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S. M. MERCIER

2,661,089

BUCKET ELEVATOR HOUSING

Original Filed Oct. 3, 1946

4 Sheets-Sheet 1

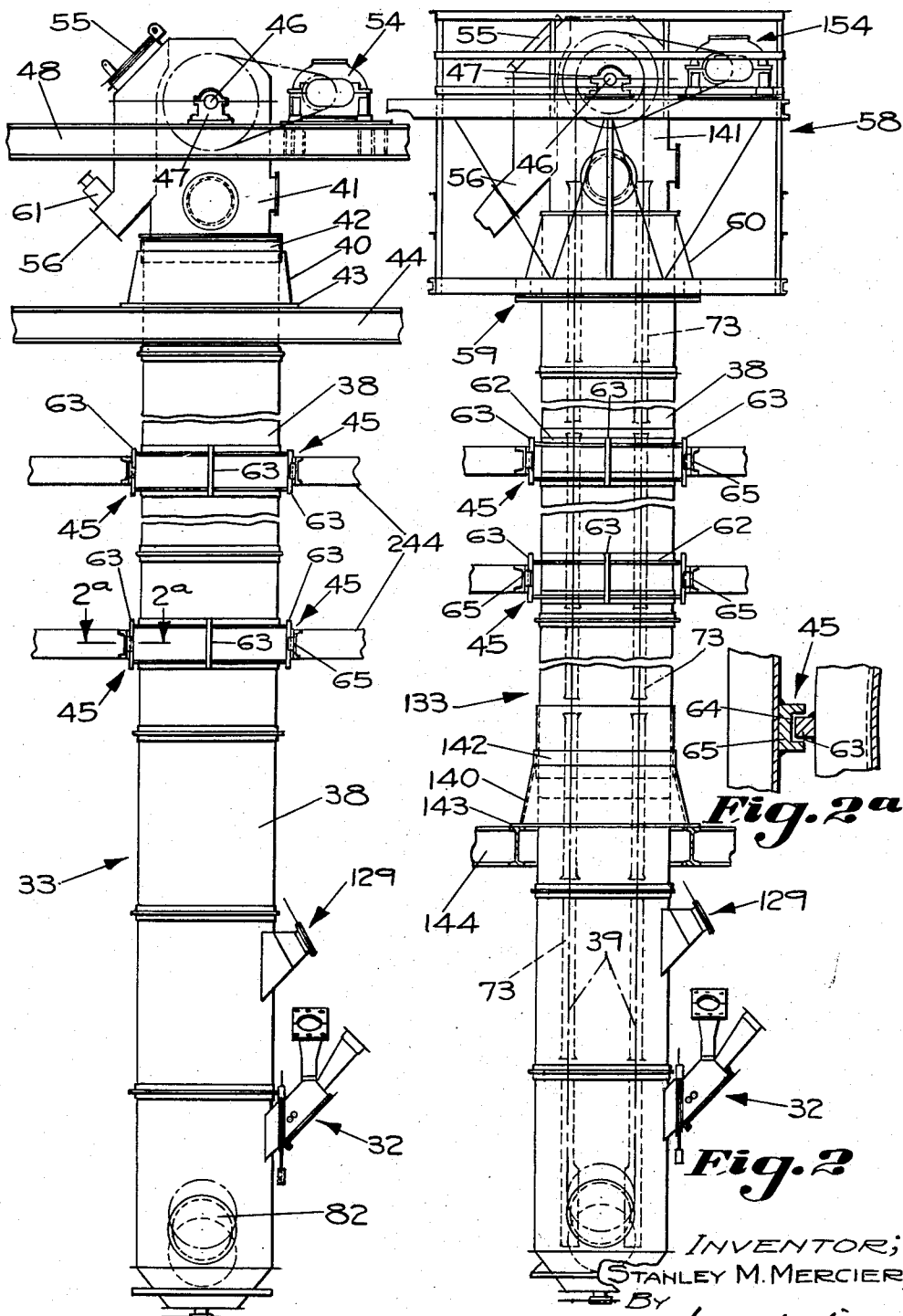


Fig. 1

Fig. 2a

Fig. 2

INVENTOR;
STANLEY M. MERCIER,

By *Nathan H. Nittman,*
ATT'Y.

Dec. 1, 1953

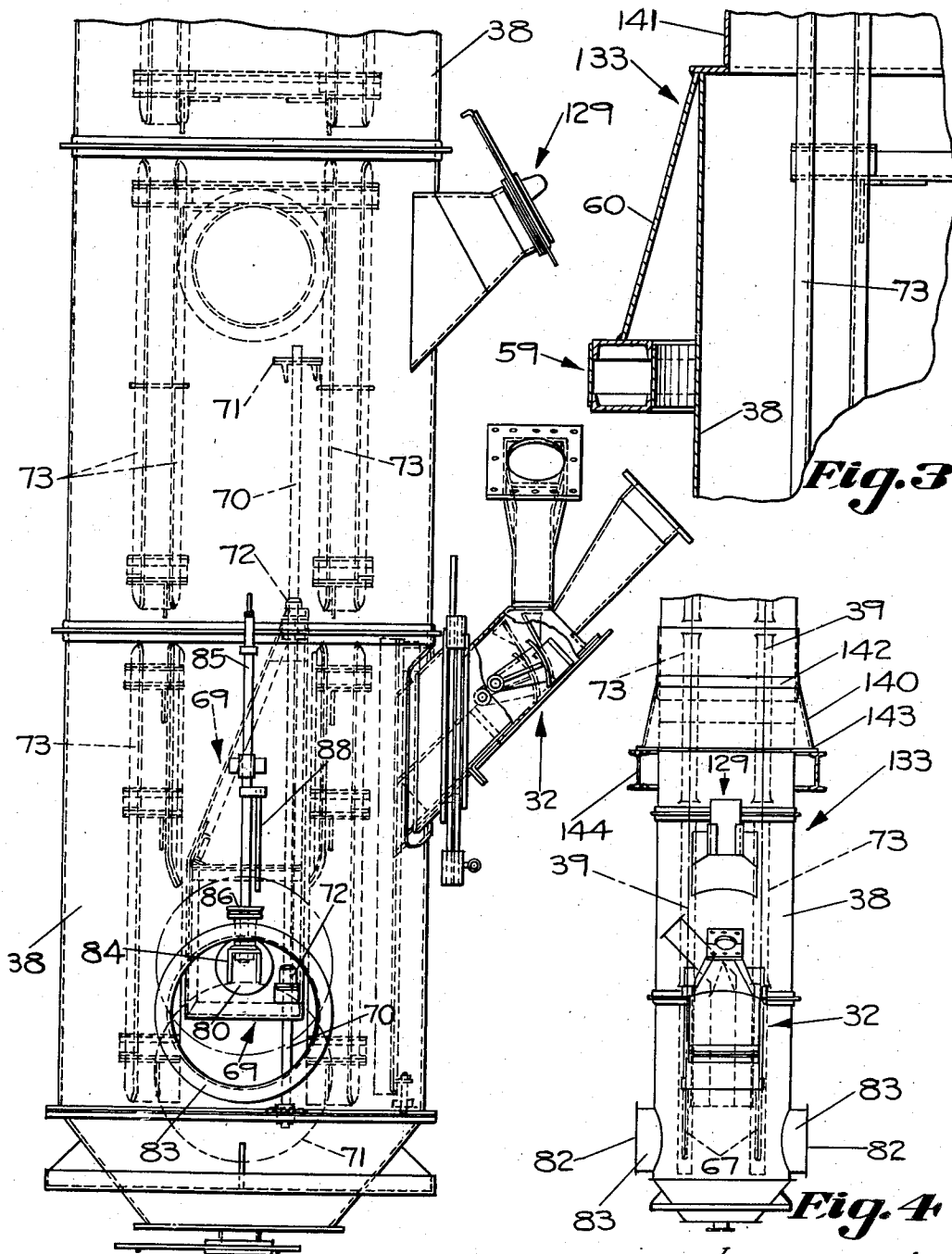
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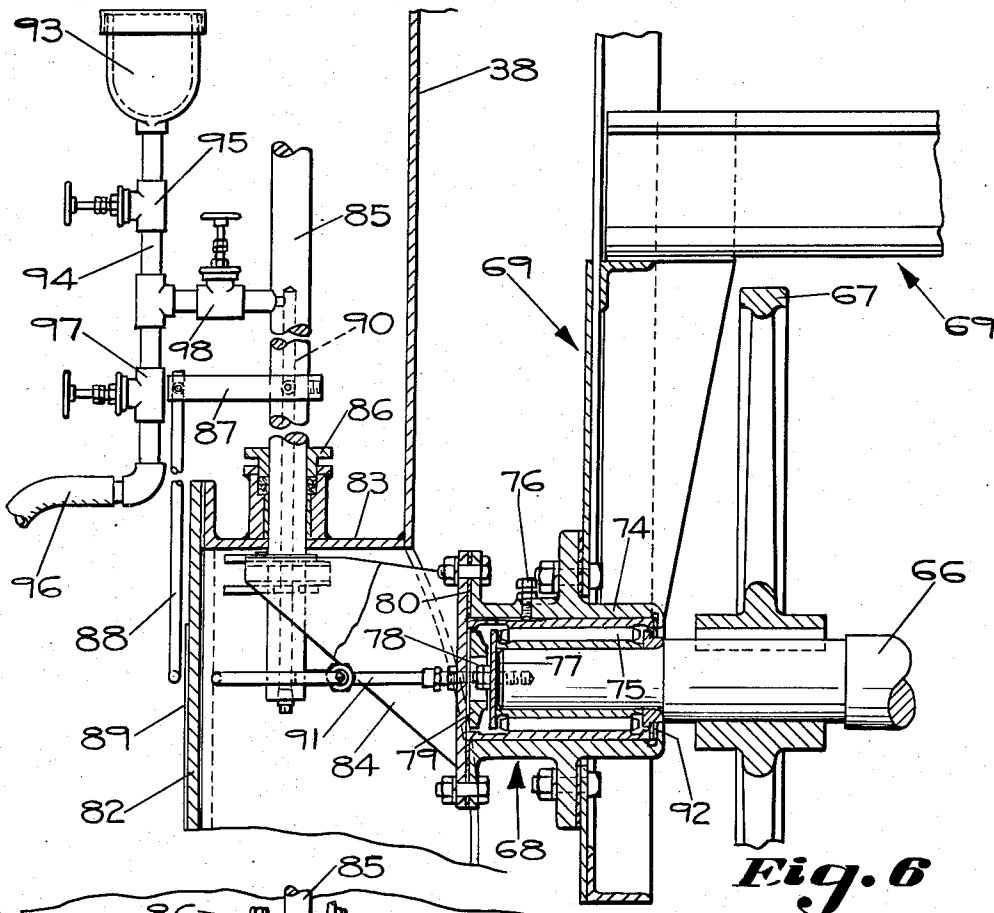
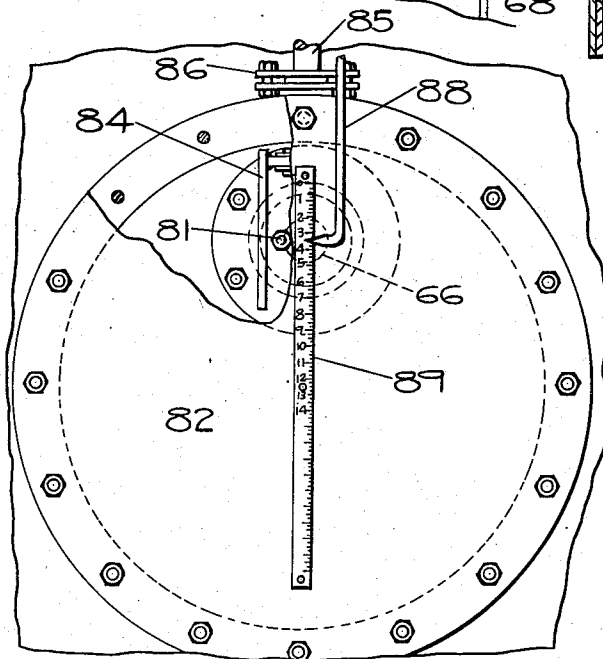
S. M. MERCIER

2,661,089

BUCKET ELEVATOR HOUSING

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INVENTOR;
STANLEY M. MERCIER,
BY
Harley H. Hutton
ATTY.

Dec. 1, 1953

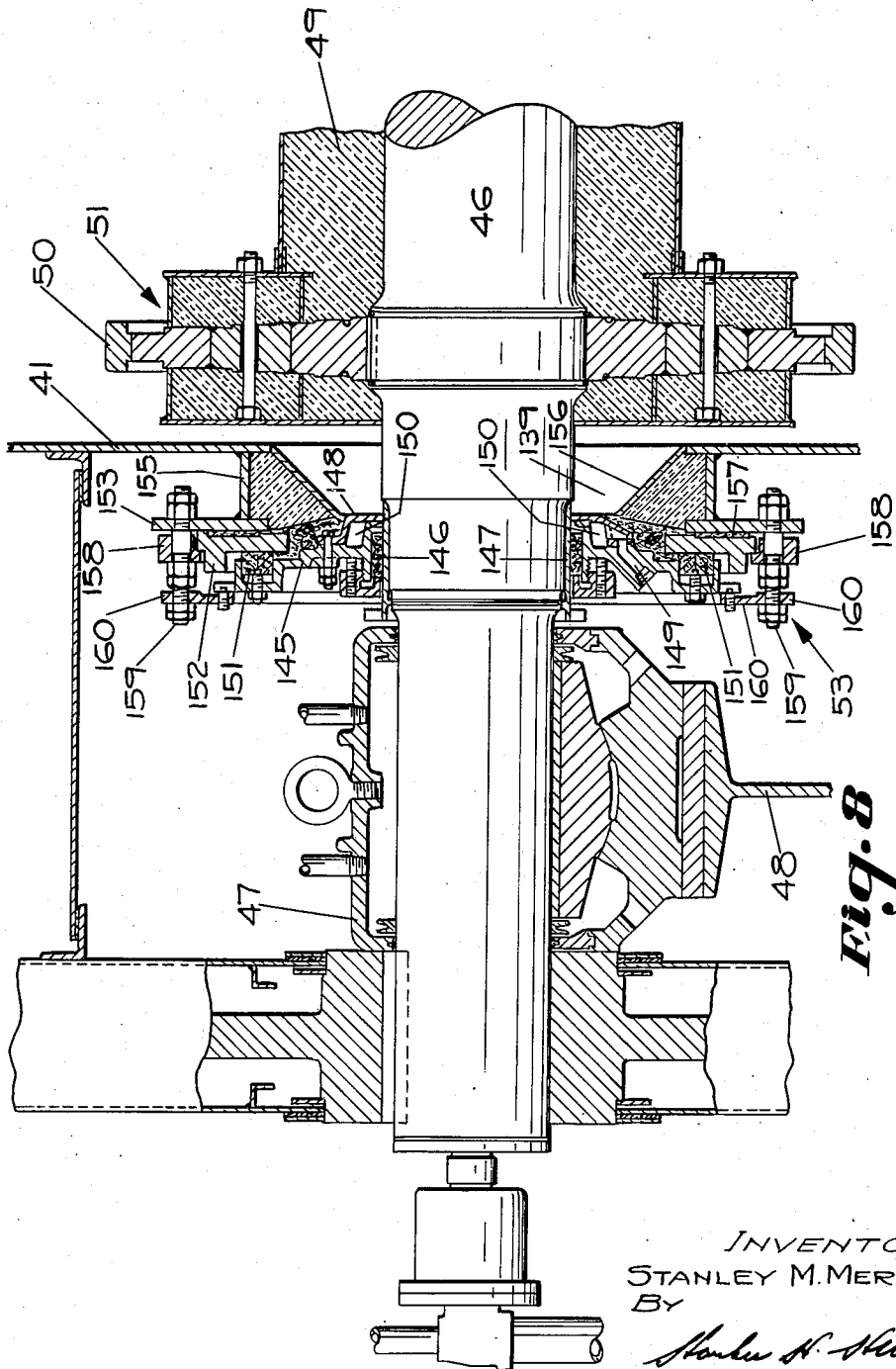
S. M. MERCIER

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BUCKET ELEVATOR HOUSING

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4 Sheets-Sheet 4



INVENTOR;
STANLEY M. MERCIER,
BY
Stanley M. Mercier
ATT'Y.

UNITED STATES PATENT OFFICE

2,661,089

BUCKET ELEVATOR HOUSING

Stanley M. Mercier, Bexley, Ohio, assignor to
The Jeffrey Manufacturing Company, a corporation of Ohio

Original application October 3, 1946, Serial No.
700,928. Divided and this application May 27,
1950, Serial No. 164,771

13 Claims. (Cl. 198—206)

1

This invention relates to a bucket elevator or conveyer.

An object of the invention is to provide an improved casing structure which is suspended substantially as a unit and provides for free expansion and contraction of the casing in response to temperature changes.

Another object of the invention is to provide an improved elevator casing which is supported by a circumferential skirt, the casing being free to expand vertically in at least one direction a substantial amount.

Still another object of the invention is to provide a casing, as above set forth, with guide means which guide the casing during its vertical expansion and contraction.

Still another object of the invention is to provide an elevator casing of the above mentioned type in which a circumferential supporting ring is employed preferably in combination with the mentioned circumferential skirt.

Another object of the invention is to provide an elevator in which there is a head shaft supporting draft means and a floating frame carrying a foot shaft, there preferably being a casing totally enclosing the draft means with bearings for the head shaft outside the casing and bearings for the foot shaft carried by said floating frame and within said casing.

A further object of the invention is to provide improved bearing construction for an elevator or conveyer in which fluid is employed to keep grit out of the bearing.

Still another object of the invention is to provide an improved seal between an elevator or conveyer casing and a rotating shaft.

A further object of the invention is to provide a totally enclosed elevator in which the foot shaft is mounted on a floating frame and is carried on bearings, both the shaft and the bearings being entirely within the elevator casing, there being indicating means outside the casing to indicate the height of the shaft relative to said casing.

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 side elevational view of an elevator involving my invention showing a portion of the guiding and supporting superstructure, the casing insulation being omitted;

Fig. 2 is a view similar to Fig. 1 of a modified form of elevator involving features of my invention;

Fig. 2^a is an enlarged detail view taken on the

2

line 2^a—2^a of Fig. 1 looking in the direction of the arrows;

Fig. 3 is an enlarged sectional view showing particularly the skirt which supports the head section and associated mechanism in the elevator of Fig. 2;

Fig. 4 is an elevational view of the boot or foot section of the elevator of Fig. 2, the showing also generally applying to the elevator of Fig. 1 except for the supporting skirt;

Fig. 5 is an enlarged side view of the elevator casing of Fig. 1 showing also the associated feed chute and observation window;

Fig. 6 is an enlarged sectional elevational view showing the foot shaft and associated mechanism;

Fig. 7 is an enlarged view of the casing adjacent the foot shaft showing the shaft indicator mechanism, parts being broken away; and

Fig. 8 is a transverse sectional elevational view of one end of the head shaft and associated bearing and seal.

This application is a division of my application Serial No. 700,928, filed October 3, 1946, now Patent No. 2,570,363, dated October 9, 1951.

Fig. 1 of the drawings illustrates the casing and its mounting means for an elevator 33 incorporating features of my invention, Figs. 2, 3 and 4 illustrating another form of elevator 133 also incorporating such features, it being understood that the elevators 33 and 133 are similar in construction except for such differences as are obvious or are pointed out hereinafter.

Each of the elevators 33 and 133 includes a generally cylindrical elongated upstanding casing or housing 38 which provides a complete enclosure for endless chain bucket elevator conveyer mechanism which is shown in detail in my parent application above identified. At the bottom is a feed chute 32.

In the completed unit the exterior surface of the casing or housing 38 includes a layer of insulating material which has not been shown in the drawings. This is because of the fact that catalytic material both in its regenerated and spent form, to be handled by said elevator, is very hot, as a consequence of which there is a high temperature within the casing 38 when the system is in operation. Because of the temperature differences which exist within the casing 38 when it is in operation, as compared with when it is shut down and particularly in view of the fact that the casing has appreciable height, for example, in one installation it is approximately one hundred and seventy-five feet high, it is neces-

sary to provide for the free expansion and contraction of said casing 38, particularly along its length. To this end I provide novel supporting or suspending and guiding features in said casings 38 of elevators 33 and 133.

In elevator 33 this supporting or suspending mechanism is in the form of a peripheral frusto-conical petticoat, skirt or flange 40 which is located near the top of said elevator and adjacent the bottom of the head section 41 of said casing or housing 38. The top of the skirt 40 is rigidly attached, as by welding, preferably around its entire periphery, to a supporting and reinforcing ring or belt 42 which in turn is rigidly attached to and forms a reinforced supporting area on the periphery of the casing or housing 38. The bottom of the skirt 40 is provided with an integral circumferential bearing flange or ring 43 about which it is rigidly attached, as by welding, which flange or ring 43 rests upon a supporting superstructure 44 which may include a pair of spaced I-beams and interconnecting cross-beams which form a part of or are attached to a building or other independent supporting structure.

The entire load or weight of the casing 38, including the head section 41 of the elevator 33, is supported by the superstructure 44 through the skirt 40 and ring 42. As a consequence of this fact it is evident that the casing 38, including the head section 41, is rigidly connected to the external supporting superstructure 44 in only one horizontal plane which is the plane of connection of the skirt 40 and the ring 42, and consequently the casing 38 is free to expand without strain under the conditions of varying temperature which occur particularly between operating and non-operating conditions. For example, if the head section 41 expands it will expand upwardly from the ring 42. If the casing 38 below the ring 42 expands it can freely expand downwardly therefrom since it is hanging free except for its connection to skirt 40 through ring 42.

The skirt 40 also provides for diametric expansion of the casing 38. As previously set forth, the skirt 40 is in the form of a peripheral frusto-conical petticoat or flange, the small diameter end of which is attached to the ring 42 and the base or large diameter end of which rests upon the stationary I-beams of the superstructure 44. In providing for the expansion of the casing relative to the superstructure the skirt 40 functions as an upstanding load supporting moment member which connects the casing 38 with the superstructure. Because the ends of the skirt substantially follow the temperatures of those members to which they are connected through conduction, the ends will expand and/or contract according to the temperatures of those members and since the superstructure is never as hot as the casing 38 the smaller end of the skirt will expand and contract with the casing while the large end of the skirt will remain more nearly at a constant temperature.

In view of the height of the casing 38 it is desirable to provide guide or anti-sway means 45 at spaced vertical intervals to guide and brace said casing 38 against excessive lateral movement which, for example, may be caused by the wind, since in most installations these elevators are built outdoors and are merely supported by open frames, of which the superstructure 44 is a part. The details of these guide or anti-sway means 45 are shown in Fig. 2^a of the drawings and are described hereinafter in connection with the description of the modification of Fig. 2.

The elevator head shaft 46 is shown in detail in Fig. 8 of the drawings, but for the time being it is sufficient to point out that it is mounted upon a pair of spaced bearings, one of which is seen at 47, there being a bearing 47 adjacent each end of the shaft, each bearing being carried in a bearing block supported upon an I-beam or other structural member 48 of the superstructure 44.

The structure of the shaft 46 and bearing 47 preferably follows the disclosure of my Patent No. 2,430,236, dated November 4, 1947. The shaft 46 is preferably covered with insulating material 49 (see Fig. 8) and preferably includes a pair of friction rings 50 which are built up of a plurality of interconnected welded rings to form friction traction wheels 51 which support and drive endless spaced-apart conveyer chains (not shown). The structure of the traction wheels 51 and associated chains preferably follows in general the construction disclosed and claimed in my application, Serial No. 607,115, filed July 26, 1945, now Patent No. 2,525,041, dated October 10, 1950.

Of particular significance in connection with this phase of the invention is the fact that the complete casing or housing 38, including the head section 41, is supported from the superstructure 44, while the bucket conveyer mechanism and head shaft 46 are supported from a spaced part of the superstructure including the I-beams 48. In view of the temperature variations to which the casing head 41 is subjected it is necessary to provide for relative movement between said shaft 46 and the casing head 41 so that the side walls of the head section 41 can move in planes at right angles to the axis of head shaft 46. To provide for this and still preserve the enclosing characteristic of the casing 38 I employ a novel seal 53 which is disclosed in detail in Fig. 8 of the drawings and hereinafter fully described.

The head shaft 46 is driven from an appropriate motor and speed reducing drive mechanism 54 mounted on the I-beams 48. I also preferably provide a normally closed explosion door 55 adjacent the top of the head section 41. Said head section 41 also includes a discharge chute 56. A hood and vent pipe 61 is provided for the three sections of the chute 56.

Attention is now directed particularly to Figs. 2, 3 and 4 of the drawings and to certain details by which the elevator 133 differs from the elevator 33 and to certain particulars in which they are similar. Except for differences in the construction of the head section 141 of the elevator 133, as compared with the head section 41 of elevator 33 and the method of supporting the casing 38 of the two elevators 33 and 133, both elevators are of substantially similar construction. The differences in support, however, provide for one difference in the relation of parts previously described in connection with the elevator 33, in that the head shaft 46 and supported conveyer mechanism 39 in the elevator 133 is supported directly from the casing 38 through the head section 141 instead of being supported independently thereof from superstructure I-beams 48. This will be evident from the following detailed description of elevator 133.

Said elevator 133 includes a petticoat, skirt or flange 140, similar to the skirt 40 of elevator 33, with which there is an associated ring 142 and ring or flange 143, the elements 140, 142 and 143 having essentially the same relative relation as the elements 40, 42 and 43. Ring 142, however, is

rigidly attached to the casing 38 of elevator 133 to form a supporting area adjacent its bottom rather than adjacent its top, and ring 143 is supported by I-beams of superstructure 144 which are adjacent the bottom thereof rather than adjacent its top. As a consequence, the casing 38 of elevator 133 is suspended or supported by the skirt 140 from the superstructure 144, with the major portion thereof projecting above the plane of support and only the foot section or bottom thereof hanging down from said plane of support.

The head shaft 46 of the elevator 133 is supported through bearings 47 and associated bearing blocks which are mounted upon channels of a head framework 58 which in turn is supported on a torsion ring 59 which circumscribes the top of casing 38 and which is attached thereto by a frusto-conical petticoat, skirt or flange 60, the bottom of which is welded to the torsion ring 59 and the top of which is welded to a supporting area formed by the top of the casing 38 and the bottom of the head section 141 thereof. It is thus evident that the frame 58 as well as the head shaft 46 and bucket elevator mechanism is directly supported from the casing 38 in this embodiment of the invention. The drive mechanism 154 for the head shaft 46 is supported by the framework 58 and is similar to the drive mechanism 54. Other features of the head section 141 follow those of head section 41 which were previously described.

In elevator 133 guides 45 are provided between the head and foot sections and, of course, in this instance they are above the supporting skirt 140, while they are below the supporting skirt 40 in elevator 33. They are, however, of similar construction in each instance. Said guides are provided by forming circumferential bands or belts 62 preferably constructed of angles, which belts 62 are rigidly attached to the casing 38 by welding. It may be pointed out that the casing 38 is preferably formed of a plurality of interconnected tubular sections which are bolted or welded together by top and bottom section flanges which are clearly seen in both Figs. 1 and 2 of the drawings.

At spaced intervals around the belt 62 are upstanding guide bars 63 which are welded to the outwardly projecting legs of the angle belts 62 and which slidably extend into notches 64 formed in brackets or clips 65 which are mounted on channel members 244 of the superstructure 44, there preferably being guides 45 located at 90 degree intervals around the periphery of the frame 38 adjacent each of the belts 62. It is thus evident that the bars 63 are rigidly attached to the casing 38 and are free to slide upwardly and downwardly in the notches 64 of the brackets 65 which are rigid with the superstructure 44. These guides 45, of course, help brace the casing 38 and prevent undesirable lateral movement or twisting thereof under atmospheric influences or under the influence of the high temperature gases within said housing 38. It is to be noted that there is a small space or clearance between the outer edges of the bars 63 and the bottoms of the notches 64 of the brackets 65 that permits diametrical expansion of the casing 38.

Attention is now directed to Fig. 6 and to the structure of the foot shaft and its associated mechanism, which structure is applicable to both elevators 33 and 133. In the bottom of the casing 38 there is a foot shaft 66 provided with spaced wheels 67 adjacent opposite ends thereof

which receive and guide the chains of the elevator mechanism 39, the knuckles of said chains contacting the peripheries of the wheels 67 and the side straps thereof overlapping the wheel rims. Opposite ends of the shaft 66 are supported in roller bearings 68 which are carried in a floating framework 69. The framework 69 is mounted for free vertical or up and down movement while being restrained against all other movement, it being mounted on a pair of upstanding rods or shafts 70 (see Fig. 5), there being a rod or shaft 70 adjacent each side of the casing 38, both said rods 70 being on one side of the shaft 66. The rods 70 are attached by appropriate plates or brackets 71 both at the top and bottom to the frame 38.

Upper and lower guide sleeves 72 are carried by and form a part of the floating frame 69 and are adapted to receive the rods 70 and slide freely therealong, thus providing for guiding of the floating frame 69 so that the shaft 66 is always in proper position to maintain the chains of the bucket elevator mechanism 39 in proper alignment with chain guides 73 which are adjustably mounted by supporting brackets on the individual sections of the casing 38. That is, the guides 73 are sectionalized with the sections of casing 38, as clearly illustrated in Fig. 5 of the drawings, and each guide 73 may be individually adjusted in right angle directions so as to align it properly to receive and guide a run of a chain 52 which is adapted to be guided through substantially the entire length of the casing 38.

The details of the bearings 68 can be seen by reference to Fig. 6 of the drawings, the other bearing and associated mechanism being of substantially identical construction. Each said bearing 68 therefore includes a block, casting or shell 74 removably bolted to frame 69 and roller bearings 75 which include inner and outer races mounted on the shaft 66 and casting 74, respectively. A set screw 76 holds the outer race against rotation. A disc or plate 77 is attached by screw means 78 to the end of shaft 66 and holds the inner race of the bearing 75 in place. A thrust washer 79 is interposed between a disc 77 and a removable cover plate or cap 80 for the casting 74. Thrust washer 79 is held against rotation and can be adjusted toward and from the disc 77 by a pair of set screws that extend into recesses in the washer 79, one of which set screws is seen at 81 in Fig. 7 of the drawings.

It is to be particularly noted that the shaft 66 and the bearings 68 are entirely within the casing 38, as a consequence of which there is no need for cooling said shaft 66 since it and the bearings 68 are subject to substantially the same temperature. Furthermore, this eliminates all of the normally present intricate mechanism involved providing a seal between the shaft 66 and the casing 38 which would otherwise be necessary to retain the totally enclosing characteristic of said casing 38. Access to the bearings 68 and associated mechanism is provided by removable circular or disc-like cover plates 82, there being one such cover plate adjacent each side of the casing, or, in other words, adjacent each end of the shaft 66. These cover plates are provided on the ends of projecting drums 83 which are formed near the bottom of the foot section of the elevator 33 or 133, as the case may be.

In order to indicate the position of the shaft 66 at all times and also to provide means for keeping the bearings 75 free of grit, dirt, foreign material, catalyst dust or the like and preferably simul-

taneously to lubricate them, I provide mechanism which is shown particularly in Figs. 6 and 7 of the drawings and which will now be described. Each bearing cover plate 80 is provided with a bracket 84 which extends into a drum 83 and is attached to the bottom of a drilled rod 85. Rod 85 extends through the top of drum 83 through a stuffing box 86 and carries an outwardly extending arm 87 which in turn carries a downwardly extending pointer arm 88 which cooperates with an indicating scale 89 carried on the plate 82. This pointer arm 88 at all times indicates the position of the adjacent end of the shaft 66. The rod 85 is partially drilled or bored as indicated by bore 90 and adjacent its bottom is connected by a flexible tube 91 which is preferably coiled about the rod 85 and communicates with the bore 90, said tube 91 leading through a fitting provided in a hole located centrally in plate 80 so that a fluid, such as air, flue gas, or the like, may be introduced under pressure into the bearing 68. Such fluid will create pressure within the bearing 68 and flow inwardly therethrough through a non-positive seal 92, thus acting to prevent the entry of foreign material into the bearing and to blow out any grit or abrasive material or any other foreign matter which may have worked past the seal 92.

In addition to cleaning out and maintaining the bearing 68 free of foreign substances, it is possible to lubricate it by utilizing the flowing fluid as a carrier medium for a lubricant. To this end a graphite pot 93 is provided which is connected to the bore 90 through pipe 94 and control valve 95, the previously mentioned source of fluid pressure being derived by pipe or conduit 96 and control valve 97. A control valve 98 is interposed between valves 95 and 97 and the bore 90. If control valve 95 is closed and valves 97 and 98 open, it is evident that cleaning fluid or gas will be delivered to the bearing 68. If valve 97 is closed and valve 95 is open, lubricating material, such as graphite, oil or the like, will be delivered to the pipe leading from valve 97 and some of it may find its way into bore 90. Thereafter, when valve 93 is closed and valves 97 and 98 are both open, any such graphite or lubricating material will, of course, be carried by the flowing fluid to lubricate the bearing 68. If valve 98 is closed all access to the bore 90 is shut off.

It is thus evident that the position of the shaft 66 at each side of the elevator may be determined at all times by visual indication outside the elevator casing, that the shaft 66 and associated bearings are totally enclosed, and that they may be cleaned and lubricated or just cleaned without opening the enclosing casing 38, as a consequence of which they may be cleaned and lubricated and then maintained clean while the unit is in operation.

Directly above the feed chute 32 is an observation window 129. This window 129 makes it possible for an operator to view the material within the buckets of the elevator mechanism without disturbing the enclosing character of the casing 38.

Attention is now directed particularly to Fig. 8 of the drawings and to the construction of the traction wheel 51 and associated mechanism and the seal 53. Near opposite ends the shaft 46 is provided with the traction wheels 51 which are formed of a plurality of welded rings, as disclosed and claimed in my application, Serial No. 607,115, now Patent No. 2,525,041, except for certain minor differences. These concentric rings are preferably under tension at normal temperatures so

that when they expand under high temperatures they still frictionally engage each other. In addition, they are welded together adjacent their peripheral edges. The major portion of the shaft 46 is imbedded in insulating material 49 which is built up around the traction wheel 51 except for a portion of the outer ring and the friction ring or tire 50 thereof.

The outer ends of shaft 46 are supported in bearings 47 and they are cooled, as disclosed and claimed in my Patent No. 2,491,899, dated December 20, 1949. The shaft 46 extends through oppositely positioned openings 139 in the head section 41 of casing 38 to reach the separately housed bearings 47, and the totally enclosed character of the casing 38 is preserved by the shaft seals 53 which provide not only for rotation of shaft 46 but also movement thereof in a plane at right angles to its axis with respect to head section 41 of said casing 38.

The seal 53 includes casting or manifold 145 in the form of a ring which surrounds or circumscribes the shaft 46 and which at its inner end is provided with a stuffing box 146 including packing rings which cooperate with a steel sleeve 147 directly attached to the shaft 46 and in effect providing a renewable packing surface thereof which cooperates with the relatively stationary stuffing box 146. Adjacent the interior edge of the casting 145 which is adjacent the sleeve 147 there is a manifold ring 148 which is attached to the manifold or casting 145 and the interior circular edge of which is spaced slightly from the sleeve 147.

A conduit 149 is provided in the casting 145 and leads to the circumferential chamber 150 formed between the manifold ring 148 and said casting 145. Air, flue gas or other fluid may be introduced through conduit 149 into the chamber 150 which will flow inwardly into the casing 38 through the peripheral orifice formed adjacent the sleeve 147, thus removing and/or preventing the entry of grit, catalyst dust, or other foreign matter into the stuffing box 146, thereby preventing undue wearing of the sleeve 147 and the packing rings of the stuffing box 146. Sleeve 147 is of such length as to provide for expansion or contraction of shaft 46 relative to casing head 47 since it can slide axially relative to packing 146. This also provides for diametrical expansion and contraction of head section 41.

Adjacent its outer periphery the casting 145 is provided with a peripheral groove which receives an adjustable seal ring 151 which has contact in a vertical plane with a seat or seal ring 152 which is rigidly but removably attached to a ring-like plate 153 which effectively forms a part of the head section 41 of the casing 38, since it is welded thereto by a ring 155. Insulating material is preferably provided on the interior of ring 155 between the main plate of head section 41 and the above-mentioned plate 153 and extends to a frusto-conical plate 156 which defines the opening 139 and forms one supporting plate for the above-mentioned insulation.

The seat or seal ring 152 is clamped rigidly to the plate 153 and compresses a gasket against the plate 153, thus providing a removable but tight connection between said ring 152 and said plate 153. The clamping of these two members is effected by two half clamping rings 158 which are clamped by cooperating nuts and bolts 159. A clamp ring 160 also mounted on nuts and bolts 159 clamps the casting 145 to the seal ring 152.

with the previously mentioned seals 151 interposed, thus providing for relative sliding movement in an upright or vertical plane between the casting 145 and the seat or seal ring 152, thus allowing for the relative movement of the head section 41 of casing 38 in an upright plane or at right angles to the axis of shaft 46.

As previously mentioned, the casing 38 is made up of a plurality of vertically superposed and attached sections removably connected together by top and bottom flanges and is preferably provided with insulating material on its external surface. In the form of the elevator illustrated in Fig. 1, the major portion of the casing 38 is suspended and hangs downwardly along an upright axis from its single support adjacent the belt 42 near its top. It is guided at spaced intervals and held against lateral swinging by the guide or anti-sway means 45 which provide for its free expansion and contraction.

In the elevator 133 of Fig. 2 the single support is adjacent its bottom at the belt 142, the major portion thereof extending upwardly and being similarly guided by guides 45. As also previously mentioned, in the elevator 33 of Fig. 1 the bucket elevating mechanism is supported from head shaft 46 by superstructure 48 independently of the supporting of casing 38, while in the form of the elevator 133 of Fig. 2, bucket elevator mechanism 39 is supported directly from the casing 38, since the head shaft supporting framework 58 is supported through the skirt 60 from the casing 38. Except for these differences the two elevators 33 and 133 are of similar construction. This applies particularly to the bucket elevator mechanism which is the same in both cases as well as the feed chutes 32, observation windows 129, discharge chutes 56, guides 45, seals 53, and foot shaft 66 and all associated mechanism described particularly in Figs. 6 and 7 of the drawings.

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 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 including an elongated upstanding casing, said casing including means forming a circumferential supporting area adjacent its top, means including a circumferential skirt for supporting said supporting area forming means, said casing being supported at least largely from said supporting area forming means and extending therefrom vertically at least in one direction a substantial amount whereby it is free to expand and contract as a unit, guide means for said casing spaced vertically from said supporting area forming means and having guiding contact with said casing while providing for its free expansion and contraction as aforesaid, and elevator conveyer mechanism in said casing.

2. An elevator including an elongated upstanding casing, said casing including means forming a circumferential supporting area adjacent its bottom, means including a circumferential skirt for supporting said supporting area forming means, said casing being supported at least largely from said supporting area forming means and extending therefrom vertically at least in one direction a substantial amount whereby it is

free to expand and contract as a unit, guide means for said casing spaced vertically from said supporting area forming means and having guiding contact with said casing while providing for its free expansion and contraction as aforesaid, and elevator conveyer mechanism in said casing.

3. An elevator including an elongated upstanding casing, said casing including means forming a circumferential supporting area, means including a circumferential skirt for supporting said supporting area forming means, said casing being supported at least largely from said supporting area forming means and extending therefrom vertically at least in one direction a substantial amount whereby it is free to expand and contract as a unit, guide means for said casing spaced vertically from said supporting area forming means and having guiding contact with said casing while providing for its free expansion and contraction as aforesaid, and elevator conveyer mechanism in said casing.

4. An elevator including an elongated upstanding casing, said casing including means forming a circumferential supporting area, means for supporting said supporting area forming means, said casing being supported at least largely from said supporting area forming means and extending therefrom vertically at least in one direction a substantial amount whereby it is free to expand and contract as a unit, guide means for said casing spaced vertically from said supporting area forming means and having guiding contact with said casing while providing for its free expansion and contraction as aforesaid, and elevator conveyer mechanism in said casing.

5. An elevator including an elongated upstanding casing, means forming a supporting area adjacent the top of said casing, means supporting said supporting area forming means, with substantially the entire casing hanging downwardly therefrom and suspended thereby, an endless elevator conveyer within said casing including a head shaft, and means for supporting said endless conveyer including said head shaft independently of said casing.

6. An elevator including an elongated upstanding casing, means forming a supporting area adjacent the top of said casing, means supporting said supporting area forming means, with substantially the entire casing hanging downwardly therefrom and suspended thereby, an endless elevator conveyer within said casing including a head shaft, means for supporting said endless conveyer including said head shaft independently of said casing, and means providing a seal between said shaft and said casing, said shaft projecting through said casing.

7. An elongated conveyer casing adapted to be supported for expansion and contraction in an upright position including a circumferential supporting ring, means supporting said ring, said casing being supported upright substantially entirely from said ring, and vertically spaced guides for said casing providing for free expansion thereof while holding it against lateral movement.

8. An elevator for elevating hot material including endless draft means, a head shaft supporting said draft means, a foot shaft, a floating frame carrying bearings supporting said foot shaft, a casing totally enclosing said draft means, said foot shaft and said bearings, bearing means outside said casing for said head shaft, and indicator means for said foot shaft located in part

11

outside said casing and showing its height relative to said casing.

9. An elevator for elevating hot material including endless draft means, a head shaft supporting said draft means, a foot shaft, a floating frame carrying bearings supporting said foot shaft, a casing totally enclosing said draft means, said foot shaft and said bearings, and bearing means outside said casing for said head shaft.

10. An elevator including an upstanding casing having a head section, means supporting said casing, conveyer mechanism in said casing including a head shaft extending therethrough, means supporting said head shaft independently of said casing, and a sliding seal between said head shaft and casing providing for relative movement between them along rectilinear paths at right angles to the axis of said head shaft.

11. In an elevator including an upstanding casing, means supporting said casing adjacent its top with the casing hanging downwardly therefrom and suspended thereby, said supporting means including a frusto-conical skirt means surrounding said casing and carrying it through one of its ends, structure supporting said skirt means through the other of its ends, and anti-sway means for said casing spaced below said skirt for restricting swinging movement of said casing.

12

12. In an elevator including an upstanding casing, means supporting said casing including a skirt means surrounding said casing and carrying it through one of its ends, structure supporting said skirt means through the other of its ends, and anti-sway means for said casing spaced from said skirt for restricting swinging movement of said casing.

13. In an elevator including an upstanding casing, means supporting substantially the entire weight of said casing in a horizontal plane whereby said casing hangs therefrom along an upright axis, and anti-sway means for said casing spaced from said supporting means for restricting swinging movement of said casing.

STANLEY M. MERCIER.

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