July 23, 1935. J. W. DENNING ET AL 2,008,688

SILO AND THE LIKE

Filed Aug. 3, 1932 4 Sheets-Sheet 1

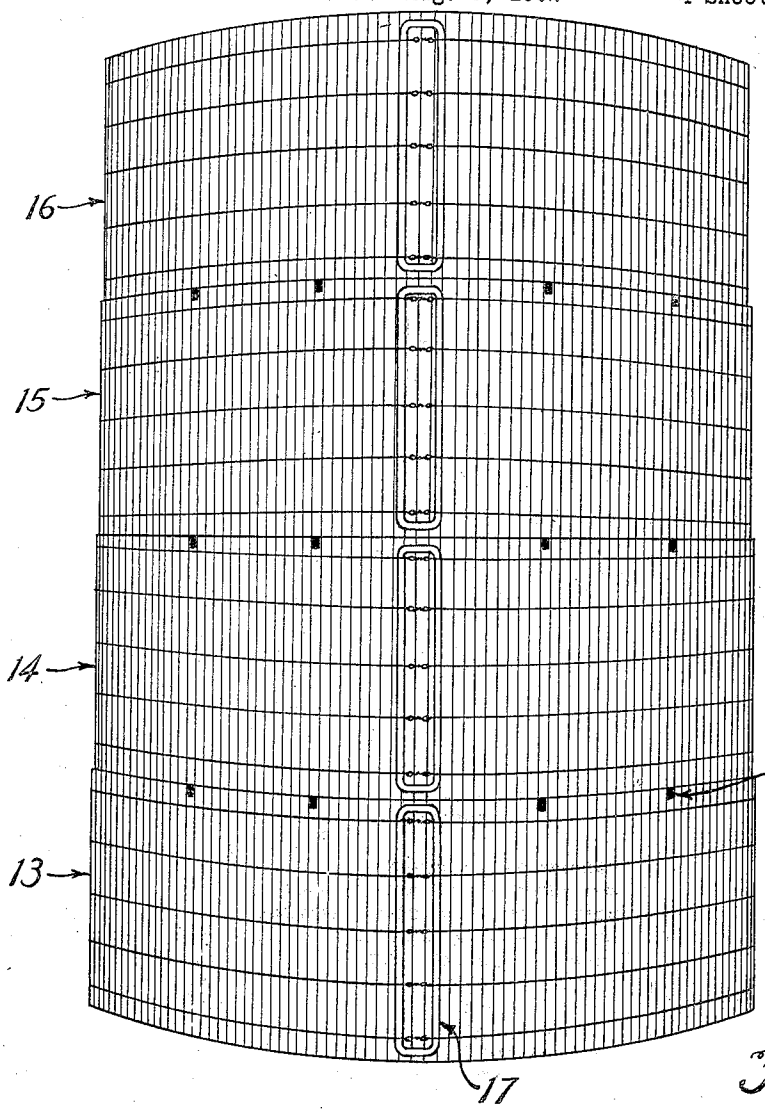


Fig 1.

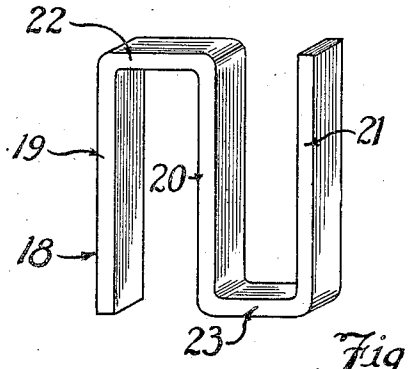


Fig 2.

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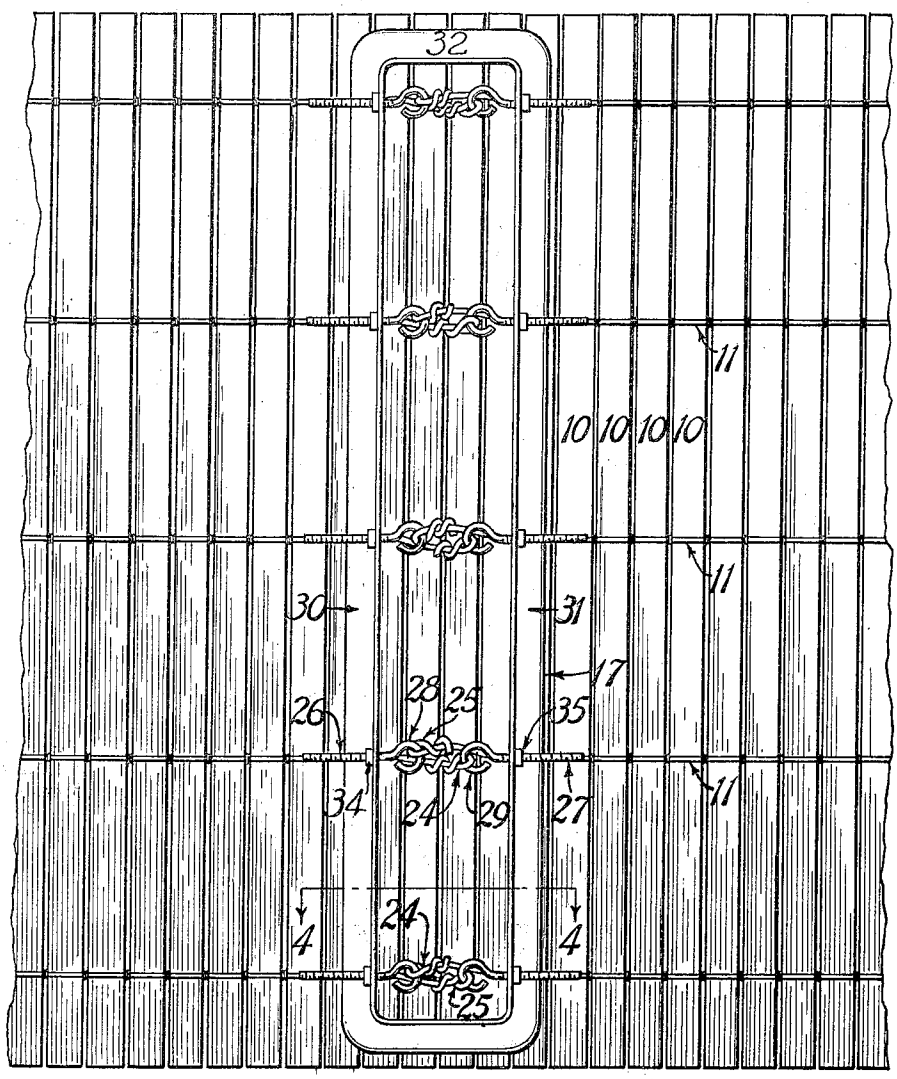


Fig 3

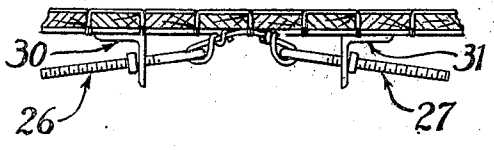


Fig 4

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SILO AND THE LIKE

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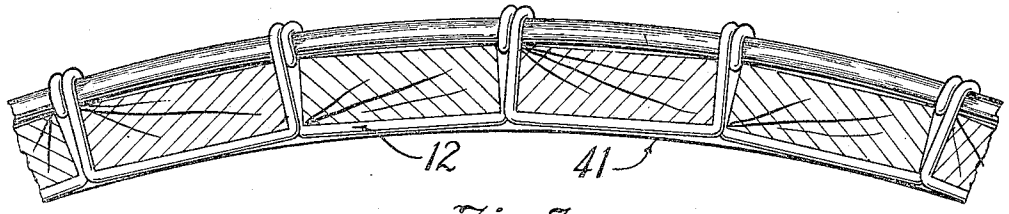


Fig 7

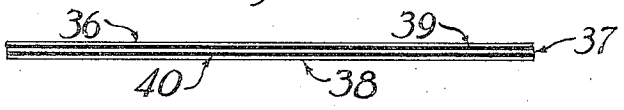


Fig 8

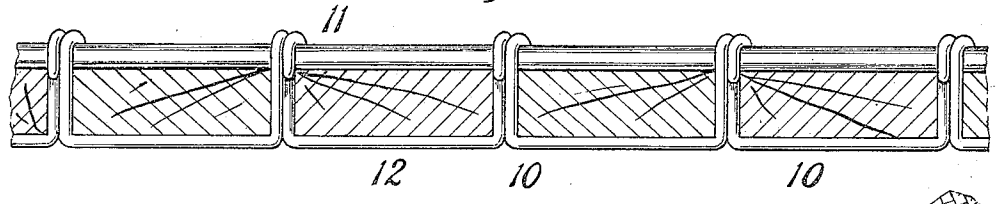


Fig 6

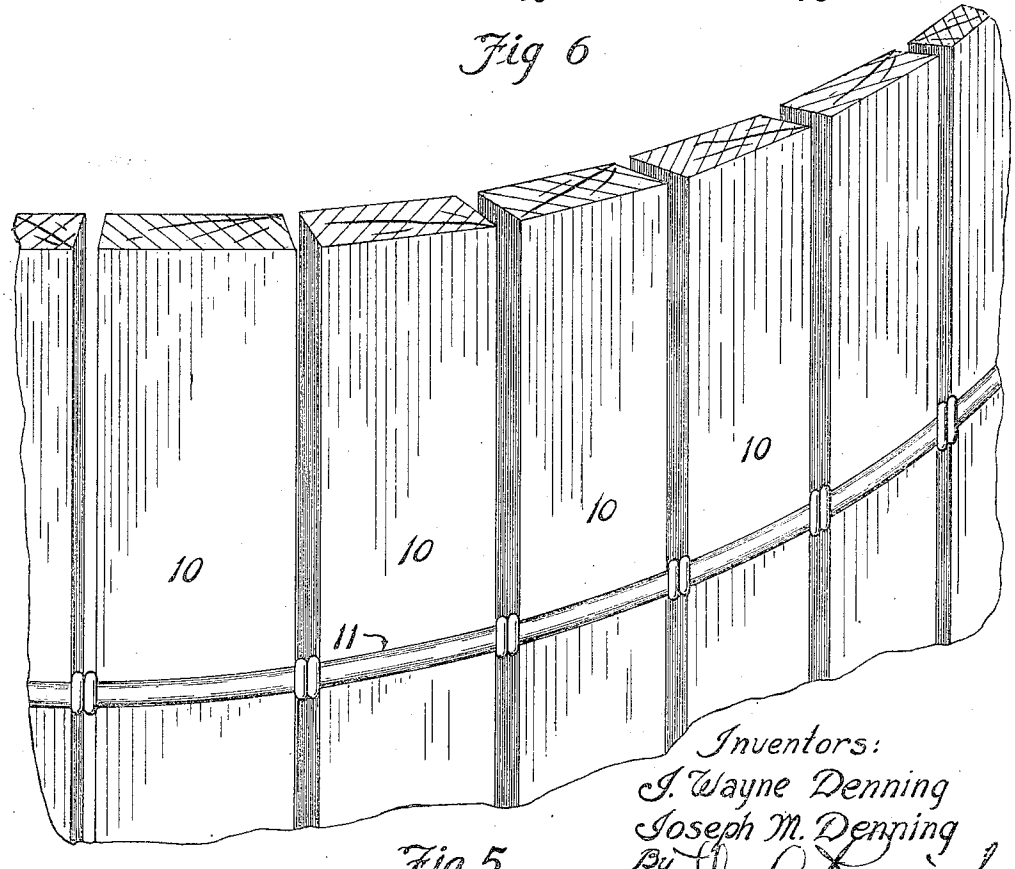


Fig 5

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SILO AND THE LIKE

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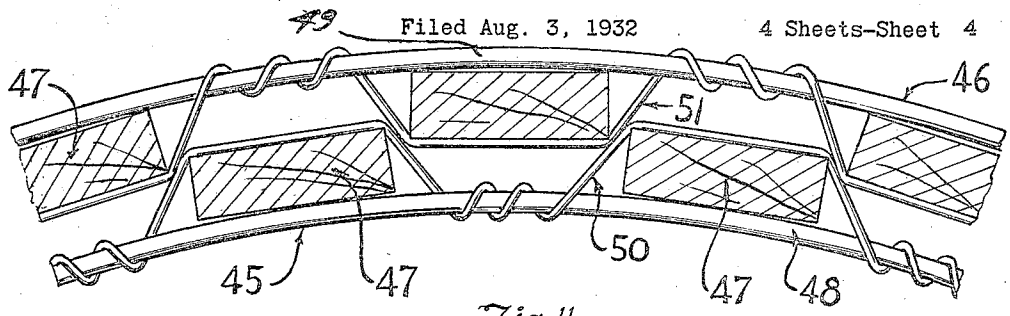


Fig 11

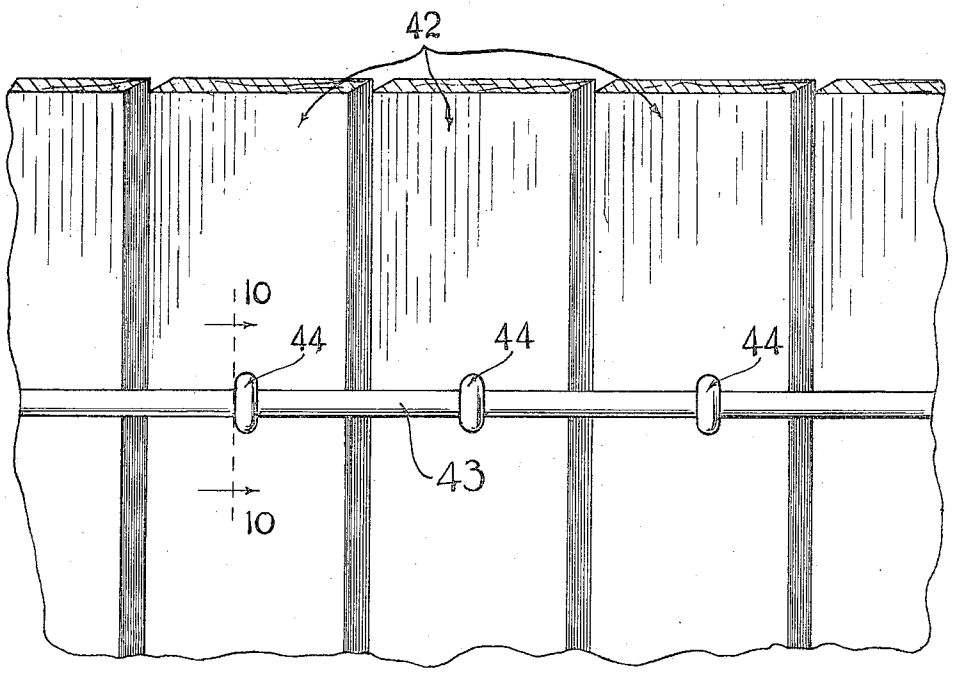


Fig 9

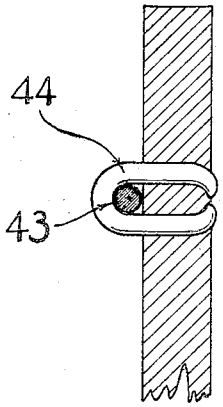


Fig 10

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UNITED STATES PATENT OFFICE

2,008,688

SILO AND THE LIKE

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Joliet, Ill.

Application August 3, 1932, Serial No. 627,368

8 Claims. (Cl. 20—1.4)

The present invention has to do with improvements in silos and the like. The silo construction herein disclosed is distinctive in the sense that it is made up from sections of wood staves and wire or similar material. One of the objects of the invention is to provide a silo construction which is made in sections which can be set on top of each other so as to build up the structure to the desired height. Each of these sections is self-contained and is formed of a strip or length of specially woven stave material so that when bent around into circular form, the staves thereof come substantially together into a tight silo construction.

In connection with the foregoing, it is an object of the invention to provide a stave structure in which the staves are set or woven so close together edge to edge that when the strip or section is bent into circular form, the edges of the consecutive staves approach each other more closely. In this connection it is an object to provide longitudinal strand wires which lie against the outer surfaces of the staves and take practically the entire tension force to which the material is subjected, said wires being relatively heavy and passing straight across from stave to stave, together with tie wires of lighter material which are extended around the other faces of the staves and are connected to the longitudinally extending heavier wires by twisting operations.

A further object of the invention relates to the provision of a new and improved connecting device at the ends of the stave structure, which connecting device is so arranged that the two ends of the section of stave material may be drawn firmly together by tightening up nuts or bolts which operate directly upon the longitudinally extending strand wires, thus providing a maximum strength and resisting power to resist the bursting force due to the material contained within the silo.

Another feature of the invention relates to the provision of a new and improved means for connecting the top and bottom edges, of the consecutive silo sections, together so as to erect the sectional structure to the desired height. This connecting means comprises a series of Z-shaped clips which can be hooked over the top edge portion of one silo section and thus establish upwardly facing sockets to receive and support the lower edge portion of the next higher silo section. By means of this simple expedient, the silo can be erected to the desired height with very little work and simple operations; and conversely, as the silo is emptied, the sections may be successively taken down and stored away.

Another object of the invention is to provide a sectionalized silo of such a nature that the different sections can be readily packed and either stored or shipped in packages of very small and convenient size. Furthermore, these sections are relatively light so that they can be easily handled and transported or erected.

A further object of the invention is to provide a silo structure embodying the above features and which is also provided with an interior lining of special paper which serves to establish a tight structure and at the same time not add appreciably to the weight or cost of the silo.

Other objects and uses of the invention will appear from a detailed description of the same, which consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings:

Figure 1 shows a perspective view of the exterior of a silo embodying the features of the present invention and which silo is built to the height of four sections;

Figure 2 shows a perspective view of one of the clips or connectors by which the consecutive silo sections are erected and supported in place;

Figure 3 shows a detailed face view of the end portions of a section of the fabric, together with the connecting device by means of which they are joined together;

Figure 4 shows a detailed fragmentary section through the connector taken substantially on the line 4—4 of Figure 3, looking in the direction of the arrows;

Figure 5 shows a fragmentary perspective view of a portion of the fabric twisted around into circular form;

Figure 6 shows a fragmentary longitudinal section through a portion of fabric as the same is originally woven in flat form and before being bent into the curved or circular form;

Figure 7 shows a view similar to Figure 6, with the exception that the fabric has been bent around into curved form;

Figure 8 shows a fragmentary longitudinal section through a piece of the lining paper used for lining the interior of the silo;

Figure 9 shows a fragmentary face view of a section of stave material of modified construction which may be used in building up the silo;

Figure 10 shows a fragmentary section on the line 10—10 of Figure 9, looking in the direction of the arrows; and

Figure 11 shows a fragmentary top edge view of a portion of silo built up from two strips of slatting of still another modified form of construction.

Referring first to Figures 5, 6 and 7, in particular, the fabric comprises a series of staves 10, which are set close together edge to edge; and the longitudinally extending tie wires 11 are placed against the outer surfaces of the different staves, there generally being provided about five of these longitudinally extending tie wires in the height of each stave section. The longitudinally extending tie wires 10 are relatively heavy and fairly stiff and are strong enough to take the necessary tension established by the bursting force due to the contents of the silo.

There are other relatively light tie wires 12, which are placed against the inside face of the stave and are then extended across the edges of the stave and wrapped around the heavy wires 11, first in one direction and then in the other, as clearly shown by examination of Figures 6 and 7, in particular. Due to the twisting of the wires 12, around the wires 11, first in one direction and then in the other, the wire sections 12 are alternately staggered above and below each other when the stave section is stood upright as in Figure 5. Furthermore, the consecutive staves 10 are placed just as close together as is possible with the twists of the wires 12 around the corresponding wires 11. This is clearly indicated in Figure 6. Then when the material is bent or twisted into the curved form of Figure 7, the wire sections 12 will lie alternately above and below each other as clearly shown in Figure 7, thus permitting the inner corners of the consecutive staves to come very close together. In fact, when the fence is twisted or bent severely, the wires 12 will slightly imbed themselves in the corner of the staves so as to permit said corners to approach even closer together.

The silo structure is built up from a series of staves sections such as 13, 14, 15, and 16, in Figure 1. Each of these sections comprises a section of the stave material bent around into circular form and with its ends then connected or joined together by means of a connector such as 17, the details of which will be explained presently. The consecutive silos sections 13, 14, 15, and 16, are of consecutively, slightly smaller size, equal substantially to the thickness of the stave material, as clearly shown in Figure 1. A series of connectors 18 are provided for supporting the consecutive silo sections in proper position. Each of these connectors 18 is formed of strap metal bent into Z form so as to establish the parallel arms 19, 20, and 21, connected together by the cross pieces 22 and 23. After the lowermost silo section 13 has been set up and its ends fastened together, a series of the clips or connectors 18 are set into place by hooking them on to the top edge of the lowermost silo section so that their upwardly facing hooks are located at the inside of the silo section. The next silo section 14 is then bent around into circular form and has its ends fastened together, and this silo section is then lifted up and set into place and supported by the upwardly facing hooks of the lower section. In this way the consecutive sections are built up and set into place on top of each other to the desired height.

The ends of each silo section are joined together by the connectors 17 in the manner which we will now explain;

For this purpose, the longitudinally extending tie wires 11 are carried a few inches past the last stave of the section and are then twisted into the loops as shown at 24 and 25 in Figure 3. Screws 26 and 27 having the eyelets 28 and 29 are fastened to the loops 24 and 25 respectively so that said screws 26 and 27 may be used as attaching means.

The connector 17 comprises a length of angle bar bent into the form of a loop having the vertical arms 30 and 31, the top cross piece 32, and the bottom cross piece 33. The tie wire ends lie beneath the arms 30 and 31, and the screws 26 and 27 are extended through holes in the outwardly extending flanges of the vertical arms 30 and 31, and nuts 34 and 35 are then threaded on to the screws 26 and 27 and tightened up so as to draw the tie wires 11 tight and so as to tighten up the silo section.

When the silo is taken down, each of the sections may have its ends disconnected by removing the nuts 34 and 35 so that the silo section can be laid out flat and stored within a minimum of space, and the connectors 17 likewise may be stored within a very small package.

Usually the interiors of the silo sections will be protected and lined with a heavy paper such as shown in Figure 8, which is a cross section through some of this paper, greatly exaggerated in thickness. This paper comprises usually three layers 36, 37, and 38, between which are placed the sisal fibres 39 and 40, the consecutive layers and sisal fibres being stuck and firmly adhered together by means of asphaltum, or other suitable material. Usually the sisal fibres of the layer 39 will extend in one direction, and the sisal fibres of the layer 40 in another direction so that the completed three ply paper is greatly reinforced and strengthened in all directions by the fibres.

In Figure 7, the paper lining is designated in its entirety by the numeral 41.

In the modified construction of Figures 9 and 10, the stave material comprises the staves 42 which are placed close together and are joined to the longitudinally extending strand wires 43 by means of U-shaped clips 44 which are driven through the staves and around the strand wires and have their inner ends riveted over as shown in Figure 10. With this type of slatting, the staves can be placed at exactly the desired spacing from each other so that when the material is bent around into curved form as in Figure 7, the edges of the staves will close together.

In the further modified construction of Figure 11, there are provided two strips of stave material designated 45 and 46 respectively. In each of these strips, the staves 47 are separated from each other a distance slightly greater than the width of the stave, and the two sections 45 and 46 are so set that their staves compliment each other and the spaces in the one section are occupied by the staves of the other section, etc. Thus the two sections together establish a substantially tight and closed silo.

It will also be noted that the strand wires 48 of the section 45 are laid against the inside faces of the staves whereas the strand wires 49 of the section 46 are laid against the outside faces of the staves; and it will also be noted that the tie wires 50 for the section 45 are deflected outwardly around the staves 47 thereof and that the tie wires 51 of the section 46 are deflected inwardly around the staves 47 thereof.

While we have herein shown and described only certain embodiments of the features of our pres-

ent invention, still we do not intend to limit ourselves thereto except as we may do so in the claims.

We claim:

1. A silo comprising a series of cylindrical sections located one above the other, each section comprising a strip of stave material formed of vertical staves and longitudinally extending strand wires, together with tie wires securing the staves to the strand wires, the staves of each section being located in close edge proximity to each other and the strand wires being located against the outer faces of said staves and the tie wires being carried around the inner faces of the staves and being twisted around the strand wires intermediate between the staves and in consecutively opposite directions, whereby the bending of the stave material into the cylindrical form of the silo results in bringing the inner edge portion of the staves into closer proximity to each other to establish a tight inclosure, means for joining together the end portions of each stave section comprising a rectangular locking member formed of angle bar having one of its flanges lying in a plane and its other flange projecting outwardly at right angles to said plane, and placed in proximity to the adjacent end portions of the stave section, threaded bolts connected to the end portions of the strand wires and extended through the opposite flanges of the time member, and nuts on said bolts operating against the flanges of the tie member and serving to place and maintain the strand wires under tension, the consecutive sections of the silo being of slightly diminishing size measured in a vertical direction, and means for connecting the consecutive silo sections together and retaining them in vertical relationship comprising Z-shaped members hooked over the upper edge portion of each lower section and serving to support the lower edge portion of each proximate upper section within the upwardly facing hook portion of such member, substantially as described.

2. A silo comprising a series of cylindrical sections located one above the other, each section comprising a strip of stave material formed of vertical staves and longitudinally extending strand wires, together with tie wires securing the staves to the strand wires, the staves of each section being located in close edge proximity to each other and the strand wires being located against the outer faces of said staves and the tie wires being carried around the inner faces of the staves and being twisted around the strand wires intermediate between the staves and in consecutively opposite directions, whereby the bending of the stave material into the cylindrical form of the silo results in bringing the inner edge portions of the staves into closer proximity to each other to establish a tight inclosure, means for joining together the end portions of each stave section comprising a rectangular locking member formed of angle bar having one of its flanges lying in a plane and its other flange projecting outwardly at right angles to said plane, and placed in proximity to the adjacent end portions of the stave section, threaded bolts connected to the end portions of the strand wires and extended through the opposite flanges of the tie member, and nuts on said bolts operating against the flanges of the tie member and serving to place and maintain the strand wires under tension, the consecutive sections of the silo being of slightly diminishing size measured in a vertical direction, and means for connecting the consecutive silo sections together and retaining them in vertical relationship, substantially as described.

3. A silo comprising a series of cylindrical sections located one above the other, each section comprising a strip of stave material formed of vertical staves and longitudinally extending strand wires, together with tie wires securing the staves to the strand wires, the staves of each section being located in close edge proximity to each other and the strand wires being located against the outer faces of said staves and the tie wires being carried around the inner faces of the staves and being twisted around the strand wires intermediate between the staves and in consecutively opposite directions, whereby the bending of the stave material into the cylindrical form of the silo results in bringing the inner edge portions of the staves into closer proximity to each other to establish a tight inclosure, means for joining together the end portions of each stave section, the consecutive sections of the silo being of slightly diminishing size measured in a vertical direction, and means for connecting the consecutive silo sections together and retaining them in vertical relationship comprising Z-shaped members hooked over the upper edge portion of each lower section and serving to support the lower edge portion of each proximate upper section within the upwardly facing hook portion of such member, substantially as described.

4. A silo comprising a series of cylindrical sections, located one above the other, each section comprising a strip of stave material formed of vertical staves and longitudinally extending strand wires, together with tie wires securing the staves to the strand wires, the staves of each section being located in close edge proximity to each other and the strand wires being located against the outer faces of said staves and the tie wires being carried around the inner faces of the staves and being twisted around the strand wires intermediate between the staves and in consecutively opposite directions, whereby the bending of the stave material into the cylindrical form of the silo results in bringing the inner edge portions of the staves into closer proximity to each other to establish a tight inclosure, means for joining together the end portions of each stave section, the consecutive sections of the silo being of slightly diminishing size measured in a vertical direction, and means for connecting the consecutive silo sections together and retaining them in vertical relationship, substantially as described.

5. A silo comprising a series of cylindrical sections located one above the other, each section comprising a strip of stave material formed of vertical staves and longitudinally extending strand wires, together with means for securing the staves to the strand wires, the staves of each section being located in close edge proximity to each other, whereby the bending of the stave material into the cylindrical form of the silo results in bringing the inner edge portions of the staves into closer proximity to each other to establish a tight enclosure, means for joining together the end portions of each slat section, the consecutive sections of the silo being of slightly diminishing size measured in a vertical direction, and means for connecting the consecutive silo sections together and retaining them in vertical relationship, comprising Z-shaped members hooked over the upper edge portion of each lower section and serving to support the lower edge portion of each proximate upper section within the upwardly facing

hook portion of said member, substantially as described.

6. A silo comprising a series of cylindrical sections located one above the other, each section comprising a strip of stave material formed of vertical staves and longitudinally extending strand wires, together with means for securing the staves to the strand wires, the staves of each section being located in close proximity to each other, whereby the bending of the stave material into the circular form of the silo results in bringing the inner edge portions of the staves into closer proximity to each other to establish a tight enclosure, means for joining together the end portions of each stave section, the consecutive sections of the silo being of slightly diminishing size measured in a vertical direction, and means for connecting the consecutive silo sections together, substantially as described.

7. A silo comprising a cylindrical section of stave material formed of vertical staves and longitudinally extending strand wires, together with tie wires securing the staves to the strand wires, the staves of each section being located in close edge proximity to each other, and the strand wires being located against the outer faces of said staves and the tie wires being carried around the inner faces of the staves and being twisted around the strand wires intermediate between the staves and in consecutively opposite directions, whereby the bending of the stave material into the cylindrical form of the silo results in bringing the inner edge portions of the staves into closer proximity to each other to establish a tight inclosure, means for joining together the end portions of the stave section comprising a rectangular locking member formed of angle bar having one of its flanges lying in a plane and its other flange projecting outwardly at right angles to said plane, and placed in proximity to the adjacent end portions of the stave section, threaded bolts connected to the end portions of the strand wires and extended through the opposite flanges of the tie member, and nuts on said bolts operating against the flanges of the tie member and serving to place and maintain the strand wires under tension, substantially as described.

8. A silo comprising a section of stave material formed of vertical staves and longitudinally extending strand wires, the staves being located in close edge proximity to each other, means for joining the staves to the strand wires, whereby the bending of the stave section into the cylindrical form of the silo results in bringing the inner edge portions of the staves into closer proximity to each other to establish a tight inclosure, means for joining together the end portions of the stave section comprising a rectangular locking member formed of angle bar having one of its flanges lying in a plane and its other flange projecting outwardly at right angles to said plane, and placed in proximity to the adjacent end portions of the stave section, threaded bolts connected to the end portions of the strand wires and extended through the opposite flanges of the tie member, and nuts on said bolts operating against the flanges of the tie member and serving to place and maintain the strand wires under tension, substantially as described.

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