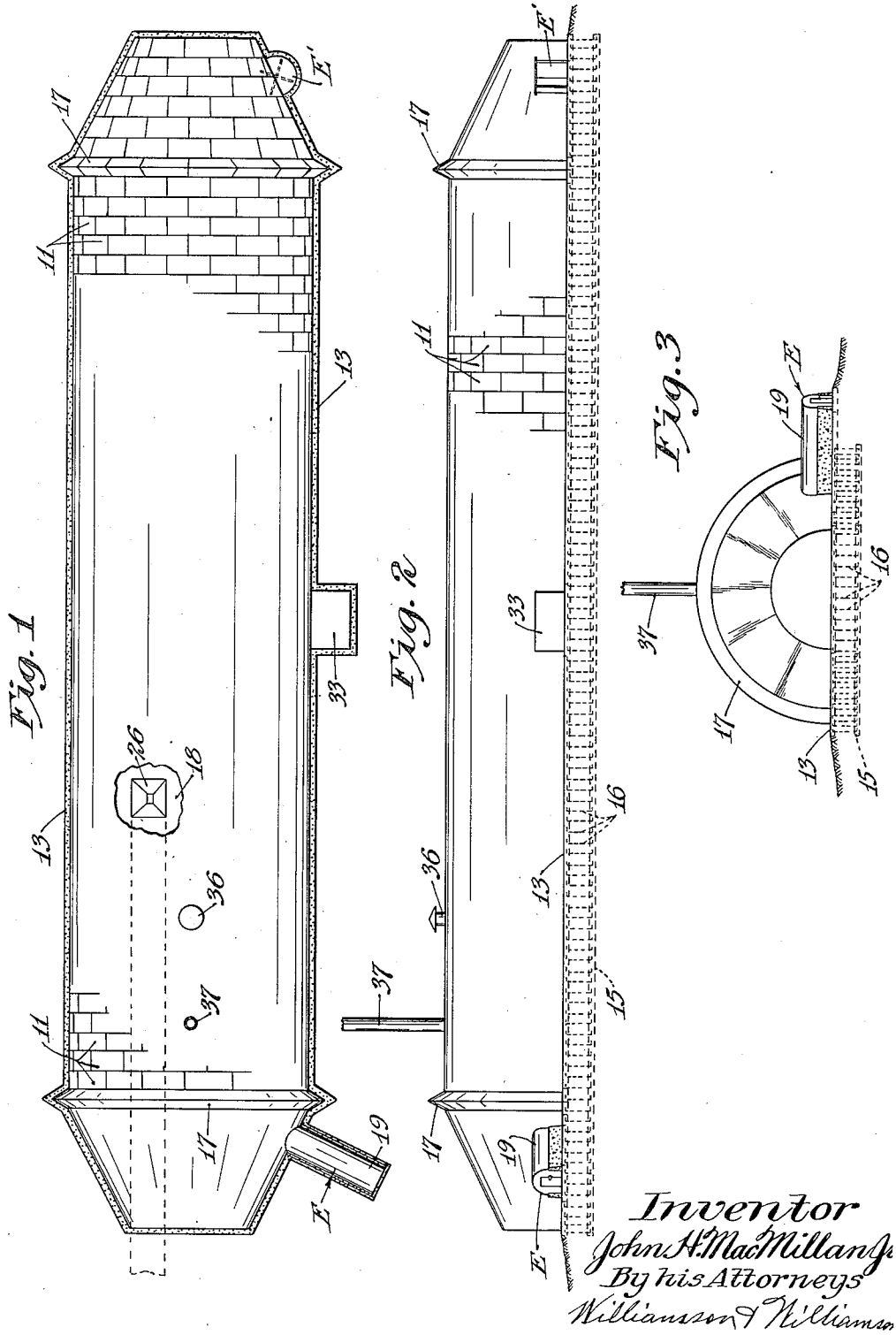
May 4, 1937. J. H. MacMILLAN, JR 2,079,461

BUILDING CONSTRUCTION

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Fig. 4

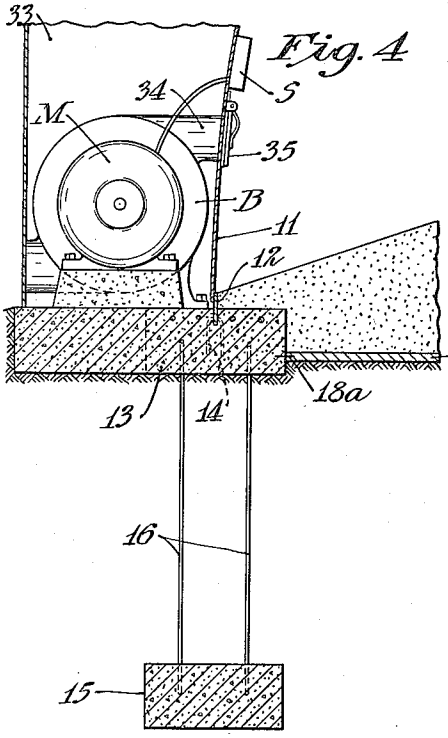


Fig. 5

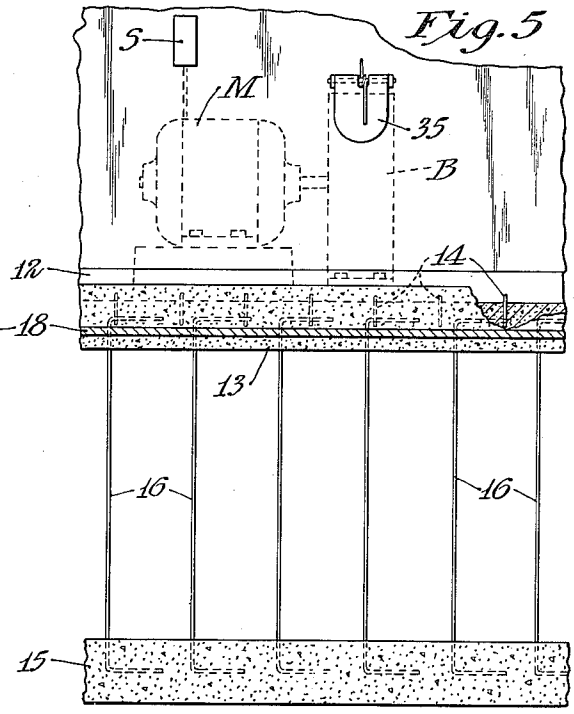
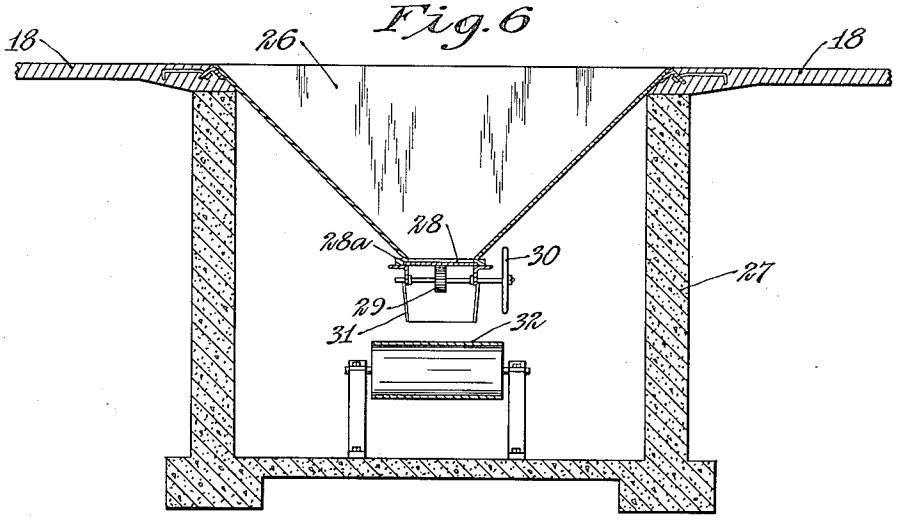


Fig. 6



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Fig. 7

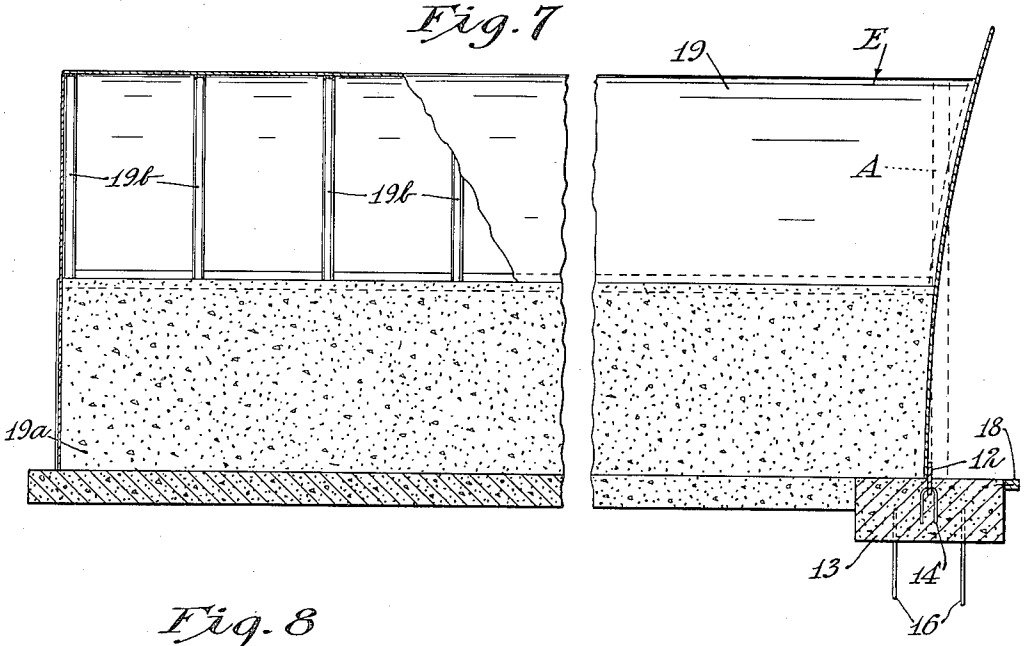


Fig. 8

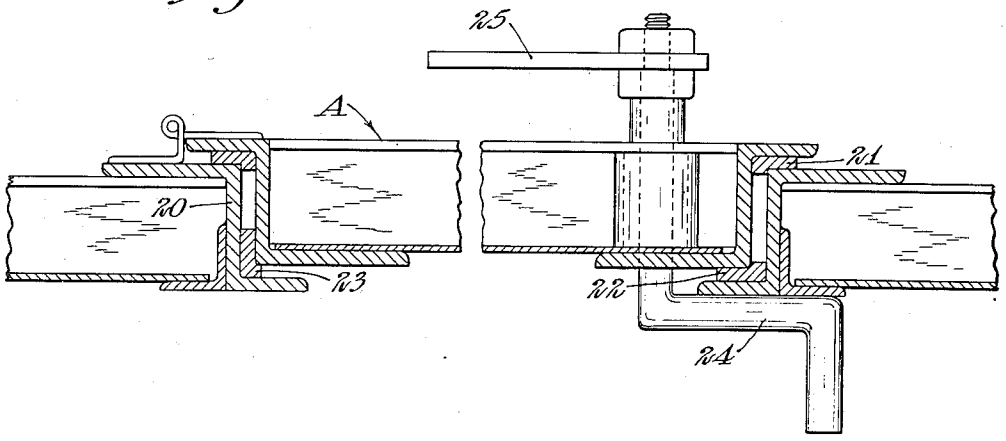
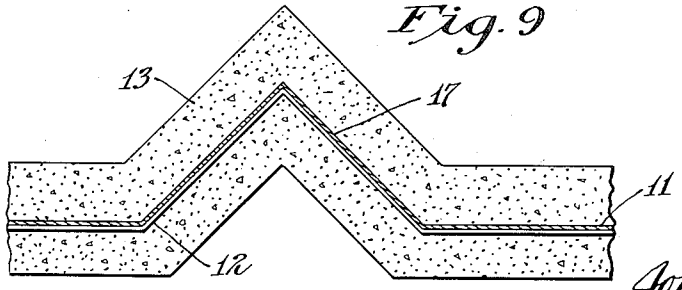


Fig. 9



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Patented May 4, 1937

2,079,461

UNITED STATES PATENT OFFICE

2,079,461

BUILDING CONSTRUCTION

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Application December 31, 1934, Serial No. 759,931

6 Claims. (Cl. 189—1)

This invention relates to building construction and more particularly to a construction for roofs or walls and roofs capable of use for large spans without requiring arches, framework or other reinforcing structure.

It is an object of my invention to provide a simple and very economical building construction which is adaptable for roof construction and in many cases for both roof and wall construction, and wherein the roof and/or walls and roof are supported principally by the continuous maintenance of an excess of air pressure within the structure over the atmospheric pressure prevailing without. The excess air pressure within our structure principally responsible for the support of the roof and/or roof and walls needs only to be slightly greater than the atmospheric pressure outside to enable a continuous membrane of sheet metal to be successfully utilized for the entire roof and in many instances (depending upon the shape of the building) for the walls and roof.

My structure may be of any convenient shape but those best adapted are shapes which facilitate the maintenance of uniform tension in the walls and roofs. Such shapes include segments of conic figures of revolution such as segments of cylinders closed at the ends, spheres, hyperboloids, paraboloids, ellipsoids, cones, etc.

It is a further object to provide in building construction of the class described, a continuous membrane of substantially impervious sheet material and apparatus for subjecting the interior of that membrane to a substantially uniform air pressure in excess of the atmospheric air pressure outside the building and sufficient to principally support the roof and/or the walls and roof, as the case may be, but not of such amount as to have any injurious or unpleasant effects upon humans or animals within the building.

A further object and advantage of my improved construction is the provision of a structure which is completely moisture-proof, due to the excess of air pressure within, which assures an outward flow of air through any crevice or leak sufficient to offset any tendency of moisture to enter therethrough.

It is another object to provide a novel and simple method for successfully utilizing and supporting a roof and/or walls and roof constructed of a membrane of sheet material by means of substantially constant air pressure within the structure somewhat greater than the atmospheric pressure outside the building.

These and other objects and advantages of the invention will be more fully set forth in the following description made in connection with the accompanying drawings, in which like reference characters refer to similar parts throughout the several views, and in which:—

Fig. 1 is a top plan view of an embodiment of my invention wherein the shape of the building is that of a segment of an elongated cylinder with closed converging ends;

Fig. 2 is a side elevation of the same;

Fig. 3 is a front elevation;

Fig. 4 is a fragmentary section through one of the walls of the building, showing the means for anchoring the foundation and also showing suitable apparatus for maintaining a substantially predetermined air pressure within the building;

Fig. 5 is a fragmentary side elevation taken from the interior of the building;

Fig. 6 is a fragmentary cross section illustrating a discharge hopper in and below the floor of the building;

Fig. 7 is a fragmentary view, mostly in side elevation with some parts broken away showing the entrance to the building provided with suitable air locks;

Fig. 8 is a detail horizontal section of a suitable form of steel door used in the air locks, and

Fig. 9 is a detail horizontal section showing a breather or an expansion section adjacent to one of the ends of the building construction.

While our structure is adapted for buildings of many various natures, purposes and shapes, the embodiment illustrated in the drawings is particularly adapted as a storage container for various materials or products, such as grain and the like.

As shown, the entire walls and roof are in the form of a continuous membrane of substantially impervious sheet material, such as sheet metal, conveniently made up of a multiplicity of sheet metal plates 11 with their adjacent edges fastened together to form air-tight seams by welding, riveting or any other desired method. The shape shown is of semi-cylindrical form with closed and outwardly convergent ends. The lower edges of the membrane forming the walls and roof are preferably welded, riveted or otherwise secured and sealed to a narrow reinforcing strip 12 encircling the entire membrane. The lower edge of reinforcing strip 12 is embedded preferably in a suitable foundation 13 which, as shown, is constructed of concrete and strip 12 is further secured to the foundation 13 by suitable means such as enlarged staples or loops 14 embedded in the concrete and passed through suitable apertures formed in strip 12.

Foundation 13 and the building structure su-

perimposed thereon are efficiently anchored by suitable means such as a heavy anchoring foundation 15 disposed several feet below the ground surface and as shown of continuous construction running parallel and below foundation 13 and to which said foundation 13 is anchored by a multiplicity of vertical tie-rods 16 spaced apart at suitable intervals and preferably having turned upper and lower ends embedded in the foundations 13 and 15 respectively. The continuous membrane constituting the walls and roof of the building may, if desired, be provided with one or more breather or expansion sections 17 which as shown are in the form of an enlarged bellows fold or outwardly extending bulge of V-shaped cross section as shown in Figs. 1, 2 and 9.

A suitable floor 18 is provided and is preferably sealed with foundation 13 by means such as a sealing strip 18a, which, as shown, is embedded in both the floor 18 and foundation 13. The entire building, as far as possible, including all joints and building ends, is made impervious to air passage.

One or more entrances E and E' are designed to facilitate entrance or exit without loss of any appreciable amount of air from within the building. An ordinary revolving door, such as shown at E' may be employed or if desired a short tunnel 19 (see particularly Fig. 7) provided with air locks may be used. Tunnel 19 is built upon a suitable concrete foundation 19a and communicates as shown with one of the ends of the building. A sheet metal arched roof is superimposed on the foundation 19a supported on reinforcing arches 19b and having its lower edges embedded and sealed with the top of the foundation. Within tunnel 19 are a pair of spaced air locks or doors A, a suitable structure of which is illustrated in detail in Fig. 8. As shown, each of the doors is hinged to a post 20 and has an out-turned flange about the entire periphery thereof, which carries a compressible sealing strip 21 for seating against the corners of the jamb and door frame. Additional sealing strips 22 and 23 may be provided on the door frame for seating against the inner edges of the door proper, and a lock 24 controlled by a crank handle 25 on the outer side of the door, may be utilized to engage the outer face of the door frame producing a camming effect to tightly seal the door when the handle is turned in the appropriate direction. As shown, a pair of doors A are located in tunnel 19, one at the juncture of the tunnel with the building and the other at the outer end of the tunnel.

In the form of building shown, a suitable discharge hopper 26 is formed in the medial portion of the floor 18, extending some little distance below the floor into an enlarged trough 27, which may be constructed of concrete. The upper edges of hopper 26 are secured to and sealed with an apertured portion of the floor and the lower and converging end of the hopper is provided with a horizontally disposed air-tight gate 28 of suitable form, which, as shown, is slidable in sealed guides 28a. The opening and closing of gate 28 is controlled by means such as a pinion 29 engaging a rack formed on the bottom of said gate and turned by suitable means such as a large hand wheel disposed at one side of the hopper. As shown, a short delivery chute 31 is disposed above an endless conveyer 32 which extends longitudinally and upwardly through the trough 27 to the outside of the building.

Suitable apparatus is provided for supplying the interior of the building with air taken from the outside, to build up the interior air pressure. As shown, I may employ an airblower B, mounted in a small housing 33 at one side of the building and with its intake communicating with the air outside the building and with its discharge 34 communicating with the interior of the side wall of the building through a suitable aperture with which discharge 34 has a sealed joint. A flap-type door 35 as shown hinged at its upper edge and urged to closed position over the air opening may be employed to prevent escape of air through the blower when the same is not in operation. Blower B, as shown, is driven by an electric motor M, also mounted in housing 35, and the operation of which may be manually controlled but is preferably controlled by means of a pressure actuated electric switch S, mounted on the interior of the building, and subjected to the pressure of the air therewithin.

A pressure controlled relief valve 36 is shown mounted in the roof of my building structure and adjacent thereto I illustrate an elongated chute or spout 37 through which material may be put into the building. An inwardly opening air tight door is provided at the bottom of spout 37 and if desired mechanical means for positively opening said door may be utilized. The length of spout 37 is preferably such that the height and weight of the column of granular material contained therein is sufficient to overcome the excess air pressure from within the building and to make possible entrance of the granular material without substantial loss of air from within. If desired an additional door may be provided at the outer end of the spout which will be closed when the column of material within the spout falls below a predetermined height.

From the foregoing description, it will be seen that the walls and roof of the building, constituting in the embodiment of the invention illustrated the entire shell construction, is substantially impervious to air and escape of air and reduction of air pressure within the interior is minimized. The blower B operates or is operated as needed to maintain a substantially continuous predetermined air pressure within the building in excess of the atmospheric air pressure outside of the building. Utilizing a membrane for the roof and/or the walls and roof of the building, such as sheet metal, the excess of the interior air pressure need only be slightly greater than the outside air pressure to adequately support the shell of the building.

In the embodiment illustrated, the operation of blower B is automatic and is controlled by the pressure actuated electrical switch disposed within the interior of the building and subjected to the air pressure therewithin. The excess of air pressure necessary is hardly noticeable and is not injurious or unpleasant to humans or animals inside the building.

If desired, an alternate blower may be provided and connected with the pressure actuated control system in such manner that if for any reason the first blower fails to respond to the action of the controls, the alternate air blower is automatically cut in.

With my construction, roofs and/or roofs and walls for large spans may be successfully constructed from relatively cheap, thin material, such as sheet metal and may be efficiently supported by the excess air pressure within, without requiring arches, framework, beams, and

other reinforcing and supporting construction. The economy in constructing such a building is substantial and is apparent from the foregoing description.

In addition to the provision of a new and improved building construction, I have provided a simple and efficient method for supporting the roof and/or roof and walls of a building which includes the steps of materially restricting escape of air from within the building and continuously maintaining within the building an air pressure in excess of the atmospheric air pressure outside of the building, which air pressure acts as the principal support for the roof and in numerous cases for the walls and roof of the building. It will further be seen that my novel methods may in addition include the automatic control for maintaining a substantially predetermined excess pressure within the building construction.

It will, of course, be understood that various changes may be made in the form, details, proportions and arrangement of the parts without departing from the scope of my invention, which, generally stated, consists in a device capable of carrying out the objects above set forth and in the novel parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:—

1. Building construction having in combination walls and a roof tightly joined and constructed of material substantially impervious to the passage of air, said building including a shell in the form of an unreinforced sheet metal membrane constituting at least a portion of the roof, a blower having its intake outside of said building and connected to discharge air under pressure within said building and means subjected to air pressure within said building for controlling the operation of said blower to maintain a substantially predetermined air pressure within said building and against said shell in excess of the atmospheric air pressure outside of said building and below a pressure sufficient to rupture said membrane.

2. Building structure comprising an enclosure in the shape of a conic figure of revolution constituting the walls and roof of a building and made from a substantially continuous unreinforced sheet metal membrane and means for continuously maintaining upon the inside of said enclosure an excess of air pressure over the atmospheric air pressure outside of said building but below a pressure sufficient to rupture said membrane.

3. Building construction having in combination walls and a roof tightly joined and constructed of material substantially impervious to the passage of air, said building including a shell in the form of a continuous unreinforced membrane constituting at least a portion of the roof, said membrane comprising a multiplicity of thin metal sheets the edges of which are secured together, a blower having its intake outside of said building and connected to discharge air under pressure within said building and means subjected to air pressure within said building for controlling the operation of said blower to maintain a substantially predetermined air pressure within said building.

4. The method of constructing and supporting the roof of a building without the use of structural reinforcing members or encircling retaining elements which consists in forming a substantially air-impervious foundation wall, forming a continuous concavo-convex diaphragm from a multiplicity of air impervious metal sheets joined and sealed together at their edges, joining the edge of said diaphragm so formed with said foundation wall and thus anchoring said diaphragm and continuously maintaining beneath said diaphragm a substantially predetermined air pressure in excess of the atmospheric air pressure outside of said diaphragm and below a pressure sufficient to rupture said diaphragm the internal pressure being sufficient to provide a supporting medium for said diaphragm and at the same time insufficient to require superposed reinforced elements on the outside of said diaphragm.

5. Building construction having in combination, foundation walls and an arched roof tightly joined with said walls and constructed of material substantially impervious to the passage of air, said roof construction being entirely formed from a multiplicity of thin metal sheets the edges of which are joined and secured together without the use of reinforcing members or encircling retaining means, a blower having its intake outside of said building and connected to discharge air under pressure within said building and means subjected to air pressure within said building for controlling the operation of said blower to maintain a substantially predetermined air pressure within said building, said roof being of general segmental cylindrical form and having end portions in the shape of truncated conical segments, said end portions being connected with the body portion of said roof by bellows-like sheet metal connections to permit limited longitudinal expansion of the roof.

6. Building construction having in combination walls and a roof tightly joined and constructed of material substantially impervious to the passage of air, said roof being composed of a material which will provide a semi-rigid and partially self-supporting structure, a blower having its intake outside of said building and connected to discharge air under pressure within said building, and means subjected to air pressure within said building for controlling the operation of said blower to maintain a substantially predetermined air pressure within said building and against said roof in excess of the atmospheric pressure outside of said building and below a pressure sufficient to rupture said roof.

JOHN H. MACMILLAN, JR.