April 14, 1953 N. E. GRAVEN 2,634,462

PORTABLE FOLDING HOUSE CONSTRUCTION

Filed June 15, 1946 2 SHEETS—SHEET 1

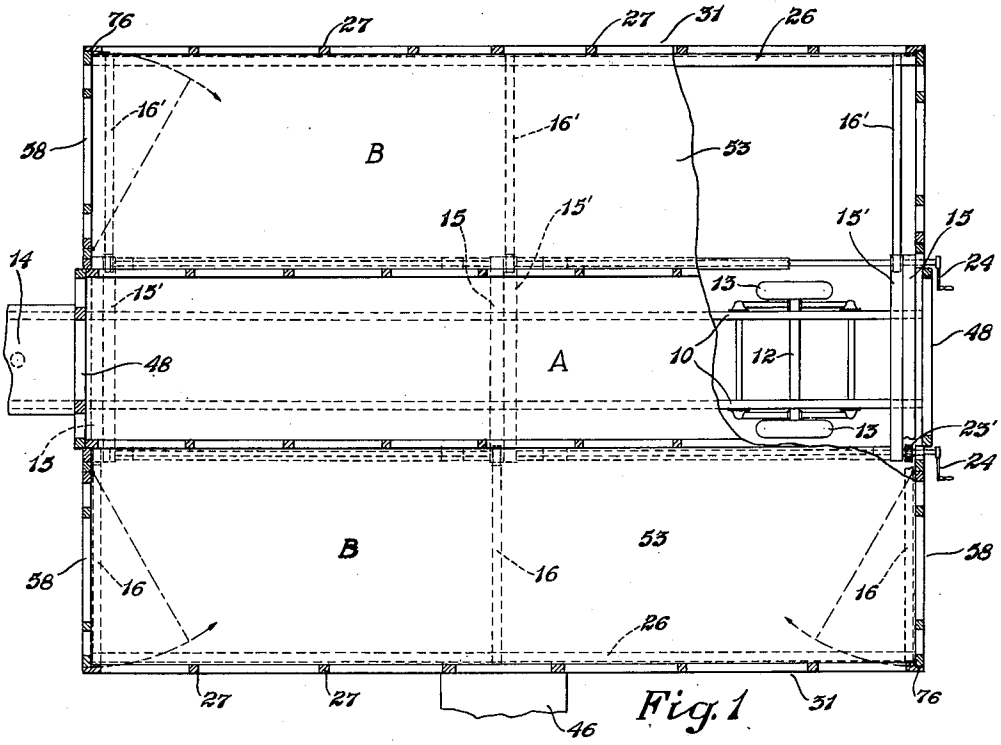

Fig. 1

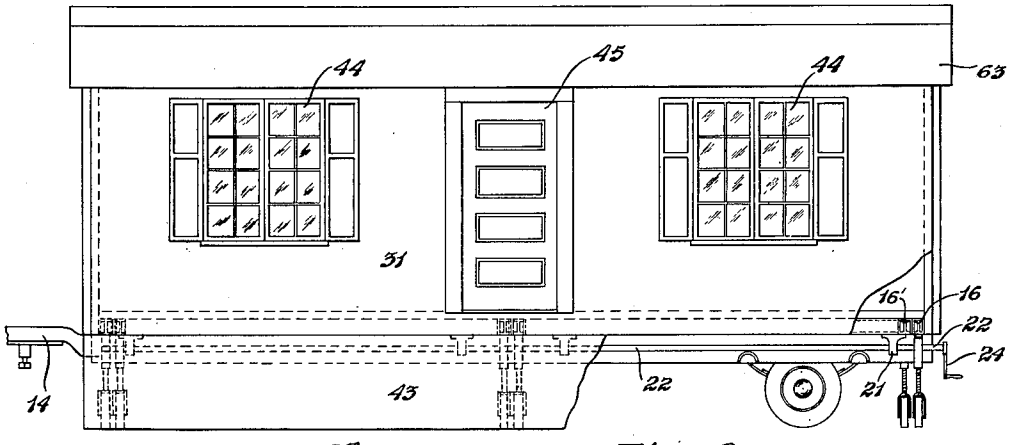

Fig. 2

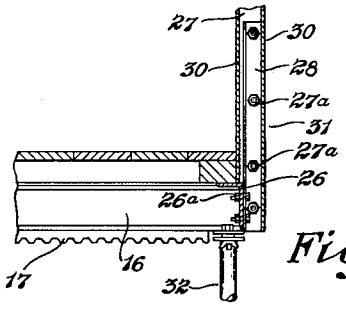

Fig. 4

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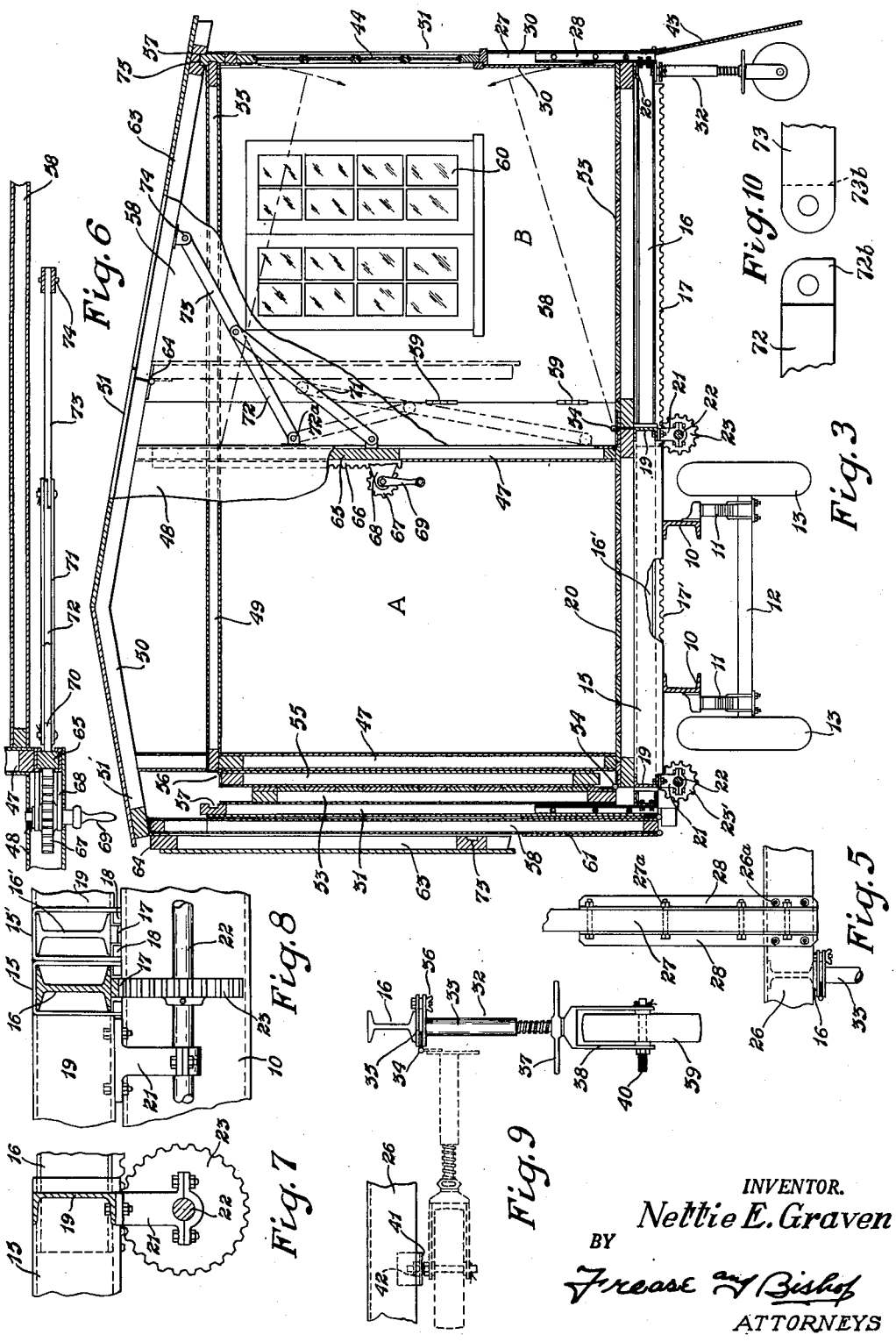

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PORTABLE FOLDING HOUSE CONSTRUCTION

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4 Claims. (Cl. 20—2)

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The invention relates generally to folding buildings, and more particularly to a portable house which can be folded into a small and compact space for being transported and unfolded, and quickly extended to become a modern dwelling of substantial size at a desired location.

Certain prior portable buildings or dwellings, such as house trailers, have been small one-room affairs, intended primarily for overnight lodging on motor trips; and such trailers have not proven satisfactory as permanent dwellings, at least to the great majority of American families. Attempts have been made to provide for extending such portable buildings to larger size, but when the building is transported such extensions either have to be torn down and disconnected from the main building, or a complicated, heavy and expensive structure results which requires special skill and equipment for folding and transporting the same.

It is a general object of the present invention to provide a complete modern house which has substantial area when fully extended on location, and which is quickly and easily folded into a small space and transported to another location where it is just as quickly and easily unfolded and extended for immediate use.

More specifically, it is an object of the present invention to provide a novel portable folding house in which all of the extensible parts fold and collapse into a small space while remaining attached to the structure of the house.

Another object is to provide a novel foldable portable house having a central permanent section or room in which all of the plumbing, heating and utility fixtures are located with suitable connections to outside supply lines.

Another object is to provide a novel portable house having a central unit to which all foldable and extensible parts are connected, and on which all folding and extending mechanism is mounted.

A further object is to provide a novel foldable portable house having transversely extensible beams and exterior side walls supported on the outer ends of said beams.

Another object is to provide a novel portable folding house having extensible portions, the walls, floors, ceilings and roofs of which all fold or collapse into vertical positions, one alongside of the other.

A further object is to provide a novel foldable portable house having a central section with all foldable parts adapted to fold against the exterior of the central section so as to permit using fixtures located in said section when the housing is completely folded.

A still further object is to provide a novel foldable portable house in which the foldable portions of the roof are so constructed and arranged that in folded position they protect other folded parts of the house.

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Finally, it is an object of the present invention to provide a novel foldable portable house which is simple and inexpensive to construct, which is compact and relatively light in weight when folded, and which is easily folded or unfolded by unskilled persons without requiring special tools or equipment.

These and other objects are accomplished by the parts, constructions, arrangements, combinations and methods which comprise the present invention, the nature of which is set forth in the following general statement, and a preferred embodiment of which is set forth in the following description and illustrated in the accompanying drawings, and which is particularly and distinctly pointed out and set forth in the appended claims forming part hereof.

In general terms, the novel and improved portable folding house comprising the present invention may be stated as including a longitudinal central section having fixed walls, floor and roof, with laterally extensible side walls mounted on the central section by means of extensible beams, floor panels hinged on said central section for being unfolded to rest on said beams when extended, ceiling and roof panels hinged on said central section for being unfolded to rest on the tops of said side walls when extended, and means for raising one or more of said roof and ceiling panels to unfolded position, there being end walls hinged to said central section for adjoining said extensible side walls in extended position.

Referring to the drawings forming part hereof, in which a preferred embodiment of the invention is shown by way of example:

Figure 1 is a plan sectional view of the novel foldable house in unfolded or extended position, parts of the floors being broken away to show the sub-structure;

Fig. 2 is a side elevation thereof with parts broken away;

Fig. 3 is an enlarged transverse sectional view, partly in elevation, showing the parts folded along one side of the central section, and extended at the other side;

Fig. 4 is an enlarged fragmentary view similar to the lower right hand corner of Fig. 3;

Fig. 5 is a fragmentary side elevational view thereof with the outer side wall covering removed;

Fig. 6 is an enlarged fragmentary plan sectional view showing the linkage for raising and lowering a roof panel;

Fig. 7 is an enlarged fragmentary view similar to Fig. 3 showing the extensible beam construc-

tion and the rack and pinion driving means therefor;

Fig. 8 is a fragmentary transverse sectional view thereof;

Fig. 9 is an enlarged fragmentary elevation of one of the folding wheel supports attached to the outer ends of the extensible beams; and

Fig. 10 is an enlarged detached view of two of the arms in the linkage for raising the roof panels.

Similar numerals refer to similar parts throughout the several views of the drawings.

While the building structure shown and described herein by way of example includes a longitudinal central room with one extensible room on each side thereof, it is to be understood that various partition walls may be provided within the central section and additional extensible rooms may be added for telescoping or folding within the extensible rooms shown, without departing from the scope of the invention.

As best shown in Fig. 3, the longitudinal central section indicated generally at A is preferably supported on two longitudinal channels or beams 10 which are in turn carried in usual fashion on leaf springs 11 mounted on the axle 12 of a pair of wheels 13. If the portable house is to be used as a trailer, only one set of wheels 13 at the rear end of the house may be required, and the front end may be provided with a towing or fifth wheel connection indicated diagrammatically at 14 in Figs. 1 and 2. In such case, a suitable dolly (not shown) may be provided for supporting the front end of the house when disconnected.

If desired, a second set of wheels may be provided under the front end of the longitudinal central section A so that the house is carried on a four-wheeled vehicle. Other arrangements of wheeled supports may be provided for transporting the house on highways or railways and the like, within the scope of the invention as defined in the appended claims.

The longitudinal channels 10 carry transverse rectangular housings 15 and 15' in which transversely extending extensible beams 16 and 16' are movably mounted, the housings 15 and 15' being located side by side in pairs and there being three pairs shown in Figs. 1 and 2, one pair at each end of the central section A and one substantially midway of the end pairs, although additional pairs may be provided as desired. Gear racks 17 and 17' are secured to the bottom surfaces of the beams 16 and 16' as by welding, and the bottom portions of the housings 15 and 15' are provided with spacer members 18 for resting on the channels 10 to provide clearance between the channels 10 and the gear racks, as best shown in Fig. 8.

Preferably, longitudinal channels 19 extend along the outer edges of the central section A and have their ends secured as by welding to the transverse housings 15 and 15'. The ends of the floor joists carrying the floor 20 of the central section A are preferably supported on the tops of channels 19, and spaced bearing brackets 21 are secured to the bottoms of channels 19 for journaling shafts 22, one extending longitudinally under each channel 19.

Each shaft 22 has fixed thereon, a plurality of pinions, each pinion meshing with one of the racks 17 or 17'. As viewed in Fig. 3, the right hand shaft 22 is provided with three pinions 23, one meshing with each of the racks 17 on the extensible beams 16, and the other shaft

22 is provided with three pinions 23', one meshing with each of the racks 17' on the beams 16'. At one end of each shaft, a crank handle 24 may be provided as shown for rotating the pinions 23 and 23' to extend and retract the beams 16 and 16' laterally in opposite directions.

When the extensible beams 16 and 16' are fully retracted within the housings 15 and 15', they occupy positions entirely below the central section A of the foldable house, which housings at all times serve to support the central section upon the longitudinal beams 10 which are in turn carried on the wheels 13 through the springs 11 and axle 12.

As best shown in Figs. 4 and 5, the extensible beams 16 and 16' have secured at their outer ends longitudinally extending angles 26, and to the outer legs of said angles vertical posts 27 are secured at intervals by means of pairs of vertical angles 28 each having one leg secured to the angle 26 as by bolts 26a and the other legs securing the post 27 between them as by bolts 27a. The angles 28 are of such dimension as to fit between ply wood panels and the like 30 secured to the inner and outer surfaces of the posts and providing exterior side walls indicated generally at 31 supported vertically at the outer ends of the extensible beams.

On the underside of the outer end of each of the beams 16 and 16' an adjustable retractable wheel support indicated generally at 32 is provided, and as indicated in Fig. 9, when the beams are retracted within the housings 15 the retractable wheel is adapted to be folded up under the longitudinal angle 26 and detachably secured thereto. The retractable wheel may include an adjustable strut 33 having a hinge connection 34 at its top and with a plate 35 on the underside of the beam 16, the strut 33 and plate 35 being secured opposite the hinge by means of a wing nut latch 36 of well known construction. The bottom of the strut 33 is provided with an adjusting handle 37 and a fork 38 in which a wheel 39 is journaled. One end 40 of the axle is extended and provided with threads, for being attached to an angle bracket 41 on the angle 26, by means of a retaining nut 42.

As indicated in Figs. 2 and 3, the bottom edges of the exterior side walls 31 may have aprons 43 hinged thereto for swinging downwardly to cover the undercarriage of the folding house when the same is in extended position. The exterior walls 31 may be provided with suitable windows 44 and a door 45 as desired, and an approach to the door 45 may be provided as indicated diagrammatically at 46 in Fig. 1, said approach including steps if desired.

The central section A is provided with fixed side walls and end walls, the side walls being supported on the floor 20 and indicated at 47, and the end walls being indicated at 48. Both the side and end walls 47 and 48 may be provided with suitable doors, and the side walls may have partition walls extending therebetween, if desired. A ceiling panel 49 is supported on the side walls 47 so that the side walls 47 and end walls 48 and ceiling 49 form a longitudinal central room extending throughout the central section A. In this room all of the plumbing, heating and electrical fixtures may be permanently located and provided with suitable connections, so that the fixtures can be quickly attached to outside supply lines whenever the house is transported to a new location. This room within the central section A is also accessible when the house is

folded and being transported because the foldable and extensible parts of the house all fold against the exterior of the room.

The side walls 47 and end walls 48 are preferably extended above the ceiling 49 to support a roof section 50 which covers the entire central section A and overhangs the side walls 47 to a substantial extent as indicated at 51. As shown in Fig. 1, the end walls 48 project slightly beyond the side walls 47.

The extensible beam 16 and 16', together with the exterior side walls 31 supported on the ends of the beams, provide extended room portions B, one on each side of the central section A. The floor panels 53 for the extended room portions B are each hinged at their inner edge to the adjacent outer edge of the central section floor 20, as by a hinge connection 54, so that when unfolded as indicated on the right side of Fig. 3, the floor panel 53 is supported on the extensible beam 16 and at its outer edge on the longitudinal angle 26 secured thereto. As shown at the left side of Fig. 3, the floor panel 53 is adapted to fold upwardly to a vertical position alongside of the adjacent side wall 47.

Preferably, ceiling panels 55 are provided for the extensible rooms B, and the ceiling panels 55 are preferably hinged at their inner edges by hinge connections 56 to the adjacent outer edge of the ceiling 49 of the central section. As shown the ceiling panel 55 is adapted to fold downwardly against the adjacent side wall 47 and the adjoining floor panel 53 is adapted to fold upwardly against the ceiling panel 55, the ceiling panel 55 being between the side wall 47 and the floor panel 53. As indicated in Fig. 3, the upper ends of the exterior side walls 31 are longitudinally notched as indicated at 57 to receive the outer edges of the ceiling panels 55 in extended position.

The end walls 58 for the extensible rooms B are preferably hinged as indicated at 59 to the projecting edges of the end walls 48 of the central section A. The end walls 58 are thus adapted to fold about their vertical inner edges, and as shown in Fig. 3, they may be arranged to fold against the outer surface of the exterior walls 31 in retracted position. Suitable windows such as indicated at 60 may be provided in the end walls 58 as desired, and aprons 61 may be hinged to their bottom edges to cover the undercarriage of the portable house when the same is extended.

The roof panels 63 for covering the extensible room portions B are preferably hinged at their inner edges by hinge connections 64 to the overhanging portions 51 of the permanent central roof section 50. As shown, the roof panels 63 are adapted to fold downwardly to a vertical position against the outer surfaces of the end walls 58 in folded position. Accordingly, the downwardly folded roof panels 63 protect and substantially cover the panels 55, 53, 31 and 58 when the same are folded in that order against the side walls 47 of the central section A.

Means for swinging the roof panels 63 upwardly into a position covering the extended room portions B may include vertical rack bars 65 slidably mounted at the outer ends of the side walls 47, and having gear racks 66 thereon which are engaged by pinions 67 journaled in brackets 68 fixedly mounted at the outer ends of said walls 47. The pinions 67 are preferably located within the projecting end walls 48, as shown in Fig. 6, and are provided with exterior crank handles 69 for rotating the pinions to raise and lower the rack bars 65. Preferably, the rack bars 65 are each provided opposite the racks 66 with a projecting ear 70 to which links 71 are pivotally connected, the other ends of the links being pivoted to the joint of a folding support arm having its inner portion 72 pivotally connected at 72a to the projecting end of adjacent side wall 47 and having its outer portion 73 pivotally connected at 74 to the underside of the roof panel 63.

By turning the crank handle 69 to move the rack bar 65 downwardly, the links 71 will cause the support arm portions 72 and 73 to fold together so that when the roof panel 63 is lowered to a vertical position the links 71 and support arms 72 and 73 will be folded alongside the projecting end of the adjacent wall 47, as indicated in dot-dash lines in Fig. 3. As shown in Fig. 10, the end of arm 72 has a corner portion 72b thereon for abutting the shoulder 73b and preventing the arms from folding in the opposite direction, so that arms 72 and 73 will be maintained in longitudinal alignment for raising the roof panels 63 as shown in Fig. 3.

It is obvious that while this linkage arrangement is shown in the drawings as applied only to the roof panels for the sake of clarity, it may be applied to the ceiling panels or the floor panels in the same manner as it is applied to the roof panels, without departing from the scope of the invention.

In the operation of the novel foldable house comprising the present invention, assuming that the house has been transported in folded condition to a desired location and disconnected from a towing vehicle, the retractible wheel supports 32 are first unlatched from the angles 26 and swung to a vertical position where they are fastened by the wing nut latches 36 with the wheels 39 resting on the ground. The crank handles 69 are then operated to raise the rack bars 65 to swing the roof panels 63 upwardly by means of the linkages 71, 72 and 73 connecting the rack bars to the panels. Preferably, the roof panels are raised slightly higher than the ends of the exterior side walls 31 so that the side walls can be extended to proper position under the roof panels. With the roof panels held in raised position, the ends walls 58 are swung outwardly about the hinges 59 to an open position which will permit the exterior walls 31 to be extended outwardly between the end walls.

The cranks 24 are then manipulated to extend the beams 16 and 16' laterally outward carrying the side walls to a position in which their upper ends are slightly beyond the notches 75 on the undersides of the roof panels 63. The floor panels 53 are then unfolded downwardly about the hinges 54 to a horizontal position resting on the extensible beams 16 and 16'. The ceiling panels are then unfolded upwardly about the hinges 56 until their outer ends are directly opposite the notches 57 at the upper ends of the walls 31.

The exterior walls 31 are now retracted inwardly by manipulating the cranks 24 to engage the outer edges of the ceiling panels in the notches 57 and the roof panels 63 are then lowered sufficiently to engage the notches 75 with the upper ends of the side walls 31. The end walls 58 are now swung inwardly to abut the ends of the ceiling panels under the roof panels, and the outer ends of the end walls 53 are interfitted into suitable notches 76 provided at the outer ends of the exterior side walls 31.

The aprons 43 and 61 are then lowered to cover the undercarriage of the housing, and suitable steps or other approaches to the doors

are moved into place. The various plumbing and electrical fixtures located in the central room of the house may then be quickly attached to suitable supply lines available in the selected location, and the house is then ready for use.

When it is desired to transport the house to a different location, the fixtures are first disconnected, and the various parts can be folded and retracted in the reverse order so that all of the various panels forming the extended rooms B are compactly folded one alongside of the other against the side walls 47 of the central section. In the retracted position of the exterior side walls 31, extensible beams 16 and 16' are all housed under the central section, with the retractable wheels folded up under the same so that when the aprons 43 and 61 are folded upwardly, the folded house is ready to be transported on its wheels 13 to another location. In folded position, the novel house is relatively narrow in width so as to move safely on the highways without danger to the occupants of passing vehicles.

The novel portable house provides a central section to which all of the foldable and extensible parts are connected and within which a central room is accessible during transportation.

Moreover, the novel house is relatively simple and inexpensive in construction, and may be folded or unfolded by unskilled persons without requiring special tools or equipment.

In the foregoing description, certain terms have been used for brevity, clearness and understanding, but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such words are used for descriptive purposes herein and are intended to be broadly construed.

Moreover, the embodiment of the improved construction illustrated and described herein is by way of example, and the scope of the present invention is not limited to the exact details of construction.

Having now described the invention, the construction, the operation and use of a preferred embodiment thereof, and the advantageous new and useful results obtained thereby; the new and useful constructions, and reasonable mechanical equivalents thereof obvious to those skilled in the art, are set forth in the appended claims.

I claim:

1. Portable folding house construction including a longitudinal central section having fixed walls, floor and roof, a pair of laterally extending beams mounted on said central section for lateral extension in directions opposite to each other, means for laterally extending said beams, exterior side walls carried on the outer ends of said beams, floor panels hinged on said central section for folding alongside said fixed walls and for being unfolded to rest on said beams when extended, ceiling panels hinged on said central section for folding alongside said fixed walls and for being unfolded to engage the tops of said exterior side walls in extended position, and roof panels hinged on said central section for folding down alongside said fixed walls and for being unfolded to rest on the tops of said exterior side walls in extended position.

2. Portable folding house construction including a longitudinal central section having fixed walls, floor and roof, a pair of laterally extending beams mounted on said central section for lateral extension in directions opposite to each other, means for laterally extending said beams, exterior side walls carried on the outer ends of said beams, floor panels hinged on said central section for folding alongside fixed walls and for being unfolded to rest on said beams when extended, ceiling panels hinged on said central section for folding alongside said fixed walls and for being unfolded to engage the tops of said exterior side walls in extended position, roof panels hinged on said central section for folding down alongside said fixed walls and for being unfolded to rest on the tops of said exterior side walls in extended position, and walls hinged to said central section for unfolding to engage the ends of said floor and ceiling panels and the ends of said side walls in extended position.

3. Portable folding house construction including a longitudinal central section having fixed walls, floor and roof, a pair of laterally extending beams mounted on said central section for lateral extension in directions opposite to each other, means for laterally extending said beams, exterior side walls carried on the outer ends of said beams, floor panels hinged on said central section for folding alongside said fixed walls and for being unfolded to rest on said beams when extended, ceiling panels hinged on said central section for folding alongside said fixed walls and for being unfolded to engage the tops of said exterior side walls in extended position, roof panels hinged on said central section for folding down alongside said fixed walls and for being unfolded to rest on the tops of said exterior side walls in extended position, a rack bar movably mounted on said central section, linkage means operatively connected to said rack bar, and a pinion meshing with said rack bar for raising at least one of said roof panels to extended position for engaging the tops of said exterior side walls.

4. Portable folding house construction including a longitudinal central section having fixed walls, floor and roof, a pair of laterally extending beams mounted on said central section for lateral extension in directions opposite to each other, gear racks on said beams, pinions journaled on said central section and meshing with said racks for extending and retracting said beams, ceiling panels hinged on said central section for folding alongside said fixed walls, floor panels hinged on said central section for folding alongside said ceiling panels, exterior side wall panels carried on the outer ends of said beams for being retracted to a position alongside of said floor panels, end wall panels hinged to said central section for folding alongside said exterior side walls, and roof panels hinged on said central section for folding down alongside said end walls, whereby said roof panels cover and protect all of the remaining panels when folded, and folding wheels mounted on the ends of said beams for engaging the ground during the extending and retracting movement of said beams.

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