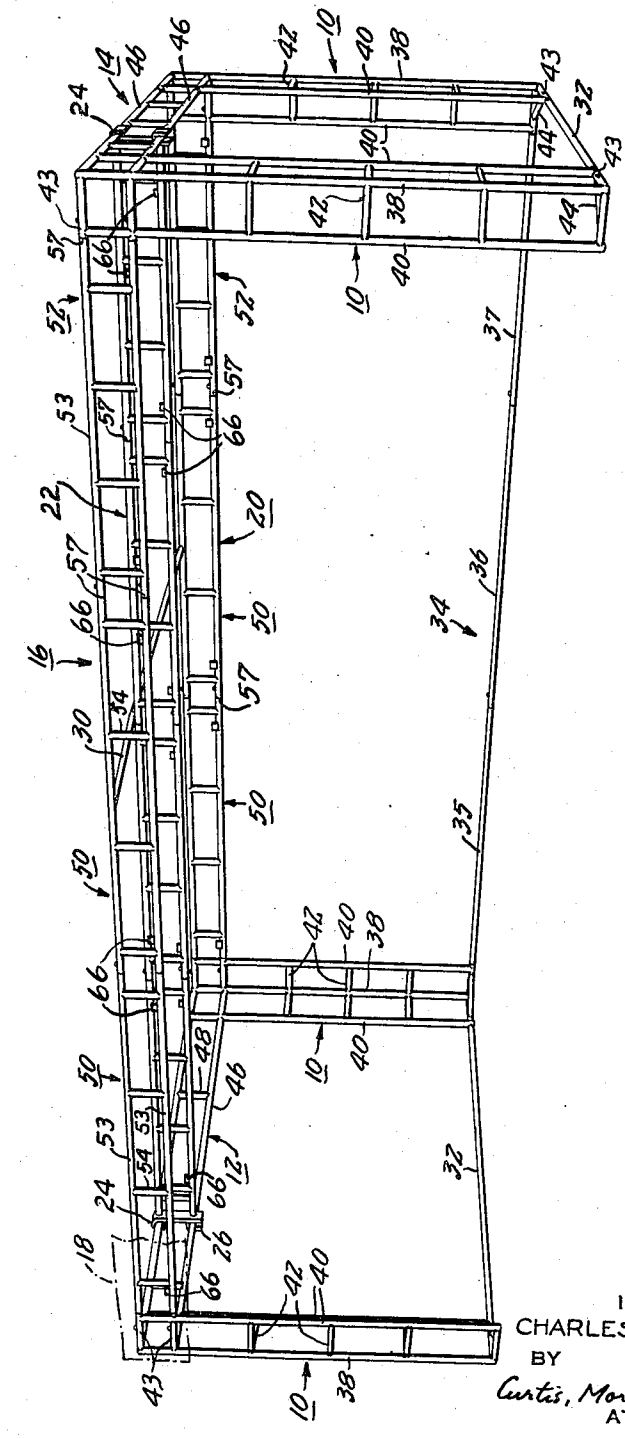
Aug. 5, 1958 C. E. SKINNER 2,846,221

COLLAPSIBLE STAGE STRUCTURE

Filed Aug. 10, 1954

3 Sheets-Sheet 1

FIG. 1.



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COLLAPSIBLE STAGE STRUCTURE

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FIG. 2.

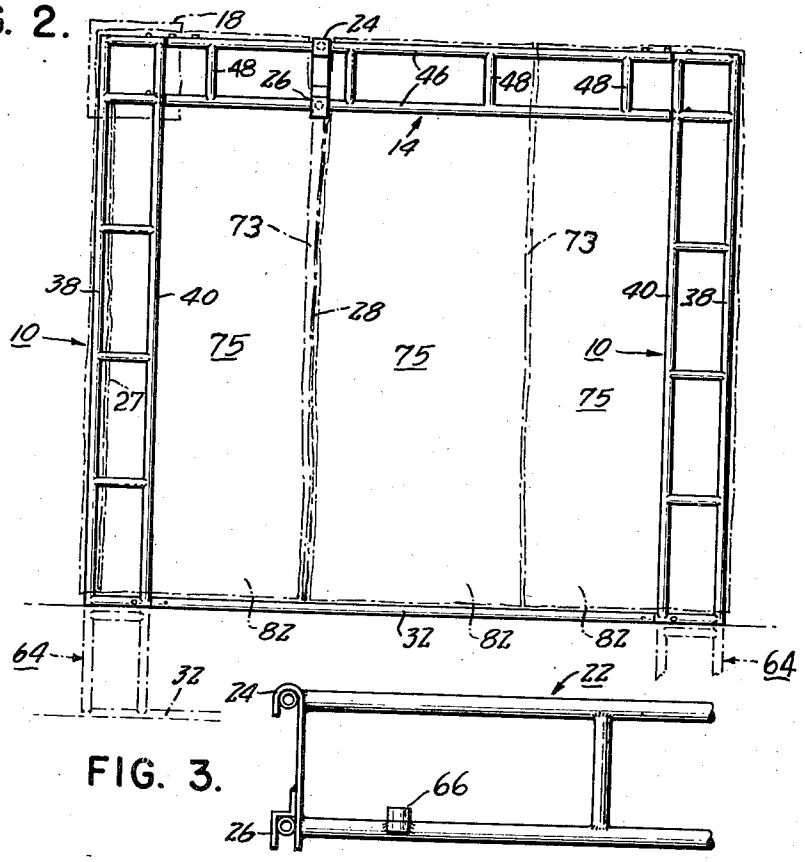


FIG. 3.

FIG. 4.

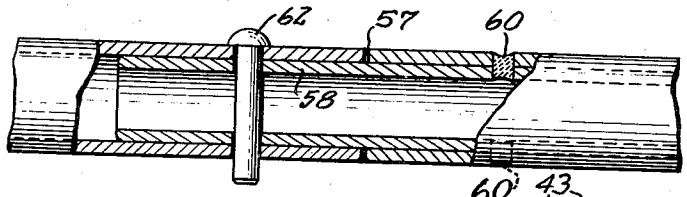
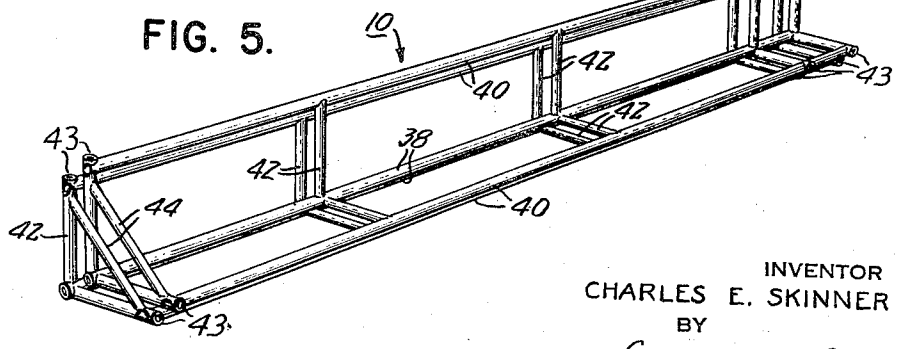


FIG. 5.



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FIG. 7.

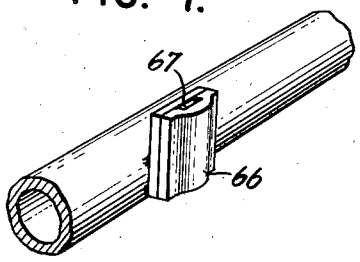


FIG. 8.

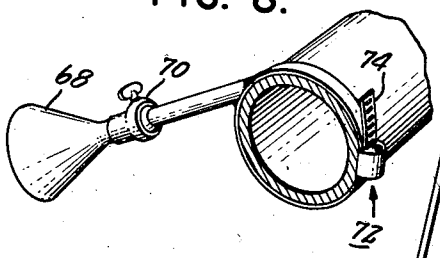


FIG. 9.

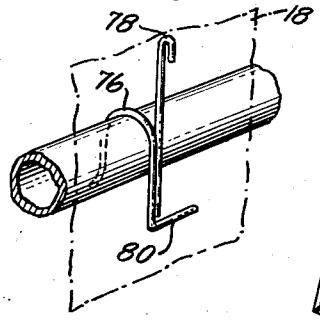


FIG. 10.

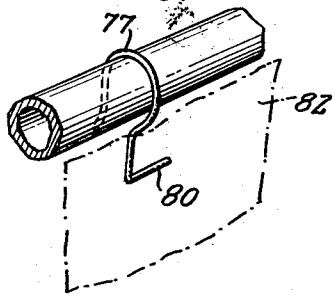
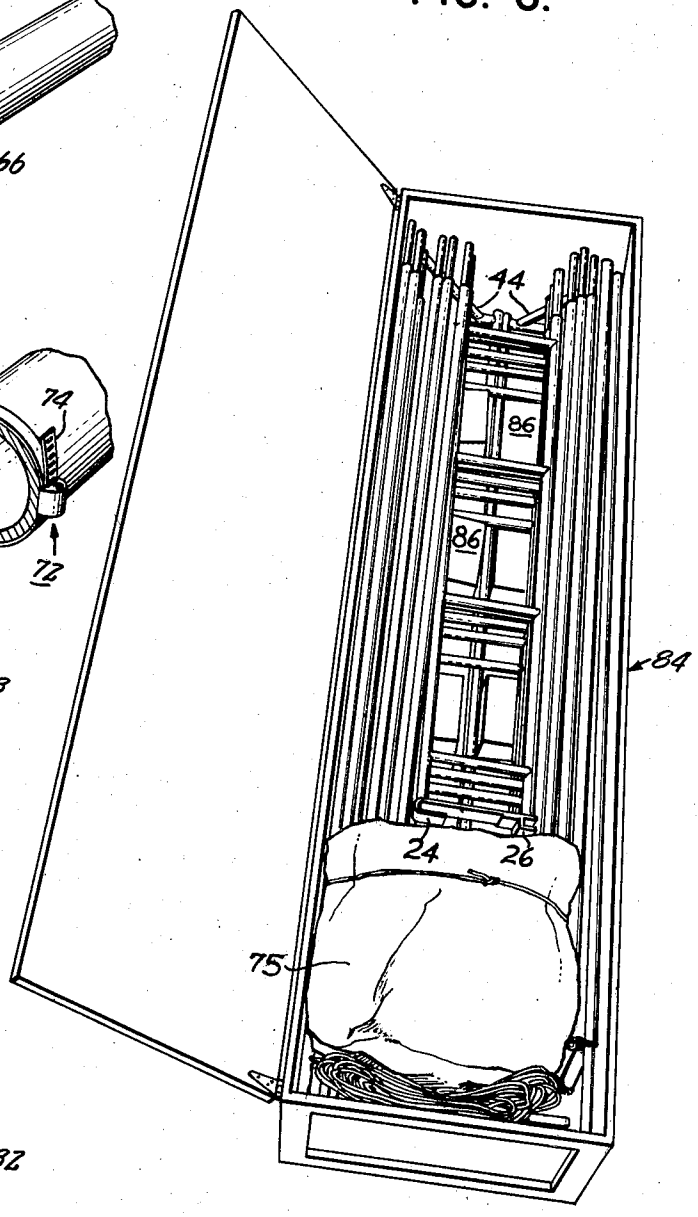


FIG. 6.



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United States Patent Office 2,846,221 Patented Aug. 5, 1958

2,846,221

COLLAPSIBLE STAGE STRUCTURE

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Application August 10, 1954, Serial No. 448,800

10 Claims. (Cl. 272—21)

The present invention relates to collapsible structures and more particularly to collapsible lightweight structures adapted to be quickly and easily assembled and disassembled and to fit together compactly with any associated equipment in disassembled form.

The present invention is described as embodied in a collapsible stage. Among the many advantages of the collapsible stage described are its extremely light weight, ease of assembly, and great strength and stability. It can be assembled in different widths or heights, and it is readily adapted for a wide variety of different stage arrangements, and when disassembled fits into a single carrying case with all of its accessories so as to be easily transportable.

The stage described is particularly advantageous for use in connection with the filming of television movies or the presentation of television shows and for regular stage plays and for various types of sales presentations, and the like.

Prior to my invention there has been a serious need for a suitable stage for putting on the various types of shows mentioned above and others have made efforts form time to time to provide a suitable stage. However, in the past it has been necessary to use stages which require a large crew to set them up and customarily have included wooden studs and plywood panels, involving a large amount of carpentry work. It is not uncommon for such prior stages to require six or seven hours for assembly even with a large crew of skilled personnel. The upright members must all be braced or fastened to the floor. Moreover, the lumber and other equipment necessary to erect such prior stages is bulky and heavy, usually weighing in excess of half a ton and often considerably more.

Whereas, the stage described herein, together with all of its accessories and even including the shipping case, weighs only slightly more than four hundred pounds.

The stage described is very easy to assemble and disassemble. With a brief set of directions, two men unfamiliar with the stage can usually erect it in one hour ready for use. After experience in erecting the stage once or twice, two men can put it up ready for use in considerably less time. The various parts of the stage slide together and yet are readily and securely locked in place, thus combining ease of assembly and strength.

In addition to its ease of assembly and light weight, the stage is very strong, readily supporting all of the lighting equipment and scenery necessary for various productions and exhibitions. The stage is adapted to carry any special or extra stage equipment or effects which may be used from time to time with the stage.

Among the further advantages of the collapsible stage described herein is the ladder-type construction of the frame, which I have found provides strength, reduction in weight and rigidity. Also, this construction enables the stage to rest firmly on uneven floor areas without teetering. Advantageously, in the frame of the stage described the various ladder-type sections are welded

together from aircraft type aluminum alloy tubing with the ends of the various sections having sleeves and sockets which slide together and are held by pins.

The various other aspects and advantages of the present invention will be understood from the following description considered in conjunction with the accompanying drawings, in which:

Figure 1 is a perspective view of the assembled frame of the stage, with portions of the front valence indicated in phantom view;

Figure 2 is a side-elevation of the right side of the stage;

Figure 3 is a partial elevational view, on enlarged scale, of the back side of one end of the movable intermediate truss which extends across the full width of the stage area;

Figure 4 is a longitudinal sectional view, on further enlarged scale, taken along the axes of two joined tubular members, showing details of a typical sleeve and pin joint which enables rapid assembly or disassembly of the stage;

Figure 5 is a perspective view, on enlarged scale, illustrating the way the legs of the stage nest together for ease in shipping;

Figure 6 is a perspective view, on enlarged scale, showing all of the sections of the frame and associated equipment nested together in the shipping case, portions of the curtain material and other equipment which lie at the top are shown broken away for purposes of illustration; and

Figures 7, 8, 9, and 10 show various details of construction and the arrangement of certain accessory equipment.

As shown in Figure 1 the stage includes four integral leg sections, generally indicated at **10**, and a left and a right side truss or header **12** and **14**, respectively, extending from front to rear between the top ends of the respective leg sections **10**. A front truss or header **16** extends across between the tops of the front legs **10** and is covered by a valence **18**, illustrated partially in phantom. A similar rear header **20** extends across the top of the rear of the stage between the tops of the rear legs **10**. A movable intermediate truss or floating header **22** is supported by pairs of hooks **24** and **25** from the two side headers **12** and **14** and can be moved forward or back depending upon the stage arrangement desired.

The main traveling curtain **27** (shown in phantom in Figure 2) is carried by a suitable track (not shown) supported along the rear of the front header **16**. This main curtain **27** is provided with draw ropes (not shown) at one side of the stage so that it can be drawn back from the middle to either side to open the stage to view.

Usually, the intermediate header **22** is arranged about ⅔ or ¾ of the way forward along the headers **12** and **14**, for it carries a second traveling curtain **28** (shown in phantom in Figure 2) supported from a suitable track (not shown) along its rear face so that the second traveling curtain can also be drawn back from the middle to either side to open the full depth of the stage to view. A single tubular cross tie **30** (see Figure 1) may be run from the middle of the front header **16** to the middle of the rear header **20**, being pinned to the tops of the three headers. The cross tie **30** may have a plurality of vertical holes along its length to enable the movable header to be pinned to it at any position desired. In many assemblies this cross tie **30** can be omitted.

In order to brace the legs **10** a unitary tubular foot tie **32** is run between the foot of each of the side legs, and a collapsible foot tie **34**, comprising three tubular sections **35**, **36**, and **37**, is run across the floor at the back of the stage between the bottom ends of the rear legs **10**. It is an advantage of the present stage that the

legs **10** are not fastened to the floor. In fact, during assembly, the various sub-assemblies can be stood up independently of each other and will remain standing while the other parts are assembled and stood up alongside. The result is a large saving in assembly time and labor.

The various foot ties can be omitted, if desired, with no loss in rigidity of the legs **10**. Moreover, these foot ties can be removed or replaced, at any time desirable during a show.

The four legs **10** are identical in construction, each leg is an integral unit having a 45° right triangular cross section and including a vertical member **38** forming the corner of the leg with two other parallel tubular members **40** spaced equal distances therefrom. Each of the vertical members **40** is joined to the corner member **38** by a number of tubular rungs **42** in a ladder-type construction. The lower rungs are evenly spaced along the length of each leg **10**. The top two rungs are spaced apart a distance approximating the spacing between the corner member **38** and each of the members **40**. Preferably the diameter of the bottom and the two top rungs **42** is the same as the diameters of the members **38** and **40** so that they can be used as sockets **43** for holding other sections of the assembled stage. The other rungs **42** may be somewhat smaller.

A single diagonal brace **44** extends between the bottom ends of members **40** to brace them when the stage is assembled, giving added strength to the legs **10** in supporting the stage. Also shown in Figure 5, by having this diagonal brace at one end the legs are enabled to be nested together, and when desired may be arranged with the diagonal braces of successive legs at alternate ends of the nested stack, thus providing further strength to the whole kit when the stage is disassembled and fitted into its carrying case ready for shipping.

The larger bottom rungs **42** in each leg serve as sockets to hold the adjacent ends of the foot ties **32** and **34** and the pairs of larger top rungs **42** form sockets adapted to hold the adjacent ends of the side, front or rear headers. It is an advantage of this arrangement that the legs themselves form portions of the rectangular perimeter of the stage, thereby reducing the span between legs and providing greater strength. As seen in Figures 1 and 2, the two side headers **12** and **14** are integral ladder-shaped trusses including two long members **46**, which span between the sockets **42** in the adjacent legs with four rungs **48** of smaller diameter. The rungs at each end are spaced in and from the near ends of the numbers **46** by a distance approximately equal to the spacing between the members **46**.

The front and rear headers **16** and **20** are of identical ladder-type construction. Each includes two longer sections **50**, and a shorter section **52**, which in the stage described here has a length of about three-quarters the length of one of the sections **50**. Each of these sections **50** and **52** comprise two long tubular members **53** and four evenly spaced rungs **54** therebetween. The spacing between the tubular members **53** is the same as the corresponding spacing between the corner member **38** and a side member **40** in any of the legs **10**.

The rung **54** at the end of the short section **52** adjacent the right leg is spaced from the near ends of members **53** by a distance equal to the spacing between the members **53**, while at the opposite end of this section **52** the rung **54** is spaced in from the near end about one-half this distance. The same general pattern is followed in the left section **50**, but in the center section **50**, the end rungs **56** are both spaced from their respective ends of this section a distance of about one-half the spacing of the two long members therein. The general pattern of the spacing of these rungs is to have the end rungs spaced in from the respective near ends of their sections a distance of one-half the spacing between the long members wherever the ends of two sections are adapted to abut in the assembled stage. Otherwise, the inward spacing of the end rungs is equal to the spacing between the long members of the section.

The movable intermediate header **22** spans across the full width of the stage, and thus is somewhat longer than either header **16** or **20**. The movable header **22** includes two identical center sections **55** having the same length as one of the sections **52** and two slightly shorter end sections **56**.

In order to enable rapid assembly and disassembly of the stage, all of the joints **57** (see also Figure 4), including one in the cross tie **30**, are telescoping joints. The cross tie **30** comprises a longer tubular member corresponding approximately to the length of one of the side headers **12** or **14** with a telescoping joint and a shorter member about twice the length of one of the rungs **42**, so as to span the full distance from the front to rear headers **16** to **20**, respectively. These joints are formed by an inner sleeve **58** secured within one tubular member with a projecting end of a size to fit snuggly within the bore of the abutting tubular member. As shown in Figure 4, the preferred arrangement is to have an inner sleeve **58** with one half of its length secured by opposed welds **60** within one of the tubular members, for example such as the members **53** in the front header **16**. The free end of sleeve **58** is drilled to receive a locking pin **62** which slides through aligned holes in the end of the abutting member **53**.

In assembling the stage the front header **16** is first assembled from its sections **50** and **52** and is then fastened to the two front legs to form the arch unit which defines the front of the stage. This initial assembly is all made flat on the ground. The arch unit is then stood up in position and is self-supporting so as to stand by itself.

Next, the rear header **20** is assembled and fastened to the rear legs **10**, all while lying flat, and the two side headers **12** and **14**, are also assembled in a vertical position to the rear legs **10**. This unit is then stood up, and while one man holds it in position, the other fastens the free ends of the side headers **12** and **14** to the sockets **43** at the top ends of the front legs **10** which are standing. The foot tie bars **32** and **34** are then assembled in place.

The movable header **22** is assembled and is raised up and hooked into any desired position along the side headers **12** and **14**. If desired, the cross tie **30** is added to complete assembly of the frame.

In order conveniently to increase the height of the stage, extension leg sections **64**, shown in phantom view in Figure 2 may be added to the bottom ends of the legs **10**. In adding the extension leg sections **64**, the foot tie tubes **32** and **34** are first removed, and three inner sleeves (not shown) at the upper ends of the vertical members of the extension leg sections **64** are slid up into the bottom ends of the vertical members **38** and **40** in the legs **10**. Holes are provided up through the bottom rungs **42** in alignment with the bores of members **38** and **40** to admit these sleeves. The foot tie tubes **32** and **34** are then reconnected in place between the bottom ends of the extension leg sections **64**.

The front and intermediate curtains **28** are carried by runners on suitable tracks (not shown) on the front and intermediate headers **16** and **22** with pull cords so that they can be drawn back from the middle toward either side of the stage. These tracks are in sections and are quickly and easily hooked in place by means of brackets which slip down into holes **67** (see also Figure 7) in T-shaped sockets spaced along the rear faces of the tubular members **53** in the headers **16** and **22**.

As shown in Figure 8 the floodlights **68** with universal joints **70** are conveniently removably held by clamps, such as the pipe clamp **72** to the top horizontal members of any one of the headers. These are hidden from the audience's view by the projecting upper edge of the valence **18**. The clamp illustrated includes a perforated strap **74** with a worm screw engaging the perforations to tighten the floodlights in place.

Among the further advantages of the stage described is the fact that the header **22** is moved forward or rearwardly simply by unhooking the **h**-shaped hooks **24** and **26** and hooking it in a new position. To enable easy adjustment of this header **22** the side panels of the stage area are each formed by three similar curtain panels **75** each having a considerable fullness when hung from the side headers **12** or **14** to give the appearance of a continuous panel. When the header **22** is forward of the center of the stage area, the hooks **24** and **26** are hung in the slit **73** between the front and center panels **75** on each side. When in position behind the center of the stage the rear slit **73** is used. The slits **73** provide a space at each side of the stage for receiving the curtains and give access to the pull cords.

The valence **18** is hung from the type of hooks **76** shown in Figure 9, and the other side and rear curtain panels are hung from the type of hook **77** shown in Figure 10. The top loop **78** of the hook **76** holds the upper edge of the valence. The bottom ends of both hooks are bent over at right angles to the plane of the hook portion and thus provide a wide area of support along the top **82** of the curtain panels **75**.

Another advantageous feature of the stage described is the fact that it packs into a carrying kit **84** along with all of its accessory equipment. When the various ladder-type sections are packed in place in the box **84**, substantially all of the rungs can be aligned with each other to provide spaces into which fit the floodlights, folded curtain panels and the various other accessories **86** such as electrical extension cords, curtain tracks, draw ropes, assembly instruction booklet, and the wooden mallet and pins, for assembly. The curtain **78** and panel material **75** are folded and laid on top of the frame sections, but are shown mostly broken away in Figure 6 to reveal the packing arrangement.

In a commercial form the stage as described, can be assembled into various sizes. The legs **10** are 8 feet 9 inches long with the overall width of the leg across each side measuring 1 foot. The side headers **12** and **14** are 8 feet long and 1 foot wide, thus providing a stage area 10 feet deep. The two longer sections **50** of the front and rear headers **16** and **20** are each 8 feet long and the short section **52** is 6 feet long giving a stage width of 24 feet.

By omitting sections **52** in headers **16**, **22** and **20** and the section **37** in the foot tie brace, the stage becomes 18 feet wide.

When desired, an extra 6 or 8 foot section **52** or **50**, respectively, is added in each of the front, movable, and rear headers and an extra section **36** or **37** is added in the rear tie bar **34** to give a stage width of 30 or 32 feet respectively. Also, an additional 6 foot or 8 foot section can be added in the side headers **12** and **14** and added to the foot tie bars **32** to provide a stage depth of 16 or 18 feet.

In a commercial form, all of the long tubular members are 1¼ inches outside diameter aluminum alloy tubing, which is available commercially as Alcoa 63S–T6. Most of the various rungs are 1 inch outside diameter tubing of the same material, except that the bottom rung and two top rungs in each leg are the larger size to provide the sockets for assembly.

The sleeves **58** are about 1 foot long and are ¾ inch pipe size, i. e., with an outside diameter of 1.050 inches which fits snuggly into the larger tubes.

All of the equipment described herein fits into the carrying case **84** which is 9 feet long, 20¾ inches high and 29¾ inches wide and with a gross weight of only about 400 pounds, which is readily carried by plane or automobile.

From the foregoing description it will be understood that the present invention is well adapted to provide the advantages discussed above and that the particular collapsible stage described is for the purpose of illustrating a specific embodiment of the invention. The stage described can be used advantageously in a wide variety of applications and may be subject to various modifications, each as may best suit it to a particular application.

What is claimed is:

1. A collapsible stage comprising four leg sections adapted to stand at the four corners of a rectangular area, each leg section comprising first, second, and third long parallel members adapted to stand vertically and arranged at the corners of a right-triangular configuration as seen in cross section, the first of said members in each leg section being adapted to stand at a corner of the rectangular area with the second and third members in each leg section being spaced from said first member and adapted to stand along the sides of said rectangular area near said corner, a plurality of spaced cross pieces in each leg section intermediate said first member and the other two, with the spaces between said cross pieces being unobstructed the ends of the uppermost cross pieces and next uppermost cross pieces in each leg section having open bores facing horizontally away from said first member forming horizontal sockets, four long trusses having pairs of vertically spaced rigid projecting elements on their ends fitting in said sockets to support said trusses between the upper ends of the leg sections with said leg sections defining portions of the rectangular perimeter of the stage and with said trusses spanned therebetween.

2. A collapsible stage comprising four leg sections adapted to stand at the four corners of a rectangular area, each leg section comprising first, second, and third long parallel members adapted to stand vertically and arranged at the corners of a right-triangular configuration as seen in cross section, the first of said members in each leg section standing at a corner of the rectangular area with the second and third members in each leg section being spaced from said first member and standing along the sides of said rectangular area near said corner, a plurality of spaced cross pieces in each leg section intermediate said first member and the other two, the ends of the two pairs of upper cross pieces in each leg section having open bores facing horizontally away from said first member forming two pairs of vertically spaced upper sockets, a pair of said cross pieces in each leg section being located at the bottom end of the leg section, each of said pairs of cross pieces having open bores facing horizontally away from said first member and forming horizontal bottom sockets adjacent to the ground level, three tie bars lying along three sides of said rectangular area adjacent to the ground level, four trusses extending horizontally between the top ends of said leg sections, said trusses each having first and second vertically spaced rigid projecting elements on their ends fitting into said upper sockets to support said trusses spanned between the upper ends of respective second and third vertical members of respective ones of said leg sections and vertically aligned with the sides of said rectangular area, and third rigid projecting elements on the ends of said tie bars fitting into said bottom sockets to tie the bottom ends of said leg sections together along three sides of said rectangular area.

3. A collapsible stage comprising four leg sections adapted to stand at the four corners of a rectangular area, each leg section comprising first, second, and third long parallel members standing vertically and arranged at the vertices of a right-triangle as seen from an end of said section, with said first member at the right-angle vertex of said triangle, a plurality of parallel spaced cross pieces extending perpendicularly from said first member to said second and third members, a first pair of said cross pieces being tubes positioned at the bottom ends of said members and having open bores facing horizontally away from said first member to form lower sockets, a diagonal brace between said second and third members at one end, a second pair of said cross pieces being tubes posi-

tioned at the top ends of said members and having open bores facing horizontally away from said first member to form top sockets, and a third pair of said cross pieces being adjacent tubes equidistant from respective tubes of said second pair and extending between said first member and said second and third members, respectively, and having open bores extending horizontally away from said first member to form intermediate sockets, said intermediate sockets being spaced from said top sockets a distance approximately equal to the spacing between said first and second members, a plurality of horizontal trusses each including a pair of rigid elements projecting from each end and fitting into a top and an intermediate socket to support said trusses intermediate the upper ends of said leg sections, and a plurality of tie bars having ends fitting into the lower sockets to hold the bottom ends of said leg sections in spaced relationship.

4. A collapsible structure as claimed in claim 3 and wherein said first, second, and third members in each leg are tubular and said first pair of cross pieces at the bottom end of each leg have holes therein aligned with the bores of said tubular members.

5. Apparatus enabling easy assembly and disassembly of a stage of rectangular area and easy transportation of the disassembled stage and all of its accessory equipment comprising a box, four leg sections, each leg section having a right-triangular configuration as seen in cross section and including a first long member adapted to stand vertically at a corner of the rectangular area and a pair of second long members parallel thereto and adapted to stand at positions along the sides of the rectangular area, said sections having a ladder type construction and including a plurality of rungs extending transversely between spaced points on respective ones of said long members, the right triangular area within each leg section being unobstructed over substantially the full length of the leg section at least four truss sections adapted to extend between the upper ends of said leg sections in the assembled stage and each having a ladder-type construction and including a plurality of long members adapted to extend horizontally in the assembled stage and a plurality of rungs extending transversely between spaced points on respective ones of said last-said long members, detachable fastening means adapted to secure said truss sections between the upper ends of said leg sections in the assembled stage, a plurality of curtain panels, detachable hanging means adapted to hang said curtain panels from said truss sections in the assembled stage, and accessory equipment, all of said sections being shorter than said box, the rungs in said various sections being spaced apart along their respective long members approximately the same distances from a first end of their respective sections, said box having a length slightly longer than the length of said leg sections and a width equal approximately to twice the distance between a first and second member in one of said leg sections, whereby said leg sections are enabled to nest together and whereby when said sections are fitted into said box with said first ends together the rungs on the various sections align with each other, leaving spaces therebetween adapted to receive said accessory equipment and portion of said curtain panels.

6. A collapsible structure comprising four leg sections standing at the four corners of a rectangular area, each leg section comprising first, second, and third long parallel members standing vertically and arranged in a right-triangular configuration as seen in cross section, the first of said members in each leg section standing at a corner of the rectangular area with the second and third members in each leg section being spaced from said first member and standing along the sides of said rectangular area near said corner, a plurality of spaced cross pieces in each leg section intermediate said first member and the second and third members, a pair of side headers and a front and rear header, each having a ladder-type construction including a pair of long members extending horizontally, one over the other, and a plurality of spaced rungs extending vertically therebetween, detachable fastening means securing each of said headers between the upper ends of a respective pair of said legs, and a movable header bridged between said side headers, said movable header having a ladder type construction and including a pair of long members, one over the other, and a plurality of spaced rungs extending vertically therebetween, and detachable and movable fastening means securing said movable header to said side headers.

7. A collapsible structure as claimed in claim 6 and wherein a plurality of curtain panels hang down from said side headers and the ends of said movable header are aligned with the spaces between said curtain panels, and wherein a draw back curtain is supported from said movable header.

8. A collapsible structure comprising a plurality of leg sections standing at the vertices of a polygonal area, each leg section comprising first, second, and third long parallel tubular members standing vertically and arranged at the vertices of a right-triangle as seen from an end of said section, with said first member at the right-angle vertex of said triangle, a plurality of parallel spaced tubular cross pieces extending perpendicularly from said first member respectively to said second and third members, a first pair of said cross pieces being positioned at the top ends of said members and having open bores facing horizontally away from said first member to form first sockets, and a second pair of said cross pieces being equidistant from respective cross pieces of said first pair and extending between said first member and said second and third members, respectively, and having open bores extending horizontally away from said first member to form second sockets, said second sockets being spaced from said first sockets a distance approximately equal to the spacing between said first and second members, a plurality of truss sections each including first and second long tubular elements with a plurality of spaced tubular rungs extending vertically therebetween, said first tubular element being aligned with and extending between the first sockets on respective pairs of said leg sections, said second tubular elements being aligned with and extending between the second sockets on respective ones of said leg sections, and a projection on the ends of each element of each truss section extending into the respective socket adjacent thereto.

9. A collapsible structure as claimed in claim 8 and wherein said tubular elements are formed in sections joined by telescoping joints, and said tubular members and tubular elements are spaced equally far apart and are of about the same diameter, said socket-forming cross pieces also having the same diameter, and said rungs having about a 25% smaller diameter.

10. A collapsible structure as claimed in claim 9 and wherein said tubular members and tubular elements are about 1¼ inches in diameter of aluminum alloy tubing and all of said cross pieces and rungs are of similar material welded thereto.

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