Nov. 1, 1966 C. D. KEELY 3,281,999

PREFABRICATED BUILDING CONSTRUCTION

Filed April 12, 1962 6 Sheets-Sheet 1

Fig. 1.

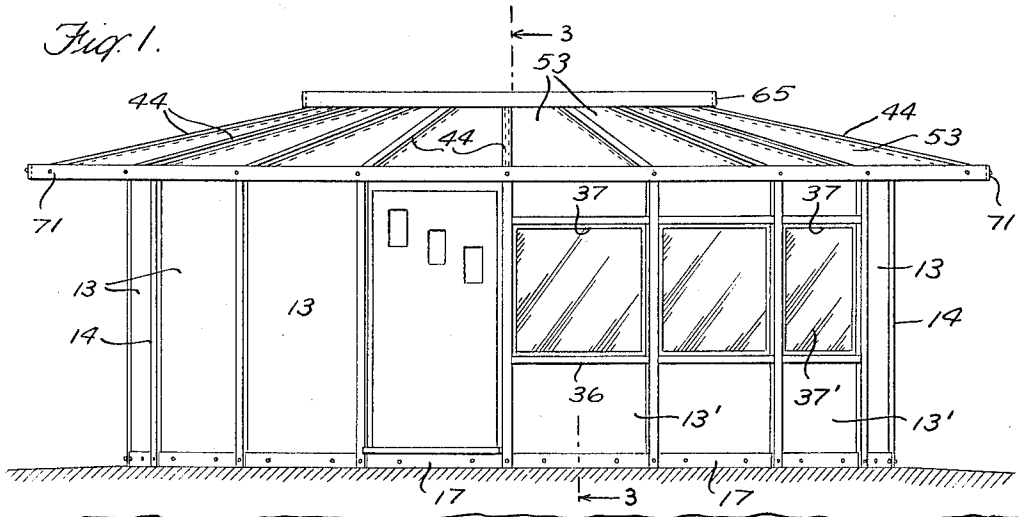
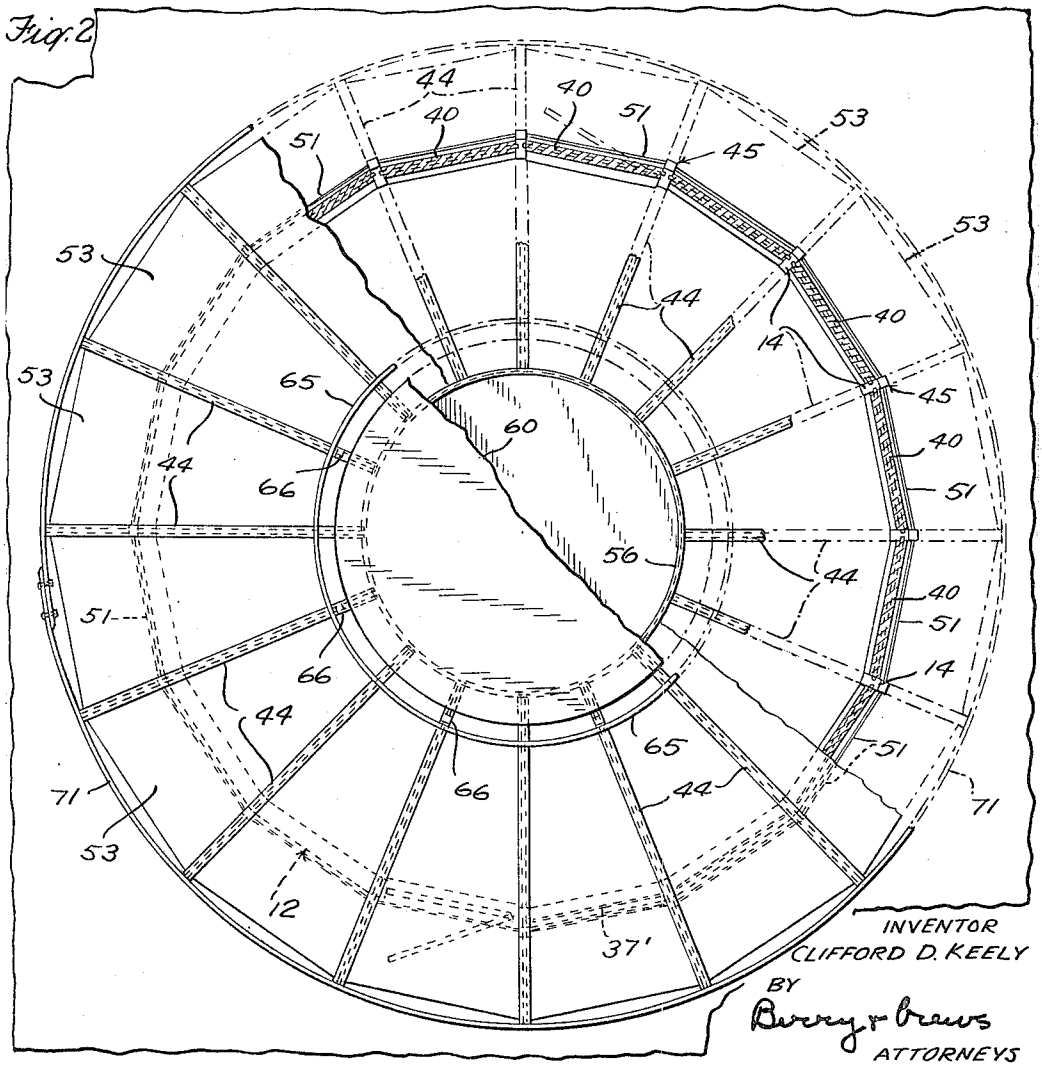


Fig. 2



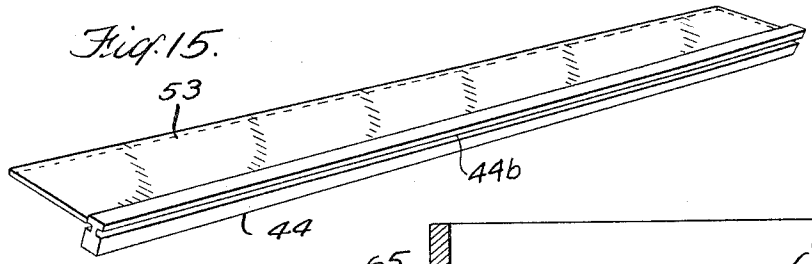
INVENTOR
CLIFFORD D. KEELY
BY
Berry & Brews
ATTORNEYS

Nov. 1, 1966 C. D. KEELY 3,281,999

PREFABRICATED BUILDING CONSTRUCTION

Filed April 12, 1962 6 Sheets-Sheet 2

Fig. 15.



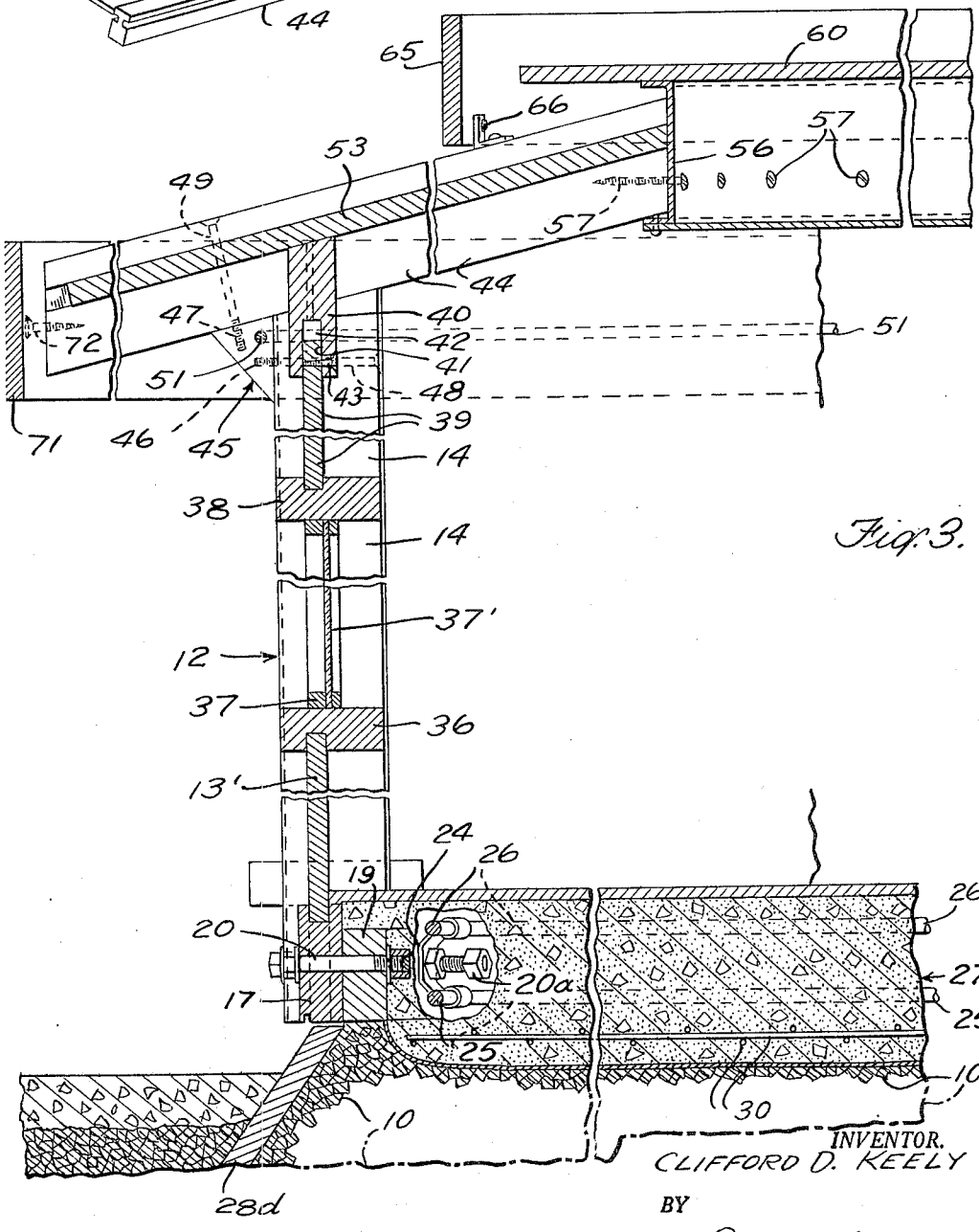


Fig. 3.

INVENTOR.
CLIFFORD D. KEELY

BY

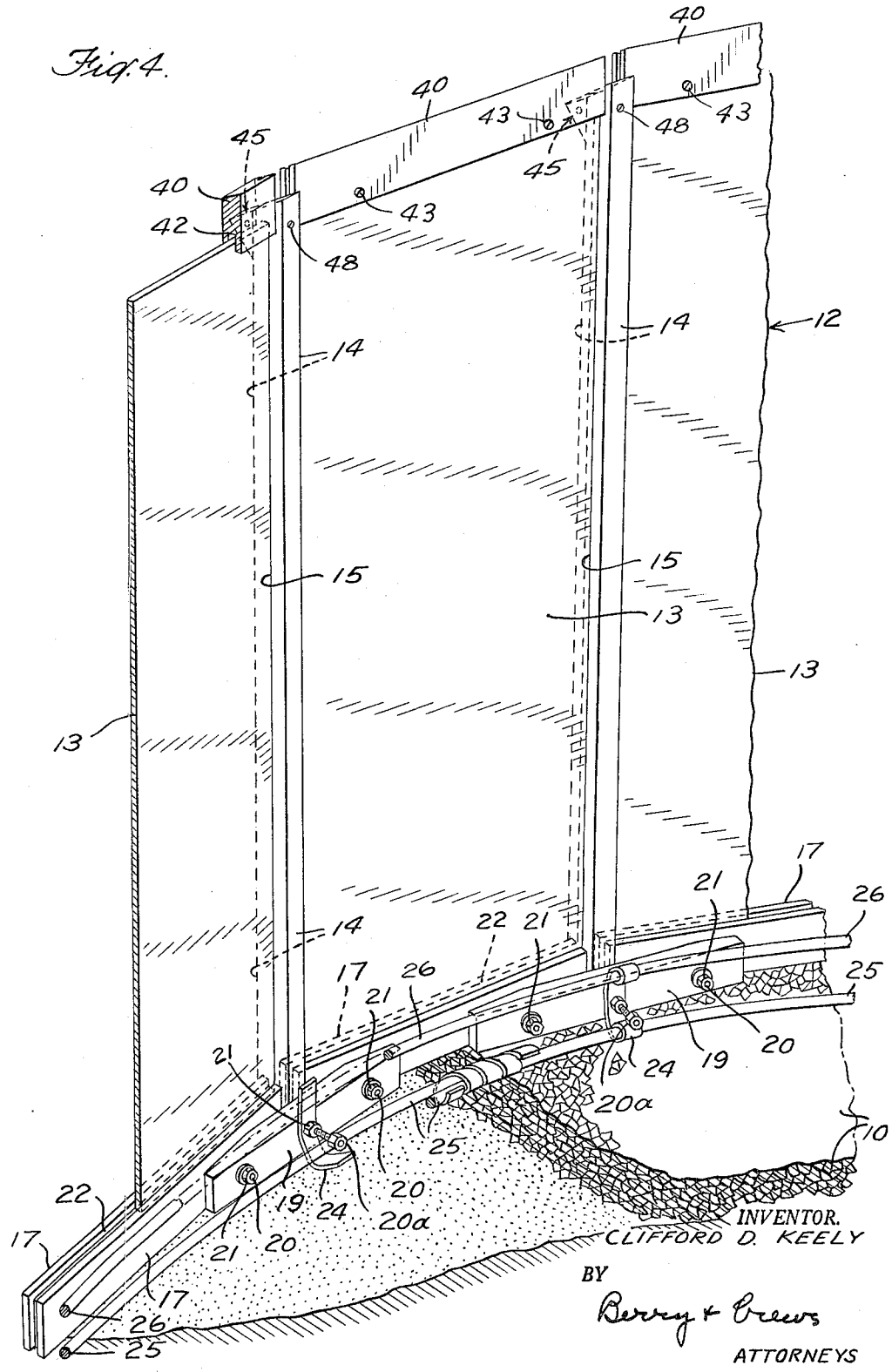
Berry & Brews
ATTORNEYS

Nov. 1, 1966 C. D. KEELY 3,281,999

PREFABRICATED BUILDING CONSTRUCTION

Filed April 12, 1962 6 Sheets-Sheet 3

Fig. 4.



INVENTOR.
CLIFFORD D. KEELY
BY
Berry & Brews
ATTORNEYS

Nov. 1, 1966 C. D. KEELY 3,281,999

PREFABRICATED BUILDING CONSTRUCTION

Filed April 12, 1962 6 Sheets-Sheet 4

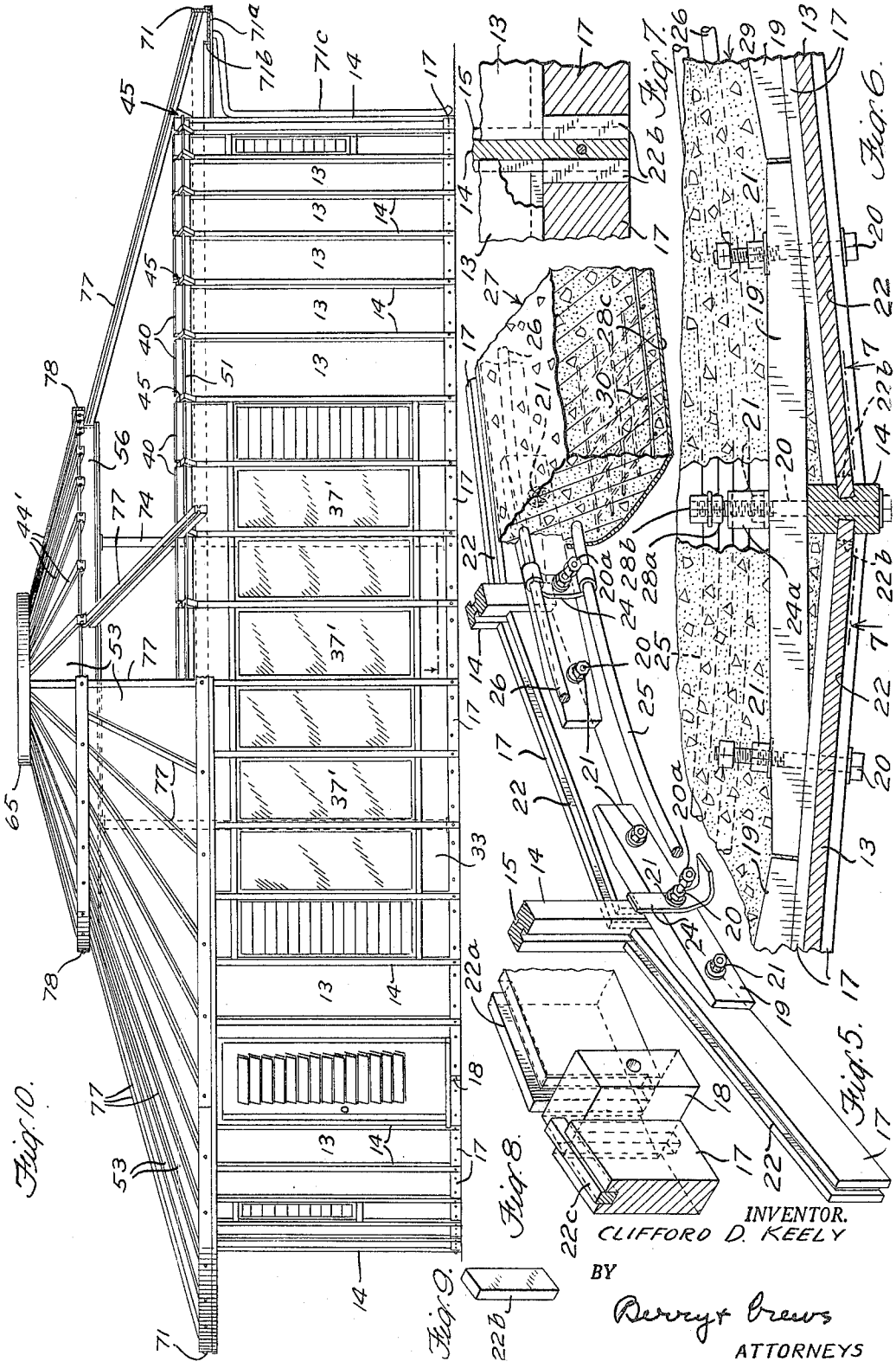


Fig. 10.

Fig. 9.

Fig. 8.

Fig. 7.

Fig. 6.

Fig. 5.

INVENTOR.
CLIFFORD D. KEELY
BY
Berry & Brews
ATTORNEYS

Nov. 1, 1966 C. D. KEELY 3,281,999

PREFABRICATED BUILDING CONSTRUCTION

Filed April 12, 1962 6 Sheets-Sheet 5

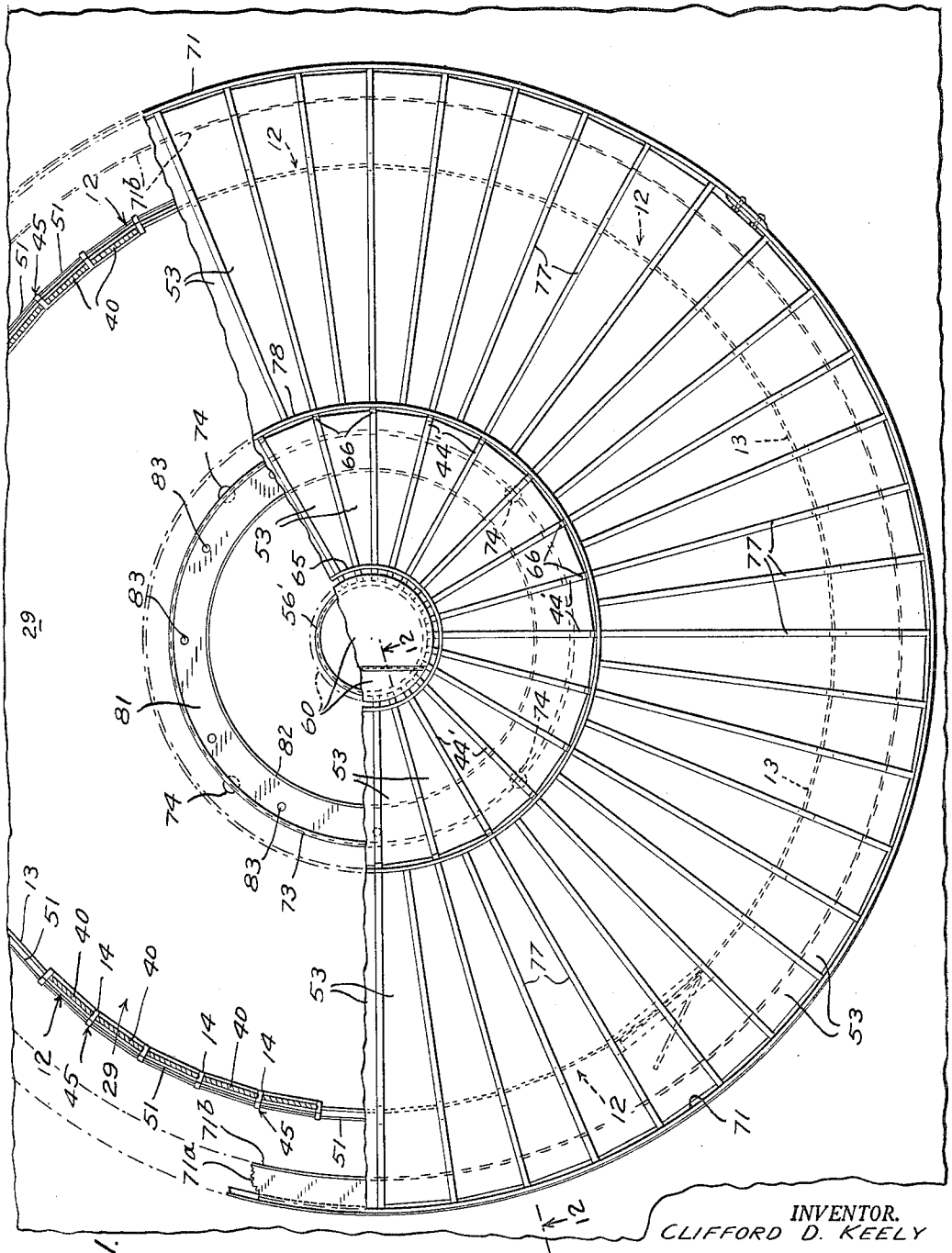


Fig. 11.

INVENTOR.
CLIFFORD D. KEELY

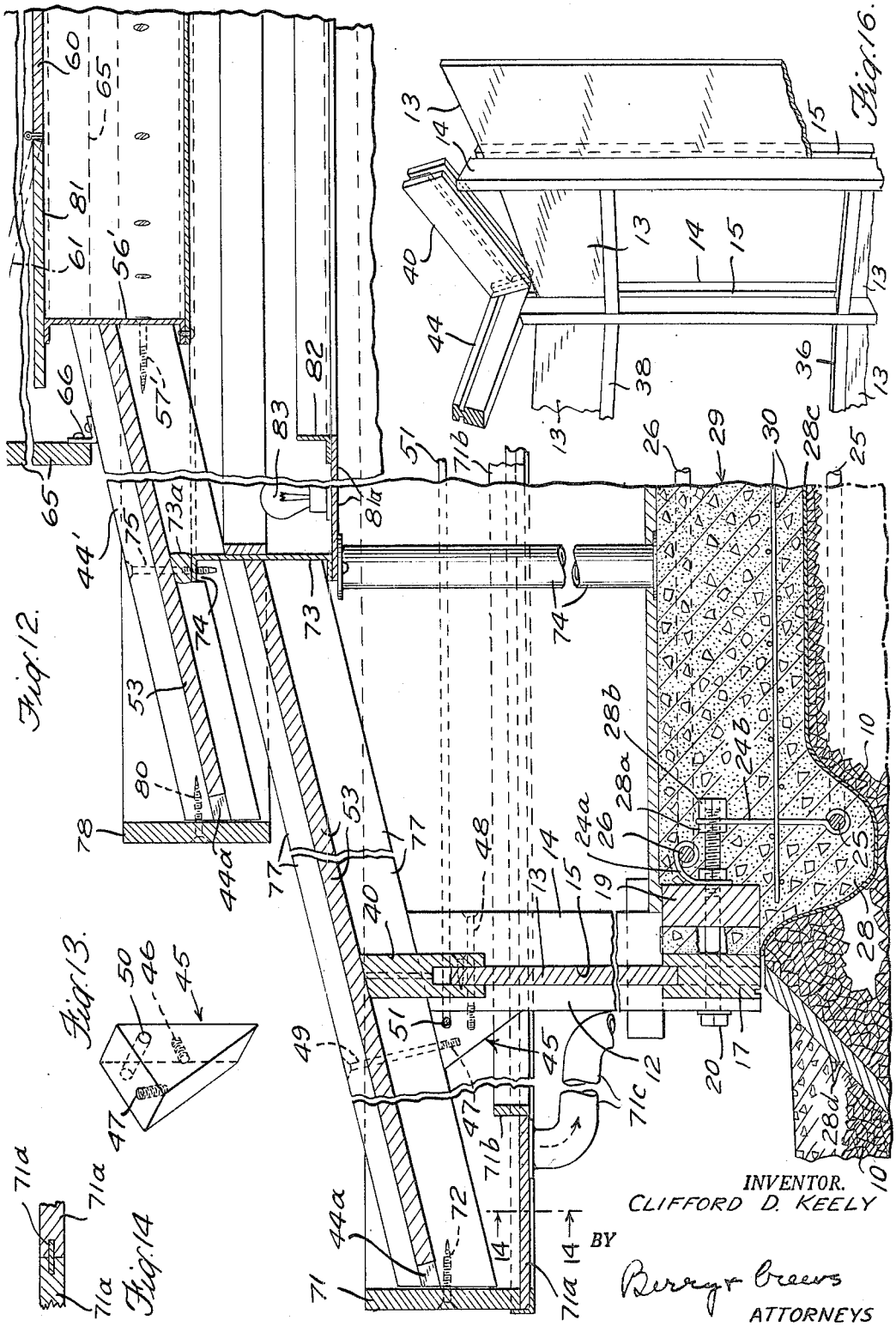
BY Berry & Crews

ATTORNEYS

Nov. 1, 1966 C. D. KEELY 3,281,999

PREFABRICATED BUILDING CONSTRUCTION

Filed April 12, 1962 6 Sheets-Sheet 6



United States Patent Office 3,281,999 Patented Nov. 1, 1966

3,281,999

PREFABRICATED BUILDING CONSTRUCTION

Clifford D. Keely, Palisades Park, N.J.; Abram A. Lebson and Milton Prigoff, executors of said Clifford D. Keely, deceased, assignors to Daniel Keely, Sussex County, N.J.

Filed Apr. 12, 1962, Ser. No. 186,925
9 Claims. (Cl. 52—82)

My present invention relates to a prefabricated building construction, and two methods of erecting same. More particularly, the present invention is an improvement upon the construction disclosed and claimed in my prior Patent 2,775,794, issued January 1, 1957, this construction being characterized by being of regular polygonal shape with more than four and preferably more than ten sides.

One object of my invention is the provision of an improved roof construction in which means are had for joining the lower ends of the rafters, preferably in the form of a circular collar tie for equalizing the load on the overhanging roof, whereby such load upon any one rafter, especially the overhanging part thereof, is distributed to the others by means of its circular beam action.

A further object is to provide an improved form of conical roof construction in which the roof is stepped, thereby dividing the rafter span and reducing the dimensions of the rafters. Intermediate supports can be additionally provided, when necessary.

A still further object is to provide an improved method of assembly the stud pieces that support the sides of the building.

A still further object is to provide an improved concrete pad construction for the support of the building.

Other objects to be attained, and advantages thereof, will be apparent from the detailed description which follows, and the features of novelty will be pointed out in the appended claims.

In buildings of the type of the present invention, wherein the roof is entirely supported by the circular wall, a problem is presented in satisfactorily taking care of stresses in the rafters occasioned by variations in the live roof loads, as by the accumulation of snow, or by people standing on the roof. In lieu of having to use rafters of greater size and weight, I have found that such load variations may be caused to be shared by the other rafters by means of my novel construction. In so carrying out this feature of my invention, I provide for a simple attachment of the rafters with the corresponding studs, as in the case of my previous patent above mentioned (but using improved means for such attachment), and as shown in said patent, I extend the rafters considerably beyond the studs. Then I connect these portions of the rafters projecting beyond the studs with a continuous, substantially circular, substantially concentric band or tie beam having the requisite tensile and compressive strengths. In this manner, displacement of a rafter end which would occur by reason of the non-uniform loading will be resisted by said band, and in such manner such load will be transmitted to adjacent rafters. While in my previously patented construction individual spacer elements were used between the rafter ends, they did not constitute a continuous beam, and had no continuous tensile strength.

For the best understanding of my invention, reference may now be had to the following detailed description taken with the accompanying drawings, in which:

FIGURE 1 is a view in elevation of an illustrative embodiment;

FIGURE 2 is a plan view thereof with parts broken away;

FIGURE 3 is an enlarged view in vertical section taken on line 3—3 of FIGURE 1, parts being broken away;

FIGURE 4 is a view in isometric projection showing the construction of the base elements, including a reinforced concrete pad which is shown partly in section;

FIGURE 5 is a view in perspective showing further the construction of the base elements, including especially the means for supporting the bars which reinforce the concrete slab circumferentially to form tie-band and perimeter beam;

FIGURE 6 is an enlarged sectional plan view of a modification, the section being taken on line 6—6 of FIGURE 10;

FIGURE 7 is a view of a detail taken on line 7—7 of FIGURE 6;

FIGURE 8 is a view in perspective showing the use of a removable stud filler block used to complete the form for the pouring of the concrete slab. These blocks are removed and replaced by wall studs during the erection of the building;

FIGURE 9 is a perspective view of the key which is shown in place in FIGURE 7;

FIGURE 10 is a view in vertical elevation of a further embodiment having a stepped roof construction, parts being broken away;

FIGURE 11 is a plan view thereof;

FIGURE 12 is a view in section taken on line 12—12 of FIGURE 11;

FIGURE 13 is a view showing a block of special shape for use in attaching the rafters to the studs;

FIGURE 14 is an enlarged detailed section taken on line 14—14 of FIGURE 12;

FIGURE 15 shows in perspective a preassembled unit of roof panel in grooved rafter; and

FIGURE 16 is a perspective view showing the details of the side walls and rafters.

It will be convenient first to describe the foundation of my improved building, reference being had to FIGURES 3, 4, 5, 6, 7 and 12. The chosen site of the building is first cleared, leveled and firmed, whereupon a layer of crushed stone 10, properly leveled, preferably two feet or more larger in diameter than the periphery of the building, is laid down. Upon this crushed stone layer will be assembled the concrete slab form made up of foundation parts 17, 18, 19, 20. Since these parts also serve as a base for the walls, they remain in place (except stud filler block 18) during erection of walls, and become an integral part of the completed building. In proceeding with the erection, suitable foundation pieces, as for example, pieces of plywood, not shown, may be placed on top of the stone at each stud location of the building, taking care that all are substantially level. The foundation units for holding the walls 12 may then be put in place upon said plywood pieces, said foundation units consisting of a sill piece 17 of trapezoidal shape, block 18, tie piece 19, and long bolts 20. Said units 17–19 are then assembled as shown in FIG. 5 in which adjacent sill pieces are separated by the stud filler block 18, and these units bolted to tie piece 19 by one of the bolts 20, the necessary holes being provided, as shown. It will be noted that the shanks of the bolts 20 project inwardly beyond the tie pieces 19 and carry nuts 21. All bolts preferably carry a second nut 20*a*, the purpose of which will be apparent, although only the center bolt is so shown. Units comprising elements 17, 18, 19 may now be put in place. The bolts 20 which project beyond the tie pieces 19 will become embedded in the concrete slab subsequently to be poured, thus affording means for anchoring the bolted structure to the concrete slab. The sill pieces 17 each have a top groove or rabbet 22 for receiving the lower edge of the panel 13. Communicating with groove 22 are end grooves which, upon alignment

with the vertical grooves in the lower end of the studs, enable the sills **17** to be locked thereby by means of keys **22***b*—see FIGURE 7. Filler blocks **18** which preferably abut tie pieces **19** are of a cross-section the same size and shape as studs **14**, preferably without dado grooves. The bolting together of the units **17–19** is continued until the ring is closed.

For the purpose of counteracting the effect of frost or other disturbance in the ground, which would compel the concrete pad to be poured to act as a beam, especially the peripheral portion thereof, it is desirable suitably to reinforce such pad. To this end, I provide an improved reinforcement by means of the usual reinforcing steel bars. In the disposition of these, I have found it advantageous to suspend one or a pair of such bars (which may be bent into circular form of the desired size) by means of straps **24**, FIGURE 5, of easily deformable metal, as for example, aluminum, which are retained in place by having a central hole, not shown, to accomodate a bolt **20**, one strap being preferably provided for each unit **17–19**, as shown. The ends of straps **24** may be bent over the bars now referred to as **25**, **26**, as best seen in FIGURES 3 and 5. Then the concrete pad is poured within the ring formed by the sill pieces **17** to a height which is flush with, or slightly higher than the tops of the sill pieces **17**, as shown in FIGURES 3 and 12. Before pouring the concrete slab, it is desirable to insert filler strips **22***c* FIGURE 8, into the said grooves **22** in the sill pieces **17**, which strips extend slightly above the top surface of the sill pieces. Thereby the said grooves **22** will not catch the concrete, and the tops of the sill pieces will be protected during the screeding operation. After the concrete has been poured, and before the wall panels **13** are inserted in said grooves **22**, the strips **22***c* are removed.

Since the forces tending to break or crack the concrete pad are greatest in the peripheral region, I have found that a saving in expense may be had by forming the concrete slab with an integral depending, reinforcing flange, as best seen in FIGURE 12 the same constituting a so-called grade beam. Here an annular depression **28** is first formed in the stone fill **10**, after which the concrete is poured to form a pad or slab **29**. Preferably embedded in the slab **29** is a steel reinforcing mat **30** of the approximate size of the slab. In this construction the reinforcing bars **25**, **26** of FIGURE 12 may be treated somewhat differently. As shown, upper bar **26** may be supported by its own strap **24***a* next to the sill piece **17**, whereas the lower bar **26** may be supported from the end of bolt **20** by means of strap **24***b* (secured thereto by being disposed between two nuts **28***a*, **28***b*), which extends downwardly into the concrete flange **28**.

For the purpose of constituting a vapor barrier, a layer of polyethylene or asphalt impregenated paper or the like **28***c* may be laid over the layer of crushed stone, FIGURES 3 and 12. Also a layer of insulating material **28***d* surrounding the stone fill **10** beneath the building itself, and preferably outwardly inclined, may be employed when climatic conditions require it or make it desirable.

After the concrete pad or slab **29** is formed, the blocks **18** are removed by first unscrewing and removing the bolts **20** which hold them in place, the person erecting the building is now ready to assemble the studs **14**, keys **22***b*, and the side panels **13**. Thereby the advantages are had that the assembly of the studs **14** and the panels **13** is facilitated, while providing a greater amount of free space during the time that the foundation is being put together and the concrete pad is poured. It will be noted that the nuts threaded upon the middle bolts **20** will have been retained in the concrete pad following the removal of such bolts, so that when the studs **14** are substituted for the blocks **18**, the same bolts may be screwed home through the same nuts that held them originally. By having the end nut **20***a* left originally with the bolt not quite penetrating to the end thereof, an additional tightening of the bolt may then be had, if necessary.

When the studs **14** are inserted in the space previously occupied by the blocks **18**, they are then preferably, in effect, locked in place by the insertion of keys **22***b*, FIGURE 7, which engage both the grooves in the studs **14** and the end groove of the sill piece **17**, as shown in FIGURE 7.

As will be apparent from FIGURE 5, the width and preferably the thickness of the blocks **18** are the same as the studs **14**. Of course various types of panels may be erected, as required, as will be noted from FIGURE 10 showing window panels **33**, door panel **34**, etc.

FIGURE 3 shows the construction of a typical window panel comprised of a shortened panel member proper **13'**, window sill **36**, window frame **37** for holding a fixed pane of glass **37'**, lintel or window header **38**, panel section **39** disposed in a groove in said lintel. Panel section **39** extends upwardly for a distance short of the roof to accommodate a panel header or spanner member **40** having groove **41** which contains the upper edge of the panel section **39** and maken a close fit therewith. The parts are formed so as normally to leave a space **42** at the top of the groove of header **40**. When the roof—to be described—has been put in place, the erector by tapping the exposed edge of the header **40**, causes it to move upwardly to make close contact with the adjacent roof panel, whereupon he secures it in place by means of two screws **43**. In this manner, any slight accumulated erros, principally due to normal allowable building tolerances, in the heights of the several pieces, are compensated for by the above mentioned space **42**, without the necessity of having to alter the dimension of any one piece. It is similarly advantageous to use the grooved header piece **40** for the full length panel, as seen in FIGURE 12. It will be understood that similarly, provision may be made for other types of windows as desired, including those of the jalousie type, as shown in FIGURE 10.

The walls of the building having been thus erected, the roof may now be formed. As in my prior patent, the roof may be formed of rafters **44** of the approximate cross-section of normal studs **14**. For the purpose of securing the rafters to the studs, I preferably employ a tie block casting or gusset **45**, FIGURES 12 and 13, conveniently of cast iron and of the same width as that of the stud face, and with the top face of the same angle to the vertical as that of the rafter. It further has two threaded holes **46**, **47**, FIGURE 13, to accommodate bolts **48**, **49** respectively, the former passing through the stud **14**, and the latter through the rafter **44**. The blocks **45** also are useful during the construction of the building, since they assist in supporting the rafters to be held in place with a minimum need for shoring. Blocks **45** also have a hole **50** to accommodate the taut-drawn cable **51** extending around the periphery of the building to enable the building walls to resist forces exerted by the roof in an outward direction, particularly until the cooperating facia collar tie-band is attached to the rafter ends, as will be hereinafter apparent.

The assembly of the rafters **44** is accompanied by that of the roof panels **53**. Desirably each dado grooved rafter **44** is first joined to a roof panel **53**, as shown in FIGURE 15 (dado groove **44***b*). In the assembly of said elements, the upper ends of the rafters **44** are joined to circular collar or channel **56**, FIGURE 3, and are attached thereto by means of screws **57**, the lower ends of the rafters resting upon the lower flange of the channel. The circular opening created by the collar **56** may be roofed over in any suitable way, as by means of a cover **60** of plywood or the like. The cover **60** is fastened to the channel **56** with screws or other suitable means, and may be provided with a tiltable hinged panel **61**, FIGURE 12, for ventilation.

A collar **65** may be disposed around the cover **60** a short distance beyond the same, as seen in FIGURES 3 and 12, to constitute an ornamental fascia therefor. It may be secured to the rafters **44** by means of angles **66**.

As previously set forth, the rafters **44** overhang the studs **14** in such a manner as to have the ends of the rafters lie in a circle, such circle preferably being concentric with the polygonal slabs **27** or **29** formed by the walls of the building.

As above set forth, it is a feature of my invention that such rafter ends are joined together as by band **71** which is connected thereto by long coarse threaded screws **72**, such band being of a material, as for example, wood, which has the requisite tensile and compressive strength so that variations in load borne by one rafter or a group of rafters, are transmitted to other rafters adjacent thereto. Furthermore, such band **71** adds to the overall strength of the building by acting as a further circumferential tie in common with the cable **51**. The coned roof could be utilized for other uses such as a car port or patio canopy, and would then be supported at this perimeter tie-band beam by pipe or wood columns at proper intervals. In such instances this tie-band would preferably be cold formed steel channel sections properly joined to form the circular perimeter. Also sectional gutter pieces **71***a* may be secured with an inner circular wall **71***b* forming a gutter for accumulation of water to be drained by leaders **71***c*, one of which is shown in FIGURE 12. This is preferable at least for the doorway areas. The joints may, if desired, be provided with locking strips **71***d* as shown in FIGURE 14.

When the diameter of the building exceeds twenty feet, rather than increase the rafter size beyond that required for the building shown in FIGS. 1 to 3, for example, I have found it desirable to create a stepped roof in the form of concentric overlapping truncated cones as seen in FIGURES 10, 11 and 12, wherein two such cones are employed. As shown, particularly in FIGURES 10 and 12, upper rafters **44'** constituting an inner set, which may be of the same cross-section as rafters **44**, are supported at their inner ends by means of the usual collar or steel channel **56'**, being attached thereto by means of screw **57'**. Then, for the purpose of supporting the outer or lower ends of said rafters, a channel **73** beam is provided, and when and if structurally necessary, is supported by columns **74**, see FIGURE 11. In the united conical frustra dead and live loads throw materials in compression due to their arched relationship which eliminates need for column supports to a certain extent, depending on rafter sizes and dimensions. Various means may be employed for joining the rafter **44'** with the channel **73**. As shown, rafter **44** is notched at **74** to accommodate the top flange of channel **73**, and the depth of said rafter reduced from the location of said notch to the outer end thereof. It may be held in place by means of a screw **75** joining the rafter **44'** to the upper flange of the channel **73**. To seal the air space between channel **73**, rafters **44'** and the roof panels, a seal **73***a* is provided.

Lower rafters **77** constituting an outer set extend from channel **73** to beyond the studs **14**, being joined thereto in the same manner as already described in connection with FIGURES 1, 2 and 3. It will be noted that as shown in FIGURE 11, the rafters of said lower set are substantially equally spaced from one another and are approximately double the number of the rafters of the upper set.

Reference has already been had to the feature providing for equalizing of the roof load in the embodiment of FIGURES 1–3. In order likewise to provide for this contingency in the embodiment now being described, similar band **78** is provided of similar material serving a similar function, and secured to each rafter end by means of a screw **80**. For covering the space bound by the ring **56'**, the same cover **60** may be employed. For the purpose of ventilation, a half moon section **81** in said cover may be hinged as shown in FIGURE 12.

If desired, a circular shelf-like member **81***a* may be secured to ring **73**, the same affording support for the flanged collar **82** which serves as a shield for indirect electric lighting (electric light **83**).

It will be obvious that both the roof and the wall construction as above described lend themselves to usual double wall construction practices with insulation, fill or blanket types in the air spaces between the exterior panels and inside dry wall boards, applied to the inside faces of the studs and rafters.

It may be remarked that the circular construction shown provides for an advantageous arrangement of living space, including the disposition of rooms around the center rotunda. It is well known that the circular construction provides a greater amount of space—in the neighborhood of 30%—for the same wall area than would be the case with the usual four-sided building.

While certain preferred embodiments of the invention have been illustrated and described in detail, it is to be understood that changes may be made therein and the invention practiced in other forms without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. In a building construction of equilateral polygonal form having more than four sides, the side walls of said construction comprising

vertically disposed studs,

wall panels, and means for joining the side edges thereof to said studs,

a generally conical roof having radially extending rafters,

roof panels between said rafters and joined thereto, said rafters corresponding in number and in location to said studs, said means permitting deflection of the rafter ends in response to variation in roof load,

means for securing the upper ends of said studs to corresponding of said rafters, said rafters projecting beyond the studs to which they are connected for a substantial distance thereby constituting said rafters as levers with their fulcrums at the union thereof with the studs, and

a substantially circular, substantially concentric, continuous band possessing substantial tensile and compressive strength, joined to the projecting portions of said rafters at points substantially removed from the points of union of the rafters and studs, whereby variations in roof load with resulting displacements of the projecting rafter ends are transmitted by said band to the other of said rafters, said band further acting as a circumferential tie to impart strength to the entire building.

2. The building construction according to claim **1** in which said circular band abuts the ends of said rafters.

3. In a building construction of equilateral polygonal form having more than four sides, the side walls of said construction comprising

wall panels,

studs separating adjacent of said panels with means for joining said panels to said studs,

a foundation for said construction comprising

sill pieces of uniform size and uniform trapezoidal shape adapted to receive the lower ends of said panels,

tie pieces connecting middle portions of adjacent sill pieces and bridging said studs, the so-connected sill pieces thereby forming a ring,

a concrete slab poured in the area within the ring formed by said sill pieces,

securing bolts extending in a general horizontal direction through said sill pieces and for an appreciable distance into said concrete, and

means secured to said bolts and depending therefrom and holding in place one or more circumferential concrete reinforcing peripherally disposed rods so positioned as to reinforce said concrete.

4. In a building construction of equilateral polygonal

form having more than four sides, the side walls of said construction comprising

vertically extending wall panels separated and secured by

vertically extending studs,

a foundation of like polygonal form comprising

a set of sill pieces of trapezoidal form adapted to receive the lower ends of said panels, one for each side of the polygon with their long bases outward, adjacent ends of said sill pieces being spaced by and joined to said vertically extending studs,

tie pieces connecting middle portions of adjacent sill pieces and bridging said studs, the so-connected sill pieces thereby forming a ring,

tie pieces connecting intermediate portions of adjacent sill pieces and bridging said studs, and

means securing said tie pieces to said sill pieces and to said studs.

5. The building construction according to claim **4** including blocks whose cross section is the same as that of said studs, said blocks being placed between adjacent ends of the seal pieces, the seal pieces, blocks and tie pieces thus forming a ring within which a concrete pad may be poured, said blocks being removable after said pad has been formed, thus permitting the studs to be inserted in the places previously occupied by said blocks.

6. The building construction according to claim **4** in which said securing means extend inwardly from said tie members, and

a concrete pad poured so as to be contained within the completed ring formed by the union of said sill pieces and tie pieces, and of a substantial thickness to engage said inwardly extending securing means.

7. In a building construction of equilateral polygonal form having more than four sides, the side walls of said construction comprising

vertically disposed studs,

wall panels, and means for joining the side edges thereof to said studs,

a generally conical roof having radially extending rafters,

roof panels between said rafters and joined thereto, said

rafters corresponding in number and in location to said studs,

means for securing the upper ends of said studs to corresponding of said rafters, said rafters projecting a substantial distance beyond the studs to which they are connected, said rafters being divided into an inner and outer set with the inner set extending from the proximity of the center of said conical roof to points intermediate the overall length of the roof, and the outer set extending adjacent said points to the outer roof periphery but so as to have said sets overlap vertically with the outer ends of the inner set above the inner ends of the outer set, and

a horizontally disposed circular beam serving to support said rafter sets at the region of their overlap.

8. The construction according to claim **7** in which the inner ends of the outer rafters abut said circular beam and the outer ends of the inner rafters extend beyond said beam and are positively connected thereto.

9. The construction according to claim **7** in which the rafters of said outer set are substantially equally spaced from one another and are approximately double the number of the rafters of said inner set.

References Cited by the Examiner

UNITED STATES PATENTS

875,396	12/1907	White	52—708
1,491,397	4/1924	Haugsjaa	25—124
2,036,180	3/1936	McNeil	52—249
2,073,358	3/1937	Williamson	52—82
2,596,914	5/1952	Piacentino	25—154
2,705,826	4/1955	Waller	25—154
2,775,794	1/1957	Keely	52—83

FOREIGN PATENTS

137,613	6/1950	Australia.
572,667	2/1958	Italy.

FRANK L. ABBOTT, *Primary Examiner.*

JACOB L. NACKENOFF, HENRY C. SUTHERLAND, RICHARD W. COOKE, *Examiners.*

J. L. RIDGILL, *Assistant Examiner.*