May 19, 1959 A. H. ROLOSON 2,887,190

ELEVATOR AND CASING STRUCTURE

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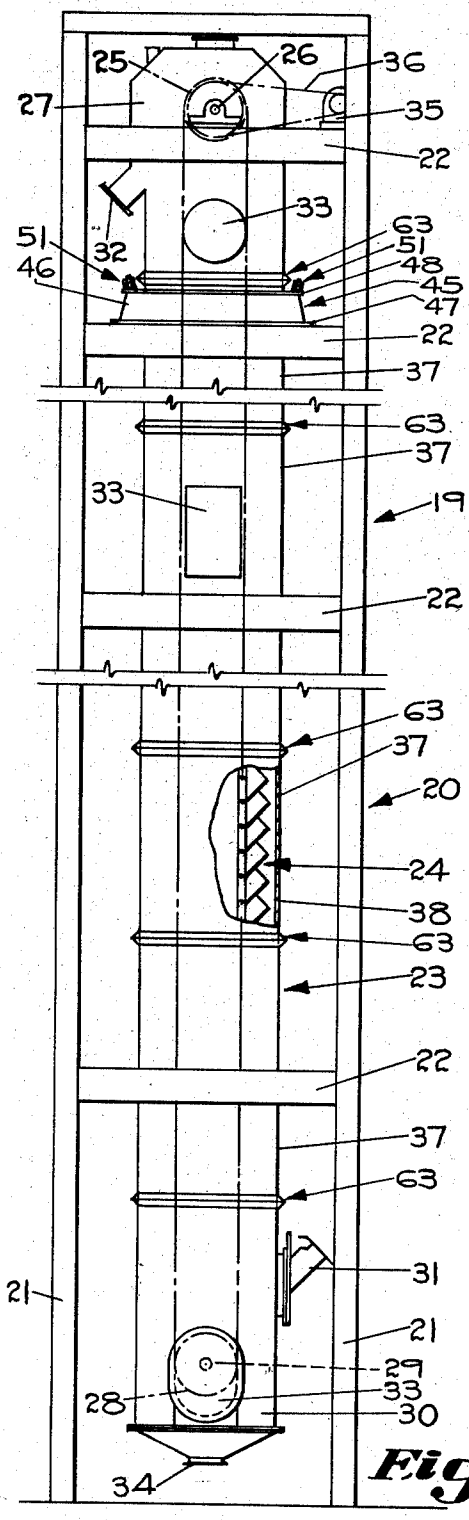


Fig. 1

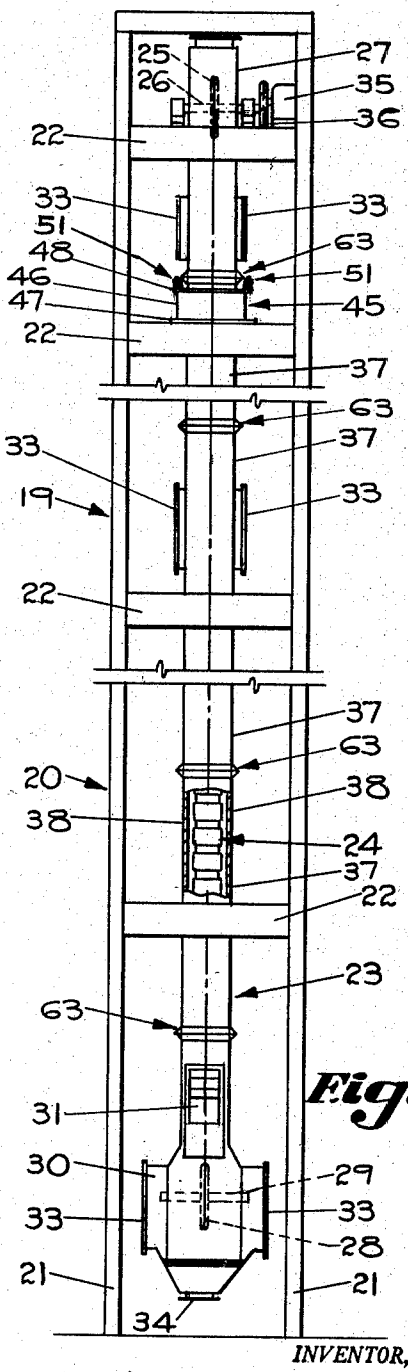


Fig. 2

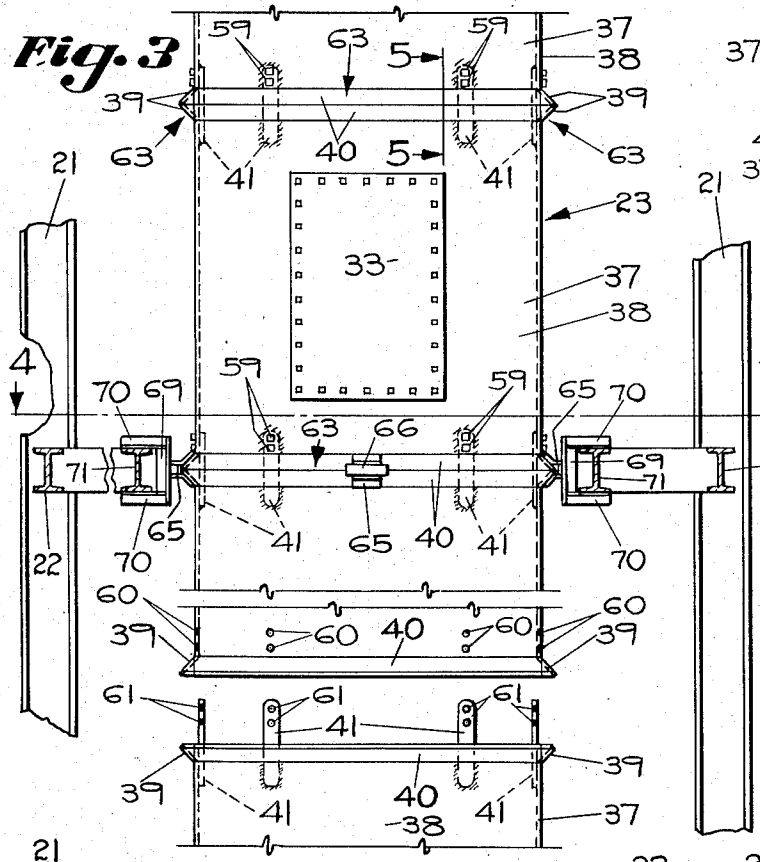
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ELEVATOR AND CASING STRUCTURE

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Fig. 3



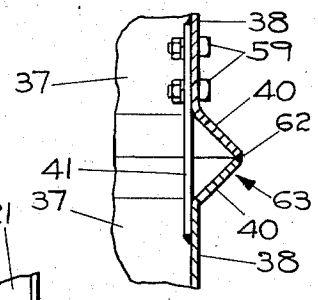


Fig. 5

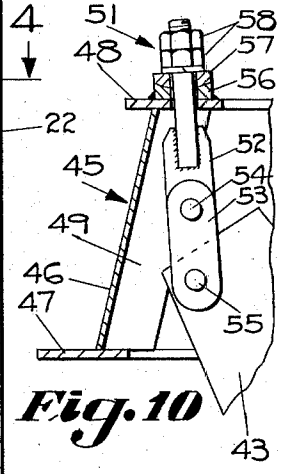


Fig. 10

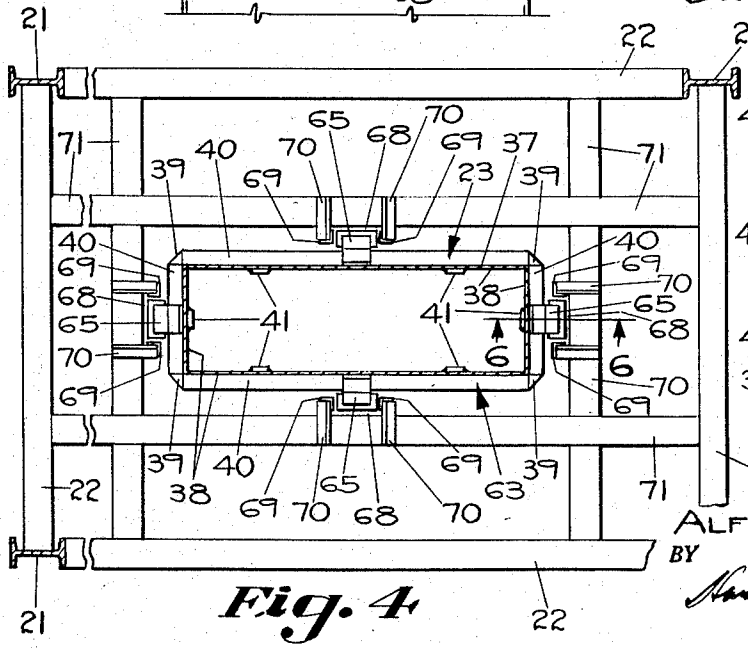


Fig. 4

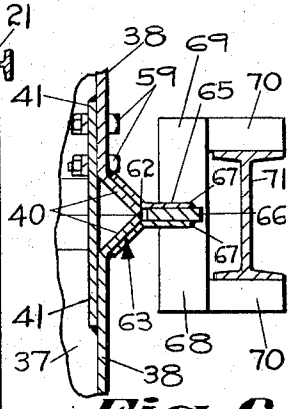


Fig. 6

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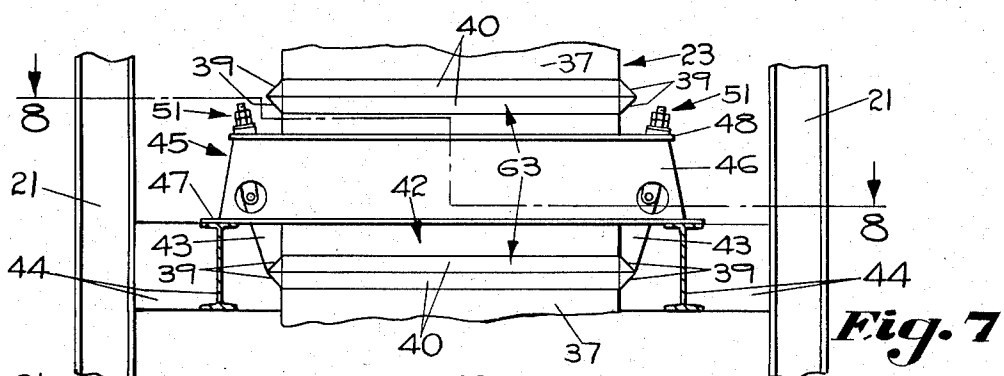


Fig. 7

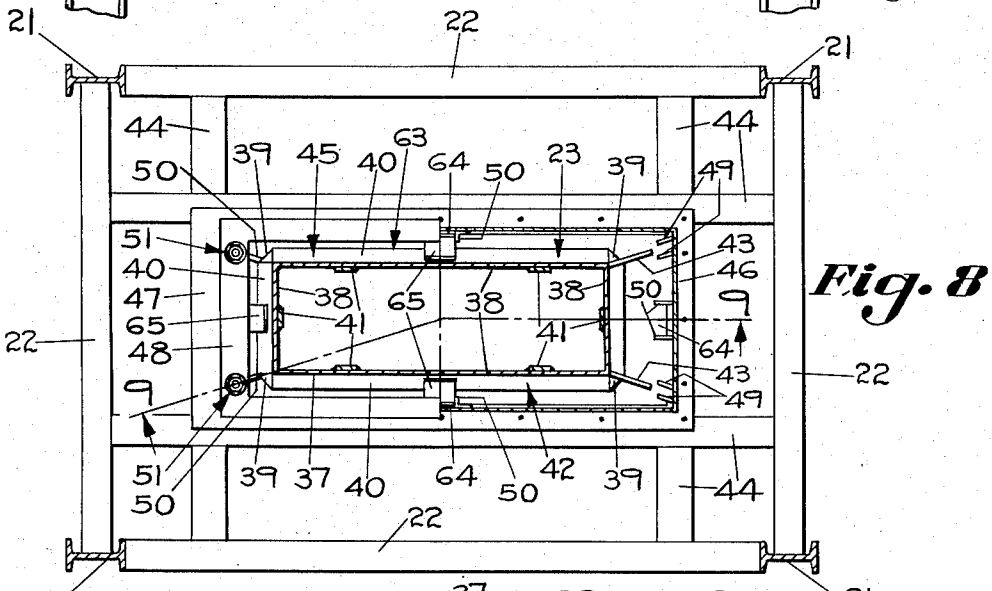


Fig. 8

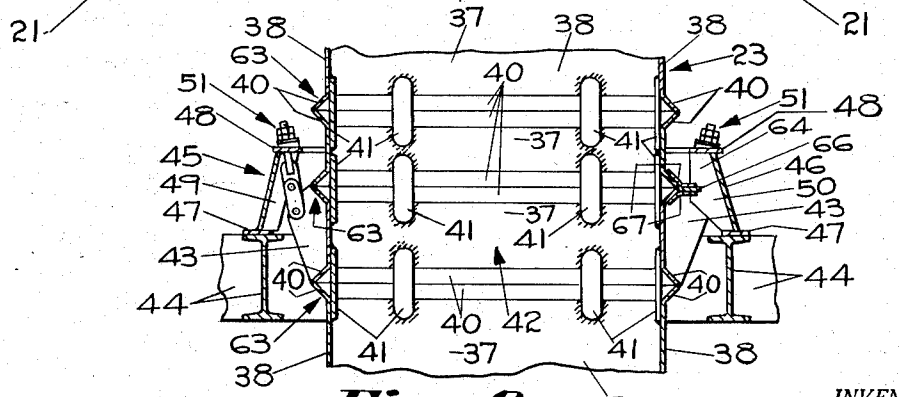


Fig. 9

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ELEVATOR AND CASING STRUCTURE

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Application November 5, 1953, Serial No. 390,332

4 Claims. (Cl. 189—1)

This invention relates to elevators and casings which may be employed therein with facility.

One object of the invention is to provide an elevator of improved construction including an improved casing or housing.

Another object of the invention is to provide an improved casing formed from a plurality of casing sections in open end to open end relation and including improved means for interconnecting said sections while stiffening the side walls of the casing.

Another object of the invention is to provide an improved casing formed from a plurality of casing sections in open end to open end relation including improved means for interconnecting said sections while stiffening the side walls of the casing and providing means by or through which the casing may be supported and/or braced against swaying.

Still another object of the invention is to provide an improved casing section including improved means at least at one of its ends whereby said casing section may be joined with another casing section.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings:

Fig. 1 is a somewhat diagrammatic side view in elevation, with sections broken away, of an elevator structure including the features of the invention;

Fig. 2 is a side view of the elevator seen in Fig. 1;

Fig. 3 is a sectional elevational view on a larger scale of a portion of the elevator apparatus seen in Figs. 1 and 2, the view showing particularly a plurality of casing sections and means for interconnecting them as well as structure for preventing swaying of the casing while permitting longitudinal motion of it with respect to its supporting or bracing structure;

Figs. 4 and 5 are views in section, these sections being taken on lines 4—4 and 5—5 respectively of Fig. 3;

Fig. 6 is a view in section, the section being taken on line 6—6 of Fig. 4;

Fig. 7 is a sectional elevational view on a larger scale of a portion of the elevator apparatus seen in Figs. 1 and 2, the view showing particularly the structure by which the casing is suspended from its supporting structure;

Fig. 8 is a view in section, the section being taken on line 8—8 of Fig. 7;

Fig. 9 is a view in section on a smaller scale the view being taken on line 9—9 of Fig. 8; and

Fig. 10 is a view in section on a larger scale of a portion of the structure by which the casing is hung from the elevator main frame or tower.

Figs. 1 and 2 of the drawings illustrate, more or less diagrammatically, a hot elevator apparatus 19 of a type employed to elevate hot catalyst in the cracking of hydrocarbons. These elevators are usually of great size, sometimes having a height of 175 feet or more and the temperatures within the casings may range up to 1000° F. or more.

The elevator 19 shown in the drawings includes an elongated upright main frame or tower 20 which is formed of four upright structural steel corner members 21 interconnected at various elevations by transverse I-beams 22 to form a rectangular generally open sided box-like tower within which there is suspended an elevator casing or housing 23 in which there is contained an endless chain and bucket elevator 24 (see Figs. 1 and 2). Elevator 24 travels over a head wheel 25 mounted upon a head shaft 26 that extends through the top or head section 27 of the casing 23. The bottom of the endless chain and bucket elevator 24 travels around a foot wheel 28 mounted upon a foot shaft 29 contained within a foot section 30 of the casing or housing 23 and is free to move bodily longitudinally therein to accommodate changes in length in the chain of the chain and bucket elevator 24 caused by expansion, contraction and wear thereof.

The casing or housing 23 includes in its foot section 30 and head section 27, respectively, a feed chute 31 by which hot catalyst may be fed into the bottom of the casing or housing 23 to the chain and bucket elevator 24, and a discharge chute 32 by which the hot catalyst is discharged from the chain and bucket elevator 24 and the casing or housing 23. The casing or housing 23 also includes a plurality of large openings or manholes in its side walls which are normally closed by plates 33 that may be removed to permit a workman to enter the casing or housing 23, or to service the foot shaft mechanism for example, and the bottom of the foot section 30 is provided with a valve mechanism 34 through which any catalyst spilled into the bottom of casing 23 may be removed.

The elevator head shaft 26, and consequently the head wheel 25 of endless chain conveyor 24, is driven from an electric motor 35 through mechanism including sprockets and a chain 36, the motor 35 being mounted adjacent the casing head section 27 and shaft 26 and on the frame or tower 20. Because the material being conveyed by the elevator 24 is very hot and should not be permitted to cool appreciatively the outside of the casing or housing 23 is covered substantially entirely by insulation, not shown.

Because of the great height or length of the casing or housing 23 it is practical only to construct the casing in sections which are interconnected to form the complete casing or housing 23 at the time that the elevator apparatus is erected and accordingly the elevator casing or housing 23 seen in the drawings is made to include the head section 27 which is open at its bottom where it is connected to the open top end of an intermediate conveyer casing portion which extends between the head section 27 and foot section 30 and is formed by a plurality of rectangular open ended casing sections 37 attached together in open end to open end relation.

The intermediate casing sections 37 are constructed in a similar manner in that each is an open ended rectangular tube including interconnected sheet metal side walls 38 having their margins adjacent each open end thereof bent from the plane of the side walls of which they form parts. These marginal portions are interconnected at each corner of the casing section by a triangular plate 39. Plates 39 have substantially the same thickness as the walls 38, are preferably formed of the same material and are welded between the flange portions of the adjacent walls 38 to provide a flange 40 at each open end of each casing section 37 that extends peripherally around it. Each of said casing sections 37 is provided with a plurality of straps, connectors or hanger elements 41 which lie against the inside surfaces of the side walls 38

and project from the open end of the conveyer section 37 a sufficient distance to be inserted into the open end of another conveyer section 37. The straps, connectors or hangers 41 are welded to the casing walls 37, but it will be obvious from the description herein contained that these straps, connectors or hanger elements 41 may be separate elements bolted or otherwise secured to the casing sections 37 when the casing or housing 23 is being assembled.

The casing or housing 23 includes, adjacent its top but below the head section 27, a plurality of relatively short intermediate casing sections which are constructed as above described and one of which sections, indicated at 42 in Figs. 7, 8 and 9 of the drawings, is further provided with four generally upright plate-like laterally diagonally extending ears, brackets or hanger elements 43 through which substantially the entire weight of the casing or housing 23 is hung upon the frame or tower 20. As indicated in Figs. 8 and 9 of the drawings, these ears, brackets or hangers 43 lie in upright planes which intersect the diagonally opposite inside corners of the casing section 42 and they form gussets that extend between the flanges 40 at the opposite ends of the section 42 and are welded to the flanges 40 and side walls 38 of this particular casing hanger portion 42 thereby stiffening the side walls 38 and end flanges 40 of the section 42 and taking some of the weight of the casing or housing through the flanges 40.

Frame or tower 20 also includes a plurality of I-beams 44 that are connected to each other and extend between the upright corner members 21 to which they may be riveted or welded just below the casing head section 27 to provide a supporting platform-like structure in the main frame or tower upon which a rectangular collar or skirt 45 which surrounds the casing or housing 23 rests and from which the casing or housing 23 is hung.

The collar or skirt 45 includes a tubular body portion 46 having two opposite upright walls and two opposite upwardly tapered inwardly sloping walls which are rigidly interconnected to each other and at their bottoms to a rectangular base frame 47 that rests upon and is bolted to the I-beams 44. The upper end of body portion 46 of skirt 45 is made integral, as by welding, with a rectangular top frame 48 that projects inwardly of the body side walls, and the body 46, base frame 47 and top frame 48 are interconnected by a plurality of gussets 49 and 50.

The supporting section 42 of the casing or housing 23 is hung upon frame or tower 20 through skirt 45 by four adjustable hanger assemblies 51 (see Fig. 10) each of which includes a bolt having a tongue 52 upon opposite sides of which there is a pair of hanger straps 53 attached to the tongue 52 by a pivot pin 54. Straps 53 straddle one of the ears, brackets or hanger elements 43 on the supporting casing section 42 and are connected thereto by a pivot pin 55. The bolt portion of each hanger assembly 51 extends upwardly outwardly through the top frame 48 of skirt 45 and a boss 56 welded thereon which is provided with a central opning of larger diameter than the bolt and a concave top surface. The bolt is provided with a washer 57 and a pair of nuts 58. Washer 57 includes a convex surface that seats in the concave surface of the boss 56 to provide a ball and socket joint between hanger assembly 51 and the skirt 45.

From the foregoing it will be readily apparent that the conveyer casing section 42 that supports substantially the entire weight of the casing or housing 23 is not only hung from the frame or tower 20 in a flexible manner but also in such manner that gravity will cause it to center itself between the hanger assemblies 51. It will also be seen that because the hanger assemblies 51 are flexible in themselves and because they are connected to the skirt 45 for limited pivotal motion through the ball and socket joints formed by the bosses 56 and washers 57 that the supporting casing section 42 is free to expand and contract due to temperature changes of the housing or casing by reason of one or more sides of the casing being at temperatures different from the remaining sides of the housing or casing 23. These conditions frequently occur in hot elevators of the type herein described and the latter condition is usually caused by winds blowing against only one or two of the sides of the conveyer casing 23 and cooling them below the temperature of those sides that are protected from the wind.

It may be mentioned here that because of the size and particularly the great length or height of the elevator apparatus 19, it is found expedient when erecting the elevator to employ a plurality of surveyors transits properly spaced and set upon the ground, the use of which permits engineers to direct workmen assembling the structure to secure its various elements together in level and plumb positions.

When the casing or housing 23 is to be assembled within the frame or tower 20 the supporting casing section 42 is first hung from frame 20, as above described, and this section 42 is then adjusted to a position wherein its central vertical axis is plumb by the proper adjustments of the nuts 58 on the hanger assemblies 51. The casing section 37 that is to be joined to the open bottom of the supporting section 42 is then positioned immediately below the open bottom end of section 42 with its straps, connector or hanger elements 41 extending into the supporting section 42 and laying against the side walls 38 thereof. Bolts 59 are then inserted through openings 60 (similar to those seen in Fig. 3 of the drawings) in the side walls 38 of section 42 and holes 61 in the free ends of the straps, connector or hanger elements 41 to hang the casing section 37 from the supporting section 42. While said casing section 37 is hung from the section 42 through the bolts 59 it may be brought to a plumb position and the bolts 59 may then be tightened. In this position the flanges 40 of the sections 37 and 42 abut each other and the free ends of the straps, connector or hanger elements 41 are then preferably welded permanently to the side walls 38 of the supporting section 42. The adjacent or abutting edges of the flanges 40 are welded together as indicated at 62 in Figs. 5 and 6 of the drawings to cause the flanges 40 of adjacent casing sections 37 and 42 to form a stiffening bead or bulge 63 that extends peripherally around the casing or housing 23 thereby stiffening its side walls and aiding in preventing them from warping and buckling when the casing is heated to or cooled from that temperature at which it operates.

The remaining casing sections 37 which comprise the casing or housing 23 and the head and foot sections 27 and 30 are connected together in a manner identical to that above described in connection with casing sections 37 and 42 and the entire casing or housing 23 is braced against swaying motion while being permitted to expand and contract by apparatus now to be described.

It may be mentioned that two or more of the casing sections 37 may be connected together to form a casing section sub-assembly to be incorporated into the casing as a single unit in the manner above described. When such is done the bolts 59 and openings 60 in the casing sections which comprise the sub-assembly may be omitted and the ends of straps, connector or hanger elements 41 may be welded directly to the side walls 38 of the adjacent casing sections 37.

Referring again to the skirt 45 (see Figs. 8 and 9), each of the upwardly extending side elements of its body 46 is provided with a pair of the spaced gussets 50 which extend upwardly to form a channel-like guide or way 64 into which a tongue 65 carried by one side wall of the casing or housing 23 extends. Each tongue 65 includes a plate 66 attached to one of the beads, bulges or reinforcements 63 by a pair of bent plates 67 welded both to the plate 66 and the bead or bulge 63. The plates 66 engage the gussets 50 only at their sides, but since there are four sets of gussets 50 and four tongues

65, one adjacent the center of each side wall of the casing or housing 23, substantially all lateral motion of the casing or housing 23 with respect to the frame or tower 20 is prevented while the casing or housing 23 is permitted to expand or contract with respect to the frame 20 by reason of the slide fits between the tongues 65 and the guides or ways 64.

Other anti-sway and expansion permitting devices (see Figs. 3, 4 and 6) may be spaced along the length of the casing or housing 23 as desired. Each of these devices is similar to that described above in that each includes four tongues 65 carried by one of the beads, bulges or reinforcements 63, as above described, that enter into guides or ways 68 formed by spaced upright elements 69 carried, through brackets 70, by frame elements 71 that extend between the horizontal beams 22 of the frame or tower 20 as do the I-beams 44 which carry skirt 45.

From the foregoing it will be seen that by this invention there has been provided an elevator that is particularly adapted to operate at temperatures different from the atmospheric temperature which includes an upstanding main frame tower or support 20 in and from which there is hung an elongated elevator casing 23 that may expand and contract with respect to its supporting frame but which cannot sway or swing with respect to it to any material degree.

It will also be seen that the improved casing or housing provided by this invention includes a plurality of rectangular casing sections 37 in open end to open end relation which are interconnected by peripheral channel-like beads or bulges 63, and that the straps or hangers 41 extend across the channel-like beads or bulges 63 to interconnect the adjacent casing section 37 for the purpose of supporting one casing section from the other during assembly and afterward for transferring substantially all tension and compression loads from one casing section to the other independently of the channel-like beads or bulges 63 thereby relieving the beads or bulges 63 of loads which would tend to expand, compress or warp them. Because the reinforcing channel-like beads or bulges 63 are made of portions of the adjacent casing sections, their wall thickness will be the same as the thickness of the walls 38 of casing section 37. Therefore, the beads or bulges 63 will expand and contract at rates substantially equal to the rate of expansion and contraction of the casing or housing walls and the reinforcing bands, beads or bulges 63 will be efficient in their function of stiffening and reinforcing the casing or housing walls at all temperatures throughout the range of temperatures to which the casing or housing may be subjected.

The forming of each of the reinforcing and stiffening channel-like beads or bulges 63 from a flange on each of the adjacent casing sections has another important advantage, namely, it provides flanges on each of the adjacent sections to be interconnected which a workman may bend as necessary to compensate for small manufacturing errors which otherwise might prevent the flanges of the adjacent casing sections from abutting each other properly for the peripheral welding together of the flanges etc.

While it is preferred to form the channel-like stiffening beads or bulges 63 at least in part of bent portions of the side walls 38 of the casing sections 37, it will be seen, of course, that the channel-like reinforcing beads or bulges 63 may be made as separate elements interconnected to the adjacent ends of the casing sections after the sections have been connected together by the straps or hangers 41 and that if so made the material from which they are formed should have substantially the same coefficient of expansion as the material of the walls 38 of the casing section 37 in order that they will prevent rather than cause, warping of the elevator casing walls.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended, and applicant therefore wishes not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of the invention, what it is desired to secure by Letters Patent of the United States is:

1. An elevator adapted to operate at elevated temperatures including an elongated upstanding main frame, an elongated elevator casing disposed within the main frame, said elevator casing comprising a plurality of open ended casing sections formed with side walls and disposed in open end to open end relation, the side walls of adjacent casing sections thereby forming continuations of each other, said main frame including means for hanging the elevator casing and supporting the weight thereof, means connecting the hanging means to one casing section, means connecting said casing sections for transferring weight from one casing section to another, means connecting said casing sections and forming stiffening elements for the side walls thereof including a peripheral flange surrounding the open ends of each of said casing sections, said flanges of adjacent casing sections being disposed with the edges thereof in contact and with the entire inner surface portions thereof spaced from each other, means joining the edges of the flanges, said stiffening elements including the entire inner surface portion thereof being exposed to the temperature within the elevator casing and expanding and contracting uniformly with the walls of the casing sections.

2. An elevator adapted to operate at elevated temperatures including an upstanding main frame, an elevator casing disposed within the main frame, said elevator casing comprising a plurality of open ended casing sections formed with side walls and disposed in open end to open end relation, the side walls of adjacent casing sections thereby forming continuations of each other, said main frame including means for hanging the elevator casing and supporting the weight thereof, means connecting the hanging means to one casing section, means connecting said casing sections and forming stiffening elements for the side walls thereof including a peripheral flange surrounding the open ends of each of said casing sections, said flanges of adjacent casing sections being disposed with the edges thereof in contact and with the entire inner surface portions thereof spaced from each other, means joining the edges of the flanges, said stiffening elements including the entire inner surface portions thereof being exposed to the temperature within the elevator casing and expanding and contracting uniformly with the walls of the casing sections.

3. In an elevator, an elongated elevator casing comprising a plurality of open ended casing sections formed with side walls and disposed in open end to open end relation, the side walls of adjacent casing sections thereby forming continuations of each other, means connected to one casing section for hanging the elevator casing, means connecting said casing sections for transferring weight from one casing section to another, means connecting said casing sections and forming stiffening elements for the side walls thereof including a peripheral flange surrounding the open ends of each of said casing sections, said flanges of adjacent casing sections being disposed with the edges thereof in contact and with the entire inner surface portions thereof spaced from each other, means joining the edges of the flanges, said stiffening elements including the entire inner surface portions thereof being exposed to the temperature within the elevator casing and expanding and contracting uniformly with the walls of the casing sections.

4. In an elevator, an elevator casing comprising a plurality of open ended casing sections formed with side

walls and disposed in open end to open end relation, the side walls of adjacent casing sections thereby forming continuations of each other, means connected to one casing section for hanging the elevator casing, means connecting said casing sections and forming stiffening elements for the side walls thereof including a peripheral flange surrounding the open ends of each of said casing sections, said flanges of adjacent casing sections being disposed with the edges thereof in contact and with the entire inner surface portions thereof spaced from each other, means joining the edges of the flanges, said stiffening elements including the entire inner surface portions thereof being exposed to the temperature within the elevator casing and expanding and contracting uniformly with the walls of the casing sections.

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