Feb. 28, 1939. A. WEILAND ET AL 2,148,596

AIR CONDITIONING UNIT

Filed Sept. 11, 1935 6 Sheets-Sheet 1

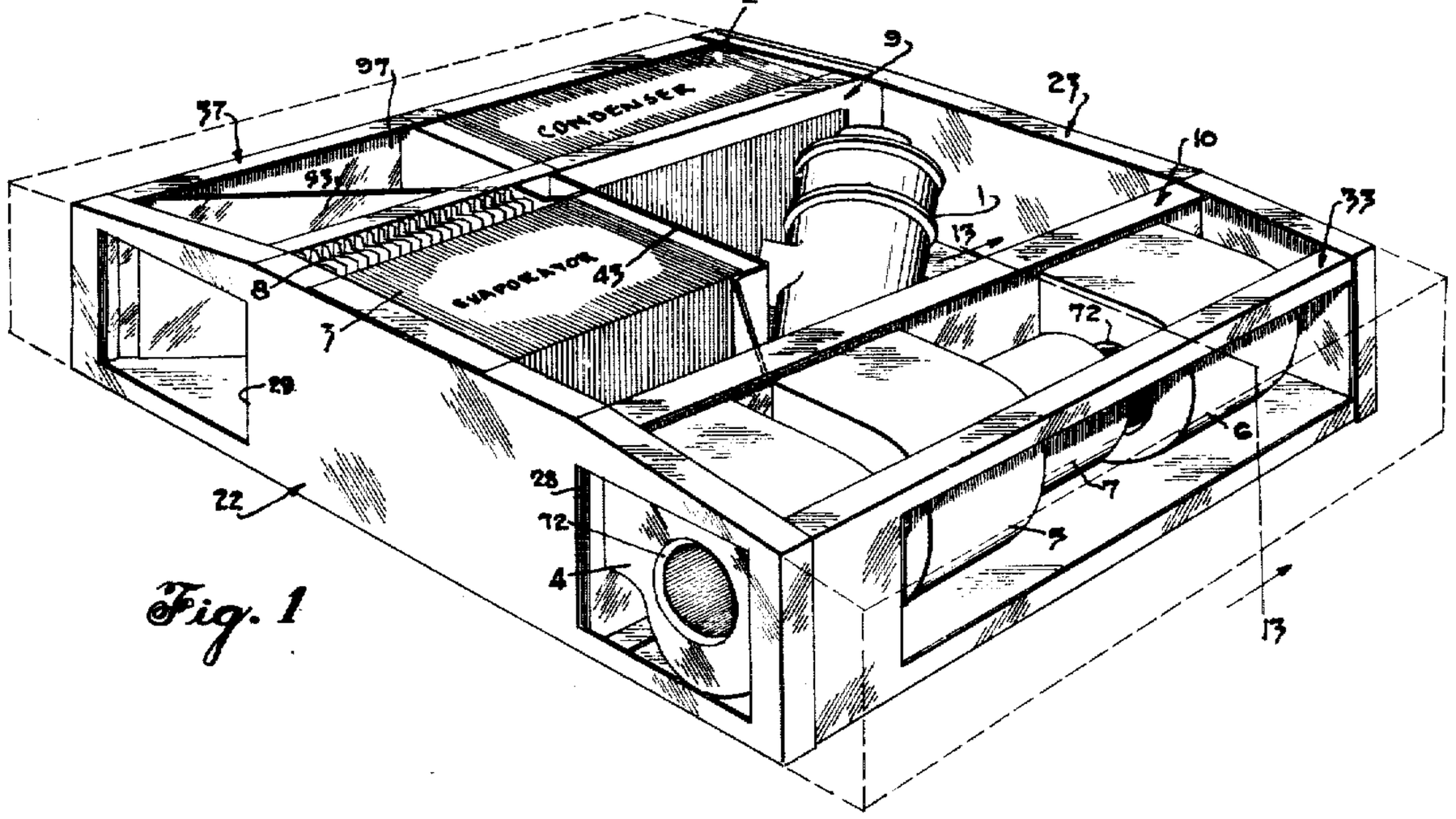

Fig. 1

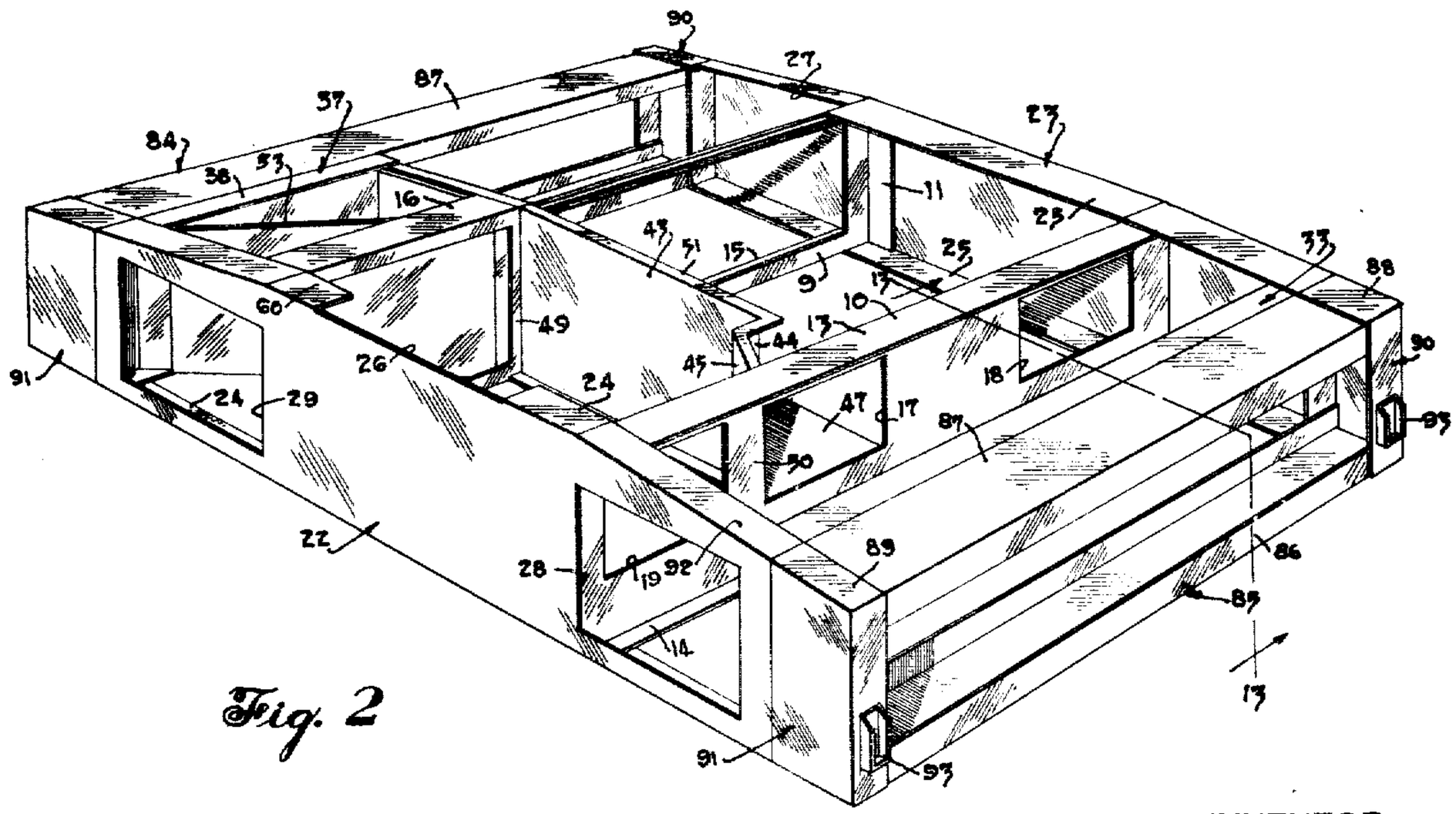

Fig. 2

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Feb. 28, 1939. A. WEILAND ET AL 2,148,596

AIR CONDITIONING UNIT

Filed Sept. 11, 1935 6 Sheets-Sheet 2

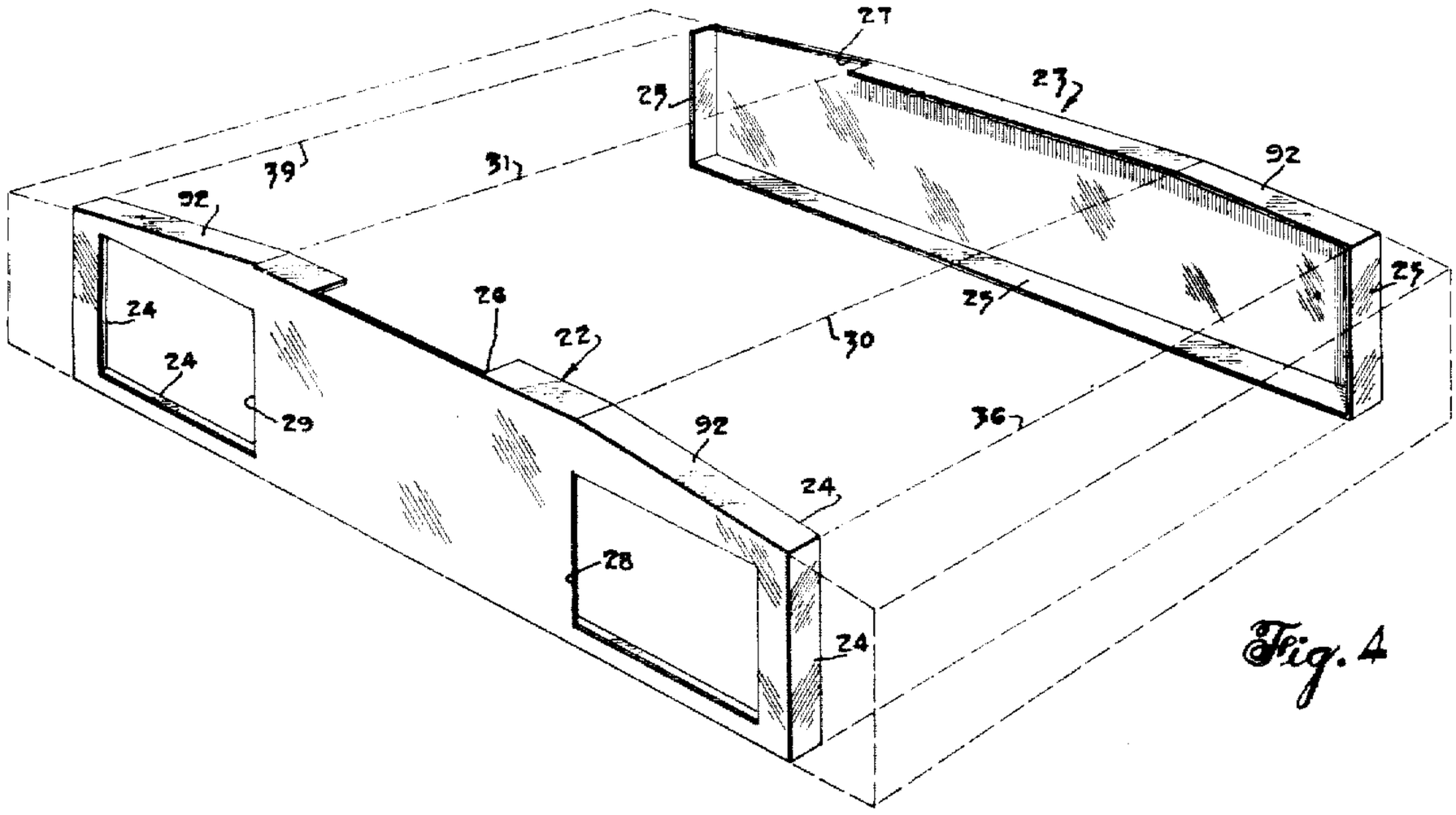

Fig. 4

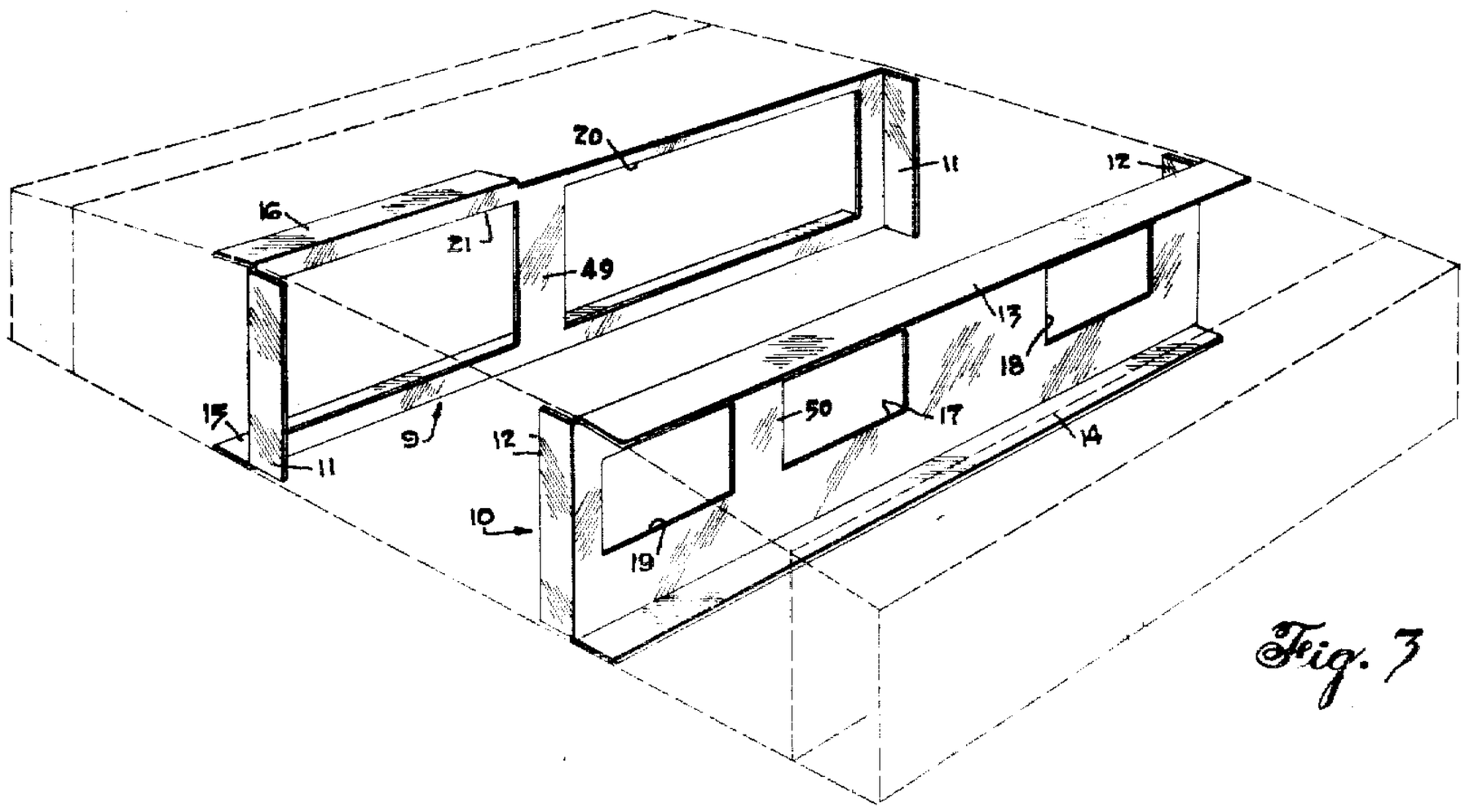

Fig. 3

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Feb. 28, 1939. A. WEILAND ET AL 2,148,596

AIR CONDITIONING UNIT

Filed Sept. 11, 1935 6 Sheets-Sheet 3

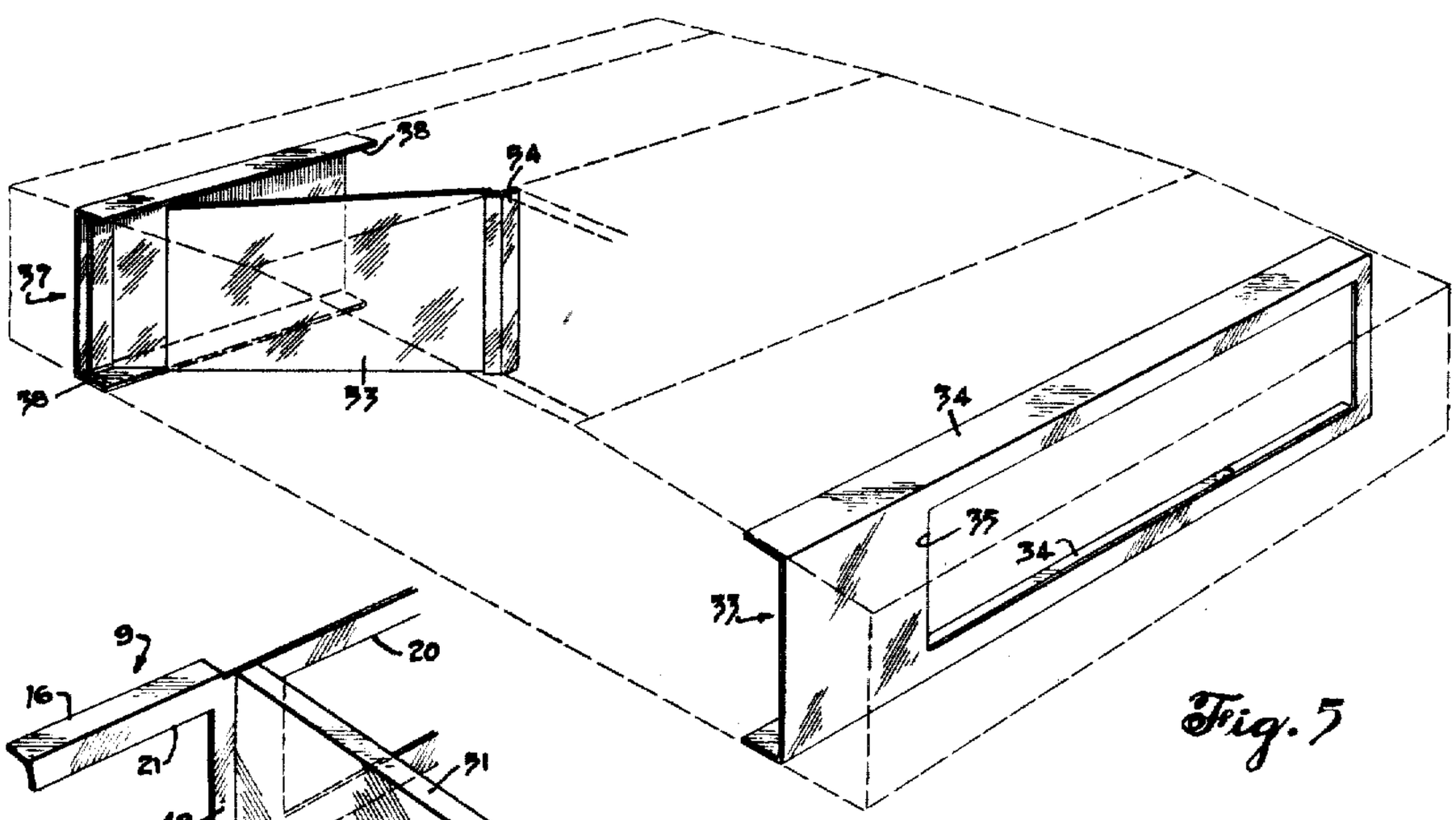

Fig. 5

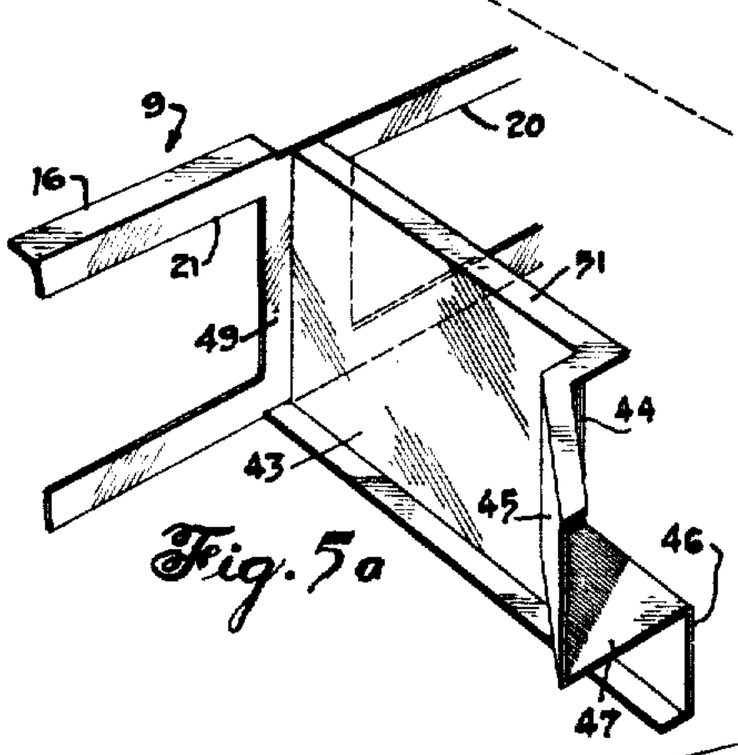

Fig. 5a

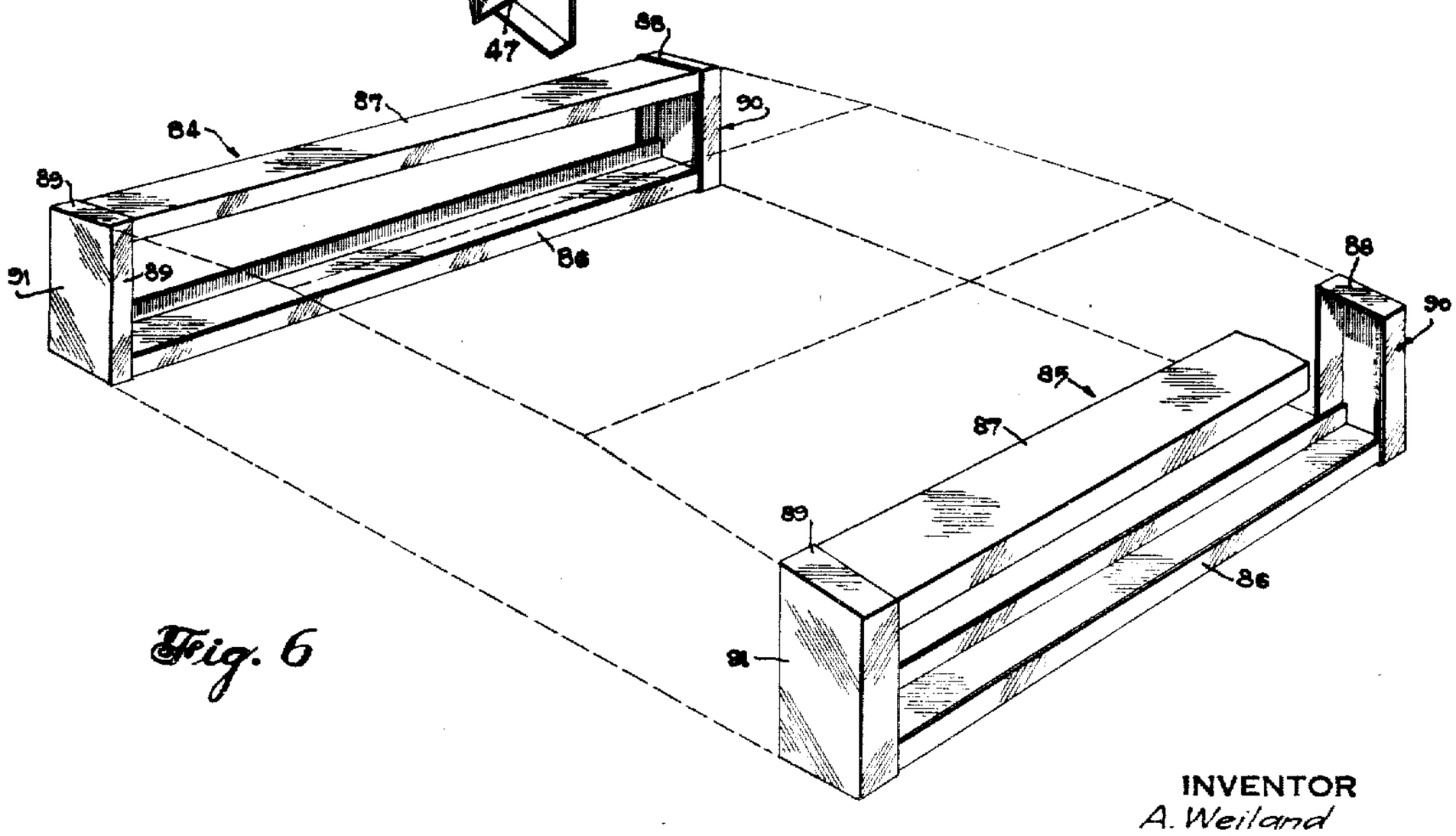

Fig. 6

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Feb. 28, 1939. A. WEILAND ET AL 2,148,596

AIR CONDITIONING UNIT

Filed Sept. 11, 1935 6 Sheets-Sheet 4

Fig. 7

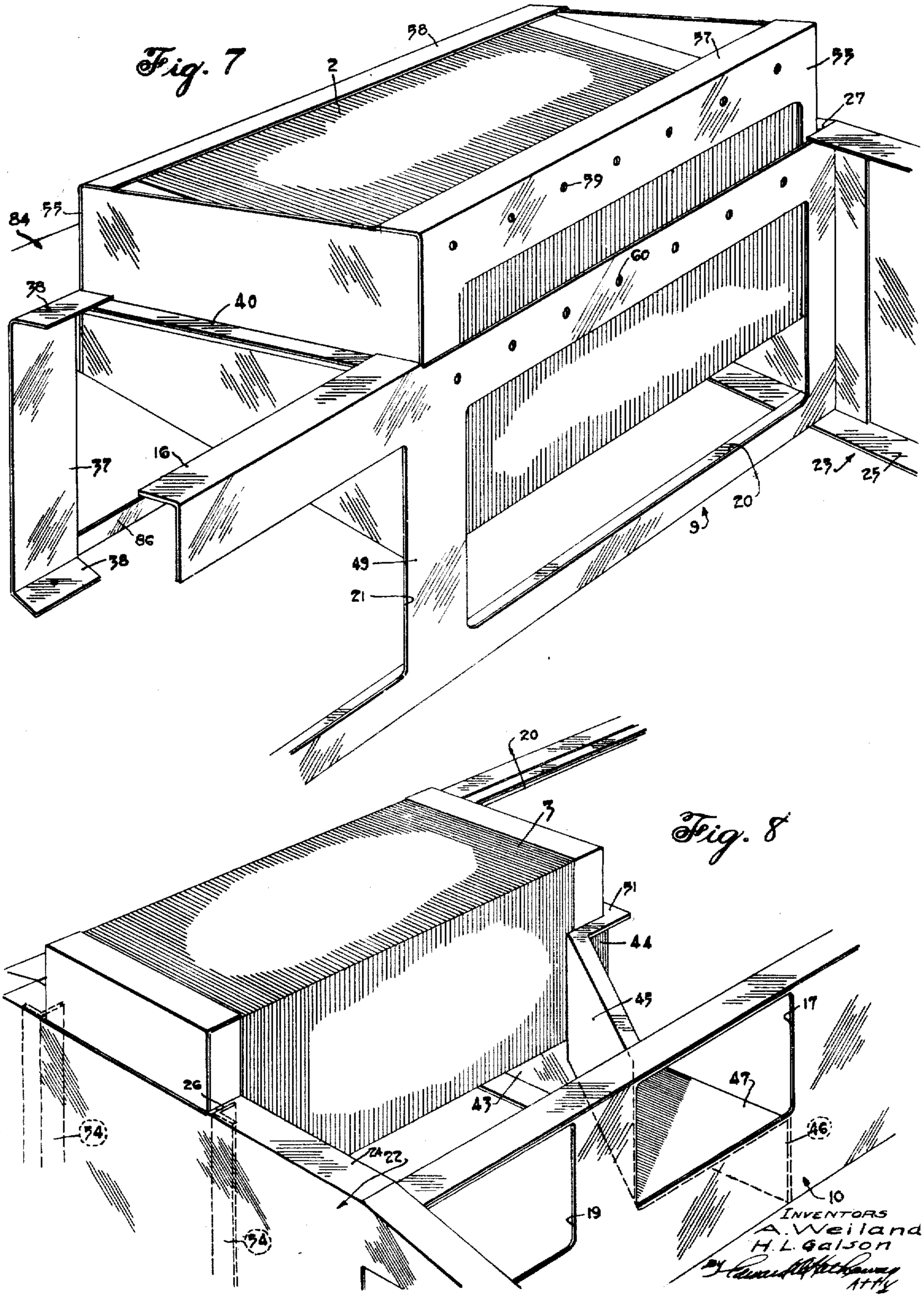

Fig. 8

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Feb. 28, 1939. A. WEILAND ET AL 2,148,596

AIR CONDITIONING UNIT

Filed Sept. 11, 1935 6 Sheets-Sheet 5

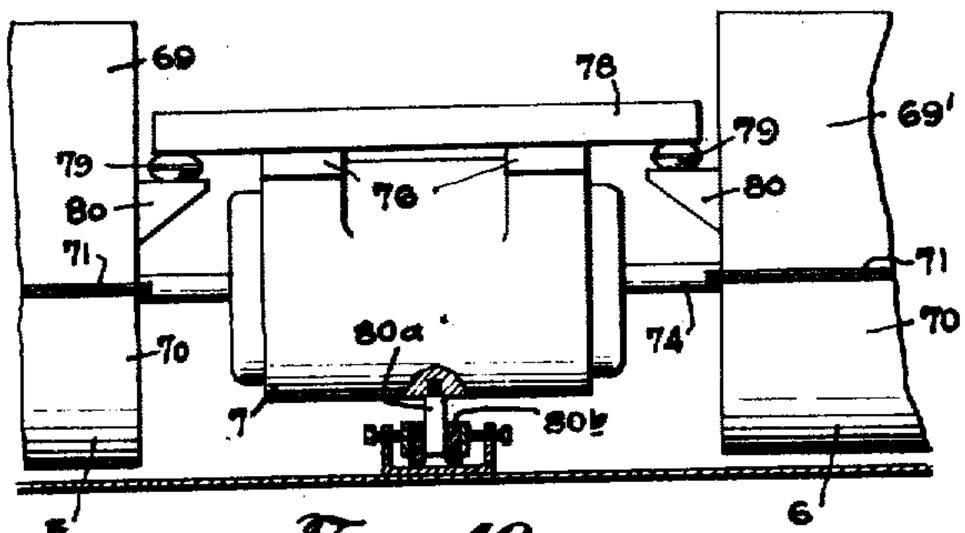

Fig. 10

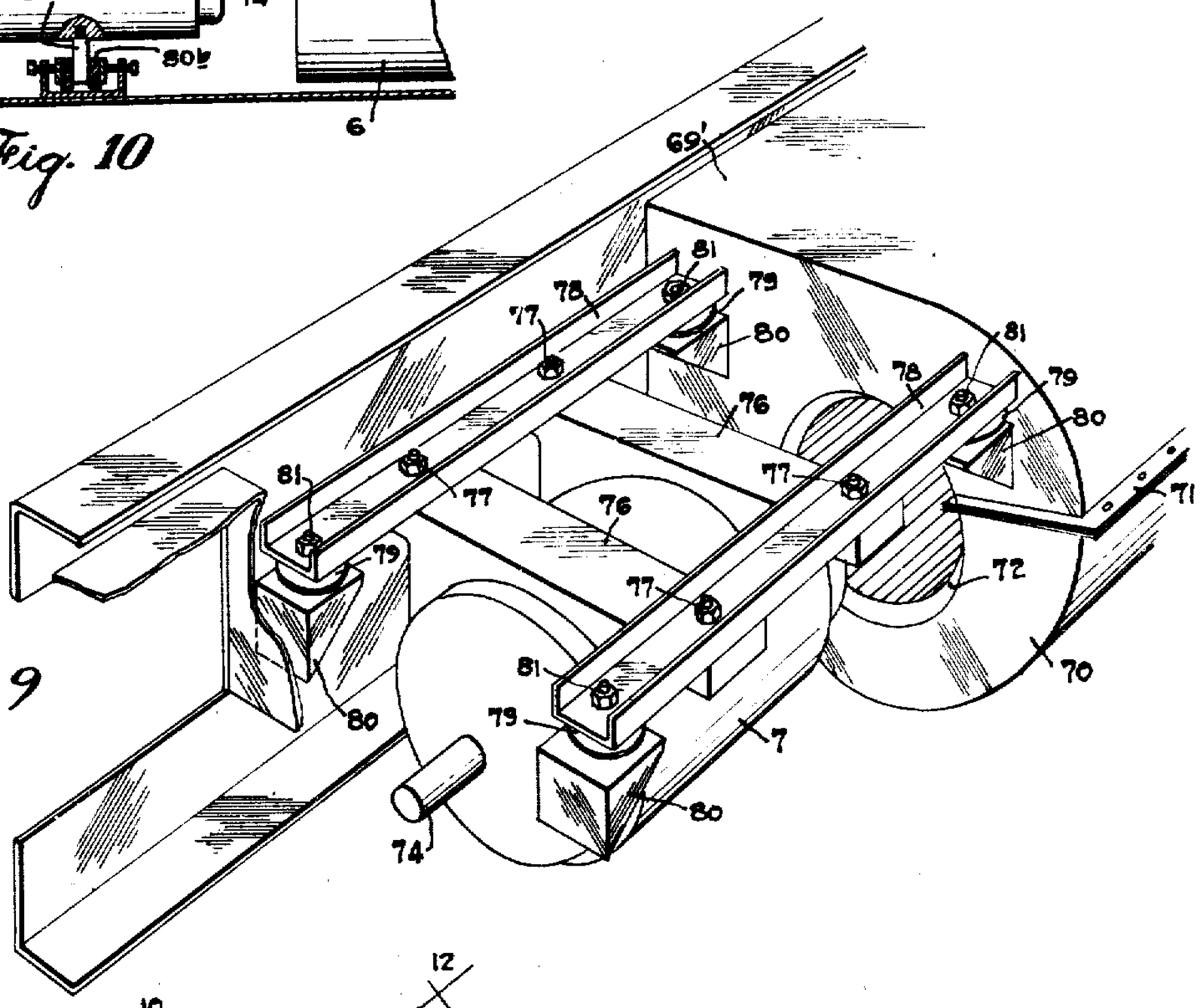

Fig. 9

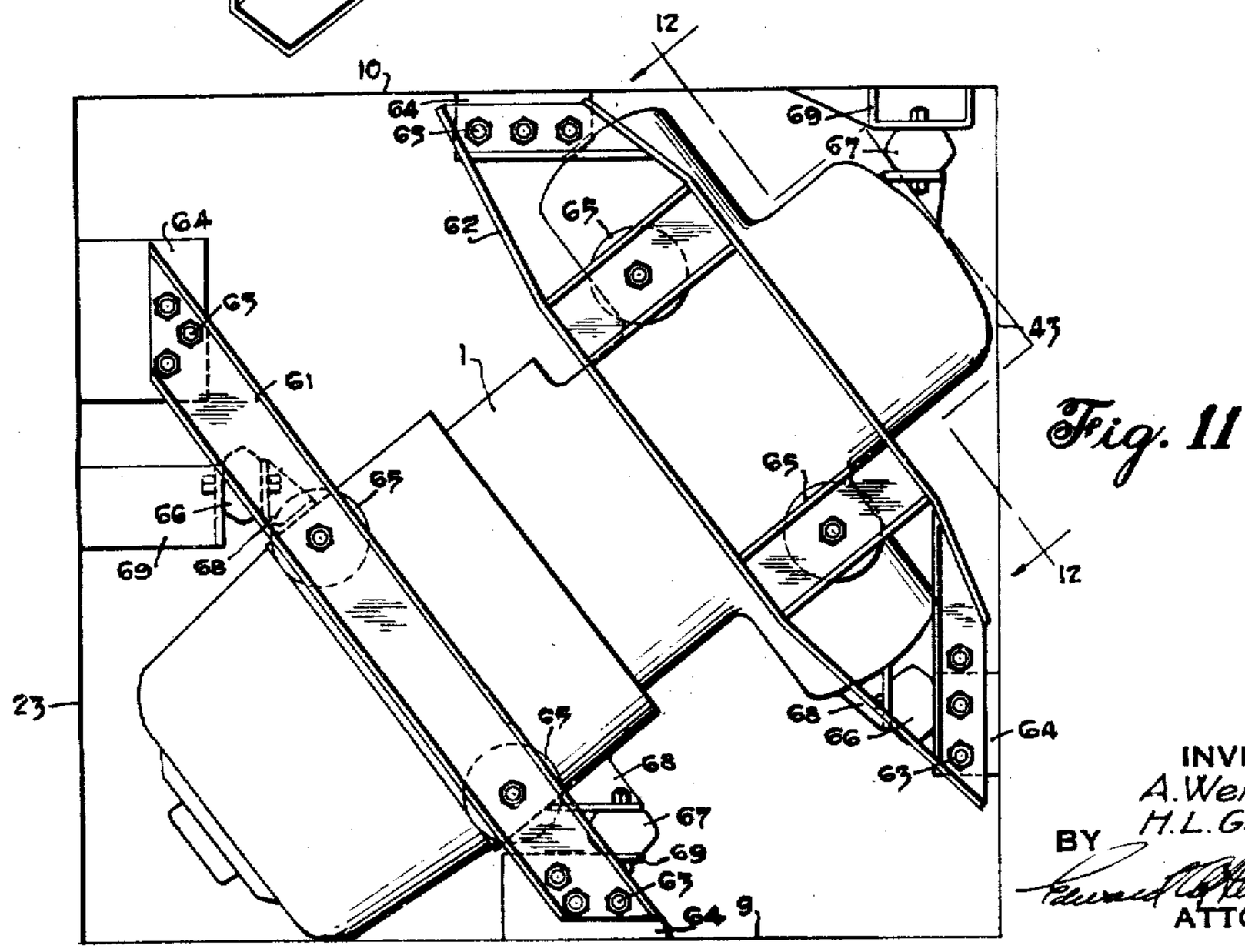

Fig. 11

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Feb. 28, 1939. A. WEILAND ET AL 2,148,596

AIR CONDITIONING UNIT

Filed Sept. 11, 1935 6 Sheets-Sheet 6

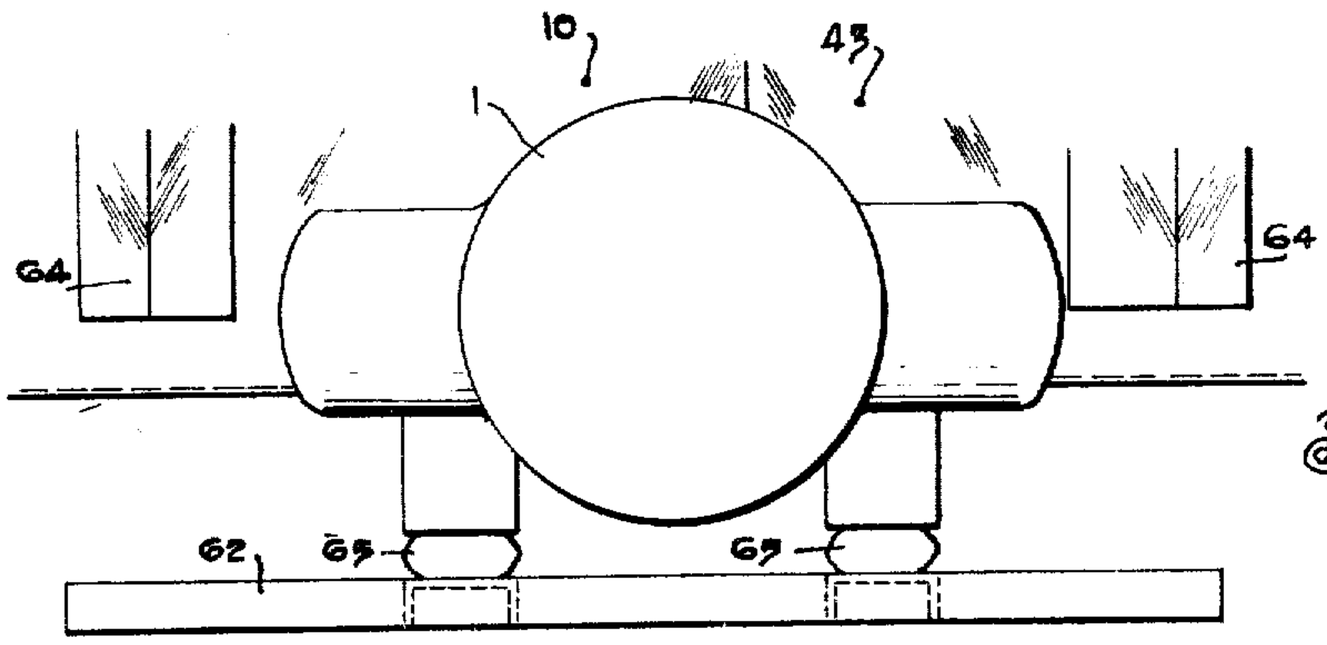
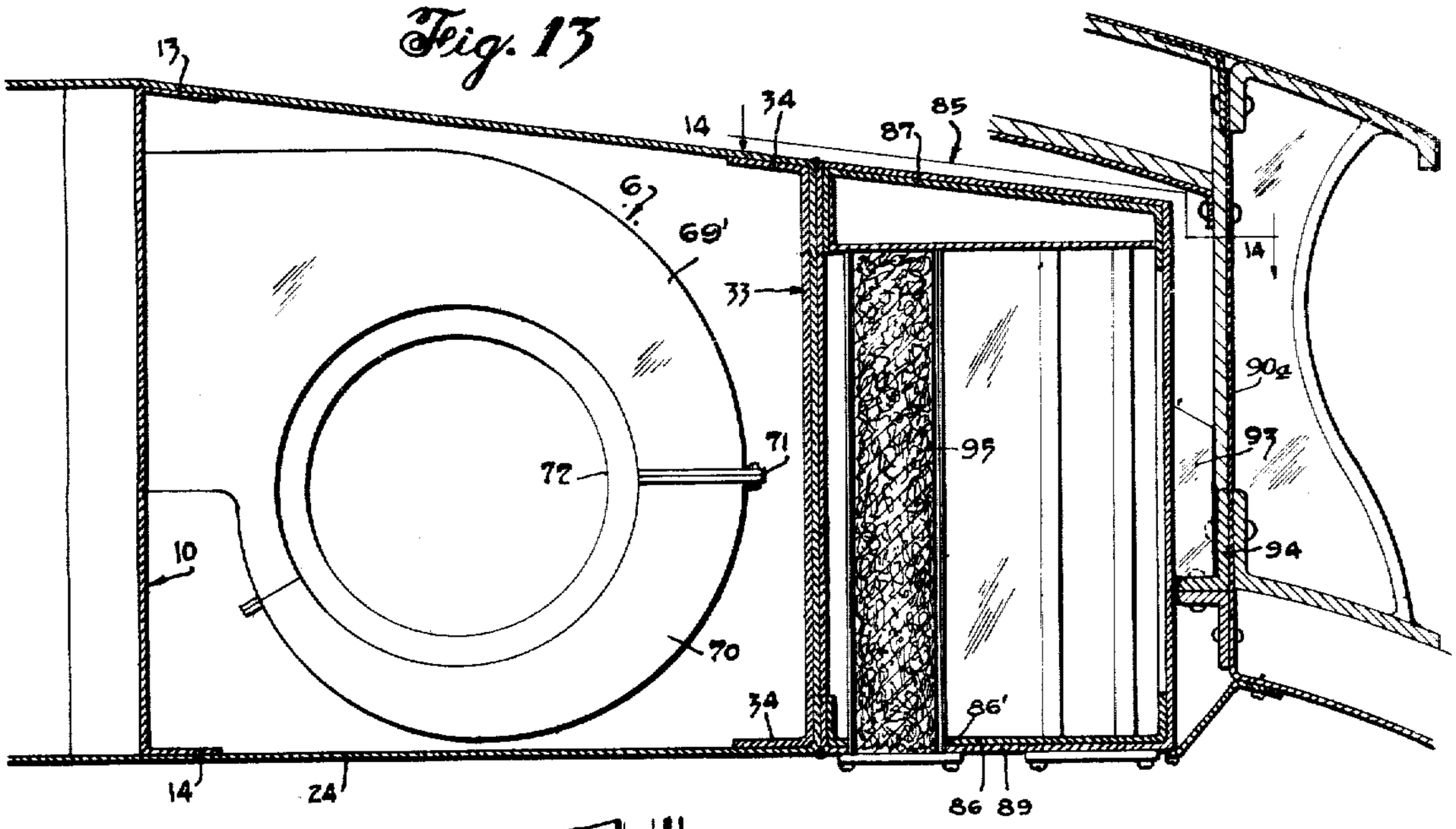


Fig. 12

Fig. 13



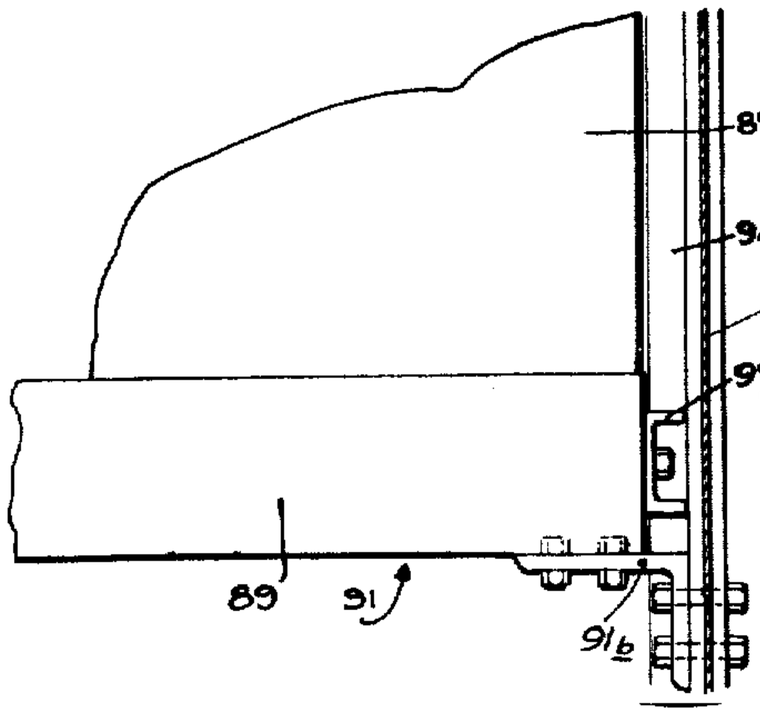


Fig. 14

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Patented Feb. 28, 1939 2,148,596

UNITED STATES PATENT OFFICE

2,148,596

AIR CONDITIONING UNIT

Alfred Welland, Philadelphia, and Henry L. Galson, Swarthmore, Pa., assignors to Baldwin-Southwark Corporation, a corporation of Delaware

Application September 11, 1935, Serial No. 40,108

10 Claims. (Cl. 62—129)

This invention relates generally to a self-contained air conditioning unit and more particularly to a unit adapted to be mounted in the monitor of a railway car, although the general arrangement and structure of the unit adapt it to other applications.

It is desirable that a self-contained air conditioning unit of the type employing a complete refrigerating system and air circulating means should be compact, economical in manufacture and maintenance, and efficient in its operation and distribution of air in an enclosure, these various features being particularly important in the application of a unit to railway cars and especially when the unit is placed in the car monitor. In adapting a self-contained unit to a monitor, it is apparent that the problem of providing a satisfactory unit is difficult not only because of the relatively narrow width and extremely shallow depth of the monitor but also in view of the necessity, in the type of unit herein disclosed, of causing condenser cooling air to be efficiently drawn in and discharged out through deck openings while at the same time efficiently circulating car air over the evaporator and discharging the same into the car with sufficient velocity but without causing drafts or substantial temperature variations in the car.

It is one object of our invention to provide an improved self-contained unit that embodies the foregoing features in a simple manner which is economical in construction, operation and maintenance and yet is efficient in operation and of comparatively light weight without sacrifice of sturdiness. A further object is to accomplish the foregoing results in such a manner that the unit may be readily and economically installed in a car monitor while still maintaining the pleasing appearance and harmonious effects of the interior architecture of the car. Another object is to so construct the component elements and arrange the same in such structural and functional cooperative relation that they may be economically formed of relatively thin plate metal while at the same time having all of the desired degree of rigidity.

Other objects and advantages will be more apparent to those skilled in the art from the following description of the accompanying drawings in which:

Fig. 1 is a perspective of the assembled unit with its top cover plates and side wings removed to show various principal elements of its construction and their arrangement;

Fig. 2 is a perspective of the frame structure per se with the various operating elements omitted for sake of clarity;

Fig. 3 is a perspective of the two longitudinal main beams of the frame;

Fig. 4 is a perspective of the two end sills;

Fig. 5 is a perspective of the two side members, one adapted for connecting the end sills together and the other adapted for connection to one of the side sills at its other end, an air flow baffle being shown in its relation to this latter side member;

Fig. 5*a* is a perspective of a transverse partition shown in its relation to one of the longitudinal beams;

Fig. 6 is a perspective of two side wings;

Fig. 7 is an enlarged perspective showing the manner in which the condenser as a unit can be removed from or inserted in the frame;

Fig. 8 is an enlarged perspective showing the manner in which the evaporator as a unit can be inserted in or removed from the frame;

Fig. 9 is an enlarged fragmentary perspective showing the manner of supporting the fan casings and fan motor with respect to one of the longitudinal beams;

Fig. 10 is a side elevation of the fan motor showing means for steadying the motor during starting and stopping of cars;

Fig. 11 is an enlarged bottom plan view of the compressor and motor unit and its supporting structure looking upward at the bottom thereof and showing the manner of cushioning the compressor against jolting of a car and of permitting the compressor to be bodily removed through the bottom of the unit while the unit remains in its installed position;

Fig. 12 is a transverse section taken on the line 12—12 of Fig. 11 but showing the compressor in its inverted position from that of Fig. 11 and also showing the partial removal of the compressor through the bottom of the unit;

Fig. 13 is an enlarged fragmentary transverse section taken on a line corresponding to lines 13—13 of Figs. 1 and 2 and showing the manner in which the unit is supported by the car roof structure together with the filters for the outside air;

Fig. 14 is a partial plan view taken on line 14—14 of Fig. 13.

In the particular embodiment of the invention which is shown herein merely for the purpose of illustrating certain principles of the invention together with one specific form among possible others that the invention might take in practice, we employ as generally shown in Fig. 1 a refrig-

erating motor-compressor unit 1, a condenser 2, an evaporator 3, a car air blower 4 and condenser air blowers 5 and 6. These blowers are driven by a common motor 7. A moisture eliminator 8 is disposed on the discharge side of the evaporator. It will, of course, be understood that the foregoing elements per se may be of any suitable construction, and if desired the heat exchange elements 2 and 3 may have their condenser and evaporator functions interchanged by suitable piping and valve mechanism such as shown in the application of C. R. Neeson, Serial No. 653,466, filed January 25, 1933, whereby the unit may function either as a cooler or heater. The compressor 1 may be of the hermetically sealed type or of the separate compressor and motor type, but they do not per se form a part of the present invention.

As shown in Figs. 2 to 6, the framework includes, Fig. 3, two longitudinal main beams 9 and 10 provided with inwardly turned end-flanges 11 and 12. Outwardly turned upper and lower flanges 13 and 14 extend for the full length of beam 10. A lower flange 15 extends for the full length of beam 9 while an upper flange 16 is short. Formed in the web of beam 10 are condenser air openings 17 and 18 and a car air opening 19 for communication with blowers 4, 5 and 6. The web of beam 9 has an opening 20 large enough to receive the combined air flow through openings 17 and 18 while an opening 21 cooperates with opening 19.

With the main beams or members 9 and 10 in their relation as shown in Fig. 3, there is next assembled therewith a pair of end sills 22 and 23, Fig. 4, provided with inwardly turned flanges 24 and 25 extending entirely around the edges. Flanges 24 and 25 are cut out respectively at 26 and 27 to receive the evaporator and condenser in a manner hereinafter described. Sill 22 is provided with an inlet opening 28 for recirculation of car air while opening 29 is provided for discharge of such air into the car. The ends of the longitudinal beams are, together with their upper and lower flanges 13—16, inserted between the upper and lower portions of flanges 24 and 25 so that the outer edge of flanges 13—16 lie along a line generally indicated at 30 and 31, Fig. 4. The end flanges 11 and 12 abut against the webs of the end sills and are welded or otherwise suitably secured thereto.

As shown in Fig. 5, a side member 33, provided with inturned flanges 34 and an air inlet opening 35, extends between the right ends of sills 22 and 23, Fig. 4, preferably on the inside of the sill flanges. The position of side member 33 will then be along the dotted line indicated at 36, Fig. 4. Another side member 37, Fig. 5, having inturned flanges 38, is secured to the left end of sill 22 preferably on the inside of the sill flanges. This side member is considerably shorter than the side member 33, but in general it will lie on a line 39, Fig. 4. To reinforce the free end of side member 37 and also to provide a guide for the condenser, there is provided as shown in Fig. 7 an angle iron 40 welded to the under side of flange 16 and to the upper one of flanges 38. To provide a partition wall between the flow of car air and outside condenser cooling air through the unit and also to permit said wall to additionally function preferably in forming the compressor and evaporator compartments, there is provided as shown in Fig. 5a a transverse partition 43. The portion of one end thereof has an offset portion 44 and an angular portion 45 while at the same end a lower portion 46 of partition 43 is formed as a straight line continuation of the main body of the partition 43. A shelf 47 connects angular wall portion 45 with the portion 46. The total depth of partition 43 is the same as that of longitudinal beams 9 and 10, and shelf 47 is level with the lower edge of opening 17, Fig. 3. As shown in Fig. 2, partition 43 has one of its ends secured to a web 49 while the edge of angular wall 45 is secured on the inner side of a web 50. The upper edge of the partition is turned over to form a flange 51. The right angle portion 44 as shown in Fig. 8 is in longitudinal alignment with one end of the portion 26 cut out from the end sill flanges 24 to provide a side support for evaporator 3. To form a continuation of partition 43 on the other side of beam 9, a panel 53, Figs. 2 and 5, is inserted between rib 49 and the forward portion of short side member 37. This member may be permanently secured or removably held by friction in its position, and to this end a small obtuse angle iron 54, Fig. 5 may be secured to the outside of web 49, Fig. 3, to provide a lateral abutment for the edge of panel 53. With the parts in their assembled relation as above described, the frame per se has the appearance shown in Fig. 2 except for two side wings which are shown therein and to be described later.

Evaporator 3 as shown in Fig. 8 is of just sufficient dimensions as to be removably received within the space defined by partition 43, angle portion 44 thereof, and cut out portion 26 of end sill flange 24 and is of a depth substantially equal to that of the end sill 22 and partition 43. The evaporator is bolted, Fig. 8, to angle irons 54 which are secured to the inside face of end sill 22 while a corresponding angle iron for the far corner of evaporator 3, Fig. 8, is similarly secured to partition 43. The lower flange 24 of the end sill provides a temporary rest for the evaporator while it is being bolted to said angle irons.

As shown in Fig. 7, condenser 2 has side frame walls 55, 55 each provided with inturned flanges 57 and 58 which form a substantial continuation of flanges 16 and 38 when the condenser is in position. Bolt holes 59 and 60 are formed in wall 55 and longitudinal beam 9 to receive bolts for holding the condenser in position. Other portions of the condenser frame may be likewise bolted to end sill 27 or the end one of flanges 25, Fig. 4. The condenser will also be supported by the lower flange 15 of beam 9, Fig. 3, and by the lower one of flanges 25 of end sill 23, it being noted that the condenser is receivable within the cut out portion 27 of the upper end sill flange.

A moisture eliminator 8, Fig. 1, of rectangular form and of any usual baffle type or other construction is receivable in the space between evaporator 3 and beam 9, it being noted that this space is provided due to the provision, Fig. 2, of a short horizontal flange portion 60 in the end sill 22. Moisture from this eliminator falls downwardly into a suitable trough from which a drain pipe conducts water laterally to the outside of the car or to any other suitable place for disposal.

The compressor 1, Figs. 1, 11 and 12, is horizontally supported within its compartment by the provision of a pair of supporting members 61 and 62 removably secured by bolts 63 to the under side of brackets 64. The end ones of said brackets are

secured to end sill 23 and partition 43 while the side brackets are secured to the longitudinal beams 9 and 10. Interposed between the compressor and cross members 61 and 62 are preferably four cushioning devices 65. There is also provided a pair of horizontally acting cushioning devices 66 and a pair of transversely acting cushioning devices 67, interposed between suitable brackets 68 on the compressor and brackets 69 on the main frame members to which members brackets 64 are secured. All of the foregoing cushioning devices per se are preferably of the type shown in the application of Alfred Weiland, Serial No. 703,804, filed December 23, 1933. To remove or insert the compressor, it is only necessary to remove the bolts 63 and the bolts which hold the cushion devices 66 and 67 whereupon the whole compressor and cross members 61 and 62 can, as a unit, pass through the bottom of the apparatus without disturbing other elements of the apparatus.

Each of the casings for blowers 4, 5, and 6, Figs. 1 and 9, comprises upper and lower portions 69' and 70 connected together along any suitable division line by bolted flanges 71. The upper portions 69' are bolted, welded or otherwise suitably secured to the outer face of longitudinal beam 10 and in communication with their respective openings 17, 18 or 19. All of the casings are of the type having inlets 72 at each end. The casings are entirely contained between the beam 10 and side member 33. The blower rotors within the casings may be of any usual form but are preferably mounted upon a common axis through a single shaft 74 which if desired may be formed in sections connected through universal or flexible couplings, but in any event are driven by a common motor 7. This motor has brackets 76 connected by removable bolts 77 to the under side of a pair of supporting members 78. These supporting members are carried on cushioning devices 79 preferably of the previously mentioned Weiland type. Suitable brackets 80 are secured to the upper stationary portion 69 of the fan casings 5 and 6. To minimize longitudinal shifting of the fan motor, a pin 80*a*, Fig. 10, is carried by motor 7 and supported between suitable adjustable rubber pads 80*b*. To remove the motor, it is only necessary to disconnect bolt and nut connections 81 associated with the cushioning devices and then laterally shift the motor and supporting members 78 so that the latter clear the sides of brackets 80, whereupon the motor unit may be moved downwardly. It will, of course, be understood that the lower removable portions 70 of the blower casings are first disconnected to permit the shaft 74 and blower rotors thereon to be removed as a unit with the motor. This arrangement has decided advantages including, among possible others, the extreme accessibility and removal of the blowers and motor therefor, the compactness it affords in combination with the remainder of the unit, and the relatively simple and effective manner in which the parts are constructed and all supported along the side of a single longitudinal beam without sacrifice of sturdiness or efficiency of operation.

As so far described, the width of the apparatus is determined by the length of end sills 22 and 23. This length is sufficient to permit the unit to be installed in a monitor of minimum dimensions. To adapt the apparatus to monitors of larger dimension, then as shown in Figs. 1, 2 and 6, supporting side wings 84 and 85 are attached by welding, bolting or other suitable means to the side members 33 and 37. These side wings are preferably identical, and hence the description of one will suffice for both. As shown in Fig. 6, upper and lower longitudinal channel members 86 and 87 are received within the flanges 88 and 89 of end pieces 90 and 91. The top flanges of these end pieces are inclined downwardly to form as shown in Fig. 4 a substantial continuation of the inclined portion 92 of the end sills, such inclination permitting the unit to more nearly conform to the curvature of the monitor roof. The side wing 85 is thus placed against the side member 33 and the inside flanges of channels 86 and 87 are welded or otherwise suitably secured to member 33. The side wing 84 is similarly welded to the shortened side member 37 and forms in effect a continuation thereof to the end sill 23, thereby forming the outer structural side for the compartment in which condenser 2 is disposed. The condenser may be bolted or otherwise secured to the inside flanges of the opposed channel members 86 and 87. The end wing 84 thus reinforces the side member 37 and also positively supports the ends of the end sills particularly the rearmost end of sill 23 as viewed in Fig. 2. Suitable stepped brackets 93, Fig. 2, are secured to the vertical flange of each of the end pieces 90 and 91. These brackets rest upon a suitable angle iron 94 or other suitable flanges projecting inwardly from the monitor structure. Such angle irons may be equal to or greater than the full length of the unit whereby after the unit is raised within the monitor and the first set of brackets rested upon the angle iron, the unit may then be slid longitudinally along the angle as a track until the forward pair of brackets is engaged by the track. Each corner of the unit may then be secured, Fig. 14, directly to the sides 90a of the monitor by bolted angle iron 91*b*.

It will, of course, be understood that suitable cover plates extend across the top and bottom of the unit from one side wing to the other and that grilles are provided for the openings 28 and 29. A further function performed by side wing 90 is that the channels 86 and 87 provide a receptacle for longitudinally extending filters 95 which in order to be inserted between the channels would be inserted vertically through suitable openings 86', Fig. 13, in channel 86 and held by any suitable bolts or other holding means.

All parts, except as otherwise noted, are formed preferably of light plate metal welded together along their various lines of juncture. Regardless, however, of the advantages of the specific frame structure, it is seen that all operating elements are disposed in a substantially common plane, specifically horizontal. The compact arrangement is specifically accomplished by the location of the condenser and evaporator on a line extending diagonally and that the compressor is on the other diagonal. Thus the condenser, compressor and outside blowers are substantially in transverse alignment while the compressor and evaporator are in longitudinal alignment, the evaporator being disposed centrally of the unit at one end thereof.

In operation.—Assuming that the refrigeration system is in operation or that it is desired to circulate car air and admit fresh air without operation of the refrigeration system, then outside air is drawn through usual deck openings in the monitor and thence passed through filters 95, openings 35 in end member 33 and into both end inlets of each blower casing 5 and 6. This air then flows through openings 17 and 18 and over

compressor 1 through opening 20, over condenser 2 and out through side wing 34 and deck openings registering therewith. Recirculated car air is drawn through opening 28 and into the forward inlet of blower casing 4 while the inlet at the opposite end of said blower draws a portion of fresh air from the path of outside air just previously described. The size of said opposite inlet can be determined in accordance with any variable quantity of fresh air desired. The combined recirculated and fresh air then flows over the evaporator 3 and through eliminator 8 and out through opening 24. The condenser cooling air and car air are maintained separate by partition 43 and its angular wall 45 while the car air after leaving the eliminator is angularly directed by wall 53. This diagonal wall provides a compartment 97 in which valve mechanism is normally disposed for effecting reversal of operation of the condenser and evaporator in the manner previously described. Condensate in the cooled car air impinges upon the baffles of the eliminator 8 and the liquid is conducted laterally outside of the car.

From the foregoing disclosure, it is seen that we have provided a very compact, sturdy and yet economical and efficient self-contained air conditioning unit that is particularly adapted for installation against ceilings and especially in railway car monitors. The construction permits shop assembly of the complete unit and yet the construction and arrangement of parts are such that the vital elements such as the compressor, fans and motor therefor may be readily removed while the unit remains in its installed position.

It will of course be understood that various changes in details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as set forth in the appended claims.

We claim:

1. A self-contained air conditioning unit comprising a frame structure; a condenser, evaporator, compressor and air circulating means supported by said structure in a substantially common plane; supplementary wing frames having longitudinal members spaced from the side of said frame structure and secured thereto by transverse members thereby defining a space within the wings together with side openings for communication with said space; and air filters disposed within said space of one of said wings.

2. The combination with a railway car monitor having spaced projections along each of its lower edges, of a frame structure removably positioned within the monitor and provided with lugs projecting from the sides thereof and engaging said projections to support the frame; and a compressor, condenser, evaporator and air circulating means supported by said frame structure in a substantially common horizontal plane; said lugs being movable through the spacing between said projections to permit the withdrawal of the unit from the space within the monitor.

3. A self-contained air conditioning unit comprising, in combination; a frame structure including a pair of longitudinal main beams and transverse elements connecting the same; compressor, condenser and evaporator elements supported by said frame structure; means forming separate passages for conducting outside air and enclosure air respectively over said condenser and evaporator; a plurality of axially aligned blowers for circulating the outside air and enclosure air through said passages, each of said blowers being provided with casing supported on the outside of one of said mean beams; and a motor also supported by said latter beam for commonly driving said blowers.

4. The combination set forth in claim 3 further characterized in that said motor and blowers have their rotors directly mounted on a common shaft.

5. A self-contained air conditioning unit comprising, in combination, horizontal frame members extending longitudinally and transversely, an evaporator centrally located at one longitudinal end of the unit, means forming a longitudinal air inlet in one end of the unit substantially at right angles to but near the side thereof and laterally offset to one side of said evaporator, means forming an outlet in the same longitudinal end of the unit in which said inlet is disposed but located near the opposite longitudinal side of the unit in laterally offset relation to the other side of said evaporator, means forming a passage for connecting said inlet with said outlet, and a blower disposed adjacent to one of said sides of the evaporator for circulating air through said passage.

6. The combination set forth in claim 5 further characterized in that the passage forming means includes a chamber between said evaporator and said outlet, and a partition in said chamber for directing air outwardly through said outlet and for providing in association with said chamber forming means a sub-compartment for reversing valve mechanism.

7. A self-contained air conditioning unit comprising, in combination, a frame including end sills, a pair of main longitudinal beams connecting said sills, a pair of heat exchange elements, means for supporting one of said heat exchange elements by and between both of said beams, means for supporting the other of said heat exchange elements on the outside of one of the beams, means forming a passage for conducting outside air over one of said elements, means forming another and separate passage for conducting enclosure air over the other of said heat exchange elements, a plurality of blowers supported by said frame for circulating outside air and enclosure air through said respective passages, and means providing inlet and outlet openings communicating with said enclosure air passage on opposite sides of said heat exchange element which is supported between said beams.

8. A self-contained air conditioning unit comprising, in combination, a frame structure having horizontal end sills and a pair of horizontal longitudinally extending members connecting said sills at points spaced inwardly from the ends thereof whereby said end sills project laterally beyond the longitudinal members; compressor, condenser and evaporator elements, means for supporting certain of said elements by said frame between said longitudinal members, means for supporting other of said elements by said frame on the outside of one of said longitudinal members; means forming a pasage for conducting outside air over said condenser; means forming a passage for conducting enclosure air over said evaporator element ; and blower mechanism supported at the outside of the other longitudinal member and between the laterally projecting portions of said end sills.

9. A self-contained air conditioning unit comprising, in combination, horizontal frame members extending longitudinally and transversely; a compressor, condenser, evaporator and motor-driven blowers all arranged in a substantially horizontal common plane; means forming a pas-

sage for conducting outside air over said condenser; means forming another and separate passage for conducting enclosure air over said evaporator; and means for supporting said blower motor for removal through the bottom of said unit.

10. A self-contained air conditioning unit comprising, in combination, horizontal frame members extending longitudinally and transversely; a compressor, condenser, evaporator and motor-driven blowers all arranged in a substantially horizontal common plane; means forming a passage for conducting outside air over said condenser; means forming another and separate passage for conducting enclosure air over said evaporator; and means for supporting said compressor for removal through the bottom of said unit.

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HENRY J. GALSON.

CERTIFICATE OF CORRECTION.

Patent No. 2,148,596. February 28, 1939.

ALFRED WEILAND.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 2, claim 3, for the word "mean" read main; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 26th day of December, A. D. 1939.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

sage for conducting outside air over said condenser; means forming another and separate passage for conducting enclosure air over said evaporator; and means for supporting said blower motor for removal through the bottom of said unit.

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Patent No. 2,148,596. February 28, 1939.

ALFRED WEILAND.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 2, claim 3, for the word "mean" read main; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 26th day of December, A. D. 1939.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)