EXTENDIBLE BOOM WITH LATCH MEANS FOR EXTENSION AND RETRACTION

Assignee: National Crane Corporation, Waverly, Nebr.

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References Cited

UNITED STATES PATENTS
3,398,492 8/1968 Nansel 52/115
3,154,025 10/1964 Worthington 212/55
3,267,625 8/1966 Holzschuh et al. 52/111
2,998,106 8/1961 Aust 52/111
859,233 7/1907 Lane 52/111
3,361,456 1/1968 Durand 52/118
2,982,379 5/1961 Fisher 52/111
3,398,645 8/1968 Nansel 52/115
3,670,465 6/1972 Cheze 52/115
3,688,455 9/1972 Zebuh 52/114

FOREIGN PATENTS OR APPLICATIONS
2,018,820 11/1970 Germany 212/55

ABSTRACT

This is an improvement in an extendible boom assembly having a lower section and an upper section and an intermediate section mounted for telescopic movement with respect to one another. The boom assembly has power means connected to the lower and upper sections for extending and retracting the boom assembly. The improvement comprises latch members carried by the upper and intermediate sections. One of the latch members is movable to a latched position wherein it retentively engages the other of the latch members so as to cause the upper and intermediate sections to be locked together for movement in unison. This one latch member is movable from its latched position to a release position wherein it releases the other latch member from retentive engagement. A bearing surface slidably engages the latch member during extension of the upper and intermediate sections, and holds the latch member in its latched position until the boom assembly extends to a predetermined point at which time it permits the latch member to move to its release position. The engagement between the two latch members is such that the movable latch member is urged towards its release position whenever the upper section extends with the latch members in retentive engagement with one another.

16 Claims, 6 Drawing Figures
This invention relates to an improvement in an extendible telescopic boom.

One problem encountered in present telescopic booms is the satisfactory sequencing of the extension of the boom sections. Usually the bottom boom section is the largest one and the upper boom sections are telescopically mounted within this bottom section. For this reason the lower booms are larger in cross section than the upper booms, and they therefore provide greater support than do the upper booms. In expanding the boom assembly it is desirable to have the lower booms extend first, one at a time sequentially with the higher booms being the last to extend. This is conventionally done by locking the upper booms together during the extension of the first section, and then by unlocking the upper boom sections one at a time sequentially, progressing from the lower sections toward the upper sections. The result of this arrangement is that the lowermost boom section extends completely to its fully extended position before the boom section immediately thereafter begins extending.

Latching devices are conventionally provided within the boom assembly for holding the upper boom sections against extension, and then for sequentially releasing them one at a time starting with the lower boom sections and progressing toward the upper boom sections. These latching mechanisms are presently spring operated, and examples of these mechanisms are disclosed in U.S. Pat. Nos. 3,398,492 and 3,398,645.

The present invention provides a result not obtained with these previous devices in that it eliminates the need for spring mechanism within the latching devices. Instead the latching devices operate automatically as the result of camming action, and cause the proper sequential latching and unlatching of the boom sections in a very reliable manner.

Therefore a primary object of the present invention is the provision of a telescopic boom wherein the boom sections will extend one at a time sequentially starting with the lowest boom section and ending with the uppermost boom section.

A further object of the present invention is the provision of a telescopic boom wherein latching means are provided for latching the unextended boom sections together in unison and for automatically unlatching the boom sections one at a time in sequential order beginning with the lowest boom section and ending with the highest boom section.

A further object of the present invention is the provision of a telescopic boom having latching mechanisms which move from latched to unlatched positions in response to camming action rather than in response to springs as in previous devices.

A further object of the present invention is the provision of a telescopic boom having a latching mechanism which can be applied to boom assemblies having any number of sections merely by placing additional latching mechanisms in the boom assembly to accommodate the additional boom sections.

A further object of the present invention is the provision of a telescopic boom having a very sturdy and durable latching mechanism.

A further object of the present invention is the provision of a telescopic boom having a latching mechanism which is compact and which can be contained within the interior of the boom assembly.

A further object of the present invention is the provision of a telescopic boom having a latching mechanism which will automatically release when each section has reached its outer extension limit and which will again become latched automatically in response to retraction of the boom sections.

A further object of the present invention is the provision of a telescopic boom which is simple in operation and economical to manufacture.

These and other objects will be apparent to those skilled in the art.

This invention consists in the construction, arrangements and combination of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in the claims, and illustrated in the accompanying drawings in which:

FIG. 1 is a fragmentary sectional view of the boom sections in their retracted positions.

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is a fragmentary perspective view showing portions of the boom sections broken away and illustrating the latching mechanism used in the present invention.

FIG. 4 is a sectional view illustrating the position of the latching mechanism when the boom sections are fully retracted.

FIG. 5 is a sectional view similar to FIG. 4 illustrating the latching mechanism when the boom sections are partially extended.

FIG. 6 is a top view showing the relative positions of the latching mechanisms in a five section boom assembly.

Referring to the drawings, the extendible boom of this invention is generally referred to in FIG. 1 by the numeral 10 and includes a lower or base section 12, an upper end section 14, and intermediate sections 16, 18 and 20.

The boom sections are telescopically mounted with respect to one another and as seen in FIG. 1, a telescoping hydraulic cylinder 22 extends along the longitudinal axial center of the boom and is anchored by a fastener 24 to the base of lower section 12 at the power cylinder's lower end and is secured by a pin 26 to the upper end section 14. The power cylinder system includes a base cylinder 28 with successively smaller telescoping cylinder sections 30, 32, and 34 which are sequentially connected to an outer piston rod 36 anchored by pin 26 to boom section 14.

On opposite sides of the boom section a plurality of guide blocks 38 are provided adjacent the outer end of the respective sections. Guide blocks 38 on the bottom side of the boom, as viewed in FIG. 1, are adapted to be engaged by stop shoulders 40 on the outer side walls of boom sections 14, 16, 18 and 20, to limit the extension of the respective sections. Hydraulic cylinder 22 through its respective telescoping sections 30, 32 and 34 will also serve to limit the outward extension of the boom sections.

Upper boom section 14 includes on its distal end a winch 40. Lower boom section 12 includes a mounting flange 42 having an aperture 44 for mounting it to a support structure.
A series of three latch mechanisms 46 are shown in Fig. 1 and are mounted within the interior of boom 10. The structure of each latch mechanism 46 is shown in detail in Figs. 3-5. Each latch mechanism 46 includes a slide chamber 48 having a female latch member 50 therein, and additionally includes a male latch member or tang 52. Referring to Fig. 3, slide chamber 48 is operatively secured to intermediate section 16 of boom 10, and tang 52 is welded to boom section 18. Slide chamber 48 includes an upper plate 54 and a lower plate 56 which are in parallel spaced relationship to one another. Two spacer plates 58, 60 are interposed between upper and lower plates 54, 56. Spacer plates 58, 60 form an oblique slide track 62 therebetween. Slide track 62 includes lateral margins which are oblique with respect to the longitudinal axis of boom 10. One end of slide track 62 is closed off by a plate 63 and the other end of slide track 62 is left open and abuts against the lateral wall of section 16 of boom 10 as is readily seen in Figs. 4 and 5. Section 16 of boom 10 includes an opening 64 (Fig. 4) in its lateral wall which aligns with slide track 62.

Female latch member 50 is a metal plate having opposite lateral edges 66, 68 (Figs. 4 and 5) which slidably engage the lateral walls of slide track 62. Latch member 50 also includes an end edge 70 which is parallel to the lateral walls of boom section 16 and is adapted to slidably engage the walls of boom section 16 at times. Within lateral edge 68 of plate 50 is a latch slot or indentation 72. Latch slot 72 includes a locking camming surface 74 and a lip 76 having a camming surface 78 facing left as viewed in Figs. 4 and 5. Extending through female latch member 50 is a plastic friction bearing 80 which is adapted to frictionally engage plates 54, 56 so as to prevent free-sliding movement of female latch member 50 within slide track 62. Friction bearing 80 permits female latch member 50 to slide in track 62 when a predetermined impelling force is applied thereto, but normally holds latch member 50 against random movement.

Welded to boom section 18 and extending rearward therefrom is male latch member or tang 52. Tang 52 includes a nose 82 which conforms substantially to the shape of latch slot 72. Nose 82 is slightly smaller than latch slot 72 so that a space 84 is provided therebetween whenever nose 82 is within latch slot 72. Nose 82 includes a locking camming surface 86 which is adapted to engage and cam against locking camming surface 74 of latch slot 72. Nose 82 also includes a lip 88 which is adapted to engage lip 76 of locking slot 72.

Referring to Fig. 4, it can be seen that end edge 70 of female latch member 50 extends through opening 64 of boom section 16 and slidably engages the interior surface of boom section 12. At a predetermined point along the length of boom section 12 is an opening 90 having a plate 92 mounted thereover. Thus the interior surface of boom section 12 provides a bearing surface for female latch member 50 as boom section 16 extends outwardly within boom section 12.

In the position shown in Fig. 4, tang 52 is inserted within latch slot 72 of female latching member 50, and because of the engagement of lips 76, 88, latch member 52 and latch member 50 are locked together. The result of this is that boom section 18 is locked to boom section 16 for movement in unison therewith. Female latch member 50 is held against substantial movement within slide track 62 by virtue of the fact that end edge 70 engages the interior surface of boom section 12.

When cylinder 22 is actuated to extend boom section 18, boom sections 18 and 16 move in unison outwardly with end edge 70 of latch member 50 slidably engaging the interior surface of boom section 12. When latch member 50 reaches a position which is in registration with opening 90 of boom section 12, latch member 50 is urged downwardly through opening 90. This downward movement is the result of the pulling force of tang 52 acting on latch member 50 and causing latch member 50 to be pulled against the oblique lateral walls of slide track 62. The resultant of this force is a force acting downwardly on latch member 50 and causing latch member 50 to be urged toward opening 90. This force always acts upon latch member 50, even when latch member 50 is not opposite opening 90, but the lateral walls of boom section 12 prevent latch member 50 from moving to the downward position until latch member 50 is in alignment with opening 90. Downward movement of latch member 50 into opening 90 causes lips 88, 76 to slide out of retentive engagement with one another and permits tang 52 to pull free from latch member 50, thereby disengaging boom section 18 from boom section 16. Space 84 between tang 52 and the internal walls of latch slot 72 permit this movement of lips 88 and 76 out of engagement with one another. The result of this action is that upon actuation of cylinder 22 boom section 16 and 18 extend outwardly in unison until boom section 16 reaches its extreme outer limit, at which time latch mechanism 46 becomes unlocked and permits boom section 18 to continue to extend outwardly to its fully extended position.

When cylinder 22 is actuated to retract boom section 18, tang 52 slides inwardly until it is matingly inserted within latch slot 72. While boom section 18 is sliding inwardly latch member 50 holds boom section 16 against inwardly sliding movement by virtue of the fact that latch member 50 protrudes within opening 90 of boom section 12. Slide track 62 and the margins of opening 90 are shown to be slightly oblique with respect to the longitudinal axis of boom 10, but this is obliqueness is only slight, and is not so pronounced so as to permit female latch member 50 to cam outwardly out of opening 90 in response to the tendency of boom section 16 to retract inwardly in unison with boom section 18. Actually slide track 62 could be made to be perpendicular to the longitudinal axis of boom section 12 in which case the camming action between lips 88, 76 would cause latch member 50 to be urged outwardly during the extension of the boom assembly.

As tang 52 is withdrawn rearwardly into latch slot 72, locking camming surface 86 of tang 52 cams against locking camming surface 74 of female latch member 50 and causes female latch member 50 to be lifted outwardly of opening 90, thereby bringing lips 88, 76 into locking engagement as is shown in Fig. 4. Thus boom sections 16 and 18 are again locked together and begin moving in unison as cylinder 22 continues the retraction of the boom assembly.

Figs. 4 and 5 illustrate how latching mechanism 46 functions in a three-boom assembly, and Figs. 1 and 5 illustrate latching mechanisms 46 in a five-boom assembly. Actually latching members 46 can be used in any number of boom sections. All that is required is that a slide chamber 48 be mounted in the larger boom section and that a tang 52 be mounted in the next
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smallest boom section, as described above for boom
sections 16 and 18, respectively. The net effect of this
is to cause the boom sections to extend one at a time
sequentially beginning with the lower sections first and
continuing one at a time through the uppermost sec-
tion. The retraction process is just the opposite, with
the uppermost section retracting fully first, the next
highest section retracting next and so on until all the
boom sections are retracted within the lowest section.
Lips 76, 88 of female latch member 50 and tang 52,
respectively, are beveled so as to facilitate the move-
ment of female latch member 50 to its release position
in response to extension of boom section 18. These
beveled surfaces of lips 76, 88 form an angle of approx-
imately three degrees with a line perpendicular to the
longitudinal axis of boom 10. Slide track 62 is shown
oblique with respect to a line transverse to the longitudi-
unal axis of boom 10, but the beveled surfaces of lips
76, 88 permit the device to function satisfactorily even
if slide track 62 is made perpendicular to the longitudi-
nal axis of boom 10.

When an oblique slide track 62 such as the one
shown in the drawings is used, it is possible to eliminate
the beveled surfaces on lips 76, 88, and these surfaces
can actually be perpendicular to the longitudinal cen-
terline of the boom. Thus the angles of slide track 62
and lips 76, 88 may be varied to any angle which causes
female latch member 50 to move to its release position
in response to pulling action by tang 52.

Thus it can be seen that the device accomplishes at
least all of its stated objectives.

I claim:
1. An improvement in an extendible boom assembly,
said boom assembly having a lower section, an upper
section, and an intermediate section mounted for tele-
oscopic movement with respect to one another, said
boom assembly having power means connected to said
lower and upper sections for extending and retracting
said boom assembly; said improvement comprising:
latch members carried by said upper section, and said
intermediate section, said latch members being ad-
jacent one another when said upper section is re-
tracted with respect to said intermediate section;
one of said latch members being movable to a latched
position wherein it retenively engages the other of
said latch members so as to cause said upper and
intermediate sections to be locked together for
movement in unison, said one latch member being
movable from said latched position to a release po-

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tion wherein said other latch member is released
from retenitive engagement with said one latch
member;

bearingsurface on said boom assembly for slidably
engaging said one latch member during exten-
sion of said upper and intermediate sections, said bear-
surfacemoving having a first portion shaped to hold
said one latch member in its latched position and
having a second portion shaped to permit move-
ment of said one latch member to its release posi-
tion; and

said other latch member engaging said one latch
member and urging said one latch member towards
its release position whenever said upper section ex-
tends with said latch members in retenive engage-
ment, whereby said one latch member will remain
in its latched position until it moves to said second
portion of said bearing surface at which time it will
be urged into its release portion by said other latch
member.
2. The improvement of claim 1 wherein said latching
members include complimentary camming surfaces
which are adapted to engage one another during retrac-
tion of said upper member for coming said one latch
member into its latched position, thereby locking said
upper and intermediate sections together.
3. The improvement of claim 2 wherein said one
latch member is carried by said intermediate section
and said other latch member is carried by said upper
section, said bearing surface being formed on said
lower section.
4. The improvement of claim 1 wherein said one
latch member is slidably mounted in a slide track for
movement from said latched to said release position,
said slide track having a longitudinal axis which is
oblique to the pulling force exerted on said one latch
member during extension of said upper section of said
boom assembly, whereby said pulling force causes said
latch member to be urged along said slide track to said
release position.
5. The improvement of claim 4 wherein said one
latch member is a plate having an indentation in one of
its margins and said other latch member is adapted to
matingly fit within said indentation, said indentation
and said other latch member having complimentary lips
which are adapted to engage and retenively hold said
latch members together.
6. The improvement of claim 5 wherein said other
latch member is smaller than said indentation so as to
permit movement of said one latch member between its
latched and release positions when said other latch
member is matingly inserted within said indentation;
said complimentary lips retenively engaging one an-
other when said one latch member is in its latched posi-
tion and said lips being free from retenitive engage-
ment with one another when said one latch member is in its
release position.
7. The improvement of claim 6 wherein said one
latch member has a friction bearing thereon frictionally
engaging said slide track for preventing free move-
ment of said latch member between its latched and releas-
end positions, said friction bearing being adapted to permit
sliding movement of said one latch member within said
slide track in response to an impelling force of prede-
termined magnitude.
8. The improvement of claim 7 wherein said lower
section of said boom assembly is hollow and includes
an interior surface, said interior surface providing said
first portion of said bearing surface, said second por-
tion of said bearing surface being formed by a radially
outwardly extending indentation in said interior surface
of said lower section.
9. The improvement of claim 1 wherein said one
latch member is slidably mounted in a slide track for
movement from said latched to said release position.
10. The improvement of claim 9 wherein said latch
members each include a lip, said lips of said latch mem-
bers engaging one another when said one latch member
is in its latched position, said lips having beveled sur-
faces which engage one another and which urge said
one latch member towards its release position in re-
sponse to extension of said upper section of said boom
assembly.
11. A boom assembly comprising:
first, second, and third booms each having tubular walls and inner and outer ends, said second boom being telescopically mounted within said third boom and said first boom being telescopically mounted within said second boom; means for extending and retracting said boom with respect to one another; a first latch member on said first boom; a second latch member on said second boom; said first and second latch members being shaped to interlock and latch said first and second booms together at times for telescopic movement in unison within said third boom; mounting means movably mounting said second latch member to said second boom for movement from a latched position wherein said latch members are interlocked to a release position wherein said latch members are free from locking engagement and said first and second booms are independently movable with respect to one another; said mounting means having means thereon for urging said second latch member toward said release position in response to pulling action from said first latch member during extension of said first boom; a bearing surface on said third boom engaging said second latch member during movement of said first and second booms within said third boom, said bearing surface having a first portion holding said second latch member against movement to said release position and a second portion freeing said second latch member for movement to said release position.  
12. A boom assembly according to claim 11 wherein said second portion of said bearing surface is shaped to engage said second latch member for holding said second latch member and said second boom against retractive movement within said third boom when said second latch member moves to its release position.  
13. A boom assembly according to claim 12 wherein said first latch member is shaped to engage said second latch member during retraction of said first boom into said second boom so as to urge said second latch member from its release position to its latched position.  
14. A boom assembly according to claim 12 wherein said second latch member includes a friction bearing thereon frictionally engaging said mounting means so as to prevent free movement of said second latch member from said release to said latch position.  
15. A boom assembly according to claim 11 wherein said mounting means comprises a track for permitting sliding movement of said second latch member laterally with respect to the longitudinal axes of said booms.  
16. A boom assembly according to claim 15 wherein said track extends obliquely with respect to said longitudinal axes of said booms whereby said second latch member is urged laterally in response to pulling action from said first latch member.