, Indiana, page 75. (Copy in Division 55.)