March 12, 1940. C. H. COVEY 2,193,714

SILO AND SILO PARTS

Filed April 18, 1939 2 Sheets-Sheet 1

Fig. 1.

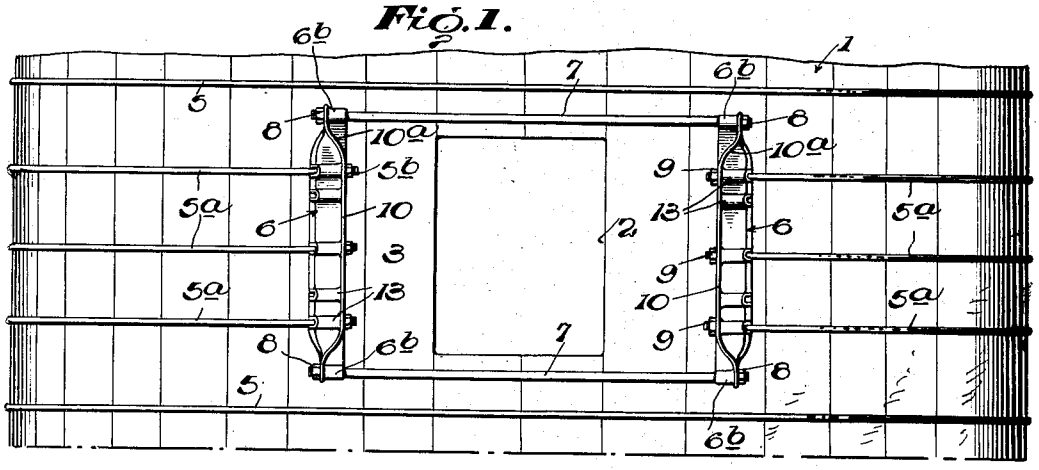


Fig. 2.

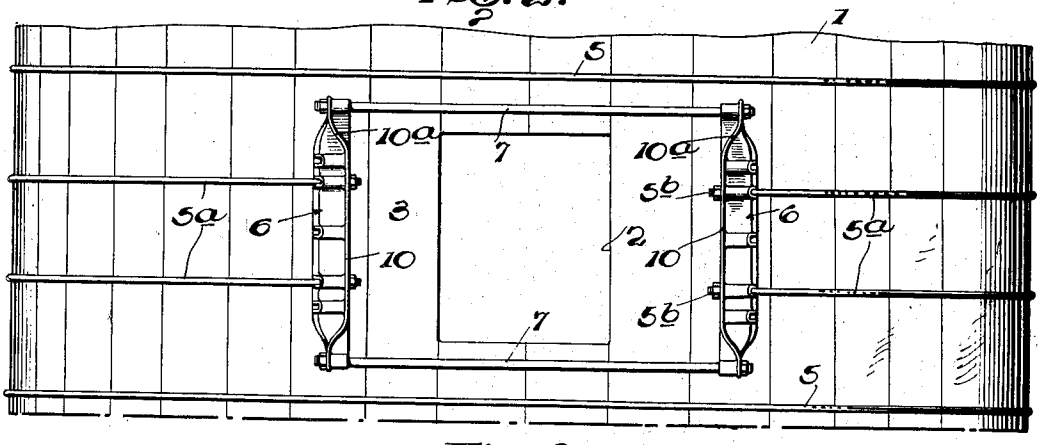
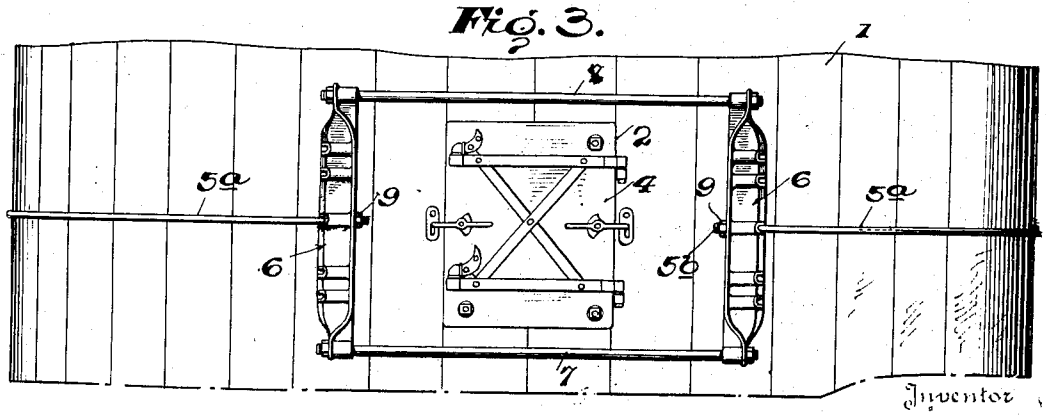


Fig. 3.



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Filed April 18, 1939 2 Sheets-Sheet 2

Fig. 4.

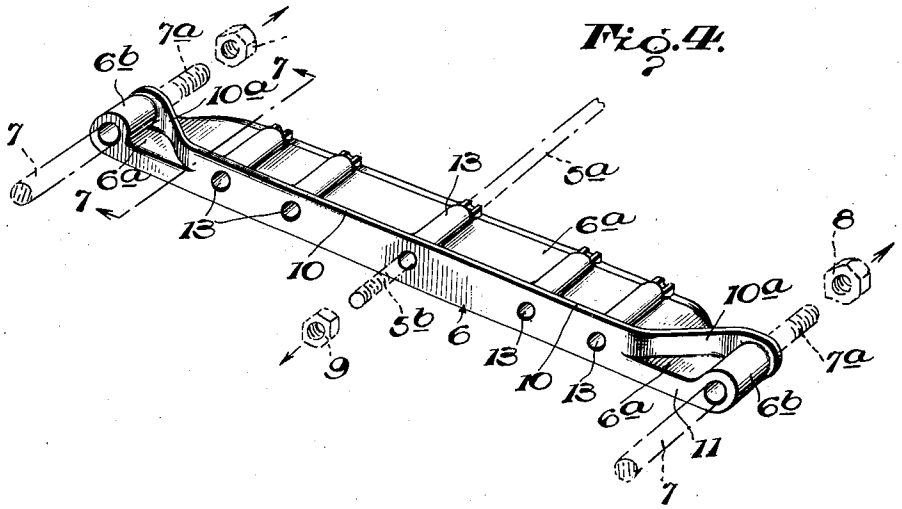


Fig. 5.

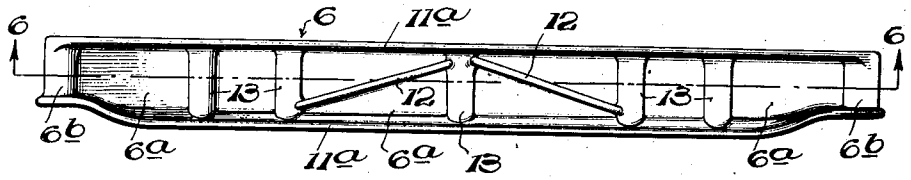


Fig. 6.

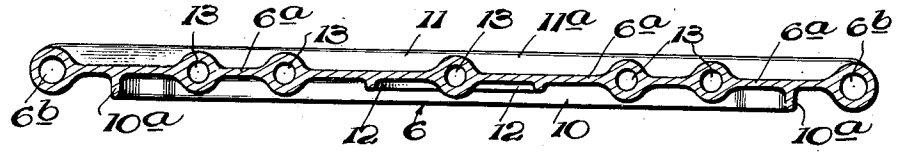
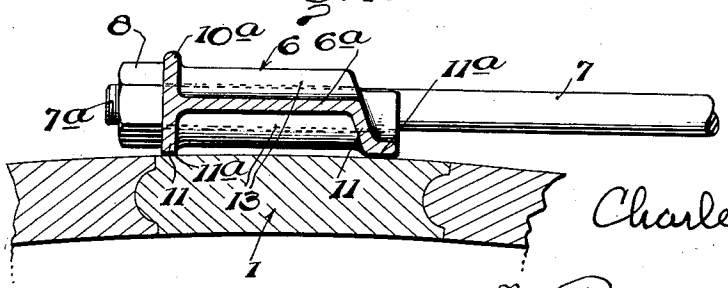


Fig. 7.



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Patented Mar. 12, 1940 2,193,714

UNITED STATES PATENT OFFICE

2,193,714

SILO AND SILO PARTS

Charles H. Covey, Marietta, Ohio, assignor to Marietta Concrete Corporation, Marietta, Ohio, a corporation of Ohio

Application April 18, 1939, Serial No. 268,615

11 Claims. (Cl. 72—6)

This invention relates to silos and silo parts, and the objects and nature of the invention will be understood by those skilled in the art, in the light of the following explanations of a preferred mechanical expression or embodiment of the invention, illustrated by the accompanying drawings, from among other forms and structures within the spirit and scope of the invention.

The invention particularly concerns built up silos and other built up substantially encircling wall structures that in use may be subjected to excessive and other internal lateral pressures tending to unduly expand such walls and render them permeable to air or moisture or to open up fissures or cracks in such walls or to break or damage the sealed joints between the staves, sections or blocks making such walls, and the hooping or banding for such walls designed to maintain the same against such expanding pressures, and also designed to avoid traversing or obstructing certain areas of such walls, such as door, window or other openings therein.

Wall structures of the character above identified and the hooping therefor, in so far as now known to me, still present difficulties constituting a serious problem, in that such walls do not under all conditions provide means that will economically and successfully maintain and hold such built-up walls particularly the lower portions thereof, against such damage by excessive internal lateral pressures, such as are sometimes generated in silos under certain conditions when loaded with ensilage particularly certain types of feed, and under certain high wind pressures.

It is an object of this invention to provide comparatively simple economical means to maintain such built-up walls against such damage under such internal lateral pressures and under external wind pressures.

A further object of the invention is to provide an enclosing wall structure such as a silo with improved banding or hooping means designed against such distortion or yielding of parts under wall expanding pressures as will permit relative dangerous expansion of the overall diameter of the hooping.

A further object of the invention is to provide spreader or manifold bars of improved advantageous characteristics, in or for hooping for silos and the like.

With the foregoing and other objects in view, as developed by the following explanation, the invention consists in certain novel structural features, and elements and in combinations and arrangements as more fully hereinafter described and specified by the appended claims.

Referring to the accompanying drawings, forming part hereof:

Fig. 1 shows in front elevation the encircling wall of a silo, in part, with looping or offsetting means of my invention connecting three exterior encircling hoops around the silo, the opening through the wall of the silo being unobstructed, the door being swung to inward open position.

Fig. 2 is a similar view showing means of my instant invention looping or offsetting two hoops around the door opening.

Fig. 3 is a similar view showing an embodiment of my invention looping or offsetting one silo hoop around the door opening, in this view the door being shown in closed position.

Fig. 4 is a perspective view of the spreader bar, broken away dotted lines indicating the tie rods with their nuts separated therefrom and a hoop end with its nuts separated therefrom.

Fig. 5 is a bottom plan of the spreader bar.

Fig. 6 is a longitudinal section taken in the plane of the line 6—6, Fig. 5.

Fig. 7 is a detailed view showing a portion of the silo wall in horizontal section, and showing in part a tie rod, and also showing a spreader bar in cross section along the line 7—7, Fig. 4.

As an example of a built-up encircling wall structure to which my invention can be adapted to produce a completed organization within the spirit of my invention, the drawings disclose in part, a substantially cylindrical silo of the built-up wall type shown by U. S. Patent No. 1,882,942, issued October 18, 1932, to Marietta Concrete Corporation, Marietta, Ohio, as assignee. Reference is made to said patent for details of the built-up enclosing wall disclosed, if necessary, where not described herein, without hereby intending to so limit the instant invention.

In the drawings, the wall 1, is a part of the substantially cylindrical wall of a vertical silo or equivalent structure, built-up in situ on and rising from a permanent strong foundation, and usually firmly anchored against tilting. This wall 1, is usually built-up from concrete staves, or other suitable blocks, or sections, course by course with the staves of each course interlocking and staves of the courses interlocking, with all joints between the staves and courses cemented or otherwise sealed to provide air and liquid tight joints to produce a wall that is tight against permeation by air and moisture particularly where vegetable matter is to be stored in the structure and subject

to fermentation in the formation of cattle feed or ensilage.

For well known purposes, this encircling wall 1, is formed with a vertical series of door or window openings 2, provided for, if so desired, by a vertical series of open-frame blocks 3, laid one on the other, and included and sealed in said wall as blocks or sections thereof, to form an integral part of the wall structure, and provide annular vertical frames for said openings. These frames can be previously molded of concrete or of any other suitable construction or material, for inclusion in said wall as the wall is built up course by course.

The instant invention, however, is not restricted to the provision of a vertical series of permanent door frames to provide separate door openings, as other provisions can be made to provide the openings required.

Any suitable means are provided for opening and closing said openings. For instance, doors 4, are shown for this purpose. Means are provided for tightly closing these doors to seal the openings into the silo, when necessary, against air and moisture leakage.

The encircling silo wall 1 is exteriorly surrounded by a vertical series of strong encircling metal hoops or bands 5, 5*a*, spaced apart vertically, with the series extending approximately from bottom to top of the silo. Each such hoop includes screw threaded couplings for the purpose of tightening or contracting the hoop around the wall to maintain the same under the desired tension to resist expansion of the wall, and to permit removal of any hoop for replacement or repair.

During erection of the silo wall, each horizontal encircling course of staves or blocks is hooped when completed, so that the hoops are applied course by course, but the hoops thus successively applied during wall erection, are usually screwed up to merely snugly surround the wall, but are not finally screwed up or tightened to their final tightness and rigid tension until the silo wall has been fully erected.

There is always the possibility that excessive lateral pressures will be generated in a silo, particularly where cut-up vegetable matter of high moisture content, such as hay among others, for instance, is being processed and fermented therein. These pressures are sometimes sufficiently high in their lateral expanding action on the silo wall, to tend to so expand and damage the same by rendering such wall at some line or point permeable to air or moisture, particularly where the wall is built up, as the slightest hair line crack or fissure in a sealed joint, will permit entrance of air or gas or seepage of liquids that will finally result in disintegration at the damaged joint. The highest internal lateral pressures occur at the lower portion of the silo wall, say from the base or foundation upwardly for ten or fifteen feet or thereabouts.

The vertical spacings of the surrounding hoops are usually varied throughout the length of the silo, to accord with the different lateral expanding pressures to which different vertical portions of such wall may be subjected. For instance, as a mere example, with a silo, built up of concrete staves, approximately twenty feet in diameter and thirty-five feet in vertical length, for the first approximately ten feet from the base, hoops will be spaced about seven and a half inches apart, more or less, the next approximately ten feet upwardly, the hoops will be spaced apart about ten inches more or less, for the next approximately ten feet upwardly the hoops will be spaced apart about fifteen inches more or less, and for the approximately top five feet the hoops will be spaced apart about thirty inches more or less. Obviously, I do not wish to limit my invention to any such formula or arrangement.

The problem of providing the silo throughout with hooping of such wall restraining strength and non-yielding and non-expansible characteristics, as to successfully hold such wall against damaging movements and/or expansion under excessive internal lateral pressures, is complicated by the presence in said wall of the vertical opening or openings. These openings necessitate the provision of means for looping or laterally offsetting certain hoops around said opening or openings to avoid obstructing said opening or openings against discharge of ensilage therefrom or against the convenient passage of the workman therethrough.

The silo hooping difficulties not heretofore solved, to the best of my information and belief, were the result of the distortable yielding non-positive character of the offset or looping means heretofore employed for carrying certain hoops around said openings, to avoid obstruction thereof.

In other words, such looping or offsetting means heretofore employed in completing the circles of certain silo hoops, permitted expansion or stretching under high internal lateral pressures in the silo that tended to expand or bulge the silo wall.

If for instance, it is assumed that each side opening of the silo, that must not be obstructed by hooping, is something on the order of thirty inches in vertical length, it will be noted that in the high pressure lower portion or section of the silo wall where the hoops are more closely spaced, say on the order of seven and a half inches apart, that several hoops will be located in the horizontal plane of the silo that includes an opening located in said high pressure lower portion, and that means must be provided to complete the circles of these hoops while bridging, offsetting or looping them around the window or door. It is assumed that three hoops 5*a*, spaced about seven and one-half inches apart, must be thus bridged around said opening to avoid obstructing the same. Such a side opening in that section of the silo wall where the hoops are spaced say on the order of about ten inches apart, will be located in a horizontal plane that includes say two hoops 5*a*, that must be bridged around said opening.

While each opening in the upper low pressure sections of the silo wall, may each require, means to bridge but one hoop 5*a*, around the opening.

The strong encircling contractile hoops 5, that fall in horizontal planes between the side openings in the silo wall, and above the topmost opening and below the lowermost opening, are continued unbroken around the silo including their coupling lugs and screw threaded connections, of the usual or other suitable construction, whereby such hoops can be adjusted to maintain the same under the desired tension around the wall. I have solved said problem of bridging one or more hoops 5*a*, around a side opening in the silo wall, to avoid obstructing such opening, while maintaining such hoop against yielding or loosening under excessive expanding pressures, and have found an embodiment of the solution successful in actual silo practice. This embodiment of my invention, generally comprises a pair of usually similar spreader bars 6, of somewhat

greater length than the vertical length of the silo side opening portion around which the banding or hooping is to be bridged or looped, with these bars 6, in use, adapted to be vertically arranged loosely or slidably on the wall surfaces at opposite sides of and usually spaced laterally from the opposite vertical boundaries of such opening, with the spaced opposing ends 5*b*, of each hoop 5*a*, that is to be bridged around the opening adapted to be preferably detachably and adjustably united to said bars 6, against give or yielding under pressure, by screw threaded connections, in such manner that one end 5*b*, of each hoop 5*a* will be normally fixed to an intermediate portion of the length of the bar 6, on that side of the wall opening, and the opposing end 5*b*, of each such hoop 5*a*, will be normally fixed to a corresponding intermediate portion of the complementary bar 6, on the other side of such opening. The length or longitudinal axis of each hoop end 5*a*, will thus be perpendicular to the longitudinal axis of each spreader bar 6, with the hoop ends 5*a*, secured to the bars against yield preferably by independent screw threaded connections whereby the hoops can be tightened and tensioned, as well as detached. The bridge around the opening is completed by separate strong upper and lower cross tie rods 7, arranged above and below the wall opening, and rigidly uniting the projecting upper and unthreaded ends of the spreader bars preferably through the medium of screw threaded connections whereby the tie rods are rendered detachable from and applicable to the spreader bars, and whereby the hoops secured to the spreader bars can be tightened and put under tension or loosened, as more fully explained hereinafter. In this example, the longitudinal axes of the separate tie rods are perpendicular to the longitudinal axes of the separable spreader bars, and means are provided for drawing the spreader bars toward each other longitudinally of the tie rods for tightening the hoops secured to the spreader bars, as when finally tensioning and setting said hoops, after assembly and completion of the silo.

The spreader bars and the tie rods bear against the adjacent surfaces of the silo wall and are slidable along said surfaces when adjusted, but are otherwise free from and are not anchored to or in the concrete or other material of the silo wall, and do not tend to damage or disintegrate said wall.

I have discovered that the difficulties with the means heretofore employed with which I am familiar, for looping the hooping around openings in the silo walls, resulted from the yielding or distortion of looping parts or connections, under excessive internal expanding pressures within the silo walls and transmitted therefrom to the hooping and the looping included therein. These difficulties have been overcome by including in my organization hereinbefore generally outlined, spreader bars that are rigid, non-flexible, non-yielding, non-distortable, and non-springable, in the directions of strains and stresses exerted thereon through the medium of the hoops and the tie rods secured thereto. The problem of producing such rigid non-yielding spreader was rendered difficult by the necessity of maintaining low production cost, and minimum weight and size. Silos are sold under conditions of intense competition and low building and assembly costs are essential, and silo requirements limit the outward projection of hooping parts adjacent to door openings. To meet these various conditions, I have produced a spreader bar 6, that is trussed against such distortion, bending, or yielding by trussing formations and arrangements that are integral with and constitute portions of the one-piece bar, and this bar is of minimum weight relative to its length and transverse width and of minimum thickness and hence constitutes a minimum outward projection from the silo wall against which it rests. These bars 6, are usually alike and hence can be produced from a single mold, if cast, or by the same dies if forged or otherwise formed, with a minimum quantity of metal relative to the rigidity of the bar.

When the hoops, spreader bars and tie rods are assembled on the silo, the pull of the tie rods 7, on the ends of a spreader bar 6, is in one direction transversely of the width of such bar, while the pull of the hoop or hoops attached to the intermediate portion of the bar is in the opposite direction transversely of the bar width, and said bars are peculiarly trussed to overcome such tendency to bow, flex, or distort each bar transversely.

In the embodiment illustrated as an example, the elongated bar 6, is relatively wide in the plane of the stresses or pull to which the bar is subjected when assembled with the tie rods and hoops, while the bar is otherwise relatively thin. The bar embodies a wide comparatively thin longitudinally elongated body plate or web 6*a*, that, in certain respects, is comparatively flat. This web 6*a*, extends approximately throughout the full length of the bar, and at its ends merges into or is integral with the two transverse strong rigid somewhat elongated eyes or tubes 6*b*, respectively. These transverse tubes form the rigid ends of the spreader bar and are of more or less massive strong formation, for attaching the tie rods to the bar ends. In other words, the opposite ends 7*a*, of each heavy strong tie rod, are preferably longitudinally screw threaded for a substantial distance, as by the rolling or displacement method to gain strength. These elongated threaded ends 7*a*, usually removably pass longitudinally through the end transverse tubes 6*b*, of a pair of spreader bars, and project outwardly therefrom.

Complementary screw threaded nuts 8, are applied to said projecting threaded ends of the tie rods 7, and screwed up thereon into engagement with the usually enlarged nut seats formed by the outer ends of said tubes 6*b*, forcing the tubes 6*b*, along the tie rods until the desired hoop tension and tightness is attained.

In the particular example shown, the two separated front ends 5*b*, of each hoop 5*a*, are longitudinally screw threaded for a substantial distance, preferably by the rolling or displacement method to gain strength, to receive complementary screw threaded nuts 9, after the hoop ends 5*b*, have been inserted transversely through the spreader bars, respectively, with said ends projecting inwardly from the inner longitudinal edge portions of said bars as distinguished from the tie rod ends which project outwardly from the opposite or outer longitudinal edge portions of the bars. The nuts 9, are then applied to the projecting hoop ends and screwed up thereon to seat against said inner longitudinal edge portions of the bars.

Each spreader bar is trussed against flexing, distorting, or springing laterally or transversely in a plane or planes of the tie rods and hoop, at either end or from an intermediate portion, by an

unbroken longitudinal trussing flange 10, extending substantially throughout the length of the bar and integral therewith and rising preferably from the outer side face of the bar, and of sturdy formation, i. e., of substantial width and elevation to gain strength and rigidity in trussing the bar ends against lateral yielding or movements with respect to the bar intermediate portion, and vice versa.

The flange 10, is preferably substantially straight throughout the major portion of its length, and there rises from the longitudinal inner margin or edge portion of the bar, almost throughout the length of the bar.

The opposite end portions 10a, of the trussing flange 10, are carried laterally and outwardly across the face of the outer end portions of the body web 6a, on inclined or curved lines from the inner longitudinal margin of the bar to the outer longitudinal margin of the bar, and preferably extend across the outer ends of tubes 6b, to brace the bar ends and form nut abutments at the outer ends of the tubes.

In the particular example illustrated, the inner side of the bar 6, that seats against the surface of the silo wall, is formed with integral depending opposite longitudinal marginal stiffening flanges 11, extending longitudinally throughout the length of the bar from one end transverse tube 6b, to the other and merging into the ends of said tubes. If so desired, the longitudinal free edges 11a, of said flanges can be located in a common longitudinal plane to contact with the outer surface of the silo wall.

If so desired, the inner side face of the body web 6a, can be formed with integral oppositely inclined trussing ribs 12, extending transversely across said face substantially from one longitudinal marginal flange to the other, to brace said body web against flexing.

The spreader bar provides means for operatively applying a hoop end thereto, preparatory to applying the hoop tightening and securing nut to the hoop end and seating or abutting the nut against the longitudinal inner edge margin of the bar. In this example, the bar is provided for receiving any number of hoop ends that may be required at any door opening of a standard silo. For instance, I show, the bar provided with several spaced tubular portions 13, extending transversely through the full width of the bar and open at their ends through both longitudinal margins of that major portion of the length of the bar, located between the inclined crossing ends 10a, of the trussing flange 10, on the outer side face of the bar.

The spreader bar can be formed with one integral tubular portion 13, to receive a hoop end, or with several of such portions, with each such portion extending transversely through the full width of the bar and its opposite longitudinal marginal edges, and located substantially centrally or midway between the outer and inner side faces of the bar.

In the particular example illustrated, I show the bar formed with five identical parallel transverse tubular portions 13, spaced apart varying distances, one of said tubular portions 13, being located midway between the two transverse end tubes 6b, and centrally between a pair of such tubular portions 13, spaced say, about ten inches apart, and centrally between another pair of said tubular portions spaced, say, about fifteen inches apart. However, I do not wish to so limit all features of my invention.

By substantially this arrangement, however, a spreader bar is provided, that is universal, for employment at substantially all silo side openings where it is necessary to loop hooping around such openings. It will be noted, that this bar will accommodate several hoops located about seven and one-half inches apart, as well as hoops located about ten inches apart, and also a hoop where the hoop spacing is about fifteen inches, with the stress of the hoops uniformly distributed between the end tubes 6a.

These tubular portions 13, integral with the bar, are so formed and arranged therein, as to constitute an important trussing and stiffening provision, against transverse distortion, bending or yielding of the bar, independent of the truss flange 10, due to strength and stiffening action of a rigid wall hollow cylinder.

Each tubular portion 13, forms a rigid wall cylinder bisected by and integral with and transversely interrupting the relatively thin body web 6a, with the ends of the cylinder merging into and opening through the opposite longitudinal marginal flanges of the bar.

The parallel longitudinal axes of the end tubes 6b, and the several tubular portions 13, are all substantially located in a common plane that substantially includes the longitudinal axis of the bar.

The peculiar formations of the body web 6a, and the tubular portions 13, are such that the web is transversely interrupted by each portion 13, with a semi-cylinder of each portion 13, rising from the level of and extending across one side of the web, and the complementary other semi-cylinder of said portion 13, rising from the level of and extending across the opposite side of said web. These rigid hollow transverse cylinders traversing and integral with the bar, are an assurance against the objectionable distortion, bending, or yielding of the bar.

It will be understood, that I do not wish to limit all features of my invention, to the employment of screw threaded connections at both ends of each tie rod, and/or at both free or separated front ends of each hoop 5a, for operatively connecting such tie rods and hoop ends to either or both spreader bars.

The foregoing descriptions of the elements, arrangement, and organization illustrated are made for purposes of explanation and not for purposes of limitation except where so required by the following claims.

What I claim is:

1. An encircling built-up wall structure having a side opening through said wall; and a longitudinal series of spaced hoops exteriorly surrounding said wall, including hooping in a transverse plane that intersects said opening, said hooping having ends terminating at opposite sides of said opening, and means for connecting said hoop ends around said opening, said means embodying a pair of separate spreader bars each trussed against transverse distortion or bending, said bars being arranged longitudinally of said wall at opposite sides of and relatively long with respect to the longitudinal length of said opening, each bar formed with opposite end transverse tubular portions, separate upper and lower straight cross tie rods adapted to said opposite end transverse tubular portions with said rods extending transversely between said bars, screw threaded connections for adjustably and removably confining said end tubular portions on said tie rods, and screw threaded connections between said hooping ends

and intermediate portions of the spreader bars, respectively.

2. An enclosing wall structure of the type substantially as described provided with a side opening through the wall thereof, and means for offsetting or looping exterior surrounding hooping around said opening, including an exterior wall restraining hoop having free ends terminating at opposite sides of said opening, substantially similar elongated rigid spreader bars vertically arranged longitudinally of and slidable on the wall surface at opposite sides of said opening, said hoop ends being operatively secured to intermediate portions of said bars, and separate transverse tie means arranged above and below said opening and extending between the upper ends, and the lower ends of said bars, respectively, with the longitudinal axes of said tie means perpendicular to the longitudinal axes of said bars, and adjustable means for operatively coupling said bar ends to said tie means and for adjusting said bars longitudinally of said tie means to tension and/or loosen said hoops.

3. An enclosing wall of the type substantially as described, having a side opening therethrough; and exterior wall restraining hooping including a hoop having separated ends terminating at opposite sides of said opening, a longitudinally elongated spreader bar longitudinally arranged on and laterally slidably engaging the surface of said wall at one side of said opening and having the adjacent hoop end extending transversely of said bar and operatively secured thereto, a substantially similar spreader bar having the other and adjacent end of the hoop operatively secured thereto, a cross tie rod arranged above said opening and connecting the upper ends of said bars, another cross tie rod arranged below said opening and connecting the lower ends of said bars, the ends of said rods passing transversely through said bar ends to render said bars slidable laterally longitudinally of said rod ends, and nuts on said rod ends having longitudinal screw threaded connections therewith and confining said bar ends on said tie rods.

4. A silo wall of the type substantially as described, including several laterally-spaced exterior wall-restraining hoops, each having separated longitudinally screw threaded ends, a pair of widely separated parallel substantially-straight elongated spreader bars, each trussed against lateral flexing, said bars being longitudinally-arranged on said wall in lateral sliding engagement therewith, each of said screw threaded ends being slidably and removably extended transversely through the spreader bar adjacent thereto, screw-threaded removable nuts on said threaded ends confining the hoop ends against outward separation from said bars, the opposite ends of each bar having transverse tubular portions rigid therewith, a tie rod connecting the upper ends of said bars and extending loosely through the tubular portions thereof, and provided with removable and longitudinal adjustable stop means for confining said bar ends to and adjusting the same on said rod, and another tie rod extending loosely through the lower tubular portions of said bars, and also provided with removable and longitudinally adjustable stop means to confine said bar portions on and to adjust the same longitudinally of said lower rod.

5. A built-up enclosing wall of the type substantially as described, having a vertical series of side openings through the wall; and series of variously spaced hoops surrounding said wall; a series of substantially identical means at each of said openings for looping hoops around such opening, each of such means including a pair of substantially-similar substantially straight longitudinally elongated rigid one-piece spreader bars trussed against transverse flexing or bending and each formed at its opposite ends with rigid transverse tubes and at its intermediate portion between its ends with a central and variously-spaced rigid tubular portions extending transversely therethrough for the passage and securing of the ends of the hoops to be looped around the openings, and a pair of upper and lower tie rods extending outwardly through said end tubes of the bars, and means adjustably confining said end tubes on said tie rods.

6. Silo hooping comprising hoops having separated spaced ends, a pair of substantially-straight longitudinally-elongated substantially-identical spreader bars rigid against transverse flexing or bending, at their opposite end extremities formed for mounting on and longitudinal sliding along tie rods, and each at its portion intermediate said extremities formed with parallel spaced tubular portions extending transversely therethrough, for extension of said hoop ends therethrough and the operative securing thereof; and upper and lower cross tie rods, having adjustable stops, for connecting together the upper and lower ends of said bars against separating movements.

7. A longitudinally-elongated substantially-straight spreader bar for use in silo and other hooping, said bar being rigid against transverse flexing, and provided with a laterally-projecting trussing flange throughout the major portion of its length located along the inner longitudinal marginal portion of the bar intermediate the bar ends, and at its opposite ends extending transversely across the bar to the opposite outer marginal longitudinal edge of the bar ends, said bar formed at its opposite ends with rigid transverse tubular portions to receive connecting tie rods and their bar and hoop tensioning means, said bar at its intermediate portion provided with tubular transverse passages to receive hoop ends and their stops.

8. A spreader bar for use in looping split hoops around silo side openings, and the like, said bar being longitudinally elongated and formed in one piece and having at its opposite ends transverse passages to receive tie rods connecting a pair of said bars located at opposite sides of said opening and provided with longitudinally adjusting outer end stops, said bar embodying a relatively-thin substantially central longitudinal body web and longitudinal marginal flanges at the opposite faces of said web and trussing said bar against transverse flexing or bending; said bar also formed with rigid-wall aproximately cylindrical tubular portions at their opposite ends opening through said marginal flanges, and extending transversely through said bar and across said web and included therein, the hoop ends adapted to be extended through said transverse tubular portions with their securing stops or nuts abutting the inner longitudinal edge margin of the bar.

9. A spreader bar for use in hooping for silos and the like, said bar being elongated with an inner side face to contact and slide laterally on the silo wall surface, said bar being flanged and rigid against transverse flexing and having opposite and transverse rigid portions to receive connecting cross tie rods and their outer end stops, and having rigid-wall tubular portions extending

transversely through the bar between the ends thereof for the passage of hoop ends and to receive the end stops on said hoop ends, at the inner marginal edge of the bar, said tubular portions including one located centrally between the bar ends, and tubular portions located between both bar ends and said central portion and providing several pairs of tubular portions of different predetermined spacings.

10. A substantially-straight longitudinally-elongated spreader bar stiffened by longitudinal flanges and provided at its ends with transverse passages to receive and render the bar longitudinally slidable on tie rods having end stops to abut the bar ends, said bar intermediate its said ends formed with one or more bar-stiffening rigid-wall hoop-end-receiving tubular portions extending transversely through said bar.

11. A logitudinally-elongated transversely-wide relatively thin spreader bar formed at its opposite ends for the transverse passage of tie rods therethrough, with stop abutments at the outer marginal portions of said ends, said bar between said ends being formed for the transverse passage of hooping therethrough, and providing a stop abutment substantially at the inner marginal portion of said bar, said bar provided with an integral trussing flange at the major portion of its length extending longitudinally of substantially the inner marginal portion of said bar and from thence extending across the end portions of the bar substantially to and along the outer marginal portions of the bar ends.

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