

Jan. 24, 1961

W. G. FORDING
FOLDING BLEACHERS

2,968,843

Filed June 26, 1959

3 Sheets-Sheet 1

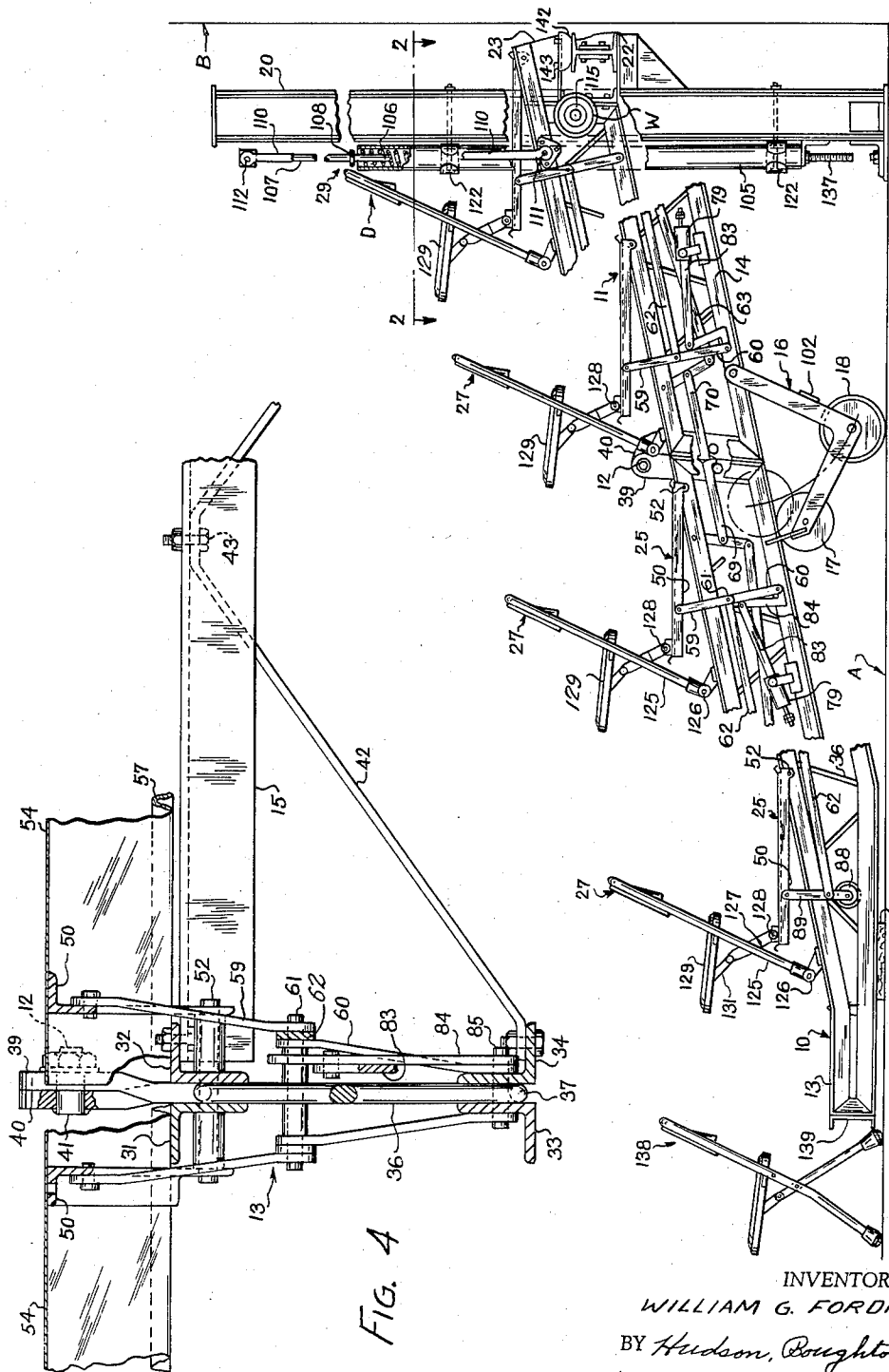


FIG. 1

FIG. 4

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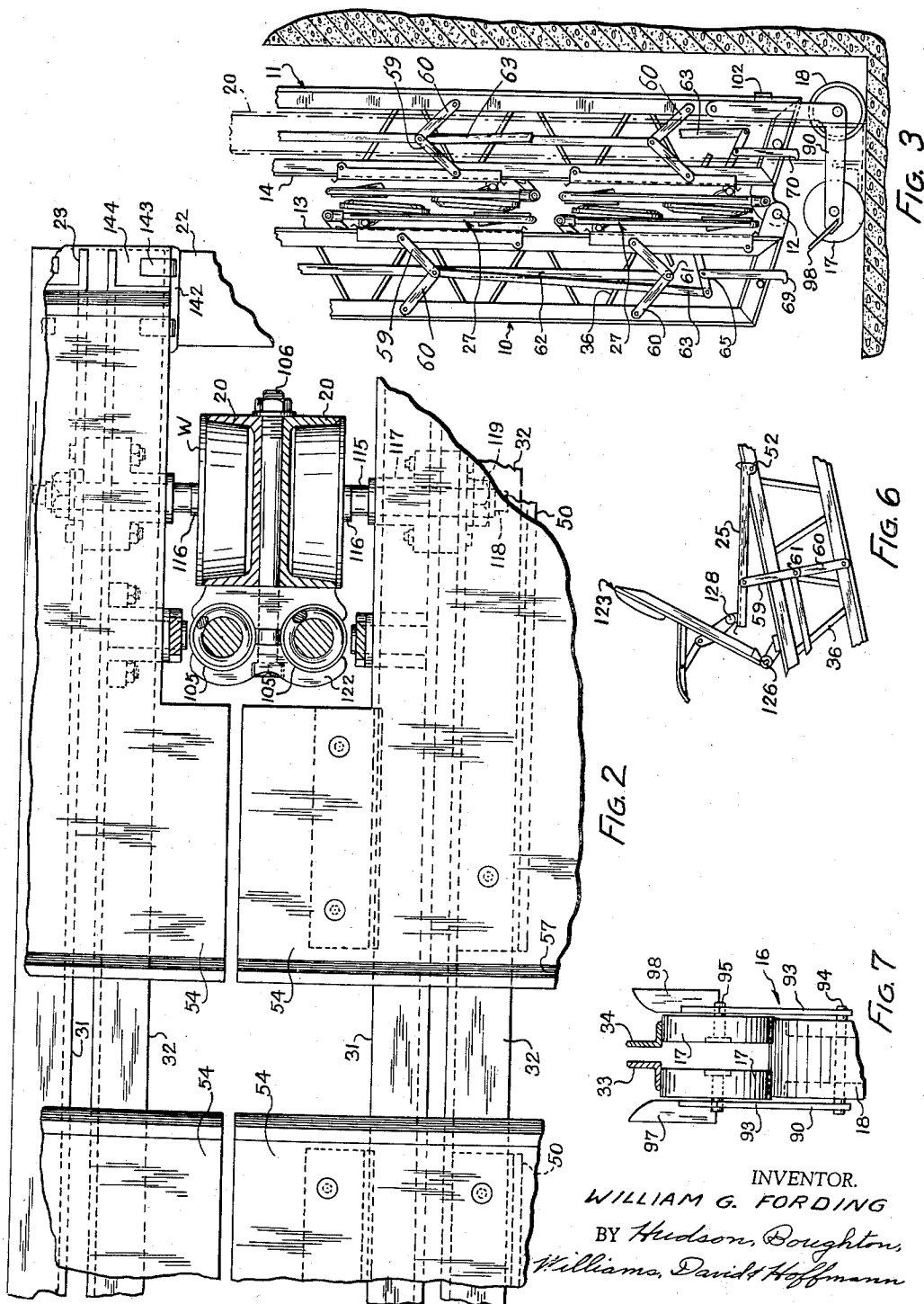
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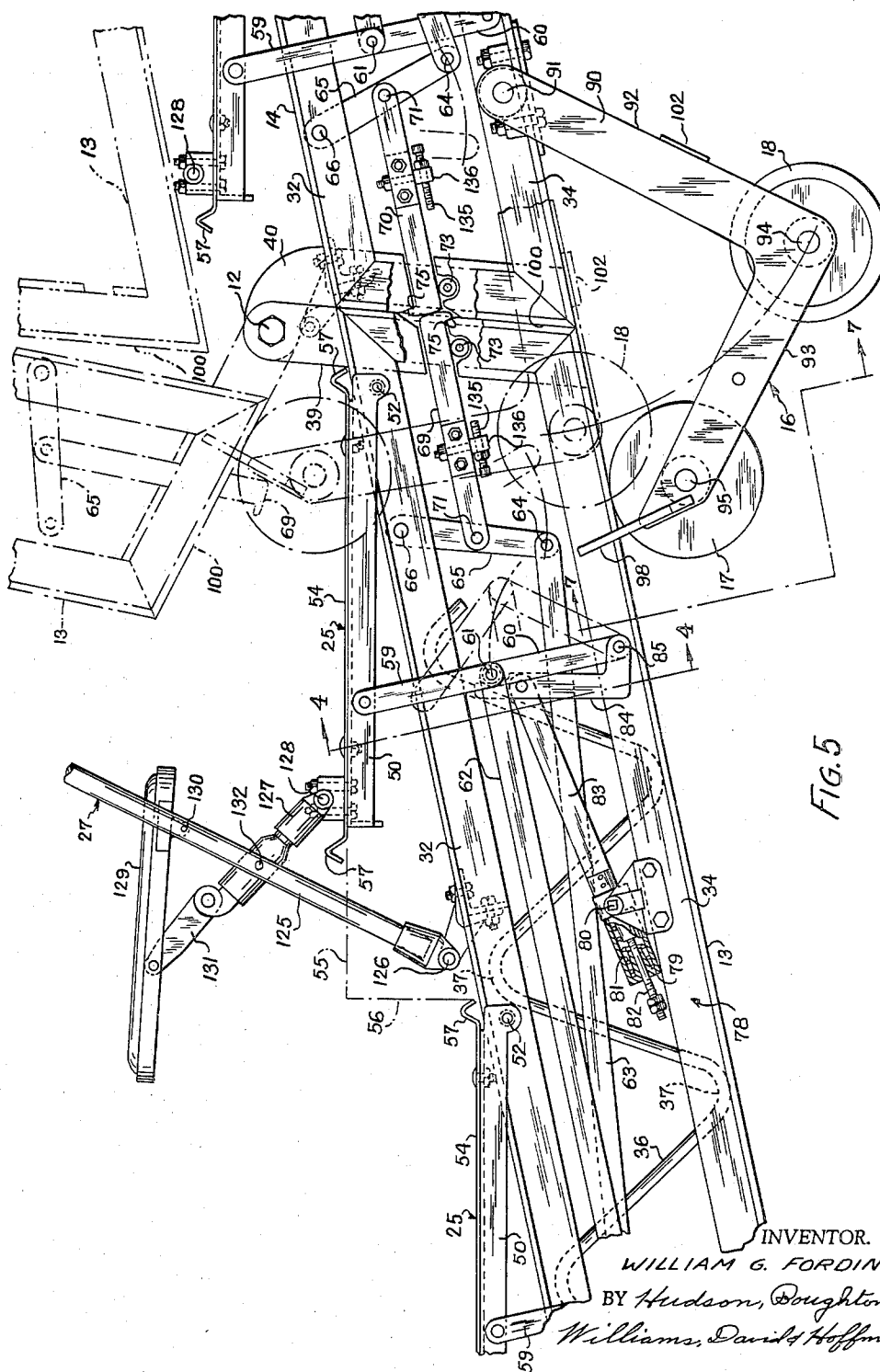
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FOLDING BLEACHERS

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Filed June 26, 1959, Ser. No. 823,211

4 Claims. (Cl. 20—1.126)

This invention relates to folding bleachers or grandstands, and more particularly to a novel bleacher or grandstand which may be conveniently folded into a compact vertically disposed unit for storage, as for example against the wall of a gymnasium or the like, and the invention has an object thereof the inclusion of a plurality of tiers with folding chairs or benches attached thereto, the chairs being connected in such a manner that they fold and unfold substantially in unison and in response to the folding and unfolding of the tiers and supporting framework.

It is another object of the present invention to provide a folding bleacher of the above mentioned character having automatically actuated folding chairs and may be conveniently constructed principally of light weight metals such as structural aluminum or the like, and which by reason of its lightness and its novel manner of folding, is capable of being folded or unfolded by manpower with a conservative expenditure of effort, and with a considerable saving in time heretofore needed to set up or take down folding chairs.

As a further object the invention aims to provide a bleacher or grandstand having generally rectangular front and rear frames hinged together to provide, when in an open or extended position, an inclined bleacher section resting on the ground or floor at the front edge portion, and elevated on vertical support means at the rear edge portion, there being transverse tiers pivotally connected to the frames and arranged in the form of ascending steps, and folding chairs or benches each having its front legs pivotally connected to the frames at substantially the level of one of the tiers and having shorter back legs pivotally connected to the next higher tier, the tiers being movable upon folding or unfolding of the frames between positions effective to automatically fold or unfold the chairs, and central support or rocker means for supporting the portions of the frames adjacent their hinged connection and having roller means thereon for supporting the bleacher when in use and when being operated and also when in its vertical or storage position.

Still another object of the improved folding bleacher of this invention is the provision of seating accommodations which are convenient and comfortable in use, which occupy little space when out of service, and which may be readily manufactured with more or fewer chairs and supporting tiers, and with longer or shorter sections thereof, these modifications being effected in a large part through the addition or deletion of duplicate parts.

Further objects and advantages of the invention will become apparent from the following detailed description of the presently preferred embodiment thereof taken together with the accompanying drawings forming a part of this specification, and in which:

Fig. 1 is a side elevation of a folding bleacher section embodying this invention showing the same in its extended, open position and with portions broken away for clarity,

Fig. 2 is an enlarged sectional view of part of the fold-

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ing bleacher of Fig. 1 taken substantially along line 2—2 thereof with some parts removed,

Fig. 3 is a side elevation of the folding bleacher of Fig. 1 illustrating the bleacher section in its folded position,

Fig. 4 is an enlarged sectional view of a portion of the bleacher taken substantially along line 4—4 of Fig. 5,

Fig. 5 is an enlarged view of the hinge and roller portion of the bleacher section,

Fig. 6 is a side elevation of a modification of the invention illustrating a folding bench therein, and

Fig. 7 is a reduced end view of the roller means illustrated in Fig. 5 taken substantially along line 7—7 thereof.

Referring to the drawings, the folding bleacher or grandstand is illustrated for convenience as being used in a room such as a gymnasium or the like having a floor A and a wall B, however the invention is well adapted to either outdoor or indoor use. The bleacher may comprise one or more seating sections placed end to end to accommodate the necessary number of persons. The description therefore will, for the most part, and as an example be directed to a single folding section, with later reference to the manner in which more than one such section is preferably associated.

The folding bleacher section illustrated in Fig. 1 in its extended position has a set of hinged inclined frames indicated generally at 10 and 11, having their hinged connection at 12. The frame 10 comprises a number of parallel composite beams such as the side beam members 13, the detailed structure of which will be later described, and the frame 11 comprises a number of parallel beams including the side members 14. The beams 13 are joined, as are the beams 14, by a plurality of transversely extending members 15, illustrated in Fig. 4.

The frames 10 and 11 are adapted to be folded about the hinge point 12 to assume a side by side relation for storage in an upright position as is illustrated in Fig. 3. Roller or rocker means generally indicated at 16 and having wheels 17 and 18, are pivoted to the beams 14 of the frame section 11 and are adapted to support the adjacent end portions of the frame sections 10 and 11 when in their open or extended positions as illustrated in Fig. 1, and when in their folded positions of Fig. 3.

The rear portion of the frame section 11 is elevated and has at the corners thereof wheel means W movably supported by vertical guide and support means comprising vertically extending channel members or rails 20. A transversely extending I-beam 22 serves as a stop or rest for an extension 23 of the rear frame 11 and determines the height of the rear portion of the frame 11 when the grandstand is extended. The front portion of the frame section 10 is adapted to rest on the floor A of the gymnasium or other room in which the grandstand or bleacher is installed. A plank 24 of approximately 1 inch thickness is conveniently interposed between the frame 10 and the floor to permit the insertion of a pinch bar to make slight sideways shifts in position if necessary to achieve perfect alignment with an adjacent bleacher section.

A plurality of transversely extending tiers 25 are arranged in ascending order in the nature of steps and extend substantially horizontally from the frame sections 10 and 11 when the latter are in their extended or open condition. Although the folding bleacher of this invention may be used without seating facilities other than the tiers themselves, it is preferable to provide a plurality of folding chairs 27. The present invention includes a system of operating links and connections whereby the tiers 25 and the folding chairs 27 are actuated by folding of the frame sections 10 and 11 about their hinged connection 12 during setting up or putting away of the folding bleachers.

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The bleachers are preferably operated between their storage positions and positions of use by man power alone and to this end the frame and beam structures are built up of light weight metal such as structural aluminum or aluminum alloys, and are provided with a spring loaded booster or biasing means 29 for aiding in the elevation of the rear portion of the frame section 11 into the vertical storage position illustrated in Fig. 3.

The operating procedure for folding the bleacher or grandstand is limited to simple lifting and pushing, there being no bolts, locks, clamps or the like requiring attention. Upon lifting of the lower front edge of the frame 10, pivoting the latter about the point 12, to a position about waist high, operating linkages later described in detail cause all of the tiers 25 to close or lower to positions substantially parallel to the beams 13 or 14 of the frame to which they are pivotally attached. The closing of the tiers 25 results in a simultaneous folding of the chairs 27 as will be presently described.

A pushing force exerted toward the wall B by the operator on the lifted frame 10 will cause the rear end of the frame 11 to rise, guided by the cooperation of the wheels W and the vertical channel members 20, and aided by the booster means 29. The adjacent edges of the frames 10 and 11, hinged at 12 and supported by the roller means 16, are carried by the latter toward the wall B until the frame 11 assumes a vertical position parallel to the wall and disposed substantially between the vertical channel members 20, and with the wheels 17, 18 of the roller means 16 both in supporting contact with the floor. To complete the storing maneuver the lower frame 10 is lifted or pivoted into a vertical position substantially parallel to the frame 11 with the closed or folded tiers and chairs therebetween.

The above procedures are reversed to shift the bleacher into extended position for use, the tiers 25 and associated chairs 27 being actuated upon the final lowering of the front portion of the frame 10 into its position resting on the plank 24 on the floor or ground.

The fabricated or composite structure of the parallel beams or members 13 and 14 each comprise spaced upper angle members or rails such as 31, 32, best illustrated in Fig. 4, and lower spaced angle members or rails such as 33, 34. The spacing of the rails 31, 32 and 33, 34 is accomplished by a separator 36 formed of pipe or rod having a series of curves or bends 37 to provide a zig-zag configuration with the bends 37 thereof secured as by welding or the like between the rails. The resulting beam structures define a series of triangles formed of the rails and of the pipe or rod, separator 36 lending strength and rigidity thereto while maintaining the weight and size thereof at a minimum.

The spacing of the rails 31-34 of the beams 13 and 14 permits the pivot point 12, formed by hinge members 39, 40, and a hinge pin 41 pressed into the member 39 and welded thereto which are disposed between the rails to be centered with respect to the beams thereby eliminating cocking or tilting of the beams and consequent likelihood of binding or locking of working parts and linkages associated therewith. There may be any number of side and intermediate parallel beams 13 and 14 in the frames 10 and 11 respectively, depending upon the number of seats to be placed side by side, ample strength being normally provided when the beams are spaced approximately the width of two chairs, for example about 36 inches apart.

Additional structural rigidity is afforded to the frames 10 and 11 by braces 42 extending between the lower rails 33, 34 of adjacent parallel beams and connected at the centers of the braces as at 43 to the transversely extending members 15, as is illustrated in Fig. 4. Generally one set of such braces 42 above the hinge point 12 in frame 11 and one below in frame 10 is sufficient.

Referring to Fig. 5 there is illustrated therein the relative positions of the adjacent end portions of the

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beams or members 13 and 14 of the frame sections 10 and 11 when in their extended or open condition and when being folded for storage, the associated tier and chair operating linkages being shown in full for the former and in dot-and-dash lines for the latter. Each of the tiers 25 comprises a plurality of arms 50 formed preferably of angle stock and hinged at the rear ends thereof to the upper rail portions 31, 32 of the side beams 13 and 14, the pivot points being indicated at 52. Overlying the arms 50 and secured thereto as by bolts or other suitable fastenings are sheet metal plates or treads 54.

The treads 54 form part of the horizontal portion of imaginary or projected steps indicated at 55 in dot-and-dash lines in Fig. 5. The riser 56 of the imaginary steps is preferably in the order of height of conventional steps, for example, approximately 7". The front and rear edges of the treads 54 are formed into ridges 57 serving as stops to prevent small articles such as coins or the like from rolling off, when accidentally dropped, and falling beneath the bleacher or grandstand.

Each of the tiers 25 is adapted to be actuated between an open position extending substantially horizontally from the frames 10 and 11, and a closed position lying substantially parallel to the frame sections and the upper rails 31, 32 thereof. The novel actuation of the tiers 25 is accomplished through the use of linkages including toggle joints formed of links 59 and 60, pivoted together at 61, and connected also at 61 to a toggle joint connecting rod 62, connecting the toggle joints of each frame. A toggle joint driving rod 63 is connected to the pivot 61 of one toggle joint of each of the frames 10, 11 and to one end 64 of a lever 65 pivoted at the other end thereof as at 66 between the upper beam rails 31, 32.

Operating or actuating plungers 69 and 70 are pivotally connected to the central portions of the links 65 as at 71, and are loosely supported by the beams 13 and 14 for reciprocating motion. The plungers 69 and 70 are adapted to be guided by rollers 73 and are each provided with a headed end portion 75 adapted to engage and move one another relative to the frame sections 10 and 11 upon opening of the latter to their extended positions. The relative movement of the plungers 69 and 70 with respect to their supporting beams 13 and 14 upon opening of the frame sections serves to shift the levers 65 and driving rods 63 to actuate the toggle joints formed by link elements 59 and 60. When the frames are in their extended position of use, the toggle joints have their links 59 and 60 substantially in alignment giving the greatest possible support to the tiers 25.

In order to preclude possible locking of the toggle joints due to a dead center or over-center condition of the links 59 and 60, which would prevent closing or folding of the frame sections 10 and 11 about the hinge 12 when it is desired to fold the bleachers, there is provided a kicker means 78 for unlocking in unison all of the toggle joints on a beam 13 or 14.

The kicker means 78 each comprises a cylinder 79 pivotally supported with respect to the beam 13 or 14 with which it is associated as at 80. A compression spring 81 is contained within the cylinder 79 and urges a plunger 82 and a link 83 connected thereto toward one of the toggle joints. The link 83 is pivoted to a kicker member 84, itself pivoted at 85 to the beam 13 or 14. The compression spring 81 acting through the plunger 82 and link 83 biases the kicker member 84 against the knee or pivot 61 of the toggle joint formed by links 59 and 60, and serves to overcome any over-center or dead center locking of the toggle joint when the bleacher is to be folded.

The stroke of the kicker plunger 82 is made adjustable by stop nuts 86 threadably positioned thereon, and the flexing of the toggle joint under the influence of the kicker member 84 is transmitted to the other toggle joints connected together by rod means 62. It will be observed

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that because the beams 13 are tapered below the lowest tier, a flanged wheel 88 is pivoted to a lever 89 supporting that tier, the wheel and lever acting in the nature of a toggle joint.

The roller or rocker means 16 comprises spaced angular arm members 90 swingably pivoted at 91 to the lower rails 33 and 34 of the frame 14, the arm members 90 including legs 92 and legs 93 substantially at right angles thereto. The wheel 18, which is disposed between the members 90 and pivoted at 94 at the corner formed by the legs 92 and 93, is always in supporting contact with the ground or floor A. Spaced wheels 17 are disposed between the swinging arm members 90 and are pivoted at 95 to the free ends of the legs 93 as illustrated in Fig. 7. A pair of guide members 97, 98 are secured to the free ends of the legs 93 and serve to align the wheels 17 with the lower rails 33, 34 of the beam member 13. The wheels are spaced to clear the plungers 69 and 70 as will presently be apparent.

The roller or rocker means 16 provides support for the adjacent end portions of the frame members 13 and 14 at positions on both sides of the hinge 12 although contacting the surface of the floor A at substantially only one point beneath the hinge, and is capable of rocking about the wheel 18 to accommodate different angles of inclination during folding procedures.

When folding the bleachers or grandstand for storage, and upon lifting the front edge of the frame 10 in the manner previously described, the wheels 17 will travel along the bottom surfaces of the frame member 13 and up the end surfaces 100 of that member as illustrated in dot-and-dash lines in Fig. 5. The spaced wheels 17 clear the end of the plunger 69 which moves to its extended or released position upon the lifting of the frame 10, and the wheel 18 and its supporting leg 92 swing to the dot-and-dash position of Fig. 5 with the leg 92 substantially parallel to the frame rails 33, 34 and with a stop member 102 disposed thereagainst. The operator folding the bleacher is able to roll the frame 11 which is supported at its lower end by the rollers or wheels 18 and at its upper end by the wheels W running in their respective vertical guide channels 20 toward the wall B. When the frame 11 has been rolled into its vertical position the wheels 17 and 18 will both be in supporting contact with the floor A and the folding of the frame 10 into its vertical position can then be completed in the manner previously described.

It will be observed that at the beginning of the folding process the frame 11 has its extension 23 resting on the I-beam 22, and is disposed at a large angle to the vertical guides 20, and that consequently only a small component of the operator's pushing force is effective towards the lifting of the rear edge of that frame. The booster or biasing means 29 is provided to exert an additional component of force tending to raise the rear end of the frame 11.

The booster 29 comprises, at each rear corner of the frame 11, and adjacent each upright channel 20, a vertical tube or cylinder 105 housing a compression spring or springs 106. A plunger 107 extends downwardly into the tube 105 and within the coil spring 106, and has a shoulder 108 thereon for engaging and compressing the latter. A plunger operating connecting link 110 is pivotally connected at 111 to the corner of the frame 11 and at its other end to the upper end of the plunger 107 as at 112.

When the bleachers are in their upright folded positions for storage the compression spring 106 will be substantially uncompressed. Upon commencing to extend or roll the hinge end of the frame 11 away from the wall in the process of setting up the bleacher for use, the link 110 will draw the plunger 107 and the shoulder 108 thereof into compressing engagement with the spring 106. As the frame 11 is extended, the rear end thereof guided by the wheels W will exert a progressively greater com-

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pressing force on the spring 106, which force will be substantially taken up by that spring preventing the possibility of the bleacher running down the operator and storing power to subsequently aid in elevating the frame 11 when returning the bleachers to their storage position.

Other boosters or biasing means such as compressed air cylinders, sheaves with cables and weights, or the like, such as are well known to those skilled in the art to which the invention relates, may be used. The wheels W which run in the vertical guide channels 20 are rotatably mounted on axles 115 which have an eccentric end portion 116, and are thereby made adjustable to accommodate slight variations in the installation of the guides 20. The axles 115 are suitably supported by support members 117 secured to the beams 14, and are provided with a squared end 118 and a locking nut 119.

In the event that a plurality of bleacher sections are to be utilized in their end-to-end arrangement to provide greater seating facilities, the vertical guide channels 20 for the adjacent corners thereof are conveniently placed in back-to-back relation as illustrated in Fig. 2. A suitable clamping means 122 serves to support a booster spring tube 105 for each bleacher section and is preferably secured to the vertical guide channels 20 as by means of throughbolts 106.

The tread plates 54 of the tiers 25 conveniently extend to one side of the bleacher sections a greater distance than they do on the other side and when several bleachers are placed end to end the adjacent tier ends will have a complete tread formed substantially thereacross.

The bleachers illustrated are shown with 4 tiers 25, however any desired number of tiers may be utilized, the additional tiers being inserted at the points shown broken away between tiers in Fig. 1. The inclination of the frames 10 and 11 with respect to the supporting structure and the wall B will remain the same regardless of the number of tiers employed, however when additional tiers are inserted the elevation of the rear edge of the frame 11, and the supporting extension 23 and I-beam 22, will be at higher points above the floor level. For these reasons the bleachers may be made inexpensively and conveniently through the use of duplicate interchangeable parts to achieve greater seating capacity. The roller means 16 in bleachers using differing numbers of tiers 25 will necessarily employ longer or shorter leg portions 92 and 93 of the swingable arm members 90 and larger or smaller wheels 17, 18 to account for the differences in height above the floor level in the portion of the frames adjacent the hinge 12. The legs 92 and 93 and the wheels 17 and 18 need only be of such a size as to clear the end of the beam 14 when the frames 10 and 11 are shifted to their storage position.

Although the bleachers have been described as including individual conventional folding chairs 27 it may be desirable to provide in their stead benches 123 extending the entire width of the tiers. Benches 123, illustrated in Fig. 6, are adapted to fold for storage under the influence of the linkages in the same manner as the folding chairs 27.

Any conventional folding chair 27 may be used in the invention, those shown having legs of tubular construction. The front legs 125 are pivoted at 126 to the frame beams 13 or 14 at approximately the level of one of the tiers 25. The rear legs 127 are shorter and are pivoted at 128 to the next higher tier 25. The seat 129 of the chair is pivoted and linked to the legs 125 and 127 as at point 130 and by link 131, respectively, for folding upon relative pivotal movement of the legs about point 132.

The arrangement of the tiers 25 pivoted at 52, and the relation between the chair pivots 128 and 126 is such that no dead center or over-center locking of the chair can occur in the closed position. Thus the bleacher unit is entirely self operating in the folding and unfolding of

the tiers and chairs upon the extending or folding of the frames 10 and 11 by the operator.

The closed or folded positions of the linkages may be determined to an extent by adjustable stop means in the form of screws 135 carried by threaded brackets 136 mounted on the operating plungers 69 and 70. The screws 135 are adapted to abut the end members of the beams 13 and 14 to limit the travel of the plungers 69 and 70. The extent of compression of the springs 106 in the tubes 105, and hence the supporting force offered thereby, may be adjusted through the use of screw means 137 which position a bottom stop for the springs.

An additional row of conventional chairs 138 may be conveniently placed in front of the lowest tier 25 to provide extra seating. The end 139 of the frame 10 is of a height equal to that of the previously mentioned imaginary step riser 56 and hence the added row of chairs 138 is lower than the first row of mounted chairs 27 by the same distance as exists between rows of mounted chairs.

The extensions 23 to the frame 11 which rest on the I-beam 22, are preferably provided with rubber bumpers or cushions 142. The cushions 142 are advantageously made of moulded rubber having bendable metal retaining tabs 143 protruding therefrom. The tabs 143 are curled or bent around a bottom flange 144 of the extensions 23 and retain the cushions in position for absorbing jars and impact upon extending the bleacher for use.

From the foregoing detailed description and from the accompanying drawings it will be readily appreciated that the invention provides novel bleacher or seating means which is convenient and time saving in use, rugged yet simple of construction, and which otherwise attains the previously mentioned objects as well as others.

Although the invention has been described with rather detailed reference to a specific embodiment thereof in the illustrated bleacher or grandstand, it is understood that the invention is not limited thereto, but rather includes such adaptations, modifications and changes as reasonably are embraced by the scope of the appended claims.

Having thus described my invention, I claim:

1. In a folding bleacher section adapted to be supported for use on a horizontal floor surface and having a front edge portion adapted to rest on said surface and a rear edge portion adapted to be supported at an elevated position, a first frame having parallel side members and a second frame having parallel side members, hinges on said side members connecting said frames for relative movement thereof between an inclined extended position with the respective side members of said first and second frames in end-to-end alignment and a folded position with the respective side members in side by side relation, vertical support means having stops for supporting said rear edge portion and including vertically extending guideways, guide roller means on said rear edge portion and cooperatively engaged with said guideways, biasing means urging said rear edge portion upwardly along said guideways, central support means pivotally connected to said first

frame at points spaced from said hinges and including first rollers for engaging said horizontal floor surface beneath said hinges, second rollers on said central support means adapted to engage said second frame at points spaced from said hinges, a plurality of transverse tiers having tread surfaces and extending between the side members of said first and second frames, said tiers being pivotally connected to said frames and forming horizontally extending steps when said frames are in said extended position, said tiers being movable to closed positions lying substantially parallel to said side members when the latter are in said folded position, and tier actuating means for moving said tiers between said horizontal positions and said closed positions in response to said relative movement between said first and second frames about said hinges, said first and second frames adapted when in said folded position to stand vertically adjacent said vertical guide means and supported by said central supporting means with said first and second rollers on said floor surface.

2. A folding bleacher section as defined in claim 1 and wherein said biasing means comprises compression spring means acting between said rear edge portion and spring holding means adapted to bear against said horizontal supporting floor, whereby said compression spring means is compressed to exert an upward biasing force when said rear edge portion is supported by said stops.

3. A folding bleacher section as defined in claim 1 and wherein said tier actuating means comprises links forming toggle joints connecting said tiers to said side members, reciprocable toggle joint driving rods supported by said first and second frames and operatively connected to said toggle joints, and first and second driving rod operating plungers on said first and second frames respectively, said plungers adapted to cooperatively contact and shift each other inwardly upon opening said first and second frames to said extended position, said driving rods and toggle joints being effective upon inward shifting of said plungers to move said tiers to said horizontally extending positions, and said driving rods and toggle joints being effective to move said tiers to said closed positions upon outward shifting of said plungers.

4. A folding bleacher section according to claim 1 and including a plurality of folding chairs each having the front legs thereof pivotally connected at substantially the level of one of said tiers and the rear legs thereof pivotally connected to another of said tiers, said chairs being adapted to fold into positions substantially parallel with said side members upon movement of said tiers to said closed positions, and said chairs being adapted to unfold into upright positions upon movement of said tiers into said horizontally extending positions.

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