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Glass et al.

[11] **3,759,399**

[45] **Sept. 18, 1973**

[54] **ADJUSTABLE, SELF-LOCKING LOAD SUPPORTING MECHANISM FOR BOOMS**

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[73] Assignee: **FMC Corporation**, San Jose, Calif.

[22] Filed: **Jan. 14, 1972**

[21] Appl. No.: **217,900**

[52] **U.S. Cl.** ..... **212/55**, 212/144, 24/263 PJ

[51] **Int. Cl.** **B66c 23/06**

[58] **Field of Search** ..... 212/55, 144; 294/82; 24/263 PJ; 254/139.1

[56] **References Cited**

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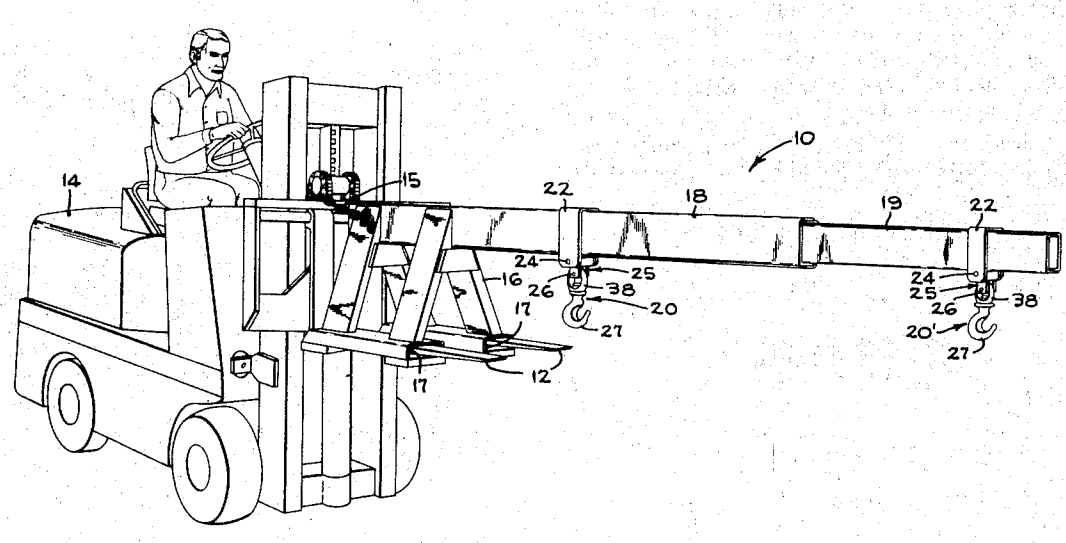
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Primary Examiner—Richard E. Aegerter
Assistant Examiner—Merle F. Maffei
Attorney—F. W. Anderson et al.

[57] **ABSTRACT**

An infinitely adjustable self-locking stirrup for mounting intermediate load hooks on an extensible boom attachment for fork lift trucks is disclosed. The mounting includes a U-shaped yoke supported on the top of one of the horizontal extensible boom sections and a pivoted clevis. The clevis is supported in the legs of the yoke closely adjacent the underside of the boom section and provides a mounting for the load hook. When the vertical axis of the clevis is maintained normal to the bottom of the boom section, a top surface on the clevis is parallel to, and has a slight clearance with, the bottom of the boom section so the stirrup mounting is free to slide along the boom section. However, when the clevis is tilted slightly, the top surface wedges against the bottom of the boom section and locks the stirrup mounting in a given position.

9 Claims, 7 Drawing Figures



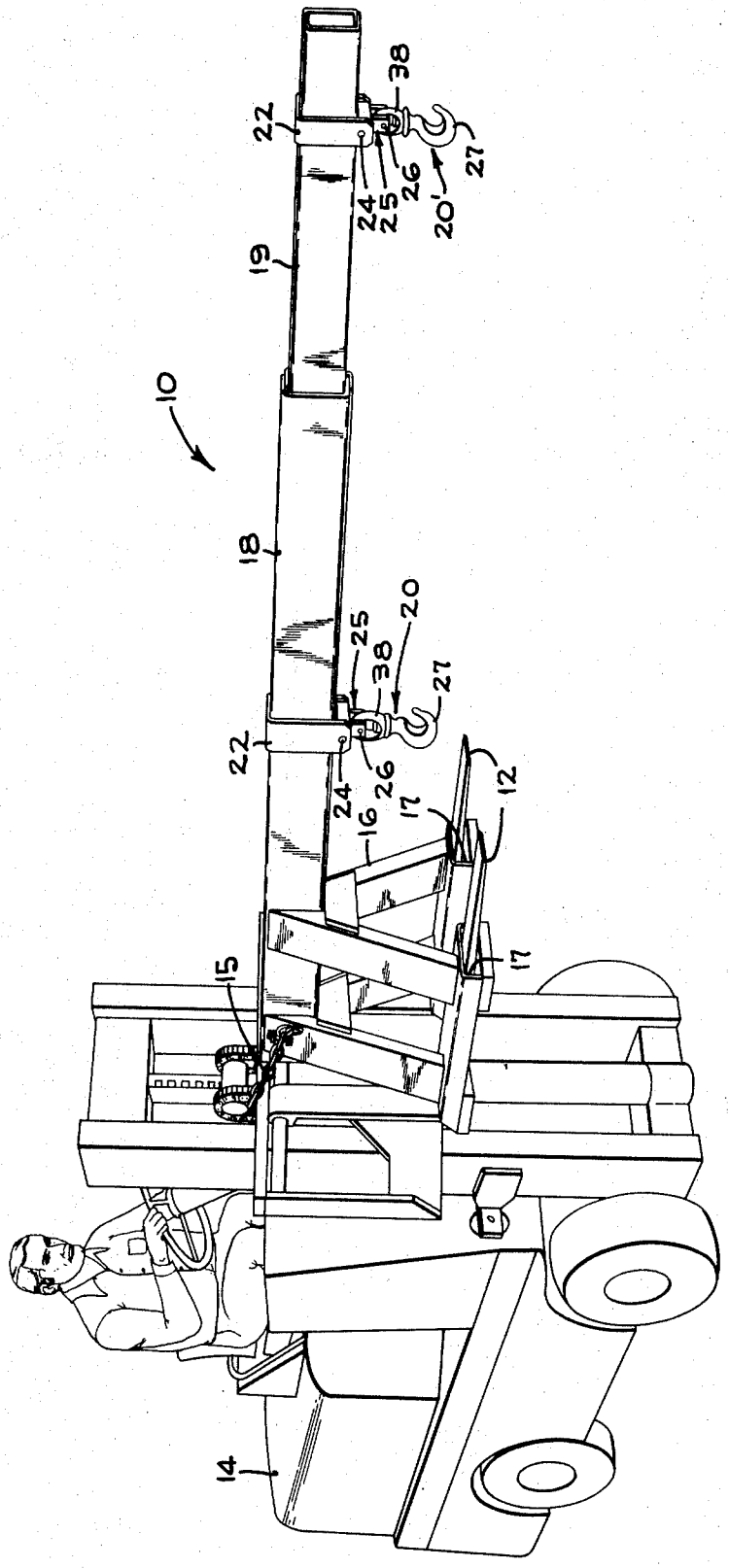


FIG_1

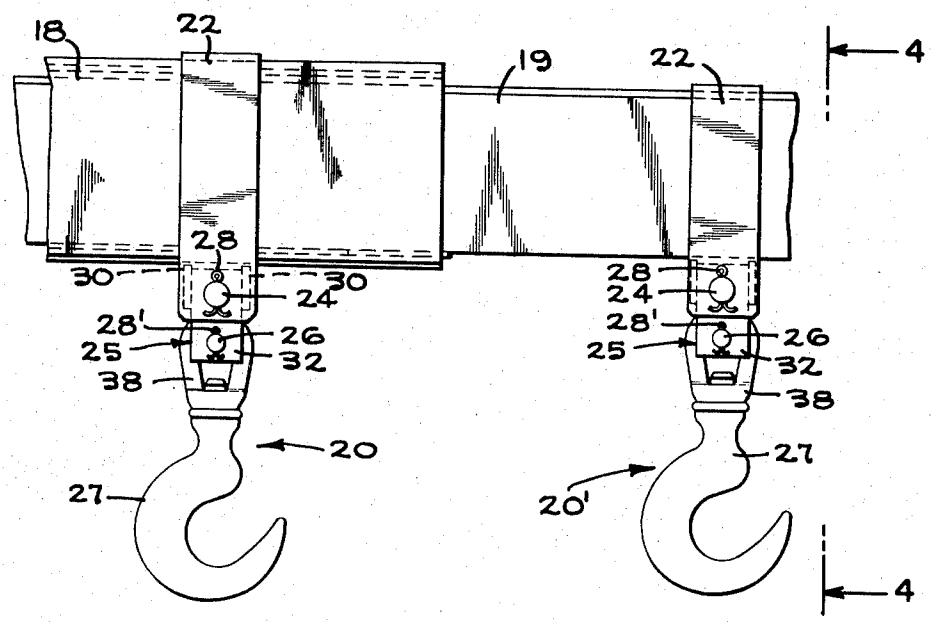

18
22
19
22
4
28
30
30
24
28'
26
25
32
38
20
27
28
24
28'
26
25
32
38
27
20'
4

FIG_2

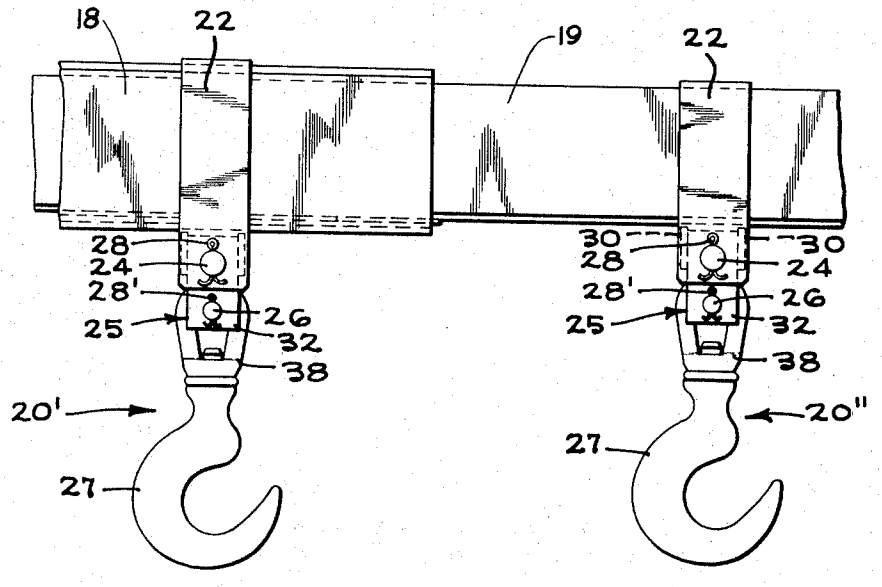

18
22
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28
24
28'
26
25
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38
20'
27
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28
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24
28'
26
25
32
38
20"
27

FIG_3

FIG_5

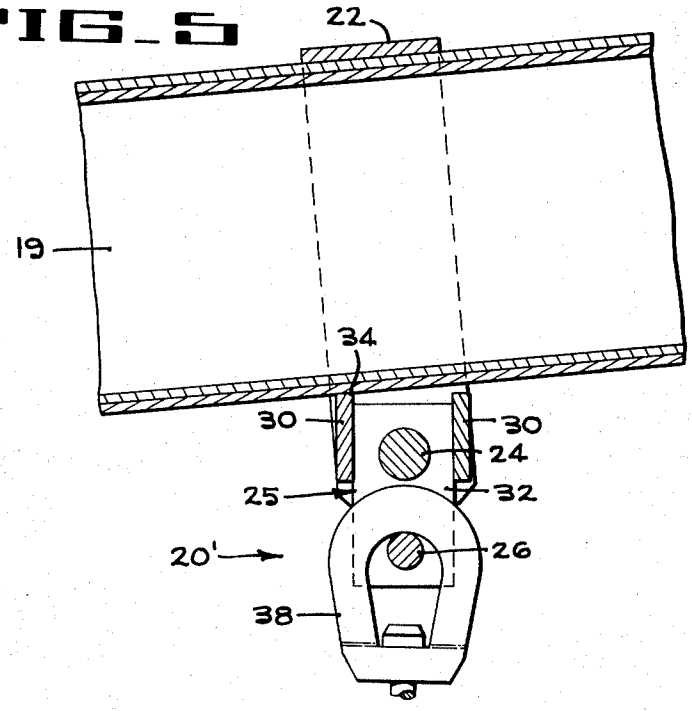


FIG_4

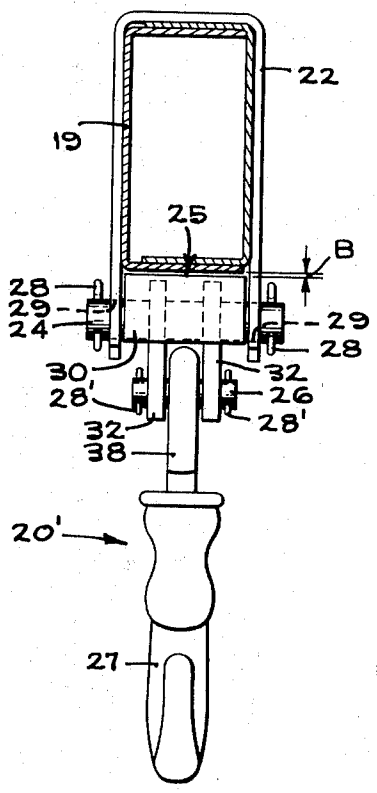


FIG_6

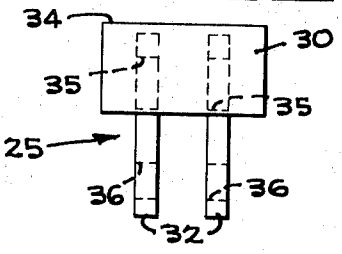
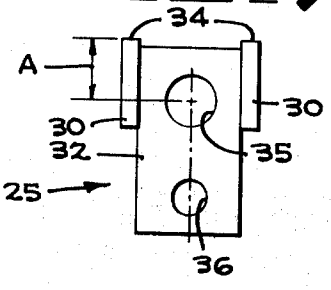


FIG_7



ADJUSTABLE, SELF-LOCKING LOAD SUPPORTING MECHANISM FOR BOOMS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to load supporting mechanism for booms, and, more particularly to an extensible boom attachment with lifting hooks intermediate the ends of the extensible boom for a fork lift truck or other front end load vehicles. The attachment permits elongated articles to be picked up and carried by the vehicle.

2. Description of the Prior Art

Telescopic booms for hoisting cranes and the like are old as shown by U.S. Pat Nos. 734,973 to J. M. Shively, 2,147,313 to R. Payson, 2,417,031 to A. E. witherell, 3,059,785 to K. S. Buckeye, 3,165,157 to R. E. Carbert, and 3,306,467 to S. O. Weempe. Various types of detachable suspension or gripping devices for beams are shown in U.S. Pat. Nos. 1,894,895 to Steele et al., 2,444,055 to D. B. McAulay, 2,961,269 and 2,961,270 to C. J. Renfroe. Hoisting Booms or attachments fitted to portable vehicles are shown in U.S. Pat. Nos. 2,417,031 to A. E. Witherell, 2,314,792 to W. E. Korner, 3,059,785 to K. S. Buckeye, 3,165,157 to R. E. Carbert, 3,264,026 to E. K. Hansen, 3,306,467 to S. O. Weempe and 3,498,485 to B. L. Godbersen. Adjustable intermediate hoisting devices are shown in U.S. Pat. Nos. 2,314,792 to W. E. Korner, 2,867,333 to A. D. DeShano, 3,264,026 to E. K. Hansen.

SUMMARY OF THE INVENTION

The apparatus of the present invention comprises a freely adjustable, self-locking mounting arrangement for a load hook on a boom. Preferably, the hook, or hooks, are mounted on a telescopic or extensible boom attachment for use with a fork lift truck or similar vehicle. In the preferred embodiment of the invention, the mounting arrangement comprises a U-shaped stirrup which slides over the top of, and is supported by, a given section of a rectangular or square boom. A clevis is pivotally mounted transversely of the boom in the lower end of the stirrup closely adjacent to the underside of the boom section and a swivel load hook is pivotally attached to the lower portion of the clevis. When the mounting stirrup with the load hook perpendicular to the longitudinal axis of the boom is pushed or pulled parallel to this longitudinal axis of the boom, the stirrup is free to slide easily along the boom to an infinite number of positions. However, when the load hook is moved to an angular position along the longitudinal axis of the boom slightly less than 90° with the bottom of the boom, a top surface of the clevis wedges against the bottom of the boom section and locks the hook at this position. This might occur when a load is suspended simultaneously from two spaced hooks with non-parallel slings. The same locking action can also occur if a load is suspended vertically from the intermediate hook and the boom is tilted longitudinally, as when the vehicle is negotiating an incline or decline or the mast of the truck is tilted backwardly or forwardly, so the relative position of the boom and the clevis for the load hook is no longer at right angles.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the intermediate load hook of the invention shown on each section of an extensible boom attachment mounted on a fork lift truck.

FIG. 2 is an enlarged partial elevational view of the extended boom of FIG. 1 showing an intermediate load hook assembly of the invention on each section of the extensible boom.

FIG. 3 is an enlarged partial elevational view of the extended boom, similar to FIG. 3, but showing a different boom attachment in which the inner boom of FIG. 2 is the same size as the outer boom of FIG. 3 to illustrate that the same stirrup for an intermediate load hook assembly may be used interchangeably on different boom sections of different attachments.

FIG. 4 is a cross-sectional view of the extended inner boom section with the intermediate load hook mounted thereon, the view being taken along line 4—4 on FIG. 2.

FIG. 5 is a cross-sectional view of the boom and the intermediate load hook, showing the locked position of the clevis with the boom tilted.

FIG. 6 is a transverse elevational view of the clevis for the intermediate hook of FIG. 3.

FIG. 7 is an end view of the clevis of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An extensible boom attachment, generally designated **10**, mounted on forks **12** of a fork lift truck **14** is shown in FIG. **1**. Chain **15** locks the attachment to the elevating carriage of the truck **14**. The attachment comprises a frame **16** having openings **17** for receiving the forks **12** of the lift truck, a fixed outer boom section **18**, a sliding inner boom section **19**, and intermediate load supporting mechanism or devices **20, 20'**. The outer boom section **18** is fixed to and supported in the upper portion of frame **16** with a substantial portion of boom section **18** extending normally horizontally beyond frame **16**. The inner boom section **19** is matingly and slidingly supported within the outer boom section **18** permitting telescoping of the inner boom section **19** into the outer boom section **18**. The sliding inner boom section **19** may be manually extended to any desired position witin its working length. Intermediate load supporting mechanisms **20, 20'** are shown on the fixed outer and sliding inner boom sections respectively to provide infinitely adjustably positioned points for attaching hooks and slings to an elongated article to be lifted and carried by the fork lift truck **14**.

The load supporting mechanisms **20, 20'** and **20''** as shown in FIGS. **1–3** are the same except for size. A series of attachment models is normally available and the size of the boom sections is selected so that the sliding inner boom section of an intermediate model may be used as the fixed outer boom section of the next smaller model in the series and the fixed outer boom section of the intermediate model may be used as the sliding inner boom section of the next larger model in the series. Thus economy of manufacture, reduction in the total number of parts in the various models and interchangeability of some parts is obtained such as the adjustable self-locking load supporting devices.

The load supporting device **20, 20'** or **20''** comprises a stirrup or slide member **22**, an upper pin **24**, a locking member or clevis **25**, a lower pin **26**, a swivel load hook **27** and locking pins **28, 28'**. The stirrup or slide member **22** is a U-shaped yoke member having legs spaced apart just slightly more than the width of the boom section over which it fits. The legs of the yoke member

project downwardly adjacent the vertical sides of the boom section and below the bottom of the boom section. A hole **29** is provided in the lower end of each leg of the yoke member for pin **24** to pass through both legs and to support the locking member **25** transversely of the boom section. Locking pins **28**, such as cotter pins, hold pin **24** at each of its ends in stirrup member **22**. Pin **24** is removable from yoke member **22**.

The locking member or clevis **25** comprises two spaced apart transverse members **30** and two spaced apart longitudinal members **32** secured to each of the transverse members **30** at right angles just slightly below the top edge locking surface **34** of the upper portion of members **30** as shown in FIGS. **6–7**. An upper hole **35** and a lower hole **36**, in vertical alignment with hole **35**, are provided in members **32** so that pins **24** and **26** respectively can pass therethrough transversely of the boom section. Holes **35** have a slight clearance over pin **24** so that the clevis **25** can pivot freely on pin **24** when assembled between the legs of stirrup member **22**. Holes **35** in members **32** of the clevis are located with respect to top surface **34** of member **30**, as indicated by dimension "A" (FIG. **7**), so that when the clevis **25** is assembled in stirrup **22** on pin **24** there will be only a slight clearance "B" (FIG. **4**) between the bottom surface of the boom section and the top surface **34** of member **30** when those surfaces are parallel. This clearance is normally in the order of one-sixteenth of an inch. The significance of this clearance dimension "B" will be brought out later in this description. Lower pin **26** in the lower hole **36** of members **32** pivotally supports load hook **27**. Load hook **27** has a shackle **38** which loosely fits over pin **26** to provide pivotal movement for the load hook **27** in a direction parallel to the longitudinal axis of the boom section. Load hook **27** further has a swivel connection between the shackle and the hook itself so that the hook can rotate about a vertical axis in shackle **38**. After hook **27** is assembled on pin **26** in clevis **25**, locking pins **28**, such as cotter pins, are provided at each end of pin **26** to prevent endwise movement of pin **26** in clevis **25**. It is to be noted that both pins, **24** and **26**, are horizontal and are positioned transversely of the axis of the boom sections so the pivotal movement of clevis **25** in the stirrup **22** and of shackle **38** in the lower end of clevis **25** is longitudinal of and parallel to the axis of the boom section on which it is mounted. The swivel mounting of hook **27** in its shackle **38** gives the hook complete rotational movement about a vertical axis.

The clearance "B" (FIG. **4**) between the top edge locking surface **34** of the transverse members of the clevis member **25** and the bottom surface of the boom section when those surfaces are parallel permits the load supporting devices to slide freely along the boom section to any intermediate position within its length when pushed or pulled parallel to the longitudinal axis of the boom thus giving the hook an infinite number of positions. However, if the hook, when supporting a load, is moved to an angle slightly less than 90° with the longitudinal axis of the boom section, the clevis will pivot on pin **24** and this will cause the top surface **34** of one of the clevis members **30** to wedge against and bite into the bottom surface of the boom section since the clearance "B" will be reduced to zero at one of the members **30**. Similarly, when the boom tilts slightly as when the truck is negotiating an incline or decline and a load on the hook holds the hook and the clevis in a vertical position, one top surface of the clevis will bite into the bottom surface of the boom, as shown in FIG. **5**, and lock the clevis and hook in a fixed longitudinal position on the boom. This condition also occurs when the mast on a fork lift truck is tilted backwardly or forwardly slightly, thus inclining the extensible boom even though the truck is traversing on a horizontal plane. This is a frequently used operating procedure. With this device it is impossible for the load to become unintentionally unclamped at any inclination of the boom from the horizontal. The self-locking hook assembly also prevents movement of the stirrup when the truck makes quick starts and stops which might cause the load on the hooks to swing or when a load is suspended simultaneously from two spaced hooks with non-parallel (i.e., not vertical) slings.

Thus an unloaded hook on either or both boom sections may be easily positioned to any desired location for the article to be lifted and carried by the truck. However, the hook will be locked to the boom when either the boom or hook is tilted for any reason, enabling the hook to resist any longitudinal forces at the hook tending to change the position of the hook. It is also to be noted that even while the stirrup is supporting a moderate load, the adjustment of the stirrup can still be made manually so long as the top surface of the clevis is parallel to the underside of the boom section on which it is installed. Further this stirrup mounting permits easy removal of a hook assembly by simply removing the clevis **25** and its pin **24** permitting the yoke or stirrup member to be lifted off over the top of the boom section. Likewise, an additional load hook may be easily added at any time without having to disassemble the boom sections. An adjustable, self-locking, easily removable stirrup mounting for a hook assembly on a boom is therefore provided.

The longitudinal direction as referred to in this description is that direction parallel to the long axis of the extensible boom sections. The transverse direction is perpendicular to the long axis of the extensible boom sections.

Although the best mode contemplated for carrying out the present invention has been shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention as defined by the attached claims.

What is claimed is:

1. A load supporting device for mounting on a boom comprising a slide member movable along the boom when not locked thereto, said slide member partially encircling the boom, said slide member having legs depending below the boom, and a locking member pivotally mounted on the legs of said slide member in close proximity to the bottom of the boom, said locking member having means to receive a load, said locking member shiftable into locking engagement with the boom in response to a shift from a perpendicular relationship between the longitudinal direction of the boom and the direction of the force of the load.

2. The load supporting device of claim **1**, wherein said locking member comprises an upper portion and a lower portion, said upper portion including a top locking surface closely adjacent and parallel to the bottom of the boom, said lower portion including the means to support a load.

3. The load supporting device of claim 2, wherein said locking member further comprises a pair of vertical longitudinally positioned plate members, each having an upper hole and a lower hole therethrough in vertical alignment, the horizontal axes of said holes being parallel to each other and to the bottom of said boom, the axes of said holes also being transverse to the longitudinal axis of the boom; at least one transverse bar member to which said longitudinally positioned plate members are securely attached in spaced relationship, said transverse bar having a flat horizontal top locking surface projecting above said longitudinally positioned plate members and located adjacent the bottom of the boom; and a pin removably supported in the lower ends of the legs of said slide member in a direction transverse to the longitudinal axis of the boom, said pin passing through said upper holes providing pivotal movement of said locking member, said lower holes providing for the support of a load.

4. A load supporting mechanism comprising in combination: a boom, a slide member mounted on the boom for movement therealong when not locked thereto, and a locking member comprising a clevis member and a pin, said clevis member having a flat horizontal top locking surface normally positioned parallel to the underside of said boom, said pin removably supported in the lower end of said slide member, said clevis member mounted on said pin to pivot in a plane parallel to the longitudinal axis of said boom with said top locking surface closely adjacent the bottom of said boom, said locking member normally held in a predetermined relationship to said boom by the force of the load, said top locking surface of said locking member spaced from said boom while said predetermined relationship is maintained, said top locking surface engaging said boom to lock said slide member to said boom when said predetermined relationship is altered, said slide member being free to slide along the longitudinal axis of said boom when said top locking surface is parallel to the underside of said boom, said slide member being locked in a fixed position relative to said boom when said clevis member is tilted slightly on said pin causing wedging of said top locking surface against the bottom of said boom.

5. The load supporting mechanism of claim 4, wherein said clevis member comprises a pair of longitudinal vertically positioned plate members, a pair of transverse vertically positioned spaced apart plate members, and a pin removably mounted in the lower end of said slide member, each longitudinal plate member having an upper hole and a lower hole therethrough with the axes of said holes being parallel to each other and to the bottom of the boom transverse to the longitudinal axis of the boom, said transverse plate members being perpendicularly secured to said longitudinal plate members in spaced apart relationship symmetrically about a vertical centerline through the upper and lower holes, said transverse plate members each having a flat, horizontal top edge locking surface projecting above said longitudinal plate members and positioned closely adjacent the underside of the boom, said pin passing through said upper holes of said longitudinal plate members providing pivotal movement of said clevis member in a direction along the longitudinal axis of the boom, said lower holes of said longitudinal plate members providing for the support of a load, whereby when said clevis member is tilted slightly in one direction, the top edge surface of one of said transverse plates will wedge against the underside of the boom and when said clevis member is tilted slightly in the opposite direction, the top edge surface of the other of said transverse plate members will wedge against the underside of the boom providing locking of said slide member in either direction of movement.

6. In an extensible boom attachment for a lift truck having an elevating carriage, the attachment having a frame removably supported on the elevating carriage and having an extensible boom comprising an outer boom section supported in and projecting substantially horizontally from the frame and an inner boom section being slidingly and telescopingly received in the outer boom section, the improvement of an adjustable self-locking load support mechanism which comprises:

a. a yoke member slidingly supported on either one of the boom sections, said yoke member mounted on the one boom section for movement therealong in an infinite number of positions between the ends of the one boom section when not locked thereto, said yoke member partially encircling the one boom section, said yoke member having a pair of legs extending downwardly below the bottom of the one boom section and having a pin removably mounted in the lower ends of said legs; and

b. a locking member pivotally mounted on said pin of said yoke member, said locking member having means to support a load and having a locking portion closely adjacent and parallel to the bottom of the one boom section, said locking member normally held in a predetermined relationship to the one boom section by the force of the load and said locking portion spaced from the one boom section while said predetermined relationship is maintained, said locking portion engaging the one boom section to lock said yoke member to the one boom section when said predetermined relationship is altered by tilting of the one boom section from a horizontal position or by tilting of said locking member from a vertical direction by the force of the load supported on said locking member, said yoke member being easily removed from the one boom section by removing said pin and said locking member.

7. The extensible boom attachment of claim 6 wherein said locking member has at least one upper hole to receive said pin and has at least one lower hole vertically below the upper hole to support a load, said locking portion of said locking member being perpendicular to a centerline through the upper and lower holes, said yoke member being free to slide along said one boom section when the centerline through the upper and lower holes remains perpendicular to the bottom of said one boom section, but said yoke member is locked to said one boom section when the perpendicular relation of the centerline through the upper and lower holes in said locking member to the bottom of said one boom section is changed, said locking portion no longer being parallel to the bottom of said one boom section and wedging of said locking portion against the bottom of said one boom section results.

8. An adjustable, self-locking load supporting mechanism for mounting on a boom comprising: a boom; a slide member mounted on said boom and movable therealong when not locked thereto, said slide member having at least one leg depending below said boom; and a locking member pivotally mounted on the lower end

of said leg, said locking member having means to receive a load and having a locking portion spaced from the bottom of said boom in a predetermined clearance relationship when said boom is horizontal and when the force of the load is acting vertically, said locking portion engaging the bottom of said boom to lock said slide member to said boom when said predetermined relationship is altered by inclining said boom from a horizontal position or by tilting said locking member due to a change in direction of the force of the load away from the vertical.

9. In an extensible boom attachment for a lift truck having an elevating carriage, the attachment having a frame removably supported on the elevating carriage and having an extensible boom supported by the frame and projecting substantially horizontally from the frame, the extensible boom comprising a first boom section slidingly and telescopingly received in a second boom section, the improvement of an adjustable self-locking load support mechanism which comprises:

a. a yoke member slidingly supported on either one of the boom sections and movable therealong in an infinite number of positions between the ends of the one boom section when not locked thereto, said yoke member having at least one leg depending below the one boom section;

b. a locking member pivotally mounted on the lower end of said one leg of said yoke member, said locking member having means to support a load and having a locking portion spaced from the bottom of the one boom section in a predetermined clearance relationship when the boom section is horizontal and when the force of the load is acting vertically, said locking portion engaging the bottom of the one boom section to lock said yoke member to the one boom section when said predetermined relationship is altered by inclining the one boom section or by tilting said locking member due to a change in direction of the force of the load away from the vertical.

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