C. A. LYONS.

ANCHORING SYSTEM FOR SILOS.

APPLICATION FILED OCT. 31, 1913.

1,175,159.

Patented Mar. 14, 1916.

2 SHEETS—SHEET 1.

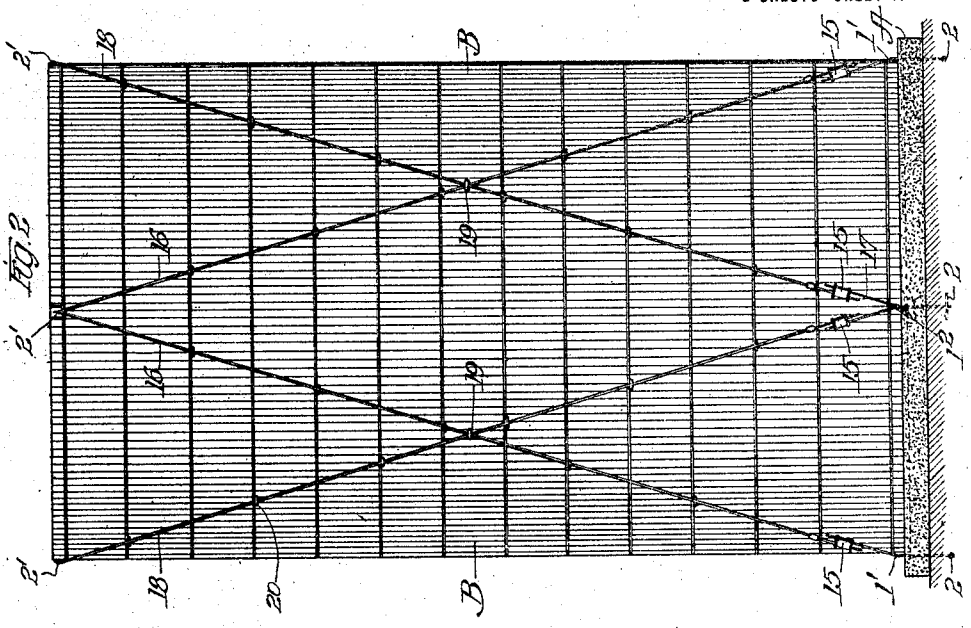


Fig. 2

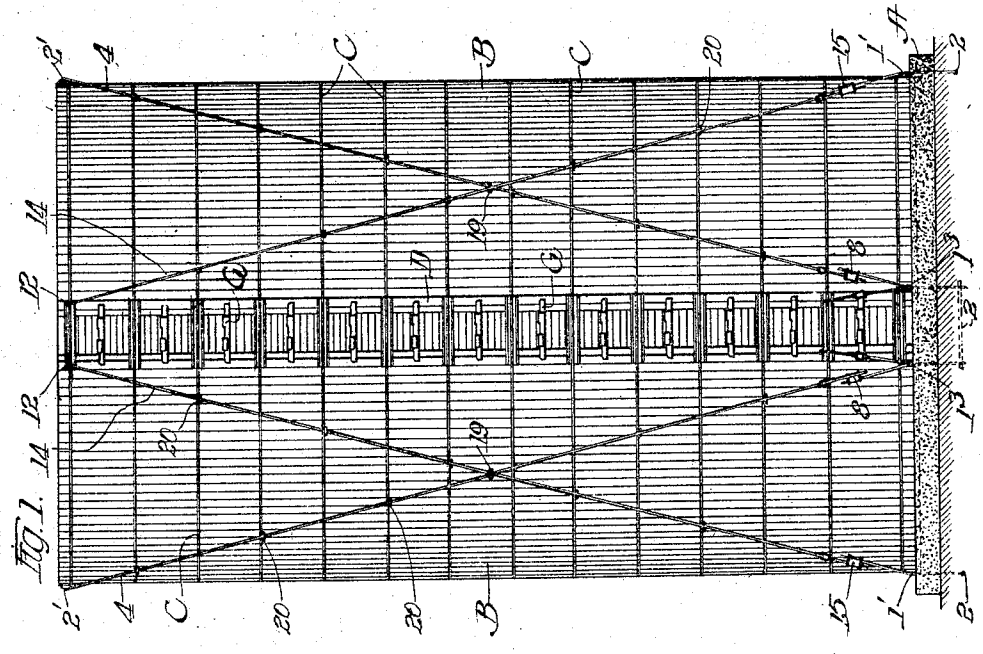


Fig. 1

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2 SHEETS—SHEET 2.

Fig. 5.

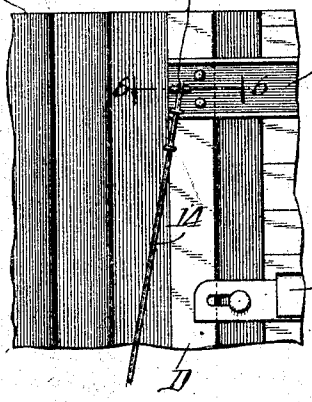


Fig. 7.

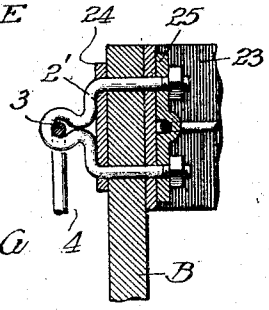


Fig. 8.

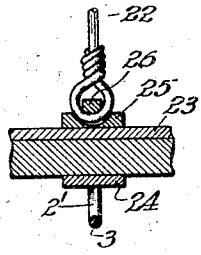


Fig. 4.

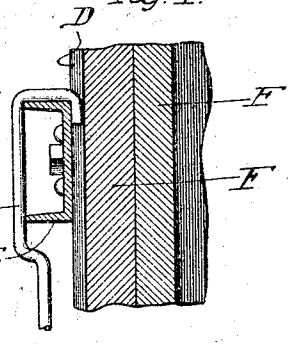


Fig. 6.

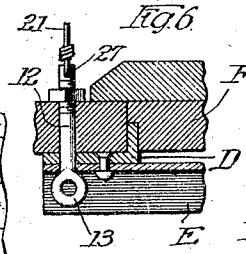


Fig. 3.

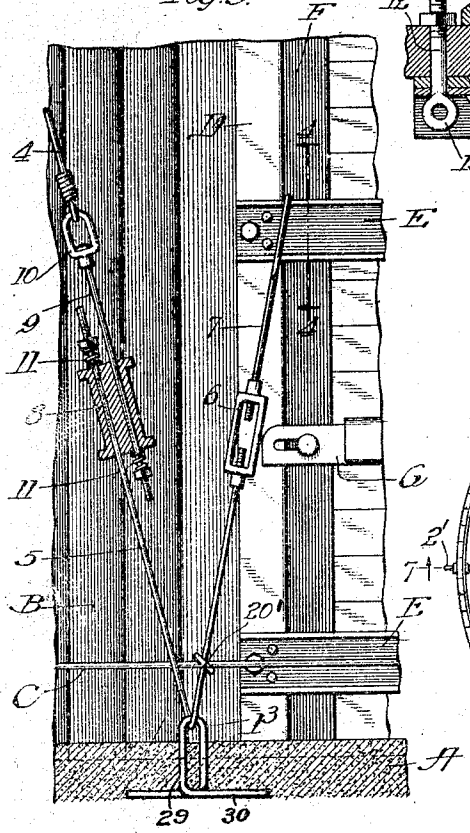
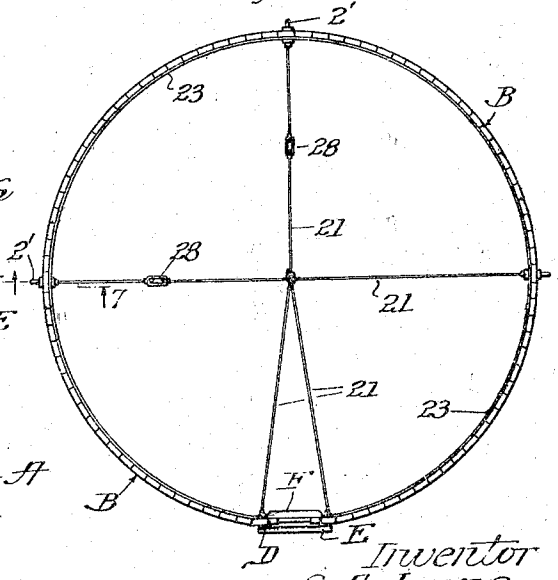


Fig. 9.



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UNITED STATES PATENT OFFICE.

CHARLES A. LYONS, OF DES MOINES, IOWA, ASSIGNOR TO WESTERN SILO COMPANY, LIMITED, OF DES MOINES, IOWA, A CORPORATION.

ANCHORING SYSTEM FOR SILOS.

1,175,159. Specification of Letters Patent. Patented Mar. 14, 1916.

Application filed October 31, 1913. Serial No. 798,413.

To all whom it may concern:

Be it known that I, CHARLES A. LYONS, a citizen of the United States, residing at Des Moines, in the county of Polk and State of Iowa, have invented new and useful Improvements in Anchoring Systems for Silos, of which the following is a specification.

The present invention comprehends improvements in silos and relates more particularly to an anchoring system for silos of the knock-down frame construction.

Silos of the knock-down frame construction are often blown over or collapsed, due to the warping of the staves and it is an object of the present invention to provide means for anchoring the silo to its foundation to overcome these disabilities and thereby insuring the stability of the structure.

Another object of the present invention is to provide a connection between the anchoring system and the silo which will prevent the anchoring system from pulling the staves of the silo frame apart and thus preventing the collapse of the silo.

A further object of the present invention is to provide a system of the character aforesaid, which may be readily applied to or detached from the silo and which may be folded in a small package, thereby taking up a small amount of space when shipping the same from the factory to the consumer.

Another object of the present invention is to supply a readily adjustable anchoring system for silos which will be strong, durable and efficient when in use and comparatively cheap in the cost of manufacture, thereby rendering the same commercially desirable.

With the above and other objects in view, the invention consists of the novel features of construction, combination, formation and arrangement of parts as will be hereinafter more fully described and particularly pointed out in the appended claims.

In the accompanying drawings has been illustrated the simple and preferred form of the invention, it being understood, however, that no limitation is necessarily made to the precise structural details therein exhibited, but the right is reserved to make changes in the formation and arrangement of parts without departing from the spirit thereof or sacrificing the efficiency of the same.

In the drawings: Figure 1 is a front elevation of a silo having its top removed and illustrating my invention as applied thereto. Fig. 2 is a rear elevation of the same. Fig. 3 is an enlarged detail of the anchoring system as applied to the silo. Fig. 4 is a detail sectional view taken on the line 4—4 of Fig. 3. Fig. 5 is a detail elevation of one connection between the binding tie and the upper end of the silo. Fig. 6 is a detail horizontal section on the line 6—6 of Fig. 5. Fig. 7 is a detail sectional view taken on the line 7—7 of Fig. 9 through the upper end of the silo illustrating another connection between the silo and the binding ties. Fig. 8 is a detail horizontal section of the same, and Fig. 9 is a plan view of the silo illustrating means for reinforcing the upper end thereof.

Reference now being had to the accompanying drawings wherein one embodiment of the present invention is disclosed, the letter A indicates a concrete base or foundation upon which is adapted to rest the silo B. The silo B comprises a plurality of staves each being connected by tongue and groove connections forming a tubular structure having hoops C encircling the outer periphery thereof in the usual manner. A door frame is mounted within the silo which comprises a pair of vertical angle irons D being connected by transverse channel bars E and a plurality of doors F are adapted to rest within the door-way of the door-frame and held in place by means of the latches G as shown. In building silos of this knock-down frame construction a base A of concrete is first formed having an annular groove within the upper face thereof and in which is adapted to rest the lower ends of the staves of the silo frame. After the foundation has been completed, the door-frame is then placed in position and subsequently the staves are built onto the frame and connected together to form the usual circular structure. The hoops C are then placed around the silo to form a rigid structure and thence, a top (not shown) may be placed upon the silo.

As stated in the beginning of the specification, it is an object of the present invention to provide means for preventing silos from being blown or otherwise knocked over and also preventing the staves thereof

from collapsing, due to their warping. To accomplish these objects, I have provided an anchoring system which comprises preferably means for connecting the upper end of the silo frame to the concrete base thereof.

Anchored within the base A are bolts being five in number, which are designed to hold the lower ends of the cables. In Figs. 1 and 2 of the drawings, I have illustrated these bolts each consisting of a single rod having eyelets formed at the extremities thereof. The cables are connected to the upper eyelets of the bolts, as will be hereinafter described and a horizontal rod 2 extends through the eyelets formed in the lower end of the bolts, thereby providing a suitable anchorage. In Fig. 3 of the drawing I have shown another form of an anchoring bolt which comprises one continuous rod being bent to form a pair of parallel side portions forming an eyelet to which the cables are connected and the extremities of the rods are bent at right angles as at 30. From this it will be seen that the concrete will fill in around the portions 29 of the bolt and over the angular portions 30 thereby providing an anchorage which will be inexpensive and eliminate the extra expense of welding the eyelets at the ends of the bolt.

The eye-bolts are arranged within the concrete base as more clearly shown in Figs. 1 and 2 of the drawings. Formed within the base on each side of the silo and diametrically opposite are eye-bolts 1′, at the rear of the silo, the base is provided with an eyelet 1^2 and a pair of eye-bolts 1^3 are provided within the base at the front of the silo adjacent to each side of the door-frame. The upper end of the silo is provided with three U-shaped bolts 2′ each having an eyelet 3 formed therewith. On each side of the silo are mounted one of these U-shaped bolts 2′ and the other one is mounted at the rear of the silo frame.

Secured to the eyelets 3 at the side of the silo are cables 4 having their ends adjustably connected to V-shaped rods 5 which are connected to the eyelets 1^3 formed within the base A adjacent to the door-frame. The extremities of the V-shaped rods 5 are threaded and the shorter arms thereof are adjustably connected by means of turnbuckles 6 to hook rods 7 which are adapted to be placed over the lower channel bars E of the door-frame. The opposite or longer arms of the V-shaped rods 5 are connected to the cables 4 through adjustable connections each comprising a block 8 having two parallel openings formed therein, one of which receives the longer arm of the V-shaped rod 5 and a threaded bolt 9 being pivotally connected at one end to the cable 4 by means of an eyelet 10 extends through the other said opening. The threaded portions of the bolt 9 and the longer arm of the V-shaped rod 5 are provided with nuts whereby the cables may be adjusted. On the extended threaded ends of the bolts 9 and the longer arms of the V-shaped rods 5, I provide heavy coil springs 11 which are interposed between the opposite ends of the lug 8 and the beforementioned nuts, thereby providing a self adjustable take-up which will tighten the cables 4 due to any shrinkage in the staves of the silo frame construction.

Extending through the door-frame and the adjacent staves of the silo are bolts 12 which are adapted to hold the door frame in place and the outer ends of these bolts are provided with eyelets 13 to each of which are connected one end of the cables 14. The lower ends of the cables 14 are connected to the eye-bolts 1′ by adjustable connections 15 being the same as the adjustable connections between the cables 4 and the longer arms of the V-shaped rods 5.

Connected to the eyelet 3 of the U-shaped bolt 2′ at the rear upper end of the silo are one end of each of the downwardly diverging cables 16—16 whic hare also connected at their lower extremities to the eye-bolts 1′ by means of the adjustable connections 15. A V-shaped rod 17 is connected to the eye-bolt 1^2 at the rear of the silo frame and has its extremities adjustably connected to cables 18 by the adjustable connections 15. These cables 18 diverge outwardly and are connected at their upper ends to the eyelets 3 of the U-shaped bolts formed diametrically opposite in the sides of the silo frame. The intersection points of the cables pass through eyelets 19 formed within the sides of the frame construction as disclosed in Figs. 1 and 2.

The hoops which extend around the periphery of the silo frame also extend through the channel bars E of the door frame which apparently hold the hoops in their proper spaced relation at this point, but to provide means for supporting the hoops around the entire frame, I have provided the staples 20. These staples pass over the bracing cables and form guides therefor and the hoops C rest upon the upper face of the staples as shown in Figs. 1 and 2 of the drawings.

To provide means for bracing the upper end of the silo frame, wires 21 and 22 respectively are connected to the frame which are of such diameter and so spaced apart to prevent any interruption of the ensilage in entering the interior of the silo.

The U-shaped bolts 2′ which extend through the upper ends of the silo frame also extend through a band 23 as more clearly shown in Figs. 7, 8 and 9, which encircles the inner periphery of the silo frame and resting upon the outer faces of the staves of the silo frame and the band 23 are

metal clamping plates 24 and 25 respectively which obviously prevent the U-shaped bolts from becoming displaced. The medial portion of each of the clamping plates 25 have stamped therefrom eyelets 26 to which are connected the opposite ends of the wire 22. Connected to the U-shaped bolt 2′ at the rear of the frame is one end of the wire 21. The opposite end of the wire 21 terminates in two sections each of which extend through openings 27 formed within the inner end of the bolt 12 and there connected as more clearly shown in Fig. 6 of the drawings. The wires 21—22 respectively are each provided with turn-buckles 28 whereby the same may be adjusted.

In building silos the foundation is first formed being provided with eye-bolts, then the door-frame is set in place. The upper ends of the cables 14 are connected to the upper end of the door-frame and the lower ends of the cables 14 are connected to the eye-bolts 1′. The hooks 7 are then placed over the lower cross bars E of the door-frame and are connected to the eye-bolts 1^3 as heretofore described. In forming this connection, it is obvious that the door-frame will be held in a rigid vertical position and then the staves of the silo frame are connected thereto in the usual manner forming the circular structure. After the circular structure has been completed, the remaining bracing cables are connected as before described, thereby forming a rigid structure.

By providing the band 23 within the upper end of the silo frame and connecting the U-shaped bolts thereto in the manner before described, it is apparent that the strains exerted upon the U-shaped bolts will prevent the wooden staves of the silo frame from being pulled apart, which would result in the collapsing of the silo.

If desired, the hooks 7 may be eliminated and the shorter arms of the V-shaped rods 5 may be connected to the lower hoops C by means of a U-shaped bolt 20′ as disclosed in Fig. 3 of the drawings.

From the foregoing it is obvious that the bracing cables of this anchoring system extend diagonally and in a cylindrical surface substantially at right angles to the base of the silo, thereby eliminating the anchoring of the cables some distance from the base of the silo to gain the proper leverage.

Considerable difficulty is experienced on account of torsional action in stave silos due to the twisting of these staves and longitudinal movement one upon the other when the silo is moved out of vertical alinement by forces, external or internal, such as that exerted by the wind or pressure of the wet silage from within or by varying expansions on different parts of the staves. By providing a silo with the anchoring system herein shown, the cables together with the inner band 23 efficiently prevent this twisting of the staves.

I claim:—

1. The combination with a silo and a base therefor, an adjustable bracing means carried by the upper end of the silo and an adjustable bracing means fastened at its upper end to the silo adjacent its top and at its lower end to the base thereof and connecting the upper end of the silo with the base in a diagonal line so as to prevent twisting of the silo.

2. The combination of a silo and a base therefor, an anchoring system comprising a plurality of diagonally extending cables, and means for rigidly fastening the cables to the upper end of the silo and to the base thereof.

3. The combination with a silo comprising a door-frame, a plurality of staves and a base therefor, of an anchoring system comprising a plurality of cables, a band encircling the upper end of the silo, means extending through the staves of the silo and said band, the said cables being connected to the said mentioned means, means for connecting the cables to the door-frame and means for anchoring the cables within the base of the silo.

4. The combination with a silo having a door-frame and base therefor, means for connecting the upper end of the door-frame with the base and means for connecting the lower end of the door-frame with the base, for the purpose specified.

5. A silo comprising a frame consisting of a plurality of staves, a door frame, and a base for the silo in combination with an anchoring system comprising a plurality of cables, means for connecting the said anchoring system with the door-frame and the base of the silo, means connecting the anchoring system with the upper end of the silo and the base thereof and means for bracing the upper end of the silo as specified.

6. The combination with a silo and a base therefor, of an anchoring system comprising a plurality of cables, bolts for securely fastening the upper ends of the cables to the silo, means for rigidly anchoring the lower ends of the cables within the base and bracing means mounted within the silo and connected to bolts as described.

7. The combination with a silo and a base therefor, of a plurality of eye-bolts anchored within the base, V-shaped rods carried by said eye-bolts, diagonally extending cables adjustably connected at one end to said rods and means for connecting the opposite ends of the cables to the upper end of the silo, substantially as and for the purpose specified.

8. The combination of a silo comprising a plurality of vertical staves, a base there-

for, an anchoring system comprising a plurality of diagonal cables, means for anchoring the lower ends of the cables to said base, a band extending around the interior of said silo near the upper edge thereof and engaging said staves and means for connecting said band with said cables for the purpose set forth.

9. The combination of a silo comprising a plurality of vertical staves, a base therefor, a plurality of diagonally arranged cables on the exterior of said silo, said cables being anchored at one end to said base adjacent to the staves and fastened at their opposite ends to the upper edge of the silo to prevent the relative rotation of the top and bottom of said silo.

10. In a stave silo having a rigid door-frame, a plurality of diagonal tension means immovably secured at their tops to the silo and anchored to the ground at their bottoms and adapted so to crowd the staves toward the door-frame, whereby the rigidity of the silo is maintained.

11. A circular stave silo in combination with diagonally arranged tension means anchored at the foot of the silo and immovably fastened to the top thereof whereby the silo is prevented from twisting.

12. A circular stave silo having a rigid door frame, comprising a base in combination with diagonally arranged tension means anchored in the base and immovably fastened to the top of the silo, whereby the silo is prevented from twisting, and means for maintaining the position of the door frame.

In witness whereof, I hereunto subscribe my name to this specification in the presence of two witnesses.

CHARLES A. LYONS.

Witnesses:
KEECER J. BELL,
CHAS. V. SHORT.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."