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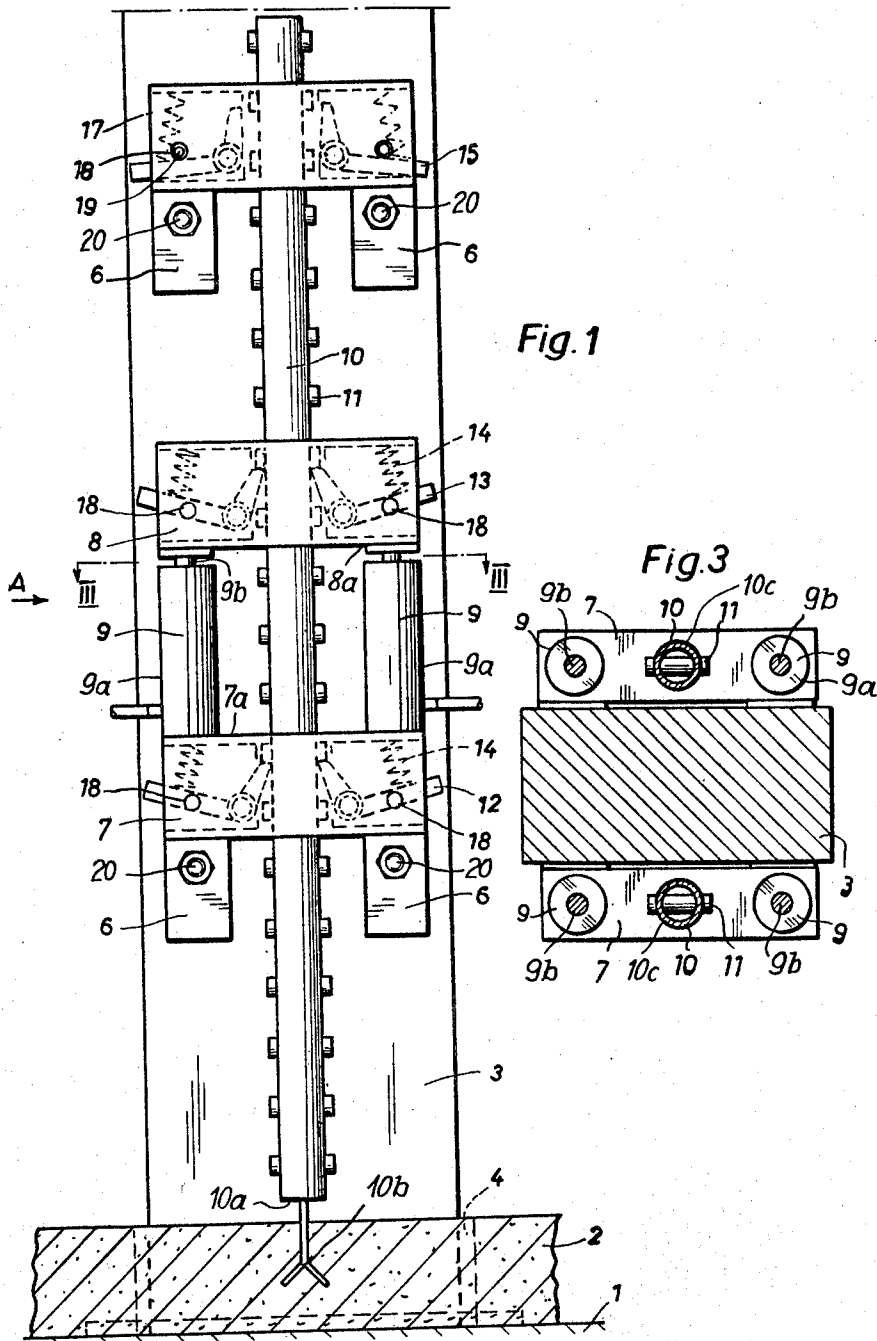
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DEVICE FOR THE STEPWISE ELEVATION OF AT
LEAST ONE STRUCTURAL MEMBER OR THE LIKE

Filed Oct. 28, 1964

2 Sheets-Sheet 1



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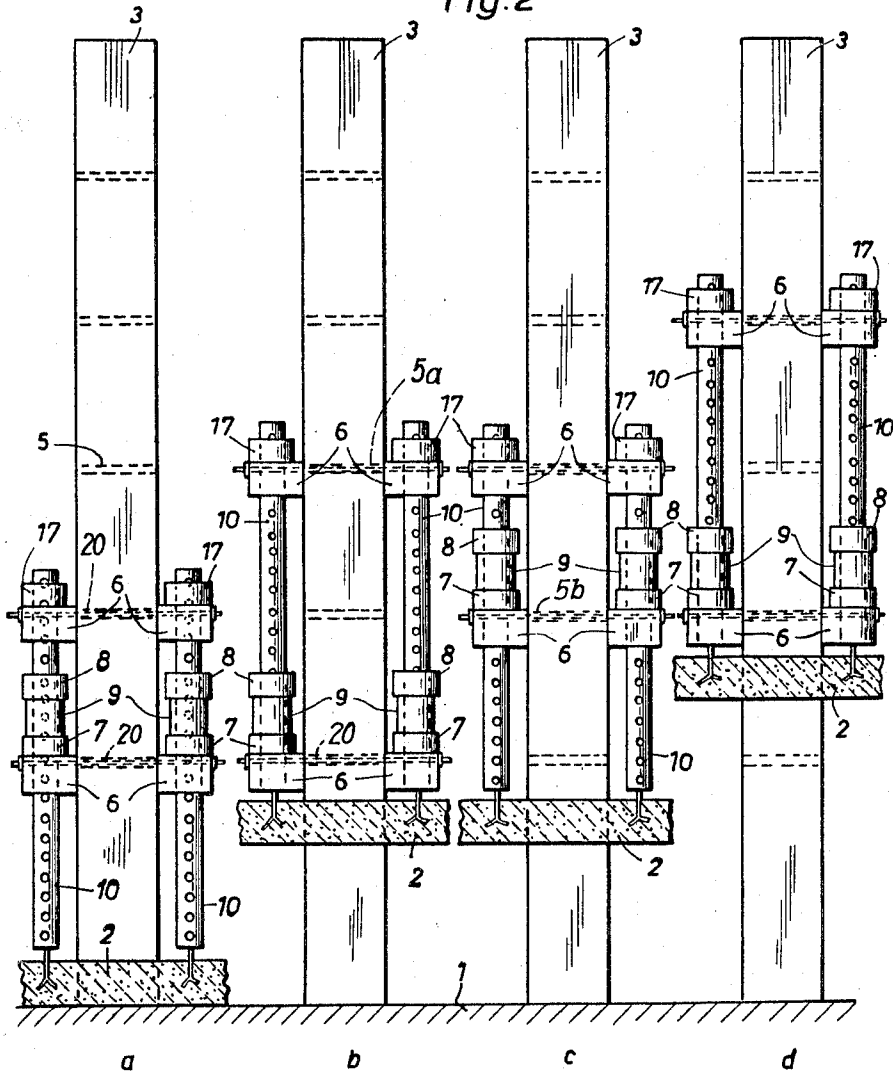
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Fig. 2



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DEVICE FOR THE STEPWISE ELEVATION OF AT LEAST ONE STRUCTURAL MEMBER OR THE LIKE

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The present invention relates to an improved device for incrementally elevating a member.

More specifically, the present invention is concerned with an improved device for the stepwise elevation of at least one structural member at, as the case may be, at least one column or support provided with pin guides, with such column serving as terminal anchoring for the raised member. Such pin guides incorporating pin means at which the structural member raised, in each case, through one step is supported by automatically engaging pawls. The inventive device is further provided with lifting mechanism possessing limited stroke transmitted to the structural member via a pin guide and the automatically engaging pawls cooperating with the pin guide. Devices of this type are known to the art for lifting structural ceilings, supporting beams and the like produced at the floor or base of the place of construction.

Accordingly, it is a primary object of the present invention to provide an improved device of the mentioned type affording the lifting of very heavy structural members in a relatively simple manner and with great safety.

Another important object of the present invention resides in the provision of an improved lifting device which is capable of raising considerable loads in a positive, reliable and safe manner, and which can be easily erected and disassembled at the place where the load is to be elevated.

According to the invention these and still further objects of the invention are achieved in that, at each lifting location there is provided at least one pin guide or guide means and at least two pawl mechanisms, that the pin guide is operatively connected with the structural member, the pawl mechanisms possess automatically engaging rearward locking pawls, and the first pawl mechanism is anchored to the lifting elements and the second pawl mechanism is anchorable to the column or support at different elevational positions.

Other features, objects and advantages of the invention will become apparent by reference to the following detailed description and drawings in which:

FIGURE 1 is a side view of a lifting location with the inventive lifting apparatus located in the starting position;

FIGURE 2 illustrates, on a somewhat smaller scale, the lifting location provided with the lifting apparatus of FIGURE 1, viewed in the direction of arrow A thereof, and depicted in four different working positions in the sub-figures marked *a*, *b*, *c*, *d*; and

FIGURE 3 is a cross-sectional view of the device of FIGURE 1, taken along the line III—III thereof.

Describing now the drawings and, with particular attention directed to FIGURE 1, reference numeral 1 denotes a foundation of a construction situs upon which lies a structural member, by way of example, a concrete ceiling or cover 2 which is to be lifted. A vertical support or column 3 is anchored in the foundation 1, extending upwardly through a metal collar 4 cast integral with the ceiling or cover 2. This vertical column 3 possesses two adjacently disposed rows of continuous bores or recesses 5 (see FIGURE 2) extending lengthwise of the vertical support 3 and in which bars or rods 20 are insertable. At both ends of these respective rods 20

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which extend out of the column 3 there are detachably connected brackets or supports 6. Generally, supports 6 are only anchored in two elevational positions. In the starting condition the supports 6 are anchored in the lowermost and second lowermost elevational positions (see FIGURE 2*a*).

At both sides of the vertical column 3 a respective first pawl or ratchet mechanism 7 is mounted to the lower supports 6. A respective second pawl or ratchet mechanism 8 is located at a distance above the associated first pawl or ratchet mechanism 7, and which is connected with the aforesaid first pawl mechanism 7 by means of two adjacently arranged lifting jacks 9 or equivalent expedients. In so doing, the arrangement is organized such that the lifting cylinder 9*a* is connected to a cover plate 7*a* of the lower pawl mechanism 7 and the lifting ram or piston 9*b* to the base plate 8*a* of the upper pawl mechanism 8. Moreover, at both sides of the vertical column 3 a respective third pawl or ratchet mechanism 17 is anchored to the upper supports or brackets 6.

A respective pin guide 10 disposed at each side of the vertical column 3 piercingly extends through the three aforescribed pawl mechanisms 7, 8 and 17. Each pin guide 10 possesses at its lower end 10*a* an anchor 10*b* engaging into the ceiling or cover 2. Advantageously, pipe or tube members 10*c* can serve as the guide means 10 which possess two lengthwise extending rows of diametrically situated pins or lift cogs 11 which cooperate with rearward locking pawls 12, 13 and 15 pivotably mounted at the pawl mechanisms 7, 8 and 17 respectively. More precisely, each of the pawl mechanisms 7, 8 and 17 possess two locking pawls 12, 13 and 15 respectively, subjected to the action of a respective spring 14 cooperating with the pins 11 in the direction of engagement. In the pivot zone of each pawl 12, 13 and 15 there is arranged at each pawl mechanism 7, 8 and 17 respectively, a bore 18 into which there can be pushed an arresting pin 19. Thus, each locking pawl 12, 13 and 15 can be brought out of engagement with the pins 11 and held in such disengaged position by means of its associated arresting pin 19 pushed through the relevant bore 18. In the starting position of the lifting device depicted in FIGURE 1, the pawls 12 and 13 of the pawl mechanism 7 and 8, respectively, are located in the engaged position with the pins 11, and the pawls 15 of the pawl mechanism 17 in the disengaged or ineffective position.

The mode of operation of the heretofore described inventive lifting device will now be considered in conjunction with FIGURE 2 embodying the sub-FIGURES 2*a* to 2*d*.

FIGURE 2*a* depicts the starting position of the inventive lifting device according to FIGURE 1, wherein the ceiling or cover 2 representing the structural member to be lifted and connected via the anchors 10*b* with the pin guides 10 bears against the base or foundation 1. For the sake of completeness, in FIGURE 2*a* the individual third pawl mechanisms 17 have likewise been illustrated. During the first phase of the lifting operation the third pawl mechanisms 17 are not utilized, accordingly their locking pawls 15 are not in engagement with the pins 11 of the guide means 10 (FIGURE 1). Now, the lifting pistons or rams 9*b* (that is, all lifting rams of all lifting units) are supplied in suitable known manner with working fluid, so that the pistons 9*b* and together with the latter the upper pawl mechanism 8 as well as the pawls 13 positively or forcefully engaging beneath the pins 11 upwardly press or raise the guide means 10 together with the structural component 2 through the stroke of the respective pistons 9*b*.

In so doing, the pawls 12 of the lowermost pawl mechanisms 7 freely slide over the pins 11 of the pin guides 10 until termination of the piston stroke when

they forcefully come into engagement with the pins 11 of the pin guides 10. Thereafter, the lifting jacks 9 are again unloaded, the pawl mechanisms 8 lower, with the pawls 13 freely gliding over the pins 11 of the pin guides 10. The pawl members 12 of the lowermost pawl mechanisms 7 anchored at the column 3 at this time retain the pin guides 10 together with the structural component 2 in the raised position corresponding to the lifting stroke. This thus attained elevated position then provides the starting position for the next lifting stroke by means of which the cover member 2 is stepwise advanced until reaching the position illustrated in FIGURE 2b where it is located just slightly beneath the support 6 anchored at the vertical column 3.

Now, at the third lowermost elevational position designated 5a (see FIGURE 2b), supports 6 are applied to the column 3 in the manner already described and the pawl mechanisms 17 anchored thereon. The pawls 15 of these pawl mechanisms 17 are engaged with the pins 11 of the pin guides 10 so that that structural component 2 is held in position by such pawls 15 of the uppermost pawl mechanisms 17. Thereafter, the lower pawl mechanisms 7, 8 together with their brackets or supports 6 are released from the column 3 and again anchored to such in the second lowermost elevational position depicted at 5b in FIGURE 2c. After anchoring the same, the locking pawls 15 of the uppermost pawl mechanisms are again disengaged and fixedly held in this disengaged position by means of the arresting pins 19 (see FIGURE 1).

As a result, the starting condition depicted in FIGURES 1 and 2a is again attained at a first elevational position. The lifting operation can now once again proceed from the beginning until the position or arrangement of the elements depicted in FIGURE 2d is reached, which again corresponds to that shown in FIGURE 2b. The ceiling or cover member 2 can, thus, be raised in the described manner until it has reached the desired elevational height. This cover member 2 is then appropriately secured at the column 3 upon reaching the terminal position, whereupon the pawl mechanisms 7, 8 and 17, pin guides 10 and support elements 6 can be removed.

In this illustrative embodiment the inventive lifting device serves to lift a single cover or ceiling member 2. However, it is also readily possible to elevate, in the described manner, a supporting beam or an entire packet of ceiling or cover members. In order to increase safety in operation, instead of the illustrated pawl mechanisms there could be employed such utilizing a plurality of superimposed pawls. Moreover, for example during the lifting operation the pawls 15 of the pawl mechanisms 17 could likewise be engaged, whereby during lowering of the lifting jacks 9 the load is not only carried by the lowermost pawl mechanisms 7, rather also by the uppermost pawl mechanisms 17, thereby also increasing safety of operation.

Now, from what has been previously explained it should also be understood that the lowermost pawl mechanisms 7 can be dispensed with and the lifting apparatus 9 can be directly anchored to the supports or brackets 6. If this is the case, then, the arrangement can also be carried out such that the upper pawl mechanisms 17 and the lifting apparatus 9 with the pawl mechanisms 8 can be supported at a single continuous support or bracket anchorable at the column 3.

The mode of operation of such a modified form of lifting device with two pawl mechanisms 8 and 17 is basically the same as that with the three pawl mechanisms 7, 8 and 17 previously described. The only difference resides in the fact that, in each instance, upon reaching the elevational position according to FIGURES 2b and 2d, where first the pawl mechanisms 17 and then the pawl mechanisms 8 are anchored in a next higher position at the column 3, the load is somewhat raised by means of

the lifting jacks 9 so that the lower pawl mechanisms 8 become subjected to load, the upper pawl mechanisms 17 unload and thus can be disassembled and again be mounted in the next higher position. Thereafter, the lifting jacks 9 are again unloaded, the load then again being supported by the pawl mechanisms 17, and further operation can then again proceed in the manner described in the previous embodiment. Naturally, with this embodiment the pawl mechanisms 17 can also be arranged beneath the pawl mechanisms 8.

With the device according to the instant invention the lifting force available at each lifting location can be doubled in comparison with known arrangements. Furthermore, relatively short pin guides 10 can be provided which are only subjected to tensile load. A further advantage of the inventive device resides in its independence as regards the shape and size of the cross-section of the vertical column or support 3. Thus, this device is particularly suitable for raising to large heights heavy structural components, as such, for instance, is the case with bridge and skyscraper construction. In the construction of skyscrapers or tall buildings it is of advantage if the brackets or supports 6 are anchorable at elevational distances at the column 3 corresponding to a story or floor.

Additionally, there can further be arranged at the upper end of the concrete column or support 3 a terminal member manufactured from sectional or structural iron or steel at which there can be anchored the pawl mechanisms. This results in the advantage that the structural component 2 can be raised up to the uppermost region of the concrete column 3 and there fixed in place.

Naturally, with the lifting operation carried out by means of the illustrated lifting device it would be possible, in each instance, during the shifting of the pawl mechanisms 7 and 8 together with their bracket or supports 6 to the next higher position, to support the structural component 2 from below, for instance by means of a steel plate which is threaded laterally onto the column 3. In this case, then, the uppermost pawl mechanisms 17 together with its associated supports 6 can be dispensed with.

While there is shown and described present preferred embodiments of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. Device for the stepwise elevation of at least one member to be raised along a column serving as a terminal anchoring for said member, comprising at least one guide means and at least two pawl mechanisms, means for anchoring said guide means with the member to be raised, lifting means for moving said guide means, said pawl mechanisms being provided with pawl means automatically engageable with said guide means, means mounting a first of said two pawl mechanisms to said lifting means and means selectively anchoring the second of said two pawl mechanisms at different elevational positions along the column.

2. Device as defined in claim 1 further including a third pawl mechanism anchored with said lifting means, said first and third pawl mechanisms being displaceable relative to one another through the agency of said lifting means, means for selectively anchoring one of said first and third pawl mechanisms at different elevational positions with said column.

3. Device as defined in claim 1 including means for anchoring said lifting means to said column at different elevational positions.

4. Device as defined in claim 1 including a respective guide means arranged at each opposite side of said column, and at least two pawl mechanisms cooperating with each guide means.

5. Device as defined in claim 4 wherein each guide means comprises a pipe member provided with a row of

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pin means, said pin means of both guide means being situated in diametrically opposed relation.

6. Device as defined in claim 1 wherein said guide means comprises pipe means provided with pin members.

7. Device as defined in claim 1 wherein said second pawl mechanism is arranged above said first pawl mechanism.

8. Device as defined in claim 1 wherein said second pawl mechanism is arranged beneath said first pawl mechanism.

9. Device as defined in claim 1 wherein said lifting means comprises at least two lifting jacks symmetrically arranged with respect to said guide means and operable upon said first pawl mechanism.

10. Device as defined in claim 1 wherein said pawl means are constructed to positively engage in one direction of action with said guide means and in another direction of action freely ratchet along said guide means.

11. Device as defined in claim 10 including spring means for normally urging said pawl means into engagement with said guide means.

12. Device as defined in claim 10 including means for holding said pawl means out of engagement with said guide means.

13. Device as defined in claim 2 wherein the lowermost pawl mechanism of said first and third pawl mechanisms

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operably coupled together via said lifting means is anchorable with said column.

14. Device as defined in claim 2 wherein the uppermost pawl mechanism of said first and third pawl mechanisms operably coupled together via said lifting means is anchorable with said column.

15. Device for the stepwise elevation of at least one member to be raised along a support structure, comprising at least one guide means and at least two pawl mechanisms, means for anchoring said guide means with the member to be raised, lifting means for moving said guide means, said pawl mechanisms including means which are engageable with said guide means in order to raise and maintain said member in raised position, means mounting a first of said two pawl mechanisms with said lifting means and means for selectively anchoring the second of said two pawl mechanisms at different elevational positions along the support structure.

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