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F. F. ROWELL

2,074,592

SILLO

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Fig. 1

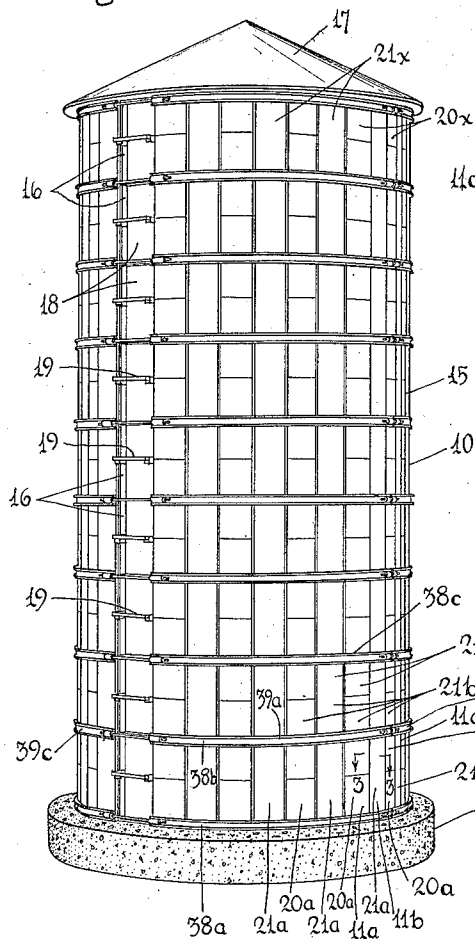


Fig. 4

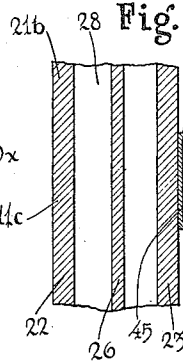


Fig. 2

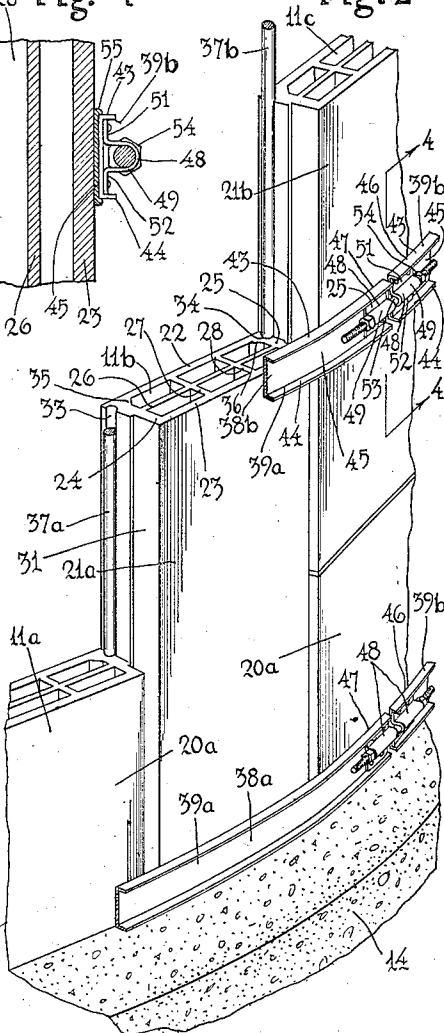
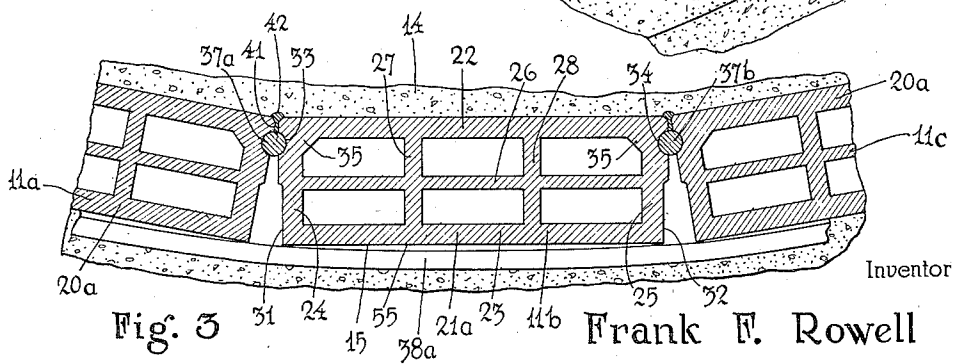


Fig. 3

Frank F. Rowell

By *Caswell & Lazard*
Attorneys

UNITED STATES PATENT OFFICE

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SILO

Frank F. Rowell, St. Paul, Minn.

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10 Claims. (Cl. 72-6)

My invention relates to silos constructed from building blocks and particularly to that type of silo in which the blocks are arranged one upon the other to form staves which are held together by means of tensioned hoops encircling the blocks upon the exterior thereof.

An object of the invention resides in providing a silo which may be constructed from tile building blocks.

Another object of the invention resides in providing a construction whereby a suitable seal is formed between the various staves of the silo.

A still further object of the invention resides in providing a construction whereby a cushion is provided between the staves to prevent injury to the blocks.

An object of the invention resides in providing a construction which will compensate for irregularities in the building blocks.

Another object of the invention resides in providing a construction which will be inexpensive and which may be easily and quickly erected without forms or elaborate temporary supports or falsework.

A still further object of the invention resides in providing a construction by means of which silos of any height or diameter may be constructed with the same type and sizes of building blocks.

In carrying out the objects of my invention I preferably utilize tile blocks which are placed one upon the other to form staves and which are formed along their lateral surfaces with grooves in which wood cushion strips are inserted. When the staves are drawn together by suitable hoops, the strips are brought into engagement with the lateral surfaces of the blocks forming a seal between the staves and also forming cushions therebetween.

In the drawing:

Fig. 1 is a perspective view of a silo illustrating an embodiment of my invention.

Fig. 2 is a perspective view of a part of the wall structure of the silo shown in Fig. 1.

Fig. 3 is a plan sectional view taken on line 3-3 of Fig. 1.

Fig. 4 is an elevational sectional view taken on line 4-4 of Fig. 2.

In the construction of silos from building blocks the previous practice has been to lay the blocks in courses and to set the blocks in cement or mortar and imbed in between the courses reinforcing rings which resisted the outward pressure to which the silo is subjected. Such construction is highly unsatisfactory in that it

is impossible to tension the reinforcing rings since they are imbedded and where Portland cement or lime are used for mortar cracks soon develop which cause leakage and spoilage of the ensilage. Where the blocks are laid in courses an unduly great amount of steel is required for reinforcing since at least one ring must be used per course and only rings of fairly large cross sectional dimensions are practical. Where hoops or bands with tensioning means have been applied upon the exterior of a silo constructed with Portland cement or lime joints, breaking or fracturing of the blocks would frequently occur. Whenever a plastic cement such as mastic has been used in the joints the same results would occur as soon as the cement had oozed out of the joints. Again irregularities in construction of the blocks and particularly tile which are formed by the extrusion method would make it practically impossible to form tight joints between the tile. The present invention overcomes all of these disadvantages in a manner which will become readily apparent from the following description of the invention.

For the purpose of illustration, a complete silo has been shown in Fig. 1 which is indicated in its entirety by the reference numeral 10. The silo is erected on a base or foundation 14 and comprises a wall structure 15 which rests directly upon said base. In the wall structure 15 is arranged a plurality of door frames 16 which provide openings for entrance into the interior of the silo. A roof 17 covers the silo proper and doors 18 close the openings in the frame 16. The foundation 14 may be constructed of concrete or any other suitable material such as masonry or brick work and the same not forming any feature of the invention has not been disclosed in detail.

The frame 16 and the doors 18 may also be of any common construction such as is now well known in the art and this particular construction has not been shown in detail. In conjunction with the said doors and frames, rungs 19 may also be employed as is now customary in the art to form a ladder by means of which access may be had to the uppermost portion of the silo.

The roof 17 may likewise be of any desired construction such as is now well known in the art and has not been shown in detail.

My invention resides in the wall structure 15 which consists of a number of staves 11 which are constructed from building blocks disposed one upon the other, said staves extending in parallel relation up to the top of the silo 10. Suffixes

a, b, c, etc. will be added to the reference numerals 11 to designate certain of the staves. The staves are constructed from two types of blocks indicated generally by the reference numerals 20 and 21 which are identical in cross section but which differ only in length. The blocks 21 are full length and the blocks 20 are substantially half length so that the blocks may be laid to break the horizontal joints. Suffixes *a, b, c, etc.* will be added to the reference numerals 20 and 21 to designate certain of the said blocks. Inasmuch as all of these blocks are similar in construction, only the block 21*a* will be described in detail. This block is preferably formed by the extrusion method which lends itself to the economical manufacture of tile and similar building blocks. Said block includes an inner wall 22 and an outer wall 23 connected by side walls 24 and 25. These walls are reinforced by means of a transversely disposed web 26 extending from the side wall 24 to the side wall 25 and by means of cross webs 27 and 28 connecting the inner wall 22 and the outer wall 23 with the web 26. The block is open at its upper and lower ends and when the blocks are placed one upon the other form a continuous stave extending throughout the height of the silo.

In the lateral surfaces 31 and 32 of the walls 24 and 25 of block 21*a* are formed grooves 33 and 34 segmental-shaped in cross section. These grooves are disposed in close proximity to the inner wall 22 and the inner structure of the block is reinforced where these grooves are situated by means of fillets 35 and 36. The grooves 33 and 34 are the same distance from the inner surface of the block and are parallel therewith so that the said grooves register with and lie in continuation of one another when the blocks are placed one upon the other to form the staves. It will also be noted that due to the arrangement of the staves that groove 33 of one stave faces groove 34 of the adjacent stave and vice versa.

In conjunction with the various blocks 21 a number of cushion strips 37 are used of which certain of said strips are designated as 37*a* and 37*b* etc. These strips are constructed of wood or some other similar resilient material and preferably redwood, cypress or any other wood having similar characteristics. These cushion strips are cylindrical in form and may be of a length equal to the height of the silo or shorter as found convenient. When short lengths are used, the same are placed end to end.

For the purpose of drawing the staves 11 of the silo together, a number of hoops 38 are employed. The suffixes *a, b, c, etc.* are added to the reference numerals 38 to designate certain of said hoops. These hoops being all identical only hoop 38*b* will be described in detail. Hoop 38*b* is made in a number of sections 39 of which the various sections are identified by the suffixes *a, b, etc.* applied to the reference numeral 39. Any number of sections may be used and preferably three or more. These sections are also identical in construction and only section 39*b* will be described in detail. This section is constructed from a channel having flanges 43 and 44 and a web 45 connecting the same. The section 39*b* is curved in the arc of a circle conforming to the curvature of the silo and is constructed so that the back of the web 45 thereof lies against the outer surfaces of the blocks 20 and 21 of the silo.

At the ends 46 and 47 of the section 39*b* are provided lugs 48. These lugs are constructed from sheet iron and are bent to provide tubular

portions 49 together with flanges 51 and 52 issuing therefrom. The flanges 51 and 52 overlie the outer surface of the web 45 and extend from flange 43 to flange 44 thereof. The flanges 51 and 52 of lugs 48 are welded to the web 45 of the section 39*b*.

The sections 39 of each hoop 38 are connected together by means of rods 53 which are threaded at their ends and which extend through the tubular portions 49 of lugs 48. Nuts 54 screwed on the ends of said rods serve to draw the parts together.

In the erection of the silo the following is the procedure: The foundation 14 is first constructed in the ordinary manner and when concrete is used it is allowed to become thoroughly set. This foundation is of a diameter slightly greater than the outer diameter of the wall 15 of the silo. A circle is next drawn for the interior of the silo and a diameter is selected such that a whole number of tile or blocks may be used in constructing the silo. One of the frames 16 is first placed upon the foundation at the proper position and blocks 20*a* and 21*a* are alternately laid adjacent one another about the circle with the lateral surfaces 31 and 32 of each block disposed in juxtaposed position with respect to the corresponding surfaces of the adjoining blocks. With the blocks so arranged, it will be found that the grooves 33 and 34 of adjacent blocks face one another and form vertical cylindrical openings. As the blocks are laid mastic or some other suitable plastic material is placed between the blocks and the foundation. The cushion strips 37 are next inserted into the openings formed by grooves 33 and 34, and project upwardly therefrom. Hoop 38*a* is now placed about the lowermost portion of the wall and upon the foundation 14 and the nuts 54 thereof tightened up sufficiently to draw the various blocks together and to bring the cushion strips 37 into engagement with the surfaces of the blocks at the grooves 33 and 34. Mastic is next placed upon the upper edges of the walls and partitions of the blocks and a series of full sized blocks 21*b* laid upon the blocks 20*a* and 21*a*. These blocks are slid along the cushion strips 37 which are readily spread apart above the laid blocks to receive the same and rest directly upon the blocks 20*a* and 21*a* with the grooves 33 and 34 thereof registering with the corresponding grooves of the blocks 20*a* and 21*a*. After the blocks 21*b* have been laid another hoop 38*b* is applied which is placed at the joints between the upper edges of the blocks 21*a* and the lower edges of the superimposed blocks 21*b*. This hoop is then tightened sufficiently to hold the blocks in engagement with the cushion strips. The upper edges of these blocks are then covered with mastic and another series of block 21*c* applied. At the same time frames 16 are added and more hoops applied and the building continues until the silo is of full height. At the top of the silo full size blocks 21*x* and half size blocks 26*x* are laid in alternation which bring the upper surfaces of the blocks up to an even level.

In the laying of the blocks mastic is applied to the exterior of the blocks throughout circumferential bands coextensive with the hoops 38. This mastic is indicated at 55 in Fig. 4 and fills in the space between the blocks and hoops thereby preventing water, ice or snow from passing between the hoops and the wall and entering the joints. In this manner the joints are protected at localities where the same would otherwise be directly subjected to the elements.

After the entire silo is erected the various hoops are tightened up sufficiently to draw the various blocks together and into firm and positive engagement with cushion strips. When this has been accomplished it will be found that the cushion strips closely contact with the surfaces of the blocks regardless of the irregularities therein so that a positive seal is effected between the various blocks, thereby making an absolutely tight construction. It will be noted that the various blocks are placed one upon the other in columnar formation so that the staves 11a, 11b and 11c etc. are formed. Due to the use of wood or similar cushion strips the pressure on the blocks is uniformly distributed and breakage or crushing of the blocks through the pressure applied to the same by means of the various hoops is entirely prevented. The grooves 33 and 34 provide shoulders which engage the cushioning strips 37 where- by the blocks are keyed in place with respect to one another.

In the design of the blocks and the cushion strips the grooves 33 and 34 and the said strips are of such diameters that the blocks are spaced throughout their entire vertical extent prior to the tightening up of the hoops. When the hoops are tightened the blocks may or may not come in contact with one another laterally, depending upon the tension in the hoops. If the blocks do come in contact, the greater part of the pressure is taken up by the cushion strips and distributed throughout the height of the blocks, thereby preventing undue localized pressure due to irregularities of blocks. This prevents breakage and injury as previously described. The dimensions of the grooves 33 and 34 and the strips 37 are such that the blocks may be laid in circles of any diameter within the limits now common in the construction of silos.

After completion of the wall structure the roof 17 may be applied in accordance with any of the usual methods.

It will be noted that the grooves 33 and 34 are slightly spaced from the inner surfaces of the walls 22 of the blocks. This leaves vertically extending crevices 41 between the adjoining blocks which extend inwardly to the cushion strips 37. Where redwood or cypress is used for cushion strips, a tight joint is formed and a joint which will endure as long as the wood. It has been found that either of these woods will endure indefinitely even when subjected to weather and conditions such as exist in a silo so that special protection of the wood in the cushion strips is unnecessary. However, if desired, the crevices 41 may be filled with a mastic 42 which can be inserted into the same by means of a gun such as is now common practice. This would prevent any of the juices from the ensilage from entering the said crevices and being soaked up by the cushion strips. Upon the interior of the silo it becomes unnecessary to take any precaution for the protection of the cushion strips since rain and weather will not injure the same.

My invention is highly advantageous in that an extremely practical building block and silo construction is provided, whereby silos of any size may be readily built from a single type of block made in two lengths. It becomes unnecessary to use Portland cement or lime for mortar in the erection of the silo where the blocks are constructed of tile so that the objections to the use of Portland cement in silos may be overcome. With the cushion strips installed as specified, injury to the blocks or tile is entirely prevented.

My silo may be erected without the need of elaborate temporary falsework or scaffolding for supporting the structure during erection. Any height of silo or any diameter of silo within certain limits may be readily built with the two sizes of blocks.

Changes in the specific form of my invention, as herein disclosed, may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In a silo circular in cross section, a number of building blocks in the form of a hexahedron having substantially rectangular lateral surfaces, said blocks being arranged one upon the other to form staves and with the lateral surfaces of the blocks in each stave disposed in juxtaposition with respect to the lateral surfaces of the blocks in adjoining staves, said juxtaposed surfaces due to the circular arrangement of the stave forming reentrant angles with one another, said juxtaposed surfaces being constructed with facing vertical grooves, the grooves in the corresponding lateral surfaces of the blocks of each stave registering with and lying in continuation of one another, said grooves being disposed near the vertexes of said reentrant angles, cushioning strips in said grooves, and means for drawing the staves toward one another and into engagement with said strips.

2. In a silo constructed of building blocks arranged with circumferentially extending joints, hoops of extensive lateral dimensions extending about said blocks, said hoops covering said joints, and a plastic material between the hoops and blocks, said material filling up the space between the hoops and blocks and excluding the elements from said joints.

3. In a silo constructed of building blocks arranged with circumferentially extending joints, channel shaped hoops extending about said blocks, said hoops covering said joints, and a plastic material between the hoops and blocks, said material filling up the space between the hoops and blocks and excluding the elements from said joints.

4. In a silo, a number of building blocks arranged one upon the other to form staves, the staves being arranged in the form of a circle and with the lateral surfaces of the blocks in each stave disposed in juxtaposition with respect to the lateral surfaces of the blocks in the adjoining staves, said blocks having complemental facing arcuate grooves in the lateral surfaces thereof, cylindrical wood cushioning strips within said grooves, and means for drawing the staves toward one another and into engagement with the cushioning strips.

5. In a silo, a number of building blocks arranged one upon the other to form staves, the staves being arranged in the form of a circle and with the lateral surfaces of the blocks in each stave disposed in juxtaposition with respect to the lateral surfaces of the blocks in the adjoining staves, said blocks having complemental facing arcuate grooves in the lateral surfaces thereof, cylindrical wood cushioning strips within said grooves, said lateral surfaces of said blocks diverging from said cushioning strips in one direction when the blocks are arranged in a circle of a predetermined diameter to cause said surfaces to clear one another when the blocks are arranged in a circle of differing diameter, and means for drawing the staves toward one another.

other and into engagement with the cushioning strips.

6. In a silo, a number of building blocks arranged one upon the other to form staves, the staves being arranged in the form of a circle and with the lateral surfaces of the blocks in each stave disposed in juxtaposition with respect to the lateral surfaces of the blocks in the adjoining staves, said blocks having complemental facing grooves in the lateral surfaces thereof, wood cushioning strips within said grooves, said lateral surfaces of said blocks diverging from said cushioning strips in one direction when the blocks are arranged in a circle of a predetermined diameter to cause said surfaces to clear one another when the blocks are arranged in a circle of differing diameter, and means for drawing the staves toward one another and into engagement with the cushioning strips.

7. In a silo, a number of building blocks substantially rectangular in cross section arranged one upon the other to form staves, the staves being arranged in the form of a circle and with the lateral surfaces of the blocks in each stave disposed in juxtaposition with respect to the lateral surfaces of the blocks in adjoining staves, wood cushioning strips disposed between the lateral surfaces of the blocks and holding the staves out of contact with one another laterally and transmitting the entire lateral pressure from one stave to the adjoining stave, said cushioning strips being disposed near the inner corners of the blocks, said lateral surfaces of the blocks outwardly of the cushioning strips diverging when the blocks are arranged in a circle of predetermined diameter to cause said surfaces to clear one another when the blocks are arranged in a circle of differing diameter, and means for drawing the staves toward one another and into engagement with the cushioning strips.

8. In a silo, a number of building blocks arranged one upon the other to form staves and with the lateral surfaces of the blocks in each stave disposed in juxtaposition with respect to the lateral surfaces of the blocks in the adjoining staves, and wood cushioning strips disposed between said surfaces, said strips forming seals between said surfaces and holding said staves out of contact with one another laterally and transmitting the entire lateral pressure from one stave to the adjoining stave, and means for drawing the staves toward one another and into engagement with said strips.

9. In a silo, a number of building blocks arranged one upon the other to form staves and with the lateral surfaces of the blocks in each stave disposed in juxtaposition with respect to the lateral surfaces of the blocks in the adjoining staves, and compressible load transmitting cushioning strips disposed between said surfaces, said strips forming seals between said surfaces and holding said staves out of contact with one another laterally and transmitting the entire lateral pressure from one stave to the adjoining stave, and means for drawing the staves toward one another and into engagement with said strips.

10. In a silo, a number of building blocks arranged one upon the other to form staves, the staves being arranged in the form of a circle and with the lateral surfaces of the blocks in each stave disposed in juxtaposition with respect to the lateral surfaces of the blocks in the adjoining staves, said blocks having complemental facing arcuate grooves in the lateral surfaces thereof, cylindrical compressible load transmitting cushioning strips within said grooves, and means for drawing the staves toward one another and into engagement with the cushioning strips.

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