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ARRANGEMENT FOR STEPWISE LIFTING OF HOISTING CRANES PREFERABLY TOWER CRANES

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FIG.1

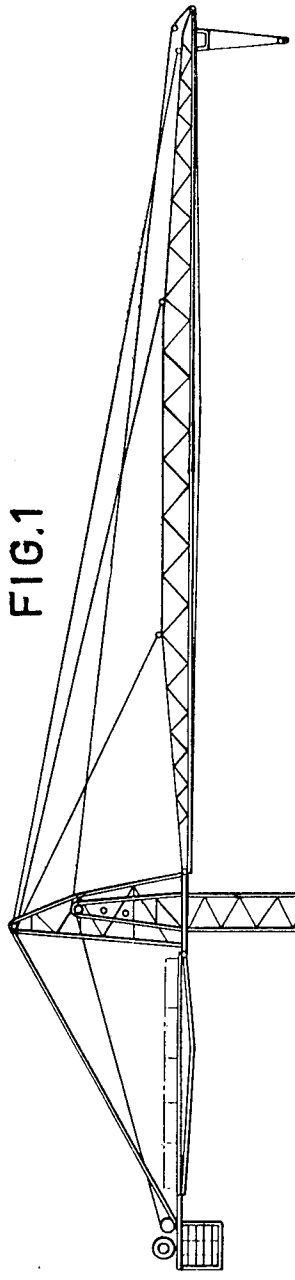

FIG.2

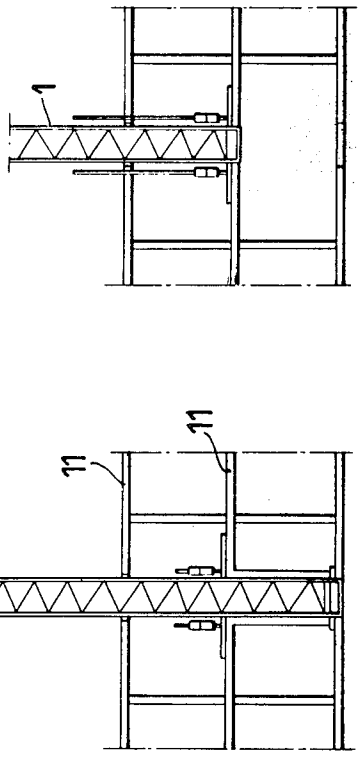

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FIG. 3

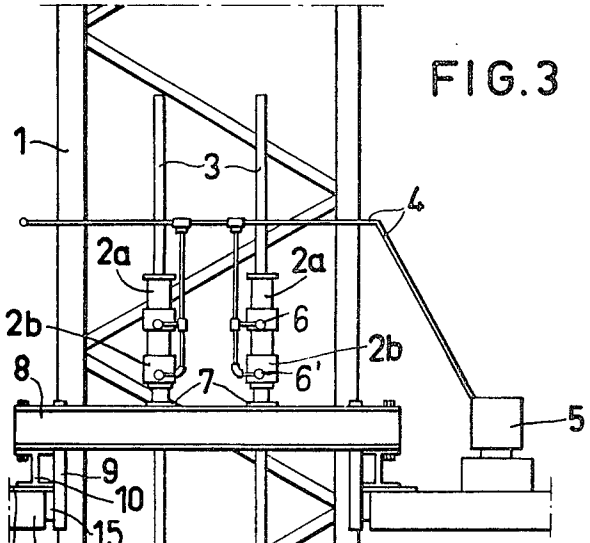

FIG. 4

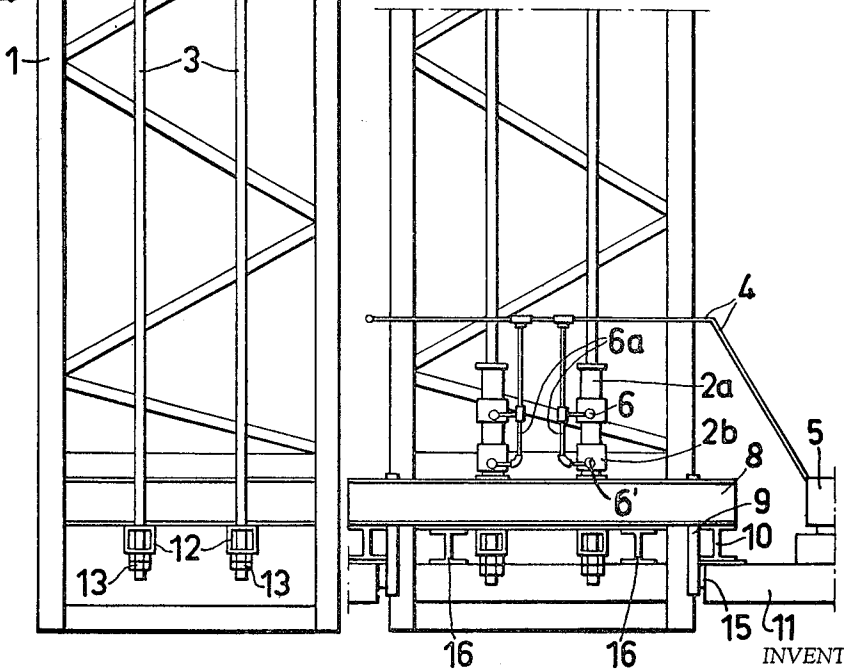

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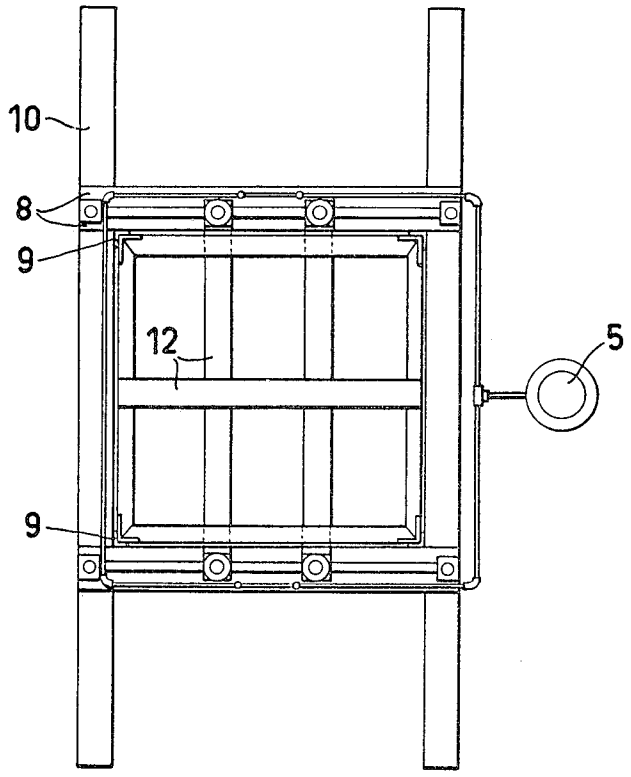
FIG. 5



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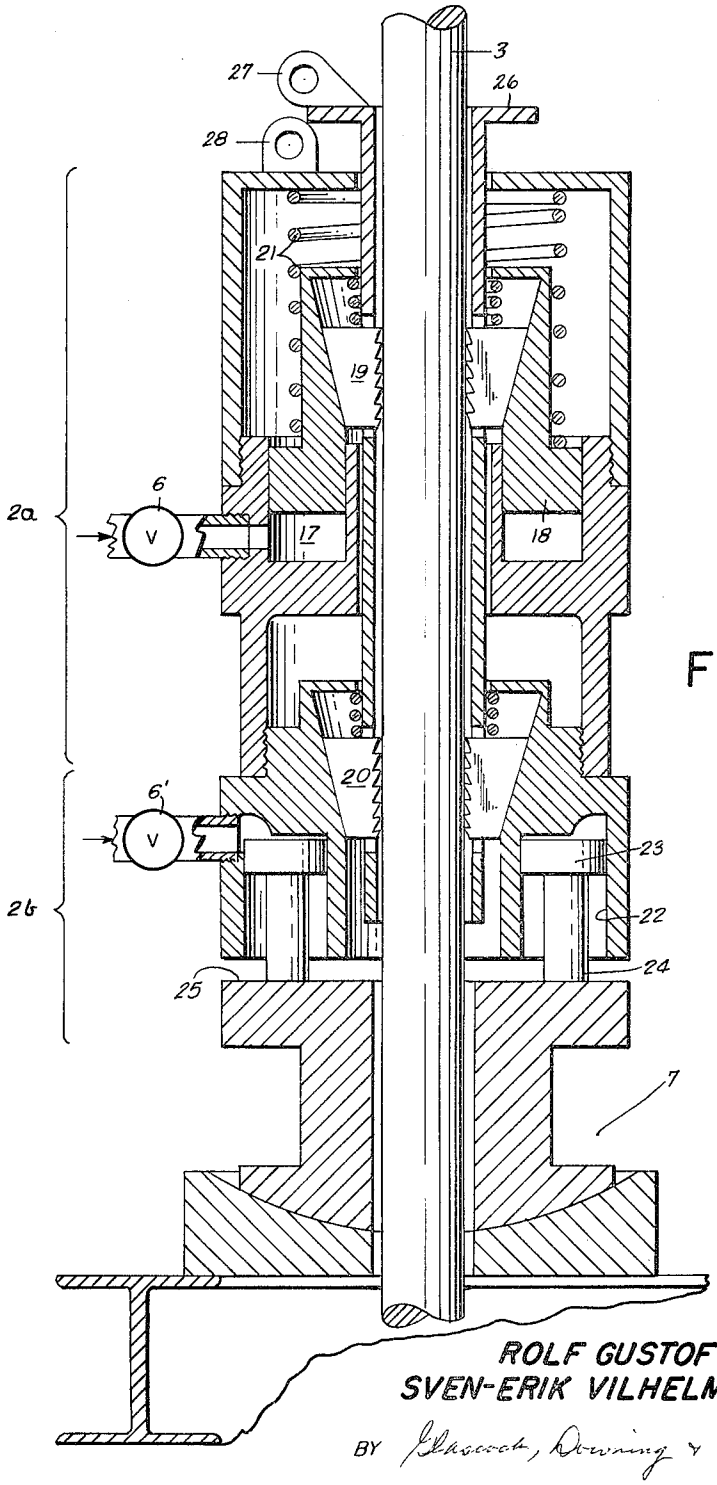

FIG. 6

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3,207,475

ARRANGEMENT FOR STEPWISE LIFTING OF HOISTING CRANES PREFERABLY TOWER CRANES

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Claims priority, application Sweden, Sept. 22, 1960, 9,043/60
5 Claims. (Cl. 254—105)

This application is a continuation-in-part of our application Serial No. 138,744 filed September 18, 1961, now abandoned.

Building construction contractors are substantially concerned with transport problems and their solutions. The local transport at the building site is now assisted to an increasing extent by so-called tower cranes which, in spite of a great number of different designs, are all constructed on substantially the same principle. They may, however, be divided into stationary, rail-bound and free-operating cranes.

This invention relates to operating equipment for cranes which are fixed in the horizontal plane and adapted to be lifted as the building construction progresses.

Cranes of the aforesaid type were heretofore lifted by means of cable winches, either in the form of separate winches manufactured specially for each individual crane type, or by means employed in combination with winches associated with the crane. For carrying out lifting operations by these devices which are often of complicated design, one must be accurately familiar with their correct handling, which in most cases requires specialists of the crane manufacturer.

It is the object of this invention to lift the cranes in a simplified and more reliable manner by employing devices which are novel for this range of uses. By employing jacks of a type to progress a bar or rod therethrough, the lifting forces are taken up by drawn rods instead of by steel cables which from a safety point of view are less hazardous. Further, by use of hydraulics, the weight of the lifting equipment can be reduced to a minimum, which is of special importance from the point of view of handling and transport. In view of the considerably lower purchase price compared with cable winches, and further due to the simple and reliable construction of the equipment which reduces the demand of specialists for carrying out the crane lifting operations, the jacks can be those shown in applicants' patent application Serial No. 194,631, or that of Von Heidenstam, Patent No. 2,756,019, used in inverted position, or any similar device, and can be made part of the standard equipment of each crane to a much greater extent than was heretofore possible with winches, thus rendering it possible to choose the moment for lifting the cranes in a better and more economical manner.

An embodiment of the invention is shown on the accompanying drawings, in which:

FIG. 1 shows a tower crane mounted in a building under construction, the lifting equipment being mounted for performing the lifting operation;

FIG. 2 shows the same tower crane lifted by one story;

FIGS. 3 and 4 show enlarged details of FIGS. 1 and 2;

FIG. 5 shows a horizontal projection of FIG. 3;

The lifting equipment applied in the embodiments shown in FIGS. 1–5 is of the hydraulic type.

FIG. 6 is a diagrammatic sectional view of a jack that may be used.

Two load distribution beams **10** with their guide bars

9 are laid on the floor slab **11** and supported on blocks **14** and inserts **15** against the hole edges of the slab **11**. Upon the load distribution beams and at right angles to the same are laid two lifting beams **8** on each side of the tower crane **1**. Four jacks **2***a* and preferably including four lowering jacks **2***b* are placed above ball joints **7** on the lifting beams **8**.

The tower crane is provided at its lower end with a lifting yoke **12** for taking the lifting forces, to which the climbing rods **3** are secured to extend through the lifting jacks **2***a* (and lowering jacks **2***b*) and rods **3** are provided at their lower end portions with lock nuts **13**. The jack equipment includes stop-cocks **6** and **6'** and connecting pipes **6***a* which are connected to an oil pressure pump **5** via an oil line **4**.

The jacks **2***a* are so constructed that they draw the rods **3** and thereby the tower crane by hydraulic pressure supplied to the jacks upwards to a certain new level. Upon returning the oil to the pump, the rods are locked automatically by conventional locking or jambing means and prevented from moving downwards. The aforesaid upwards movement is usually called the lifting step. By repeated lifting steps which may be carried out by manually operated valves or by automatic means, the tower crane is lifted to the desired level, i.e., to the floor **11** where it is to be unloaded again by inserting the unloading beams **16** below the lower end of the tower crane (FIG. 4). The crane is lowered onto the unloading beams **16** by the lowering jacks **2***b* which comprises merely a piston and cylinder means between the jack **2***a* and the jack support, which were lifted to their highest position and are now lowered by returning the oil to the pump, whereby also the tower crane is lowered onto the beams **16**.

The lifting equipment **2***a* and **2***b* is, in this position, entirely free of the tower crane load and can be lifted upwards moving along rods **3** to the next floor for another lifting operation.

The climbing jack **2***a* is constructed according to the climbing principle and comprises cylinder and piston means **17** and **18**, respectively, and separate sets of gripping members **19** and **20**. The members **19**, **20** may be cogged wedge-jaws which can be moved relative to each other along the smooth climbing rod **3** by hydraulic (or pneumatic) action within the jack body. One set of the wedge-jaws being mounted in the cylinder of the jack and the other in the piston. Normally jacks of this type are used so that the jack body climbs upwards on a fixed, or stationary rod, the jack itself transferring the lifting power directly to the object to be lifted. In the present invention, however, the jack **2***a* is mounted in a fixed position, while the rod is movable upwardly through it. The oil pressure fed to the jack thus draws the climbing rod **3** upwards and lifts the crane upwards a distance corresponding to the cylinder stroke (lifting step) of the jack. Oil pressure in cylinder **17** lifts piston **18**. Wedge-jaws **19** grip the bar **3** and lift it. When the oil pressure from pump **5** is turned off, and the oil flow stops, the whole load will tend to sink downwardly, but this is automatically prevented as the lifting rod **3** is immediately locked by the wedge-jaw members **20** of the jack, which are engaged against the rod by wedge action. A return pressure spring **21** in the jack forces the piston into the cylinder and thus also the oil is forced back to the tank of the pump **5**. The piston is followed by its set of wedge-jaws, which are automatically disengaged from the climbing rod as the piston returns to the bottom of the cylinder. When the piston has reached the bottom of the cylinder, the jack is again in its initial position for a new lifting step. The oil under pressure is again manually or automatically permitted to flow into cylinder **17**, and the

work cycle is repeated until the crane has been lifted to the desired height.

In cases, when the climbing jack **2***a* is not constructed for lowering the rod **3** about 5 cm., a lowering jack **2***b* is applied directly under the climbing jack **2***a*. The lowering jack **2***b* includes cylinder and piston means **22** and **23** with the free ends of piston rods **24** engaging upper planar surface **25** of the ball joint **7**. In other words, the lowering jack is a simple hydraulic piston jack with the cylinder stroke of 5–10 cm. It has no gripping members at all, and the lifting rod **3** passes through it quite freely. Its purpose is only to assist by the final unloading of the lifted crane on the joists concerned (**11**). During the lifting of the tower crane the lowering jack is in its bottom position and its stop-cock **6'** shut. When the climbing jacks **2***a* have lifted the tower crane to full height, their stop-cocks **6** are shut and the stop-cocks **6'** of the lowering jacks **2***b* are opened. By the oil pressure the lowering jacks **2***b* are now brought to lift a distance corresponding to the cylinder stroke and thus to raise the whole tower crane. Now the discharging beams **16** are inserted through the lower part of the crane mast. By letting the oil out of the lowering jacks they will sink and thus the whole tower crane, until it rests on the discharging beams **16**.

The lowering jacks **2***b* may be left out in the cases when the climbing jacks **2***a* per se are constructed for a lowering of at least about 5 cm. They need not necessarily be of hydraulic type or the like, but may also be screws.

The lifting equipment is now quite free from the tower crane, and can be dismounted and moved to another tower crane. Lifting the jack by means of a release cylinder **26** which extends downwardly past wedge-jaws **19** and **20**, and when lifted release cylinder **26** pulls wedge-jaws **19** and **20** out of engagement with their wedge surfaces so the entire jack structure will move upwardly along rod **3** without binding. Apertured lugs **27**, **28** may be provided as a safety measure to receive a padlock or the like to prevent inadvertent release of the wedge-jaws when the jack is in use.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof, and therefore the invention is not limited by that which is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What we claim is:

1. Means for raising a tower crane vertically from floor to floor of a building or the like as it is being built, said means comprising a lifting yoke adapted to support the lowest portion of the crane tower, a plurality of rods extending upwardly from said yoke a distance greater than the distance from floor to floor of the building, a jack means mounted on each said rod, support means adapted to be placed on the floor of the building next above the said lifting yoke to receive and support said jacks, and means to operate all said jacks simultaneously to lift said rods, said jacks including jambing means to prevent retrograde movement of said rods with respect to said jacks whereby said jacks may be intermittently operated to lift said tower crane step by step.

2. The device of claim **1**, in which said support means comprises beams to distribute the load and includes guide means slidingly engaging the tower.

3. The device of claim **1**, in which said jack means includes a hydraulic piston and cylinder means.

4. The device of claim **1**, in which additional means are provided between said jack means and said support means whereby said jack means may be raised and lowered with respect to said support means.

5. The device of claim **4**, in which said additional means comprise hydraulic cylinder and piston means.

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WILLIAM FELDMAN, *Primary Examiner.*