April 14, 1953

A. C. HAISCH

2,634,831

FOLDING BRACE

Filed Nov. 24, 1951

3 Sheets-Sheet 1

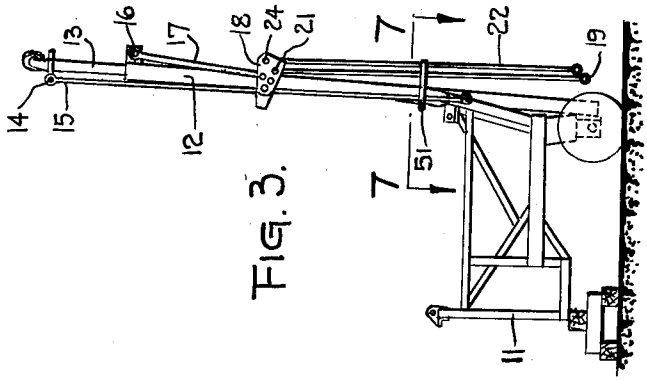

FIG. 3.

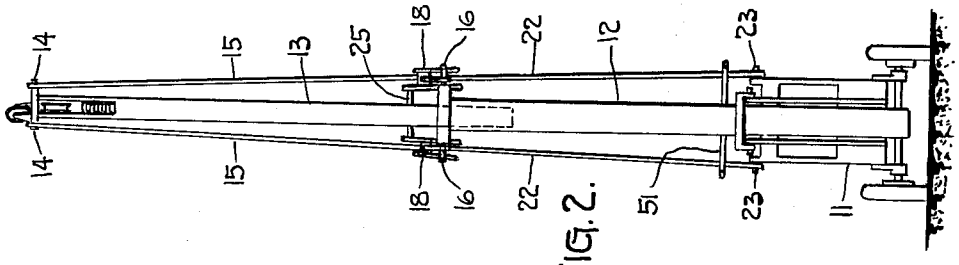

FIG. 2.

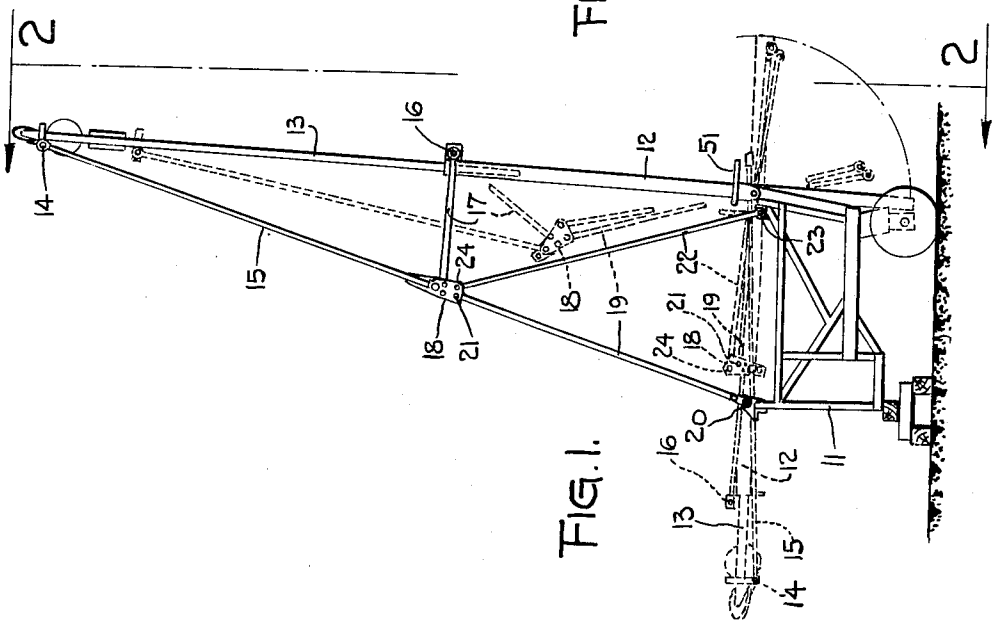

FIG. 1.

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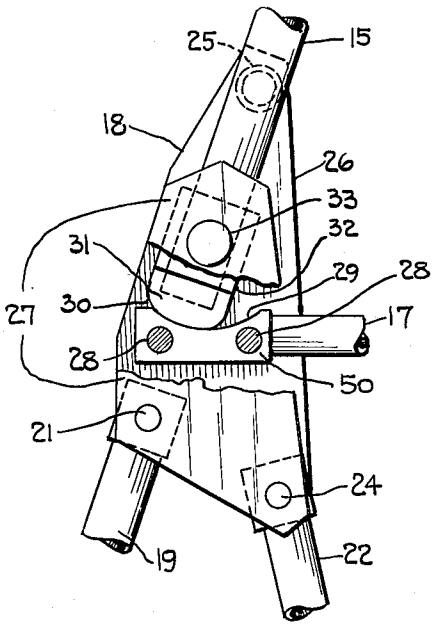

FIG. 4.

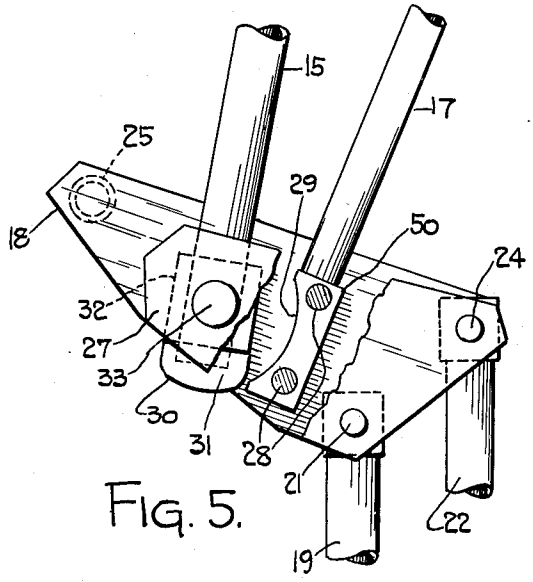

FIG. 5.

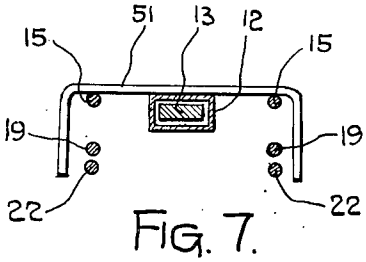

FIG. 7.

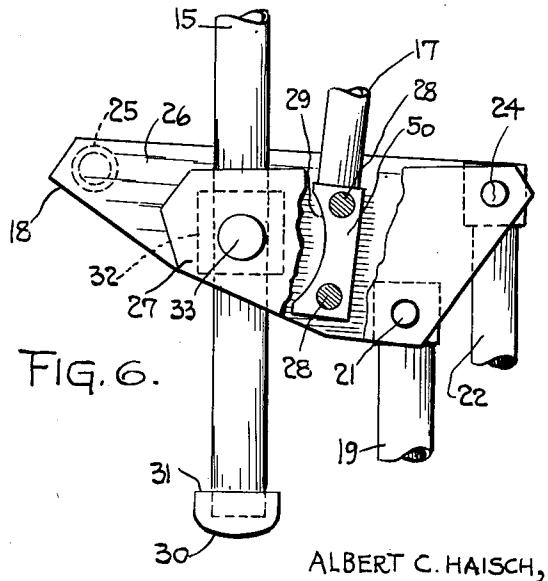

FIG. 6.

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FOLDING BRACE

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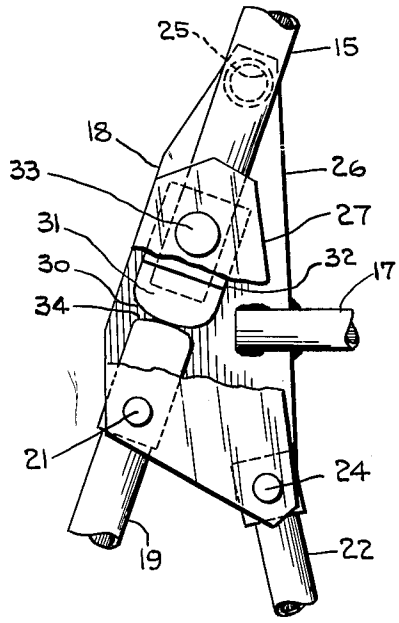

FIG. 8.

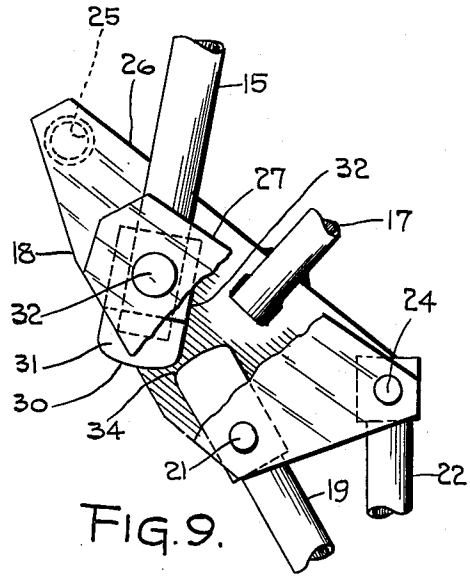

FIG. 9.

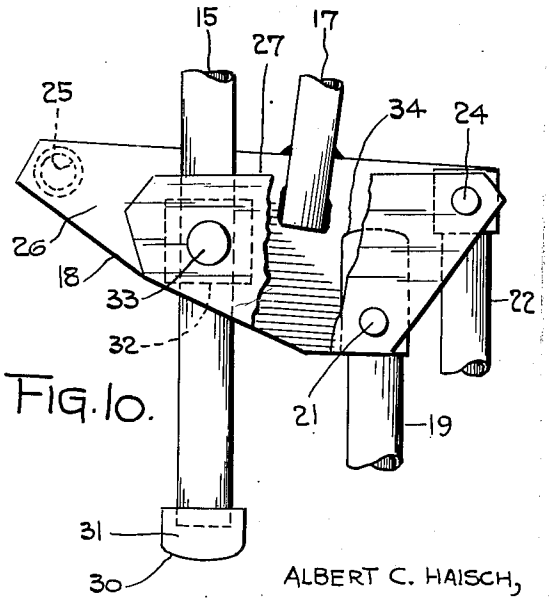

FIG. 10.

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Patented Apr. 14, 1953

2,634,831

UNITED STATES PATENT OFFICE

2,634,831

FOLDING BRACE

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Application November 24, 1951, Serial No. 258,067

19 Claims. (Cl. 189—15)

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This invention relates to new and useful improvements in folding braces, particularly as used in support of telescopic masts or derricks, such as those on portable drills.

Heretofore the braces supporting such masts have been of such a nature that when raising or lowering the mast it has been necessary to climb the mast to at least partially attach (or detach) the braces, or otherwise of such nature that the braces could withstand only tension, and not compression, loading. In the first case, climbing the mast is quite hazardous, because of the height involved and limited footing and hand holds; there also results an appreciable delay in the mast-raising operation. And in the second case the limitation on type of load which the braces can withstand cuts in half the usefulness of the braces and leaves the compression-support problem unsolved; the mast itself must be built more strongly, and, of course, made heavier, in order itself to stand the loads which preferably should be carried in compression by the braces.

Accordingly, it is a principal object of the invention to provide a new type of folding brace construction for telescoping masts, in which the operations necessary to prepare the braces for telescoping or extending of the mast can be performed entirely from the base level of the mast.

A further principal object is to provide such braces which will support compression loads as well as tension loads.

A further object of the invention is to provide a brace arrangement such that, when the mast is being telescoped, the braces fall automatically as a unit into collapsed transport position, it being necessary only to disconnect the braces from the main frame of the drill, which can be done from the ground level.

In addition to the objects, above stated, a number of novel and useful details have been worked out, which will be readily evident as the description progresses.

The invention consists in the novel parts and in the combination and arrangement thereof, which are defined in the appended claims, and of which two embodiments are exemplified in the accompanying drawings, which are hereinafter particularly described and explained.

Throughout the description the same reference is applied to the same member or to similar members.

Figure 1 is a side elevation of the braces as applied to a drill having a telescoping mast, the dotted lines indicating portions of the braces in the partially-telescoped position of the mast and

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in the position when the mast is fully telescoped and folded for transport.

Figure 2 is a rear view of the drill, showing the drill and braces in operating position, with the mast fully extended.

Figure 3 is a side view, similar to Figure 1, but showing the mast and braces in the fully-telescoped position of the mast.

Figure 4 is a partial side view of the first embodiment of the invention, partially cut away, showing a portion of the braces in the fully-extended position of the mast.

Figure 5 is a side view, similar to Figure 4, but showing the portion of the braces in the partially-telescoped position of the mast.

Figure 6 is a side view, similar to Figure 4, but showing the portion of the braces in the fully-telescoped position of the mast.

Figure 7 is a top section view, taken along the line 7—7 in Figure 3.

Figure 8 is a side view, similar to Figure 4, showing a second embodiment of the invention.

Figure 9 is a side view, similar to Figure 5, showing the second embodiment of the invention.

Figure 10 is a side view, similar to Figure 6, showing the second embodiment of the invention.

Referring particularly to Figures 1 and 2, it is seen that the main frame 11 of the drill, which contains the drilling machinery (not shown), supports at its rear end the telescoping mast to be hereinafter described. The drill frame 11, the means for its support, the drilling machinery, and the telescoping mast are of conventional design, the details of which do not constitute any part of the invention. In accordance with the usual design, the foot portion 12 of the mast is pivotally mounted at the rear top corner of the frame 11, to permit tilting to a horizontal carrying position on top of the frame, from the substantially vertical extended operative (i. e., erected) position. The mast is, in its preferred form, made up of two rigid telescoping sections, namely the foot 12 and the extensible portion 13.

The mast is braced in its vertical position by the improved construction of collapsible folding braces, of which the construction shown and described herein is merely an illustrative form.

Pivotally attached as at 14 adjacent the top of the extensible portion 13 of the mast are two upper link braces 15. Similarly attached as at 16 adjacent the top of the lower or foot section 12 of the mast are horizontal braces 17, each carrying at its outer end in fixed relationship a connecting or bracket member 18. Braces 15 are

associated with bracket 18 in a manner to be described later herein.

A pair of lower front braces 19 are detachably connected at their lower ends adjacent the upper front of frame 11, by means such as bolts 20, and are at their upper ends pivotally connected as at 21 to member 18.

A pair of lower rear braces 22 are similarly attached by bolts 23 adjacent the upper rear of frame 11 and by pivotal connections 24 to member 18.

Horizontal member 25 (Figure 2), fixed at each end to one of bracket members 18, serves as a spacer to maintain a fixed distance between the brackets and also provides rigidity to the structure.

Referring also to Figure 7, it is seen that a member 51 is fixed to the foot portion 12 of the mast just above the main frame 11. The function of member 51 will be explained later.

Turning also to Figure 4, it is seen that each bracket 18 consists of an inside plate 26 and a smaller outside plate 27, fixed together in spaced relationship on either side of brace 17 by the rivets 28 by means of which brace 17 is affixed to the bracket.

The forward ends 50 of braces 17 have formed on their upper surface cam seats 29, within which fit the convex surfaces 30 of cam 31 which are fixed on the lower end of braces 15. Braces 15 are slidably supported within hollow members 32, which are pivotally supported between plates 26 and 27 as at 33, braces 15 being limited in their upward travel by the contact between hollow members 32 and the shoulders of cam 31.

In the second embodiment of the invention, illustrated in Figures 8, 9 and 10, the cam seats 29 are replaced by second cam means 34 formed on the slightly extended upper ends of braces 19. To avoid interference of braces 17 with cams 31 and 34, it is preferable in this embodiment that the overlap between braces 17 and plates 26 and 27 be of small dimension; this may be readily facilitated by having a welded connection between these braces and the plates, as shown in Figures 8, 9 and 10.

The operation of the first embodiment of the invention will now be described. When the drill is in the operating position, with the mast fully extended as shown in full lines in Figure 1, the braces (adjacent brackets 18) are in the position shown in Figure 4. In such condition, hollow members 32 are held in position by plates 26 and 27, which are in turn supported by braces 17, 19 and 22. Braces 15 are held from longitudinal movement in an upward direction by the contact between cams 31 and the lower portion of members 32, and are held from downward longitudinal movement by the contact between the convex surfaces 30 of cams 31 and the cam seats 29. Thus braces 15 will withstand forces acting to put them either in compression or tension. Althought not an essential element of the invention, preferably the longitudinal axes of braces 15 and 19 in each set are in line, so that compression and tension forces in braces 15 can be sustained by braces 19 alone. Braces 22 may then, at the sacrifice of support at the upper end of the foot portion 12 of the mast, be eliminated. It is also preferable, though not essential, that the axes of braces 15, 19 and 22 in each set lie in the same plane, in order to avoid eccentric loading in those braces.

When it is desired to telescope the mast, the drill operator merely removes bolts 20 and 23, which connect braces 19 and 22 to the main frame 11, and swings these braces into position for retention by member 51, as can be seen from Figures 1, 3 and 7. The operator can, of course, do this without climbing the mast of the drill. The operator then telescopes the mast by power means which are well known in the art and need not be detailed here.

When braces 19 and 22 are disconnected from the main frame 11, they are supported by braces 15 and 17, through brackets 18. As the mast telescopes, braces 15 lower brackets 18, which pivot on braces 17 about point 16. When braces 17 attain a position just short of vertical (Figure 5), the support of braces 19 and 22 is transferred from braces 15 to braces 17. Cam seats 29 have then rotated out from under cams 30 and no longer prevent braces 15 from downward travel through hollow members 32. Continued telescoping of the mast (Figure 6) causes braces 15 to slide through members 32 until the mast is fully telescoped (Figure 3). Braces 19 and 22 are so positioned that when their weight is entirely supported by braces 17, braces 17 will hang slightly forwardly from vertical; so that when the operation is reversed, that is, the mast is extended, braces 15 will have leverage on brackets 18 through braces 17 and fulcrums 16 to make possible the raising of brackets 18 and braces 17, 19 and 22. It will be noted that member 51 serves to hold the lower braces 19 and 22 away from the main frame 11, so that in lowering, the braces do not become entangled in the main machinery (not shown) carried by main frame 11. In the fully telescoped position, member 51 also supports the lower end of braces 15 so that when the mast is lowered to transport position (as described below) braces 15 will support brackets 18 to constrain those brackets and braces 19 and 22 in their folded position.

When the telescoping action has become complete, as shown in Figure 3, the operator may then by well-known means not shown here, lower the mast to transport position by pivoting it downward about the upper rear of frame 11 to the position shown also in dotted lines of Figure 1.

When the operator wishes to erect the drill for operation, the above procedure is merely reversed. As the mast is extended, from the position shown in Figure 3, braces 15 will, after the shoulders of cams 31 have contacted hollow members 32 (Figure 5), raise braces 17 to the position shown in the full lines in Figure 1. The operator then swings braces 19 and 22 from behind member 51 to the position shown in full lines in Figure 1 and replaces bolts 20 and 23. The drill is then ready for operation.

From the above description, it is evident that the brace arrangement provided by this invention is of a nature that will resist both rearward and forward forces exerted against the top of the mast by the drilling action. It is equally evident that the mast may be fully telescoped or extended without it being necessary for the drill operator to climb the mast to detach or fasten the braces.

Having now described and illustrated two forms of the invention, it is to be understood that the invention is not to be limited to the specific form or arrangement of parts herein described and shown.

I claim:

1. In a supporting structure for a telescoping

mast, which includes a foot section of the mast pivoted on a main frame for tilting from a substantially horizontal position to a substantially vertical position, and an extensible section of the mast extensible longitudinally along the foot section, the combination of: a substantially horizontal link brace at one end pivotally connected to the foot section of the mast adjacent the top thereof; a second link brace at one end operatively associated with the other end of the horizontal link brace in supportable relation therewith, and at the other end detachably connected to the main frame at a point removed from the connection therewith of the foot section of the mast; a first member connected to said other end of the horizontal link brace; a third link brace at its upper end pivotally connected to the extensible section of the mast adjacent the upper end thereof, and on the lower end having a cam operatively associated with said first member; a hollow second member pivotally carried by said first member for pivotal movement in a substantially vertical plane, the hollow member encircling the third link brace above the cam portion in close, slidable relationship; and a cam seat operatively associated with said first member, against which said cam portion abuts, to prevent downward longitudinal movement of said third link brace when the mast is fully extended, and to permit such movement when the mast is telescoped a predetermined amount.

2. Supporting structure according to claim 1, further characterized by the fact that the cam seat is rigidly connected to said first member.

3. Supporting structure according to claim 1, further characterized by the fact that the cam seat is rigidly connected to said horizontal link brace adjacent said other end thereof.

4. Supporting structure according to claim 3, further characterized by the fact that the cam seat is also rigidly connected to said first member.

5. Supporting structure according to claim 4, further characterized by the fact that the longitudinal axes of the second and third link braces are in line.

6. Supporting structure according to claim 1, further characterized by the fact that the longitudinal axes of the second and third link braces are in line.

7. Supporting structure according to claim 1, further characterized by having a fourth link brace at one end pivotally connected to said first member and at the other end detachably connected to the main frame adjacent the connection therewith of the foot section of the mast.

8. Supporting structure according to claim 7, further characterized by the fact that the longitudinal axes of the second and third link braces are in line.

9. Supporting structure according to claim 8, further characterized by the fact that the longitudinal axes of the second, third and fourth link braces lie in a common plane.

10. A supporting structure according to claim 1, further characterized by having a fourth link brace at one end pivotally connected to the first member and at the other end detachably connected to the main frame adjacent the connection therewith of the foot section of the mast, and a third member fixed adjacent the bottom of the foot section of the mast, to constrain the second and fourth link braces from entanglement with the main frame when the mast is telescoped.

11. Supporting structure according to claim 1,

further characterized by the fact that the cam seat is formed on said one end of the second link brace.

12. Supporting structure according to claim 11, further characterized by the fact that the longitudinal axes of the second and third link braces are in line.

13. Supporting structure for a telescoping mast, which mast includes a foot section mounted on a main frame and an extensible section, the supporting structure including: a connecting member; a first link brace at its upper end pivotally connected to the extensible section of the mast adjacent the upper end thereof, and at its lower end having an operative connection with the connecting member, said operative connection including a guide member mounted on the connecting member and interlocked in longitudinal sliding relationship with the first link brace, and first stop means associated with the first link brace and the connecting member to limit upward sliding movement of the first link brace relative to the guide member; a second link brace at one end pivotally connected to the foot section of the mast adjacent the upper end thereof, and at its other end connected, through the connecting member, pivotally to the lower end of the first link brace; a third link brace at its lower end detachably connected to the main frame at a point removed from the connection therewith of the foot section of the mast, and at its upper end pivotally associated with the connecting member; and second stop means associated with said first link brace and one of the other link braces and shiftable, by the relative pivoting of said first link brace and said one of the other link braces into engaged position to prevent downward longitudinal movement of the first link brace with respect to the guide member when the mast is fully extended, and into disengaged position to fully permit such movement upon telescoping of the mast a predetermined amount.

14. Supporting structure according to claim 13, further characterized by the fact that the second stop means comprises a cam member rigidly connected to said connecting member.

15. Supporting structure according to claim 13, further characterized by the fact that the second stop means comprises a cam member integral with said upper end of said third link brace.

16. Supporting structure for a telescoping mast, which mast includes a foot section mounted on a main frame adjacent one end thereof and an extensible section, including: two connecting members; a pair of inclined first link braces each at the lower end detachably connected to the main frame at opposite sides and adjacent the other end thereof and each at the upper end pivotally connected to one of said two connecting members; a pair of oppositely inclined second link braces each at the lower end detachably connected to the main frame at opposite sides and adjacent said one end thereof and each at the upper end pivotally connected to one of said connecting members; a third link brace connected at each end to one of said connecting members, to maintain said members in spaced relationship; a pair of substantially horizontal fourth link braces each connected at one end to the foot section of the mast at opposite sides and adjacent the top thereof and each connected at the other end to one of the connecting members; a pair of hollow members each pivotally supported by one of said con-

necting members for pivotal movement in an approximately vertical plane; a pair of inclined fifth link braces each at one end pivotally connected to the extensible section of the mast adjacent the top thereof and adjacent the other end slidably supported within one of said hollow members; first engaging means formed on said other ends of the fifth link braces to engage said hollow member, to prevent disengagement of said braces and hollow members by upward sliding motion of the braces; and a pair of second engaging means each operatively associated with one of said connecting members to prevent downward sliding motion of said fifth link braces when the mast is fully extended but to permit such motion when the mast has been telescoped a predetermined amount.

17. Supporting structure according to claim 16, characterized by the fact that: the first engaging means consist of enlarged cams formed on said other ends of the fifth link braces; the connecting members are rigidly attached to the third link brace and to the fourth link braces; the longitudinal axes of the first, second and fifth link braces in each set lie in a common plane; the longitudinal axes of the first and fifth link braces in each set are in line; and each of the second engaging means consists of a cam seat rigidly attached to one of said connecting members to engage the cam on one of said fifth link braces when the mast is fully extended, and to disengage from said cam when the mast has been telescoped a predetermined amount.

18. Supporting structure according to claim 16, characterized by the fact that: the first engaging means consist of enlarged cams formed on said other ends of the fifth link braces; the connecting members are rigidly attached to the third link brace and to the fourth link braces; the longitudinal axes of the first and fifth link braces are in line; and each of the second engaging means consists of a cam seat formed on and adjacent said other end of one of said first link braces to engage the cam on one of said fifth link braces when the mast is fully extended, and to disengage from said cam when the mast has been telescoped a predetermined amount.

19. Supporting structure for a telescoping mast, which mast includes a foot section mounted on a main frame adjacent the rear thereof and an extensible section, the supporting structure including: a substantially horizontal first link brace at one end pivotally connected to the foot section of the mast adjacent the upper end thereof and extending forwardly above the main frame; a connecting member connected to the other end of said first link brace; a rearwardly inclined second link brace at its lower end detachably connected to the main frame adjacent the front thereof and at its upper end pivotally connected to the connecting member; a hollow member pivotally supported by said connecting member for pivotal movement in an approximately vertical plane; a rearwardly inclined third link brace at its upper end pivotally connected to the extensible section of the mast adjacent the upper end thereof and adjacent its lower end extending through and supported within the hollow member in close slidable relationship, and having an enlarged cam fixed to said last mentioned lower end below and abutting against said hollow member to prevent upward sliding motion of the third link brace; and a cam seat operatively connected to the connecting member, abutting against the cam, to prevent downward sliding motion of the third link brace when the mast is fully extended and to move out of such abutting engagement and out of alignment with the longitudinal axis of the third link brace when the connecting member and first link brace move pivotally downward a predetermined amount as the mast is telescoped.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
801,372	Faltz	Oct. 10, 1905
2,340,351	Thornburg	Feb. 1, 1944