CRANE BOOM HAVING WEAR PADS

Assignee: Walter Kidde & Company, Inc., Clifton, N.J.
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Primary Examiner—Milton Kaufman
Assistant Examiner—R. H. Lazarus
Attorney—Brady, O'Boyle & Gates

ABSTRACT

Wear pads or bearings for telescoping crane booms consists of units on the rear and top and forward end and bottom of adjacent telescoping sections. Each wear pad unit comprises plural wear pad or plate sections floatingly mounted on cushioning elements within a retainer. The strength or spring constant of the cushioning elements may vary within the units to meet conditions of varying stress. The wear pad units are self-adjusting to accommodate inherent angularity between telescoping boom sections.

5 Claims, 8 Drawing Figures
CRANE BOOM HAVING WEAR PADS

In the prior art relating to plural section telescoping crane booms of the type consisting of rectangular box-like boom sections, it has been customary to equip each section with wear pads at its rear end and upper side to frictionally engage the top wall of the next outermost section of the boom. In like manner, the forward end and bottom of each boom section is provided with wear pads to frictionally engage the bottom wall of the next innermost telescoping boom section. The wear pads are flat single plate elements held in some form of rigid retainer on the particular boom section carrying them. Wear pads are preferred over roller devices because the heavy stresses involved can be distributed over a wide area, rollers being essentially line contact devices.

In practice, however, difficulty is experienced with conventional wear pads particularly when the telescoping boom sections are extended under load near the maximum possible extent. Under these conditions, there is a certain amount of inherent canting between interfitting boom sections and this canting produces angularity between the friction faces of the wear pads and the walls of the boom sections on which they ride. As a result, excessive wear and binding near the corners of the wear pads results and uneven wear takes place and, after a period of time, the wear pads must be replaced. Additionally, when the stress becomes concentrated at the corners of the wear pads, the advantage of stress distribution over an area is lost and the wear pads become no better than rollers. Also, this stress concentration will produce excessive stress and flexure in the walls of the box-like boom sections which they contact.

In view of the above defect in the prior art, it is the purpose of this invention to provide greatly improved and more efficient wear pad units for the telescoping sections of crane booms wherein the wear pad or bearing plate elements are floatingly supported in their retainers or resilient cushioning elements and therefore have the ability to adjust automatically their wear faces to compensate for the canting of boom sections as the boom is extended. According to the invention, the wear pad units may consist of plural pad elements individually supported on cushioning elements whose spring constant or strength may be varied to meet particular conditions of loading or stress at that particular pad element. The wear pad units are therefore self-adjusting and have the ability to maintain full face-to-face frictional contact with the boom section walls which they oppose during operation.

Other features and advantages of the invention will be apparent during the course of the following description.

BRIEF DESCRIPTION OF DRAWING FIGURES

FIG. 1 is a diagrammatic representation in cross section of a crane boom equipped with wear pads in accordance with the prior art and illustrating on an exaggerated scale the canted condition of a pair of interfitting boom sections;

FIG. 2 is a longitudinal vertical section, partly in elevation, through a telescoping crane boom equipped with the wear pads of the invention;

FIG. 3 is an enlarged vertical section taken on the staggered line 3—3 in FIG. 2;

FIG. 4 is a fragmentary horizontal section taken on line 4—4 of FIG. 3;

FIG. 5 is a similar section taken on line 5—5 of FIG. 3;

FIG. 6 is a view similar to FIG. 1 showing on an exaggerated scale the self-adjusting or self-seating ability of the wear pad elements;

FIG. 7 is a vertical sectional view similar to FIG. 3 showing a modification; and

FIG. 8 is an enlarged fragmentary vertical section taken on line 8—8 of FIG. 7.

DETAILED DESCRIPTION

Referring to the drawings in detail wherein like numerals designate like parts throughout, and referring first to FIG. 1, wherein there is shown a fragmentary portion of a telescoping crane boom including a fly section 10 and one midsction 11, both being rectangular box members in cross section. The boom in question may embody three, four or even five telescoping sections including a base section. In any case, according to prior art practices, wear pads or plates 12 are conventionally secured to the rear end and upper side of each boom section which must telescope into a next outermost section, and in like manner similar wear pads 13 are conventionally secured at the forward end and lower side of each boom section which must receive telescopically therein a next innermost section. The conventional prior art wear pads 12 and 13 are seated in some form of rigid retainer on the boom section carrying them and the wear pads constitute unitary relatively large area pads which do not have the ability to adjust or seat themselves automatically against the faces of the boom sections which they oppose. Consequently, when the adjacent boom sections become canted, particularly near the limit of their extension as shown exaggerated in FIG. 1, the corner regions only of the wear pads will frictionally engage the opposing surfaces of the boom sections and the wear pads, to a great extent, will lose their ability to distribute stresses over relatively wide surface areas. In the extreme, a line contact condition between the corners of the wear pads and the opposing walls of the boom sections will be approached with an undesirably high concentration of stresses on the top and bottom walls of adjacent boom sections producing bending and distortion thereof. As a result of this, it is customary to heavily reinforce the top and bottom boom section walls throughout their lengths by reinforcing plates 14.

Referring now to FIGS. 2 through 6, an improved form of wear pad constituting the subject of the present invention is illustrated. The improved wear pad structure is shown in conjunction with a plural section telescoping crane boom including boom sections 15, 16, and 17. As shown in FIG. 3, each individual boom section is a rectangular box member fabricated from welded plate stock. Each boom section includes top walls or webs 18, 18' and 18", bottom walls 19, 19', and 19" and vertical side walls 20, 20' and 20". In the embodiment shown, the side walls 20, 20' and 20" are spaced inwardly of the longitudinal edges of the top and bottom walls of the particular box-like boom sections to allow placement of the wear pads substantially directly above and below the vertical side walls 20, 20' and 20" so that the latter will function as columns under loading and the top and bottom walls of the boom sections will be substantially relieved of trans-
verse bending stresses. It should be understood, how-
ever, that the improved wear pads of this invention may also be employed successfully with box-like boom sec-
tions constructed by other methods known in the art.

As shown in the drawings, the improved wear pads comprise upper and lower pairs of assemblies 21 and lower pairs of assemblies 22 located respectively in laterally spaced relation on the rear and top of each boom section which must telescope into a next outer-
most section and on the front and bottom of each boom section which must receive telescopically a next inner-
most section.

Considering a typical upper wear plate assembly 21, the same comprises a plurality, such as three, individual relatively small wear pads or plates 23 having flat wear faces for direct frictional contact with the opposing top wall of the next outermost boom section 15 or 16 in FIG. 2. The wear plates 23 of each unit are positioned in elongated rectangular retainer recesses 24 of rein-
forcing plates 25 which span the top walls of the boom sections carrying them transversely and are securely welded to such a top walls to locally reinforce the same as shown in the drawings. Beneath each wear pad sec-
tion 23 in each retainer recess 24 is a belleville spring 26 having its tapered end facing upwardly as best shown in FIG. 3. Belleville springs are suitable because they are essentially stiff small displacement springs and no large displacement is required in the present appli-
cation. The belleville springs simply serve to cushion the individual wear pads 23 and render the same self-
adjusting or self-seating against the flat opposing wall of the next outermost boom section. This feature allows the wear pads 23 to compensate automatically for cant-
ing of adjacent boom sections and this ability to adjust or compensate is shown graphically and on a somewhat exaggerated scale in FIG. 6. In this figure, it can be ob-
served that the upper wear pads 23 are all totally contact-
ting the top wall of the boom section 16 despite the canted relationship of the boom sections 16 and 17. The high concentration of stresses discussed in con-
nection with FIG. 1 is completely avoided and the wear on the pad elements 23 is drastically reduced.

Another feature of the invention is that the indi-
vidual belleville springs 26 may be varied in strength or stiffness to counteract the stress or loading on a par-
ticular pad. For example, again referring to FIG. 6, the rearmost wear pads 23 on the boom section 17 should have the strongest springs under them because the heaviest loading is at this location. In any case, how-
ever, all that is required is a spring force sufficient to assure proper load distribution over the entire flat face of the wear pad in question. As stated, each pad ele-
ment 23 is floatingly supported on its own cushion or spring element and is essentially self-adjusting or self-
seating.

Referring not to the lower wear pad assemblies 22, FIG. 5, each of these embodies the same plurality of rectangular wear pad sections 27 which may be identi-
cal to the elements 23. Beneath each pad section 27 is a belleville spring 28 similar or identical to the springs 26 of the upper assemblies. The pads 27 and springs 28 are located in retaining recesses 29 of bottom U-shaped reinforcing struts 30 whose opposite vertical side por-
tions 31 are welded to the vertical walls of the particu-
lar boom section in question to reinforce this boom sec-
tion locally. As shown in FIGS. 2 and 3, the bottom wall of the particular boom section is also provided with openings 32 immediately above the recesses 29 to receive and retain the wear pads 27. The wear pads 27 of the lower assemblies function in the same manner and possess the same advantages as described above for the upper assemblies 21.

FIGS. 7 and 8 of the drawings depict a modification of the invention wherein single elongated upper and lower wear pads 33 and 34 are employed in the assem-
bles in lieu of the plural smaller sectional wear pads of the previous embodiment. Beneath each elongated wear pad 33 and 34 in the retainer cavity 35 or 36 is a single leaf spring 37 of sufficient strength to render the associated pad firmly seated against the opposing wall of the next adjacent boom section and essentially self-
adjusting. As in the previous embodiment, the single pads 33 and 34 float on the springs 37 and a complete surface contact between the wear faces of the pads and the opposing boom section walls is assured with a resulting load distribution over a considerable surface area, even when boom sections are canted as in FIGS. 1 and 6. All other parts and their functions are identical to corresponding parts in the previous embodiment and no further description of the structure in FIGS. 7 and 8 is deemed to be necessary for a proper understanding of the modification.

The terms and expressions which have been em-
ployed herein are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifica-
tions are possible within the scope of the invention claimed.

I claim:

1. In an extensible telescoping crane boom, a pair of telescopically interfitting boom sections each having side webs and a top and a bottom web, upper and lower load supporting wear pad assemblies respectively on the rear end and top of the interior boom section inter-
posed between and being substantially parallel with the top webs of the two boom sections and on the forward end and bottom of the exterior boom section inter-
posed between and being substantially parallel with the closely adjacent bottom webs of the two boom sections, upper and lower pairs of wear pads included in said upper and lower wear pad assemblies, the improvement comprising said lower wear pad assembly including a heavy retainer plate connected beneath the bottom web of the exterior boom section and having retaining recesses therein located directly below said side webs of the interior boom section, belleville springs having a small vertical height resting in the bottoms of said recesses, the wear pads of the lower pad resting on top of said belleville springs and extending upwardly through retaining apertures in the bottom web of the exterior boom section and engaging the bottom web of the interior boom section, said belleville springs operative to universally resiliently urge said wear pads of the lower pair into substantially complete seating engage-
ment with the bottom web of the interior boom section, the wear pads of the upper and lower pairs being located directly above and below said side webs of the interior boom section for transmitting forces directly
thereto, and the side webs functioning substantially as columns to absorb said forces.

2. An extensible telescoping crane boom as set forth in claim 1 including plural separate closely spaced belleville springs in each of said retaining recesses arranged longitudinally of the exterior boom section, and said wear pads of the lower pair each comprising a corresponding number of separate load supporting wear pad sections resting on the respective belleville springs and each being substantially universally self-adjusting.

3. An extensible telescoping crane boom as set forth in claim 1 in which said upper wear pad assembly includes a heavy retainer plate connected to the top of the top web of the interior boom section and having retaining recessed therein located directly above said side webs of the interior boom section, upper belleville springs having a small vertical height resting in the bottoms of said recesses, the wear pads of the upper pair resting on top of said upper belleville springs and extending upwardly through and above the retaining recesses into engagement with the top web of the exterior boom section.

4. The structure of claim 9, and said retaining recesses being elongated rectangular recesses positioned horizontally of the boom, said load supporting wear pad sections each comprising a substantially square flat plate element and the several plate elements within each recess substantially filling the recess.

5. The structure of claim 9 and said belleville springs in each retaining recess being of unequal strength with the strongest belleville spring disposed beneath the load supporting wear pad section closest to the forward end of the exterior boom section which is resisting the greatest load.