April 23, 1963 R. E. SCHIEBER, JR 3,086,256

FOLDING STAGE

Filed April 2, 1959

4 Sheets-Sheet 1

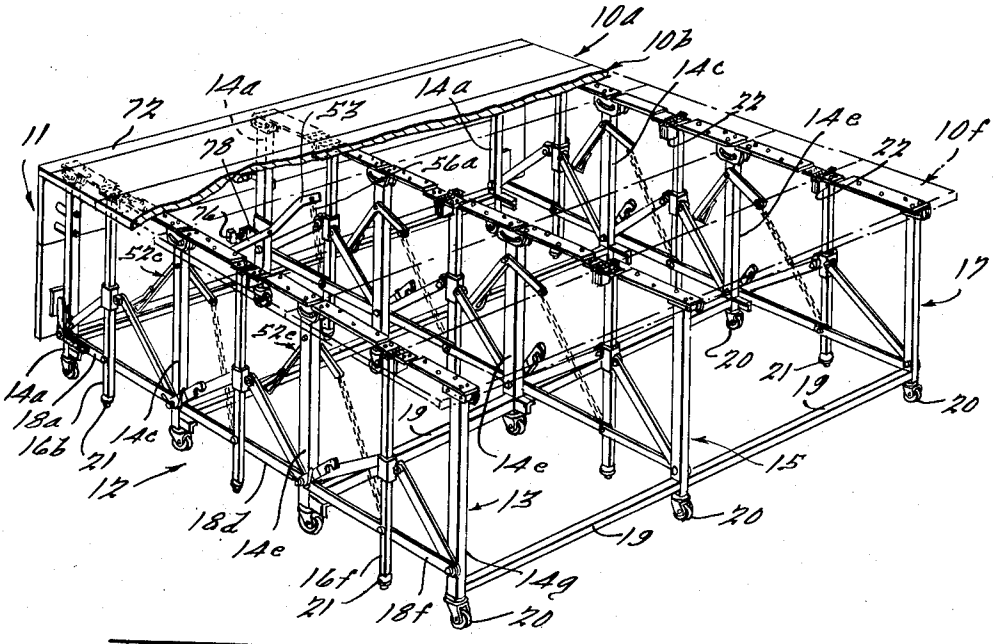

Fig. 1.

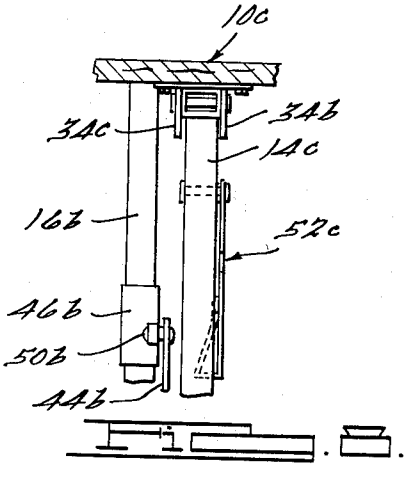

Fig. 3.

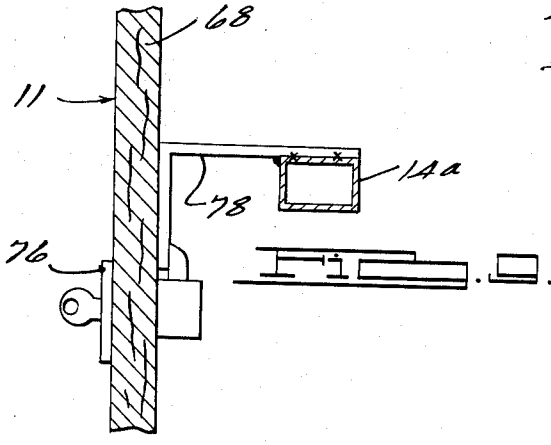

Fig. 2.

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4 Sheets-Sheet 2

FIG. 2.

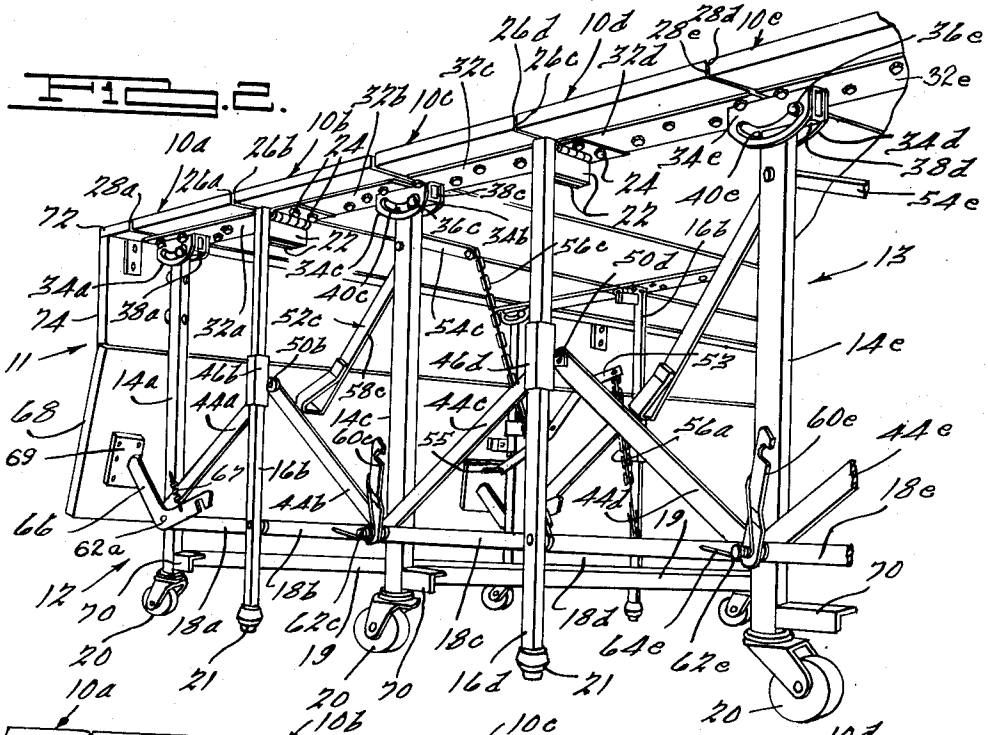
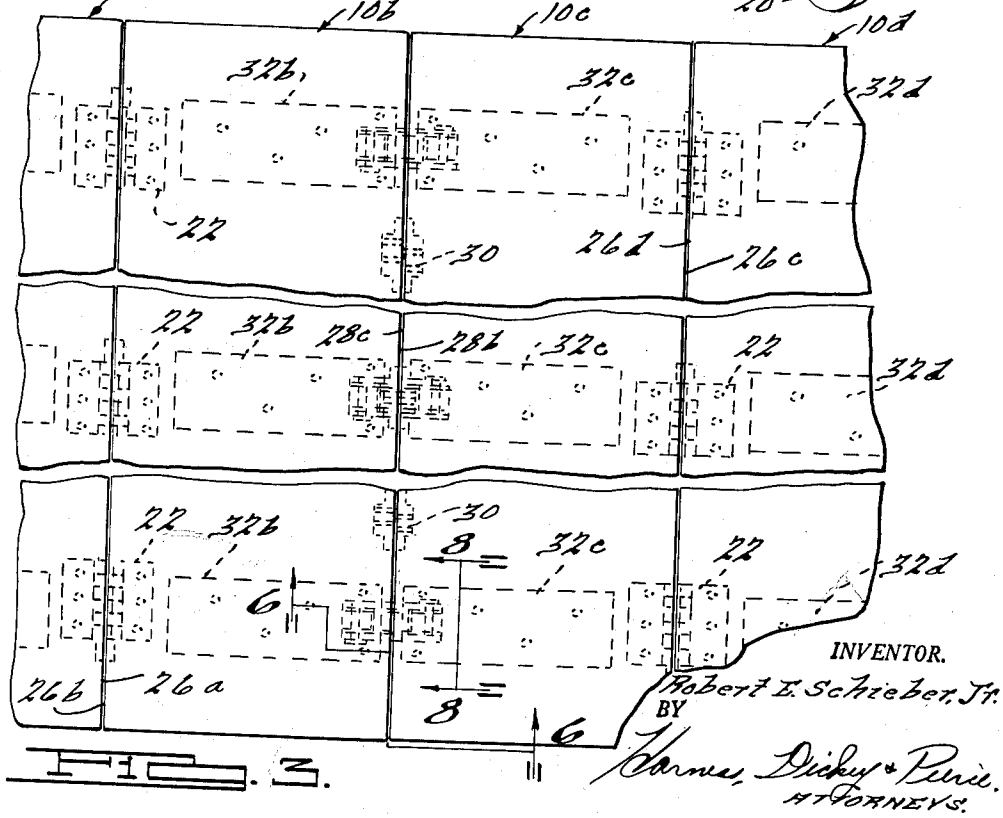


FIG. 3.



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FOLDING STAGE

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4 Sheets-Sheet 3

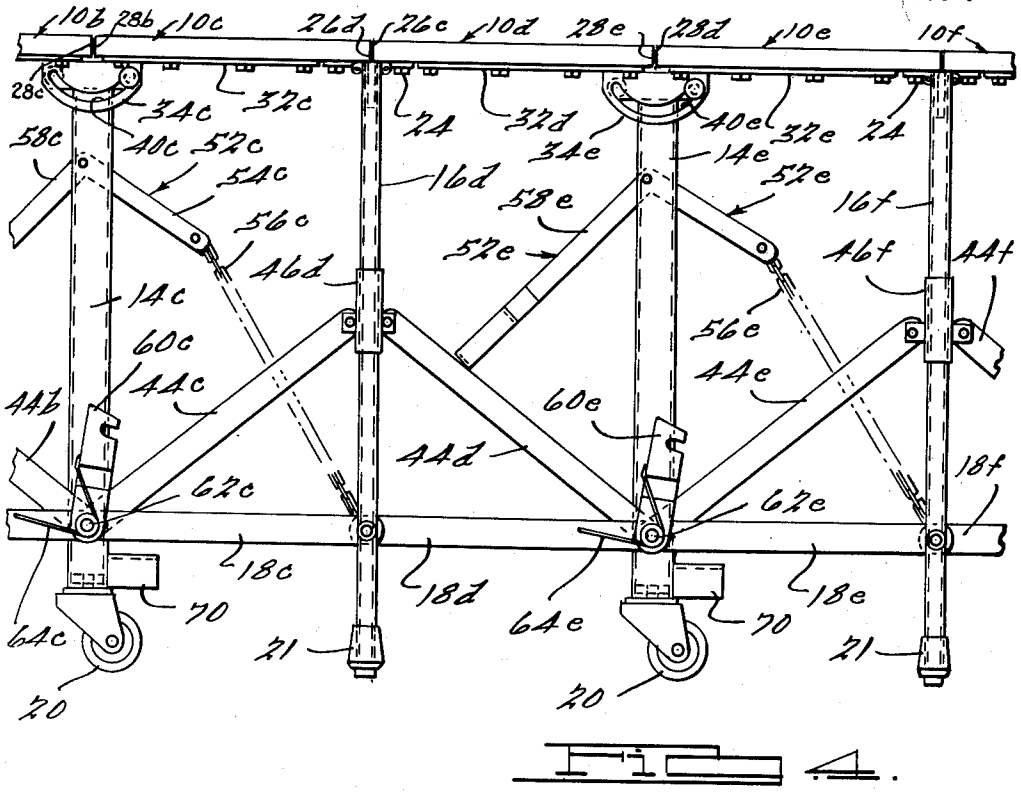

FIG. 1.

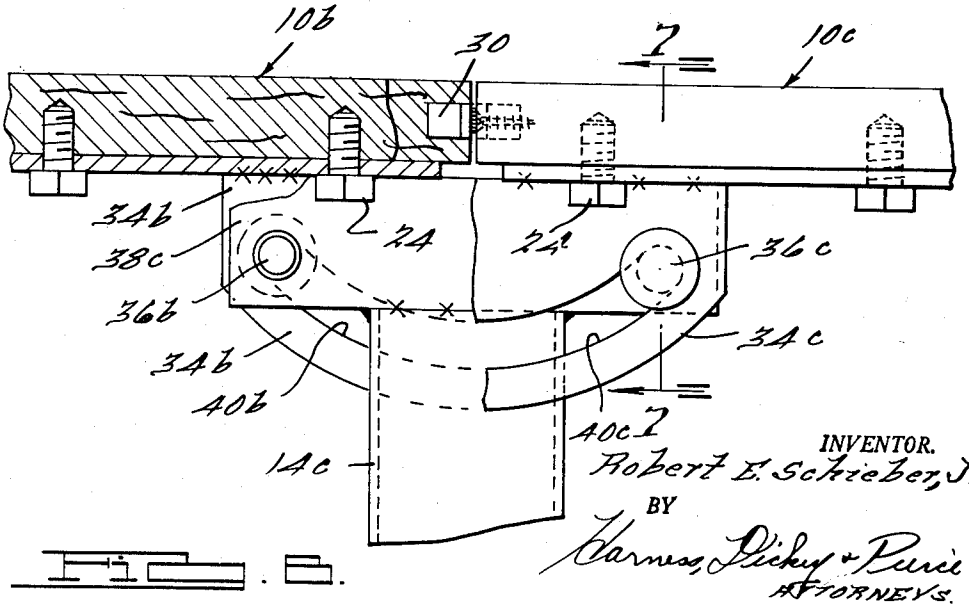

FIG. 2.

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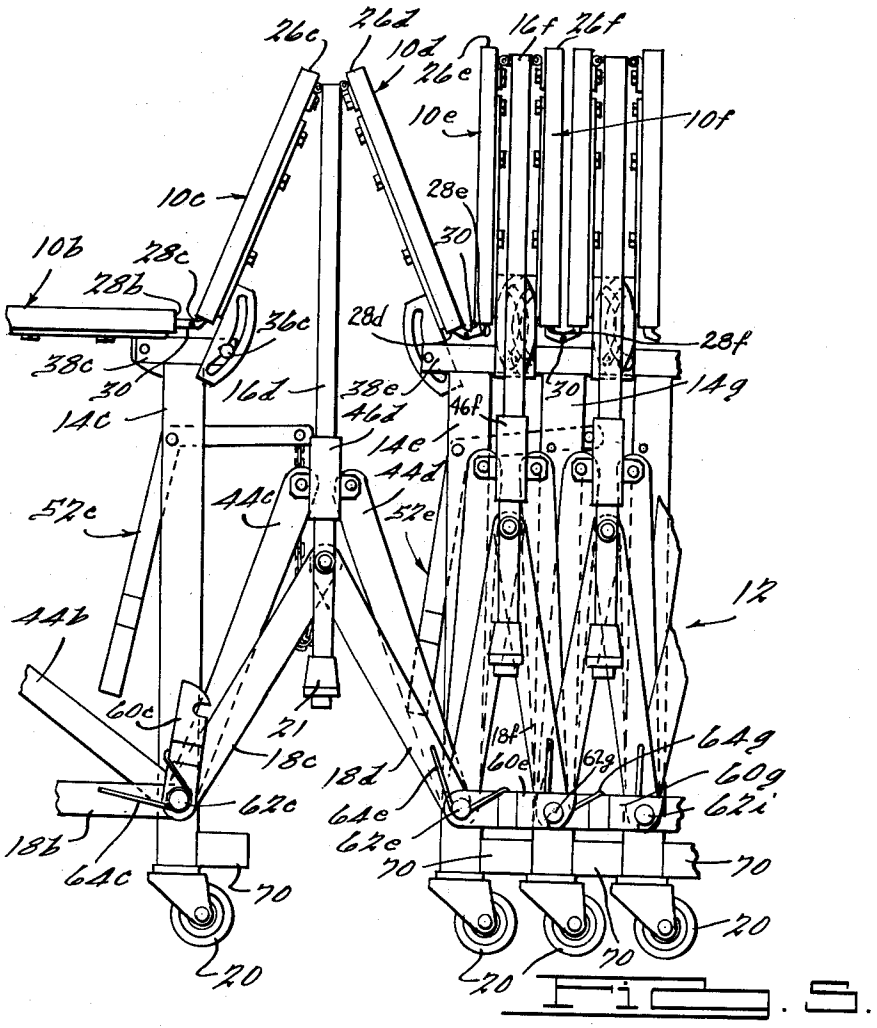
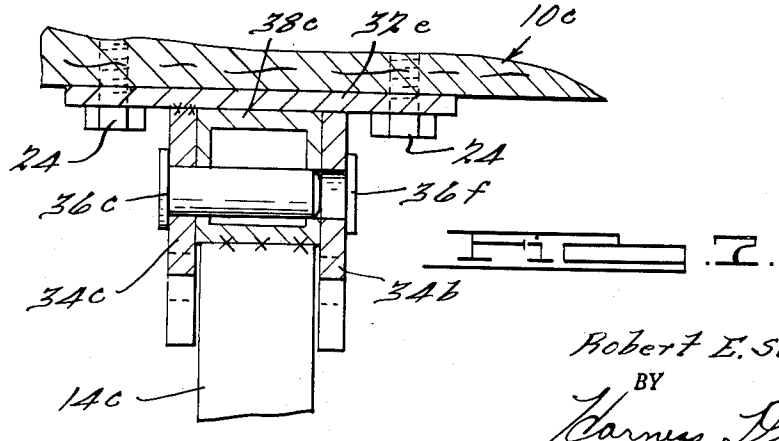
4 Sheets-Sheet 4





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United States Patent Office 3,086,256 Patented Apr. 23, 1963

3,086,256

FOLDING STAGE

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Filed Apr. 2, 1959, Ser. No. 803,668
1 Claim. (Cl. 20—1.123)

This invention relates to improved collapsible, or folding platforms, or stages of the type commonly used to provide a performing stage in school gymnasiums, cafeterias, or other halls, which are generally built with level floors and not especially designed to include fixed, raised platforms, or where insufficient space is available for a fixed stage.

One important object of the present invention is to provide an improved folding platform, or stage, which can be easily folded for storage, and readily and quickly unfolded and set up for use when and where desired.

Other objects of the invention are: to provide an improved folding stage having a smooth and unobstructed surface without recesses or projecting hardware, thereby improving the convenience of persons using the stage and also facilitating cleaning and refinishing of the stage surfaces; to provide an improved folding stage including a plurality of juxtaposed planks, or panels, which fold up accordion-fashion for storage, and including a hinge arrangement whereby all of the panels are hinged from beneath the upper surface of the stage, thus avoiding the need to locate hinge pintles or other hardware on the upper surface or in recesses in the upper surface; to provide in a folding stage of the stated character, an improved arrangement for breaking the joints between the panels as the stage is folded up for storage; and in general to provide an improved folding platform, or stage construction which is relatively inexpensive to manufacture, simple to operate, and rugged and dependable in service.

The foregoing and other objects and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment thereof taken in conjunction with the drawings wherein:

FIGURE 1 is a perspective view with parts broken away of a collapsible, or folding stage according to a preferred embodiment of the invention;

FIG. 2 is a fragmentary perspective view of the stage shown in FIG. 1, but taken on a larger scale and from a different angle of view to show certain details thereof;

FIG. 3 is a fragmentary plan view of the folding stage illustrated in FIGS. 1 and 2;

FIG. 4 is a fragmentary side elevational view of the folding stage shown in the preceding figures, showing the platform in its open, or extended position;

FIG. 5 is a fragmentary, side elevational view of the stage shown in the preceding figures showing the stage in a partly folding position as it appears during unfolding thereof;

FIG. 6 is a fragmentary, side elevational view, partly in section, taken along the line 6—6 of FIG. 3;

FIG. 7 is a cross-sectional view taken along the line 7—7 of FIG. 6;

FIG. 8 is a fragmentary cross-sectional view of the stage taken along the section line 8—8 of FIG. 2; and

FIG. 9 is a fragmentary horizontal sectional view showing a detail of the latching arrangement for locking the stage in its collapsed, or folded position.

A folding stage according to a preferred embodiment of the invention is shown in the drawings, and comprises a plurality of panels, or planks **10***a*, **10***b*, **10***c*, **10***d*, **10***e* and **10***f* which may be of wood, and which are arranged side by side, with their abutting edges hinged together so that the panels can fold together in a zigzag, or accordion-like pattern. Any desired number of panels may be included in the construction depending on the desired size of the stage in view of the width of the panels as determined by their strength and the desired load capacity of the stage. The stage as illustrated in FIG. 1 includes only six panels, but as illustrated in FIG. 5 would include at least ten panels, seven of which are shown. The number of panels is not in any way limiting.

A two-piece apron **11** extends down from the front edge of the stage to provide a neat appearance, and may, if desired, be extended to floor level.

The panels **10***a*–**10***f* are supported upon a sturdy substructure generally designated **12** which may be of steel, and which supports the stage both in its extended position and in its folded, or collapsed position. As shown, the substructure **12** includes three rows **13**, **15**, and **17** of supporting legs **14***a*, **14***c*, **14***e*, **14***g*, **16***b*, **16***d* and **16***f*, which may be of tubular steel or other rigid material having the desired strength. Fewer or more rows may be provided, if desired, depending upon the width of the platform and the load it is designed to bear in relation to the strength of the panels **10***a*–**10***f*. The different rows **13**, **15**, and **17** of the supporting understructure are connected together at their tops by means of the panels **10***a*–**10***f*, and are connected together near the bottom by rigid, laterally extending members such as the angle irons **19**, which are secured as by welding near the bottoms of the legs **14***a*, **14***c*, **14***e*, and **14***g*.

The three rows **13**, **15**, and **17** of the substructure are identical to each other in construction and operation, and operate synchronously during folding and unfolding of the stage. The following description will be related to the single row **13**, in the foreground of FIGS. 1 and 2, and it will be understood that the construction of each one of the rows is identical to the row described, except for change of hand between the two rows **13** and **17** along the opposite sides of the stage.

The legs **14***a*, **14***c*, **14***e*, and **14***g* are parallelogram linked to the legs **16***b*, **16***c*, and **16***f* through the panels **10***a*–**10***f* at their upper ends, and through links **18***a*–**18***f* at their lower ends. Alternate ones **14***a*, **14***c*, **14***e* and **14***g* of the legs are provided with rollers **20**, which are preferably castered, as illustrated for ease in moving the stage while it is in its folded transport, or storage position. The legs **16***b*, **16***d*, and **16***f* between each two of the roller mounted legs are provided with rubber tips **21** to insure good frictional, nonmarring engagement with the floor, to hold the stage against lateral movement while it is in use.

The parallelogram folding action of the panels **10***a*–**10***f* is arranged so that during folding the rubber tipped legs **16***b*, **16***d*, and **16***f* move upwardly, and are supported in an elevated position, as shown in FIG. 5. When the stage is fully folded, it is supported entirely on the roller mounted legs **14***a*, **14***c*, **14***e* and **14***g*, and can be readily moved about on the rollers **20**.

During folding of the stage from its open, or extended position to its fully folded position, the panels **10***a*–**10***f* fold downwardly relative to the rubber tipped legs **16***b*, **16***d*, and **16***f* and fold upwardly relative to the roller mounted legs **14***a*, **14***c*, **14***e* and **14***g*. The panels **10***a*–**10***f* are hinged directly to the rubber tipped legs **16***b*, **16***d*, and **16***f* by butt hinges **22**. One plate (not separately designated) of each one of the hinges **22** is fixed as by screws **24** to the bottom of one of the panels **10***a*–**10***f*, respectively, near the edge **26***a*, **26***b*, **26***c*, **26***d*, **26***e*, or **26***f* thereof adjacent to the rubber tipped legs. The other plate of each hinge is rigidly secured as by welding to the leg **16***b*, **16***c*, or **16***f* to provide a load supporting connection between the legs **16***b*, **16***d*, and **16***f* and the panels. The pintles (not separately designated) of the

butt hinges 22 are disposed below the panels 10*a*–10*f* and do not present a problem with respect to obstructing the top surface. The hinges 22 are secured to the panels by means of screws 24 which extend only partly through the panels, and do not protrude above the top surface.

The opposite edges 28*a*–28*f* of the panels must fold about a hinge axis located in or above the plane of the upper surface of the stage. This requirement is not readily compatible with the desirability of making the stage surface clear, flat, and unobstructed by recesses or projecting hardware such as hinge pintles, while still providing a smooth folding action without binding or rubbing contact between the panel edges, and providing a tight joint between the panels when the stage is opened, or extended. Previous folding stages have used hinges along the panel edges 28*a*–28*f* having pintles either projecting above the top surface of the stage or recessed in niches in the panels, thus obstructing the surface or making it difficult to clean and to refinish.

In the present construction, the panels 10*a*–10*e* meet tightly along their edges 28*a*–28*e* above the roller mounted legs 14*a*, 14*c*, and 14*e* when the stage is in its open position, yet are completely clear and unobstructed. Fully concealed hinges 30 which may be, for example, of the type sold commercially by the Soss Manufacturing Company are used to join the edges 28*a*–28*e* of the panels above the roller mounted legs. According to the present invention, provision is made to minimize the stresses imposed upon the fully concealed hinges 30, and to relieve them of load, since they are relatively not strong and do not have the most effective purchase on the panels, being recessed into the panel edges and secured by screws extending parallel to the major surfaces of the panels. Provision is also made to attach the panels 10*a*–10*f* pivotally to the roller mounted legs 14*a*, 14*c*, 14*e*, and 14*g* to keep the legs in alignment with the panels and to ensure the proper parallelogram action during folding.

In the open position of the stage, the panels 10*a*–10*f* are supported by the legs 14*a*, 14*c*, 14*e*, and 14*g*, resting directly upon cross members 38*a*, 38*c*, 38*e*, and 38*g* fixed on top of the legs, thus minimizing the load placed upon the concealed hinges 30. Bearing and reinforcing plates 32*a*–32*f*, which may be of steel, are secured along the bottoms of the planks 10*a*–10*f* above each row 13, 15, and 17 of the substructure for rigidifying the planks and protecting them from abrasion and crushing forces.

The pivotal connection between the planks 10*a*–10*f* and the roller mounted legs 14*a*, 14*c*, 14*e*, and 14*g* is provided by a sliding hinge arrangement including slotted guide plates 34*a*–34*e*, which are rigidly secured as by welding to the reinforcing plates 32*a*–32*e*, and which extend downwardly along alternately opposite sides of the roller mounted legs 14*a*, 14*c*, 14*e*, and 14*g* to engage guide pins 36*a*–36*e*. The guide pins 36*a*–36*e* are fixed on and extend laterally in alternately opposite directions from the cross members 38*a*, 38*c*, 38*e*, and 38*d* through the slots 40*a*–40*e* respectively of the guide plates.

Each one of the guide plates 34*a*–34*e* is secured to only one of the panels 10*a*–10*e*, and the slots 40*a*–40*e* are curved about the same pivot axes as the concealed hinges 30 to permit the guide plates 34*a*–34*e* to swing upon the pins 36*a*–36*e* during folding and unfolding of the stage. The guide plates 34*a*–34*e* keep the legs 14*a*, 14*c*, 14*e* positively aligned both laterally and longitudinally. Lateral alignment is achieved by the relatively close spacing of the guide plates 34*a*–34*e* laterally on the opposite sides of the cross pieces 38*a*, 38*c*, as best shown in FIG. 7. Longitudinal alignment is achieved by the pin-in-slot arrangement.

The slots 40*a*–40*e* are sufficiently long and the pins 36*a*–36*e* are displaced from the center lines of the legs 14*a*, 14*c*, 14*e*, and 14*g* to permit a full 90° swing of the panels so that the panels 10*a*–10*e* may be folded to a vertical position, as illustrated in FIG. 5. In this construction, the concealed hinges 30 control the folding action of the panels 10*a*–10*e* relative to each other and keep their edges 28*a*–28*d* properly spaced from each other to prevent scuffing or rubbing.

The substructure 12 is reinforced by a collapsible truss arrangement (not generally designated) including diagonally extending links 44*a*–44*f* which are pivotally connected between the lower ends of the roller mounted legs 14*a*, 14*c*, 14*e*, and 14*g* and sleeve members 46*b*, 46*d*, and 46*f*, which are slidably fitted upon the vertically movable legs 16*b*, 16*d*, and 16*f*. The links 44*a*–44*f* act in pairs to form triangular trusses when the stage is in its extended, or open position and rigidify the parallelogram structures. When the stage is folded from its extended position to its storage position, the vertically movable legs 16*b*, 16*d*, and 16*f* move upwardly relative to the sleeves 46*b*, 46*d*, and 46*f*. The pivot connections 50*a*–50*f* between the links 44*a*–44*f* and the sleeves are preferably spaced outwardly from the sleeves, as shown, so that the links 44*a*–44*f* support the sleeves 46*b*, 46*d*, and 46*f* against tipping and thus rigidify the vertically movable legs when the stage is in its folded position.

During folding of the stage from its open, or extended position to its folded, storage position, the successive pairs of the panels 10*a*–10*f* fold in a successive folding action, thus minimizing the force required for folding, and rendering the stage relatively easy to fold up for storage, and also easy to manage when unfolding. The first section of the stage, including the first two panels 10*a* and 10*b*, for example, completes a major part of its folding travel before the next section, including the panels 10*c* and 10*d*, starts to fold, and, similarly, the second section, including the panels 10*c* and 10*d*, completes most of its folding travel before the third section starts to fold. A relatively simple, but highly effective arrangement is provided to ensure this action and to break the folds successively, so that a push against the forward edge of the stage will be translated into a proper folding force for folding the stage rather than being transmitted in a direction to move the stage along the floor.

For this purpose, bell cranks 52*c* and 52*e* are pivoted upon all of the roller mounted legs except the legs at the rear end of the stage. The rearwardly projecting arms 54*c* and 54*e* of the bell cranks extend rearwardly when the stage is fully opened, and are connected at their ends by chains 56*c* and 56*e* to the vertically movable legs 16*d* and 16*f* immediately to the rear of the legs 14*c* and 14*e* on which the bell cranks are mounted. The front arms 58*c* and 58*e* of the bell cranks extend downwardly and forwardly, and are bent laterally to bring their lower ends into line with the roller mounted legs 14*a* and 14*c*. The vertically movable legs 16*b*, 16*d*, and 16*f*, the truss links 44*a*–44*f*, and the lower parallelogram links 18*a*–18*f* are all laterally offset from the roller mounted legs 14*a*, 14*c*, 14*e*, and 14*g* to permit engagement of the front bell crank arms 58*c* and 58*e* by the roller mounted legs 14*a* and 14*c*, respectively, immediately in front of them.

During folding of the stage, the roller mounted legs 14*a*, 14*c*, 14*e* and 14*g* approach each other, and the leg 14*a*, for example, of the first section to be folded strikes the front arm 58*c* of the first bell crank during the terminal portion of the folding travel of the first section, and the remaining closing travel of the leg 14*a* pivots the bell crank 52*c* in a counterclockwise direction to lift the next vertically movable leg 16*d* off the floor, thereby starting the folding action of the next section, which in this example includes the panels 10*c* and 10*d*.

A special foot-operated lever 53 is pivoted on a bracket (not separately designated) on one of the front legs 14*a* for breaking the first section, that is, for breaking the fold between the first two panels 10*a* and 10*b*. A chain 56*a* is connected between the rear end of the lever 53 and the vertically movable leg 16*b* immediately behind it. A foot bar 55 projects from the forward end of the lever 53 for actuating it.

The lever **53** is mounted to clear the apron panel **68** when the stage is open and the panel **68** is swung down to its vertical, or closed position. The apron panel **68** is normally raised for folding the stage, thereby providing access to the foot bar **55**.

The stage may thus be folded in a row of dominoes sequence, the terminal portion of the folding travel of each section initiating the folding of the succeeding section. It has been found that by using the chains **56***c* and **56***e*, or other tension members to connect the rearwardly extending arms **54***c* and **54***e* of the bell cranks to points relatively low on the vertically movable legs **16***d* and **16***f*, a relatively smooth and easy lifting action is achieved, and the force required in folding the stage is reduced.

Notched bars, or hooks **60***c*, **60***e*, and **60***g* (FIG. 5) are provided for locking the stage in its closed position when it is folded. The hooks **60***c*, **60***e*, and **60***g* are pivoted upon pins **62***c*, **62***e*, and **62***g* near the bottoms of the roller mounted legs **14***c*, **14***e*, and **14***g* respectively, and their movement is controlled by the lower parallelogram links through torsion coil springs **64***c*, **64***e*, and **64***g*, which are pivoted on the pins **62***c*, **62***e* and **62***g*, respectively. The springs **64***c*, **64***e* and **64***g* are each provided with two arms (not separately designated) the forward ones of which engage the links **18***b*, **18***d*, and **18***f*, respectively, immediately forwardly of the pivot pins **62***c*, **62***e* and **62***g*, and the rear ones of which are fixed to the hooks **60***c*, **60***e* and **60***g*, respectively. When the stage is in its open position, and the links **18***b*–**18***f* are horizontal, the springs **64***c*, **64***e* and **64***g* raise the hooks **60***c*, **60***e* and **60***g* and hold them in a vertical position. When the stage is folded, the links **18***b*–**18***f* pivot in a clockwise direction, as viewed in FIG. 2, and through the springs **64***c*, **64***e* and **64***g* pivot the hooks **60***c*, **60***e* and **60***g* to a horizontal position.

The first section of the stage is locked by a hook **66**, which is in the form of a bell crank, and which is pivoted upon the pin **62***a* on the front roller mounted leg and spring urged in a counterclockwise direction by a spring **67** connected between the hook **66** and the first leg **14***a*. The hook **66** is actuated by the lower apron panel **68**, when the panel is swung downwardly. An abutment plate **69** is fixed on the rear surface of the apron panel **68** for engaging the forward arm of the hook **66** and pivoting the hook to move its rear arm into a horizontal position as the apron panel **68** is closed. With this construction, when the stage is folded and the apron panel **68** is locked in its closed position, the hook **66** is positively held in engagement with the pin **62***c* on the second roller mounted leg **14***c*.

The pins **62***c*, **62***e*, **62***g* and **62***i* (FIG. 5) extend sufficiently far outwardly, and the hooks **66**, **60***c*, **60***e* and **60***g* are laterally offset sufficiently to engage the pins when the roller mounted legs are moved to their fully closed position.

During folding of the stage, the hooks **60***c*, **60***e* and **60***g* are moved toward their horizontal positions successively as the successive sections reach their fully folded positions, and are thereafter engaged by the pins **62***e*, **62***g* and **62***i* immediately to the rear of the hooks. The pins **62***e*, **62***g* and **62***i* cam the hooks **60***c*, **60***e* and **60***g* upwardly against the urging of the springs **64***c*, **64***e* and **64***g* until they reach the notches (not separately designated) whereupon the springs **64***c*, **64***e* and **64***g* drive the hooks into locking engagement of the pins. The apron panel **68** may be closed at any time after the first stage section is folded to engage the hook **66** upon the pin **62***c* and thereby to lock the first section in its folded position.

When the stage is completely folded and the apron panel **68** is moved to its closed, or vertical position, all of the hooks **66**, and **60***c*, **60***e* and **60***g* are horizontal and in engagement with the pins **62***c*, **62***e*, **62***g* and **62***i* immediately to the rear of the pins **62***a*, **62***c*, **62***e* and **62**g upon which the hooks are respectively mounted, thus holding the roller mounted legs and the entire stage from unfolding.

The stage may be locked in this position by means of a key operated lock, such as the spring lock **76** illustrated in FIG. 9 which may be mounted in the hinged, lower apron panel **68** for engagement with a catch plate **78**. The catch plate **78** may be, for example, secured to the first leg **14***a* of the central row **15** in the substructure. When thus locked, the sage may be moved about as desired in its folded storage condition.

When it is desired thereafter to open the stage, the lock **76** may be unlocked and the apron panel **68** raised sufficiently far to release the hook **66**, thus allowing the biasing spring to swing the hook **66** out of engagement with the first lock pin **62***c*, to unlock the first section of the stage. Unfolding of the first section moves the parallelogram link **18***b* toward its horizontal position, thereby drawing the second hook **60***c* toward its vertical position and unlatching the next lock pin **62***e*. Since, during opening of the stage there is a tension force upon the latched ones of the hooks **60***c*, **60***e* and **60***g*, the hooks will be retained in engagement with the pins **62***e*, **62***g* and **62***i* until the springs **64***c*, **64***e* and **64***g* are stressed sufficiently by the parallelogram links **18***b*–**18***f* to overcome the retaining frictional engagement.

Bumpers **70** which may be simple angle iron pieces, as illustrated, are secured to and extend rearwardly from the roller mounted legs **14***a*, **14***c* and **14***e* for limiting the travel of the roller mounted legs toward each other when the stage is in its closed position. The bumpers **70** are dimensioned to space the lower ends of the legs **14***a*, **14***c* and **14***e* apart a distance equal to the spacing between their upper ends to keep them in straight vertical alignment when the stage is in its folded position.

A relatively narrow extension panel **72** is provided at the forward end of the stage to cover the extension of the cross pieces **38***a* beyond the center line of the front legs **14***a*, and to close the space between the first panel **10***a* and the upper panel **74** of the apron.

What is claimed is:

In a folding stage construction of the type having a plurality of juxtaposed panels hinged together along their adjacent edges and foldable between a generally horizontal position wherein they constitute a supporting surface and a zigzag accordion-like folded position for storage, and a substructure comprising a first plurality of legs at alternate hinge points below the junction of the edges which are downwardly disposed when the stage is folded, a second plurality of vertically movable legs hinged at intermediate hinge points, and means to raise said vertically movable legs to facilitate folding of the panels, the improvement comprising fully concealed hinges for joining the panels together along their edges that are exposed downwardly when the stage is in its folded position, said hinges being arranged to pivot about pivot axes, and means for pivotally connecting the panels to said first plurality, respectively, of vertically extending leg portions of the substructure that extend generally in the vertical planes of said pivot axes, said connecting means including guide plates secured to the bottom surfaces of the panels and having arcuate slots curved about said pivot axes, said guide plates being disposed in abutting sliding relationship with said first plurality, respectively, of leg portions, and pins fixed to said first plurality, respectively, of leg portions of the substructure and extending therefrom generally parallel to said pivot axes through said slots at positions offset from the vertical planes of said pivot axes, whereby during folding and unfolding travel of the panels said guide plates and said pins cooperate to keep said first plurality, respectively, of leg portions and the panels in predetermined alignment with each other.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

898,374	Jessen	Sept. 8, 1908
1,655,217	Brown	Dec. 18, 1925
1,747,290	Corrigan	Feb. 18, 1930
1,935,246	Kirsch	Nov. 14, 1933
2,227,871	Wigell	Jan. 7, 1941
2,668,331	Horn	Feb. 9, 1954
2,699,978	Mugler	Jan. 18, 1955
2,734,708	Cohn	Feb. 14, 1956
2,815,541	Lappin	Dec. 10, 1957
2,831,740	Schieber	Apr. 22, 1958
2,841,831	Mackintosh	July 8, 1958