

Sept. 17, 1963

R. J. LAPPIN ET AL
MOBILE FOLDABLE BLEACHER

3,103,707

Filed Nov. 20, 1959

4 Sheets-Sheet 1

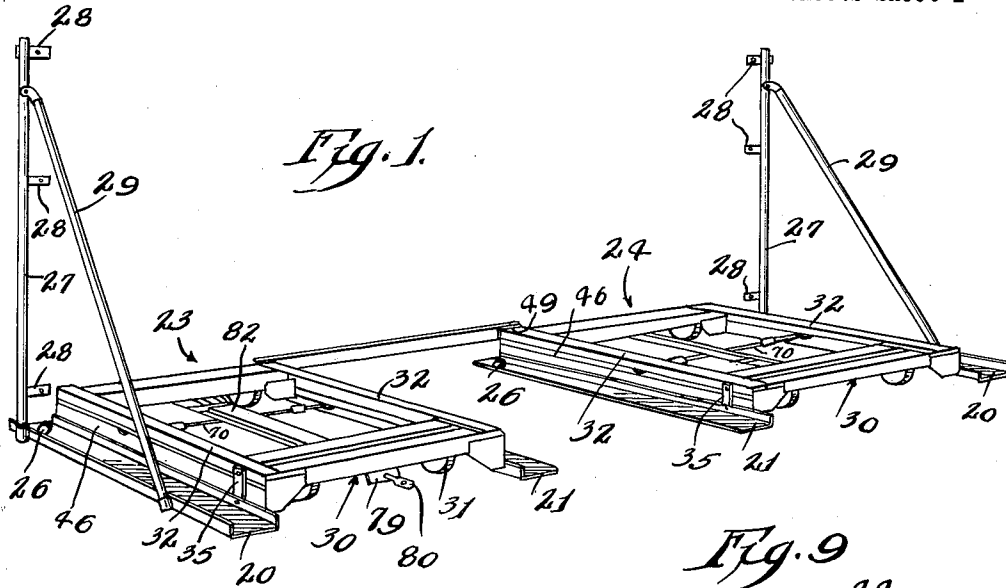


Fig. 9

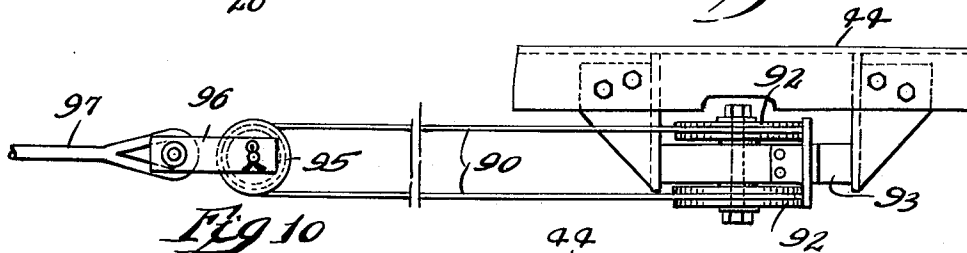


Fig. 10

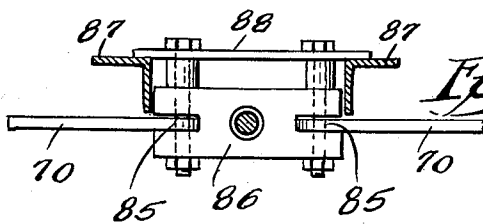
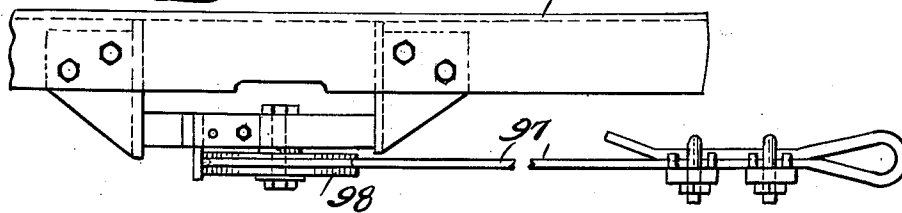


Fig. 11

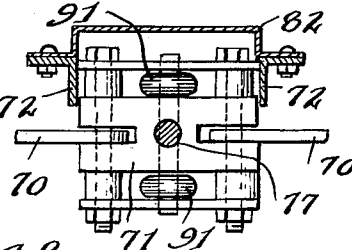


Fig. 8

Inventors
Richard J. Lappin
By James E. Marshall
Hofgren, Brady,
Wagner, Allen & Stillman
Attorneys

Sept. 17, 1963

R. J. LAPPIN ET AL
MOBILE FOLDABLE BLEACHER

3,103,707

Filed Nov. 20, 1959

4 Sheets-Sheet 2

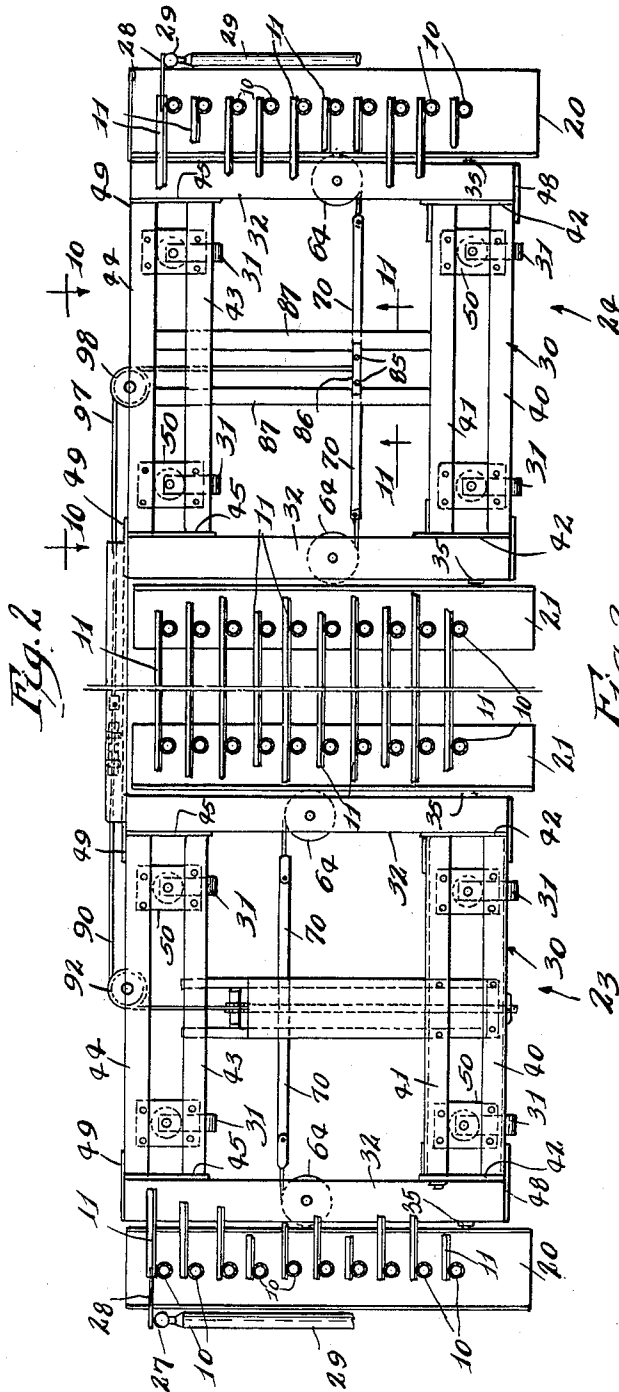
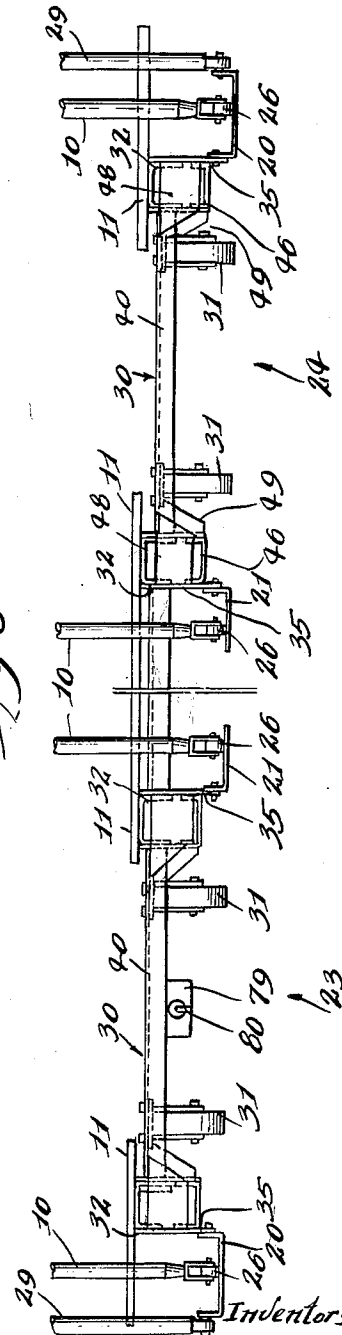


Fig. 3



Inventors
Richard J. Lappin
James E. Marshall
By Hoffgren, Brady,
Wagner, Allen & Stillman
Attorneys

Sept. 17, 1963

R. J. LAPPIN ET AL
MOBILE FOLDABLE BLEACHER

3,103,707

Filed Nov. 20, 1959

4 Sheets-Sheet 3

Fig. 6

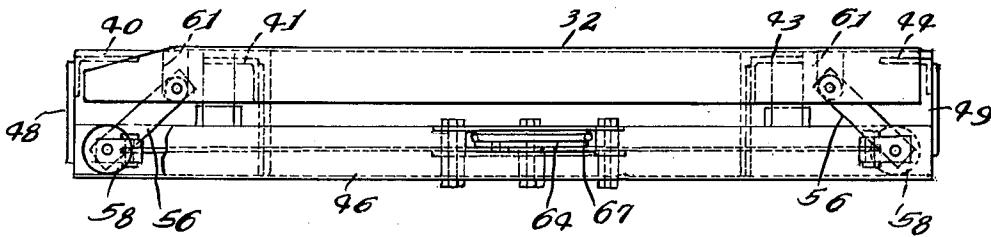


Fig. 7

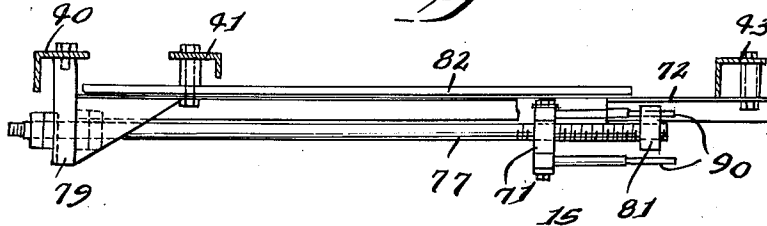
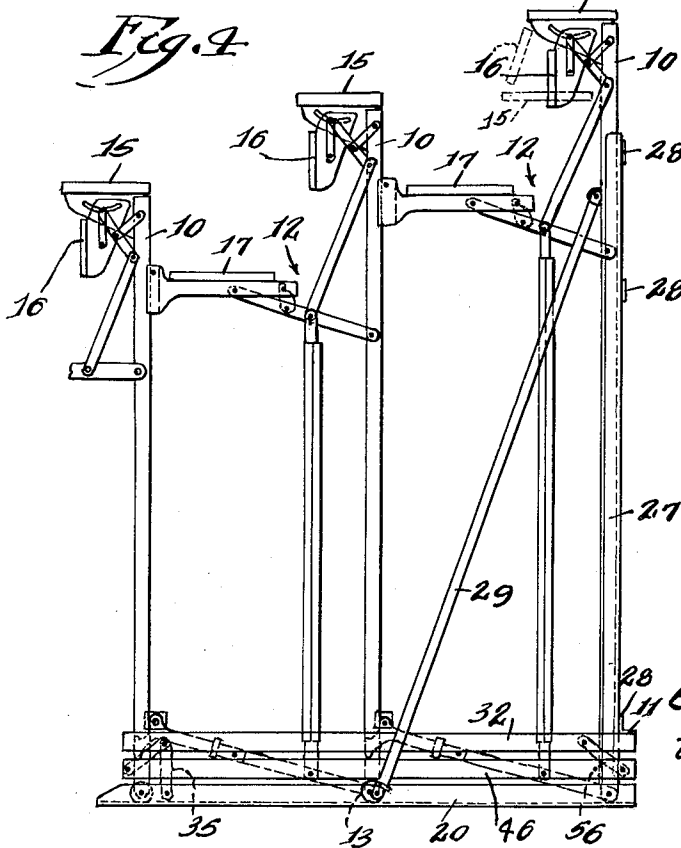


Fig. 8



Inventors
Richard J. Lappin
James E. Marshall
By Hoffman, Brady,
Wagner, Allen & Stillman
Attorneys

Sept. 17, 1963

R. J. LAPPIN ET AL
MOBILE FOLDABLE BLEACHER

3,103,707

Filed Nov. 20, 1959

4 Sheets-Sheet 4

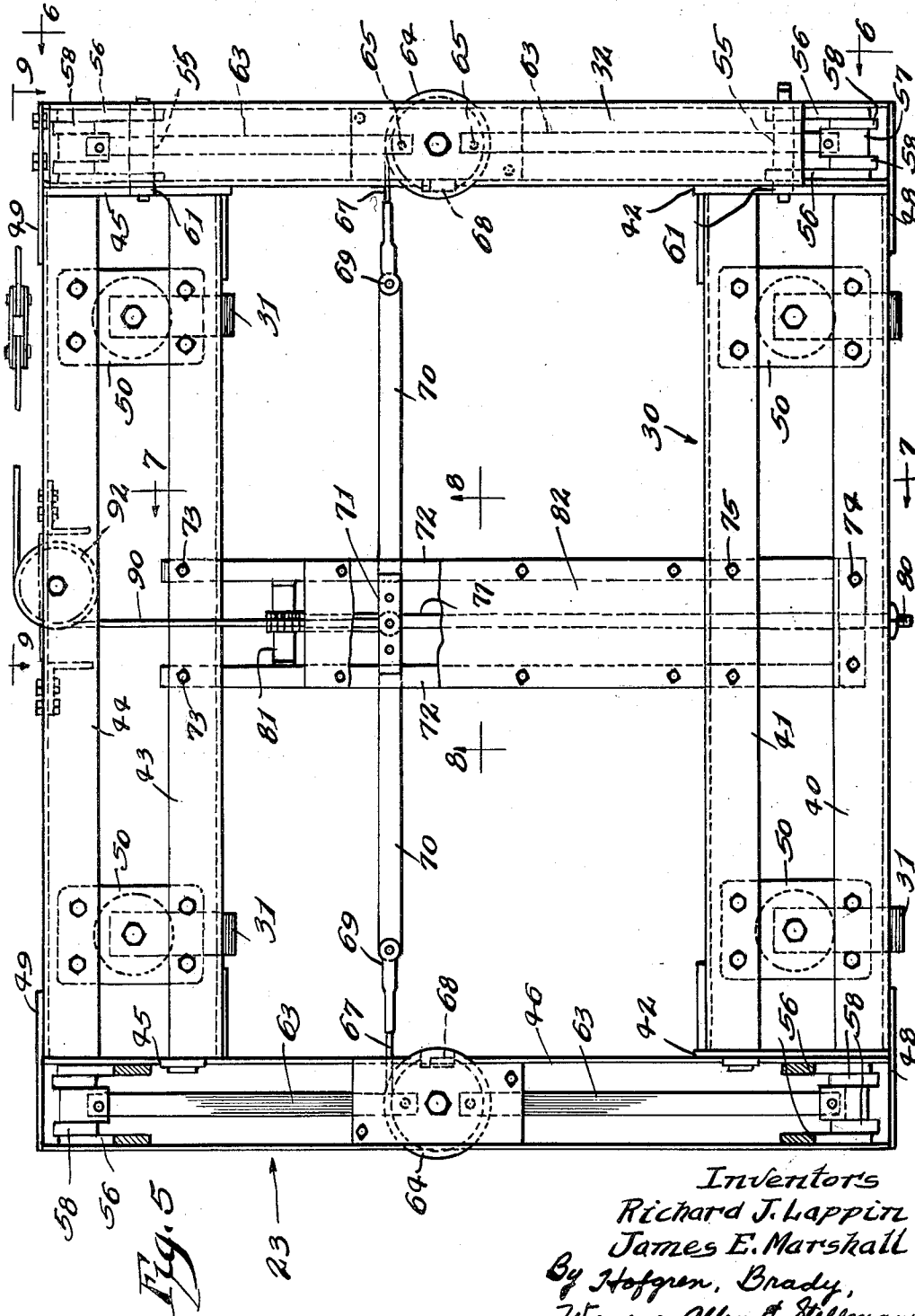


Fig. 5

23

Inventors
Richard J. Lappin
James E. Marshall
By Hoffman, Brady,
Wagner, Allen & Stillman
Attorneys

1

3,103,707

MOBILE FOLDABLE BLEACHER

Richard J. Lappin and James E. Marshall, Kalamazoo, Mich., assignors to Brunswick Corporation, a corporation of Delaware

Filed Nov. 20, 1959, Ser. No. 854,327

4 Claims. (Cl. 20—1,126)

This invention relates to a collapsible spectator supporting structure such as a foldable grandstand, and more particularly to an assemblage of the type described which is mobile in the sense that it may be moved from place to place while collapsed or folded.

It is a general object of the invention to provide a new and improved spectator supporting structure of the type described.

A more specific object is to provide a new and improved assemblage of the type described including a truck frame having floor engaging wheels thereon, a lift frame movably mounted on the truck frame for elevation relative thereto, means on the lift frame engageable with the collapsible bleacher structure for elevating the same off the floor, and means interconnecting the truck frame and the lift frame for elevating the latter relative to the former.

Another object is to provide a new and improved assemblage of the type described including a motion-transmitting means interconnecting the truck frame and the lift frame for elevating the latter on the former and providing a substantial mechanical advantage so that a single human operator upon turning a manually accessible operating member is able to elevate the lift frame and a load thereon of the order of several tons.

An important advantage of the mobile truck and lift mechanism described herein resides in its capacity for ready attachment to existing foldable grandstands, and it is also an object of the invention to provide a new and improved truck of the type described which is attachable to existing bleacher structures to thereby provide a self-contained mobile unit.

Other objects and advantages will become readily apparent from the following detailed description taken in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view of an attachable truck structure with lift mechanism constructed according to the principles of the present invention and adapted for use with existing foldable grandstands of a commercially available type;

FIG. 2 is a top plan view of the mechanism illustrated in FIG. 1, also showing the manner in which such mechanism may be attached to a foldable grandstand;

FIG. 3 is a front elevational view of the structure illustrated in FIG. 2;

FIG. 4 is an end elevational view, taken from the right end of FIGS. 2 and 3, additionally illustrating details of a typical folding grandstand;

FIG. 5 is an enlarged fragmentary plan view, similar to FIG. 2, omitting any showing of a folding grandstand, omitting floor engaging plates seen in other views, and omitting the leftmost lift plate;

FIG. 6 is an end elevational view of the structure illustrated in FIG. 5, taken from the right end of FIG. 5;

FIG. 7 is a fragmentary sectional view taken at about the line 7—7 of FIG. 5;

FIG. 8 is a fragmentary sectional view taken at about the line 8—8 of FIG. 5;

FIG. 9 is a fragmentary rear elevational view taken at about the line 9—9 of FIG. 5;

FIG. 10 is an enlarged fragmentary rear elevational view taken about the line 10—10 of FIG. 2; and

FIG. 11 is an enlarged fragmentary sectional view taken at about the line 11—11 of FIG. 2.

2

While an illustrative embodiment of the invention is shown in the drawings and will be described in detail herein, the invention is susceptible of embodiment in many different forms, and it should be understood that the disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

The construction of the grandstand per se illustrated herein including transverse rows of interconnected upright supports, seatboards, skirtboards, footboards, and interconnecting foldable linkage, may be of the general type illustrated, for example, in Lappin et al. Patent 2,815,541 of December 10, 1957, and in the pending application of Isadore T. Wurn, filed January 3, 1957, as Serial No. 632,382 (assigned to the assignee of this application), now Patent No. 2,983,968, granted May 16, 1961.

Referring now to the drawings in more detail, a typical bleacher adapted for use in the present invention may include a plurality of laterally spaced upright supports as at 10 arranged in transverse rows of decreasing heights from rear to front, each transverse row including laterally spaced supports aligned with corresponding supports in the other rows in front to rear series as will be understood on reference to FIG. 2. The supports 10 in each transverse row are substantially rigidly interconnected by a framework of bracing means which includes angle irons as at 11 suitably secured to each of the supports in the row. The transverse rows of supports are interconnected by foldable linkage means generally designated at 12 (FIG. 4) which facilitate relative displacement of the rows of supports in a front to rear direction toward and away from the rearmost row between an extended usable condition illustrated in FIG. 4 in full lines and a stacked storage condition illustrated in full lines in FIG. 2 and in part in broken lines in FIG. 4. In order to facilitate movement of the transverse rows of supports disposed forwardly of the rearmost row, the supports therein are each preferably provided at the lower end thereof with a roller or wheel as at 13 (FIG. 4) which enables movement of the support freely over a floor or the like.

The upright supports 10 and the foldable linkages 12 support, for each of the transverse rows a seatboard as at 15, a skirtboard as at 16, and a footboard as at 17. While only three rows or transverse supports 10 have been illustrated in FIG. 4, it will be appreciated that there may be almost any number of such rows of decreasing heights to a frontmost row where the seatboard 15 is positioned at a level such that the floor may be utilized for resting the feet and no footboard 17 need be associated with such a row. In FIG. 2, it will be appreciated that the transversely extending angle irons 11 which serve to interconnect the upright supports 10 in each transverse row have intermediate portions broken away in order to avoid obscuring the details of the lift mechanism associated therewith. In FIG. 3, only the rearmost row of supports 10 has been illustrated. As the rearmost row of transverse supports normally is fixed or relatively fixed, these supports are not provided at the lower ends with rollers corresponding to those at 13 on other supports.

Referring now to the truck and lift mechanism which enables elevation and mobility of the bleacher, a modification chosen for illustration herein is adapted for use with a so-called "four horse" bleacher, that is, one in which each of the transverse rows of supports includes four supports 10. This means that there are four laterally spaced lines or series of supports aligned in a front to rear direction. Accordingly, the truck and lift mechanism, as viewed in FIGS. 1, 2 and 3 includes four laterally

spaced parallel floor engaging plates as at 20 and 21, each having a sufficient length in a front to rear direction for supporting each of the supports 10 in the associated series when these supports are arranged in their stacked condition as illustrated in FIG. 2. The floor engaging plates 20 corresponding to the laterally outermost series of supports 10 are in the form of upwardly facing channel shaped members, while the plates 21 corresponding to the two inwardly positioned series of supports are in the form of upwardly facing angle shaped members. It will be appreciated that the length of the bleacher may vary considerably, and accordingly the number of upright supports in each transverse row may vary. For example, there may be only two upright supports in which case only two floor engaging plates would be necessary, or there may be only three supports in each row in which case only three floor engaging plates would be needed.

When the bleacher structure is collapsed or folded, so that all upright supports are resting on the floor plates 20 and 21, the bleacher structure and the floor plates may be elevated in order to facilitate movement of the bleacher on a floor or the like. In the embodiment chosen for illustration, the truck and lift mechanism comprises a pair of trucks 23 and 24. In the event the bleacher includes only two upright supports in each transverse row, only one truck, as at 23, would be necessary and it would include two floor plates as at 20. In the event that each transverse row of upright supports includes only three separate supports 10, the two trucks 23 and 24 may be used, but with only a single intermediate floor plate, as if the floor plates 21 were immediately adjacent and joined together.

Normally, a foldable bleacher of the type described would include a rearmost row which is rigidly anchored to an upright wall surface or some other means which provides a rigidity preventing the bleacher from tipping. In the present construction where it is desirable to provide for mobility of the bleacher, the rearmost row of upright supports obviously could not be rigidly attached to an upright wall surface. Instead, the floor plates 20 and 21 play an important part in stabilizing the bleacher against tipping. More particularly, each is provided adjacent the rear end thereof with a boss or the like as at 26 suitably welded or otherwise rigidly secured to the floor plate, and the rearmost upright supports 10 are securely attached respectively to the bosses. Additionally, the laterally outermost floor plates 20 carry A-shaped bracing frames including an upright post as at 27 anchored to the floor plate 20 at the lower end and including a plurality of laterally inwardly extending bars as at 28 rigidly attached to the post and attachable rigidly to the associated upright support 10 of the bleacher. The posts 27 are stabilized by diagonally extending brace members as at 29 which are attached at the lower end thereof to the floor plates 20 and attached at the upper ends thereof to the posts 27. It will be understood that this bracing structure stabilizes the rearmost transverse row of upright supports, and that the weight of the forwardly extending portions of the bleacher on the floor plates 20 additionally insures against the bleachers tipping either while being folded or unfolded or while in use.

Each of the trucks 23 and 24 includes a truck frame 30 (FIG. 5) having floor engaging wheels or casters thereon as at 31 and each truck frame has movably mounted thereon for elevation relative thereto a pair of laterally spaced parallel lift plates each in the form of an inverted channel 32. In FIG. 5, the leftmost lift plate 32 has been omitted. Each of the lift plates 32 has a sufficient length in a front-to-rear direction to underlie each of the transverse bleacher frames when the latter are in stacked positions as illustrated in FIG. 2, and are movable upwardly on the truck frame to engage the underside of the transversely extending bleacher angle irons 11 to thereby lift the entire bleacher structure.

Adjacent the forward ends, the lift plates 32 are attached to the forward ends of the associated floor plates 20 and 21 as by means of links 35. The lift plates 32 bear the greater portion of the weight of the bleacher as they are elevated, and the links 35 insure that the floor plates are raised off the floor as the bleacher is lifted. At the rear, the floor plates 20 are lifted by virtue of the attachment of the rearmost supports 10 to the lugs 26.

The truck frame 30 associated with the truck 23 includes, at the front, a pair of spaced parallel angle irons 40 and 41 which face each other and which are secured together at opposite ends as by plates 42 which are welded or otherwise suitably secured to the angle irons. At the rear of the frame, a similar pair of angle irons 43 and 44 are secured together at opposite ends as by plates 45. The front and rear framework thus provided is secured together at opposite ends by spaced parallel upwardly facing channel members 46 which may be suitably secured to the plates 42 and 45 as by welding. Lift plates 32 in the form of inverted channels (previously described) are mounted on the truck frame for vertical movement in positions overlying the truck frame channels 46. At the front end, the truck frame channels 46 are closed by plates as at 48 which are suitably secured in place, and at the rear the channels are closed by plates 49. The plates 48 and 49 confine opposite ends of the overlying lift channels 32. The transverse angle members 40, 41, 43 and 44 provide a means to which caster mounting plates 50 may be attached.

In order to provide for elevation of the lifting channels 32, near opposite ends of each channel it is provided with transversely disposed pivot pins 55, each of which carries a pair of links 56 extending downwardly in an inclined direction, forwardly at the front of the frame and rearwardly at the rear of the frame. At the lower ends, each pair of links 56 carries a shaft 57 having a pair of rollers 58 thereon bearing against and movable along the lower truck frame channel 46. At the laterally inner end, each pivot pin 55 is vertically slidable in an upright slot as at 61 in the front and rear tie plates 42 and 45 respectively, so that if the rollers 58 are moved along the tracks 46 in a direction to move the links 56 toward upright positions, the pivot pins 55 are forced upwardly along the slots 61 thereby elevating the lift plates 32.

In order to provide for movement of the links 56 and the rollers 58 in a manner to cause elevation of the lift plates 32, each shaft supporting the rollers 58 is connected by means of a connecting rod 63 to a pulley or sheave 64 turnably mounted on the truck frame channel 46. The connecting rod is pivotally connected to the roller shaft 57 and is also pivotally connected to the sheave 64 at a position eccentric of the sheave axis; as at 65. It will be understood that the two connecting rods 63 at each side of the truck frame, one disposed forwardly and one disposed rearwardly, are both connected to the same sheave 64. In this manner, it will be understood that simultaneous turning motion of the two sheaves 64 at opposite sides of the truck frame will cause simultaneous motion of all four connecting rods 63 in a direction to draw the lower ends of links 56 inwardly toward a central portion of the truck frame thereby elevating the upper ends of links 56 and the lift channels 32.

In order to provide for rotation of the sheaves 64, each has one end of a cable 67 secured thereto as at 68. Opposite ends of the cables 67 are secured respectively at 69 to links 70 which are in turn suitably secured to a nut 71 slidably mounted on the truck frame in a manner such that movement of the nut in a front-to-rear direction causes motion of the links 70 and the cables 67 to turn the sheaves 64.

In order to provide for slidable mounting of the nut 71, the truck frame 30 associated with the truck 23 includes a pair of parallel angle irons as at 72 secured at the rear to the angle member 43 as at 73 and secured at the front to angle members 40 and 41 as at 74 and 75.

The nut 71 is slidable between the angle members 72 and is threadably mounted on a manually operable driving screw 77. The screw 77 is mounted at the front of the truck frame for rotation in a depending plate as at 79, but is retained against axial movement so that rotation of the screw causes movement of the nut along the screw. At the forward end, the screw 77 is provided with an eyelet as at 80 or some other formation suitable for receiving a crank handle for operating the lift mechanism. Adjacent the rear end of the screw 77, it is prevented from dropping by means of a strap as at 81 (FIG. 5) having opposite ends secured to the angle members 72 and a mid-portion extending transversely beneath the screw 77. Preferably, the operating screw is covered for most of its length by a cover member 82 secured to the angle members 72.

As will be understood upon reference to FIG. 2, the lift mechanism for elevating the lift channels 32 on each of the trucks 23 and 24 is similar as regards the pivot pins 55, the links 56, the rollers 58, the connecting rods 63, the sheaves 64, the cables 67 and the links 70, except that on the truck frame associated with the truck 24, the pulleys 64 rotate in a direction opposite to those on the truck 23. On the frame associated with the truck 24, the means for effecting operation of the connecting links 70 is somewhat different from that associated with the truck 23. More particularly, where two trucks are necessary due to the length of the bleacher involved, it is desirable to provide for operation of the lift mechanisms on both trucks simultaneously and under control of a single operating member such as the screw 77 associated with the truck 23. Accordingly, a cable means is provided interconnecting the screw-operated nut 71 and the links 70 associated with the truck 24 in order to cause simultaneous elevation of all lift channels 32.

To this end, links 70 on the truck 24 are pivotally connected as at 85 to a cross head 86 (FIGS. 2 and 11) slidable in a front-to-rear direction between a pair of angle members as at 87 and suspended between the angle members by means of a tie plate 88 slidable along the top of the angle irons. The cross head 86 is connected by cable means to the slidable nut 71 associated with the truck 23.

The cable means includes a cable 90 which is doubled and which has opposite ends connected to the nut 71 as at 91. The two lengths of the cable 90 thus provided pass respectively about a pair of pulleys or sheaves as at 92 (FIGS. 2 and 9) suitably mounted for rotation on a supporting structure 93 suspended from the rearmost angle member 44 on the truck 23. The mid-portion of cable 90 is passed about a sheave 95 carried by links 96 in turn attached to a cable 97 passing about a sheave 98 on the truck 24 and having its opposite end suitably secured to the cross head 86. The sheave 98 may be suitably mounted for rotation on a support suspended from the rearmost angle member 44 on the truck 24. By this interconnection, it will be understood that slidable movement of the nut 71 in a rear-to-front direction of the truck 23 will cause a simultaneous opposite front-to-rear movement of the cross head 86 on the truck 24. Simultaneous movement of the nut 71 and the cross head 86 causes simultaneous actuation of each of the lift channels 32.

It will be understood that the truck and lift mechanism described may be readily attached to existing bleacher structures of the character mentioned with substantially no modification of existing bleachers. The truck and lift mechanism may also be attached to bleacher constructions during initial assembly. An important advantage in the present construction resides in the substantial mechanical advantage provided in the motion transmitting mechanism between the operating screw 77 and the lift plates 32 so that with only a minimum effort on the part of a human operator applying a suitable crank handle to the operating screw 77 an entire bleacher may be elevated

off the floor sufficiently to be moved about on rotation of the caster wheels 31. This is important as bleachers of the type described may weigh as much as 8,000 lbs. In a typical installation, the overall mechanical advantage may be of the order of 4400 to 1. For example, utilizing a 7-inch crank handle to operate the screw 77, the mechanical advantage provided from the crank handle to the pitch diameter of the screw is approximately 20 to 1; the advantage provided from the pitch circumference of the thread to the lead of the thread is approximately 21 to 1; the ratio of lead on the screw to the circumference of the sheaves varies, but the average advantage provided between the screw and the sheaves is about 3 to 1; the mechanical advantage provided at the sheave on the circumference to which the cables are attached to the crank pins to which the connecting rods are attached is about $1\frac{1}{2}$ to 1; and the advantage provided from the sheaves to the lifting links varies, but the average is about $2\frac{1}{2}$ to 1. Thus, using a crank handle with a radius of about 7 inches, on the operating screw 77, the entire bleacher may be lifted approximately 1 inch by approximately 100 revolutions of the crank handle.

Another important advantage in the present construction resides in the use of a truck or truck frame having wheels or casters fixedly supported thereon so that the truck is readily movable and also having a separate lift frame or separate lift plates movably mounted on the truck frame to lift the bleacher without incurring excessive bending movements as in the case where the casters are pivotally mounted to produce the lifting motion by a pivotal movement.

We claim:

1. A mobile foldable tiered spectator receiving assemblage, comprising, successive transverse rows of upright supports of gradually decreasing heights from rear to front, each row including laterally spaced supports generally aligned with corresponding supports in the other rows in front to rear series, generally horizontally disposed bracing means rigidly connecting the supports of each transverse row, a spectator receiving platform carried by each of said rows of supports at decreasing levels from rear to front, foldable linkages connecting the transverse rows of supports for relative displacement in a front to rear direction toward and away from the rearmost row between a stacked storage condition and an extended usable condition, floor engaging rollers on the supports in each of the rows forwardly of the rearmost row, laterally spaced parallel floor engaging plates one for each front-to-rear series of supports, each having a front-to-rear length sufficient for supporting the associated series of supports when stacked, means securing the rearmost supports respectively to said plates, a truck between the laterally spaced series of supports beneath the level of the bracing means including floor engaging wheels, laterally spaced parallel lift plates having a front-to-rear length sufficient for underlying all said bracing means when stacked, the lift plates being disposed for elevation into engagement with the bracing means to lift the supports, means connecting the lift plates to the floor plates adjacent the front end thereof for lifting the front ends of the floor plates when the lift plates are raised, and means interconnecting the truck and the lift plates for raising the latter on the former to lift the supports and floor plates off the floor thereby enabling movement of the entire assemblage on the floor.

2. A mobile tiered spectator receiving assemblage, comprising, successive transverse rows of upright supports of gradually decreasing heights from rear to front, each row including laterally spaced supports generally aligned with corresponding supports in the other rows in front to rear series, generally horizontally disposed bracing means connecting the supports of each transverse row, a spectator receiving platform carried by each of said rows of supports at decreasing levels from rear to front,

means connecting the transverse rows of supports for relative displacement in a front to rear direction toward and away from the rearmost row between a stacked condition and an extended condition, floor engaging plates one for each front-to-rear series of supports, each having a front to rear length sufficient for supporting the associated series of supports when stacked, means securing the rearmost supports respectively to said plates, a truck between the laterally spaced series of supports beneath the level of the bracing means including floor engaging wheels, lift plates mounted on the truck for elevation relative thereto into engagement with the bracing means when stacked to lift the supports, means connecting the lift plates to the floor plates adjacent the forward ends thereof, and means interconnecting the truck and the lift plates for raising the latter on the former to lift the supports and floor plates off the floor thereby enabling movement of the entire assemblage on the floor.

3. A truck attachable to a foldable bleacher or the like to render the bleacher mobile, comprising a rectangular truck frame having floor engaging wheels thereon, a pair of laterally spaced parallel separately movable lift plates mounted on the frame for elevation relative thereto, means for connecting the lift plates to a foldable bleacher, a pair of laterally spaced parallel tracks on the frame beneath the lift plates respectively, a pair of upwardly inclined links between each track and associated lift plate spaced in a front to rear direction, each link having an upper end pivoted on the lift plate and having a roller on the lower end thereof bearing on the track, a pulley rotatable on the frame adjacent each track intermediate opposite ends of the adjacent lift plate, a pair of connecting rods pivotally connected eccentrically to each pulley and pivotally connected respectively to the associated links so that rotation of the pulley moves the links toward upright positions to elevate the lift plates, a cable attached to each pulley for turning the pulley, a manually operable screw axially retained on the frame between the tracks and rotatable on the frame about an axis parallel to the tracks, a nut threaded on the screw and slidably mounted on the frame, and links connecting the nut to the cables so that rotation of the screw elevates the lift plates.

4. A truck for use with a collapsible bleacher or the like, comprising, a truck frame having floor engaging wheels thereon, a lift frame mounted on the truck frame for elevation relative thereto, and means for elevating the lift frame on the truck frame including an inclined link having one end pivotally connected to one frame and having a roller on the other end bearing against the other frame so that movement of the link toward an upright position elevates the lift frame, a manually operable screw rotatable on the truck frame, means interconnecting the screw and link to elevate the lift frame on rotation of the screw comprising: a pulley rotatable on the truck frame, a rod connected to the pulley eccentrically and connected to the link, a cable attached to the pulley, a nut threaded on the screw, and means connecting the nut to the cable so that rotation of the screw causes elevation of the lift frame.

References Cited in the file of this patent

UNITED STATES PATENTS

640,942	Peacock	Jan. 9, 1900
791,968	Wiley	June 6, 1905
1,276,210	Hamelback	Aug. 20, 1918
2,061,235	Horn	Nov. 17, 1936
2,206,788	Meacham	July 2, 1940
2,370,887	Soskin	Mar. 6, 1945
2,512,534	Shaw	June 30, 1950
2,576,426	Thurzo	Nov. 27, 1951
2,650,731	Adler	Sept. 1, 1953
2,676,720	Noble	Apr. 27, 1954
2,815,541	Lappin et al.	Dec. 10, 1957
2,877,507	Walworth	Mar. 17, 1959
2,968,841	Vance	Jan. 24, 1961

FOREIGN PATENTS

430,854	France	Aug. 24, 1911
---------	--------	---------------

OTHER REFERENCES

Medart Telescopic Gym Seats, by Fred Medart Products Inc., St. Louis, Mo., pp. 3, 5, 11, March 1959.