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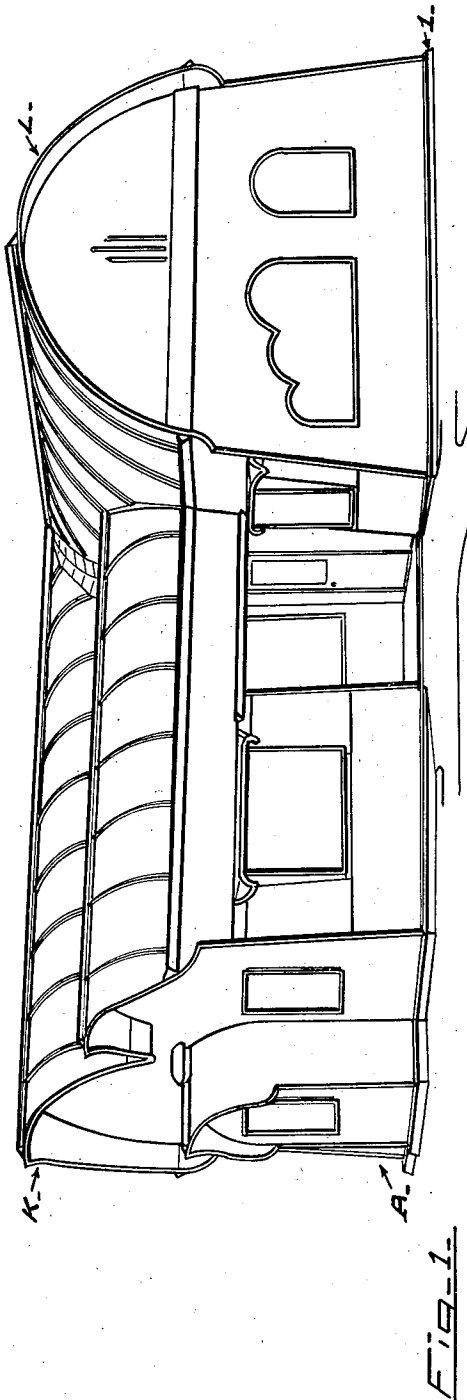
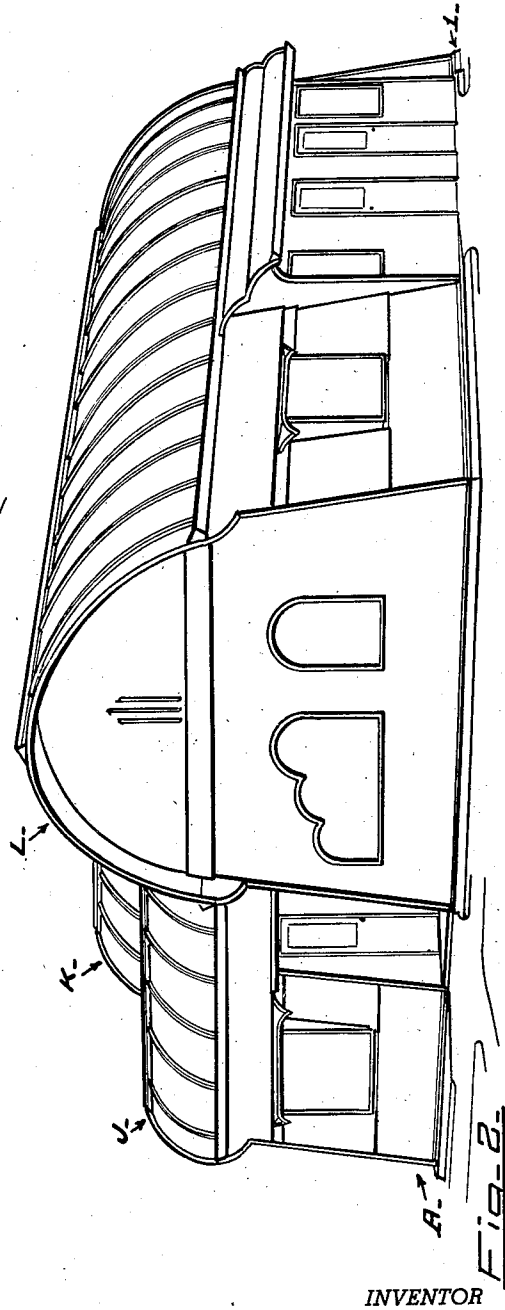
W. F. DREW

2,360,831

STEEL BUILDING

Filed July 17, 1940

6 Sheets-Sheet 1



INVENTOR

William F. Drew

Oct. 24, 1944.

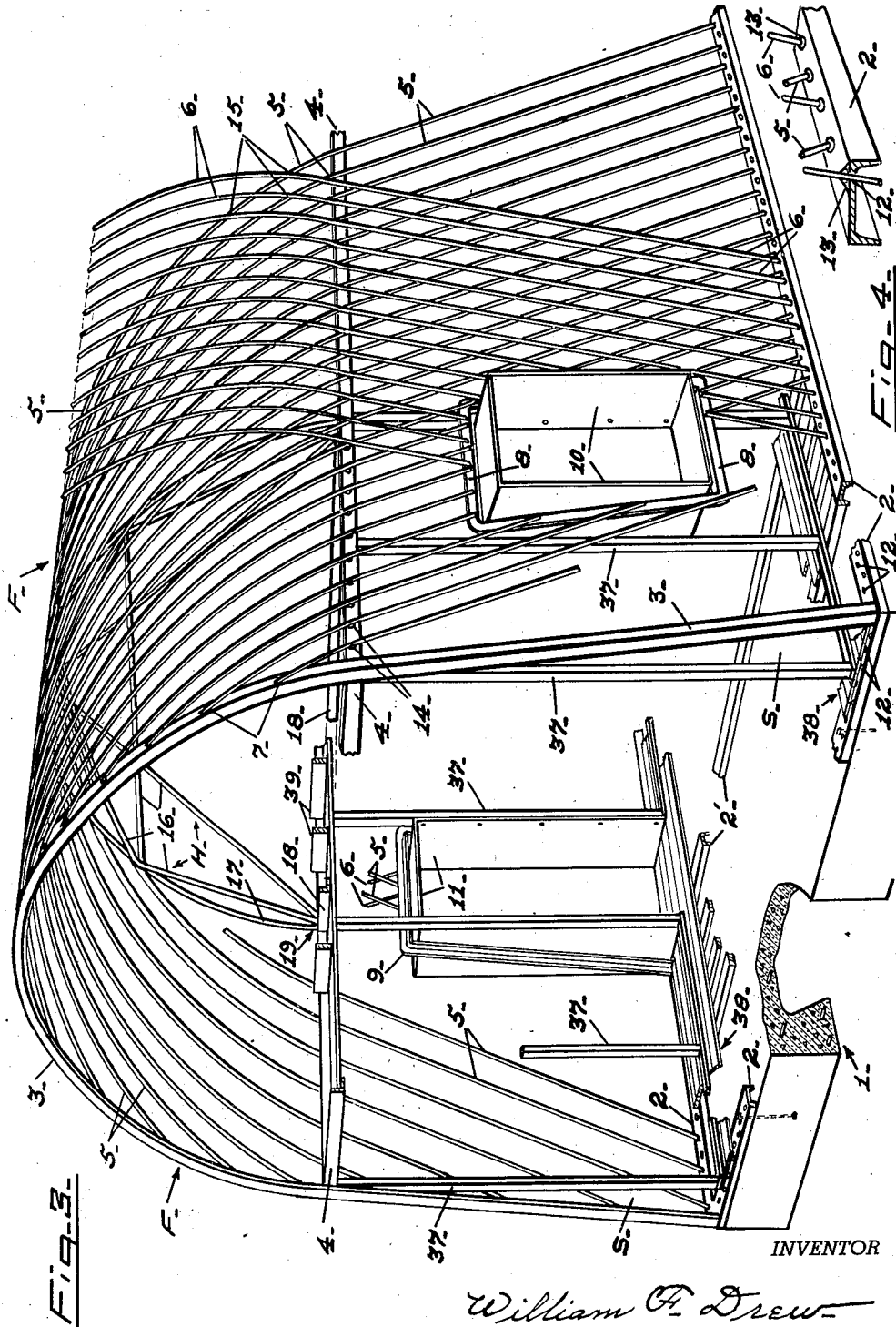
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STEEL BUILDING

Filed July 17, 1940

6 Sheets-Sheet 2



Oct. 24, 1944.

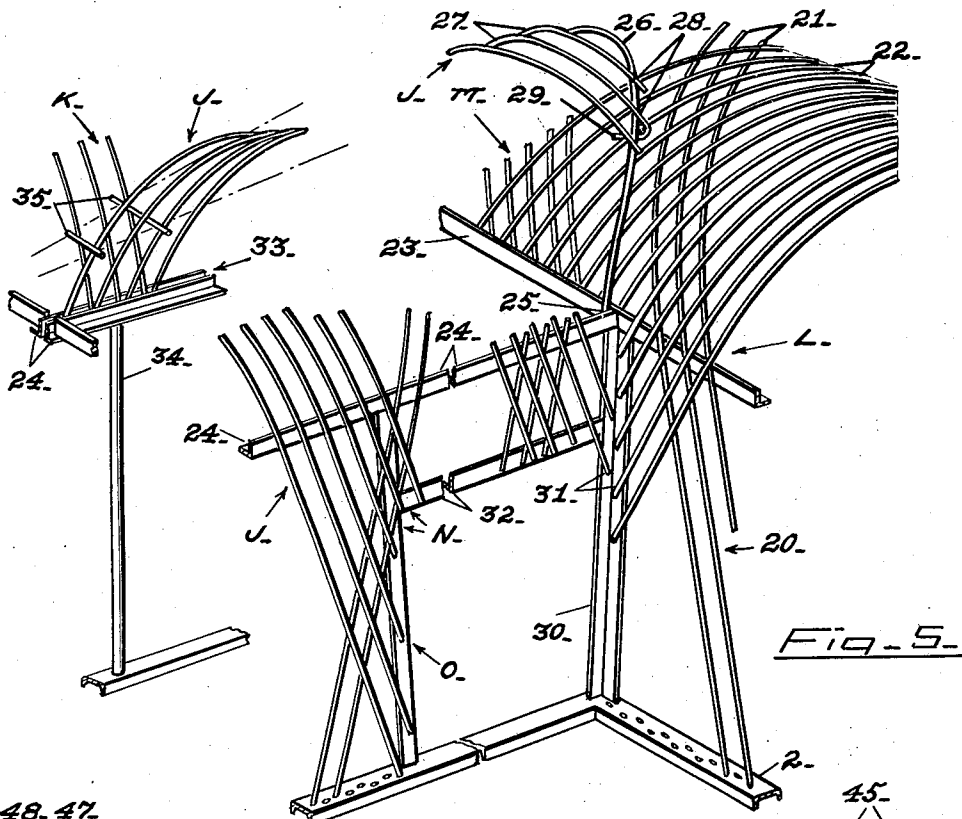
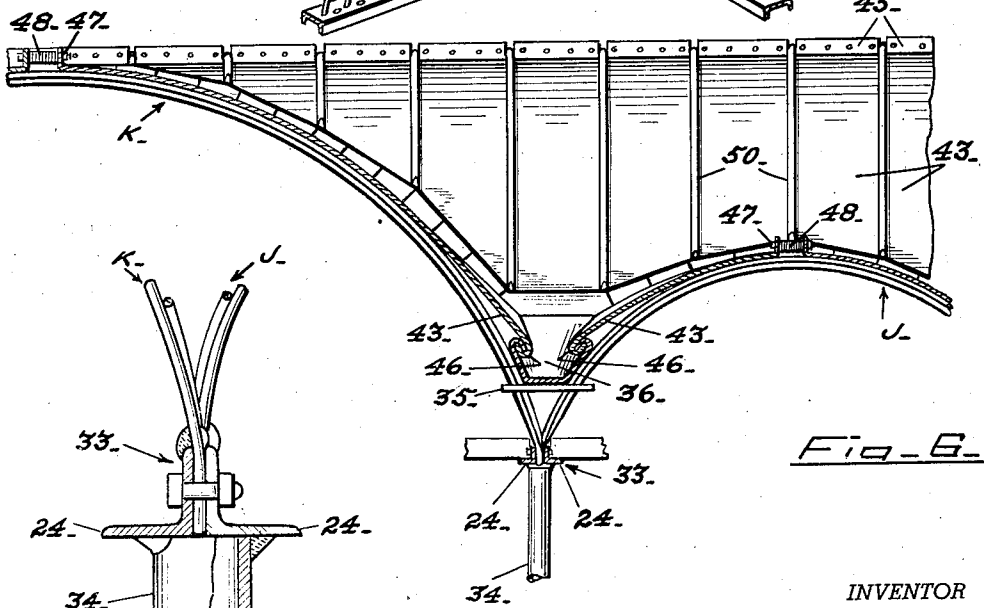
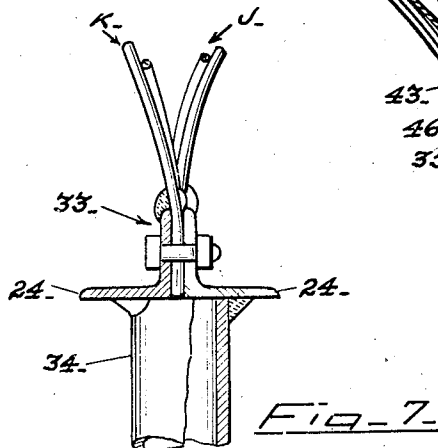
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STEEL BUILDING

Filed July 17, 1940

6 Sheets-Sheet 3



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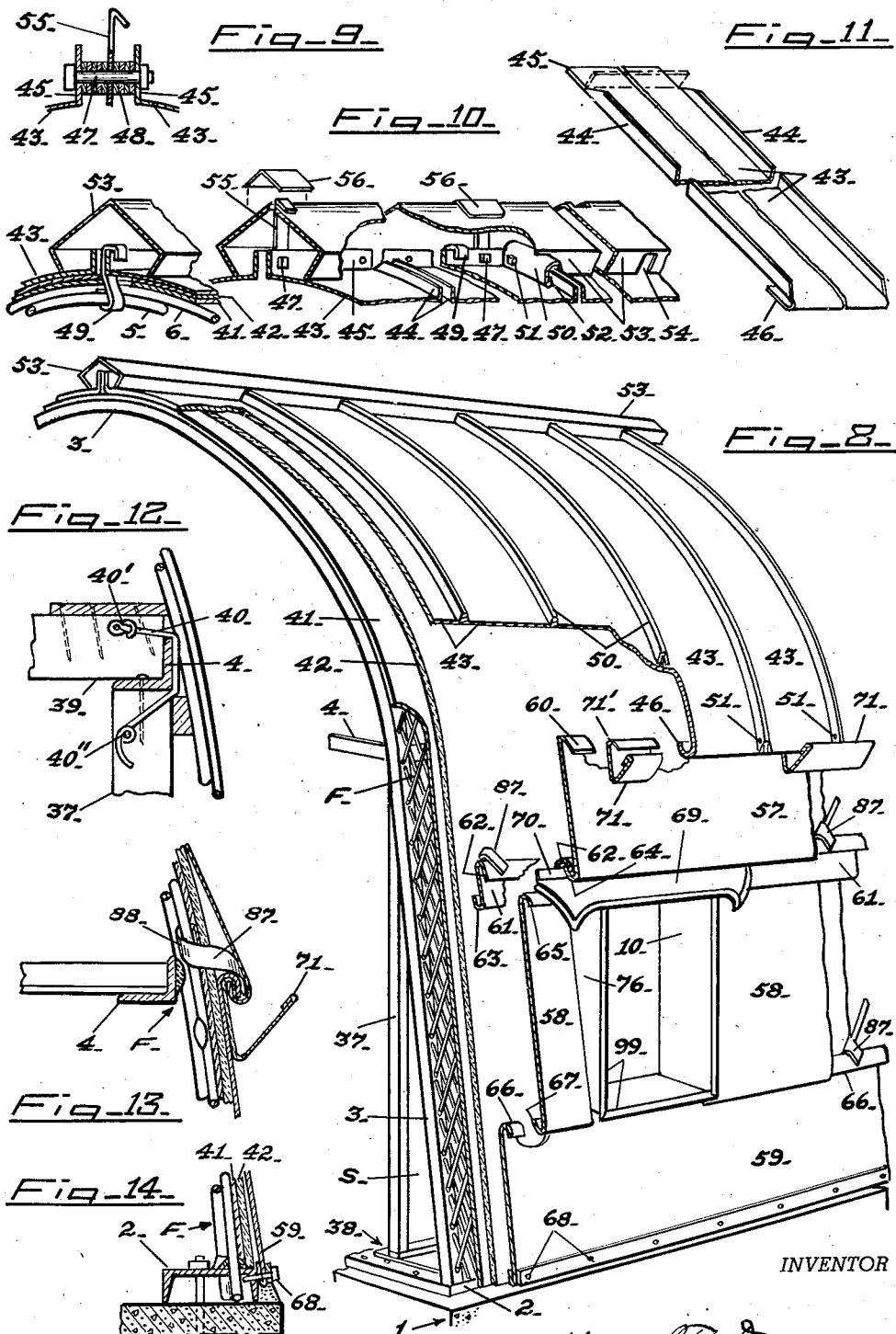
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STEEL BUILDING

Filed July 17, 1940

6 Sheets-Sheet 4



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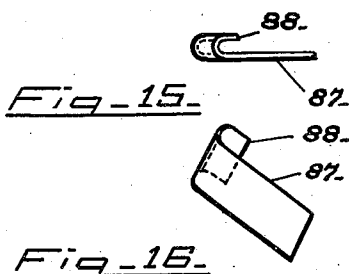
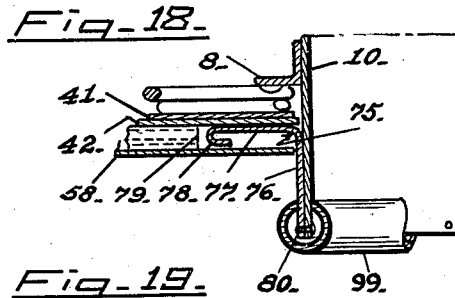
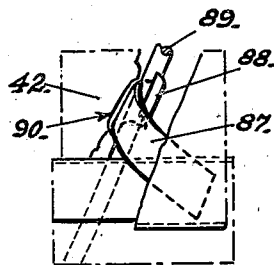
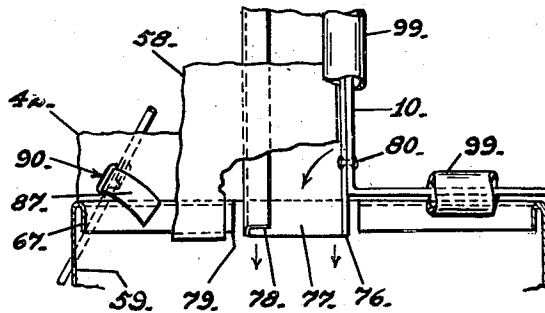
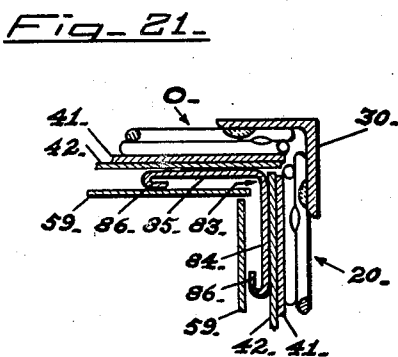
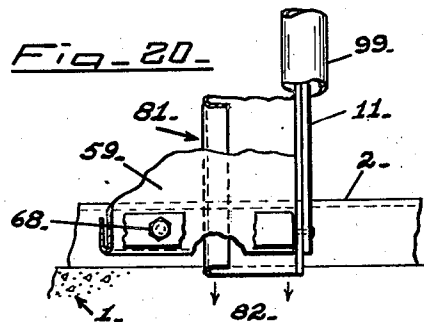
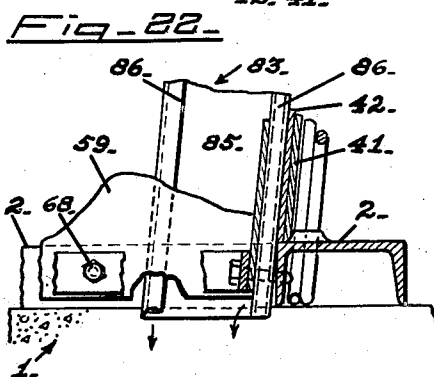
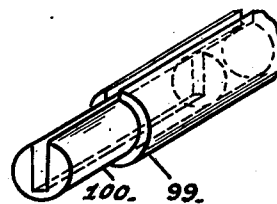
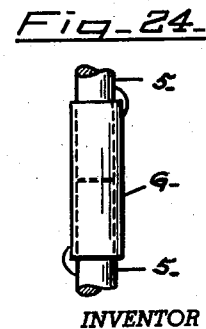
W. F. DREW

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STEEL BUILDING

Filed July 17, 1940

6 Sheets-Sheet 5



William F. Drew

UNITED STATES PATENT OFFICE

2,360,831

STEEL BUILDING

William F. Drew, Los Angeles, Calif.

Application July 17, 1940, Serial No. 346,019

3 Claims. (Cl. 189—1)

My invention relates to improvements in the construction of steel buildings and has particular reference to the superstructure framework and exterior covering thereof.

An object of the invention is to provide a unitary two side wall and roof framework of great strength, flexibility and facility of erection in consideration of the use of a small amount of light weight material including a plurality of steel bars some of which have both of their terminals anchored to the foundation for opposite side walls of a building and all of which are disposed to form a continuous framing for both of the side walls and the roof.

Another object of the invention is to provide a building structure embodying a unitary or continuous wall and roof framing in the form of steel ribbing consisting of a plurality of layers of diagonally positioned, spaced, unitary steel bar members, the bars of one layer being imposed upon the next in reverse directional disposition and erected in fixed relation to one another by welding the bars of successive layers each to the other.

Another object is to provide a building structure embodying unitary wall and roof framing in the form of steel ribbing relatively spaced to provide a self-sufficient supporting surface for a non-self-supporting sheathing adapted to cover and enclose the ribbing and form the hull of a building.

Another object of the invention is to provide a framework of steel ribbing for building structures wherein the steel members thereof are so proportioned, allotted and combined in fabrication on the job as to first, construct a framework of steel commercially and productively comparable in cost with building framing constructed of other materials more generally used for this purpose; second, provide a disposition and assembly of parts eliminating the necessity for highly accurate shop layout and shop fabrication costs; third, provide a combination of framework parts such that the major portion of construction requirements are effected without the exercise of extensive fitting-up operations or field equipment.

A further object of the invention is to provide a form for and structural arrangement of the steel elements of a building framework embodying highly elastic limit qualities, which, when subject to earth shocks will resiliently resist distortion and disassociation of the parts; second, provide a covering or sheathing which, in association with the framing affords the security of

a unitary structure correspondingly eliminating superstructural hazards during earthquake occurrences.

Another object is to provide a sheet metal exterior sheathing and finish for the building framework wherein the members constituting the roof and wall finish are preformed to requisite shape and provided with edging flanges or hems adapted to hold assembled and interlock the component parts and also form a part of means whereby the assembled portions are collectively secured to the building framework to provide a united, weatherproof exterior finish.

Another object is to provide a sheet metal exterior finish structure for buildings wherein the elemental parts, preformed relative to the edging requirements of this invention and adapted to form the exterior roof and wall sheathing and finish, are assembled, interlocked and secured to the building framework without resorting to soldering or welding operations or the use of means penetrating any of the sheet metal exterior relied upon to weatherproof the building interior.

Another object is to provide a sheet metal exterior finish structure for buildings wherein unit sections of the roof and wall structure, preformed to embody the edging of this invention, are assembled as a sheathing "suspended" from the roof crown or comb and sustained thereby as a "hanging" roof and wall finish providing for free expansional or contractive vertical movement of the whole to prevent unequal or localized buckling or distortion of the sheathing and further provide a simple mode of assembly and fitting-up of the parts in which the "rule" is—shear to length, adjust and affix the comb portion and "hang up" the parts.

Another object is to provide a sheet metal exterior finish structure for buildings wherein the unit portions of the wall siding consist of sheets of material providing the desired width and preformed to embody the edging of this invention are applied to the building framing as belt courses disposed; above, between and below window openings for the purpose of simplifying erection operations. Further, in building walls of usual height, commercial sizes of sheathing are, by this method of use, rendered suitable to requirements by limited piecing and shearing-to-width operations.

Another object is to construct a metal framing and metal sheathing structure so combined as to provide for free expansion or contraction of the parts both vertically and horizontally of the structure and thereby prevent buckling or distortion.

tional strains more particularly in the exterior metal sheathing. The structure hereof also provides free intercompensating vertical movement of the metal sheathing relative to the framework when expansion or contraction movement of the parts occur and eliminates objectional noises otherwise resulting from expansion or contraction movement of the metal shell relative to the metal framework.

Another object is to provide a building hull wherein the major portion of the superstructure framing and exterior sheathing is constructed of bar and sheet steel members having an insulating material associated therewith for excluding transference of normal heat or cold qualities of atmospheric conditions either from or to the interior of the structure.

Another object is to provide a building structure exteriorly fireproof to ignition by sparks, firebrands or similar causes and which, due to the disposition of insulating material is highly resistant to ignition both externally and internally, by the proximity of exterior heat. Further, upon inclusion of fireproof closures for light and other openings the building structure of this invention provides efficient attainment of a fireproof building structure.

Another object is to provide for a building hull which readily lends itself to being sheathed by material sprayed thereon, either metal or plastic.

Another object is to provide a simple, inexpensive, readily applicable and novel trimming or finish member for the exposed or "raw" edges of the sheathing and other exterior parts.

With the above and other objects in view the invention consists in the novel construction and combination of parts hereinafter described, illustrated in the accompanying drawings, and set forth in the claims hereto appended, it being understood that various changes in form, proportion, size and minor details of construction within the scope of the claims may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Referring to the drawings:

Figure 1 is a perspective view showing one design of building arrangement embodying my invention.

Figure 2 is a perspective view of the building design shown in Figure 1 illustrating the structure from a different point of view.

Figure 3 is a schematic perspective view of assembled parts embodied in a unit portion of the superstructure framing of my invention, multiples of which are united to form the desired superstructure arrangement.

Figure 4 is a fragmentary perspective view of the base member of the framing adapted to receive and affix the members of the superstructure to the building foundation.

Figure 5 is a schematic perspective view illustrating; first, the joining of angularly disposed wall framing at intersections; second, the provision of a self contained trussed framework over exterior wall openings; third, the method of joining the members of angularly disposed roof portions of the structure to each other; fourth, the provision of a self contained truss formation in the roof of one unit as self supporting and respectively supporting an adjoining roof to provide a spanned opening between the unit structures; and fifth, the joining of the arch portions of respectively parallel unit structures and the provision of gutter supporting means therebetween.

Figure 6 is a part-sectional view showing the intersection of arch portions of parallel roof units respectively disposed to right angularly adjoin a third unit roof structure shown in elevation.

Figure 7 is an enlarged fragmentary part sectional detail view of one method of uniting and supporting adjoining parallel arch structures at the spring of the respective arches.

Figure 8 is a fragmentary elevational perspective view, with portions broken away for display of parts showing a portion of a completed wall and roof structure of a building unit constructed in accordance with my invention.

Figure 9 is a sectional detail view of means for adjustment; compensating for inaccuracies in and the aligned joining of the sheet metal roof sheathing at the crown of the roof arch.

Figure 10 is an enlarged detail perspective view, with parts broken away and parts omitted for display, of the crown portion of the roof arch showing the method of uniting and securing the sheet metal sheathing members each to the other and to the arch framing and the crown capping sealing the structure to the weather.

Figure 11 is a perspective view of a preformed sheet metal roofing unit, multiples of which are united to form the roof sheathing.

Figure 12 is a fragmentary sectional view showing the relation of interior wall furring and ceiling joist members to the framing and means for securing them thereto.

Figure 13 is a fragmentary sectional view showing the relation of the exterior sheathing members to the framework and the means for securing the metal components thereof together at the belt line framing.

Figure 14 is a fragmentary sectional view showing the relation of the framing and the exterior sheathing members to the framing base member.

Figure 15 is a perspective view of means employed to connect the exterior metal sheathing to the interior frame work.

Figure 16 is another perspective view of the means shown in Figure 15.

Figure 17 is a fragmentary elevational view, with parts broken away for showing the interrelation of parts of the framework and sheathing as secured together by the attachment member shown in Figures 15 and 16.

Figure 18 is a fragmentary horizontal sectional view of one side of a window or door casing particularly showing the means employed to insure non-leakage of the joint formed at the intersection of the casing member and the exterior sheet metal sheathing.

Figure 19 is a fragmentary elevational view taken at the bottom of a window casing showing the disposition of parts as effecting the discharge of leakage onto the outer surface of the wall structure.

Figure 20 is a fragmentary elevational view taken at the bottom of a door casing showing the disposition of parts as effecting the discharge of leakage onto the outer surface of the foundation structure.

Figure 21 is a fragmentary horizontal sectional view of a corner of exterior walls of the structure with particular reference to the means employed to insure non-leakage of the joint formed at the intersection of the exterior sheet metal sheathing.

Figure 22 is a fragmentary elevational part sectional view taken at the bottom of the wall corner structure showing the disposition of the

parts as effecting the discharge of leakage onto the outer surface of the foundation structure.

Figure 23 is a perspective view of the means provided to join the ends of finish molding, open seam tubing or the like employed to encase, cover and finish the edges and joints of parts of the building structure.

Figure 24 is an elevational view of the sleeve employed to join the ends of the bars or rods providing the ribbing of the building structure.

Figure 25 is a fragmentary sectional view of the end or gable wall structure on a plane slightly in front of the center line of the crown of the roof arch and showing the gable overhang design of roof illustrated in Figures 1 and 2.

Figure 26 is a horizontal sectional view showing a corner intersection of a gable wall and side wall of the building design illustrated in Figures 1 and 2.

Figure 27 is a vertical cross sectional broken view showing parts adapted to form a canopy, porch, cornice, lean-to or addition as connected to the main building structure.

Figure 28 is a plan view showing the arrangement of the metal base members of the building design shown in Figures 1 and 2 and their disposition as forming closed rectangles to prevent "spreading" of the wall portion of the structure.

Figure 29 is a side elevation of an end portion of ribbing as used in the type of building shown in Figure 30.

Figure 30 is a cross sectional view of a modified building design wherein the ribbing members of Figure 29 form vertical wall and pitch roof framing.

Figure 31 is a fragmentary sectional view of a modified form of the invention wherein the ribbing is sheathed by use of a coating of cement, "gunite" or other material sprayed on or otherwise applied thereto.

Referring now more specifically to the drawings, Figures 1 and 2 show one form of steel building A of the small home type, which may be erected under methods and with structural arrangements embodying the present invention.

As shown in Figure 3, steel framing F for opposed side walls and a roof is erected on a foundation 1 on which is bolted inverted channel base members 2 having welded or otherwise fixed thereto upright end frames 3 of angle iron or the like and of an inverted U shape or arch form, there being but one of such frames shown in Figure 3. Belt members 4 are welded or otherwise fixed together and to the end frames 3 at ceiling level whereby to tie the end frames together and form therewith the skeleton frame of the building superstructure.

To complete the steel framing so that there will be provided a unitary arch-like framing of an inverted U shape corresponding to the end frames 3 and which will be self supporting and self-sustaining, I employ a novel steel ribbing construction consisting of steel bars 5 and 6 of circular or non-angular cross section diagonally and helically disposed in opposite directions between the end frames and base members whereby to intersect one another and form a unitary network. Bars 5 are erected successively to follow the general curvature or outline of the end frames and said bars lie in parallel spaced relation and are inclined to the left looking at Figure 3. Bars 6 are then successively erected in the same spaced parallel relation to one another as bars 5 but are oppositely inclined and lie upon

and intersect bars 5 at regularly spaced intervals between the end frames and the base members for opposed side walls of the building. Certain of the bars 5 and 6 extend from the base member for one side wall to the base member for the opposite side wall in helically arched form. Those of the shorter diagonally and helically extended bars 5 and 6 which intersect the end frames are welded thereto as at 7. Those of the bars 5 and 6 which intersect the inclined steel frames 8 and 9 embracing the steel window and door casings 10 and 11 respectively, are welded or otherwise fixed thereto. These casings are disposed in vertical position whereas the frames 8 and 9 have the same inclination inwardly as the adjacent side wall framing portions of the respective bars 5 and 6. All of the bars 5 and 6 which are anchored to the base members 2 are inserted in spaced apertures 12 in and welded or otherwise fixed to said base members as at 13 as shown in Figure 4. These apertures facilitate the individual and successive erection of the bars 5 and 6 since the latter are normally straight and are bent to follow the curvature of the end frames 3. Thus it is seen the apertures serve to hold the bars in place and properly spaced during and after erection thereof and also facilitate effective welding of bars to the base members.

Where the bars 5 and 6 intersect the belt members 4 they are welded or otherwise fixed thereto as at 14, and where the bars intersect one another they may be welded together as at 15. However, it is obvious that requisite intersection of bars 5 and 6 and adequate strength in the framing formed thereby, does not require that said bars be welded together at each intersection although if desired could be resorted to without objectionable cost.

Many of the bars 5 and 6 can be likened in shape to a croquet wicket which has been helically distorted while maintaining its inverted U shape. Some of the other bars 5 and 6 are like segments of such helically arched bars and others are substantially straight and diagonally disposed. The most economical and efficient ratio of strength to weight of material used results when the bars are disposed at an angle of from 50 to 70 degrees. Therefore it is manifest that the steel framing comprising the base members 2 and framing 3 and bars 5 and 6, and, in some instances the belt or girder members 4, arranged as here shown described as a unitary structure, serves as self-supporting and self-sustaining framing for opposite side walls and the roof of a building, and affords a self-sufficient supporting surface for non-self-supporting sheathing which may be applied to cover and enclose the framing so as to form the hull of the building. Moreover, it should be observed that such a steel framing is primarily composed of steel units requiring no intricate preforming or special fabrication. This is especially true of the helically disposed ribbing bars 5 and 6 constituting the major portion of the structure, which are normally straight and bent to desired form during erection of the framing. As seen in Figure 24 steel ribbing bars may be pieced end to end by means of a coupling sleeve G.

In some constructions it may be desirable to reinforce the framing with trusses and in such cases I may arrange series of steel bars 16 and a steel bow 17 similar to bars 5 and 6 but vertically disposed relative thereto so as to provide anchorage for the cord truss member H spring-

ing from the belt members 4 and extending to the top crown of the framing and welded or otherwise fixed to the bow 17 and where intersecting one another and the belt members 4 and the bars 5 and 6 as particularly shown in the top-center portion of Figure 3. These trusses may thus be formed at desired intervals in the framing and it is seen that a horizontal steel member 18 fixed to and between the belt members 4 on opposite side wall portions of the framing will also act as a chord for the truss formation. The member 18, bars 16 and bow 17 where meeting one another at common points on the belt members 4 may be welded or otherwise fixed together and to said belt members as at 19.

Where it is desired to add to the main framing or framing similar to that shown in Figure 3, for example, to form building shown in Figures 1 and 2, or any similar multiple room or multiple unit structure, additional or wing framing may be readily and easily erected and interconnected with the main framing or multiples thereof as shown in Figures 5, 6 and 7.

This joining of building units wherein wing framings J and K are angularly related to unit L as shown in Figures 1, 2, 5, 6, 7 and 28 is effected by constructing the unit L in the same manner as the single unit of Figure 3 and omitting portions of the side wall 20 equaling the wing width by terminating the ribbing bars 21 and 22 corresponding to bars 5 and 6 at the belt member 23 as seen in Figure 5.

As shown in Figure 5 the bars 21 and 22 of the arch of the unit L are terminated at and welded to the belt member 23 which forms a lintel for the openings of wing J and K as shown only for wing J in this figure. Such construction of the roof portion of the unit L provides a girder structure M over said openings without necessitating the use of a complemental roof structure.

Further joining of the angularly disposed units is provided by simply joining the belt members 24 of units J and K to the belt 23 of the unit L by welding or otherwise as at 25 in Figure 5.

A simple and efficient means of uniting the structural arch portion of the bars 21 and 22 of unit L, also the corresponding bars of units J and K, includes a steel bar 26 of suitable size and cross section such as a round bar or tubing, readily bent to the contour of the intersecting arches, and welded exteriorly to the arch bars 22 forming the aforesaid girder portion M. To the member 26 the ends of those of the framing bars 27 of the unit J which form the abutting arch portion of the unit, are welded as at 28.

It is noteworthy that no painstaking layout or fitting of this "joint" is required as the bars are welded as they lie without regard to the amount of overlap or inward end projection, as the overlapped or projecting parts are bent as at 29 to embrace the bars 21 and 22 of the unit L and further secure the arch portions together as shown in Figure 5.

The joining of wall framing intersections of angularly disposed units is effected, Figure 5, by welding the ends of successive bars which are progressively elongated below the belt line to reach the intersection line of the respective walls, to the corner framing member 30 as at 31. Respective bars are snipped off to roughly estimated limits providing only for welding attachment to the member 29.

When an opening is desired in an exterior wall of the structure for example, the opening N in wall O of unit J as shown in Figure 5, a header

member 32 is disposed at the upper end of the opening and below the belt member 24, so that, together with said belt member and those of the ribbing bars 27 which extend between and are welded to the header and belt member, there will be formed an effective truss for reinforcing the framing in compensation for the ribbing omitted in forming such an opening.

The contiguous portion of parallel units J and K have the ribbing bars thereof joined to a common dual belt member 33 as by being welded or otherwise fixed to and between the parallel sections of the belt unit as shown in the extreme upper left portion of Figure 5 and in Figures 6 and 7. In other words the ribbing bars of the units J and K where the arches of said units meet, are cut off at the belt level and welded or otherwise fixed to the belting 33 formed by the bolt connected parallel belt members of the respective units and it is unnecessary to continue such bars to the foundation, or below the belt members. Instead, metal columns such as the one 34 in Figures 5, 6 and 7 are extended from the foundation and welded or otherwise fixed to said foundation and the belt member 33.

As shown in Figures 5 and 6 a plurality of short ribbing bars 35 are welded to and horizontally between adjacent ribbing bars of the units J and K above the belt unit 33 whereby to provide a support for a gutter 36.

It is important to note that the side wall portion of the framing units embodying this invention, such as units F, J, K and L are inclined so that they lean or slant inwardly to the spring of the roof arching portion of the framing, whereby the qualities of a shored structure are provided. Furthermore, this inclination provides for appreciable dead air spaces in the side walls, and also facilitates the erection and support of the sheathing and coverings in that the latter elements will lie closer upon and be partially supported by the framing.

As shown in Figure 3 vertical furring members 37 are extended from the flooring 38 to the belt members 4 and ceiling joists 39 whereby to provide for the erection of interior walls and the dead air spaces as at S in the side walls between the furring members and the ribbing bars 5 and 6. Figure 8 shows how coverings, as will be hereinafter described, will lie close upon and be supported by the framing due to the aforesaid inclination of the side wall portions and also shows how the insulation or dead air space S is formed in a side wall. As shown in Figure 12, when wooden members such as furring 37 and ceiling joists 39 are used they may be anchored to the belt member 4 by means of flexible wire ties 40 having the preformed eyes 40'. Spikes driven through these eyes into the joists secure the ties thereto. The ties are then looped around the belt member, drawn taught and wound upon the spikes 40'' driven in the furring.

Figures 8 to 14 inclusive show the roof and side wall exterior coverings and sheathing and the manner in which they are applied so as to "hang" on the framing F.

As here shown a continuous or "one piece" layer or sheet 41 of flexible roofing material is laid on the framing so as to cover the roof and side wall portions, following which a similar sheet or layer 42 of thermal insulation material such as asbestos, is laid over the roofing material. Due

to the inclination of the side wall portions of the framing these sheets will be effectively supported and hang on the frame in close contact therewith.

Beginning with the roof, a plurality of elongated sheet steel sheathing sections 43 of suitable gauge are laid side by side to extend over and cover each half of the roof with their upper ends joined in opposed relation at the "ridge" point or top center of the roof. If a large roof, the necessary length of sections may be obtained by the usual methods of joining sheet metal. As shown in Figure 11 each sheathing section has upstanding flanges 44 at its longitudinal edges and a transverse upstanding flange 45 and a turned under hook portion 46 at respective ends. The end flange 45 may be preformed or left flat so that it may be bent into place on-the-job and otherwise the sheathing sections are preferably preformed. As shown in Figures 8 and 10 these sections are laid on the roof so as to conform to the curvature thereof and be laterally and longitudinally spaced apart at their longitudinal and end edges respectively, with the side flanges 44 in spaced parallel relation to one another and the end flanges 45 similarly disposed. The end flanges 45 are secured together with bolts 47 (Figure 9) having spacing washers 48 thereon and the ridge joint thus formed may be anchored to the framing F' by means of the S shaped hooks or clips 49 as shown in Figure 10 whereby the sheathing and also the inner coverings 41 and 42 through which hooks extend, are anchored to the frame and held against displacement relative to one another and the roof portion of the framing. The washers 48 may be used as shims for longitudinally adjusting the sheathing sections to properly position the "eave" defining edges thereof.

The side flanges 44 lying opposed and spaced apart are covered and structurally connected by means of elongated inverted U shaped metal cover members 50 which need be bolted as at 51 at their ends only with the bolts passing through the flanges 44. The flanges 44 are laterally spaced from one another and the sides of the members 50 whereby the sheathing is free for necessary expansion and contraction movements. However, the longitudinal edges of the members 50 are hemmed as at 52 so as to closely fit against the sheathing surfaces to provide substantial joints, and on the whole these joints remain effectively weather-proof and have the necessary strength while being "flexible."

A hollow sheet metal comb member 53 covers the "ridge" joints formed by connecting the end flanges 45 together and also encompass the upper ends of the flanges 45 and covering members 50 as shown in Figure 10 so as to weather-proof such parts. Notches 54 in the sides of the comb member accommodate the "ribs" formed by the flanges 45 and cover members 50 and permit the longitudinal edges of the comb to have close contact with the upper surfaces of the sheathing sections.

In order to secure the comb 53 in place, tie clips 55 fastened to and between flanges 45 by the bolts 47 are extended through slits in the crown of the comb and bent over thereon as shown in Figure 10. Closure plates 56 are soldered or otherwise secured on the comb to seal the slits and prevent leakage.

To accomplish the insertion of windows without the exercise of extensive fitting-up labor the sheathing for the side walls of the building is

composed of metal sheets applied in the form of belts which, for example, consists of the belt 57 joined to the lower ends of the roof sheathing sections at the eave line and extending downward to the top of window openings, a main intermediate sheathing belt 58 and a lowermost sheathing belt 59 extending from the base members 2 on the foundation 1, to the lower edge of the main intermediate belt at the sill level of window openings. These belts run from one end frame 3 to the other the full length of the side walls but could be pieced or formed of a plurality of suitably joined sections if desired. The upper sheathing belt 57 has an outwardly bent flange forming a hook 60 along its upper edges for engaging the hook ends 46 of the roof sheathing so as to be suspended at the "eave" line.

In order to best adapt the intermediate belt 58 to window openings in the walls I employ a distance belt 61 of required width to join the top and intermediate belts and provide for the required window height between the belts 57 and 59. Along its longitudinal edges this distance belt is formed with hook-flanges 62 and 63 for establishing a hooked engagement with similar hook-flanges 64 and 65 on the lower edge of belt 57 and the upper edge of belt 58 respectively. The edge of the lower siding belt 59 has a similar hook-flange 66 which hooks over the hook flange 67 on the lower edge of the intermediate belt 58, while the lower edge of the said lower belt is bolted as at 68 to the base members 2.

It will now be seen that by reason of the particular construction of the exterior sheathing members and the manner in which they are joined to one another and applied to the framing, all such members and finish elements attached thereto will be suspended from the comb or ridge portion of the framing for purposes hereinafter set forth.

As shown in Figure 8 the window casing 10 is disposed between the upper and lower siding belts 57 and 59 and the intermediate belts 58 and 61 are cut to abut the sides of the casing as shown in Figures 8, 18 and 19. Obviously, when a door is to be provided the lower belt 59 is also cut to abut the sides of the door casing 11 as shown in Figure 20.

At the top of the window casing a canopy member 69 is extended outwardly from the point where it lies between the top of the casing 10 and the lower edge of the upper belt 57, and has a flange 70 which extends upwardly between the flange 64 and the face of the distance belt 61 whereby to anchor the canopy.

As shown in Figures 8 and 27, I may provide an eave trough 71 which has a hook-flange 71' fitting over the hooks 46 on the roof sheathing sections in turn overlapped by the hook 60 of the belt member 57 and is thus suspended and interlocked as an effective gutter.

Where a canopy 72 as shown in Figure 27, is desired as for a doorway or porch, such canopy is provided with a hook-flange 73 to hang over the hooks 46 at the eave line. When both the eave trough and canopy are employed they are locked in the order named to the "eave" hooks 46 after which the hook-flange 60 is fitted over them into the hooks 46. The canopy 72 may have a lower hook-flange 74 which will hook around the hook 64 on the lower edge of the upper belt 57. A gutter 72' similar to the one 71 may be mounted on the outer edge of the canopy 72 if desired.

As shown in Figures 8, 18 and 19 where the sections of the belt 58 abut the sides of the window casing 10 an angular flashing member 75 (Figure 18) is positioned to have substantially the same vertical extent as the window frame and to lead below it so as to discharge over the outer surface of the lower belt 59 as shown in Figure 19. This flashing strip has one portion 76 laid flat against the sides of the casing 10 and the other portion 77 extended behind the belts 58 and 61, the latter portion has a rolled flange or open hem 78 along its longitudinal edge to form a vertical gutter to catch any water leaking in between the vertical edges of the adjacent sections of the belt 58 and the outer portion 77 of the strip. The hook-flanges of the lower and intermediate sections are cut away as at 79 to accommodate the extension of the lower end of the portion 77 of the flashing as shown in Figure 19 whereby to discharge the drainage onto the outer surface of the lower belt. It is noted that the portion 76 of the flashing strip is riveted as at 80 to the window casing as shown in Figures 18 and 19, to hold the strip in place.

The door frame 11 and abutting sheathing belts, as shown in Figure 20 illustrating the bottom of the door casing, are equipped with the flashing means 81 constructed and arranged in the same manner as the strip 75 for the window. This strip projects below the belt 59 and discharges over the outer face 82 of the foundation.

As shown in Figures 21 and 22 where angularly related wings of the building form a corner, as typified by the walls O and 20 in Figure 5, a flashing means 83 having portions 84 and 85 each formed with an open hem 86 is extended the height of the walls behind the siding belts of which the one 59 is shown. This strip forms two drain channels to run off water which may have leaked in at the corner joint, the discharge being effected in the same manner as with the door arrangement, Figure 20, and as seen in Figure 22.

As shown in Figures 15, 16 and 17 a bendable tie clip 87 is provided for tying the sheathing and associated coverings and elements to the framing without recourse to means perforating the exterior weather-proofing sheathing. One end of this clip is preformed with a hook portion 88 adapted to hook around any adjacent framing bar as the one 89 while the other end is adapted to be inserted between the hook flanges and the sheathing and siding members to hold the latter to the framing. It should be noted that these clips are inserted from the inside of the structure through slits 90 in the coverings 41 and 42. These clips are used wherever it is deemed necessary to tie in the sheathing to the framing and some of its uses are indicated in Figures 8, 13 and 19 at sheathing joints.

In Figures 25 and 26 is shown an end wall for the building, wherein a net work of ribbing bars 91 similar to the framing F as to pattern, are anchored to the base members 2 for the end walls in the same manner as bars 5 and 6 and similarly connected to end frames 3 and belt members 4. Paper-backed metal lathing 92 is secured to the bars 91 by means of ties 93 whereby a plastic finish 94 may be given the wall. This end wall is completed in one architectural style as shown in Figures 1 and 2 by forming a gable 95 with a series of sheathing sections 96 formed to desired outline contour and bolted to adjacent roof sheathing sections and having the joints covered

by the members 50 in the same manner as shown in Figures 8 and 10.

As shown in Figure 26 the siding belts 57, 58, 59 and 61 are extended as at 97 beyond the end frames 3 to embrace the plastic finish, and the metal lathing is flanged as at 98 to abut the extensions 97. The outer edges of extensions 97 and flanges 98 and the outer edges of the gable 95 are finished with trim members embracing and covering them. As here shown these trim members comprise open-seam tubing 99 into the open seams of which the aforesaid edges are extended. This tubing is frictionally or otherwise held on said edges. All other raw edges of the structure such as on the window and door casings 10 and 11, canopies, etc. are finished with this trim as shown in Figures 8, 13, 19 and 20.

As shown in Figure 23 the trim tubing 99 may be pieced end to end by means of a grooved plug 100 fitted into contiguous ends of tubing sections with the groove of the plug registering with the open seams.

Figure 28 shows a plan of the base members for the building shown in Figures 1 and 2 wherein the base members 2 are fixed as by welding or otherwise to one another and cross members 2' whereby to form a series of closed rectangular base structures to prevent spreading of the foot of the wall structure incident to earth shocks.

As shown in Figures 29 and 30 my invention is embodied in a conventional building B having the framing and ribbing 101 and 102 respectively, disposed to form vertical walls and a pitch roof.

In Figure 31 I have shown a modified form of exterior finish to cover ribbing made of steel bars arranged as shown in Figures 3 and 5 or in Figure 29. This finish comprises a foraminated or meshed reinforcement 103 secured to the ribbing bars by means of tie members 104, and a plastic or other finish substance 105 which may be sprayed on by heat, air under pressure or otherwise applied.

I claim:

1. In a steel building, a foundation, arched upright end frames anchored on the foundation, a belt joining said end frames to define a ceiling level, a plurality of continuous laterally spaced apart and parallel steel bars of non-angular cross section fixed to said foundation, end frames and belt members and extending helically thereof to form a part of a steel framing for opposite side walls and a roof of the building, other continuous steel bars of non-angular cross section extending in spaced parallel relation to one another and helically in the opposite direction to and crossing and contacting the first named bars and said foundation, end frames and belt members throughout the area of said side walls and roof whereby to complete the framing for the side walls and roof.

2. In a steel building, a skeleton frame, and superimposed layers of diagonally disposed and helically arched steel bars of non-angular cross section forming a wall and roof framing, another wall and roof framing formed of identical bars, means for forming a joint of the roof portions of said framings including belt members fixed to certain of said bars and defining a ceiling level and clamping together ends of bars of said roof framings and a column support for said joint.

3. In a steel building, a foundation, a frame fixed to the foundation, a plurality of steel bars of non-angular cross section erected on said foundation and said frame in layers so as to form

a unitary superstructure framing for the building, the bars of one layer being helically disposed in spaced parallel relation to one another, and the bars of the other layer crossing the bars of said one layer, means for fixing bars of one layer to and in contact with the bars of the other layer, and means for fixing terminals of bars of

each layer to said foundation and said frame, a steel bar of non-angular cross section bent to form a bow interiorly of the roof portion of said superstructure framing and affixed to bars of one of said layers; and other bars fixed to said bow to form chords thereof.

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