

Nov. 27, 1951

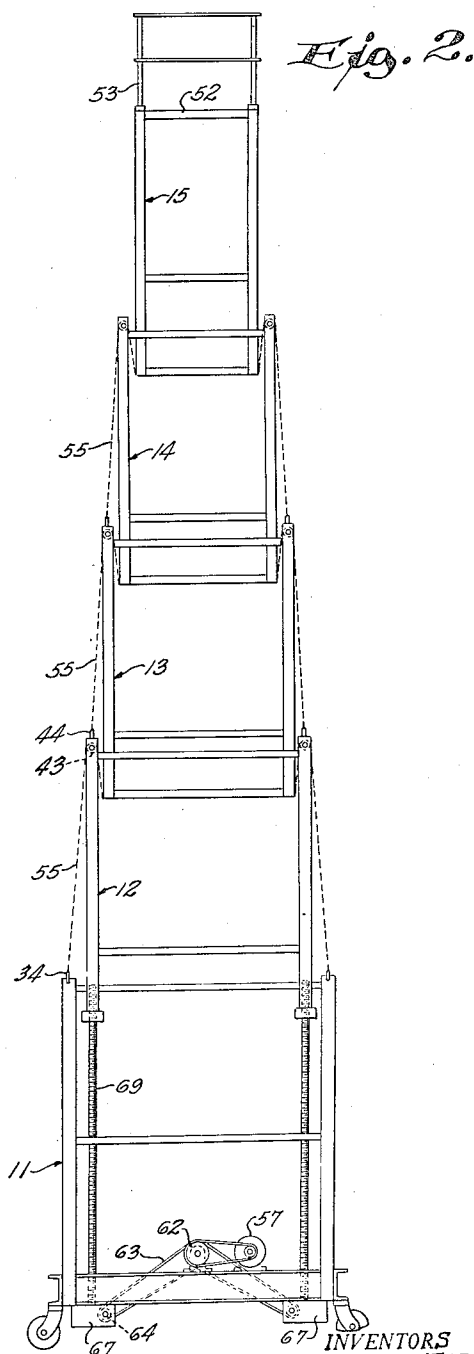
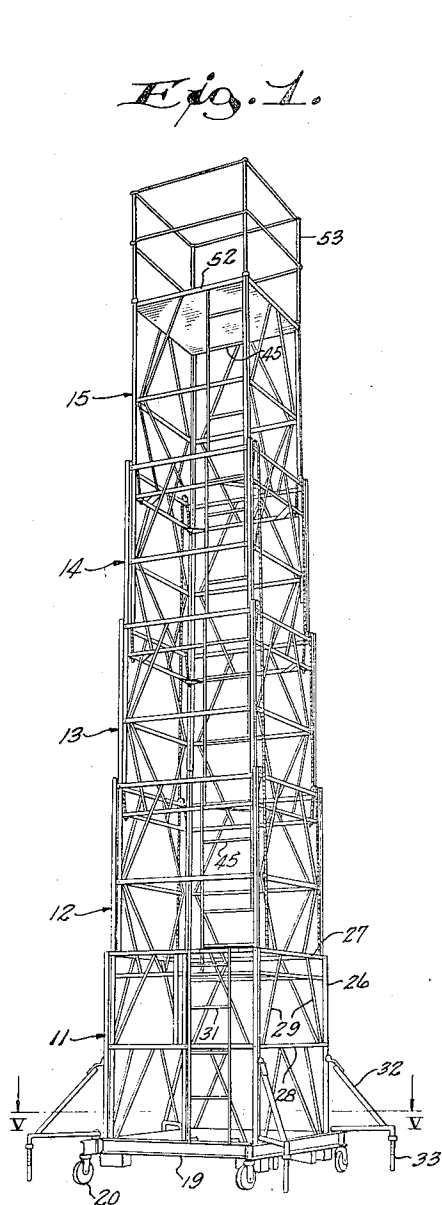
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2,576,389

TELESCOPING TOWER

Filed March 22, 1945

4 Sheets-Sheet 1



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Fig. 3.

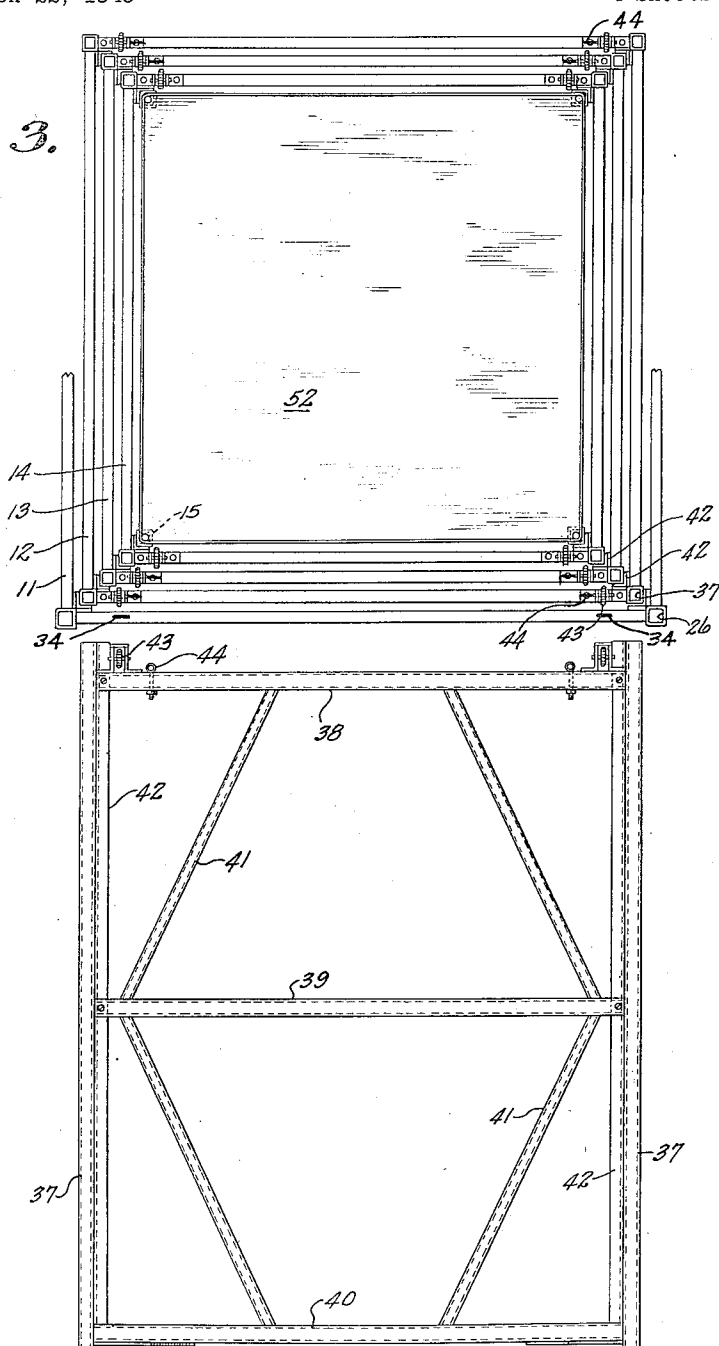


Fig. 4.

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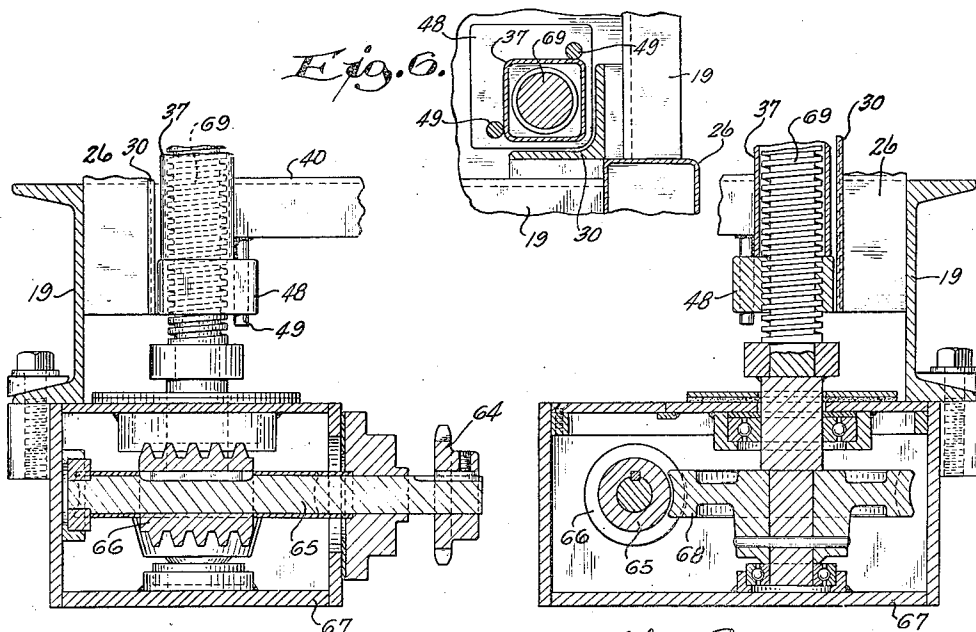
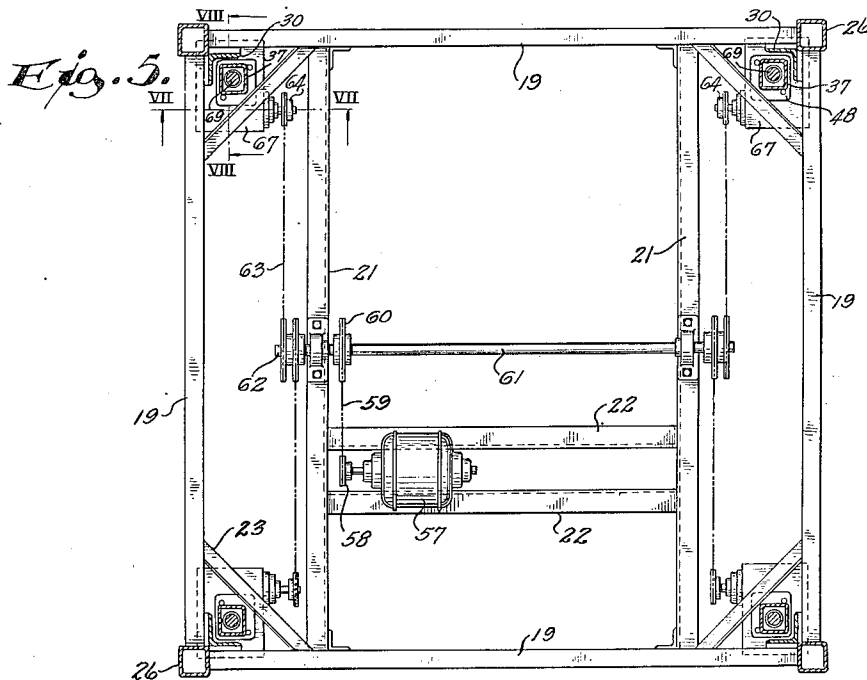
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Fig. 9.

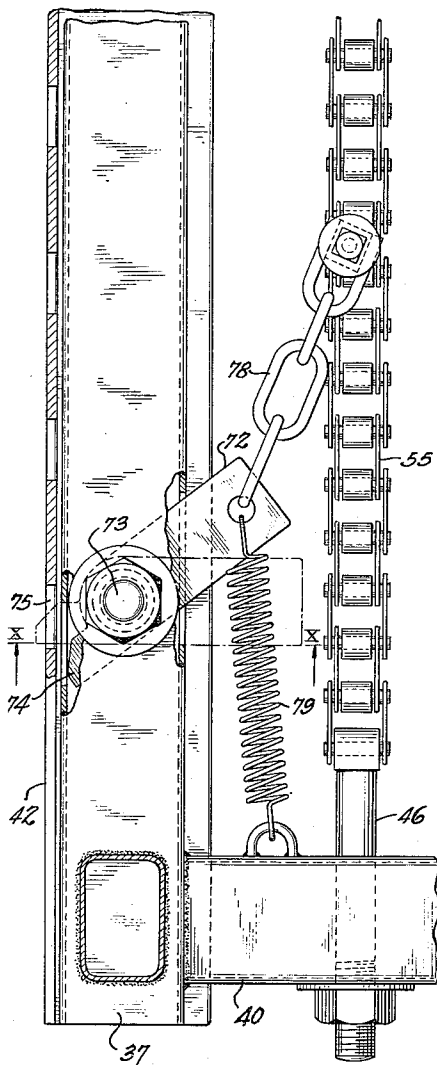


Fig. 10.

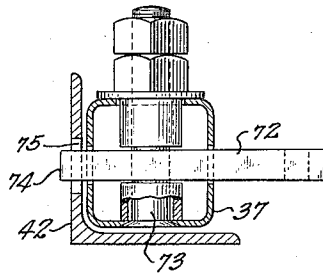


Fig. 11.

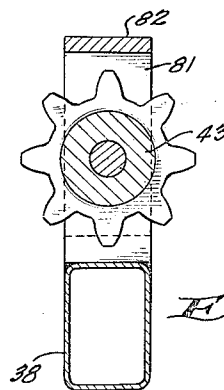
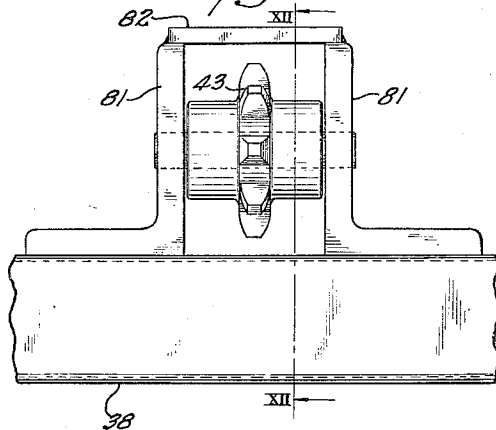


Fig. 12.

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UNITED STATES PATENT OFFICE

2,576,389

TELESCOPING TOWER

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Application March 22, 1945, Serial No. 584,216

1 Claim. (Cl. 189—14)

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This invention relates to improvements in telescopic towers and particularly to towers in which a plurality of raising sections are lifted simultaneously.

It is one object of the invention to provide a telescoping tower having a plurality of lifting sections nesting in a base section in the lowered position of the tower and therefore occupying only the floor space required for the base section.

Another object of the invention is to provide a rising tower in which each of the lifting sections is guided and raised by the action of the section immediately below the lifting section under consideration.

Another object of the invention is to provide a telescoping tower in which adjacent lifting sections have the same rate of rise relative to each other.

Another object of the invention is to provide a tower having a plurality of lifting sections coacting in series to secure a raising of all the lifting sections simultaneously and to the same extent relative to the preceding or lower section in the series, thereby securing the same degree of raising of all sections relative to each other at any given elevation.

Another object of the invention is to provide a raising tower in which the operating mechanism is divided into a plurality of portions acting on individual sections, and in which any such portion of the operating mechanism may be removed and replaced without dismantling other portions of the operating mechanism.

Another object of the invention is to provide a lifting tower of telescopic construction in which the sections are lifted by independent mechanisms severally so related to adjacent sections above the first lifted section as to lock any given section individually against downward movement beyond a predetermined extent in case of failure of any of the lifting mechanisms.

Another object of the invention is to provide a telescoping tower which is of such light weight and such small dimensions when in the lowered position as to be readily portable, in which a rapid rate of simultaneous lifting of all of the sections can be obtained, and in which simple operating mechanism is employed and is divided into portions singly lifting each one of the sections of the tower.

Objects and advantages other than those above set forth will be apparent from the following description when read in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view of the telescopic

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tower of the present invention in the raised position;

Fig. 2 diagrammatically illustrates the nesting relation of the several sections of the tower to each other, the relation of the operating mechanism in the tower base section to the first raising section, and the relation of the operating mechanism for lifting the several raising sections and the action thereof in groups of three sections;

Fig. 3 is a top plan view showing the several lifting sections of the tower in nested relation;

Fig. 4 is a side elevation of one of the lifting sections;

Fig. 5 is a sectional view of the base section of the tower, taken on the plane of the line V—V of Fig. 1, but omitting the wheels and their mounting and the outriggers of the tower;

Fig. 6 is an enlarged fragment of a corner of the base section and the first lifting section;

Fig. 7 is a section taken on the plane of the line VII—VII of Fig. 5;

Fig. 8 is a section on the plane of the line VIII—VIII of Fig. 5;

Fig. 9 is an enlarged fragment of one of the lifting sections taken in elevation, together with a vertical section of a fragment of the guide for such section;

Fig. 10 is a section taken on a horizontal plane through the line X—X of Fig. 9;

Fig. 11 is an enlarged elevation of a portion of the raising mechanism of the several lifting sections above the first section; and

Fig. 12 is a section taken on a vertical plane on the line XII—XII of Fig. 11.

The several sections are preferably formed generally of square tubing to minimize the weight of the structure, the several pieces of tubing being joined either by directly welding the pieces together or by means of angles, plates, or other suitable joint-forming structures. Generally the structure comprises a base section and a plurality of lifting sections with only the first lifting section driven directly from operating mechanism mounted in the base section, and the remaining lifting sections being raised by the section below and assisting in raising the next higher section. The sections are so dimensioned that they nest in the base section and severally provide guides for the succeeding or inner sections immediately adjacent any given section. The particular lifting mechanism disclosed reduces the weight of such mechanism to a minimum and causes simultaneous raising of all sections from the nested position to the full extended position of the tower and to the same

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degree and at the same rate for the various sections relative to each other.

Referring to the drawings by reference numerals, numerals 11 to 15, inclusive, severally and generally designate a base section and a plurality of lifting sections, the sections being numbered in sequence from the base section to the last raising or the working platform section. It will be obvious that any number of raising sections may be employed if the base section is suitably dimensioned to give adequate working space on the last raised section and if the interdependent portions of the structure are made of sufficient strength to support the portions superimposed thereon.

The base section 11 is shown as being constructed with a substantially square bottom frame of suitably joined structural shapes such as the channels 19 which are preferably extended at the four bottom frame corners to form mountings for wheels 20. Other angles or channels 21 extend across the bottom frame for stiffening the frame, and together with members 22 provide a support for the mechanism for operating the tower. The corners of the bottom frame 19 are reinforced by bars or angles 23 extending interiorly across the several corners of the frame and cooperating with the frame members in supporting portions of the operating mechanism. Uprights or posts 26 are erected on the bottom frame 19 at the corners thereof and are joined by top rails 27 to form a substantially cubical frame. The frame sides are braced, at approximately the middle of the corner post heights, by horizontal braces 28 which are connected by diagonal braces 29 with the bottom frame 19 and with the top rails 27. An angle designated 30 is fixed in each of the inside vertical corners of the base section to serve as a guide for the next section, which is the first raising section 12. A ladder 31 is fixed on one side of the base section which is also provided with outriggers 32 pivoted on the bottom frame 19 and the corner posts 26 and provided with screws 33 for securing ground contact of the outriggers under all conditions to assure stability of the tower in its extended position. The base section 11 is also provided with anchors indicated (in Fig. 2) at 34 in the top rails 27 adjacent the upper corners of the frame to provide four attachment points, for a purpose which will appear hereinafter.

The lifting sections 12 to 15 are generally similar in structure (except as will be described) and it is therefore necessary to describe only one such section. Referring now to Figs. 3 and 4, it will be seen that the lifting sections comprise vertical members or corner posts 37 joined by horizontal members or cross bars adjacent the top and bottom ends of the corner posts, and also at approximately the center of such posts as indicated at 38, 39, and 40, the bars being braced by diagonally extending members 41. It will be understood that the above mentioned frame members are preferably made of tubing both for the purpose of minimizing the weight and to receive a portion of the operating mechanism in the case of the first lifting section. Each lifting section accordingly also forms a substantially cubical frame and is provided with a ladder 45 (see Fig. 1) on the same side of the tower as ladder 31 to allow climbing of the tower when at any elevation.

The lifting sections 12, 13, and 14 are also provided with angles 42 set into the interior of

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the several vertical corners thereof to provide guides for the section nesting into another section. Thus the angles 30 of the base 11 provide guides for the first lifting section 12, the angles 42 of the section 12 provide guides for the second lifting section, and so forth. Each of the lifting sections 12, 13, and 14 has four chain sprockets, generally indicated at 43, (shown in detail in Figs. 11 and 12) mounted on the top bars 38 adjacent the upper corners of the sections and also have four anchors 44 preferably mounted adjacent such sprockets to serve respectively as the carrying means for and as attachment points for some of the operating mechanism.

The first lifting section 12, in addition to the above structure common to the several lifting sections, also has a nut 48 mounted at or in the lower end of the several corner posts 37 and keyed as at 49 to the bottom bars to prevent rotation of such nuts. And the fourth or last lifting section has a working platform 52 secured thereon with a railing 53 about such platform.

The several lifting sections are connected with the base section and are interconnected by chains, indicated at 55, fastened at one end, for example, to the chain anchors 34 on the base, passing over the sprockets 43 of the first lifting section 12 and fastened at the other end to the bottom of the second lifting section 13 as by an anchor 46 to raise such second section. The driving chains for the third lifting section 14 are fastened to the chain anchors 44 on the first lifting section 12 and pass over the sprockets 43 of the second lifting section and are fastened at one end to the bottom of the third lifting section. The interconnections for the remaining lifting sections are grouped in threes similar to the groupings described immediately above, as will be seen from the diagram in Fig. 2, and hence need not be further described.

Driving mechanism for the tower is mounted on the bottom frame of the base section 11, the drive being shown as employing an electric motor 57 although any other power means or manual effort may be used to raise the tower. The motor 57 is connected by sprocket wheel 58 and chain 59 to a sprocket wheel 60 mounted on a shaft 61 from which power is taken to each of the four corners of the base section 11 to drive similar mechanisms. Each of such mechanisms includes a driving sprocket 62 for a chain 63 running over a sprocket 64 keyed on a shaft 65. The shaft 65 has keyed thereto a worm 66 within a suitable casing 67 mounted in the inside corner of the bottom frame 19. The worm 66 engages a worm gear 68 fixed to the end of a screw 69 rotatably mounted in casing 67 and extending upwardly inside the vertical corner of the bottom section and through the nut 48 into the corner posts 37 of the first lifting section 11.

The four drives 62 to 69, inclusive, are identical, and, being driven from the same source of power at the same speed, simultaneously act to lift the first raising section 12. As the section 12 lifts, the sprockets 43 idle or roll under the chains 55, and the reach of the chains between the anchors 34 and the sprockets 43 is lengthened, while the reach of the chain between the sprockets 43 and the bottom of the next raising section 13 is shortened. Such shortening of the latter reach of the chain lifts the second lifting section 13 within the first lifting section 12 and the two sections are therefore raised simultane-

ously at the same rate and hence to the same degree relative to each other. The simultaneous action above described also takes place between the second and third and between the third and fourth lifting sections so that all of the sections rise at the same time and by the same amounts. It will be understood, of course, that the pitch of the screws 69 and the relations of the sprockets 43 and chains 55 are preferably so chosen that the rate of travel of the nuts 48 on the screws, and the rate of travel of the chains 55 over the sprockets 43 will produce the same amount of rise in the first lifting section and the succeeding lifting sections, respectively. It will also be understood that the number of lifting sections may be multiplied indefinitely, provided only that the dimensions of the tower are kept within practical limits and that the weight of the lifting sections, above the first lifting section, does not exceed the strength of the lowermost chains 55 on which all of the lifting sections 13, 14 and 15, above the first lifting section 12, are supported.

Even though the chains 55 are chosen with a sufficiently great factor of safety, it is desirable that each of the lifting sections 13, 14, and 15 be provided with means coacting with the next lower section to prevent the dropping of such sections in the event of breakage of a chain under load or any other failure of any of the lifting mechanisms of such sections to operate properly. The means herein employed severally include a dog 72 mounted on a pivot 73, in each of the vertical corner posts 37 of the sections 13, 14, and 15, and having a nose 74 extensible into any one of several slots 75 cut through the guides 42 at regular spacings. One end of each of the several dogs 72 is connected by way of a chain 78 with the adjacent lifting chain 55, and such chains 78 severally hold the dogs in retracted position against the tension of a spring 79 extending between the end of each dog and a cross member 40 of the several sections. So long as the chains 55 are under load and taut, the chains 78 keep the dogs in the full line position shown (in Fig. 9) at which the nose 74 of each of the dogs is retracted into the corner posts 37, and the springs 79 are kept under tension. If the chains 55 become slack for any reason, the chains 78 also become slack and the springs 79 pivot the dogs 72 clockwise to project the nose 74 of each dog into the first of the slots 75 met by the dog in the downward movement of the section. In practice, the slots 75 are formed on approximately two inch centers, and it is hence impossible for the tower to drop farther than two inches upon any failure of a lifting mechanism.

It has also been found desirable in practice to interconnect the trunnions 81 of the sprockets 43 at the upper ends of such trunnions by a bar 82,

which serves as a guard for retaining the chain 55 on the sprockets during all movement thereof and particularly to prevent twisting of the chain on the sprockets.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claim.

We claim:

In a telescoping tower, a base section, a plurality of lifting sections nested within said base section, all of said sections being rectangular in plan and having vertical members at each corner, the adjacent vertical members of said sections cooperating to guide the sections when moving relative to each other, four jackscrews mounted on said base section adjacent the corners thereof and engaging the first of said lifting sections, power means mounted on said base section for simultaneously actuating said jackscrews to raise the first lifting section, chains interconnecting all of said sections and having rolling contact with the upper portion of all lifting sections intermediate the base section and the last lifting section, said chains being anchored adjacent the corners of said sections to provide stability for each lifting section about any horizontal axis contained within the base of such section, dogs pivotally mounted on each of said vertical members on said lifting sections and adapted to operatively engage vertically spaced slots in the adjacent cooperating vertical members, means connecting said dogs to said chains to retain said dogs in an inoperative position when said chains are tensioned, and biasing means acting to move said dogs into operative engagement with said slots to prevent relative movement between the adjacent vertical members when said chains are not in tension.

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