D. E. VIRTUE.

SILO.

APPLICATION FILED MAY 8, 1912.

1,093,898.

Patented Apr. 21, 1914.

2 SHEETS—SHEET 1.

Fig. 2a

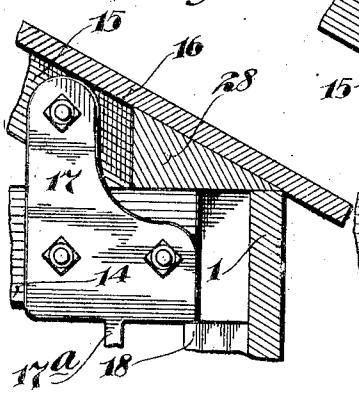


Fig. 2

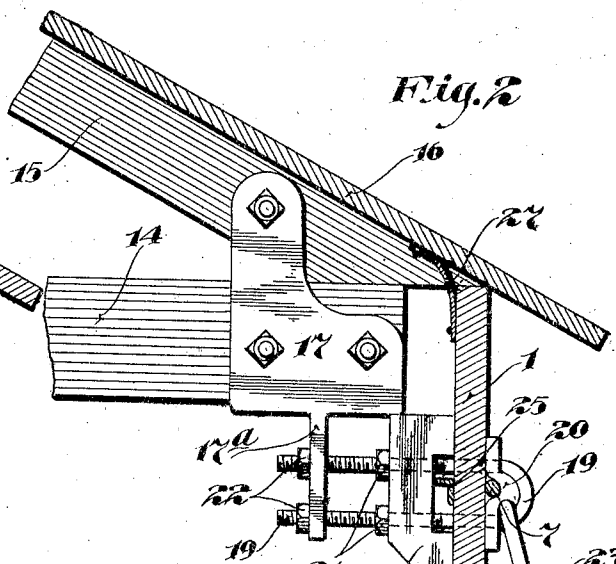
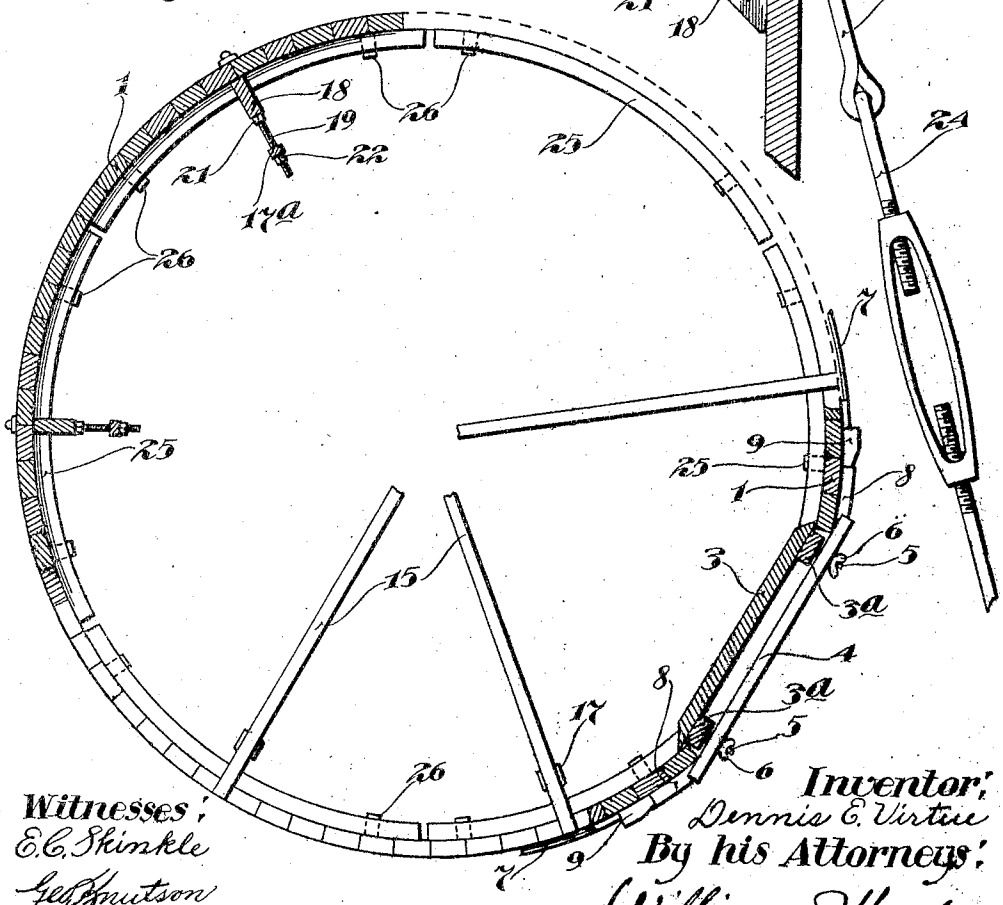


Fig. 1



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2 SHEETS-SHEET 2.

Fig. 7

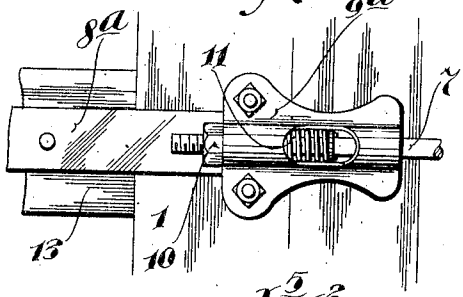
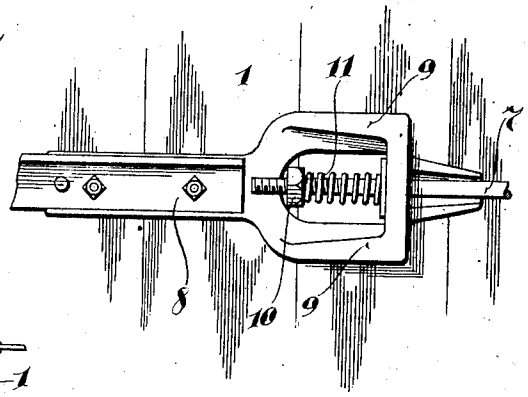


Fig. 6



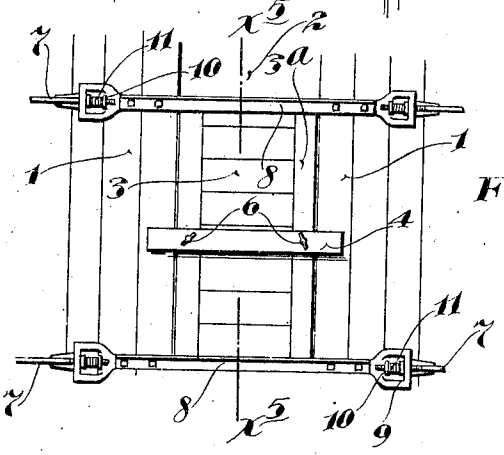


Fig. 3

Fig. 5

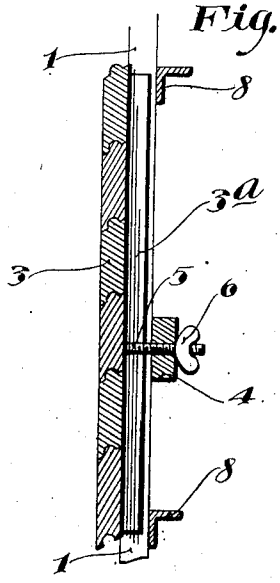
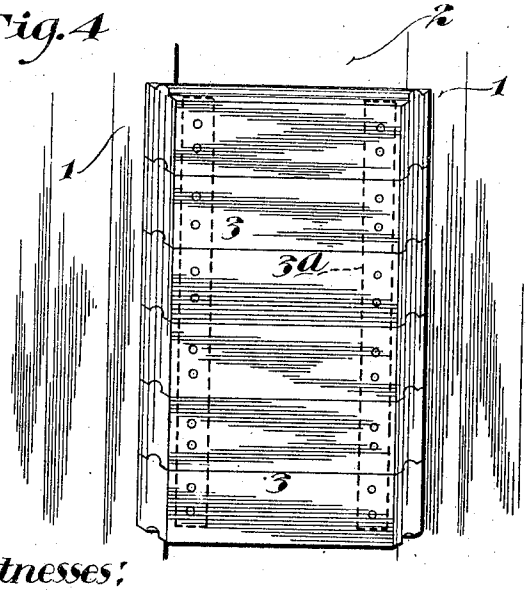


Fig. 4



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UNITED STATES PATENT OFFICE.

DENNIS E. VIRTUE, OF OWATONNA, MINNESOTA.

SILO.

1,093,898. Specification of Letters Patent. Patented Apr. 21, 1914.

Application filed May 8, 1912. Serial No. 695,905.

To all whom it may concern:

Be it known that I, DENNIS E. VIRTUE, a citizen of the United States, residing at Owatonna, in the county of Steele and State of Minnesota, have invented certain new and useful Improvements in Silos; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Particularly, the invention is directed to the provision of an improved silo structure in which the walls of the silo are capable of expanding and contracting movements, in respect to the silo roof. It is a well known fact that the walls of silos of wood construction will expand and contract very considerably under varying conditions of moisture and heat, and that the roof structure, even when constructed of wood will have radial beams which are not much affected by expansion and contraction in a direction radially of the silo. Hence, there is a necessary relative movement of the silo walls, in respect to the roof structure. Hitherto, so far as I am aware, no proper provision has been made for permitting of these relative movements due to expansion and contraction, and it has been the custom to positively anchor the tops of the vertical staves of round or cylindrical wall silos, to the roof structure. The result has been in some instances, that when the walls are contracted against the roof, the top of the silo would flare and openings would be formed between the staves. Stave silos should be preferably cylindrical, so as not to interfere with the settling of the silage, and furthermore, their joints should always be tight, so as to retain the heat and insure perfect curing of the silage. All of these conditions I meet by my invention in an extremely simple and efficient manner.

The invention is illustrated in the accompanying drawings wherein like characters indicate like parts throughout the several views.

Referring to the drawings, Figure 1 is a horizontal section taken through a silo designed in accordance with my invention; Fig. 2 is a vertical section taken through a portion of the roof and upper wall of the silo; Fig. 2^a is a view corresponding to Fig. 2, but illustrating a slightly modified construction; Fig. 3 is a view in elevation showing a portion of the silo wall in one of the door sections of the silo; Fig. 4 is a view looking at the parts shown in Fig. 3 from the inside of the silo; Fig. 5 is a vertical section taken on the line x^5 x^5 on Fig. 3; Fig. 6 is a detail view showing a connection between one of the hoops and doorway bridge bar or brace; and Fig. 7 is a view corresponding to Fig. 6, but illustrating a slightly modified construction.

The numeral 1 indicates the staves comprising the vertical cylindrical wall of the silo. At one place, the staves are omitted to afford a doorway 2 that preferably extends from bottom to top of the silo. This doorway is adapted to be closed to any desired extent and to be opened at a vertical point by a multiplicity of door sections 3, shown as made up of boards nailed, or otherwise secured to the heavy vertical cleats 3^a, which cleats are so spaced that they will fit between the staves 1 that immediately join the doorway 2. These door sections 3 are independently removable and are adapted to be independently secured in the doorway 2, preferably by clamping bars 4 that overlap the adjacent staves 1 and are detachably secured to the respective door sections by clamping bolts 5, shown as equipped at their outer ends with large thumb nuts 6.

The hoops which hold the wall staves 1 together are made up of approximately circular rods 7, and so-called bridge or brace bars 8. The bridge bars 8, as shown, are made of angle iron sections and they span the doorway 2 and are bolted, or otherwise rigidly secured to the staves that are immediately or closely adjacent to the doorway and are also bolted or otherwise rigidly secured to rod anchoring stirrups or heads 9, through which the threaded ends of the hoop rods 7 are passed. The threaded ends of the said hoop rods 7 are provided with nuts 10 between which and the stirrups 9, heavy coupling springs 11 are compressed. These springs 11 permit expansion and contraction of the hoops, so that they will adapt themselves to expansion and contractions of the circular walls made up of wooden staves 1. The nuts 10 are within the reach of a ladder afforded by the bridge bars 8 and clamping bars 4, and the tension of said

spring should, of course, be such as to resist the outward pressure of the silage contained within the silo.

The construction illustrated in Fig. 7 is substantially like that just described, except that the bridge bar 8^a is shown as made from a flat bar, the anchoring head 9^a is shown as in the form of a casing, and a strut or spacing member 13 in the form of a 2x4 or the like, is inserted between the staves adjacent to the doorway, and is bolted to the said bridge bar 8^a.

In Fig. 2, the roof structure is shown as made up of joist 14, rafters 15, and roof boards 16. The roof boards 15 overlap the upper ends of the wall staves 1 and the beveled ends of the joist also, as shown, slightly lap over the said staves. The joist 14 terminate considerably short or inward of the said staves, so as to permit of expansion and contraction of the silo wall. Bolted to the outer ends of the joist 14 and rafters 15 are so-called coupling brackets 17, preferably cast structures, the lower outer portions of which rest directly upon bearing blocks or brackets 18 that are rigidly supported on the inner surfaces of the silo wall and take the entire weight of the roof structure. As shown, each bearing block 18 is rigidly secured to a single stave by long U-bolts 19 that are passed inward through said staves and through hoop guides 20 and through the coöperating bearing blocks 18. Nuts 21 applied to the threaded ends of the U-bolts rigidly clamped to bearing blocks 18 against the staves. The other nuts 22 on the threaded ends of said U-bolts are adapted to bear against a depending leg 17^a of the coöperating coupling bracket 17. These nuts 22 should be so adjusted as to permit maximum expansion of the staves. This being done, the wall of the silo is free to expand and contract, in respect to the roof structure and the roof structure is all the time securely anchored to the wall. Also, adjustment of the nuts 22 serves to set the roof structure in proper concentric relation to the wall. The hoop rods 7 are loosely passed through the hoop guides 20 and the hoop guides are formed with notches which adapt the upper end loops 23 of the anchor rods 24 to be coupled to the bowed portions of the U-bolts 19.

Within the wall of the silo are the segmental reinforcing bars 25 shown as formed from angle iron sections, and each of these is clamped to the silo wall, by one of the bearing blocks 18 (see Figs. 1 and 2). A plurality of fastening clips 26 are also preferably applied to each bar 25 to secure the same at intervals to certain of the staves 1 with freedom for endwise sliding movements. These segmental reinforcing bars 25 are applied in a broken circular series with the ends thereof spaced apart far enough to permit expansion and contraction of the silo wall. With this slip joint connection between the silo wall, and roof, expansions and contractions of the silo wall are permitted, as already stated, and furthermore, it is possible, from time to time, to draw and tighten the staves, so as to always maintain tight joints.

To form a tight joint between the upper edge of the silo wall and the roof throughout all of the adjustments or relative movements of the wall, I provide a self-adjustable joint, or packing, preferably in the form of a flexible joint strip 27 of heavy canvas, or similar material which is applied, or otherwise secured at its edges to the silo wall and to the roof boards. This construction is shown in Fig. 2. In Fig. 2^a, I show an endless or annular filling strip 28, which rests upon or directly overlies the upper edge of the silo wall in all adjustments thereof. There should be one stay rod 23—24 for each inner reinforcing bar 25, and when the silo is thus anchored, it will be free to expand or contract, but will be firmly held, so that it cannot collapse under wind pressure even when empty.

What I claim is:

1. In a silo, a wall and a roof having a slip joint connection, an expansible and contractible brace secured to said wall, and means anchoring said roof to said brace and permitting expansion and contraction of said wall in respect to said roof.

2. In a silo, a wall and a roof, having a slip joint connection, an expansible and contractible brace secured to said wall, means anchoring said roof to said brace and permitting expansion and contraction of said wall in respect to said roof, and anchoring rods anchored to said brace at their upper ends.

3. In a silo, the combination with a cylindrical wall made up of wooden staves, of a roof connected on said wall by a slip joint, an expansible and contractible hoop surrounding the upper portion of said wall, and a connection anchoring said roof to said hoop and permitting expansion and contraction of said wall in respect to said roof.

4. In a silo, the combination with a cylindrical wall made up of wooden staves, of circumferentially expansible hoops surrounding said staves, bearing blocks secured to the inner surface of certain of said staves, a roof structure resting on said bearing blocks and having clearance from the said wall permitting expansion and contraction of the latter, and devices anchoring said roof to said wall but permitting adjustments for circumferential expansion and contraction of the latter.

5. In a silo, the combination with a cylindrical wall made up of wooden strips, of circumferentially expansible hoops sur-

rounding said staves, bearing blocks secured to the inner surface of certain of said staves, a roof structure resting on said bearing blocks and having clearance from the said wall permitting expansion and contraction of the latter, devices anchoring said roof to said wall but permitting adjustments of circumferential expansion and contraction of the latter, and circumferentially spaced segmental reinforcing bars clamped to the inner surface of said wall by said bearing blocks.

6. In a silo, the combination with a cylindrical wall made up of wooden strips, of circumferentially expansible hoops surrounding said staves, bearing blocks secured to the inner surface of certain of said staves, a roof structure resting on said bearing blocks and having clearance from the said wall permitting expansion and contraction of the latter, devices anchoring said roof to said wall but permitting adjustments of circumferential expansion and contraction of the latter, circumferentially spaced segmental reinforcing bars clamped to the inner surface of said wall by said bearing blocks, guides for said outer hoops, bolts connecting said guides, bearing blocks and roof structure permitting circumferential adjustments or expansions of said wall.

7. A silo, including a side wall and a roof, and an internal contractible and expansible brace extending around the side wall, the roof being connected to the brace.

8. A silo, including a side wall, a roof, and an internal contractible and expansible brace extending around the interior face of the side wall, said brace being independently movable with relation to the roof, and means slidingly connecting the brace to the side wall permitting the brace to be expanded and contracted.

9. A silo including a side wall, a roof, and an internal expansible and contractible brace extending around the interior face of the side wall, and roof beams slidingly connected to said brace.

In testimony whereof I affix my signature in presence of two witnesses.

DENNIS E. VIRTUE.

Witnesses:
F. D. MERCHANT,
HARRY D. KILGORE.