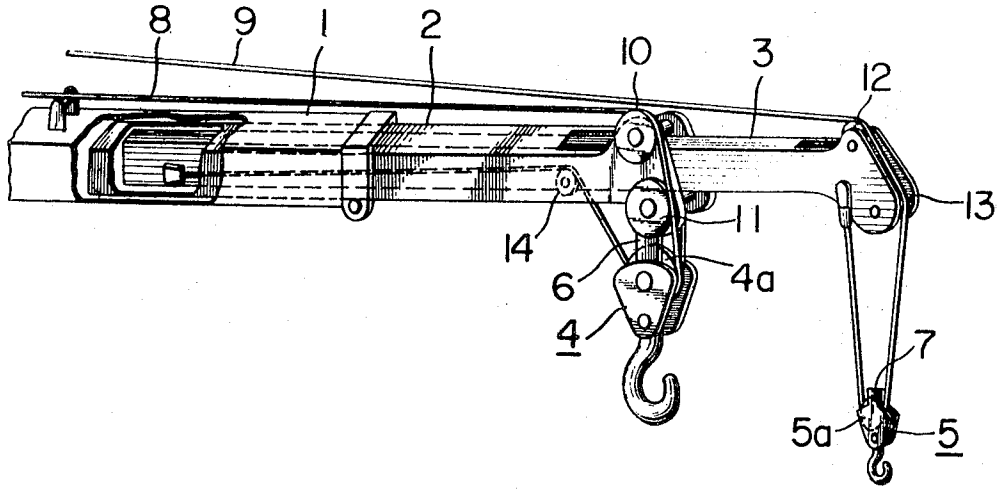
June 23, 1970 TATSUO NAKAMURA 3,516,554

TWO-STAGE EXTENSIBLE BOOM

Filed March 21, 1968 2 Sheets-Sheet 1

Fig. 1



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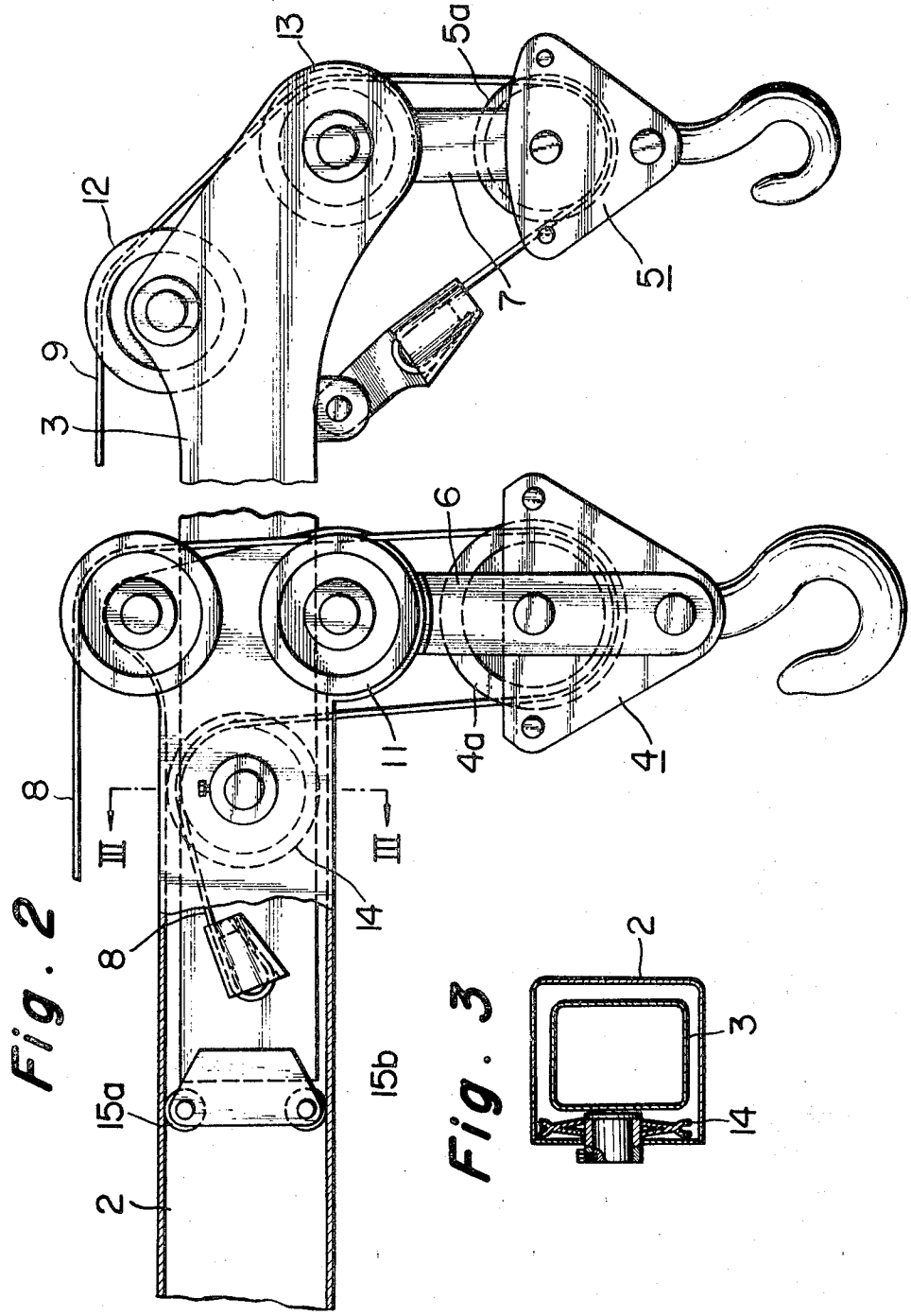


Fig. 2

Fig. 3

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United States Patent Office 3,516,554 Patented June 23, 1970

3,516,554

TWO-STAGE EXTENSIBLE BOOM

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Filed Mar. 21, 1968, Ser. No. 715,044
Int. Cl. B66c 23/04
U.S. Cl. 212—55 1 Claim

ABSTRACT OF THE DISCLOSURE

A two-stage extensible boom, comprising a main boom member, an intermediate boom member, and an end boom member. The intermediate boom member is movable relative to said main boom member by a hydraulic means. The end boom member is movable relative to said intermediate boom member by controlling wire ropes for hanging hooks at the tip of the intermediate boom member and the end boom member, without using any separate extending means.

This invention relates to a two-stage extensible boom, more particularly to a crane boom extensible in two stages, which has two movable boom members to be driven by a hydraulic means and hook manipulating wire ropes, respectively.

A known hook manipulating wire rope of a crane boom has one end connected to a driving winch and the opposite end secured to the tip of the boom, and the wire rope is used only for effecting vertical reciprocation of the hook. To make the crane boom extensible, it has heretofore been necessary to provide a separate operating mechanism for each extensible member, in addition to the hook manipulating wire rope.

An extensible boom according to the present invention has a main boom member, an intermediate boom member slidably fitted in the main boom member, and an end boom member slidably fitted in the intermediate boom member. The intermediate boom member has a hook suspended from the tip thereof by means of a first wire rope. The end boom member has a sub-hook suspended from the tip thereof by a second wire rope having one end secured to the tip of the end boom member. The first wire rope for manipulating the hook of the intermediate boom member is not secured to the tip of the intermediate boom member, but fastened to the rear end of the end boom member through a guide pulley mounted inside of the intermediate boom member. Thus, the boom can be extended by moving the end boom member forwards relative to the intermediate boom member, by taking up the first wire rope in excess of that extent where the hook is raised to a predetermined uppermost position. In other words, the first wire rope acts both as a hook manipulating means and as a boom extending means. The boom can be contracted simply by taking up the second wire rope to manipulate the sub-hook, while releasing the first wire rope accordingly.

In order to insure smooth rotation of each pulley built integrally with the hook and sub-hook when such hook and sub-hook are brought to the uppermost position, a strap is mounted on each pulley, which strap acts not only as a cover of the pulley but also as a stopper thereof.

For a better understanding of the invention, reference is made to the accompanying drawings, in which:

FIG. 1 is a perspective view, with a part thereof cut away, showing construction of a two-stage extensible boom according to the present invention;

FIG. 2 is an enlarged side view, with a part thereof in section, of the essential portion of the two-stage extensible boom; and

FIG. 3 is a sectional view taken on the line III—III of FIG. 2.

Like parts are designated by like numerals and symbols throughout the drawings.

Referring to FIG. 1, a two-stage extensible boom according to the present invention has a main boom member **1**, an intermediate boom member **2** slidably fitted in the main boom member **1**, and an end boom member **3** slidably fitted in the intermediate boom member **2**. An extending means (not shown), such as a hydraulic cylinder, is inserted between the main boom member **1** and the intermediate boom member **2** to reciprocate the intermediate boom member **2** relative to the main boom member **1**.

A hook unit **4** having a pulley **4***a* is suspended from the tip of the intermediate boom member **2**, while a sub-hook unit **5** having a pulley **5***a* is suspended from the tip of the end boom member **3**. A strap **6** having a U-shaped cross section is integrally mounted on the hook unit **4** so as to cover the top of the pulley **4***a*. Accordingly, when the hook unit **4** is lifted to its uppermost position, the strap **6** comes into contact with the tip of the intermediate boom member **2**, to insure smooth rotation of the pulley **4***a*, by preventing the direct contact of the wheel of the pulley **4***a* with the boom member **2**. A similar strap **7** is integrally mounted on the sub-hook unit **5**.

A wire rope **8** is extended to the hook unit **4** through hook suspending pulleys **10** and **11** located at the tip of the intermediate boom member **2**, to facilitate vertical manipulation of the hook. Another wire rope **9** is extended to the sub-hook unit **5** through hook suspending pulleys **12** and **13** located at the tip of the end boom member **3**, to raise and lower the sub-hook unit. One end of the wire rope **8** is secured to a driving winch (not shown), while the opposite end thereof is extended through the hook suspending pulleys **10**, **11**, the hook pulley **4***a*, and another guide pulley **14** mounted inside of the intermediate boom member **2**, and then connected secured to the tip of the end boom member **3**.

One end of the sub-hook manipulating wire rope **9** is secured to a driving winch (not shown), while the opposite end thereof is extended through the hook suspending pulleys **12**, **13**, and the sub-hook pulley **5***a*, and then secured to the tip of the end boom member **3**.

Referring to FIGS. 2 and 3, guide wheels **15***a* and **15***b* are mounted at the rear end of the end boom member **3**.

In the boom of the present invention with the aforesaid construction, the end boom member **3** can be extended out of the intermediate boom member **2** by taking up the hook manipulating wire rope **8**. The wire rope **8**, at first, lifts the hook unit **4** to its uppermost position in contact with the tip of the intermediate boom member, and then draws the rear end of the end boom member **3** in forward direction. When the hook unit **4** is at its uppermost position, the strap **6** engages with the tip of the intermediate boom member **2**, and the hook pulley **4***a* rotates smoothly without making any direct contact with the boom member **2**. The extent of the forward movement of the end boom member **3** corresponds to the length of the wire rope **8** taken up after the arrival of the hook unit **4** at its uppermost position. It is preferable to set the furthest allowable forward position of the end boom member **3** at a position where the end of the wire rope **8** secured to the boom member **3** is brought to the proximity of the guide pulley **14**.

To move the end boom member **3** rearwards into the intermediate boom member **2** to contract the extensible boom, the wire rope **9** is taken up. The sub-hook unit **5** is, at first, raised to its uppermost position in contact with the tip of the end boom member **3**. Then, the strap **7** comes into direct contact with the boom member **3** to insure smooth rotation of the sub-hook pulley **5***a*, as the strap **6** insures uninterrupted rotation of the hook pulley **4***a*.

Thus, if the wire rope 9 is further taken up while keeping the strap 7 of the sub-hook unit 5 in contact with the end boom member 3, the end boom member 3 can be easily pulled rearwards into the intermediate boom member 2, to contract the boom. It is of course necessary to release the wire rope 8 in conjunction with the taking up of the wire rope 9, so that the rearward movement of the end boom member 3 can be effected smoothly.

As described in the foregoing, according to the present invention, there is provided a two-stage extensible boom which can be extended and contracted to a desired length simply by taking up and releasing hook manipulating wire ropes 8 and 9 of the boom, without using any separate mechanism for effecting such extension and contraction. Thus, the operation of the extensible boom is very easy. Furthemore, the structure of the boom is very simple, to allow low cost production thereof.

What is claimed is:

1. A two-stage extensible boom, comprising a main boom member; an intermediate boom member slidably fitted in said main boom member; end boom member slidably fitted in said intermediate boom member; a hook suspended from the tip of the intermediate boom member by a first wire rope in a vertically reciprocative manner; a sub-hook suspended from the tip of said end boom member by a second wire rope in a vertically reciprocative

manner, said first wire rope having one end secured to a driving winch and the opposite end secured to the rear end of said intermediate boom member, so that the first wire rope operatively engages with hook suspending pulleys mounted at the tip of said intermediate boom member, a pulley of the hook, and a guide pulley mounted inside of the intermediate boom member; said second wire rope having one end secured to a driving winch and the opposite end secured to the tip of the end boom member, so that the second wire rope operatively engages with sub-hook suspending pulleys mounted on the tip of the end boom member and a pulley of the sub-hook; and a hydraulic means to move said intermediate boom member relative to said main boom member.

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U.S. Cl. X.R.

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