This invention relates to scaffolds and more particularly to improved portable scaffold assemblies of adjustably variable height.

Many construction and servicing operations, in particular those involving maintenance of aircraft, require that the scaffolding from which the work is performed be set at various heights. In the case of an airplane wing, for example, the portion of the wing nearest the fuselage is generally closest to the ground, the wing extending upwardly at an angle moving toward the tip, and variable height scaffold units of a portable nature have been developed to serve this need. Each variable height unit, however, is necessarily limited in working space and maintenance crews have adopted the technique of bridging the space between two or more scaffold units with temporary planking. Dangerous working conditions result. Moreover, presently used variable height scaffolds are in the form of a platform carried at the free end of a pivoted truss assembly adapted to be swung upwardly from a supporting base in a large arc. This results in displacement of the platform longitudinally as it is swung upwardly, and it is often necessary to reposition the entire assembly once the platform is elevated. Both personnel and equipment are endangered by this practice.

In accordance with the present invention, there is provided a scaffold assembly of simplified and improved design and which, in addition, overcomes the several disadvantages of presently used scaffold systems.

Another object of the invention is to provide an adjustable scaffold which is stable in all positions of adjustment. A further object of the invention is to provide a scaffold assembly which entirely dispenses with the need for moveable bridging planking in elevated positions.

In accordance with the present invention, there is provided a scaffold assembly including a platform mounted for straight vertical movement relative to a supporting base, which can be of the wheeled variety for portability. Pivoted to the platform is a stair assembly, the opposite end of which rests on the ground at a point spaced from the platform. The grounded end of the stair assembly includes a ground support enabling it to be readily carried along with the portable support base and also to shift inwardly along the ground as the platform rises from a fixed location, the stair treads being individually pivoted and coupled to control linkage so that they are at all times in a horizontal plane. The design of the scaffold units is such that two or more can be readily integrated by joining the normally grounded end of one of the stair assemblies to the platform of another scaffold unit. In this fashion the stair treads, now disposed horizontally in a common plane, afford an elongated working space between two scaffold units, the entire elevated working space being fully protected by fixed railings, upstanding margins and other safety features. Also, in accordance with the invention, the vertically movable platform can be power driven through the agency of a pneumatic drive including an energy recovering as well as motion controlling system energized by the forces attendant lowering of the platform.

A representative embodiment of the invention from which the above and other features and objects of the invention will be readily apparent is described below having reference to the accompanying drawings in which:

Figure 1 is a view in side elevation showing a series of scaffold units integrated beneath an airplane wing to form scaffold assembly.

Figure 2 is an enlarged view in end elevation of the scaffold unit of Figure 1, isolated from its companion scaffold unit, and

Figure 3 is an enlarged view in side elevation of a scaffold unit partially elevated and showing a portion of a second unit joined thereto.

Referring to the drawing, there are illustrated scaffold units 10, each including a base 11 preferably mounted on castor wheels 11a for portability, and a vertically movable platform 12 joined to the base 11 through a lifting truss assembly indicated generally by the numeral 13.

The lifting truss 13 can take the form of a pantograph type linkage including, working from the base upwardly, a first pair of beams 14 and 15 (best seen in Figure 2) hinged through pivotal connections 14a and 15a to upwardly standing U-shaped lugs 16 and 17 affixed to the base 11. A second pair of beams 18 and 19 are also hinged to the base 11 through pivotal connections 18a and 19a, respectively, including upwardly standing U-shaped lugs 20 and 21, also fixed to the base. The upper ends of the beams 14 and 15 are hinged through pivotal connections 14b and 15b, respectively, to the lower ends of a third pair of beams 22 and 23, the upper ends of which are in turn hinged through pivotal connections 22a and 23a to the platform 12, the coupling to the platform being completed through downwardly facing U-shaped lugs 24 and 25, respectively. The upper ends of the beams 18 and 19 are similarly hinged through pivotal connections 18a and 19a to the lower ends of beams 26 and 27, respectively, which are in turn hinged at their upper ends to the platform 12 through pivotal connections 28 and 29, the latter including downwardly facing U-shaped lugs 30 and 31.

Joined in the pivotal connections 18a and 19a, respectively, are bracing beams 32 and 33, the lower ends of which are hinged to the beams 14 and 15, respectively, in pivotal connections 34 and 35 near the lower ends of the beams 14 and 15. Similarly, a pair of bracing beams 36 and 37 are joined at their lower ends in the pivotal connections 14b and 15b and are hinged at the upper ends to the beams 26 and 27, respectively, through pivotal connections 38 and 39, which are spaced downwardly from the upper ends of the beams 26 and 27 by an amount corresponding approximately to the spacing of the pivotal connections 34 and 35 from the lower ends of the beams 14 and 15. For lateral stabilization, cross bridging is inserted between beams 18 and 19, in the form of a pair of traverse members 40 and 41 bridged by a diagonal member 42. Similarly, the upper pair of beams 26 and 27 are reinforced by cross members 43 and 44 and a diagonal member 45.

In order to raise the platform 12 from the supporting base 11, lift means in the form of a jack 46 is disposed between a cross member 46a and a corresponding cross member 11a on the base 11. The member 46a is linked to the beams 14, 18 at one of its ends and to the beams 15, 19 at its other end, pivotal connections being effected at each joint. The jack is adapted to be actuated by means of a control assembly 47 mounted on the platform 12 and coupled to the jack through high-pressure tubing 48 which can be either flexible throughout or flexible at its curved portions to accommodate the ver-
tical motion. The control assembly 47 can take the form of a pressure source, such as a storage tank or a pump, actuated by a handle 47a, and suitable valve control means, not shown, for directing fluid to or from the platform 12.

In order to secure the movable platform 12 in any one of its range of positions, locking means in the form of a slotted and notched arm 64 is pivotally connected to the beam 22 of one end with a pin 65 fixed to the platform 12 being received in its notched slot. As the platform rises, the locking means automatically secures it in successively higher positions. To lower the platform, it is necessary that the operator, in addition to manipulation of the control assembly 47, hold the locking means in its inoperative position freeing the pin 65 from the notches. A safety catch can be engaged with the arm 64 to prevent accidental release. When the scaffold is in use, it is advisable to disable the caster wheels of the base. To this end, anchoring pads are provided to engage the ground, the pads preferably being carried by extendable arm means for supplementary support against tipping.

Platform 12 is protected on two of its sides by handrails 66 and 67 and on its third side by the removable chain 68. The fourth side is the approach through which access to the platform is gained, this side being the terminal or upper end of a stairway assembly indicated generally by the numeral 69. The assembly 69 includes a pair of stretcher or carriage beams 70 hinged at their upper ends to the platform 12 in pivotal connections 71 and joined at their lower ends by fixed crosspiece 72 in which caster wheel means 73 are mounted. Each stretcher 70 carries a hand or safety rail 74, and, at the upper end of the side rails 74, the rails 66 and 67 on the platform 12 are formed with extensions 66a and 67a bridging the generally triangular space therebetween the extensions being slightly laterally offset from the hand rails 74 for reasons presently to be described. The stretchers 70 carry a series of treads 75 in the form of plate members hinged connected to the risers by means of pivotal connections 76 adjacent their inner edges. Each tread 75 has secured thereto a rocker arm 45 lug 80 secured to the platform 12.

Each stair tread connection is such that for every angular position of the stretchers 70, the stair treads 75 are held in a horizontal position. In this fashion, as the platform 12 is lifted, the stairway remains usable at all times, the grounded end of the stairway rolling inwardly on its wheel means 73 as the platform rises.

In the event two staging units 10 are used together, the stairway assembly 69' of one unit is convertible in accordance with the present invention into a bridging platform by swinging it upwardly into the horizontal plane of the platform 12 and securing the normally grounded end thereto. As illustrated in Figure 2, for example, the stair and platform assembly 69', shown at the upper left-hand portion of the figure and constituting a stair assembly identical to that 69 of the staging unit 10, has been coupled to the platform 12 by means of a coupling indicated generally by the numeral 80. The coupling includes an L-shaped channel 81 adjacent the normally grounded end of the stair assembly and received in a channel 82 formed at the edge of the platform 12. It will be recalled that this edge of the platform is normally bounded by the removable chain 68. Preferably, a rubber bumper 83 is secured to the exposed upper edge generally higher than the platform 12 on three sides both to protect equipment being serviced from damage and to tighten the coupling 80 between mated staging units.

With the stair assembly 69' disposed in a horizontal plane, forming a continuous surface from which repair and maintenance operations can be conducted. The side rails, without repositioning or alteration, fully protect the horizontal runaway. In addition the pivot connection between each stair tread and the stretcher 70 is such that an upwarding safety lip or edge results.

In certain cases, corresponding platforms 12 of two integrated units may be necessarily disposed at slightly different levels, as might be the case, for example, when servicing an airplane wing. Normally, a significant variation in heights would break up the coplanar arrangement of the stair treads which form the surface of the bridging member between the two units. In accordance with the present invention, the pivotal connection 79 between the stair tread control bar 78 and the fixed depending lug 80 can be disabled to afford lost motion in either direction over a distance determined by the length of a slot 84 in the member 80. By shifting the axis of the pivotal connection 79 along the length of the slot 84, the stair treads 75 can be maintained coplanar not only in a horizontal plane, but in the slightly angled plane of the stretchers 70, thus forming an inclined but smooth runway between platforms. In those cases in which the platform 12 is relatively close to the ground, the horizontal positioning of the stair treads 75 can be shifted into the plane of the stretchers to form a smooth ramp leading from the ground to the platform 12.

Thus, if desired, heavy equipment can be wheeled on a dolly to the platform 12 before it is raised. Also, the inclined ramp can be used as the last stage of a series of the ramp section, not part of the illustrated equipment, leading from the ground to the raised platform.

It will be understood that any number of basic units can be combined to form, for example, stairings extending the entire length of an airplane wing or extending all around a building under construction and from which masons, for example, can work, raising the platforms as one as their work progresses upwardly. While the invention has been illustrated and described above, having reference to a particular embodiment thereof, it will be understood that it can take various other forms and arrangements within the scope of the present invention which should not therefore be regarded as limited except as defined in the following claims.

We claim:

1. A scaffold assembly comprising a supporting base, a work platform, linkage means between the base and the platform for guiding the platform in vertical motion, jack means for raising and lowering the platform, access stairway means including a bank of stair treads, means to pivotally secure said bank at its upper end to said platform means to support the lower end of said bank on the ground to move toward and away from the base as the platform is respectively raised and lowered, said treads each being pivotally mounted in the bank for swinging movement on a horizontal axis, and control linkage means joined to each of said treads and responsive to pivotal movement of the bank relative to the platform to maintain the threads in a horizontal plane, said stairway including first securing means adjacent its normally grounded end remote from the platform, said platform including on an edge other than that of the pivotal connection of the stairway, second securing means complementary to that of the stairway, whereby two laterally spaced apart scaffold assemblies can be integrated by uniting the first and second securing means disposed respectively on the platform of one assembly and the stairway of the other assembly to form a bridging platform between the two vertically movable platforms said stairway tread control means driving the treads of the bridging stairway into coplanar relationship.

2. A scaffold assembly comprising a supporting base, a work platform, linkage means between the base and the platform for guiding the platform in vertical motion, jack
means for raising and lowering the platform, access stair-
way means including a bank of stair treads, means to
pivotal secure said bank at its upper end to said plat-
form, means to support the lower end of said bank on
the ground to move toward and away from the base as
the platform is respectively raised and lowered, said treads each being pivotally mounted in the bank for
swinging movement on a horizontal axis, and control link-
age means joined to each of said treads and responsive
to pivotal movement of the bank relative to the platform
to maintain the treads in a horizontal plane, including
lost motion means selectively adapted to disable the con-
trol means for the treads to maintain the treads in a hor-
izontal plane, whereby the stair treads can be swung into
coplanar relationship at angles slightly above or slightly
below the horizontal.

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