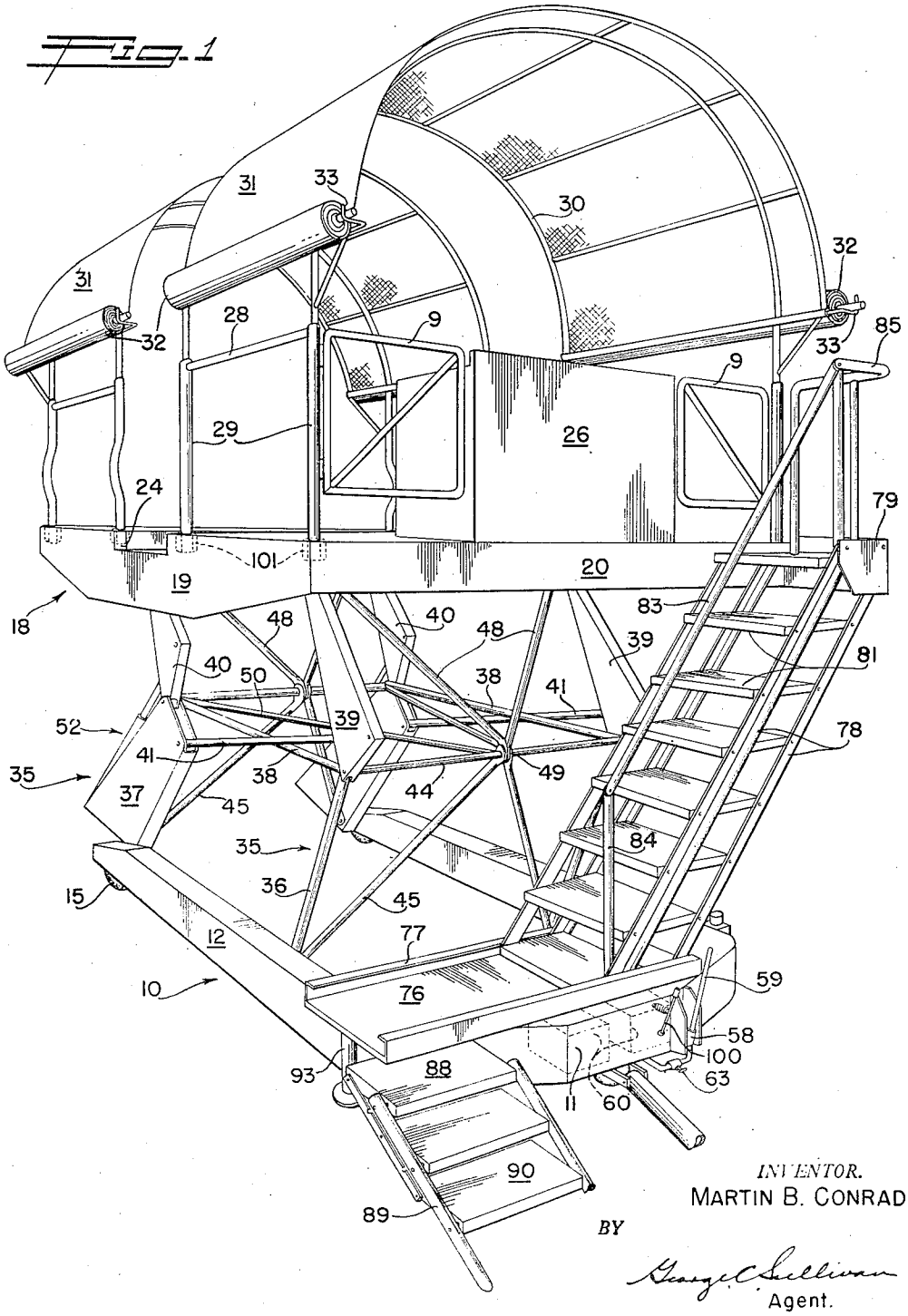
April 5, 1949. M. B. CONRAD 2,466,155

ADJUSTABLE WORKSTAND

Filed March 30, 1946 4 Sheets-Sheet 1

Fig. 1



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ADJUSTABLE WORKSTAND

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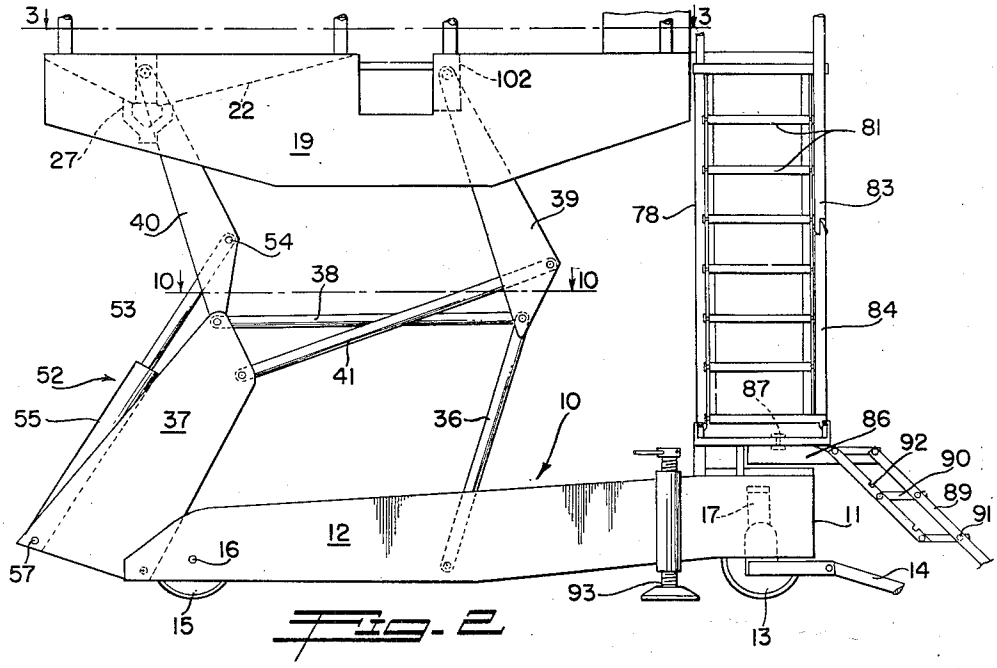


Fig. 2

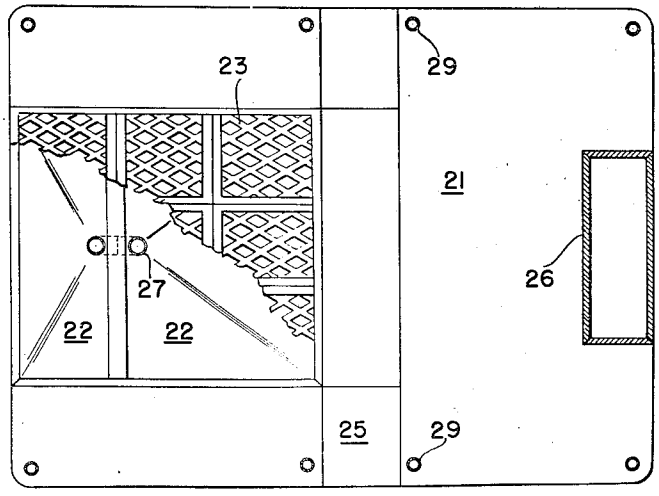


Fig. 3

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ADJUSTABLE WORKSTAND

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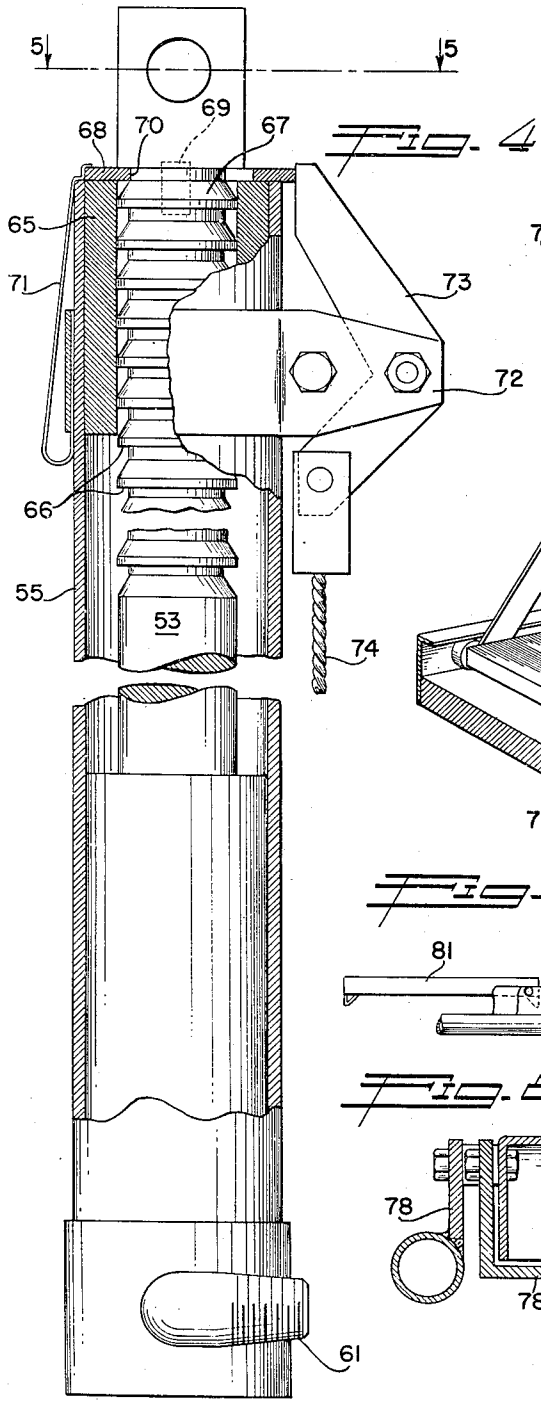


Fig. 4

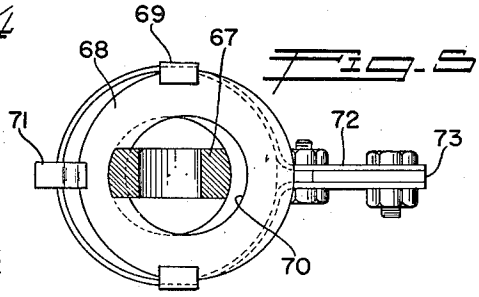


Fig. 5

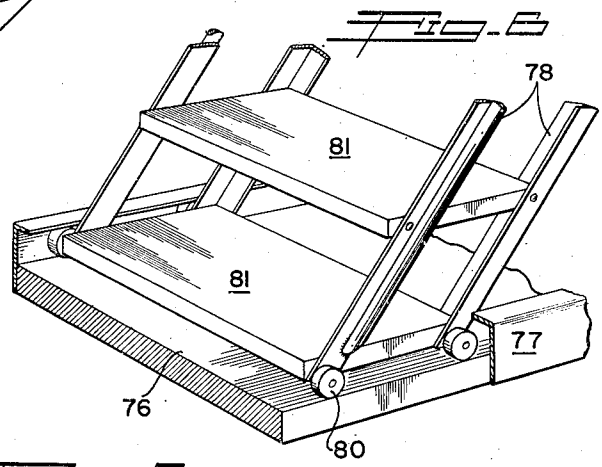


Fig. 6

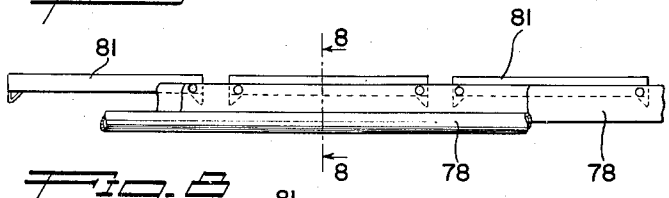


Fig. 7

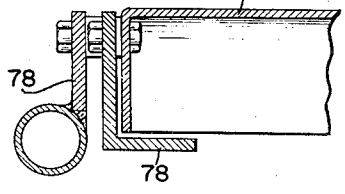


Fig. 8

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ADJUSTABLE WORKSTAND

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Fig. 9

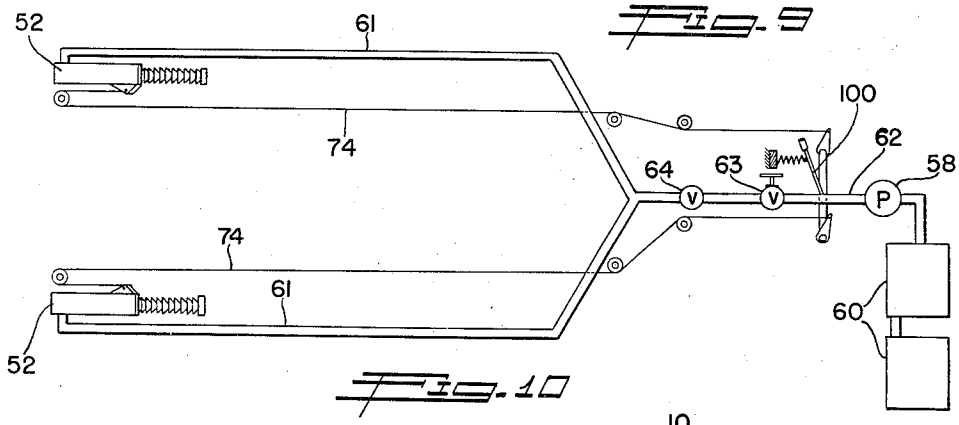
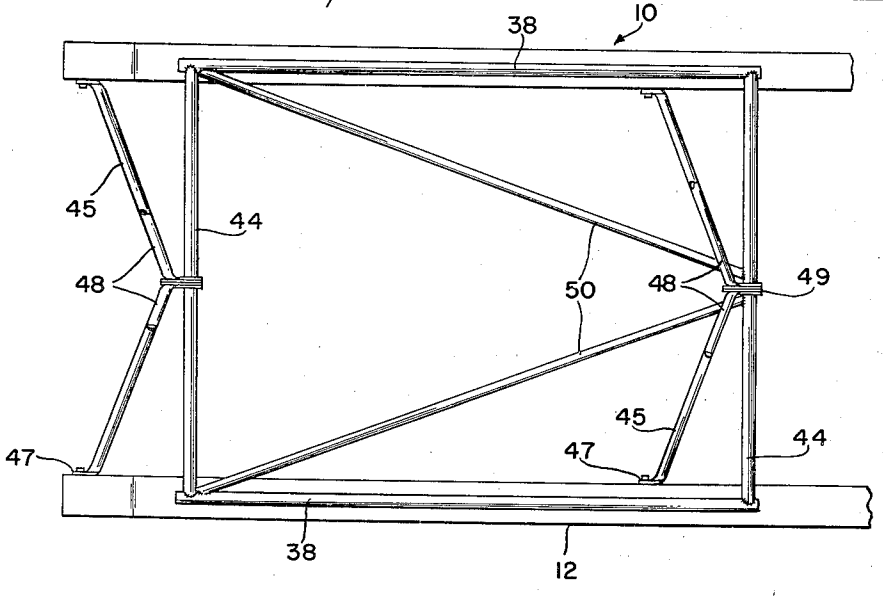


Fig. 10



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2,466,155

UNITED STATES PATENT OFFICE

2,466,155

ADJUSTABLE WORKSTAND

Martin B. Conrad, Houston, Tex., assignor to Airquipment Company, Burbank, Calif.

Application March 30, 1946, Serial No. 658,562

8 Claims. (Cl. 304—29)

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This invention relates to docks or platforms, and relates more particularly to work stands useful in servicing aircraft, etc. It is a general object of this invention to provide a practical, portable service stand of wide application and having a substantial range of vertical adjustment.

In the inspection, servicing and repair of airplanes it is necessary to provide platforms or stands for the workmen. The various models of airplanes are of different heights and proportions, and it is not feasible to employ a service stand of fixed height for the servicing and repair work. For example, the engines of one model of airplane may be several feet higher than those of another model, assuming the craft to be at rest on the field, and a stand that is suitable for the servicing of engines of the first airplane would be useless in the case of the second.

It is an important object of the present invention to provide a dock or stand of the general character above referred to that is portable to be readily movable from place to place, and that embodies a work platform capable of extensive vertical adjustment to be useful in working upon the engines and other elements of airplanes of various models and types.

Another object of the invention is to provide a multiple parallelogram system for supporting work platforms, and other objects, which is capable of supporting the object for true vertical movement without horizontal motion. The invention provides a multiplicity of parallelogram link systems so connected and related that they are operable to produce vertical elevation and depression of the supported object through practically any range of movement without appreciable horizontal displacement. In fact, it is possible to relate the multiple systems to obtain true vertical movement only.

Another object of the invention is to provide a stand of the class mentioned characterized by a horizontally stable fluid pressure operated mechanism for elevating and supporting the vertically adjustable platform. The above referred to parallelogram link system is provided with trussing, which stabilizes the same to prevent horizontal instability, and one or more hydraulic ram units are associated with the linkage to effect the vertical movement of the platform.

Another object of the invention is to provide a service stand of the character referred to having safety means associated with the rams or cylinder and piston mechanism, of the platform elevating means, which precludes the possibility

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of accidental dropping or lowering of the platform.

A further object of the invention is to provide a service stand incorporating an adjustable stair means providing free access to the platform at all elevations, the stair means automatically adjusting itself to the platform elevation and maintaining its treads horizontal at all times.

A still further object of the invention is to provide an adjustable service stand of the character mentioned in which provision is made for the reception of the propeller blades of the engine being serviced and for receiving or draining off oil, etc., from the engine.

Other objects and features of the invention will be readily understood from the following detailed description of a typical preferred form of the invention wherein reference will be made to the accompanying drawings in which:

Figure 1 is a perspective view of the adjustable stand provided by this invention showing the platform in an elevated position;

Figure 2 is a fragmentary side elevation showing the parallelogram linkage for supporting the platform;

Figure 3 is a horizontal sectional view taken substantially as indicated by line 3—3 on Figure 2;

Figure 4 is an enlarged longitudinal section of one of the ram mechanisms for elevating the platform, with certain parts appearing in side elevation;

Figure 5 is a horizontal sectional view taken substantially as indicated by line 5—5 on Figure 4;

Figure 6 is an enlarged fragmentary perspective view of the lower portion of the stair means;

Figure 7 is a fragmentary front view of the stair means in a fully lowered condition;

Figure 8 is an enlarged fragmentary sectional view taken as indicated by line 8—8 on Figure 7;

Figure 9 is a diagrammatic view of the fluid pressure system embodied in the stand; and,

Figure 10 is a horizontal sectional view illustrating the trussing, taken substantially as indicated by line 10—10 on Figure 2.

The stand or dock of the invention includes a wheel-supported base frame 10 which is generally U-shaped in plan view, having a front portion 11 and two rearwardly extending side portions or beams 12. A steerable wheel 13 is carried by a trunnion 17 mounted midway between the ends of the front portion 11, and is equipped with hitch or draft means 14 to facilitate movement of the stand. Wheels 15 are mounted on axles 16 suit-

ably journaled in the rear portions of the side beams 12, which may be of box construction as illustrated.

The stand structure further includes a horizontal, vertically movable platform 18. The platform is preferably rectangular in plan elevation, and may be of any selected construction. As illustrated, the platform 18 has suitably braced beam-like sides 19 and ends 20, which carry the floor 21. The outer or rear portion of the floor is equipped with drain pans or oil sumps 22 covered by a perforate grid 23 and equipped with a common drain means 27. The grid 23 is preferably sectional and removable to allow free access to the sump. The sump is adapted to receive oil, water, etc., from the engine, or other mechanism being worked upon. The sides 19 of the platform are notched at 24 to receive the propeller blades of large aircraft when the platform is brought to the required position and elevation under the engine. The floor 21 has a removable section 25 aligned with the notches 24 to receive the propeller blades and to permit the same to pass into the notches. A workbench 26 may be arranged at the forward end portion of the platform 18.

A hand rail 28 is provided for the sides of the platform 18 and is supported by spaced vertical posts 29. A removable chain may be engaged between the rearmost posts 29 to form a guard at the rear end of the platform. Certain of the posts 29 may be bowed outwardly to facilitate the passage of the propeller blades over the platform structure. The lower ends of the posts 29 are removably engaged in keepers or sockets 101 set in the platform so that the guard rail assembly and associated parts may be removed from the platform when desired. The workbench 26 extends across the major portion of the platform front and suitable gates 9 are provided at the ends of the bench to complete the safety rail means of the platform. While not essential, canopies may be provided for the platform 18. In the drawings the canopies comprise curved tubes or pipes 30 covered by sections of canvas or other fabric 31. The lower ends of the pipes 30 are removably engaged in the upper ends of the guard rail posts 29, and the fabric 31 is carried by rolls 32 removably engaged in troughs or brackets 33 mounted on the pipes 30. The two canopies are spaced apart to leave a clear area above the removable floor section 25. It will be noted that the canopies are adapted for individual removal and installation.

The means 35 for supporting and adjusting the platform 18 includes a multiple parallelogram system of links at each side of the structure. In the invention as illustrated in Figures 1 to 10, there are two like assemblies, each embodying two parallelogram systems, although the invention may be embodied in structures incorporating one or more assemblies, each comprising three or more such parallelogram linkage systems. Each platform supporting assembly illustrated in Figures 1 to 10 includes a forward link 36 hinged at its lower end to a side beam 12 of the base, and a rear link 37 hinged to the beam 12 adjacent its rear end. A horizontal link 38 extends between and is pivotally connected with the upper ends of the forward and rearward links 36 and 37. The upper parallelogram system of each assembly includes a forward link 39 pivotally connected with the upper end of the link 36, and a rear link 40 pivotally connected with the upper end of the link 37. The upper ends of the links 39 and

40 are pivotally secured to spars 102 at the under side of the platform 18.

In order to synchronize motion of the upper and lower parts of the multiple parallelogram system, and to assure substantially vertical movement of the platform, I provide a member 41 connected between the rear link 37 of the lower parallelogram system and the forward link 39 of the upper parallelogram system. The member 41 is pivotally connected with the links 37 and 39 at points spaced from their respective points of connection with the fore-and-aft link 38. Although I have shown the member 41 extending between the links 37 and 39, it is to be understood that the member may extend between corresponding points on the links 36 and 40. In the drawings I have shown the links 37, 39 and 40 as box beam members, it being apparent that they may be constructed of single elements or of several component rod or link members. With the linkage just described, the platform 18 is capable of vertical movement through a distance of several feet with only a very minor fore-and-aft displacement, while remaining horizontal at all times. It is to be understood that there is a multiple parallelogram system of links of the kind just described at each side of the structure.

It is important to brace the assembly to eliminate or reduce to a minimum, lateral movement and displacement of the platform 18 when in all positions. The brace means is preferably a truss arrangement comprising a substantially rectangular frame comprising the above described links 38 and front and rear members 44 secured to or engaged between the links 38. The front and rear members 44 of the frame are coincident with the axes of the pivotal connections between the links 38 and the links 36 and 37, and if desired, may be utilized as the trunnions of these connections. Pairs of diagonal trusses 45 are pivotally associated with each member 44, and extend downwardly and laterally to the side beams of the base 10 where they are pivotally secured at 47; see Figure 10. Similar pairs of trusses 48 are pivotally engaged on the members 44 at 49 and extend upwardly and laterally to have their upper ends pivotally connected with the side beams 19 of the platform 18. In practice the truss members 45 and 48 may be identical. In addition to the trusses 45 and 48, I provide two braces 50 secured to the forward member 44 adjacent its center to extend rearwardly and laterally for attachment, as by welding, to the links 38 adjacent their rear ends. The trussing and bracing just described are effective in stabilizing and steadying the structure against lateral deflection, even in cases where substantial loading is imposed on the platform 18.

Fluid pressure actuated means is associated with the above described parallelogram linkage assemblies for effecting vertical movement of the platform 18. Although this means may comprise a single cylinder and piston unit, I prefer to associate a cylinder and piston mechanism 52 with each of the above described linkage assemblies. In the arrangement illustrated in Figures 1 to 10, a cylinder and piston device or ram mechanism 52 is connected between the upper rear link 40 and the lower rear link 37 of each linkage system. The rams 53 of the mechanisms are pivotally connected with the links 40 at points 54 spaced from the lower ends of the links. The cylinders 55 are pivotally connected at their lower ends to the links 37 at points 57. Assuming the platform 18 to be in a raised position, as shown in Figure 2,

the points 57 are spaced rearwardly from the lower pivotal axes of the links 37, and the points 54 of the connection of the rams 53 with the links 40 are spaced above the upper ends of the links 37. With this disposition of the ram mechanisms 52, their loadings are substantially constant though the full movement of the platform 18 and the mechanisms assume substantially horizontal positions when the platform is at the lower extremity of its movement.

The means for supplying actuating fluid pressure to the ram mechanism 52 includes a suitable pump 58 preferably mounted on the forward portion 11 of the base. I have shown a pump of the manually operated type provided with an actuating lever 59. Tanks 60 for the hydraulic fluid or oil employed are mounted in the boxed base portion 11 adjacent the pump. I prefer to manifold the two ram mechanisms by providing a single fluid pressure system for the two rams; see Figure 9. This comprises a pipe 61 extending from adjacent the pump 58 to the cylinders 55 of the mechanisms 52. The pipe 61 may be arranged on the inner sides of the base members 11 and 12. A single branch pipe 62 extends from the pump 58 to the pipe 61. A manually controllable needle valve 63, or the equivalent, is interposed in the branch 62 so that the operator may readily govern the speed of platform movement, especially during lowering of the platform. A second needle valve 64, having a fixed setting, is also provided in the branch pipe 62 to restrict fluid flow and thus retard platform movement in the event the platform is allowed to lower when the valve 63 is fully open.

The ram mechanisms are preferably equipped with ratchet means for retaining the platform 18 at any selected elevation. This means prevents lowering of the platform in the event fluid pressure bleeds or leaks away from the ram units. Referring now to Figures 4 and 5, it will be seen that a guide bushing 65 of medium soft metal such as Kirksite, bronze, brass, or the like, is fixed in the upper portion of each cylinder 55 to surround the ram 53. The major upper portions of the rams 53 are formed with a multiplicity of axially spaced annular serrations, each presenting a flat normal lower face 66 and a sloping upper face 67. A plate or disc 68 is shiftably engaged on the upper end of the cylinder and bushing 65, being retained thereon by guide clips 69. The disc 68 has a central opening 70 sufficiently large to pass the serrations which are cylindrical at their peripheries. A leaf spring 71 is secured on the cylinder and engages the disc 68 to urge it to a position offset from the longitudinal axis of the ram assembly. When in this offset position the disc 68 is adapted to engage the normal face 66 of any one of the serrations to prevent downward travel of the ram. During upward or outward movement of the ram, the sloping faces ratchet past the spring-held disc and the disc does not interfere with the free outward travel. However, upon any slight downward travel of the ram 53 the disc 68 engages under a shoulder 66 to prevent further downward movement.

Means are provided for manually releasing the ratchet discs 68 to allow downward movement of the rams 53 and this permit lowering of the platform 18. A bracket 72 is secured on each cylinder 55 and a lever or bell crank 73 is pivoted in each bracket. The upper arms of the levers 73 cooperate with the discs 68 and operating cables 74 are attached to the lower lever arms. The cables or lines 74

preferably extend to the forward end of the structure and are connected together for simultaneous operation by a suitable handle 100. The handle or lever 100 is adjacent the pump handle 59 and is spring held in a position where the dogs or discs 68 are operative to prevent lowering of the platform; see Figure 9. When the operator pulls the cables 74, the discs 68 are shifted to positions in coaxial relation to the rams 53, and the rams are thus allowed to move downwardly under the control of the valves 62 and 64.

The apparatus further includes a vertically extensible stair system to permit free access to the platform 18 when at any elevation. A horizontal landing 76 is supported above the forward portion 11 of the base 10 and is provided at its edges with parallel guide rails 77. Two spaced pairs of rail members 78 are pivotally suspended from a forwardly projecting landing 79 on the platform 18. The members 78 extend downwardly to the landing 76 and their lower ends are equipped with rollers 80 which cooperate with the tracks 77. A plurality of spaced stair treads 81 are pivotally secured at their ends to the members 78. It will be observed that the stair means just described is an adjustable parallelogram arrangement in which the treads 81 remain horizontal at all elevations of the platform 18. When the platform 18 is raised and lowered, the rollers 80 ride along the tracks 77 and the angularity of the members 78 changes, although the treads connected therebetween preserve their parallel relationship. The treads 81 are spaced and proportioned to present a substantially continuous flat horizontal surface when the platform 18 is brought to its lowermost position as shown in Figure 7. This surface is adapted to form a floor for the workmen.

A hand rail 83 is provided for the stair means. The rail 83 is parallel with the members 78 and is pivotally supported at its lower end by a post 84 associated with the lowermost tread 81. The upper end of the rail 83 is pivotally attached to a guard rail structure 85 on the landing 79. It will be observed that the rail 83 at all times remains in an operative position parallel with the members 78.

I prefer to provide a second stair means to facilitate access to the platform 76. This means includes a support or bracket 86 mounted at the under side of the landing 76 by a vertical hinge pin 87. The bracket 86 has a horizontal projection 88 forming the upper step or tread of the supplemental stair means. Two spaced pairs of spaced rail members 89 are pivotally secured to opposite edges of the projection 88. The outer or forward members 89 are adapted to rest on the ground or field when the stair is extended but the rear members 89 terminate some distance above the ground. Spaced treads 90 are secured at their ends to the members 89 by pivot pins 91. The members 89 and treads 90 form a parallelogram linkage capable of adjustment to conform with the ground level, etc., while maintaining the treads 90 horizontal. The stair system is capable of being raised to a horizontal position where it is fully collapsed. Notches 92 are formed in the upper edges of the rear members 89 to receive the hinge pins 91 at the forward edges of the treads 90 and projection 88 when the assembly is thus raised. To condition the stand for movement across the field, it is usually preferable to raise the stair means just described, to a horizontal position where it is fully folded, and to then swing the collapsed assembly rearwardly

about the hinge pin 87. This brings the folded stair under the landing 76 where it leaves the forward end of the stand free and unobstructed.

Suitable ground engaging pads 93 are provided on the side beams 19 of the base 10. These pads may be of any selected type, but are preferably adjustable to conform with the ground level and to compensate for variations in height of the loaded base 10. The pads 93 serve to stabilize the base when the stand is in use.

From the above detailed description it will be seen that I have provided a practical adjustable work or service stand having extensive utility. The platform 18 may be raised to any required height by simply operating the pump 58, and the ratchet disc 68 automatically locks the rams 53 in the required elevated positions. The multiple parallelogram linkages assure vertical movement of the platform 18 with a minimum horizontal displacement, and the trussing associated with the linkages prevents lateral deflection and the tipping of the platform. The platform remains horizontal and stable at all elevations, constituting a dependable stand for the servicing of airplane engines, etc. The stair means follows the platform 18 throughout its full range of movement while preserving the treads 81 in horizontal planes, thus providing for ready access to the platform at all times. The parallelogram linkages and trussing are such that the platform may be lowered by control of the valve 63 to a horizontal position at or immediately above the base 10. With the platform 18 in this extreme downward position, the stair treads 81 form a flat horizontal landing from which either gate 9 may be easily reached.

Having described only a typical form of the invention, I do not wish to be limited to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

I claim:

1. The combination of a base, a platform above the base, a multiple parallelogram linkage supporting the platform on the base for vertical movement comprising a pair of spaced lower links pivoted on the base, a pair of spaced upper links pivoted to the platform, means pivotally connecting the corresponding links of said upper and lower pairs, a link member substantially parallel with the base extending between and connecting the two pairs of links at said means, and a tension member extending between and pivotally connected with a lower link and an upper link to restrain the platform against appreciable horizontal movement during vertical movement thereof, and means for moving the platform vertically.

2. A device of the character described comprising a substantially horizontal base, a substantially horizontal platform above the base, a multiple parallelogram linkage supporting the platform on the base for vertical movement including a lower forward link pivoted to the base, a lower rear link pivoted to the base, an upper forward link pivoted at its upper end to the platform and pivotally connected at its lower end with the upper end of the lower forward link, an upper rear link pivoted at its upper end to the platform and pivotally connected at its lower end with the upper end of the lower rear link, a link member pivotally connecting said four links at the points of pivotal connection of the upper links with the lower links, and a tension member extending between and pivotally connected with the lower rear link and the upper forward link to restrain the platform against horizontal movement during vertical movement thereof, and means for moving the platform vertically.

3. A device of the character described comprising a substantially horizontal base, a substantially horizontal platform above the base, a multiple parallelogram linkage supporting the platform on the base for vertical movement including a lower forward link pivoted to the base, a lower rear link pivoted to the base, an upper forward link pivoted at its upper end to the platform and pivotally connected at its lower end with the upper end of the lower forward link, an upper rear link pivoted at its upper end to the platform and pivotally connected at its lower end with the upper end of the lower rear link, a link member pivotally connecting said four links at the points of pivotal connection of the upper links with the lower links, and a tension member extending between and pivotally connected with the lower rear link and the upper forward link to restrain the platform against horizontal movement during vertical movement thereof, and cylinder and piston means associated with said linkage for moving the platform vertically.

4. A device of the character described comprising a base, a platform above the base, spaced multiple parallelogram linkage systems supporting the platform on the base for vertical movement, said systems including pairs of upper and lower links, and pivotal connections between the links of each pair, truss means connected with the linkage systems and with the base and platform for stabilizing the platform including horizontal members coincident with the axes of said connections, and diagonal members extending from said horizontal members to the base and platform, and means for moving the platform vertically.

5. A device of the character described comprising a base, a platform above the base, spaced multiple parallelogram linkage systems supporting the platform on the base for vertical movement, a cylinder and piston mechanism associated with said systems for moving the platform vertically, ratchet means for preventing retrograde movement of the piston of said mechanism to retain the platform in any selected position and manually operated means for releasing the ratchet means including a flexible operating line extending to a point remote from the cylinder and piston mechanism.

6. A device of the character described comprising a substantially horizontal base, a substantially horizontal platform above the base, a multiple parallelogram linkage supporting the platform on the base for vertical movement including a lower forward link pivoted to the base, a lower rear link pivoted to the base, an upper forward link pivoted at its upper end to the platform and pivotally connected at its lower end with the upper end of the lower forward link, an upper rear link pivoted at its upper end to the platform and pivotally connected at its lower end with the upper end of the lower rear link, a link member pivotally connecting said four links at the points of pivotal connection of the upper links with the lower links, and a tension member extending between and pivotally connected with the lower rear link and the upper forward link to restrain the platform against

horizontal movement during vertical movement thereof, and a cylinder and ram mechanism connected between one of the lower links and one of the upper links for moving the platform vertically.

7. A device of the character described comprising a base, a platform above the base, means supporting the platform on the base for vertical movement, means for moving the platform vertically, a landing on the base, pairs of parallel members pivoted to the platform and extending downwardly to the landing, spaced horizontal stair treads pivoted to the members to remain horizontal during vertical movement of the platform, and means supporting the members on the landing for free horizontal movement during vertical movement of the platform.

8. A device of the character described comprising a base, a platform above the base, means supporting the platform on the base for vertical movement, means for moving the platform vertically, a landing on an end of the base, pairs of parallel members pivoted to the platform and extending downwardly to the landing, spaced horizontal stair treads pivoted to the members to remain horizontal during vertical movement of the platform, and roller and track means supporting the members on the landing for free

horizontal movement during vertical movement of the platform.

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