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BOOM IN A TRUCK-CRANE

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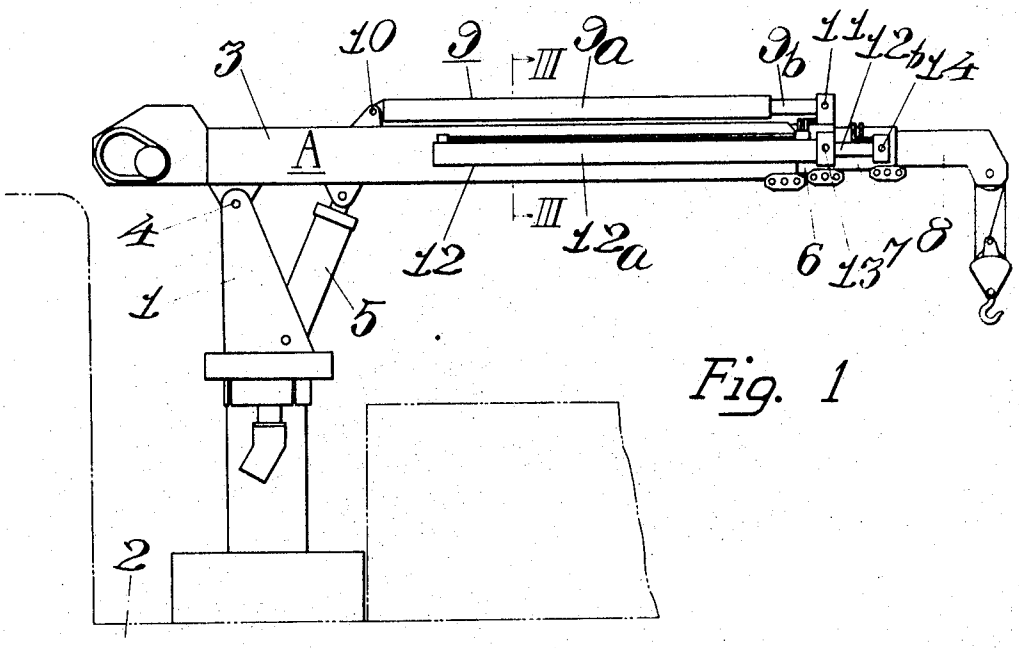
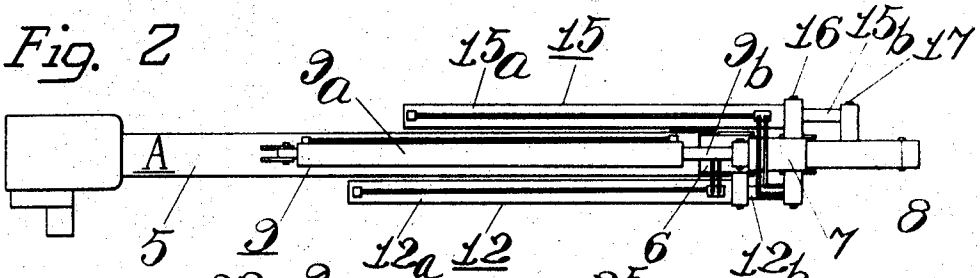


Fig. 1

Fig. 2



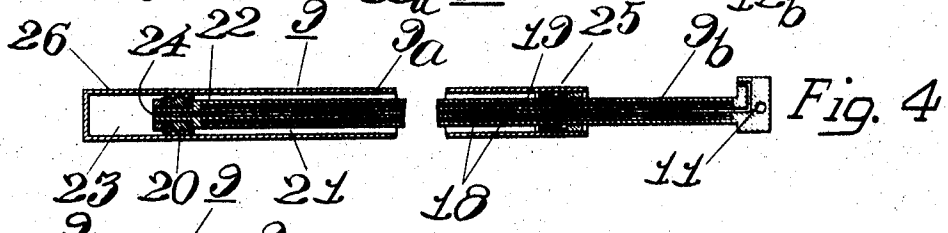


Fig. 4

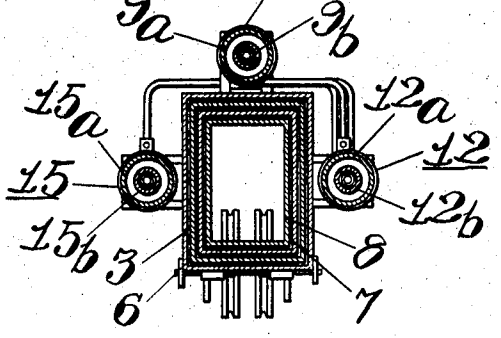


Fig. 3

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BOOM IN A TRUCK-CRANE

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ABSTRACT OF THE DISCLOSURE

A boom in a truck-crane has more than three extensible boom sections. The boom sections are extended or telescoped controllably by hydraulic piston cylinders individually provided for the boom sections. The hydraulic piston cylinders are connected to each other by double-fluid passages so that they are controlled by a single hydraulic system.

This invention relates to a boom in a truck-crane. More particularly, it relates to means for extending and telescoping a boom of the above kind, particularly one having more than three telescopic boom sections.

In a telescopic boom of a crane mounted on a truck, high extensibility of the boom is a prerequisite. To wit, it is required that the boom, consisting of a plurality of telescopic boom sections, can be telescoped as short as possible when the truck is running, while, in its operation, can be extended as long as possible.

However, up to the present, there have been several problems for imparting high extending and telescoping efficiencies to a boom of the above-mentioned kind especially when it is hydraulically actuated and operated. For example, in a conventional boom in which all of its telescopic boom sections are operated by a single double-acting multistage hydraulic piston cylinder, the manufacturing cost of such hydraulic piston cylinder is considerably high. It has the further disadvantages that, since said hydraulic piston cylinder has to be secured to the crane regardless of its length and weight at only two points, viz., at the forward end of its piston rod and at the base end of its main hydraulic cylinder, it has to be strongly-built so as to have firm resistances against buckling, with the consequent result that it becomes heavy and huge disproportionately to the boom on which it is mounted. Particularly when the boom consists of comparatively long boom sections, or four or more telescopic sections, piston rods and cylinders thereof have to be so heavy and huge that they can not be put to practical use.

It has been suggested to provide independent single-acting hydraulic hoists between telescopic boom sections, but no concrete technics has been developed as regards the arrangement of such hydraulic hoists on the boom sections and the system for supplying hydraulic fluid to each of the hydraulic hoists which move with the boom sections as they are extended or telescoped. In principle, the main object of the present invention is, therefore, to provide a boom of the kind consisting of three or more telescopic boom sections and subsequently having a high extensibility or having comparatively long boom sections, with extending and telescoping means which are free from the above-described disadvantages in conventional booms.

In a concrete form, the main object of the present invention is to provide a boom of a truck-crane comprising a relatively fixed outermost boom section, successive extensible boom sections telescopically inserted into one another, including a first extensible boom section telescopically inserted in the relatively fixed boom section and an innermost extensible boom section, a hydraulic piston cylinder pivotally secured at one end to the outer wall of the relatively fixed outermost boom section and at another end to the foremost part of the first extensible boom section, and hydraulic piston cylinders in a number less by one than that of the successive extensible boom sections each pivotally secured at a foremost part of the hydraulic cylinder thereof to the foremost part of one of the successive extensible boom sections and at a free end of the piston rod thereof to the foremost part of one of another successive extensible boom sections which is telescopically inserted into the afore-mentioned one of the successive extensible boom sections, all of the hydraulic piston cylinders, except the one whose piston rod is pivotally secured to the innermost etxensible boom section, being respectively provided with a pair of hydraulic fluid passages running inside the piston rods along the axial directions thereof and interconnecting the hydraulic piston cylinders.

In the accompanying drawings in which a preferred embodiment of a boom of a crane having four telescopic boom sections is illustrated in accordance with the present invention:

FIG. 1 is a side view of the present invention boom mounted on a vehicle by a revolving post;

FIG. 2 is a plan view of FIG. 1;

FIG. 3 is an enlarged vertical sectional view of FIG. 1 along the line III—III, and

FIG. 4 is a longitudinal section view of one of the hydraulic hoists of the present invention boom.

With reference to the accompanying drawings, a relatively fixed boom section **3** of a boom A is pivotally secured at its base portion by a pivot pin **4** to the uppermost end of a revolving post **1** which is mounted on a vehicle **2**. A hydraulic hoist **5** fixed at one end to the revolving post **2** and at another end pivotally sceured to the relatively fixed boom section **3**, elevates the boom. The boom A consists of said relatively fixed outermost boom section **3**, a first extensible boom section **6** telescopically inserted into the relatively fixed outermost boom section **3**, a second extensible boom section **7** telescopically inserted into the first extensible boom section **6**, and the third extensible innermost boom section **8** telescopically inserted into the second boom section **7**. These boom sections have tubular or box configuration for maximum strength and to provide a housing for a successive boom section to be telescopically inserted thereto. The number of these extensible boom sections which are telescoped successively into one another may vary in accordance with the requirements of the applications.

The relatively fixed boom section **3** and first extensible boom section **6** are controllably connected by a hydraulic piston cylinder **9**. Said hydraulic piston cylinder comprises a cylinder **9***a* and a piston rod **9***b* which is fitted through one end of said cylinder **9***a*. Cylinder **9***a* is connected to the upper wall of the relatively fixed boom section **3** adjacently to the base end thereof by a pivot pin **10**, and the free end of the piston rod **9***b* is fitted to the foremost upper end of the first extensible boom section **6** by a pivot pin **11**. The first extensible boom section **6** is further connected to the second extensible boom section **7** by a hydraulic poston cylinder **12** which consists of a cylinder **12***a* and a piston rod **12***b*. Said cylinder **12***a* is pivotally secured to the foremost right side of the first extensible boom section **6** adjacent the outer end thereof, or at the end of cylinder **9***a* having the front opening through which the piston rod **12***b* is reciprocably inserted into the cylinder. The free end of the piston rod **12***b* of the hydraulic piston cylinder **12** is pivotally connected by a pin **14** to the right side of the second extensible boom section **7** adjacent the outer end of the latter. Another hydraulic piston cylinder **15**, having a cylinder **15***a* and piston rod **15***b*, connects the second and third extensible boom sections **7** and **8**. The foremost or open end portion of said cylinder **15***a* is fitted to the front left side of the second extensible boom section **7** by a pivot pin

16, and the free end of said piston rod 15*b* is pivotally secured at the point 17 to the front left side of the third extensible boom 8.

All of the above-mentioned hydraulic piston cylinder, except the piston cylinder 15 which is fitted to the third innermost extensible boom section 8, are provided with a specific hydraulic fluid supplying system that can supply the hydraulic fluid to the hydraulic piston cylinders 9, 12, 15 successively through them. The piston rod 9*b* of the hydraulic hoist 9 is provided in its inside with double pipes, one of which 18 encircles another 19 concentrically with the latter. Said hydraulic pipe or passage 18 communicates with a chamber 21, defined in the cylinder by a piston 20 at the inner end of the piston rod 9*b*, through a fore 22 perforated on the pipe adjacently to the piston 20 of the piston rod 9*b*, while the other hydraulic pipe 19 communicates with a chamber 23, defined in the cylinder 9*a* by the piston 20 at the opposite side, through its opening 24 through the piston 20. The fluid pipes 18 and 19 communicate respectively with a hydraulic chamber (not shown) defined in the cylinder 12 at one side of the piston thereof, and with a hydraulic member (not shown) defined in the same cylinder 12 at the opposite side of said piston. The hydraulic fluid supplied either into the chamber 21 or chamber 23 from fluid supplying openings 25 or 26 of the hydraulic piston cylinder 9 not only works the piston 20, but also works in the hydraulic piston cylinder 12. The hydraulic piston cylinder 12, having the same construction as the piston cylinder 9 supplies a part of the hydraulic fluid supplied thereto into the hydraulic piston cylinder 15.

In the boom having the above constructions, when a hydraulic fluid is supplied from the fluid supplying opening 26 into the hydraulic piston cylinder 9 at the chamber 23 thereof, the hydraulic piston cylinders 9, 12, 15 expand in unison resulting in the extension of the boom sections 6, 7, and 8. When the hydraulic fluid is supplied from the fluid supplying opening 26 into the chamber 21 of the hydraulic piston cylinder 9, the hydraulic piston cylinders 9, 12, 15 are retracted in unison resulting in telescoping the boom sections.

What is claimed is:

1. A mobile crane comprising, in combination, a mobile crane truck; an extensible boom pivotally mounted, adjacent its inner end, on a support on said truck; a hydraulic hoist connected between said support and said boom to raise and lower said boom; load supporting means mounted on the outer end of said boom; said boom having a plurality of tubular cross section boom members constituted by a base member, a first extensible boom member telescopically inserted into said base member and additional extensible boom members telescopically received in succession in each other and in said first extensible boom member, said additional extensible boom members including a longitudinally outermost end boom member; said base member being pivoted to said support and connected to said hoist, and said end member carrying said load supporting means; a first hydraulic actuator including a first cylinder having an open outer end and a closed inner end, a first piston in said first cylinder and

a first piston rod conected to said first piston and extending through the outer end of said first cylinder, the inner end of said first cylinder being connected to said base boom member adjacent the inner end of said base boom member, with said first cylinder extending along the exterior surface of said base boom member, the outer end of said first piston rod being connected to said first extensible boom member adjacent the outer end of the latter; a plurality of second hydraulic actuators equal in number to said additional extensible boom members, said second hydraulic actuators interconnecting said extensible boom members in succession; each second hydraulic actuator including a second cylinder having an open end and a close end, a second piston in the associated second cylinder and a second piston rod connected to the associated second piston and extending through the open end of the associated second cylinder; each second cylinder being connected adjacent its outer open end to a respective additional extensible boom member and extending, in the retracted position of the associated second actuator, along the exterior surface of said base boom member; each second piston having its outer end connected to the extensible boom member disposed next within the extensible boom member connected to its associated second cylinder; each first and second piston dividing the associated cylinder into a first chamber adjacent the closed end of the associated cylinder and a second chamber containing the associated piston rod; each piston rod, except the piston rod connected at its outer end to said boom member, being formed with first and second fluid flow passages extending longitudinally thereof, each first fluid flow passage communicating with the associated first chamber in the respective cylinder, and each second fluid flow passage communicating with the associated second chamber in the respective cylinder; first fluid flow means serially inter connecting said first fluid flow passages; and second fluid flow means serially interconnecting said second fluid flow passages; whereby, upon supply of working fluid under pressure to the first chamber of said first fluid flow actuator, said fluid under pressure is simultaneously effective in each of said first chambers and, upon supply of fluid under pressure to the second chamber of said first actuator, the fluid under pressure is also supplied to the second chambers of each said actuators.

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