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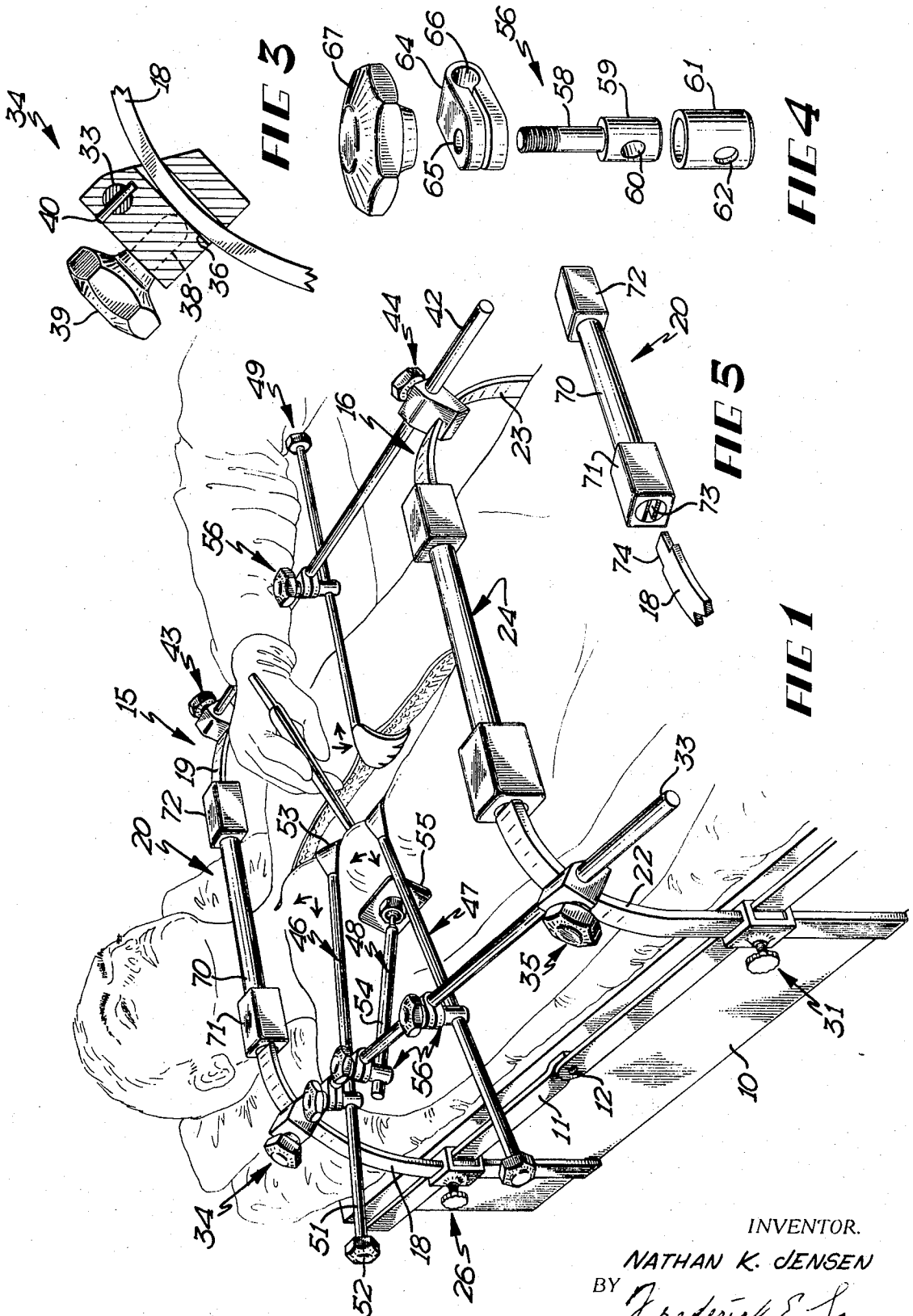
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3,572,326

CHEST WALL RETRACTOR

Filed May 6, 1968

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

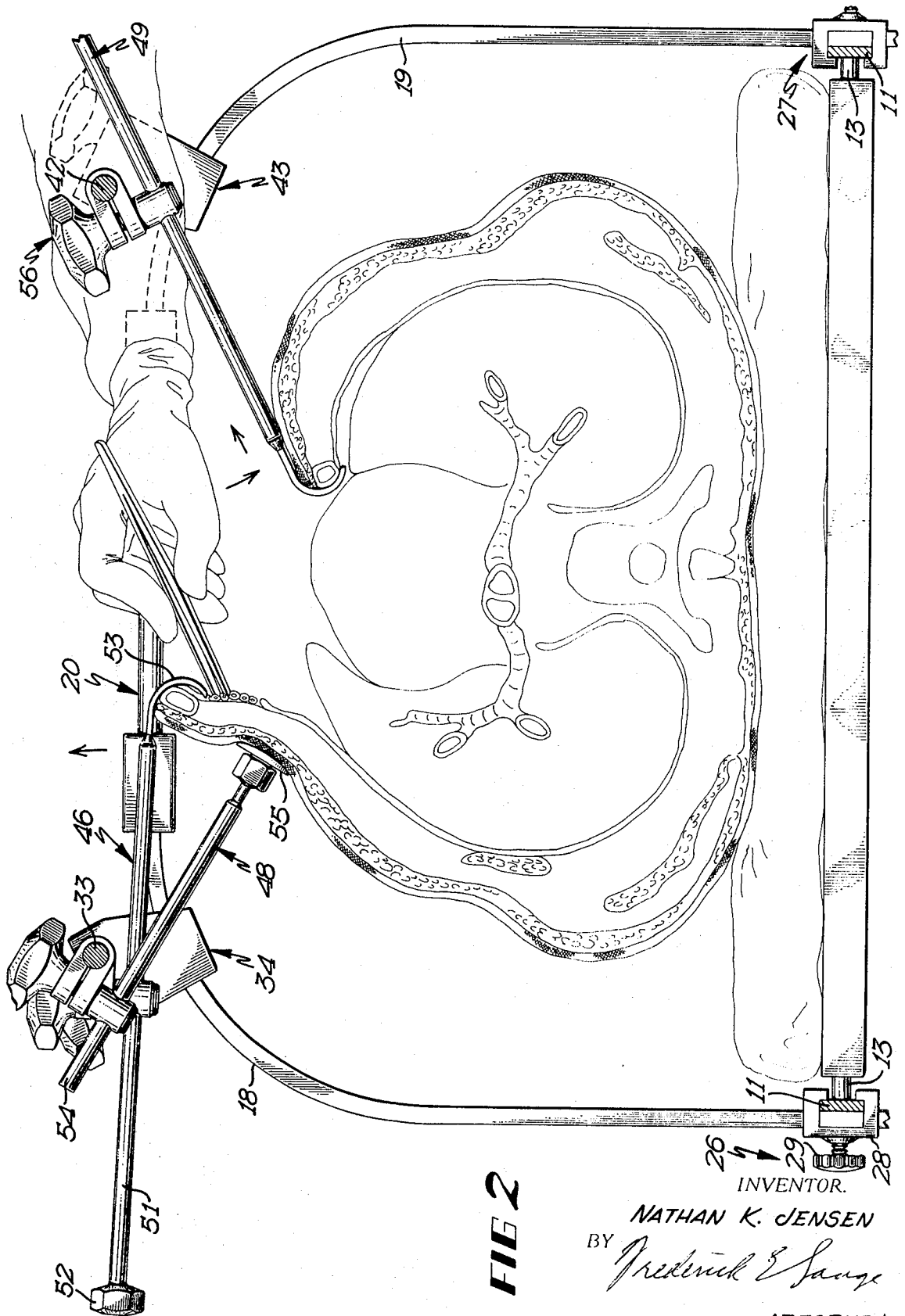


FIG 2

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3,572,326

## CHEST WALL RETRACTOR

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10 Claims

### ABSTRACT OF THE DISCLOSURE

A surgical retractor having a plurality of inverted U-shaped supports having their lower ends adapted to be secured to the side rails of an operating table, a pair of bars secured to the curved portions of the U-shaped supports, one on each side of the table, and retracting elements adjustably secured to the bars and adapted to engage the opposite edge portions of a surgical incision to exert counteracting forces on the body of the patient, the radius of curvature of the U-shaped supports approximating the distance between the outer extremities of the ribs and the vertebral column of a human of typical dimensions so that upon adjustment of the bar outwardly, the chest wall, in the case of a chest incision, is moved upwardly and outwardly. A pusher member may also be mounted on one of the bars to hold a portion of the body inwardly while the portion adjacent the incision is being pulled out by the retractor. The U-shaped supports each have a removable link member to permit the introduction of surgical coverings, these link members also being adapted to support a retractor or other surgical implement.

### BACKGROUND OF THE INVENTION

In the past, it has been customary during major surgery, particularly on the chest or abdomen, to employ retracting devices which are applied to the edges of the surgical incision and which are then pulled back manually by a surgical assistant to expose the area on which the surgeon must work. As the availability of surgical assistants has decreased throughout the years, there has been an increasing demand for a self-retaining surgical retractor. Not only does this eliminate the need of one or more surgical assistants but it also provides more steady retraction than is possible with the intermittent pull of a fatigued human arm.

As a result, various arrangements have been proposed for holding surgical retracting devices in positions selected by the surgeon. Some of these involve the use of rings which are supported in one manner or another from the surgical table, the rings in turn carrying retracting devices which can be adjustably secured with respect to the rings. This prior type of arrangement provides for only a limited adjustment of the retractor elements and makes no provision for simultaneously moving several retractor elements in any desired direction. In another arrangement which has been proposed, members secured to a bed rail of an operating table in turn have bars secured thereto, these bars in turn carrying clamps which adjustably hold retractors or other surgical implements. Again, however, there is no provision for moving more than one retractor or even one retractor over a fixed path which provides the desired movement of the portion of the body to which the retractor is attached.

### SUMMARY OF THE INVENTION

This invention is concerned with a retractor for surgical use in which a wide range of adjustments of the retractor elements is available and in which it is possible to readily adjust the retractor elements over a path which results in the desired movement of the portion of the body adjacent the incision. I accomplish this by providing a supporting

member adapted to be secured to a surgical table and in which a retractor supporting element is adjustably secured to a curved portion of the supporting member so that upon the retractor supporting means being moved along the curved portion of the supporting member, the retractor is moved upwardly and outwardly to impart the desired movement to the portion of the body to which the retractor is secured. More specifically, the retractor of the present invention employs two inverted U-shaped supporting members adapted to extend over an operating table with the side legs of the supporting members straddling and each adjustably secured to the table, and a pair of bars adapted to extend longitudinally of the table on opposite sides of it each of the bars extending between the curved portions of the supporting members and adjustably secured thereto. The retracting elements are adjustably secured to these bars.

It is contemplated that the curved portions of the supporting members have a radius of curvature approximating the distance between the outer extremities of the limbs and the vertebral column of a human of average dimensions so that upon the retracting element being engaged with the edge portion of an incision in the chest and rigidly fastened with respect to the bar, the bar can be adjusted outwardly about said curved portion of the supporting members to move the chest wall outwardly and upwardly a desired amount while moving the ribs in a manner to impose a minimum strain thereon.

It is also contemplated that a pusher member may be used in cooperation with a retractor element, this pusher member being pressed against the chest in an area removed from the edge of the incision so that as the severed portion of the chest wall is moved outwardly, the remaining portion of the wall is held inwardly by the pusher member.

Each of the U-shaped supporting members may consist of two outer curved elements and a center connecting element which is removable to facilitate the introduction of surgical coverings prior to the operation. This removable center connecting element may have means for attaching to it a further retractor or other surgical implement.

The means for holding the retractors and any other surgical implements on the longitudinal bars includes a clamping means with a single clamping member which is effective not only to hold the clamping means against movement with respect to the bar but also to hold a surgical implement in its adjusted position against movement with respect to the clamping means.

Various other objects and features of the invention will be apparent from a consideration of the accompanying specification, claims and drawing.

### BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of my improved retractor in use, the retractor being secured to the side rails of the surgical table;

FIG. 2 is a cross-sectional view of the retractor in use, the body being operated on, the longitudinal bars, and the side rails being shown in section;

FIG. 3 is a view, partly in section, of the clamp employed to hold the longitudinal bars in position with respect to the U-shaped supporting member;

FIG. 4 is an exploded view of the clamp used to hold the shanks of the surgical instruments in adjusted position with respect to the longitudinal bar to which they are secured; and

FIG. 5 is a fragmentary view showing the manner in which the center rod of the U-shaped members is held with respect to the curved end portions of these members.

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#### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the improved retractor is shown in connection with an operating table 10 of conventional construction. Rigidly secured to each side of the operating table is a side rail 11. This side rail may be hinged as indicated at 12 where the bed is of a design to permit tilting one portion of the table with respect to the other. The side rail 11 as best shown in FIG. 2 are spaced outwardly from the bed, being secured thereto by posts 13. The frame of the retractor includes two inverted U-shaped members 15 and 16. Each of these support members 15 and 16 actually consists of three separate members. Referring to U-shaped member 15, this comprises two curved band members 18 and 19 and a center detachable section 20 which will be described later. The U-shaped support 16 similarly comprises two curved band members 22 and 23 and a removable center section 24.

Referring to FIGS. 1 and 2, and specifically to the U-shaped member 15, the two curved members 18 and 19 are secured to the side rails 11 by clamping members 26 and 27. The clamping member 26 comprises a yoke member 28 through which the curved band 18 extends and which extends partially around the rail 11 of the operating table. A set screw 29 with a suitable actuating handle extends through the outer wall of the yoke 28, being in threaded engagement therewith. Upon the set screw being turned inwardly by operation of the manual actuator, the curved member 18 is firmly clamped against the table rail 11 holding the curved member 18 against movement with respect to the table rail 11. The clamp 27 is of similar construction and operates to clamp curved member 19 to the rail 11 on the opposite side of the operating table. Similar clamps are employed in connection with the U-shaped member 16, as indicated in FIG. 1. The only clamp visible is the clamp on the left-hand side of the bed, this clamp being designated by the reference numeral 31.

Adjustably secured to the curved members 18 and 22 is a longitudinal rod 33, preferably of circular cross section. This rod extends through apertures in clamps 34 and 35, this being shown in section in FIGS. 2 and 3. The rod 33 is held against rotation with respect to the clamp by a pin 40 which is press fitted into the clamp and extends through the rod 33. The clamp 34 has a slot 36 therethrough through which the curved member 18 extends. A set screw 38 having a knob 39 extends through the upper portion of the clamp 34 and is designed to engage the outer surface of curved member 18. When the set screw 38 is tightened, the set screw serves to hold the clamp 34 rigidly with respect to curved member 18. The clamp 35 associated with the curved portion 22 is similar to clamp 34 except that no pin extends through the clamp 34. Thus the rod 33 can be withdrawn from clamp 35. The single pin 40 in clamp 34 prevents any relative rotation of rod 33 with respect to clamps 34 and 35. When the two clamps 34 and 40 are tightened, the bar 33 extending through these clamps is held against movement with respect to the curved portions 18 and 22. Since these portions are rigidly attached to the side rails of the table, the bar 33 is held against movement with respect to the operating table. A bar 42 similar to bar 33 extends between the curved portions 19 and 23 and is held immovably with respect thereto by clamps 43 and 44 similar to clamps 34 and 35, respectively. Again, since curved portions 19 and 23 are rigidly held with respect to the rail 11 on that side of the bed, the bar 42 is rigidly held with respect to the operating table.

Various implements are adjustably secured to the bars 33 and 42. In the drawing I have shown a pair of retractors 46 and 47 and a "pusher" member 48 as being secured to bar 33 and a retractor 49 as being secured to bar 42. The retractors 46 and 47 may be either in the

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form of a "rake" or a "cats-paw," the "rake" as conventionally used in medical terminology being a device which has relatively dull teeth while a "cats-paw" is a similar device having sharp teeth. Referring to the retractor 46, it will be noted that this has a shank portion 51 of circular cross section. At the outer end of the shank 51 is a knob 52 designed to be manually manipulated. This knob is preferably detachable from the shank, as being threaded thereon. At the inner end of the retractor 46 there is a curved portion 53 having suitable claws for engaging the body adjacent the surgical incision. The retractors 47 and 49 are of similar construction. The "pusher" 48 has a shank 54, likewise of circular cross section. Secured to its inner end by a suitable ball joint connection is a pusher plate 55. This pusher plate by reason of the ball joint connection between it and the shank 54 adjusts itself to lie firmly against a selected portion of the body regardless of the particular angular disposition of that portion of the body.

The shank portions of the retractors and pushing members are held in position with respect to the bars 33 and 42 by suitable clamping members. These clamping members which have been designated by the reference numeral 56 are all of identical construction. The construction of the clamping member 56 is shown in detail in FIG. 4 which is an exploded view of this clamping member. It will be noted that the clamping member has a cylindrical shank 58 which is threaded at its upper end and has at its lower end a cylindrical knob 59 having an aperture 60 extending therethrough. The diameter of the aperture 60 corresponds to the outer diameter of the shank 51 or shank 54 of the associated surgical implement. Extending over the head 59 is a hollow sleeve 61 having an aperture 62 extending therethrough. A bifurcated clamping member 64 has an aperture 65 therethrough, the diameter of the aperture 65 corresponding to the diameter of the shank 58. The member 64 has a cylindrical passage 66 therethrough which is normally of the same diameter as the rod 33 or 42, as the case may be. This cylindrical passage 66 is located at the inner ends of the slotted clamping jaws. A clamping knob 67 is adapted to be threadedly engaged with the upper threaded portion of shank 58. When the unit is assembled, the shank of the surgical implement extends through the aligned slots 60 and 62. The bifurcated clamping member 64 extends over the shank 58 engaging the upper end of sleeve 61 which projects above the head 59. The knob 67 is threadedly engaged with the upper end of threaded member 58. The rod 33 extends through the passage 66. Upon knob 67 being tightened, the head 60 is pulled up with respect to sleeve 61 so as to tightly clamp the shank of the surgical instrument with respect to members 59 and 61. At the same time, the two jaws of the bifurcated clamp 64 are squeezed together to clamp the rod 33 passing through the passage 66. Thus, by tightening knob 67, the clamping mechanism 66 is firmly secured against movement with respect both to the shank of the surgical instrument and also with respect to the longitudinal rod 33 on which the clamping member is located.

The clamp 56 permits a wide range of adjustment of the surgical implements. For example, referring to the retractor 46, when the knob 67 is loosened, the shank 51 may be slid inwardly or outwardly with perfect freedom to adjust its longitudinal position. At the same time, the shank 51 may be rotated about its own axis or about the axis of rod 33. It also may be rotated about the axis of the shank 58 of the clamp. Thus, with the very simple clamp construction of clamp 56, it is possible to have complete freedom of adjustment of the implement in any direction and about any axis.

Referring to FIG. 5, the center section 20 and the manner of its connection to the curved sections of the supporting member is shown in more detail. It will be noted that this center section 20 consists of a cylindrical rod 70 to which is rigidly secured two head members 71

and 72 of square cross section. A slot 73 extends from the outer face of each head member inwardly for a slight distance. Each of the curved members is provided with a short tongue 74 which is of the same width as the width of the slot 73. In operation, after the curved members 18, 19, 22 and 23 are fastened to the rails of the table by the clamping members 26, 27 and 31, the curved members may be sprung apart sufficiently to permit the insertion of the tongue 74 into the slot 73 of the intermediate section 20. Due to the tongue 74 being relatively short as compared with the length of head members 71 and 72, the section 20 can be inserted without springing apart the curved members to any great extent. The intermediate section 20 is held against rotation by reason of the fact that the tongue 74 and the slot 73 are flat. Furthermore, by reason of the resilient force exerted by members 18 and 19, the member 20 is held against any appreciable longitudinal shifting. It is possible, by reason of the cylindrical rod 70, to use the center sections 20 and 24 for mounting additional instruments where this is desirable. The diameter of the rod 70 is the same as the diameter of rods 33 and 42 so that it is possible to use a clamp such as clamp 56 which is employed to mount the various instruments on rods 33 and 42.

#### USE OF APPARATUS

It will be readily apparent that initially all of the elements are disassembled. Because of their being disassembled, it is possible to place all of the elements in a suitable sterilizer. The clamps 26, 27 and 36 are assembled on the table rails and the curved portions 18, 19, 22 and 23 are fastened in position on the table rails at the proper elevation above the patient. The various clamps 56 holding the shanks of the various surgical instruments can be slid over the free ends of rods 33 and 42. The rods 33 and 42, which are already secured to clamps 34 and 43 can now be inserted through the apertures in clamps 35 and 44. The clamps 34, 35, 43 and 44 are now slid over the inner ends of the curved portions 18, 19, 22 and 23, and the knobs 39 associated with clamps 34, 35, 43 and 44 are then clamped to hold the rods 33 and 42 in the desired position, preferably a position close to the upper end of the curved portions 18, 22, 19 and 23.

Up to this point, the center sections 20 and 24 of the U-shaped supporting members have not been inserted. This provides an opening between the facing extremities of curved members 18 and 19 on the one hand, and curved members 22 and 23 on the other hand. A surgical plastic sheet can be inserted in this opening and used to cover the patient, the incision being made through this plastic sheet. Members 18 and 19 are now spread apart sufficiently to permit the insertion of the associated center section 20. Similarly, curved members 22 and 23 are spread apart sufficiently to permit the insertion of the curved center section 24. The retractor is now completely assembled and ready for use. After the surgical incision has been made through the plastic sheet, the claws of the retractors are hooked over the edges of the incision. The pusher member is adjusted so that the pusher plate engages the body at the desired point. The various knobs of the clamp 56 are tightened in position to hold the shanks of the various surgical instruments in the desired positions with respect to the body. It is now possible to loosen the knobs 34 and 40 and to move the bar 33 carrying the various surgical instruments on that side of the body. When the bar 33 is moved outwardly, the clamps 34 and 40 follow the curved portions 18 and 22, causing both outward and rotative movement of rod 33. This outward and rotative movement is in turn transmitted to the various surgical instruments which are rigidly attached to bar 33 by reason of the clamps 56. Due to the curved nature of the curved portions 18 and 22, the edge of the chest wall is moved outwardly and upwardly. As indicated above, the radius of curvature of portions 18 and 22 is preferably equal to approximately the distance between

the edge of the end of the ribs and the vertebral column of an average human being. The result is that when the chest wall along with the ribs is moved by reason of movement of bar 33 along the curved portions 18 and 22, the ends of the ribs are moved over a path closely corresponding to the path that they would tend to follow if forced outwardly. Because of the fact that the pusher 48 and the two retractors 46 and 47 remain securely fastened with respect to rod 33, this movement of the retractors 46 and 47 is very consistent, this movement being determined by the radius of curvatures of curved members 18 and 22. As soon as the chest wall has been moved outwardly the desired amount, the knobs of clamps 34 and 40 are re-tightened and the chest wall is held in the desired position throughout the operation.

The retractor 49 is provided primarily for the purpose of exerting a counteracting force on the body. The angular position of the retractor is such that the chest wall on that side is not being pushed upwardly but remains in substantially its normal position. It is obvious, however, that the presence of retractor 49 prevents rotation of the body of the patient.

As best shown in FIG. 2, the function of the pusher member 48 is to reduce as much as possible the portion of the chest wall which is moved outwardly. In many cases, as shown in FIG. 2, it is desired of the surgeon to work on certain blood vessels of the chest wall. What he desires to do is to turn outwardly the portion of the chest wall nearest the incision while minimizing the displacement of the rest of the chest wall. This becomes possible with a combination of the retractor members and pusher members, as shown in FIG. 2. While movement of rod 33 outwardly along the curved support members 18 and 22 causes the pusher member 48 to also move outwardly, the same relative positions are maintained between the pusher plate and the claws 53 of the retractor elements. It is thus possible to move the chest wall outwardly by movement of rod 33 without placing any undue strain on the chest wall by reason of uncoordinated movement of the claws and pusher member.

#### CONCLUSION

It will be seen that I have provided a retractor for surgical use in which it is possible to simultaneously move a number of surgical instruments over a path closely conforming with the desired travel of movement of the chest wall or other portion of the body adjacent a surgical incision. It will further be seen that I have provided such a retractor in which the parts can be readily assembled and disassembled and, at the same time, maintain their relative positions in a secure manner during the surgical operation.

While I have shown a specific embodiment of my invention for purposes of illustration, it is to be understood that the scope of the invention is limited solely by that of the appended claims.

I claim as my invention:

1. A retractor for surgical use comprising a supporting member having an arcuately curved portion of substantial extent, clamping means adapted to secure said supporting member to the side of an operating table with said curved portion extending over the table transversely thereto, retractor supporting means for adjustably supporting a surgical retractor, a retractor having a body engaging portion and a shank adjustably held by said retractor supporting means, and means including releasable clamping means holding said retractor supporting means on the curved portion of said supporting member for movement therealong, the curvature of said curved portion being such that when said clamping means is released, and the retractor supporting means is moved along said curved portion of said supporting member toward the outer edge of the table, the retractor supported thereby is moved over an arcuate path so that when it is attached to a portion of a body, it pulls such portion outwardly and upwardly.

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2. The retractor of claim 1 in which the retractor is for use with chest surgery and in which the radius of curvature of said curved portion approximates the distance between the outer extremities of the ribs and the vertebral column of an adult human of average dimensions.

3. A retractor for surgical use comprising:

a plurality of spaced inverted U-shaped supporting members each having two side legs and two intermediate curved portions of substantial extent, means adapted to adjustably secure the side legs of each supporting member to an operating table with the side legs straddling the table and with said supporting members spaced from each other longitudinally of the table,

a pair of bars, means adjustably securing one of said bars to the corresponding curved portions of said plurality of supporting members and the other of said bars to the opposite corresponding curved portions of said plurality of supporting members so that when said supporting members are thus secured to an operating table said bars extend longitudinally of the table on opposite sides thereof,

and retracting elements having longitudinal shank portions and each adjustably secured to one of said oppositely disposed bars for longitudinal movement with respect thereto, said retracting elements having body engaging portions adapted to engage the opposite edge portions of a surgical incision to exert counteracting forces on the body of a patient on the table.

4. The retractor of claim 3 in which the curved portions of said supporting members to which one of said bars is secured have a radius of curvature approximating the distance between the outer extremities of the ribs and the vertebral column of an adult human of average dimensions so that upon said retractor being secured to an operating table with a chest surgery patient thereon and one of said retracting elements being engaged with the edge portion of an incision in the chest and rigidly fastened with respect to said bar to which it is secured, said bar can be adjusted outwardly about said curved portions of said supporting members to move the chest wall outwardly and upwardly a desired amount while moving the ribs in a manner to impose a minimum amount of strain thereon.

5. The retractor of claim 4 in which there is adjustably secured to said one bar a retractor element having a hook portion which is adapted to be engaged near the edge of the incision and a "pusher" member having a plate portion which is adapted to be pressed against the chest at an area removed from said edge so that as the severed portion of the chest wall is moved outwardly, the remaining portion of said wall is held inwardly by said "pusher" member.

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6. The retractor of claim 3 in which each of said supporting members also has a center connecting element which extends between the curved portions and is removably connected thereto so as to be readily removable to facilitate the introduction of surgical coverings prior to the operation.

7. The retractor of claim 6 in which said center connecting member has means for fastening the same to said curved members without any substantial spreading apart of said curved members.

8. The retractor of claim 6 in which said center connecting member has a portion with the same cross-sectional configuration as said bars so as to facilitate attaching to said portion a further retractor or other surgical implement.

9. The retractor of claim 3 in which at least one of said bars is a rod of circular cross section and in which one of said retracting elements is secured to said rod by means which enables rotative adjustment of said retractor about the longitudinal axis of said rod, adjustment of said retractor parallel to the longitudinal axis of said rod, or adjustable extension or retraction of said retractor.

10. The retractor of claim 3 in which the curved portions have a curvature such that when one of said bars is moved outwardly along said curved portions of said supporting members, the bar is also rotated about the axis of curvature of said curved portions to cause said retracting element secured thereto to be moved both outwardly and upwardly.

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