ABSTRACT OF THE DISCLOSURE

An auxiliary tower crane erection system is provided. An auxiliary tackle or secondary pulley system is employed at the commencement of erection of the tower crane in order to raise the top component and jib of the crane several yards to an intermediate vertically-oriented position. A main tackle system then raises the tower crane to a fully erected position. The foregoing abstract is not intended to define the scope of the invention and is only provided to permit a cursory review of the gist of the invention.

This invention relates to tower cranes.

In French patent specification No. 3,347,777 of Oct. 23, 1962, there is described a method of erecting a tower crane pivotal about the base, the essential distinguishing feature of which is that it comprises replacing the single cable supporting the jib in normal operation by a second erecting cable associated with a set of pulley blocks coupled by a train of pulleys and controlled by an operating winch, in placing this second erecting cable under tension or relaxing it, according to circumstances, and in forming the tower from two components articulated one above the other, with the lower component articulated to a pivotal platform of the crane, while the upper component is articulated to the corresponding end of the jib, means being provided for locking this articulation.

Struts are provided in this previously proposed crane which are articulated on the one hand to a fixed point on the upper component of the tower or pylon and on the other hand to a point on the pivotal platform. Provision is also made in the prior proposal for the point of attachment of the set of pulley blocks, at the operating winch side, to include a fixed pin journalled in a member rigidly attached to the platform.

In the practical embodiment of the prior invention referred to, the tower is folded, when in the transportation configuration, with the two components superimposed, and with the jib resting on top of the upper component. To bring the crane into action, the tower is first erected. To do this, a pull is exerted on the articulation between the two tower components through a tackle, causing it to rear up, while two lateral struts, articulated to the pivotal base and to the upper component, of the tower, keep the latter straight as it rises.

It will be appreciated that the forces to be applied by the tackle is very large at the start of the opening process, because of the small angle to each other of the two tower components and the small angle between the struts and the upper component.

The present applicant also envisaged previously improvements regarding changes both in the method of articulating the struts to the upper component of the tower or pylon and in the particular method of attachment of the tackle to the pivotal platform, as well as in the locking of the two parallel struts on the upper components of the tower when this is extended, to prevent an inadvertent reversal of the action.

In fact, in the patent specification hereinafter referred to, both the erection and dismantling of the crane were each continuous operations. The action was continuous and the extension of the various components was carried out simultaneously, the forces having to be applied at the start of erection being in excess of the actual weights involved.

The prior improvements already mentioned, by considerably reducing these forces, enabled the erection system proposed in that patent to be extended to more powerful and hence heavier cranes. Their effect was that the operations of erection and dismantling were no longer continuous and the early stage of erection was dissociated so that the components involved were raised progressively, the top part of the tower, in particular, not being raised until the lower part had reached a certain angle of inclination.

In the previously proposed crane, the free end of each strut attached to the tower is no longer articulated to it by means of a fixed pin, but with the aid of a pin arranged to slide in a guide, so that, while the bottom of the tower is rising, the end of each strut follows the path of these guides, during which action the top end of the tower remains resting on a cross-piece fixed to the pivotal platform.

According to a second improvement in the previously proposed crane the pull of the tackle is used for raising the top end of the tower, by virtue of the point of attachment of the fixed pulley of the tackle being yoked to one end of a lever having two converging arms, articulated at a fixed point to the pivotal platform, the free end of the second arm being arranged to bear against the underside of the top end of the tower in such a way as to bring about a gradual lift when the pulley-block cables are tensioned.

An object of the present invention is to enable the lifting principle described in the patent mentioned hereinafter to be extended to still heavier cranes.

According to the present invention there is provided in a tower crane, a base, a first elongate structure pivotally mounted on the said base, a second elongate structure pivotally connected at one end to the end of the first elongate structure remote from the base, jib means mounted at the end of the second elongate structure remote from the pivotal connection to the first structure, strut means pivotally connected at each end respectively to the base and to the second elongate structure, auxiliary structure connected to the base and capable of being moved to an upright position during erection of the crane, a first pulley system, a second pulley system, a cable common to both said pulley systems, and a member movable along said auxiliary structure and arranged to support, at least in part, said first elongate structure as the latter is moved towards an upright position, said second pulley system being arranged to bring said member and the first elongate structure to an intermediate position and said first pulley system being arranged to bring said first and second elongate structures to a fully erected position.
Thus it will be appreciated that the crane in accordance with the invention includes a double tackle system having two separate functions, one tackle acting in accordance with the previous patent, while the other, in conjunction with the first, serves to raise the top component of the tower and the jib several yards in a vertical plane, the first tackle completing the associated raising of the articulation of the two tower components.

The presence of the auxiliary tackle thus enables the upper component of the tower to be raised in the most favourable conditions in relation to the lower component, at the time when the forces to be applied are highest, the main tackle being brought into play for continuing the action of extension only when the main effort needed for the initial stages of the lift has been applied.

The essential distinguishing feature of the present invention is thus the addition to the tackle used in the main patent of a second tackle, the lifting action of which is restricted in time and space, this action being carried out in the most favourable dynamic conditions possible, at the commencement of erection, that is to say when the lifting strain to be overcome is at its highest.

In this way, the dissociation of the respective efforts, that applied at the start of erection by virtue of the provision of the auxiliary tackle and that applied by the main tackle after the commencement of erection, makes it possible to overcome the problem of raising very heavy cranes.

An embodiment of a crane in accordance with the invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings in which:

FIGURE 1 shows in side elevation the crane ready for conveyance, the uprights having been lowered to the horizontal and both the main and auxiliary tackles not being under tension;

FIGURE 2 shows in side elevation the crane ready for raising, the jib having been lowered under the upper component of the tower itself having been extended and fixed in position according to the overall crane height aimed at; the main and auxiliary tackles are under tension, the uprights being raised, and the cross-piece for lifting the top component of the tower is bearing against the upper end of the latter;

FIGURE 3 is a perspective view showing the position of the crane at the moment when the cross-piece has reached the end of its travel at the upper free end of the uprights, when the pull of the main tackle is alone sufficient to complete the extension action in progress in accordance with the patent hereinbefore referred to; and

FIGURE 4 shows the crane erected, the tackle cable being slack and the uprights having been lowered on to the struts.

In the example shown in the accompanying drawings, S is the pivotal base of the crane, P1 the lower crane component, P2 the upper crane component and P2' a telescopic portion of P2, which can be opened out depending upon the desired overall height of the crane. The crane jib is referenced F.

As shown in FIGURE 3, two lateral parallel struts G are articulated at G to a structure rigidly attached to the pivotal base S.

At M1 and M1' are the two parallel half-tackles acting in accordance with the patent hereinbefore mentioned.

At M2, on the other hand, are the various parts making up the auxiliary tackle linked to the tackle M1—M1'. The function of tackle M2 is to raise component P2 of the tower several yards vertically, whereas component P1 is raised by the action of tackle M1. The two members referenced V are uprights situated opposite struts G.

FIGURE 3 shows the run of pulley cable X, which is taken continuously round the two half-tackles M1 and M1' of the main tackle and over the auxiliary tackle M2. This cable X starts from a drum W of the operating winch and runs over the small mobile pulley A1, then under fixed pulley C1, returning to pass over mobile pulley B1 and fixed pulley D1. This constitutes the first half of tackle M1. From D1, the cable rises to pulley E1, at the top end of the first upright V, then passes under T1 and T2 and back up to pulley E2, at the top end of the second upright V. This constitutes tackle M2. From there, the cable runs under pulleys D2 and B2, returns over C2 and back under A2 and is attached near C2 to a fixed point Y. This forms the second half of the tackle, M1'.

Auxiliary structure in the form of uprights V, which are lowered to the horizontal while the crane is being moved from site to site, are automatically raised by the pull on cable X at the commencement of erection, the upper component P2 of the tower being then raised by a cross-piece T, moved by tackle M2 in a direction parallel to the uprights V. The height of these uprights V is not limited, but is so chosen that, when cross-piece T ceases to move, the angle between the two tower sections P1 and P2 is wide enough.

When tackle M2 has finished raising P2 and F, the pull of cable X then acts on tackle M1—M1', which, by means of cable Z, attached at Z1 and Z2 to the spindle of pulleys B1 and B2, is able by itself alone to raise P1 and simultaneously to complete the raising of P2, P2' and F.

If uprights V are lowered as shown in FIGURE 1 when in a state of rest, it will be clear, as shown in FIGURE 2, the initial pull on cable X will have the effect of raising them to the vertical.

Once the crane is erected, however, as shown in FIGURE 4, uprights V are lowered temporarily on to struts G.

I claim:

1. In a tower crane:
   a base,
   a first elongate structure pivotally mounted on the said base,
   a second elongate structure pivotally connected at one end to the end of the first elongate structure remote from the base,
   the jib means mounted at the end of the second elongate structure remote from the pivotal connection to the first structure,
   strut means pivotally connected at each end respectively to the base and to the second elongate structure,
   auxiliary structure connected to the base and capable of being moved to an upright position during erection of the crane,
   a first pulley system,
   a second pulley system,
   a cable common to both said pulley systems, and
   a member movable along said auxiliary structure and arranged to support, at least in part, said first elongate structure as the latter is moved towards an upright position,
   said second pulley system being arranged to bring said member and the first elongate structure to an intermediate position and said first pulley system being arranged to bring said first and second elongate structures to a fully erected position.

2. In a tower crane according to claim 1:
   a support structure
   said base being mounted on said support structure for pivotal movement about a vertical axis.

3. A tower crane according to claim 1, wherein the auxiliary structure includes:
   two elongate members,
   said elongate members carrying the second pulley system at the ends thereof remote from the base.

4. A tower crane according to claim 3 wherein the movable member is a cross-piece and is movable along said elongate members.

5. A tower crane according to claim 1, further comprising:
   structure upstanding from the base, and
pivot means connecting said upstanding structure to
the said auxiliary structure,
said auxiliary structure being movable to the upright
position by said cable and the second pulley system.
6. A tower crane according to claim 1, comprising:
winch means by which the effective length of the cable
can be varied.